

Ministry of Public Works
The Republic of Liberia

THE PREPARATORY SURVEY
ON
THE PROJECT FOR RECONSTRUCTION OF
SOMALIA DRIVE IN MONROVIA (PHASE-2)
IN
THE REPUBLIC OF LIBERIA

January 2017

JAPAN INTERNATIONAL COOPERATION AGENCY

KATAHIRA & ENGINEERS INTERNATIONAL
YACHIYO ENGINEERING CO.,LTD
INGÉROSEC CORPORATION

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to consist of Katahira & Engineers International and Yachiyo Engineering CO.,LTD and Ingérosec Corporation.

The survey team held a series of discussions with the officials concerned of the Government of the republic of Liberia, and conducted a field investigations. As a result of further studies in Japan, 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 Republic of Liberia for their close cooperation extended to the survey team.

January, 2017

Akira Nakamura
Director General,
Infrastructure and Peacebuilding Department
Japan International Cooperation Agency

Summary

1. Outline of the Country

The Republic of Liberia is located in south-west of Western Africa and the in the north latitude 5°. The territory is facing the Atlantic Ocean.

Liberia has a population of 4.4 million (based on the Population World Bank in 2015) and 111,000 square kilometers in area. The GNI in 2015 was 2,053 million US dollars, or 380 US dollars per person (according to the World Bank data). The main industries in Re are agriculture, forestry and mining, especially iron ore production is well-known. The export amount of iron ores accounted for 51.4% of total export amounts in 2015. In addition, natural rubber, diamonds and timber are pulling Liberia's economy along as main export goods.

Another important source of foreign income is a ship registration fee. As Liberia gives special tax treatment to ships, many foreign flag ships are registered in Liberia for the sake of convenience. The ship registration is an important measure to acquire foreign currency

2. Background of the Project

Liberia, after more than 10 years from the internal conflict occurred in 2003, the rehabilitation and the reconstruction are underway. In the Monrovia metropolitan area the population increase due to the flow of returnees is salient and the rehabilitation and improvement of city infrastructure is an urgent task. Especially, in many places of the city area, traffic congestion is observed due to the increase of traffic volume, therefore, measures such as improvement of the roads are necessary. The government of Liberia (GoL) formulated the Economic Stabilization and Recovery Plan (ESRP) for the economic and social restoration after the outbreak of Ebola. In the aforementioned plan, the government of Liberia recognized that the delay of infrastructure development led to the delay in the provision of public services including medical services. The government of Liberia places the transport and traffic sector as one of the most urgent issues to be tackled in the future.

The Somalia drive (13.2km), one of the major trunk roads in Monrovia metropolitan area, connects the port and inland area, and also is used as a community road by the surrounding communities. However, the existing two lane road (one lane for each side) is not sufficient to cover the increased traffic volume, and the traffic congestion became continuous. In order to improve the situation mentioned above, the government of Liberia requested assistance for widening the existing two lane road to four lane road to the government of Japan. Based on the request, Japan's grant aid assistance "the Project for Reconstruction of Somalia Drive in Monrovia" has been implemented. (The Exchange of Notes was signed in 2013, Hereinafter referred to as the "Phase 1 Project"). However, the deterioration of the existing two lane road

which is out of scope of the Phase 1 Project has progressed rapidly and it is needed to be improved.

The objective of this survey is to examine the necessity and relevance of the Project in detail, elaborate outline design and implementation plan and estimate the Project implementation cost.

3. Outline design of the study and contents of the project

JICA dispatched the preparatory study team to Liberia between 25 January to 3 March 2016 for 1st stage of site investigation and 21 July to 4th August 2016 for 2nd stage of site investigation for the execution of outline design study for Somalia Drive, about 13.2 km in total length, and the team conducted the discussions with concerned Liberia officials and investigations of the project site.

After coming back Japan, the team carried out outline design for the appropriate contents of the Project based on the result of the field survey and prepared the draft report of the study for the result of outline design.

JICA dispatched the team to Liberia from 6th November to 20 November 2016 for the explanation of draft report and the team made discussions, confirmation and agreement regarding the contents of the draft report.

The contents of the Project finally agreed are shown below.

Road design requirements are as follows.

- ✓ Rehabilitating of the existing Somalia Drive 2-Lane road (Total distance: 13.2km from Free Port Is. to Red Light Is.)

Table-1: Overview of Facilities (Repaired Components)

Section	Repaired Components	Repaired Item
Somalia Drive 13.2km	Rehabilitating of existing road	Rehabilitating existing 2-lane road to 4-lane.
	Junction Improvement	Cross type junction 7 places.
	Road Structure	Construction of gravity retaining wall. Wire mat.
	Drainage Facilities	Construction of road shoulder U- drainage facilities. Construction of RC pipe (φ300-500mm) facilities.
	Road Facilities	Street lighting. Traffic Signal
	Curb Stones	Construction of curb stones, Installation of curb stone.
	Center Separator	Separating existing and new road by separator
	Side walk Pavement	Construction of sidewalk. Surface is Asphalt Pavement.
	Safety Facilities	Construction of Road/ Regulate sign, Cross walk.

Typical cross sections of subject road are as below.

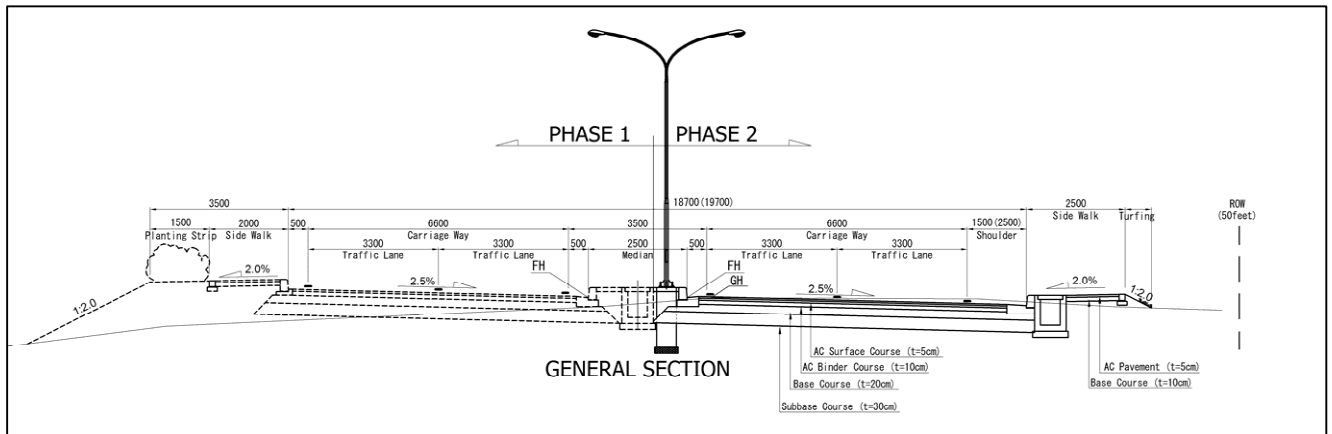


Figure-1: Typical Cross Section

Contents of the facilities under outline design scheme are as below.

Table-2 Contents of the Facilities under Outline Design Scheme

Facilities	Specifications	Quantity
Road Length	Free Port Junction to Red Light Junction	13.2 km
Carriage way Pavement	Asphalt pavement (Hot Asphalt Concrete) (t=150mm)	113,310 sq.m
	Upper Sub-base Course (Mechanical Stabilized Aggregate) (t=200mm)	114,700 sq.m
	Lower Sub-base Course (Crusher Run) (t=300mm)	103,460 sq.m
Junction Improvement	Cross type junction with left turn lane	2 places
	Cross type junction	5 places
	T type junction	174 places
Sidewalk Pavement	Asphalt pavement (t=50mm, width 2.5m)	25,100 sq.m
	Sub-base Course (Mechanical Stabilized Aggregate) (t=100mm)	25,100 sq.m
Drainage	U-Shape Concrete Drain (Bottom Width = 300mm-500mm)	9,633 m
	RC pipe Culvert (Pre-cast, Inner Diameter = 400mm-700mm)	2,442 m
Road Structure	Gravity Retaining Wall	190.9 m
	Wire Mat	224 sq.m
Curb Stone	Curb Stone	10,039 m
	Verge Block	11,136 m
	Median Strip Block	10,765 m
Traffic Sign	Warning & Regulatory Signs	44 set
Road Marking	Center Line (w=150mm), Shoulder Line (w=150mm), Pedestrian Crossing (w=450mm), Stop Line (w=450mm), etc.	73,000 m
Street	Street lighting H=8m	266 places

4. Implementation Schedule and Project Cost

In case the Project is implemented by Japan's Grant Aid, the period for the detailed design is 7.0 months and the implementation period is 45.0 months in total. The cost borne by Liberia side to implement the Project is estimated at 190,000 US\$.

5. Project Evaluation

(1) Relevance

- ① A number of people receive benefit from the Project; Direct beneficiary of the Project includes the road user and the resident whose population is 300 thousand people and indirect beneficiary of the Project includes 1.2 million people who live in Great Monrovia.
- ② Liberia can operate and maintain the project facilities by themselves using its fund, labor and technology as excessively special techniques are not required.
- ③ This Project will reconstruct basic infrastructure, which is one of the important subjects among National Plan “the Economic Stabilization and Recovery Plan (ESRP)” As Monrovia’s population is growing rapidly, this Project is urgent to solve the traffic congestion.
- ④ As for the countermeasures against traffic accidents after effects of road improvement on environment and society are observed, measures such as the establishment of traffic safety facilities, improvement of junction and construction of sidewalk are fully taken.
- ⑤ It is expected that this project will be implemented without difficulties by the Japanese Grant Aid scheme.

(2) Effectiveness

1) Quantitative Effect

Expected effect	Standard Value (Present, 2016)	Target Value (After Implementation 3 years) 2024
Passenger Car Unit (Number / day)	24,713	39,263
Transport Volume		
Passenger Number (person / year)	71,742,188	79,332,655
Freight Volume (ton / year)	21,759,840	32,441,200
Travelling Hour (minutes)		
Morning Peak time	61	18
Free Port Is. – Red Light Is.		

2) Qualitative Effect

- ✓ Safety securement
The safety for the pedestrian will be secured by separating sidewalk and carriage way by the construction of sidewalk and curb stone.
- ✓ Decrease in the frequency of maintenance by improvement of drainage facilities
The damage to the base course from rain water will be prevented by the improvement of drainage facilities, resulting in decrease in the frequency of maintenance.
- ✓ Smooth traffic by bus bay
The safety of passenger on the bus as well as smooth traffic will be secured by the construction of bus bay at the place which a large number of people get on and off.

Contents

Preface	
Summary	
Contents	
Location Map / Perspective	
List of Figures & Tables	
Abbreviations	

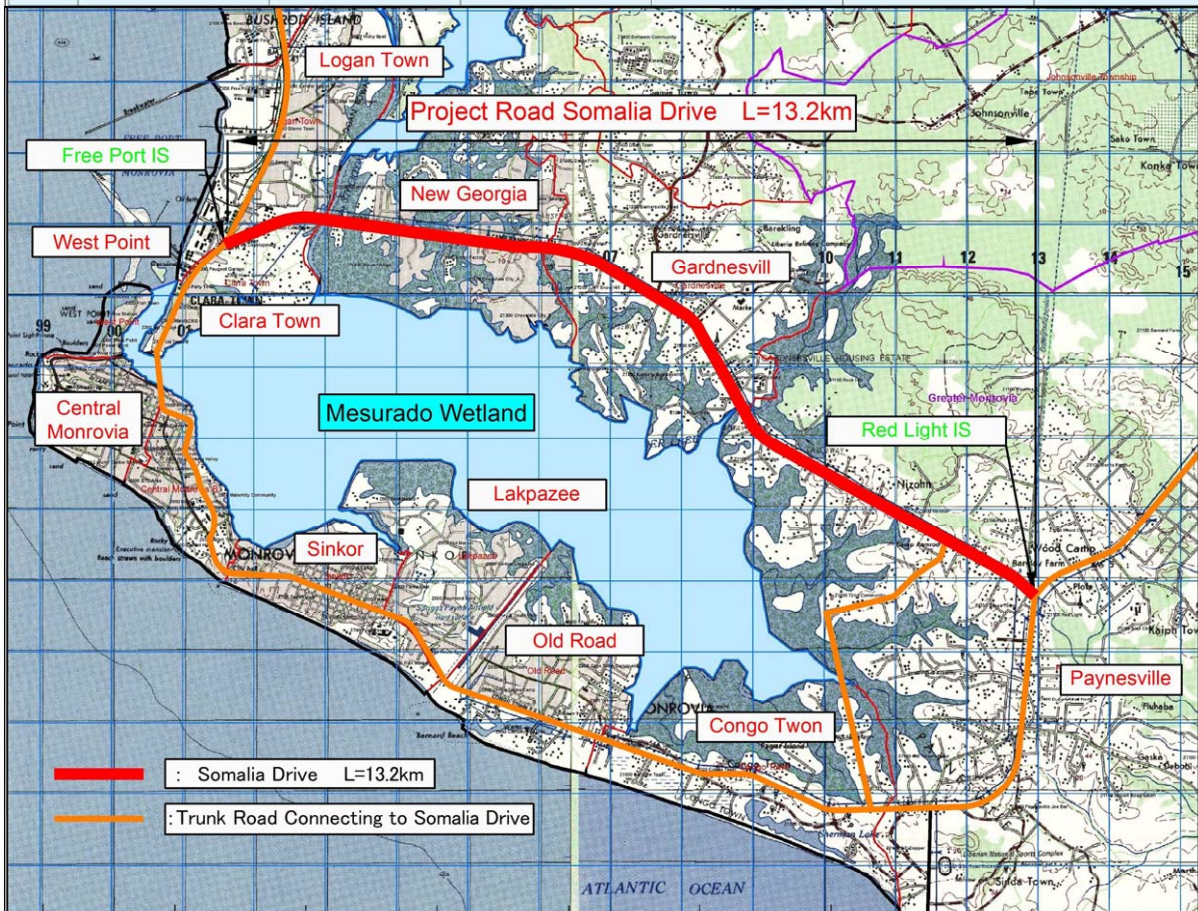
	Page
CHAPTER 1 BASIC CONCEPT OF THE PROJECT	1- 1
1-1 Project Background.....	1- 1
1-2 Natural Conditions	1- 2
1-3 Environmental and Social Consideration.....	1- 3
1-3-1 Environmental Impact Assessment	1- 3
1-3-1-1 Outline of the Project Component Affecting Environment and Society	1- 3
1-3-1-2 Environment and Society	1- 3
1-3-1-3 System and Organization of Environmental and Social Considerations in Liberia	1- 8
1-3-1-4 Comparison of Alternatives.....	1-15
1-3-1-5 Scoping.....	1-20
1-3-1-6 TOR of Environmental and Social Considerations	1-23
1-3-1-7 Result of Environmental and Social Survey	1-26
1-3-1-8 Impact Assessment.....	1-30
1-3-1-9 Cost for Mitigation Measures and Implementation of Mitigation Measures.....	1-35
1-3-1-10 Monitoring Plan	1-40
1-3-1-11 Stakeholder Meeting	1-40
1-3-1-12 Baseline Survey.....	1-41
1-3-2 Land Acquisition and Resettlement	1-45
1-3-2-1 Necessity of Land Acquisition and Resettlement.....	1-45
1-3-2-2 Framework of Land Acquisition and Resettlement.....	1-46
1-3-2-3 Magnitude and Scope of Land Acquisition and Resettlement	1-55
1-3-2-4 Measures of Comparison and Assistance	1-57
1-3-2-5 Grievance Redress Mechanism	1-60
1-3-2-6 Implementation Structure.....	1-61
1-3-2-7 Implementation Schedule.....	1-63
1-3-2-8 Budget and Source	1-63
1-3-2-9 Monitoring Structure of the Proponent	1-64
1-3-2-10 Public Participation	1-66

CHAPTER 2	CONTENTS OF THE PROJECT	2- 1
2-1	Basic Concept of the Project	2- 1
2-1-1	Upper Objective and Project Objective	2- 1
2-1-2	Scope of the Requested Japanese Assistance	2- 1
2-2	Outline Design of the Japanese Assistance	2- 2
2-2-1	Design Policy (Construction Plan).....	2- 2
2-2-2	Basic Plan	2- 3
2-2-2-1	Design Criteria	2- 3
2-2-2-2	Geometric Design	2- 3
2-2-2-3	Cross Section Component.....	2- 4
2-2-2-4	Pavement Design.....	2- 5
2-2-2-5	Intersection Plan.....	2- 9
2-2-2-6	Road Drainage System.....	2-15
2-2-2-7	Ancillary Facility of Road.....	2-17
2-2-3	Outline Design Drawing	2-18
2-2-4	Implementation Plan	2-97
2-2-4-1	Implementation Policy	2-97
2-2-4-2	Implementation Conditions	2-98
2-2-4-3	Scope of Works	2-100
2-2-4-4	Consultant Supervision	2-101
2-2-4-5	Quality Control Plan	2-103
2-2-4-6	Procurement Plan	2-104
2-2-4-7	Operation Guidance Plan	2-106
2-2-4-8	Soft Component (Technical Assistance) Plan	2-106
2-2-4-9	Implementation Schedule.....	2-106
2-2-5	Greenhouse Gas (GHG) Mitigation Plan.....	2-107
2-2-5-1	GHG Mitigation Estimation Method	2-107
2-2-5-2	Input Data.....	2-107
2-2-5-3	CO ₂ Emission Estimate	2-108
2-3	Obligations of Recipient Country	2-109
2-4	Project Operation Plan	2-110
2-5	Project Cost Estimation.....	2-111
2-5-1	Initial Cost Estimation	2-111
2-5-2	Operation and Maintenance Cost.....	2-112
CHAPTER 3	PROJECT EVALUATION	3- 1
3-1	Preconditions.....	3- 1
3-2	Necessary Inputs by Recipient Country	3- 1
3-3	Important Assumptions	3- 1
3-4	Project Evaluation.....	3- 1

3-4-1	Relevance.....	3- 1
3-4-2	Effectiveness.....	3- 2

[Appendices]

1. Member List of the Study Team
2. Survey Schedule
3. List of Parties Concerned
4. Minutes of Discussions (M/D)
5. Technical Note
6. Environment and Social Consideration
7. Design Data



Location Map



Perspective (Road Section)



Perspective (Stockton Bridge Section)

List of Figures & Tables

< Figure >		Page
Figure 1.3-1	Population Distribution along the Project Road.....	1- 4
Figure 1.3-2	Land Use	1- 5
Figure 1.3-3	Tentative Boundary of Mesurado Wetland.....	1- 6
Figure 1.3-4	Procedure to Obtain ESIA License.....	1-10
Figure 1.3-5	Organization Chart of EPA.....	1-14
Figure 1.3-6	The Existing Somalia Drive and Proposed Alternatives	1-15
Figure 1.3-7	Location of Each Survey	1-41
Figure 1.3-8	Organizational Chart for the implementation of the Resettlement Action Plan	1-62
Figure 2.2-1	Standard Cross Section.....	2- 5
Figure 2.2-2	Cracking Ratio and Pavement Modified Method.....	2- 9
Figure 2.2-3	Lane Configuration and Signal Phasing (Free Port Intersection).....	2-10
Figure 2.2-4	Lane Configuration and Signal Phasing (New Georgia Intersection)	2-11
Figure 2.2-5	Lane Configuration and Signal Phasing (Bardnesville Intersection)	2-11
Figure 2.2-6	Lane Configuration and Signal Phasing (Neezoe Intersection)	2-12
Figure 2.2-7	Lane Configuration and Signal Phasing (72nd Intersection)	2-13
Figure 2.2-8	Plan of Intersection Flow	2-14
Figure 2.2-9	Intersection Evaluation Index.....	2-14
Figure 2.2-10	Rain Fall Data in Monrovia.....	2-98
< Table >		
Table 1.3-1	Tide (2015 – August 2016).....	1- 7
Table 1.3-2	Project/Activity which ESIA is required.....	1- 8
Table 1.3-3	Draft Standard of Ambient Air Quality in Liberia and the Standard of WHO	1-12
Table 1.3-4	Draft Standard of Water Quality Standard of SW-1 in Liberia and the Standard of WHO	1-13
Table 1.3-5	Draft Standard of Noise in Liberia and the Standard of IFC.....	1-13
Table 1.3-6	Vibration Standard of Noise in Ghana	1-14
Table 1.3-7	The Comparison between the Propose Project Plan, Altenative-1, -2, -3 and No-Action	1-17
Table 1.3-8	Scoping for the Project.....	1-20
Table 1.3-9	TOR of Environmental and Social Survey	1-24
Table 1.3-10	Result of Each Environmental and Social Survey.....	1-26
Table 1.3-11	Impact Assessment based on the Result of Survey	1-30
Table 1.3-12	Expected Mitigation Measures and their Cost Necessary for Implementation	1-35
Table 1.3-13	Monitoring Plan	1-40
Table 1.3-14	Detail of the Ambient Air Quality Survey	1-42
Table 1.3-15	Result of the Ambient Air Quality Survey	1-42

Table 1.3-16	Detail of Water Quality Survey	1-43
Table 1.3-17	Result of Water Quality Survey.....	1-43
Table 1.3-18	Detail of Noise & Vibration Survey	1-44
Table 1.3-19	Result of Noise Survey.....	1-44
Table 1.3-20	Comparison between Liberian Legislations and JICA Guidelines for Environmental and Social Considerations, 2010	1-49
Table 1.3-21	Population, Gender of PAPs.....	1-56
Table 1.3-22	Structure Type of Occupied Structures.....	1-56
Table 1.3-23	Entitlement Matrix for the Project	1-58
Table 1.3-24	Grievance Redress Mechanism in Liberia.....	1-60
Table 1.3-25	Member of Grievance Redress Committee (Draft)	1-61
Table 1.3-26	Proposed Schedule of Implementation.....	1-63
Table 1.3-27	Budget for the Implementation of Resettlement Action Plan.....	1-63
Table 1.3-28	Criteria and Indicators for Internal Monitoring.....	1-64
Table 1.3-29	Criteria and Indicators for External Monitoring.....	1-66
Table 1.3-30	Outline of the Stakeholder Meetings.....	1-67
Table 2.2-1	Road Segmentation	2- 4
Table 2.2-2	Result of Traffic Survey and Traffic Forecast	2- 6
Table 2.2-3	The Comparison of the Design Load	2- 6
Table 2.2-4	Result of Pavement Structure Design.....	2- 8
Table 2.2-5	Standard Properties of Thermoplastic Resin Elastomer Asphalt.....	2- 8
Table 2.2-6	Saturation Flow Rate and VCR (Free Port Intersection).....	2-11
Table 2.2-7	Saturation Flow Rate and VCR (New Georgia Intersection)	2-11
Table 2.2-8	Saturation Flow Rate and VCR (Bardnesville Intersection)	2-12
Table 2.2-9	Saturation Flow Rate and VCR (Neezoe Intersection).....	2-12
Table 2.2-10	Saturation Flow Rate and VCR (72nd Intersection).....	2-13
Table 2.2-11	Comparison Study for Surface Drainage System.....	2-16
Table 2.2-12	The Location of the Flow End of Drainage.....	2-17
Table 2.2-13	Classification of Connecting Road.....	2-18
Table 2.2-14	Undertaking of the Both Government.....	2-100
Table 2.2-15	Quality Control Plan for Concrete Works	2-103
Table 2.2-16	Quality Control Plan for Earth & Pavement Works	2-103
Table 2.2-17	Procurement Plan for Major Materials.....	2-104
Table 2.2-18	Procurement Plan for Major Equipment	2-105
Table 2.2-19	Implementation Schedule	2-106
Table 2.2-20	CO ₂ Emission Factors [g-CO ₂ /km] for Vehicle Types.....	2-107
Table 2.2-21	Average Travel Speed [km/hr]	2-108
Table 2.2-22	Average Daily Traffic Vehicle Volume • Distance [Nos. • km].....	2-108
Table 2.2-23	Annual CO ₂ Emission at Three Sections [tons/year].....	2-108
Table 2.5-1	Maintenance Work and Annual Cost.....	2-112

Abbreviations

AASHTO	:	Amirian Association of State Highway and Transportation Officials
CBR	:	California Bearing Ratio
CO	:	Carbon Monoxide
CO ₂	:	Carbon Dioxide
dB	:	Decibel
DO	:	Dissolved Oxygen
ECOWAS	:	Economic Community of West African States
EPA	:	Environmental Protection Agency
ESAL	:	Equivalent Single Axle Load
ESIA	:	Environmental and Social Impact Assessment
GIZ	:	Gesellschaft für Internationale Zusammenarbeit
GNI	:	Gross National Income
GoL	:	Government of Liberia
IFC	:	International Financial Corporation
IIU	:	Infrastructure Implementation Unit
JICA	:	Japan International Cooperation Agency
L.C	:	Liberian Constitution
LRPRC	:	Liberia Refugee Repatriation and Resettlement Commission
MCC	:	Monrovia City Corporation
MHSW	:	Ministry of Health and Social Welfare
MIA	:	Ministry of Internal Affairs
M.M.L	:	Minerals and Mining Law
MLMI	:	Ministry of Lands, Mines and Energy
MOF	:	Ministry of Finance
MPW	:	Ministry of Public Works
NO ₂	:	Nitrogen Dioxide
NTA	:	National Transit Authority
OP	:	Operational Policy
PAPs	:	Project Affected Persons
PAHs	:	Project Affected Households
PCC	:	Paynesville City Corporation
PCU	:	Passenger Car Unit
RAP	:	Resettlement Action Plan
RIS	:	Information Sheet on Ramsar Wetlands
ROW	:	Right of Way
RPM	:	Respirable Particulate Matter
SO ₂	:	Sulfur Dioxide
SPM	:	Suspended Particulate Matter
SS	:	Suspended Solids
TOR	:	Terms of Reference
USAID	:	United States Agency for International Development
USD	:	United State Dollars
WB	:	World Bank
WHO	:	World Health Organization

CHAPTER 1 BASIC CONCEPT OF THE PROJECT

1-1 Project Background

Liberia, after more than 10 years from the internal conflict occurred in 2003, the rehabilitation and the reconstruction are underway. In the Monrovia metropolitan area the population increase due to the flow of returnees is salient and the rehabilitation and improvement of city infrastructure is an urgent task. Especially, in many places of the city area, traffic congestion is observed due to the increase of traffic volume, therefore, measures such as improvement of the roads are necessary. The government of Liberia (GoL) formulated the Economic Stabilization and Recovery Plan (ESRP) for the economic and social restoration after the outbreak of Ebola. In the aforementioned plan, the government of Liberia recognized that the delay of infrastructure development led to the delay in the provision of public services including medical services. The government of Liberia places the transport and traffic sector as one of the most urgent issues to be tackled in the future.

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The objective of this survey is to examine the necessity and relevance of the Project in detail, elaborate outline design and implementation plan and estimate the Project implementation cost.

1-2 Natural Conditions

The republic of Liberia is located at south-west of West Africa and the in the north latitude 5° . Territory is 111 thousands sq.km and bordered on the Ivory Coast in east, Guinea in north, Sierra Leone in west, the Atlantic Ocean in south. Regarding topography, High mountain of 4,500m in altitude is located in north-west area, the altitude become lower abruptly to the seaside, the tropical jungle is located in the seaside.

The project area of Greater Monrovia is located the seaside in the center of Liberia, there are the Mesurad wetland which is registered under the Ramsar Convention for protection of water fowl in the south side of Somalia Drive.

The climate in Monrovia city is characterizes by monsoon (rainy) season and dry season. The monsoon season extends from May to October and the dry season is from November to April. Annual precipitation reaches as much as 6,260mm.

Terrestrial formation is composed of the Edina Sandstone, Payneville Sandstone and Fluvial & Deltac Deposits.

1-3 Environmental and Social Considerations

1-3-1 Environmental Impact Assessment

1-3-1-1 Outline of the Project Component Affecting Environment and Society

According to the JICA Guidelines for Environmental and Social Considerations, 2010 (JICA Guidelines), the Project is classified into Category “B” based on the reasons the Project is not large-scale road project, large-scaled involuntary resettlement and logging is not required and their potential adverse impacts on the environment and society are not serious.

The outline of the Project components affecting the environment and society around the Project site is as follows

- Renovation of the existing 2-lane Somalia Drive (Total distance: 13.2km from Free Port Is. to before Red Light Is.)
- Renovation of intersections including Free Port Is.
- Improvement of drainage facility
- Development of stopping lane and bus stops
- Installation of sign boards, road markings and pedestrian crossings

1-3-1-2 Environment and Society

(1) Census

Based on the 2008 census survey that GoL was carried out, it referred to from the next section. As a result of hearing GoL, census has been carried out once every 10 years, the next is planned in 2018.

(2) Population

Based on the Census Survey carried out by GoL in 2008, the population along the Project road with 1 km wide each side turned out to be 307,537, which accounts for about 32% of the total population in Greater Monrovia. The population density along the Project road is about 10,000 per km². The highest population community is Chicken Soup Factory which is located almost center of the Project road.

According to the World Bank study is 4,503,438 people in Liberia (2015), According to the United Nations study is the 4,615,000 people in Liberia (2016).

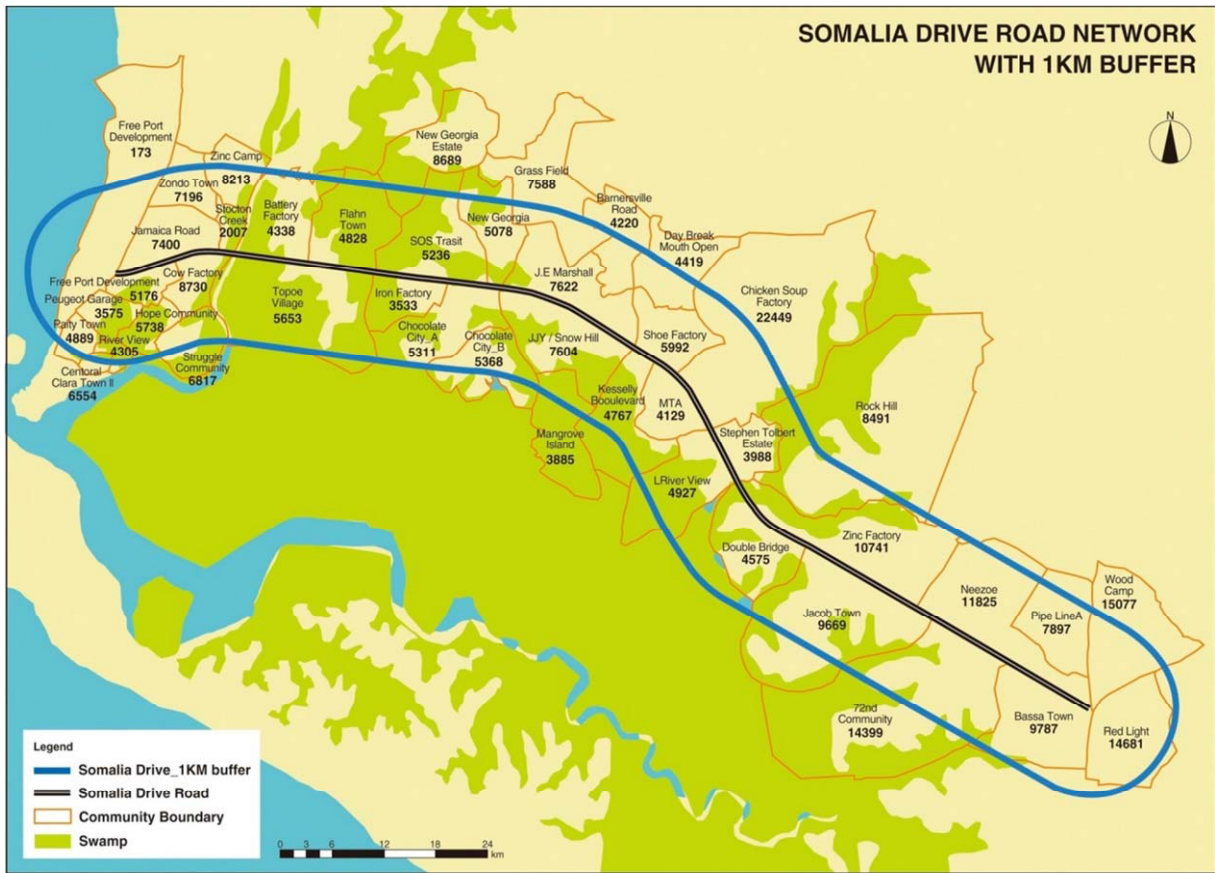


Figure 1.3-1 Population Distribution along the Project Road

(3) Land Use

The land along the Project road is mainly used for commercial facilities such as kiosk, market, gas station, business center etc. and factory such as paint, brick, furniture etc. Also, there are public facilities such as school, church and hospital. There are National Transit Authority (NTA) of the yard and parking stop of small buses and taxis. Residential area has spread to the hinterland of the wayside region.

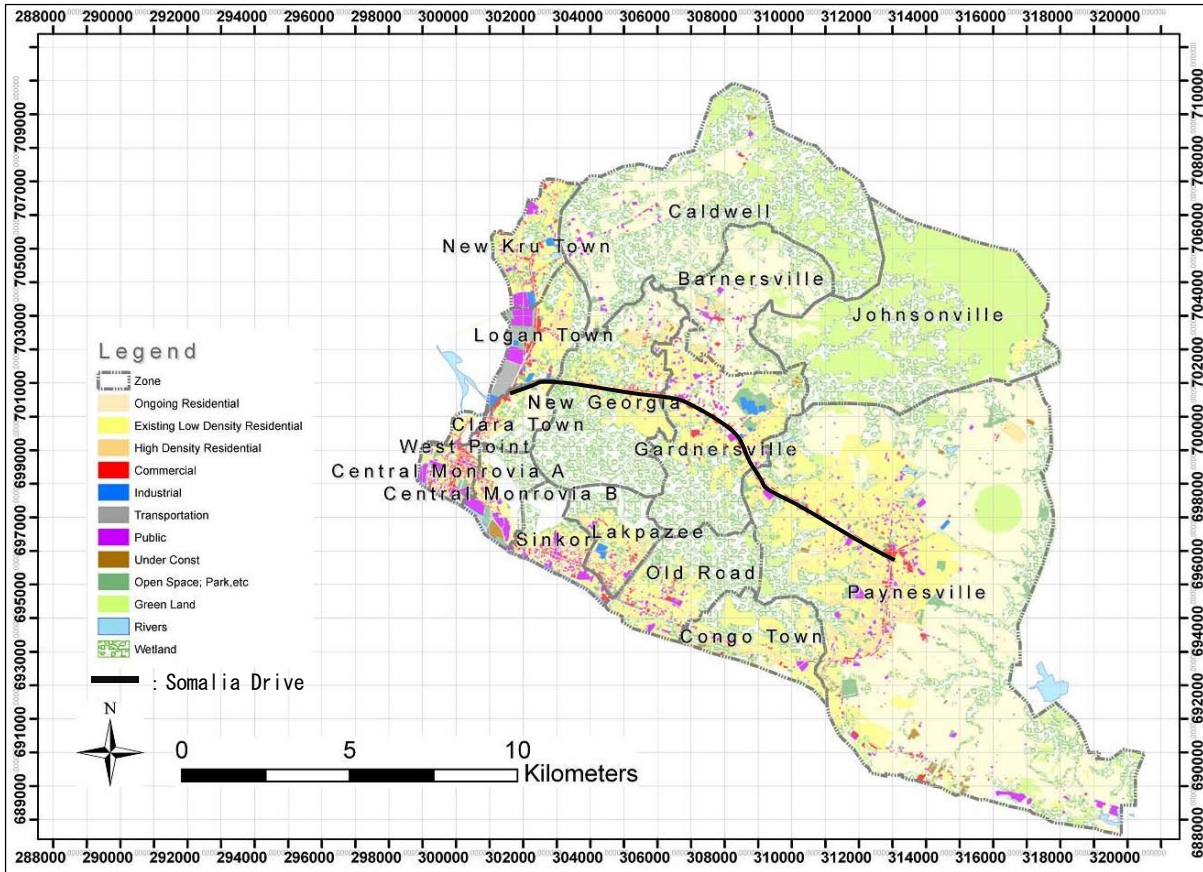


Figure 1.3-2 Land Use

(4) Natural Environment

Topography and Geography

The Project road is located in north side of the Mesurado Wetland and almost flat area. Terrestrial formation is composed of the Edina Sandstone, Paynesville Sandstone and Fluvial & Deltac Deposits.

Climate

The climate in Monrovia city is characterizes by monsoon (rainy) season and dry season. The monsoon season extends from May to October and the dry season is from November to April. Annual precipitation reaches as much as 6,260mm.

Natural Reserve Area

No natural reserve area does exist around the Project road.

Wetlands designated as the Ramsar Convention

The Project road is close to the Mesurado Wetland designated as the Ramsar Convention. According to “Information Sheet on Ramsar Wetland (RIS), the area of the Mesurado Wetland is about 6,760 ha, however the exact boundary of the Medurado Wetland has not been determined.

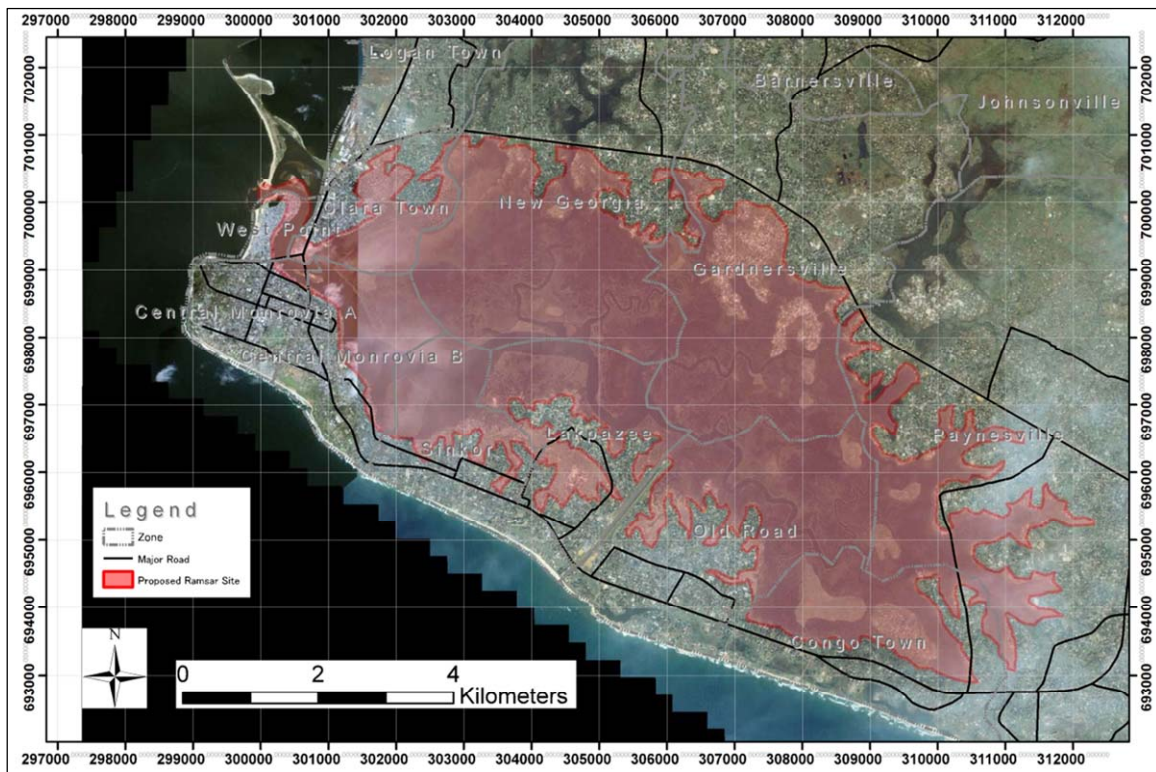


Figure 1.3-3 Tentative Boundary of the Mesurado Wetland

Precious Spices and their Habitat

There are mangrove trees ranging in the Mesurado Wetland. However, these mangrove trees have been used for construction materials and fire woods by local residents. Birds such as spoonbill, curlew sandpiper, etc. inhabit the mangrove forests.

River/Lake/Coast

Water flows into the Mesurado Wetland through mainly two creeks, Stockton Creek and Waner Creek, and flows out to the sea through Mesurado Wetland.

Tide

Mesurado wetland is connected to the sea, always tide has occurred. In 2015 - August 2016, highest(high tide) is 1.51m, and the lowest(Low tide) was a -0.04m.

Table 1.3-1 Tide (2015 - August 2016)

	High tide	Low tide	Average (high tide)	Average (low tide)
January 2015	1.48	-0.01	1.17	0.28
February 2015	1.51	-0.02	1.18	0.27
March 2015	1.49	0.00	1.17	0.28
April 2015	1.43	-0.01	1.17	0.28
May 2015	1.38	0.01	1.16	0.28
June 2015	1.35	0.07	1.16	0.29
July 2015	1.40	0.06	1.17	0.28
August 2015	1.49	0.00	1.19	0.26
September 2015	1.47	-0.02	1.19	0.26
October 2015	1.43	-0.04	1.19	0.26
November 2015	1.42	-0.01	1.17	0.28
December 2015	1.39	0.04	1.16	0.29
2015	1.51	-0.04	1.17	0.27
January 2016	1.39	0.07	1.16	0.29
February 2016	1.45	0.03	1.17	0.28
March 2016	1.47	0.02	1.17	0.28
April 2016	1.46	-0.02	1.17	0.27
May 2016	1.43	-0.04	1.17	0.27
June 2016	1.42	-0.01	1.17	0.27
July 2016	1.41	0.04	1.17	0.28
August 2016	1.42	0.06	1.18	0.28
2016	1.47	-0.04	1.17	0.28

(5) Socio-economic Condition

Involuntary Resettlement

As a result of the socio-economic survey carried out from February to June 2016 for the preparation of Resettlement Action Plan (RAP), 26 Project Affected Households (PAHs), 37 Project Affected Persons (PAPs) and 25 Projected Affected Structures were confirmed in the Project area.

Land Acquisition

This project, from Phase 1 in the same manner as in the existing road edge center is 75 feet by MPW, are specified in the ROW. However, in the 75 feet ROW, a great impact on the Project Affected Persons (PAPs) and MPW is unable to ensure the budget needed for land acquisition. Therefore, for the purpose of minimizing the PAPs, it is a 50feet of the minimum required land acquisition range in the project implementation has been agreed between the MPW.

Public Facility

There are 17 schools, 1 vocational school, 9 clinics/hospitals, 24 churches and 2 multi-purpose play fields along the Project road.

Local Economy and Industry

There are a lot of kiosks/vendors, tentative structures and factories such as paint, furniture and car repair shops in operation along the Project road. Also, there used to be a lot of factories such as battery production, zinc production and food processing by the civil war in 1980' however, those factories were closed down and no plan to be restarted at this moment.

Cultural Heritage

No historically and culturally important heritage does exist along the Project road.

1-3-1-3 System and Organization of Environmental and Social Consideration in Liberia

(1) Environmental and Social Impact Assessment Procedural Guidelines

Outline

Environmental Impact Assessment Procedural Guidelines, 2006 obliges a project opponent to carry out Environmental and Social Impact Assessment (ESIA) and submit the ESIA report to EPA. Projects/Activities which ESIA is required are classified into 26 categories shown in Table 1.3-2 and the Project corresponds with "13. Building and Civil Engineering Industry".

Table 1.3-2 Project/Activity which ESIA is required

No.	Project/Activity
1.	Agriculture
2.	Livestock and Range Management
3.	Forestry Activity
4.	Fisheries Activity
5.	Wildlife
6.	Tourism and Recreational Development
7.	Energy Industry
8.	Petroleum Industry
9.	Food and Beverage Industry
10.	Textile Industry
11.	Leather Industry
12.	Wood, Pulp and Paper Industry
13.	<i>Building and Civil Engineering Industry</i>
14.	Chemical Industry
15.	Extractive Industry
16.	Non-metallic Industry (Products)
17.	Metal and Engineering Industry
18.	Waste Treatment and Disposal
19.	Water Supply
20.	Health Projects
21.	Land Reclamation and Land Development
22.	Multi-Sectorial Project

No.	Project/Activity
23.	Trade: Importation and Exportation
24.	Urban and Rural Development
25.	Policy and Program
26.	General

Procedure of Environmental and social Impact Assessment

The detail procedure of ESIA is shown in Figure 1.3-4. Since the Project is to reconstruct the existing Somalia Drive, ESIA must be carried out and ESIA report for the Project report shall be prepared based on the detailed site survey and road design, and submitted to EPA. In addition, the ESIA includes RAP because involuntary resettlement is required.

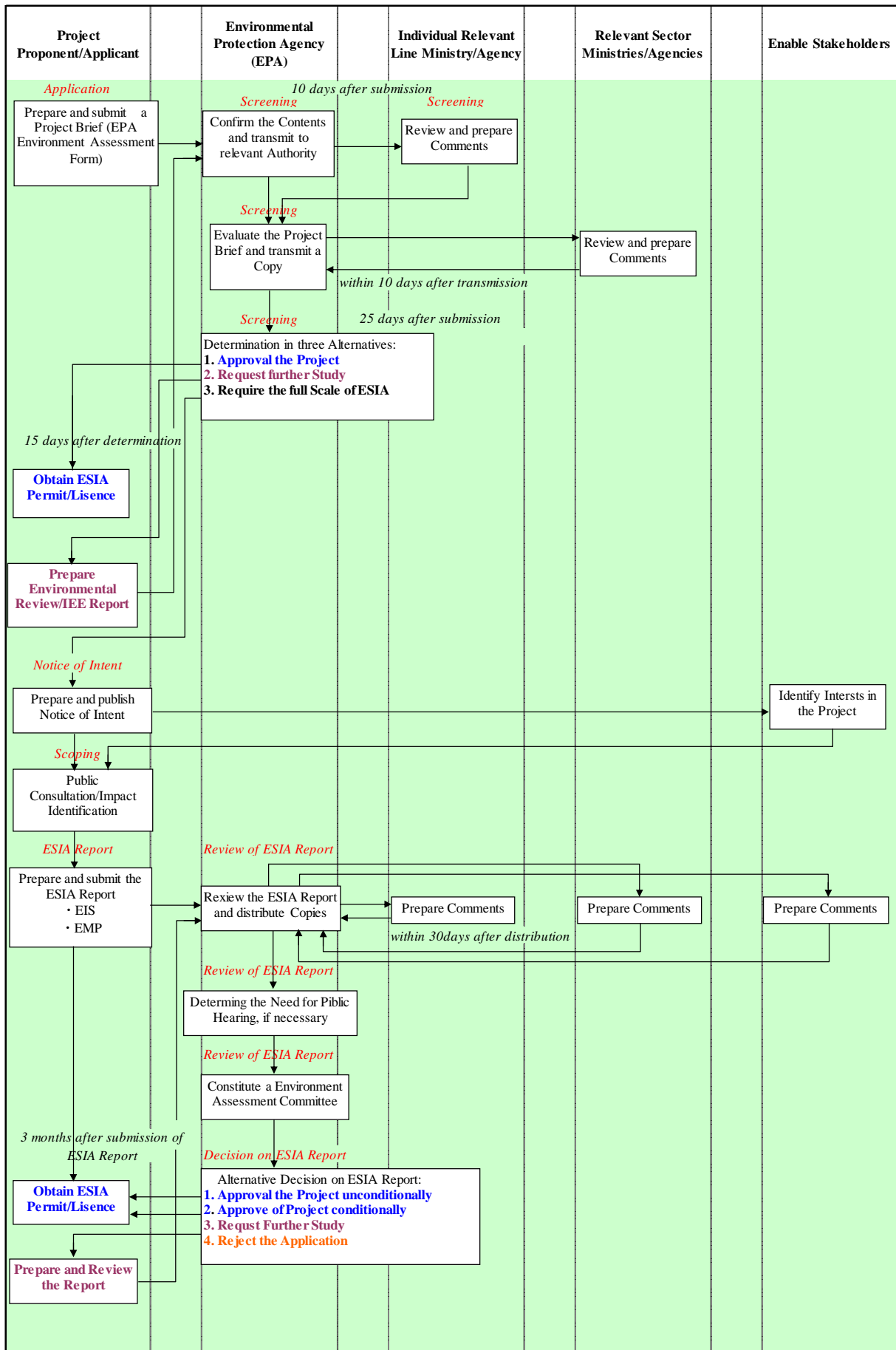


Figure 1.3-4 Procedure to Obtain ESIA License

(2) Environmental Law and Regulation

National Environment Policy (2003)

This policy aims at improving the physical environment, quality of life and coordination between economic development, growth and sustainable management of natural resources.

Key objectives of the policy includes;

- The systematic and logical framework with which to address environmental issues;
- Benchmarks for addressing environmental problems in the medium to long-term;
- Context for financial/donor support to particular sectors and non-sector;
- The means for generating information and awareness on environmental problems; and
- To demonstrate Liberia's commitment to sustainable management of the environment.

(3) National Wetland Policy in Liberia (Draft)

This draft policy which aims at preservation of five wetlands designated as Ramsar Convention in Liberia including the Mesurado Wetland. However the policy is still under reviewing process. Key policies include;

- The recognition that there is direct link between wetlands and wetland functions to their surroundings, particularly aquatic ecosystems, and so to ensure wetland conservation for sustainable development there is a need for an integrated ecosystem approach;
- Continuous scientific researches and the development of expertise on wetlands in Liberia is the basis for achieving wetland conservation;
- The health and health needs of Liberians depend greatly on wetlands and their functions;
- Wetland conservation is greatly achieved through a coordinated, cooperative approach involving all relevant stakeholders, including local people and the private sector;
- The need to integrate wetland issues in all sectors to ensure conservation outcomes;
- Recognition of the Liberian Government's role in advocating for the conservation of wetlands, while respecting the rights of the local people to land ownership and the decision making process;
- The need for basic change in the attitude and perceptions of Liberians regarding wetlands through communication and education programs at national and local levels; and
- Wetland development is on the basis of environmental impact assessment.

(4) Environmental Regulation

Ambient Air Quality Standard (Draft)

The draft standard for ambient air quality is prepared at this moment however, it is not in force yet. EPA recommends using this draft standard for the ambient air quality assessment. The draft standard and the standard of World Health Organization (WHO) for the purpose of reference are shown in Table 1.3-3.

Table 1.3-3 Draft Standard of Ambient Air Quality in Liberia and the Standard of WHO

Pollutants	Time-weighted Average	Concentration in Ambient Air			
		Industrial Areas	Residential, Rural & Other Areas	Sensitive Areas	WHO*1)
Sculpture	Annual Average*	80 µg/m ³	60 µg/m ³	15 µg/m ³	-
Dioxide (SO ₂)	24 hours**	120 µg/m ³	80 µg/m ³	30 µg/m ³	20 µg/m ³
Oxides of Nitrogen (NO ₂)	Annual Average*	80 µg/m ³	60 µg/m ³	15 µg/m ³	40µg/m ³
	24 hours**	120 µg/m ³	80 µg/m ³	30 µg/m ³	200µg/m ³
Suspended Particulate Matter (SPM)	Annual Average*	360 µg/m ³	140 µg/m ³	70 µg/m ³	-
	24 hours**	500 µg/m ³	200 µg/m ³	100 µg/m ³	-
Respirable Particulate Matter (RPM) (size less than 10 microns)	Annual Average*	120 µg/m ³	60 µg/m ³	50 µg/m ³	20µg/m ³
	24 hours**	150 µg/m ³	100 µg/m ³	75 µg/m ³	50µg/m ³
Lead (Pb)	Annual Average*	1.0 µg/m ³	0.75 µg/m ³	0.50 µg/m ³	0.50 – 1.0 µg/m ³
	24 hours**	1.5 µg/m ³	1.00 µg/m ³	0.75 µg/m ³	-
Ammonia	Annual Average*	0.1 mg/ m ³	0.1 mg/ m ³	0.1 mg/m ³	-
	24 hours**	0.4 mg/ m ³	0.4 mg/m ³	0.4 mg/m ³	-
Carbon Monoxide (CO)	8 hours**	5.0 mg/m ³	2.0 mg/m ³	1.0 mg/ m ³	1.0 µg/m ³
	1 hour	10.0 mg/m ³	4.0 mg/m ³	2.0 mg/m ³	3.0 µg/m ³
*	Annual Arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval.				
**	24 hourly/8 hourly values should be met 98% of the time in a year. However, 2% of the time, it may exceed but not on two consecutive days.				

Remark: *1):WHO Ambient Air Quality Standard

Water Quality Standard (Draft)

The draft standard for water quality is prepared at this moment however, it is not in force yet. EPA recommends using this draft standard for water quality assessment. The draft standard classifies water quality into five categories depending on land use and then establishes each standard by the categories. The Mesurado Wetland is ecologically sensitive area therefore Category SW-I is applied for water quality assessment of the Project. The draft standard in Liberia and the standard of WHO for the purpose of reference are shown in Table 1.3-4

- ✓ SW-I : Salt Pans, Shell Fishing, Mari-culture and Ecologically Sensitive Zone
- ✓ SW-II : Bathing, Contact Water Sports and Commercial Fishing
- ✓ SW-III : Industrial Cooling, Recreating and Aesthetics
- ✓ SW-IV : Harbor
- ✓ SW-V : Navigation and Controlled Waste Disposal

Table 1.3-4 Draft Standard of Water Quality Standard of SW-1 in Liberia and the Standard of WHO

Type of Water			SW-I (Ecologically Sensitive Zone)	WHO* ¹⁾
Parameter	pH		6.5 - 8.5	6.5 – 8.5
	Dissolved Oxygen	(mg/l)	5.0	5.0
		(%)	60	-
	Color and Odor		No noticeable color or offensive odor	-
	Floating Matters		Nothing obnoxious or detrimental for use purpose	-
	Suspended Solids		None from sewage or industrial waste origin	-
	Oil and Grease		(mg/l) 0.10	0.1
	Heavy Metals	Mercury (Hg)	(mg/l) 0.01	0.006
		Lead (Pb)	(mg/l) 0.01	0.01
		Cadmium (Cd)	(mg/l) 0.01	0.003

Remark: *1): WHO Guidelines for Drinking-water Quality, 4th Edition

Noise Standard (Draft) and Vibration

Based on hearing survey to EPA, the draft standard for noise is prepared at this moment however, that for vibration is not prepared. EPA recommends using the draft standard for noise and Ghana standard for vibration for noise and vibration assessment of the Project. The draft noise standard in Liberia and the standard of International Financial Corporation (IFC) for the purpose of reference are shown in Table 1.3-5. Table 1.3-6 shows the Ghana standard for vibration.

Table 1.3-5 Draft Standard of Noise in Liberia and the Standard of IFC

Facility		Noise limits B (A) (Leg)	
		DAY 06:00 – 14:00	NIGHT 22:00 – 06:00
A	Any building used as hospital, convalescence home, home for the aged, sanatorium and institutes of higher learning, conference rooms, public library, environmental and recreational site	45	35
B	Residential buildings	50	35
C	Mixed residential (with some commercial and entertainment)	50	35
D	Residential + industry or small-scale production + commerce	60	50
E	Industry	70	60
IFC Guidelines* ¹⁾	Residential	55	45
	Industrial	70	70

Remark: General Environmental Guideline, 2007

Table1.3-6 Vibration Standard of Noise in Ghana

Zone	Description of Areas of Noise Reception	Permissible Noise Level in DB(A)	
		DAY 06:00 –1-4:00	NIGHT 22:00 – 06:00
A	Residential areas with low or infrequent transportation	55	48
B1	Educational (school) and health (hospital, clinic) facilities	55	50
B2	Areas with some commercial or light industry	60	55
C1	Areas with some light industry, places of entertainment or public assembly, and places of worship located in this zone.	65	60
C2	Predominantly commercial areas	75	65
D	Light industrial, commercial areas	70	60
E	Predominantly heavy industrial areas	70	70

(5) Environmental Protection Agency (EPA)

EPA was established in 2004 and is in charge of environmental administration in Liberia. EPA is under presidential direct control, and only authority to coordinate, instruct and supervise all projects related to environment in Liberia. EPA has updated the organization to 2010-2011. The organization chart of EPA is shown in Figure1.3-5.

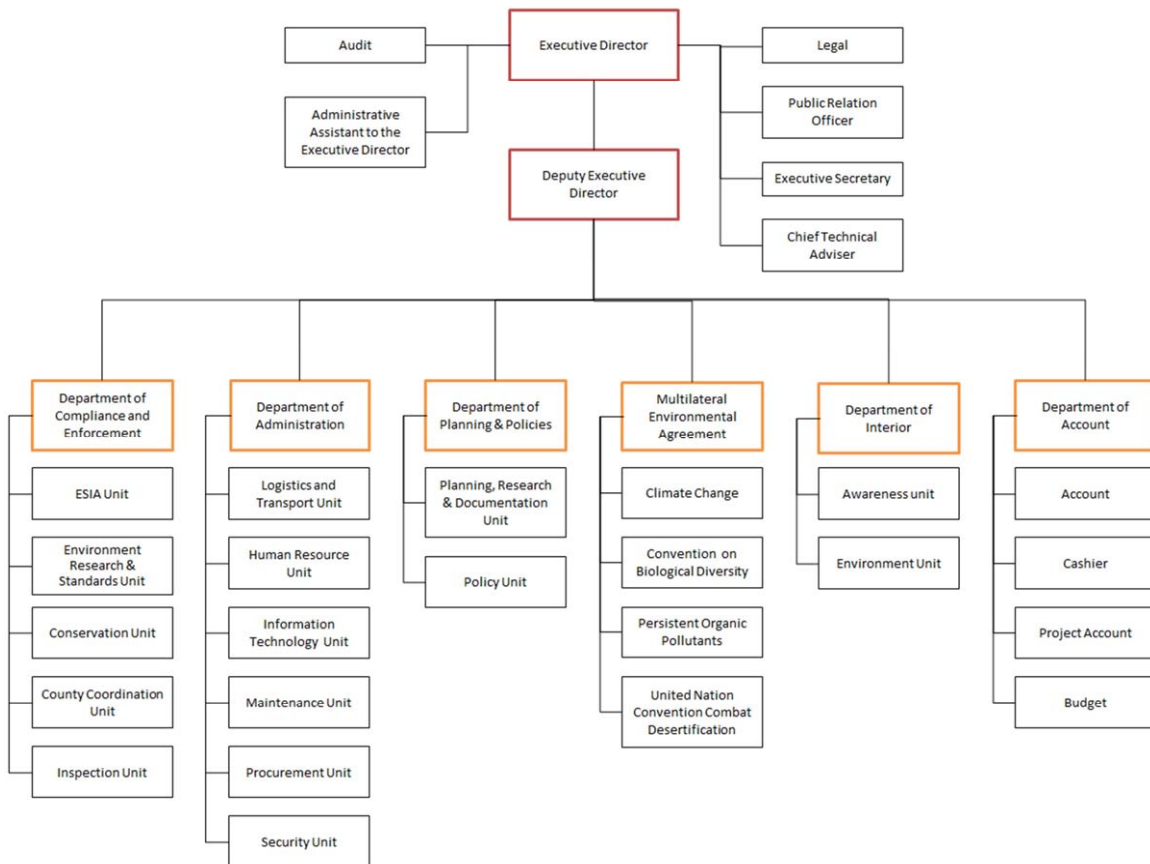


Figure 1.3-5 Organization Chart of EPA

1-3-1-4 Comparison of Alternatives

(1) Comparison of Alternative

Figure 1.3-6 shows The Existing Somalia Drive and Proposed Alternatives.

Table 1.3-7 shows the comparison of this proposed Project Plan, Alternative-1,-2,-3 and No-Action.

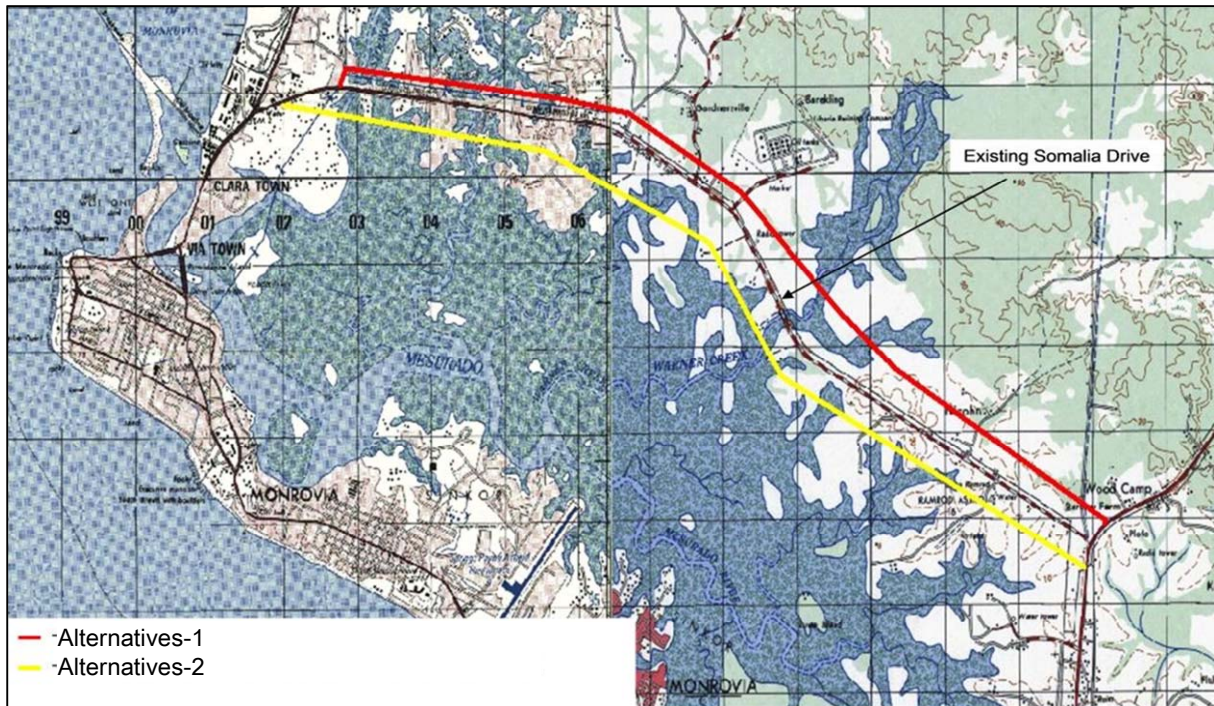


Figure 1.3-6 The Existing Somalia Drive and Proposed Alternatives

① Proposed Project Plan

This proposed project plan consists of the expansion of the entire existing Project road, 13.2km by using ROW, 50 feet. This project has a large impact on kiosks/vendors and tentative structures in operation in ROW, 50 feet, however, the impact on involuntary resettlement of permanent structures is small because most of the ROW has already been acquired by GoL. The project cost is relatively small due to only one bridge construction and then the construction period is short.

② Alternative-1

This alternative considers constructing a new 2-lane motor road north of the existing Somalia Drive (red route). It would be 11.5 kilometers of road connected to the Monrovia-Kakata Highway, about 375 meters north of the Red Light Intersection. Towards the Freeport of Monrovia, this road will link with the Jamaica Road and connect with the existing Somalia Drive. It is only 1.25 kilometers of the Somalia Drive that will be upgraded into a 4-lane road.

③ Alternative-2

This alternative considers constructing a new 2-lane motor road south of the existing Somalia Drive (yellow route). It would be a 12.8 kilometers road connected to the Monrovia-Kakata Highway, about 325 meters south of the Red Light Intersection. It connects with the United Nations Drive at about 150 meters south of the Freeport Intersection. This alternative was withdrawn from consideration as it is expected to lead to the involuntary resettlement of many legitimate property owners along that route within the Paynesville and Bushrod Island areas. It is also expected to penetrate a vast portion of the Mesurado wetland, which is a Ramsar projected area.

④ Alternative-3

This alternative was considered for reconstructing the existing 2-lane road using 75 ft. from the median of the new 4-lane road under construction, on the right flank from the Freeport of Monrovia to Red Light. As such, a survey was conducted in 2016 to establish the number of likely PAPs. It was determined from the survey that over 400 residential and commercial structures, occupied by over 1,000 PAPs within the proposed zone would have been affected.

⑤ No-Action Alternative

Under the No-Action Alternative, the short-term environmental impacts identified in the ESIA for the Project would not occur. Conversely, the objectives of the Project would not be met, and easing the traffic problem between the Freeport and Red Light corridor will not be solved. While an alternative scenario may be considered over subsequent years, increase in population in the settlements along the route and the passenger car unit of the road is likely to increase over the years, as predicted. This is going to result in a serious transport problem for the communities and road users and also result into serious social and environmental adverse impacts as well as serious economic damage.

Table 1.3-7 The Comparison between The Propose Project Plan, Alternative-1,-2,-3 and No-Action

Item	Proposed Project	Rating	Alternative-1	Rating	Alternative-2	Rating	Alternative-3	Rating	No Action	Rating
Component	<ul style="list-style-type: none"> Reconstruction of 13.2km existing road 50feet ROW 	—	<ul style="list-style-type: none"> New construction of 11.5km road Expansion of 1.25km existing road 4 new bridges construction 	—	<ul style="list-style-type: none"> New construction of 12.8 km road Expansion of 0.20 km existing road 9 new bridges construction 	—	<ul style="list-style-type: none"> Reconstruction of 13.2km existing road 75feet ROW 	—	—	—
Construction Cost*1	USD 48.8M	-1	USD 90.0M	-2	USD 110.5M	-3	USD 50.2M	-1	—	0
Construction Period	3 year	-1	4.2 year	-3	5 year	-3	3.3 year	-1	—	0
Technical Aspect	<ul style="list-style-type: none"> Easy reconstruction because of existing road 	+2	<ul style="list-style-type: none"> 11.5km new road and 4 new bridges construction may require special construction methods. 	-2	<ul style="list-style-type: none"> Since some bridges require structures over the Mesurado Wetland, special technics are necessary. 	-2	<ul style="list-style-type: none"> Easy reconstruction because of existing road 	+2	<ul style="list-style-type: none"> Easy maintenance Continuous large-scale repair work is necessary because of poor drainage facility. 	+2
Improvement of Traffic Capacity	<ul style="list-style-type: none"> Possible to deal with traffic capacity in 2031. 	+3	<ul style="list-style-type: none"> Possible to deal with traffic capacity in 2031. 	+3	<ul style="list-style-type: none"> Possible to deal with traffic capacity in 2031. 	+3	<ul style="list-style-type: none"> Possible to deal with traffic capacity in 2031. 	+3	<ul style="list-style-type: none"> Impossible to deal with increased traffic demand 	-2
Regional Development	<ul style="list-style-type: none"> Promoted well 	+3	<ul style="list-style-type: none"> Promoted well 	+3	<ul style="list-style-type: none"> Promoted but limited due to the Mesurado Wetland 	+3	<ul style="list-style-type: none"> Promoted well 	+3	<ul style="list-style-type: none"> Due to heavy traffic jam, regional development is limited. 	-2
Obligation of Recipient Country	<ul style="list-style-type: none"> Relocation of water pipes and removal of oil pipelines are necessary. Cost for RAP implementation is mediocre. 	-1	<ul style="list-style-type: none"> Detail survey is necessary to identify utility. Cost for RAP implementation is extremely large. 	-3	<ul style="list-style-type: none"> Detail survey is necessary to identify utility. Cost for RAP implementation is large. 	-3	<ul style="list-style-type: none"> Relocation of water pipes and removal of oil pipelines are necessary. Cost for RAP implementation is larger than the Proposed Project. 	-2	<ul style="list-style-type: none"> No work 	0
Social Consideration	<ul style="list-style-type: none"> Involuntary resettlement for resident is relatively a little. Impact against tentative vendors is large. It is possible to mitigate impact by implementing RAP properly. 	-1	<ul style="list-style-type: none"> Involuntary resettlement for resident is 5 times as large as the proposed project. Impact against tentative vendors is small. 48 ha of land acquisition is necessary. 	-3	<ul style="list-style-type: none"> Involuntary resettlement for resident is 2 times as large as the proposed project. Impact against tentative vendors is small. 53 ha of land acquisition is necessary. 	-3	<ul style="list-style-type: none"> Involuntary resettlement for resident and tentative vendor is large. Impact against tentative vendors is large. It is possible to mitigate impact by implementing RAP properly. 	-3	<ul style="list-style-type: none"> Serious impact will be due to deterioration of existing bridge and road. 	0

Item	Proposed Project	Rating	Alternative-1	Rating	Alternative-2	Rating	Alternative-3	Rating	No Action	Rating
Environmental Consideration	- Impact against water quality, noise & vibration and ecosystem is limited by implementing mitigation measures properly. - Ambient air quality will be almost same level as No action.	-1	- Impact against water quality, noise & vibration and ecosystem is limited by implementing mitigation measures properly. - Ambient air quality will be almost same level as No action.	-1	- Since the alternative is very close to the Mesurado Wetland, large negative impact is expected. - Ambient air quality will be almost same level as No action.	-3	- Impact against water quality, noise & vibration and ecosystem is limited by implementing mitigation measures properly. - Ambient air quality will be almost same level as No action.	-1	- Ambient air quality will deteriorate due to heavy traffic jam.	-2
Evaluation	Very Good	+3	Very Bad	-8	Very Bad	-11	Good	0	Bad	-4

Rating: Significant Positive / Negative Impact : +/-3, Positive /Negative impact : +/-2, Slight Positive / Negative Impact : +/-1, Same Impact : 0
Remark: USD1.00 = JPY119.47

(2) Alternative Study Results

Alternative -1 and Alternative -2 will have significant negative impact on Mesurado wetland and cause large involuntary resettlement. And no-action alternative will not be able to accommodate future traffic volume in 2031. Also, Alternative -3 will cause larger involuntary resettlement than the proposed project.

As shown in Table 1.3-7, the proposed project is evaluated to be the most suitable component in consideration of future traffic capacity, environmental impact, involuntary resettlement.

1-3-1-5 Scoping

The scoping of the Project is shown in Table 1.3-8.

Table 1.3-8 Scoping for the Project

Category	#	Environmental and Social Item	Assessment		Reason of Assessment
			Planning & Construction Stage	Operation Stage	
Pollution Measures	1	Air Quality	B-	B±	<p>Construction Stage : Tentatively air quality is expected to deteriorate because of dust arising from the removal of existing structures and the construction of new roads as well as emission gas arising from construction vehicles.</p> <p>Operation Stage : Due to the increase of traffic volume, emission gas arising from vehicles is expected to affect air quality. Dust arising from traffic is expected to be improved due to the pavement of unpaved roads.</p>
	2	Water Quality	B-	B±	<p>Construction Stage : Water quality is expected to deteriorate due to muddy water during earth work and construction of the bridges. Also, discharged water from construction machinery is expected to contaminate water quality. Moreover residual materials in the abandoned oil pipeline along the Project road are expected to leak when demolishing.</p> <p>Operation Stage : When raining, dust and oil spilled on the road is expected to flow into the rivers. However, erosion by rainwater can be avoided since the rainwater is collected and discharged into the rivers through drainage facilities.</p>
	3	Wastes	B-	D	<p>Construction Stage : Abandoned soil and wastes arising from construction works are expected to generate.</p> <p>Operation Stage : No factor affecting the surrounding environment is expected.</p>
	4	Soil Contamination	B-	D	<p>Construction Stage : Oil spill from the construction machinery and vehicles is expected</p> <p>Operation Stage : No factor affecting the soil around the Project area is expected.</p>
	5	Noise & Vibration	B-	B-	<p>Construction Stage : Noise and vibration arising from the operation of construction machinery and vehicles is expected.</p> <p>Operation Stage : There are easily-influenced facilities such as school, clinic and house along the Project road. Therefore due to the increase of traffic volume and the travel speed of vehicles, noise level is expected to deteriorate.</p>
	6	Subsidence	D	D	No work triggering subsidence is expected.

Category	#	Environmental and Social Item	Assessment		Reason of Assessment
			Planning & Construction Stage	Operation Stage	
	7	Offensive Odor	B-	B-	<p>Construction Stage : Offensive odor by emission arising from construction machinery and vehicles is expected to deteriorate.</p> <p>Operation Stage : Emission arising from vehicles is expected to increase.</p>
	8	Sediment	B-	D	<p>Construction Stage : Muddy water is expected to settle down on the river bed during the construction of the bridges.</p> <p>Operation Stage : No factor affecting sediment is expected.</p>
Natural Environment	9	Protected Areas	B-	C-	<p>Planning Stage : Since the Project road is close to the Medsurad Wetland designated as Ramsar Convention, the construction of roads and bridges are expected to affect the Mesurado Wetland. In addition, there is possibility that other protected areas exist along the Project road.</p> <p>Construction Stage : It is expected that construction materials are ill-maintained then it is flown into the Mesurado Wetland and rivers by rainwater.</p> <p>Operation Stage : Due to the increase of convenience around the Project road, indirect impact such as estate development etc., is expected to increase.</p>
	10	Ecosystem	B-	C-	<p>Planning Stage : Endangered species are expected to exist around the Project road.</p> <p>Construction Stage : Trees within ROW are expected to be cut. Also, habitat loss around the Project road is expected.</p>
	11	Hydrology	D	D	No work triggering hydrology is expected.
	12	Topography & Geology	B-	D	Construction Stage : Inappropriate earth cut and earth fill are expected to be implemented. Also, disorganized cutout from the quarries is expected.
Social	13	Resettlement	A-	B-	<p>Planning Stage : Measures to minimize involuntary resettlement are not expected to be taken. Also, if involuntary resettlement is unavoidable, Resettlement Action Plan (RAP) must be prepared. However, RAP is not expected to be in accordance with JICA Guidelines and WB Guideline (OP 4.12). Moreover the resettlement is not expected to be implemented in line with the RAP approved by EPA.</p> <p>Construction & Operation Stage : Appropriate monitoring works are not expected to be implemented.</p>
	14	The Poor	B±	B+	Construction Stage : PAPs are expected to include the poor. However, the poor is expected to benefit from the creation of new jobs arising from the construction works.

Category	#	Environmental and Social Item	Assessment		Reason of Assessment
			Planning & Construction Stage	Operation Stage	
					<u>Operation Stage</u> : Positive impacts such as the improvement of access to social service such as school and clinic are expected because of the development of the Project road.
	15	Ethnic Minority & Indigenous Minority	D	D	No ethnic minority and indigenous minority suffering loss around the Project site do exist.
	16	Local Economy such as Employment and Livelihood etc.	B±	B+	<u>Planning Stage</u> : Due to the involuntary resettlement, employers and/or employees working at vendors and shops in ROW are expected to lose their jobs. <u>Construction Stage</u> : The number of tentative employees engaging in the construction works is expected to increase. <u>Operation Stage</u> : The construction of commercial facilities and factories are expected to increase along the Project road because the traffic congestion will be mitigated. Eventually, employment opportunity is expected to increase.
	17	Land Use and Utilization of Local Resources	B-	B+	<u>Planning Stage</u> : Appropriate land acquisition in line with RAP is not expected to be implemented. Also, local resources are expected to exist. <u>Operation Stage</u> : The land price along the Project road is expected to go up due to the mitigation of traffic congestions.
	18	Water Usage	B-	D	<u>Construction Stage</u> : In case the river water is used, the water usage is expected to be limited due to the inflow of muddy water during construction. Also, water quality of the rivers and well-waters is expected to deteriorate.
	19	Existing Social Infrastructures and Services	B±	B+	<u>Planning Stage</u> : By introducing safety measures, positive impact on existing social infrastructures and services is expected. <u>Construction Stage</u> : Traffic congestion is expected to be heavier near the Project road. <u>Operation Stage</u> : Due to the mitigation of traffic congestion of the Project road, the convenience of surrounding roads is expected to increase.
	20	Social Institutions such as Social Infrastructure and Local Decision-making Institutions	D	D	No factor affecting social institutions and local decision-making institutions is expected due to just the expansion of the existing road.

Category	#	Environmental and Social Item	Assessment		Reason of Assessment
			Planning & Construction Stage	Operation Stage	
	21	Misdistribution of Benefit and Damage	D	D	No factor affecting misdistribution of benefit and damage is expected due to the expansion of the existing road.
	22	Local Conflict of Interests	D	D	No factor affecting local conflict of interests is expected due to the expansion of the existing road.
	23	Cultural Heritage	D	D	No cultural heritage does exist around the Project road.
	24	Landscape	D	B+	<u>Operation Stage</u> : Landscape is expected to be better due to planting trees and grass.
	25	Gender	D	D	No factor affecting gender issue is expected due to the expansion of the existing road.
	26	Right of Children	D	D	No factor affecting right of children is expected due to the expansion of the existing road.
	27	Infectious Diseases such as HIV/AIDS	B-	D	<u>Construction Stage</u> : Infectious diseases such as HIV/AIDS are expected to spread due to the inflow of construction workers into the Project site during construction stage.
	28	Working Condition including Occupational Safety	B-	D	<u>Construction Stage</u> : Working condition including occupational safety for construction workers is expected to deteriorate.
Others	29	Accident	B±	B-	<u>Planning Stage</u> : By introducing safety measures, prevention measures on accident is expected to be promoted. <u>Construction Stage</u> : Accidents during construction works and accidents involving a third person are expected to happen. <u>Operation Stage</u> : The number of accidents is expected to increase due to the increase of traffic volume and the improvement of travel speed.
	30	Global Warming	B-	B+	<u>Construction Stage</u> : CO ₂ emission from construction machinery is expected to increase, however the impact is expected to be limited. <u>Operation Stage</u> : CO ₂ emission is expected to be reduced since CO ₂ emission per vehicle goes down. In the long run, the volume of CO ₂ emission is expected to decrease.

Assessment Level) A+/- : Significant positive/negative impact is expected.
B+/- : Some positive/negative impact is expected.
C+/- : Extent of impact is unknown.
D : No impact is expected.

1-3-1-6 TOR of Environmental and Social Considerations

The Terms of Reference (TOR) for the environmental and social consideration of the Project is shown in Table 1.3-9 based on the scoping of the Project (Table 1.3-8).

Table 1.3-9 TOR of Environmental and Social Survey

Survey Item	Investigation Item	Investigation Method
Alternatives	① Consideration of alternatives	① 5 alternatives including No-action are compared in the light of Construction Cost, Technical and/or Maintenance Aspect, Improvement of Traffic Capacity, Regional Development, Obligation of Recipient Country, Social Consideration and Environmental Consideration.
Air Quality	① Confirmation of air quality standard in Liberia and WHO ② Understanding of current air quality ③ Understanding of the volume of future air pollutants such as NO _x and SPM based on future traffic demand ④ Confirmation of the location of school and clinic which are affected easily by air pollution ⑤ Impact during construction ⑥ Monitoring survey results carried out by MPW	① Investigation into existing documents. ② Implementation of baseline survey along the Project road ③ Forecast of the volume of air pollutants in 2031 ④ Site investigation and investigation into existing documents ⑤ Investigation into construction details such as method, duration, location, construction machinery, the number of vehicle etc. ⑥ Investigation into monitoring survey capacity of MPW by checking existing reports and hearing survey
Water Quality	① Understanding of current water quality of rivers and water-wells ② Confirmation of the water usage of rivers and water-wells ③ Construction method and sanitation management ④ Confirmation of the abandoned oil pipe line and residual in the pipeline ⑤ Confirmation of drainage facilities ⑥ Monitoring survey results carried out by MPW	① Implementation of baseline survey at the rivers and water-well. ② Site investigation and hearing survey. ③ Investigation into construction methods in light of environmentally friendly method. ④ Hearing survey to Liberia Refinery Company to understand the exact location of the oil pipe line and its residual ⑤ Investigation of the Project design drawings ⑥ Investigation into monitoring survey capacity of MPW by checking existing reports and hearing survey
Wastes	① Disposal method of construction wastes ② Possibility of recycle and/or reuse	① Hearing survey to related organizations and investigation into similar projects ② Investigation into wastes whether the wastes meet standards required for construction materials
Soil Contamination	① Provision for oil spill during construction	① Investigation into the construction details such as method, duration, construction machineries, the number of vehicles, working area etc.
Noise & Vibration	① Confirmation of noise and vibration standard in Liberia, Ghana and IFO ② Understanding of current noise and vibration level ③ Distance from the source origins of noise and vibration to residential area, clinic and school ④ Impact during construction ⑤ Provision for noise and vibration in operation stage ⑥ Understanding of the future noise level based on future traffic demand ⑦ Monitoring survey results carried out by MPW	① Investigation into existing documents. ② Implementation of baseline survey along the Project road ③ Site investigation ④ Investigation into construction details such as method, duration, construction machineries, the number of vehicles, working area etc. ⑤ Soundproofing measures such as soundproof barrier and planting trees ⑥ Forecast of future noise level in 2031 ⑦ Investigation into monitoring survey capacity of MPW by checking existing reports and hearing survey

Survey Item	Investigation Item	Investigation Method
Offensive Odor	<ul style="list-style-type: none"> ① Emission control standard ② Impact during construction ③ Understanding of the volume of future air pollutants such as NOx and SPM based on future traffic demand 	<ul style="list-style-type: none"> ① Investigation into existing documents and hearing survey ② Investigation into construction details such as method, duration, construction machineries, the number of vehicles, working area etc. ③ Forecast of air pollutants in 2031
Sediment	<ul style="list-style-type: none"> ① Impact during construction 	<ul style="list-style-type: none"> ① Investigation into construction details such as method, duration, construction machineries, the number of vehicles, working area etc.
Protected Areas	<ul style="list-style-type: none"> ① Confirmation of the protected and important area around the Project road ② Conservation program for the Mesurado Wetland ③ Understanding of the current situation of the Mesurado Wetland. ④ Construction material management method 	<ul style="list-style-type: none"> ① Investigation into existing documents and hearing survey to local residents ② Investigation into existing documents and hearing survey to EPA ③ Site investigation, hearing survey ④ Investigation into construction plans and the location of material stock yard
Ecosystem	<ul style="list-style-type: none"> ① Endangered species in Liberia ② Impact on fauna and flora 	<ul style="list-style-type: none"> ① Hearing survey to EPA and local residents ② Site investigation
Topography & Geology	<ul style="list-style-type: none"> ① Confirmation of construction detail ② Confirmation of quarries and sand pits 	<ul style="list-style-type: none"> ① Discussion with MPW and investigation into the Project design drawings ② Hearing survey and site investigation
Resettlement	<ul style="list-style-type: none"> ① Consideration of minimizing involuntary resettlement alternatives ② Confirmation of the magnitude of land acquisition and resettlement ③ Assistance for RAP preparation ④ Confirmation of WB project in terms of RAP ⑤ Monitoring survey results carried out by MPW 	<ul style="list-style-type: none"> ① Investigation into plans that the number of involuntary resettlement is minimized and the Project benefit is maximized ② Investigation into laws/regulations and related to resettlement ③ Site survey to investigate the number and kind of project affected structures ④ Investigation into laws/regulations in Liberia concerning resettlement, JICA Guidelines and WP OP4.12 ⑤ Investigation into monitoring survey capacity of MPW by checking existing reports and hearing survey
The Poor	<ul style="list-style-type: none"> ① Understanding of the distribution of the poor ② Employment involving the construction works ③ Access status to public facilities such as school and hospital 	<ul style="list-style-type: none"> ① Investigation into the distribution of the poor based on senses survey carried out by GoL in 2008 ② Investigation into construction details such as method, duration, construction machineries, the number of vehicles, working area etc. ③ Investigation into the location of public facilities and the time & cost necessary to reach the facilities
Local Economy such as Employment and Livelihood etc.	<ul style="list-style-type: none"> ① Confirmation of the number of kiosks/vendors in operation in ROW ② Confirmation of work which local residents are able to be involved 	<ul style="list-style-type: none"> ① Implementation of the socio-economic survey ② Investigation into construction details such as method, duration, construction machineries, the number of vehicles, working area etc.
Land Use and Utilization of Local Resources	<ul style="list-style-type: none"> ① Understanding of the status of land use and the usage of local resources 	<ul style="list-style-type: none"> ① Investigation into existing documents, hearing survey and site investigation
Water Usage	<ul style="list-style-type: none"> ① Understanding of the status of water usage 	<ul style="list-style-type: none"> ① Hearing survey and site investigation

Survey Item	Investigation Item	Investigation Method
Existing Social Infrastructures and Services	① Understanding of existing infrastructure and social services	① Hearing survey and site investigation, investigation into existing documents
Infectious Diseases such as HIV/AIDS	① Understanding of the current status of HIV/AIDS	① Investigation into existing documents and hearing survey
Working Condition including Occupational Safety	① Confirmation of working condition and laws/guidelines ② Understanding of the current status of working conditions in Monrovia	① Investigation into existing documents ② Hearing survey
Accident	① Understanding of the number of accidents ② Location where accidents are likely to happen ③ Confirmation of construction plan	① Hearing survey and Investigation into existing documents ② Investigation into the Project design drawings ③ Investigation into construction details such as method, duration, construction machineries, the number of vehicles, working area etc.
Global Warming and Climate Change	① Confirmation of construction plan ② Understanding of the volume of future CO ₂ emission based on future traffic demand	① Investigation into construction details such as method, duration, construction machineries, the number of vehicles, working area etc. ② Forecast of the volume of CO ₂ emission in 2031

1-3-1-7 Result of Environmental and Social Survey

The result of the environmental and social survey is shown in Table 1.3-10 based on the TOR of environmental and social survey shown in Table 1.3-9.

Table 1.3-10 Result of Each Environmental and Social Survey

Survey Item	Result of Survey
Alternatives	<ul style="list-style-type: none"> 5 alternatives including No-action were weighted in the light of Construction Cost, Technical and/or Maintenance Aspect, Improvement of Traffic Capacity, Regional Development, Obligation of Recipient Country, Social Consideration and Environmental Consideration, and the optimum option was selected.
Air Quality	<ul style="list-style-type: none"> The draft standard for ambient air quality is established however, it has not been in force yet. Baseline survey at 3 points was conducted. (The survey result is shown in 1-3-1-12 Baseline Survey.) Due to the alleviation of traffic congestion in operation stage, the travel speed of vehicles is expected to be normalized. Hence the volume of emissions (CO₂, NO_x, SPM) of the Project road predicted in 2031 will be the almost same as that for the No-action in 2031 in spite of the increase of future traffic volume. There are 17 schools, 9 hospitals/clinics, and 24 churches confirmed along the Project road. Construction plans and methods minimizing the impact of ambient air quality are taken into account. Emission-controlled construction machinery is utilized without unnecessary idling. As a result of environmental reports prepared by MPW and discussions with persons in charge of ESIA in MPW, it was confirmed that MPW was able to implement the monitoring survey for ambient air quality (excluding lead and zinc).

Survey Item	Result of Survey
Water Quality	<ul style="list-style-type: none"> • The draft standard for water quality is established however, it has not been in force yet. • According to the hearing surveys to local residents around the Project area, water in the rivers and water-wells along the Project road is not used for drinking. • Construction plans and methods affecting water quality as less as possible are introduced. • Baseline survey at 2 points at the rivers and 1 location at the water-well was conducted. (The survey result is shown in 1-3-1-12 Baseline Survey.) • There are tentative toilets under the existing Stockton Bridge and Double Bridge, and the waste material of the toilets is discharged into the rivers directly. • No residual is left in the oil pipeline abounded. • There is a slaughtering facility upstream of the Stockton Creek, and the waste water from the facility is discharged into the river directly. • Rain water on the Project road is collected and discharged into the rivers through designed drainage facilities. • As results of environmental reports prepared by MPW and discussions with persons in charge of ESIA in MPW, it was confirmed that MPW was able to implement the monitoring survey for water quality.
Waste	<ul style="list-style-type: none"> • Wastes arising from the construction works of Project road such as waste soil and rubble are reused and/or recycled as much as possible. Wastes not being reused and/or recycled such as used oil are disposed properly by facilities authorized by EPA. • Container for waste has been established by the MCC, waste generated in the vicinity of the market and housing and the like have been brought around road. Container, in principle once per week, MCC is recovered by the collection and Transportation Company from which you took the contract, but is transported to the final disposal site, waste that could not enter the container has been left on the road without being collected. Moreover, waste is illegally dumped around the container have also been left not collected, some of these wastes, have contributed to the existing gutter clogging.
Soil Contamination	<ul style="list-style-type: none"> • The impact on soil contamination by oil leaked from construction machinery is little because the construction machinery is maintained well.
Noise and Vibration	<ul style="list-style-type: none"> • The draft standard for noise level is established however, it has not been in force yet. In addition, no standard for vibration is not established even draft version. • Baseline survey at 4 areas around the Project road was conducted. (The survey result is shown in 1-3-1-12 Baseline Survey.) • Appropriate construction methods and low-noise construction machinery are introduced therefore the impact of noise and vibration affecting the surrounding environment is little. • There are 17 schools, 9 hospitals/clinics, and 24 churches confirmed along the Project road. • 1.5m width of green belt along the road, and trees are planted in it.
Odor	<ul style="list-style-type: none"> • There is no emission control standard in Liberia. • Emission-controlled construction machinery is utilized without unnecessary idling. • Due to the alleviation of traffic congestion in operation stage, the travel speed of vehicles is expected to be normalized. Hence the volume of emissions (CO₂, NO_x, SPM) of the Project road predicted in 2031 will be the almost less than 40% that for the No-action in 2031 in spite of the increase of future traffic volume.
Sediment	<ul style="list-style-type: none"> • Waste water arising from construction works is not discharged into the rivers directly.
Protected Areas	<ul style="list-style-type: none"> • There is no protected area except for the Mesurado Wetland around the Project road. • Direct impact on the Mesurado Wetland is limited because the road expansion area is opposite site (southern side) of the wetland and most of ROW area is already possessed by MPW and leveled flat in advance. • National Wetland Policy in Liberia (Draft) is established however, it has not been in force yet. • There is no law/regulation in terms of the conservation of the Mesurado Wetland except for the policy above. • EPA conducts regular inspections around the Mesurado Wetland in order to watch illegal dumping and construction.

Survey Item	Result of Survey
	<ul style="list-style-type: none"> • EPA places sign boards to appeal local residents to understand the conservation of the Mesurado Wetland. • Based on hearing survey to EPA and site survey, the negative impacts on the Mesurado Wetland are likely to be ① the increase of traffic volume, ② water contamination, ③ the increase of construction wastes, ④ the promotion of mangrove cutting, ⑤ the promotion of estate development and housing land development in and/or near the Mesurado Wetland and ⑥ the activation of business activity. • In order to avoid running off construction materials from stock yards, measures such as ① to stock them in the fenced yard, ② to stock them in the yard away from the Mesurado Wetland and rivers, and ③ to cover them over anti-scattering sheet against wind and rainfall.
Ecosystem	<ul style="list-style-type: none"> • As a result of hearing survey to EPA and local residents, no protected species is confirmed around the Project road. • There is possibility that aquatic fauna is affected by water contamination during the bridge construction. • There are about 10 trees in ROW.
Hydrology	<ul style="list-style-type: none"> • Less impact method for bridge construction on hydrology and river bed (Steel Pile Pressing Method) is selected.
Topography & Geology	<ul style="list-style-type: none"> • No earth filling and cutting work requiring special skill is planned. • Borrow pits and quarries for the Project are well-maintained.
Resettlement	<ul style="list-style-type: none"> • 5 alternatives including No-action were weighted in the light of Construction Cost, Technical and/or Maintenance Aspect, Improvement of Traffic Capacity, Regional Development, Obligation of Recipient Country, Social Consideration and Environmental Consideration, and the optimum option was selected. • Liberian laws/regulations and RAP for projects in greater Monrovia prepared by WB were investigated in order to prepare the RAP for the Project. • 26 PAHs (37 Project Affected Structures) were confirmed in ROW, 50 feet, by the socio-economic surveys. • About 94% of PAPs are involved in commercial business (kiosks/vendors). Their relocation site is selected under the authorization of MPW to the area in or outside of ROW where newly constructed road structures are not disturbed. • Draft RAP in accordance with JICA Guidelines and WB OP4.12 was prepared. • MPW had a lot of experience in carrying out monitoring surveys for WB projects.
The Poor	<ul style="list-style-type: none"> • About 55% of population living in urban area in Liberia is classified into the poor¹. Therefore the population of the poor living around the Project road is estimated to about 670 thousand because the total population around the Project road (great Monrovia) is about 11-47 thousand. • The poor benefit from employment opportunities because the construction of the Project road creates many works without special skills. • The access time and cost to Monrovia city center is reduced by the implementation of the Project.
Local Economy such as Employment and Livelihood etc.	<ul style="list-style-type: none"> • USD 200 per household of compensation for business is paid in terms of the resettlement of commercial business (kiosks/vendors). • During construction stage, the employment opportunity for construction works goes up.
Land Use and Utilization of Local Resources	<ul style="list-style-type: none"> • Some part of ROW is occupied by house or commercial businesses (kiosks/vendors) illegally. • There is no local resource around the Project road. However, the alleviation of traffic congestion is promoted by the implementation of the Project. • Land developments and the attraction of enterprises are promoted around the Project road because of the alleviation of traffic congestion.
Water Usage	<ul style="list-style-type: none"> • Water in the rivers and water-wells around the Project road are utilized for the purpose of only washing cars and clothes. • Local residents can utilize the water in the rivers and water-wells during construction and in operation stage.

¹ Income is less than USD1.0 per day.

Survey Item	Result of Survey
Existing Social Infrastructures and Services	<ul style="list-style-type: none"> • Some of existing bus stops are located in ROW therefore they are affected by the Project. However new bus stops are constructed by the Project. Temporal bus stops during construction stage are required. • Traffic congestion is likely to become worse during construction stage however, it is minimized by appropriate mobilization of traffic controllers. • Existing social infrastructures and services are affected positively by the implementing of road widening, safety measures and congestion alleviation measures.
Infectious Diseases such as HIV/AIDS	<ul style="list-style-type: none"> • The infection rate of HIV/AIDS among adult in Liberia is relatively low, 1.1%. Ministry of Health & Social Welfare establishes the National Strategic Plan (NSP) 2015-2020, and is trying hard to prevent HIV/AIDS prevalence.
Working Condition including Occupational Safety	<ul style="list-style-type: none"> • Labor law in Liberia has been established.
Accident	<ul style="list-style-type: none"> • There is a no place expecting traffic accidents on the Project drawings. • Sidewalk, sign board and road marking are introduced as safety measures. • The safety for bus users in getting in and out is improved by the renovation of existing bus stops. • There is possibility that third persons are involved in the accidents during construction stage. • There are many construction sites where construction workers do not put on protective equipment such as helmet and safety shoes in Monrovia.
Global Warming and Climate Change	<ul style="list-style-type: none"> • Environmentally friendly construction machinery is utilized however it is unavoidable to increase the emission of CO₂ from the machinery on a temporary basis. • The volume of emission of CO₂ for the Project road predicted in 2031 will be the almost less than 40% that for the No-action in 2031 in spite of the increase of future traffic volume.

1-3-1-8 Impact Assessment

Based on the result of survey in Table 1.3-11, the impact assessment is shown in Table 1.3-10.

Table 1.3-11 Impact Assessment based on the Result of Survey

Category	#	Environmental and Social Item	Assessment at the Scoping		Assessment base on the Result of Survey		Reason of Assessment
			Planning, Construction Stage	Operation Stage	Planning, Construction Stage	Operation Stage	
Pollution Measure	1	Air Quality	B-	B-	B-	B±	<p>Planning Stage : As a result of the baseline survey, the value of NO₂ exceeds the draft standard in Liberia at all survey points. (The survey result is shown in 1-3-1-12 Baseline Survey.)</p> <p>Construction Stage : Due to the operation of construction machinery, ambient air quality is deteriorate tentatively but the impact is limited.</p> <p>Operation Stage : Due to the alleviation of traffic congestion in operation stage, the travel speed of vehicles is expected to be normalized. Hence the volume of emissions (CO₂, NO_x, SPM) of the Project road predicted in 2031 will be the almost same as that for the No-action in 2031 in spite of the increase of future traffic volume. In addition, the impact of dust is alleviated by paving unpaved road.</p>
	2	Water Quality	B-	B-	B-	B±	<p>Planning Stage : As a result of the baseline survey, the color and odor etc. exceed the draft standard in Liberia at all survey points. (The survey result is shown in 1-3-1-12 Baseline Survey.)</p> <p>Construction Stage : Waste water from construction site and construction machinery is likely to affect water quality tentatively. No residual is confirmed in the oil pipeline abandoned.</p> <p>Operation Stage : There is possibility that oil and dust on the Project road flow into the rivers. However the runoff of sand from existing earthen roads decreases. In addition, the erosion by rainfall is mitigated by the development of drainage facilities. On the other hand, the amount of waste water is likely to increase because the estate development and housing land development are promoted.</p>
	3	Wastes	B-	D	B-	D	<p>Construction Stage : Most of wastes arising from the construction works are recycled and/or reused therefore, the amount of wastes to be disposed is a little. In addition, the disposal wastes are treated properly by facilities authorized by EPA.</p> <p>Operation Stage : No waste affecting surrounding environment is generated.</p>

Category	#	Environmental and Social Item	Assessment at the Scoping		Assessment base on the Result of Survey		Reason of Assessment
			Planning, Construction Stage	Operation Stage	Planning, Construction Stage	Operation Stage	
	4	Soil Contamination	B-	D	B-	D	<p>Construction Stage : There is possibility that oil leaking from construction machinery however, the impact is limited by implementing regular maintenance for the machinery and educations to workers.</p> <p>Operation Stage : No soil contamination affecting surrounding environment happens because the Project is to reconstruct and expand the existing road.</p>
	5	Noise & Vibration	B-	B-	B-	B±	<p>Planning Stage : As a result of the baseline survey, all survey points in terms of noise level exceed the standards recommended by EPA. (The survey result is shown in 1-3-1-12 Baseline Survey.)</p> <p>Construction Stage : Construction methods with low impact of noise and vibration are introduced. In addition, construction works generating large noise and vibration are done only daytime.</p> <p>Operation Stage : In addition, noise and vibration generated by vehicles are alleviated by leveling the road surface. However, due to the increase of traffic volume, the noise and vibration level in some areas deteriorate.</p>
	6	Subsidence	D	D	D	D	No work triggering subsidence is expected.
	7	Offensive Odor	B-	B-	B-	B-	<p>Construction Stage : The volume of emission arising from construction machinery increases however, the impact is limited.</p> <p>Operation Stage : The future volume of emissions predicted in 2031 in Project road is almost less than 40% that of No-action in spite of the increase of future traffic volume .</p>
	8	Sediment	B-	D	B-	D	No work triggering sediment is expected.
Natural Environment	9	Protected Areas	B-	C-	B-	B-	<p>Construction Stage : Though the Project road goes near the Mesurado Wetland, direct impacts on the wetland are limited due to the distance. In addition, construction materials are maintained well in the stock yards away from the wetland therefore, no direct impact on the Mesurado Wetland and the rivers happens.</p> <p>Operation Stage : Due to the improvement of traffic capacity and convenience of the Project road, ① the increase of traffic volume, ② water pollution, ③ the increase of construction waste dumping, ④ the promotion of mangrove cutting, ⑤ the promotion of the estate development and housing land development in and/or outside of the wetland and ⑥ the activation of commercial business are expected.</p>

Category	#	Environmental and Social Item	Assessment at the Scoping		Assessment base on the Result of Survey		Reason of Assessment
			Planning, Construction Stage	Operation Stage	Planning, Construction Stage	Operation Stage	
	10	Ecosystem	B-	C-	B-	C-	<p>Planning Stage : No protected and endangered species is confirmed around the Project road.</p> <p>Construction Stage : The Project area has been developed and leveled in advance therefore, large-scale earth works are not required. However, direct and/or indirect impact on ecosystem is expected during the bridge construction.</p> <p>Operation Stage : Direct and/or indirect impact on ecosystem is unknown.</p>
	11	Hydrology	B-	D	D	D	No work triggering hydrology is expected.
	12	Topography & Geology	B-	D	D	D	<p>Planning Stage : Earth works requesting special skills are not planned.</p> <p>Construction Stage : Appropriate construction management is done. In addition, borrow pits and quarries for the Project are maintained well.</p>
Social Environment	13	Resettlement	A-	B-	A-	B-	<p>Planning Stage : 26PAHs (37 Projected Affected Structures) were confirmed even though 5 alternatives were weighted in order to avoid and minimize involuntary resettlement. However RAP for the Project was prepared in accordance with JICA Guidelines and WB OP4.12.</p> <p>Construction/Operation Stage : MPW has enough capacity to carry out the monitoring works for the RAP implementation.</p>
	14	The Poor	B±	B+	B±	B+	<p>Construction Stage : Since PAPs include the poor, involuntary resettlement is required. However, they benefit from employment opportunity arising from the construction works for the Project.</p> <p>Operation Stage : The access time and cost to Monrovia city center is reduced by the implementation of the Project.</p>
	15	Ethnic Minority & Indigenous Minority	D	D	D	D	No ethnic minority and indigenous minority does not exist around the Project road.
	16	Local Economy such as Employment and Livelihood etc.	B±	C+	B±	C+	<p>Planning Stage : Employment of employers and employees involving in commercial business (kiosks/vendors) are affected tentatively due to involuntary resettlement.</p> <p>Construction Stage : Due to the construction works for the Project, workers involving in the project increase during construction stage.</p> <p>Operation Stage : Employment opportunities along the Project road increase due to the promotion of business facilities and factories, and estate development.</p>

Category	#	Environmental and Social Item	Assessment at the Scoping		Assessment base on the Result of Survey		Reason of Assessment
			Planning, Construction Stage	Operation Stage	Planning, Construction Stage	Operation Stage	
	17	Land Use and Utilization of Local Resources	B-	B+	B-	C+	<p>Planning Stage : Though all ROW areas are possessed by MPW, 449 Project Affected Structures exist. Therefore, appropriate RAP implementation is necessary in order to resettle them to alternative land</p> <p>Operation Stage : The land price around the Project road is likely to goes up due to the alleviation of traffic congestion and the increase of convenience of the Project road.</p>
	18	Water Usage	B-	D	D	D	<p>Planning Stage : The construction of the Project road does not affect water usage during construction stage.</p> <p>Construction Stage : Since water quality does not deteriorate, water in the rivers and water wells can be used as well.</p>
	19	Existing Social Infrastructures and Services	B±	B+	B±	B+	<p>Planning Stage : Due to the road expansion, safety measures and the alleviation of traffic congestion, the convenience of existing social infrastructures and services is improved.</p> <p>Construction Stage: Traffic congestion is likely to become worse during construction stage however, it is minimized by appropriate mobilization of traffic controllers.</p> <p>Planning Stage : Due to the road expansion, the access of existing social infrastructures and services is improved.</p>
	20	Social Institutions such as Social Infrastructure and Local Decision-making Institutions	D	D	D	D	Little impact on social institutions such as social infrastructure and local decision-making institutions was confirmed.
	21	Misdistribution of Benefit and Damage	D	D	D	D	There is no factor affecting misdistribution of benefit and damage.
	22	Local Conflict of Interests	D	D	D	D	There is no factor affecting local conflict of interests.
	23	Cultural Heritage	D	D	D	D	No cultural heritage does exist around the Project road.
	24	Landscape	D	B+	D	B+	Operation Stage : Trees and turf to improve the landscape to be planted in the road.
	25	Gender	D	D	D	D	There is no factor affecting gender issue.
	26	Right of Children	D	D	D	D	There is no factor affecting right of children.
	27	Infectious Diseases such as HIV/AIDS	B-	D	B-	D	Construction Stage : Due to the inflow of construction workers, there is possibility that infectious diseases such as HIV/AIDS is spread but the impact is limited.

Category	#	Environmental and Social Item	Assessment at the Scoping		Assessment base on the Result of Survey		Reason of Assessment
			Planning, Construction Stage	Operation Stage	Planning, Construction Stage	Operation Stage	
	28	Working Condition including Occupational Safety	B-	D	B-	D	Constitution Stage : Construction plans in accordance with labor laws in Liberia are established. However there is possibility that the plans are not implemented properly.
Others	29	Accident	B±	B-	B-	B-	Planning Stage : Safety measures in terms of hardware side are planned to avoid accidents. Construction Stage : Construction plans prioritizing safety management are established. However, there is possibility that accidents involving third persons happen. Furthermore, workers are likely to have accidents without wearing safety equipment such as helmet. Operation Stage : Since drivers are not used to the Project road just after the opening of the Project road, they are likely to make an accident.
	30	Global Warming	B-	B+	B-	B-	Construction Stage : CO ₂ is generated from construction machinery. Operation Stage : The volume of emissions of CO ₂ predicted in 2031 will be the almost less than 40% that for the No-action in 2031 in spite of the increase of future traffic volume .

Assessment Level) A+/- : Significant positive/negative impact is expected.

B+/- : Some positive/negative impact is expected.

C+/- : Extent of impact is unknown.

D : No impact is expected.

Note) about the impact of the building to be considered (school and others), by reason of that and the above table that is remote from the measured ROW end, it is assumed that no special measures are necessary.

1-3-1-9 Cost for Mitigation Measures and Implementation of Mitigation Measures

The expected mitigation measures and their cost necessary for the implementation of the mitigation measures based on the environmental and social items assessed at A- and B- in Table 1.3-11 on Assessment of the Result of Survey are shown in Table 1.3-12.

Table 1.3-12 Expected Mitigation Measures and their Cost Necessary for Implementation

#	Impact Item	Expected Mitigation Measures	Implementation Organization	Responsible Organization	Cost (USD)
Planning Stage / Construction Stage					
1	Air Quality	<ul style="list-style-type: none"> • Appropriate construction machinery is used and maintained regularly. In addition, unnecessary idling is avoided. • Water spraying is done regularly to avoid raising sand dust during dry seasons. • In case backfilling materials and construction materials are stocked temporarily in the stock yards or the construction site, these materials are covered by sheets to avoid scattering. • Left-turn lanes are introduced at major intersections and then traffic congestion around the intersections is alleviated, eventually the volume of air pollutants from vehicles decrease. • The alleviation of traffic congestion and decrease of on-street parking are promoted by developing parking space and area for sorting out merchandize. • Regular monitoring surveys are carried out around the Project road. In addition, in case the values get worse extremely compared to baseline survey's values, MPW finds out the reason and implement measures necessary. • JICA recommend for line ministries and organizations to strengthen restrictions on unleaded gasoline use^{*1}. • JICA recommend for line ministries and organizations to strengthen restrictions on ill-serviced vehicles^{*1}. 	Contractor / MPW	MPW	22,500
2	Water Quality	<ul style="list-style-type: none"> • Appropriate construction machinery is used and maintained regularly. • Waste water arising from construction works is not discharged into the rivers directly. • Oil fence and anti-water pollution net are utilized during bridge construction. • Construction machinery is not washed in the rivers. • Temporal toilets under the Stockton Bridge and Double Bridge are removed. 	Contractor	MPW	22,500

#	Impact Item	Expected Mitigation Measures	Implementation Organization	Responsible Organization	Cost (USD)
		<ul style="list-style-type: none"> Regular monitoring surveys are carried out around the Project road. In addition, in case the values get worse extremely compared to baseline survey's values, MPW finds out the reason and implement measures necessary. JICA recommend for line ministries and organizations to strengthen restrictions on ill-serviced vehicles^{*1}. 			
3	Waste	<ul style="list-style-type: none"> Wastes are recycled and reused as much as possible. Wastes unable to be recycled and reused are disposed by facilities authorized by EPA. 	Contractor	MPW	-
4	Soil Contamination	<ul style="list-style-type: none"> In order to avoid oil leaking from construction machinery, regular maintenance works are done. 	Contractor	MPW	-
5	Noise and Vibration	<ul style="list-style-type: none"> Appropriate construction machinery is used and maintained regularly. Low-noise construction machinery is utilized. Construction works are done during only daytime around school and clinic/hospital. In case of night work, the permission of Monrovia police is obtained and the notice of the work is notified to local residents in advance. Regular monitoring surveys are carried out around the Project road. In addition, in case the values get worse extremely compared to baseline survey's values, MPW finds out the reason and implement measures necessary. JICA recommend for line ministries and organizations to strengthen restrictions on ill-serviced vehicles^{*1}. Surface joints on road are reduced as many as possible in order to keep flatness of the Project roads. Dumpy earthen roads are paved. 1.5 m width of green belt is installed along the entire road length and trees are planted in it. 	Contractor / MPW	MPW	30,000
7	Odor	<ul style="list-style-type: none"> Appropriate construction machinery is used and maintained regularly. In addition, unnecessary idling is avoided. Left-turn lanes are introduced at major intersections and then traffic congestion around the intersections is alleviated, eventually the volume of air pollutants decrease. The alleviation of traffic congestion and decrease of on-street parking are promoted by developing parking space and area for sorting out merchandize. 	Contractor	MPW	-

#	Impact Item	Expected Mitigation Measures	Implementation Organization	Responsible Organization	Cost (USD)
		<ul style="list-style-type: none"> JICA recommend for line ministries and organizations to strengthen restrictions on ill-serviced vehicles^{**1}. 			
8	Sediment	<ul style="list-style-type: none"> Waste water with mud arising from construction works is not discharged into the rivers directly. 	Contractor	MPW	-
10	Ecosystem	<ul style="list-style-type: none"> Trees in ROW not affecting newly constructed road structures are not cut. Monitoring surveys for aquatic species in bridge construction sites, Stockton Creek and Warner Creek, are carried out. 	Contractor / MPW	MPW	40,000
13	Resettlement	<ul style="list-style-type: none"> RAP in accordance with JICA Guidelines and WB OP4.12 is prepared. Resettlement is carried out according to the RAP. Monitoring works for resettlement is carried out according to the RAP. 	MPW	MPW / EPA	-
14	The Poor	<ul style="list-style-type: none"> The poor and PAPs are given priority to be employed by the construction works for the Project. PAPs especially commercial business (kiosks/vendors) are allowed to be resettle the area in or outside of ROW where newly constructed road structures are not disturbed. 	Contractor / MPW	MPW	-
16	Local Economy such as Employment and Livelihood etc.	<ul style="list-style-type: none"> Local residents are employed as many as possible by the construction works without special skills. PAPs especially commercial business (kiosks/vendors) are allowed to be resettle the area in or outside of ROW where newly constructed road structures are not disturbed. 	MPW / Contractor	MPW	-
17	Land Use and Utilization of Local Resources	<ul style="list-style-type: none"> RAP is implemented properly. 	MPW	MPW / EPA	-
19	Existing Social Infrastructures and Services	<ul style="list-style-type: none"> Traffic controllers are mobilized properly. Temporal bus stops are installed. 	Contractor / MPW	MPW	-
27	Infectious Disease such as HIV/AIDS	<ul style="list-style-type: none"> Education for HIV/AIDS is provided for workers. In addition, the contract of the Project implementation with the contractor stipulates the article of the education above. 	Contractor / MPW	Ministry of Health & Social Welfare	-
28	Working Condition including Occupational Safety	<ul style="list-style-type: none"> The contract of the Project implementation with the contractor stipulates that labor laws in Liberia must be complied. 	Contractor / MPW	Ministry of Labor	-
29	Accident	<ul style="list-style-type: none"> Safety educations are provided construction workers with. The contract with the contractor stipulates the implementation of the safety educations. 	Contractor / MPW	MPW	-

#	Impact Item	Expected Mitigation Measures	Implementation Organization	Responsible Organization	Cost (USD)
		<ul style="list-style-type: none"> Construction workers put on safety equipment such as helmet and safety shoes. 17 pedestrian crossings are installed around facilities such as school and church. Sidewalks separated from carriage ways are installed. Medians serving as safety zone are installed. Left-turn lanes are installed at the major intersections including the existing road in order to avoid rear-end accidents. Sign boards and road markings with a high regard for safety are placed. The safety for bus users in getting in and out are secured by introducing new bus stops. In terms of the operation route of construction vehicles, MPW and the contractor discuss it with Monrovia Police and Monrovia City Corporation as well as local residents in advance. Information such as construction plans is disclosed to the public through newspapers and radios. 			
30	Global Worming	<ul style="list-style-type: none"> Appropriate construction machinery is used and maintained regularly. In addition, unnecessary idling is avoided. 	Contractor / MPW	MPW	-
Sub-total					115,000
Operation Stage					
1	Air Quality	<ul style="list-style-type: none"> Regular monitoring surveys are carried out around the Project road. In addition, in case the values get worse extremely compared to baseline survey's values, MPW finds out the reason and implement measures necessary. JICA recommend for line ministries and organizations to strengthen restrictions on unleaded gasoline use^{*1}. JICA recommend for line ministries and organizations to strengthen restrictions on ill-serviced vehicles^{*1}. 	MPW	MPW / Monrovia Police	6,750
2	Water Quality	<ul style="list-style-type: none"> JICA recommend for line ministries and organizations to strengthen restrictions on ill-serviced vehicles^{*1}. Regular monitoring surveys are carried out around the Project road. In addition, in case the values get worse extremely compared to baseline survey's values, MPW finds out the reason and implement measures necessary. 	MPW / EPA	Monrovia Police	6,750
5	Noise and Vibration	<ul style="list-style-type: none"> Regular monitoring surveys are carried out around the Project road. In addition, in case the values get worse extremely compared to baseline survey's values, MPW finds out the reason and implement 	MPW	MPW	9,000

#	Impact Item	Expected Mitigation Measures	Implementation Organization	Responsible Organization	Cost (USD)
		measures necessary. • JICA recommend for line ministries and organizations to strengthen restrictions on unleaded gasoline use※1. • JICA recommend for line ministries and organizations to strengthen restrictions on ill-serviced vehicles※1. • In case pot holes and damages on the Project road are found, they are repaired immediately. • Trees planted in the green belt are maintained well.			
7	Odor	• JICA recommend for line ministries and organizations to strengthen restrictions on ill-serviced vehicles※1.	MPW	Monrovia Police	-
9	Protected Area	• JICA recommend for EPA to put the National Wetland Policy in Liberia (Draft) in force to be enforceable. • MPW share all information acquired through the baseline and monitoring surveys for the Project with EPA.	EPA/MPW	EPA	-
10	Ecosystem	• Monitoring surveys for aquatic species in bridge construction sites, Stockton Creek and Warner Creek, are carried out.	MPW/EPA	MPW/EPA	12,000
13	Resettlement	• Monitoring works for resettlement is carried out according to the RAP.	MPW	MPW/EPA	-
29	Accident	• Traffic flow is controlled just after the opening of the Project road in cooperation with Monrovia Police.	Monrovia Police	Monrovia Police	-
Sub-total					34,500
Grand Total					149,500

Remark: ※1) They have to be acknowledged to be difficult at this moment in light of the condition of Liberia and the capacity and human resources of EPA and line ministries. However, it is possible to promote them together with GIZ because GIZ has been supporting traffic sectors for years in Ministry of Transport.
 In the current Monrovia police by Somalia drive, as appropriate checkpoints has been implemented, improvements have been. (Photo below)

1-3-1-10 Monitoring Plan

The monitoring plan of the Project in construction stage and operation stage for first two years is shown in Table 1.3-13. However, the monitoring plan will be modified in the Detailed Design (D/D), if necessary. The monitoring surveys in construction state shall be carried out by the Contractor, and compiled and submitted to EPA and JICA by MPW. Those in operation stage shall be carried out by MPW, and compiled and submitted to EPA and JICA by MPW as well.

Table 1.3-13 Monitoring Plan

Kind of Survey	Parameter	Survey Point (same as each baseline survey*1)	Frequency Upper: Construction Stage Lower: Operation Stage	Responsible Organization
【Construction Stage】 【Operation Stage】				
Ambient Air Quality	PM _{2.5} , PM ₁₀ , CO, NOx, SOx, Wind Direction/Velocity	Starting Point (Urban), Middle Point (Suburb), End Point (Urban)	Every Four Months Every Six months	Contractor /MPW
Noise & Vibration	Noise & Vibration Level ($L_{Aeq} \cdot L_{Amax} \cdot L_{Amin}$)	Residential Area, School Area, Light Industrial Area, Commercial Area	Every 4 Months Every Six Months	Contractor /MPW
Water Quality	pH, SS, EC, COD, DO, Oil, Conductivity, Turbidity, Odor, Color	Stockton Creek, Warner Creek, Water-well	Every Four Months Every Six months	Contractor /MPW
Biological	Fauna	Stockton Creek, Warner Creek	Every Six Months Every Six Months	Contractor /MPW

1-3-1-11 Stakeholder Meeting

In terms of the environmental and social considerations for the Project, stakeholder meetings were taken place. (latter meetings is shown 1-3-2-10 Public Participation.)

1-3-1-12 Baseline Survey

Ambient air quality Survey, water quality survey and noise & vibration survey were conducted as baseline surveys. Figure 1.3-7 shows the location of each survey points.

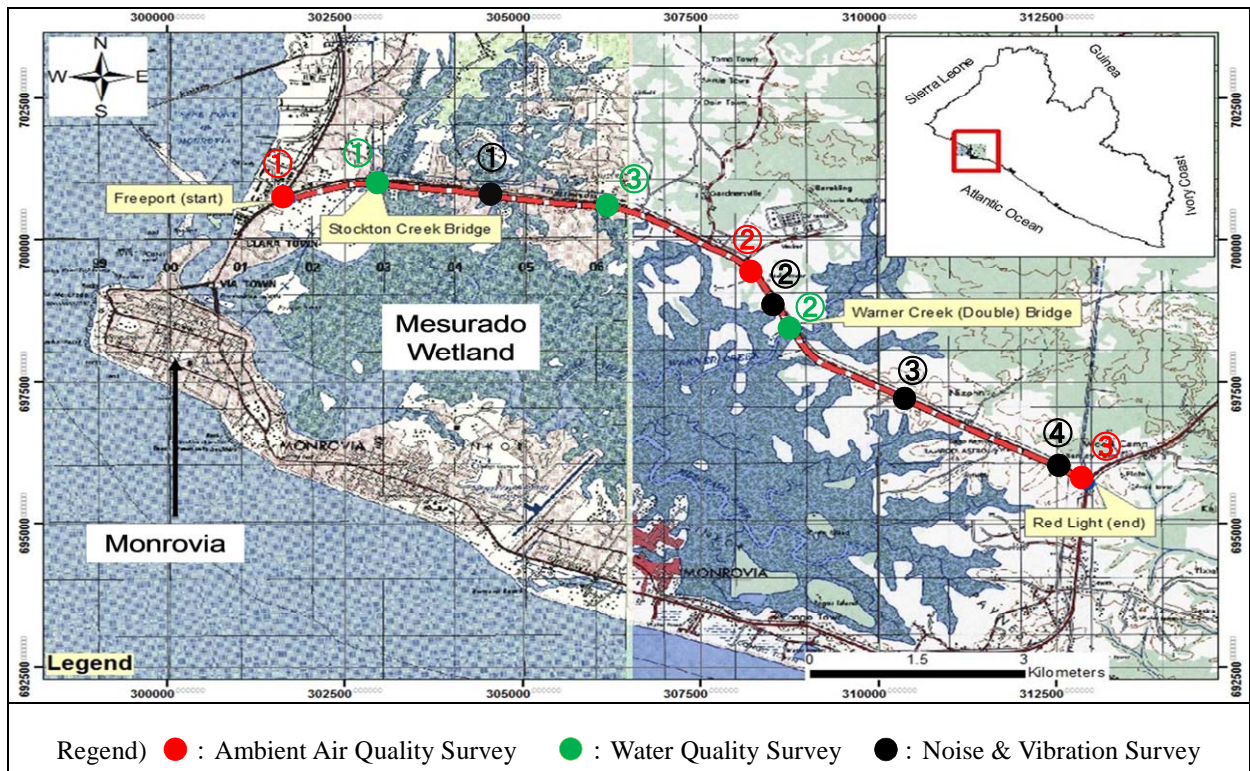


Figure 1.3-7 Location of Each Survey

(1) Ambient Air Quality Survey

Ambient air quality survey was carried out at 3 points at the edge of ROW. Table 1.3-14 shows the detail of the survey and Table 1.3-15 shows the result of the survey.

Table 1.3-14 Detail of the Ambient Air Quality Survey

Parameter	Particulate Matter (PM _{2.5} , PM ₁₀), Nitrogen Dioxide (NO ₂), Sulfur Dioxide (SO _x), Carbon Monoxide (CO), Ammonia, Lead (Pb) , Wind Direction, Wind Velocity		
Survey Point	3 Points along the Project road (Starting Point, Middle Point, End Point)		
	① Starting Point	② Middle Point	③ End Point
	N 6°20'15.61"	N 6°19'36.61"	N 6°17'33.10"
	W 10°47'33.54"	W 10°44'01-40"	W 10°41'27.29"
Survey Method	Continuous survey with air sampler		
Survey Period	From 4th to 12th, March 2016		

Table 1.3-15 Result of the Ambient Air Quality Survey

Parameter	Unit	Survey Points			Liberia * ¹	WHO	Time Weighted Average
		① Starting Point	② Middle Point	③ End Point			
PM _{2.5}	µg/m ³	95	184	89	—	—	—
PM ₁₀	µg/m ³	258	148	166	100 60	50 20	24 hours 1 year
SO _x (SO ₂)	µg/m ³	0	0	0	80 60	20 —	24 hours 1 year
NO _x (NO ₂)	µg/m ³	1450	1810	2290	80 60	— 40 (NO ₂)	24 hours 1 year
CO	mg/m ³	9460	1350	2700	4,000 2,000	3,000 1,000	1 hour 8 hours
Ammonia	mg/m ³	0.3	0.3	0.3	0.4 0.1	—	24 hours 1 year
Lead	µg/m ³	ND	ND	ND	1.00 0.75	—	24 hours 1 year
Wind Speed	m/s	0.27	0.82	1.26	—	—	—
Wind Direction	—	ESE	SSW	N	—	—	—

Remark: *1) Residential, Rural & Other Area standard is applied

PM 2.5 of and 10 is the time weighted average concentration of 8 hours. Compared with a reference value of the WHO that use 24 hours weighted average concentration is difficult. The value of NO₂ in all survey points exceeds the Draft standard in Liberia. The expected main reason is vehicles with low speed due to heavy traffic congestions.

(2) Water Quality Survey

Water quality survey was carried out at 2 rivers and 1 water-well. Table 1.3-16 shows the detail of the survey and Table 1.3-17 shows the result of the survey.

Table1.3-16 Detail of Water Quality Survey

Parameter	Temperature, pH, Conductivity, Turbidity, Color, Odor, Total Dissolved Solid (TDS), Suspended Solid (SS), Chemical Oxygen Demand (COD), Dissolved Oxygen (DO), Escherichia Coli (E coli), Oil		
Survey Point	3 Points (Stockton Creek, Warner Creek, Water Well, refer to Figure 1.3-7)		
	① Stockton Creek	② Warner Creek	③ Water-well
	N 6°18'57.07"	N 6°20'23.73"	N 6°20'18.83"
	W 10°43'41.07"	W 10°46'49.52"	W 10°46'45.99"
Survey Method	Water samples are collected and analysed in laboratory authorized by EPA.		
Survey Period	Dry Season: 9 th March 2016, Rainy Season: 19 th July 2016		

Table1.3-17 Result of Water Quality Survey

	①Stockton Creek	②Warner Creek	③Water-well	Liberia (Draft)	WHO
Temperature (°C)	29	30	—	-	-
	25	26.2	26.7		
pH	7.7	7.5		6.5-8.5	6.5-8.5
	6.2	7.3	6.7		
Conductivity (µS/cm)				-	-
	150	150	260		
Turbidity (NTU)	48	46	0	-	5
	5	5	0		
Color (Co-Pt)	147	143	—	No Color	15
	160	192	212		
Odor	No Odor	No Odor	No Odor	No Odor	-
	No Odor	No Odor	No Odor		
Dissolved Oxygen (mg/l)	5.6	13.9	32.5	-	30
	7.4	4.8	26.7		
Total Suspended Solid (mg/l)	19	11	—	-	30
	80	—	46		
COD (mg/l)				-	30-50
	300	210	140		
Colon Bacillus (MPN/100ml)	4.1	4.8		5.0	5.0
	15	10	12		
Oil (mg/l)*1)	>2 ppm and < 5 ppm	>2 ppm and < 5 ppm	> 2 ppm	0.1	0.1

Remark: Upper: Dry Season, Lower: Rainy Season

*1): It is impossible to analyze oil precisely in Liberia at this moment.

All samples have muddy color and high turbidity value. In term of the rivers (①Stockton Creek, ②Warner Creek), this is because of muddy water coming from up streams and trash abandoned along the river sides. In terms of the water-well, this is because of the inflow of rain water with mud around the water-well. The rivers and well water has been used in the car wash, and that water containing oil after the car wash has been flowing into the rivers and wells.

(3) Noise & Vibration Survey

Noise & Vibration survey was carried out at 3 points at the edge of ROW. Table 1.3-18 shows the detail of the surveys and Table 1.3-19 and Table 1.3-20 show the result of the survey.

Table 1.3-18 Detail of Noise & Vibration Survey

Parameter	Noise/Vibration Level: $L_{Aeq} \cdot L_{Amax} \cdot L_{Amin}$			
Survey Point	4 points (refer to Figure 1.3-7): Inside of buildings at the edge of ROW (Residential Area, School Area, Light Industrial Area, Commercial Area)			
	① Residential Area	② School Area	③ Light Industrial Area	④ Commercial Area
	N 6°18'33.90"	N 6°19'06.11"	N 6°20'21.85"	N 6°17'44.72"
	W 10°43'28.35"	W 10°43'42.61"	W 10°47'15.87"	W 10°41'07.52"
Survey Method	Noise & Vibration meters are installed inside of the buildings at the edge of ROW and the value of noise & vibration in a 24-hour period			
Survey Period	24 hours × each 1day Residential Area: 9 th March 2016, School Area: 5 th March 2016, Light Industrial Area: 7 th March 2016, Commercial Area: 4 th March 2016			

Table 1.3-19 Result of Noise Survey

Facility		Survey Result dB (A) (Leg)		Draft Liberian Standard dB (A) (Leg)	
		Day 06:011-4:00 (Min.-Max.)	Night 22:01-06:00 (Min.-Max.)	Day 06:011-4:00	Night 22:01-06:00
①	Any building used as hospital, convalescence home, home for the aged, sanatorium and institutes of higher learning, conference rooms, public library, environmental and recreational site	66 (52-88)	59 (52-87)	45	35
②	Residential buildings	73 (43-79)	71 (56-79)	50	35
③	Mixed residential (with some commercial and entertainment)	76 (64-95)	71 (58-92)	50	35
④	Residential + industry or small-scale production + commerce	73 (66-90)	67 (60-78)	60	50
—	Industry	-	-	70	60
IFC Guidelines ^{*1)}	Residential	-		55	45
	Industrial	-		70	70

Remark: *1)IFC : International Finance Corporation

All survey points exceed the draft standard in Liberia. The expected reasons are that

- Large-sized vehicles travel with low speed during traffic congestion,
- Large-sized vehicles park in ROW and sort out merchandise or maintain vehicles while idling,
- Ill-serviced vehicles make noise,
- A lot of vehicles pass through ROW in order to avoid traffic congestion and
- Since the surface of ROW is uneven and earthen road, noise is made by passing vehicle.

1-3-2 Land Acquisition and Resettlement

1-3-2-1 Necessity of Land Acquisition and Resettlement

The Project is to reconstruct and expand the existing Somalia Drive Road and the Project area has already taken by MPW. However, according to socio-economic surveys (Population Census Survey, Asset and Land Survey, Livelihood Survey) carried out from February to June 2016, 25 project affected structures (26 PAHs) were confirmed in the Project area (ROW, 50 feet, from the centerline of the road). Therefore it is necessary to resettle those PAHs properly in order to implement the Project.

In the Master Plan Study on urban Facilities Restoration and Improvement in Monrovia in the Republic of Liberia, JICA, 2009 (JICA Master Plan), ROW of the Project used to be 150 feet, though ROW was narrowed up to 50 feet in order to reduce the number of involuntary resettlement. Also, 5 alternatives including No-action were weighted in order to minimize PAHs/PAPs and the most suitable plan was adopted for the Project. (The detail is shown in Table 1.3-7 Comparison of Alternatives.) However, there are project affected structures mainly tentative commercial structures such as kiosk and vendor along the Project road and thus land acquisition and resettlement in accordance with Liberian Laws as well as JICA Guidelines is required.

1-3-2-2 Framework of Land Acquisition and Resettlement

(1) Framework of Land Acquisition and Resettlement

Liberian Constitution 1986

Article 1-4 (a) and (b) of the Constitution gives right to all individuals to own property, either on individual basis or in conjunction with other individuals, as long as they are Liberian citizens. The right to ownership of property, however, does not extend to mineral resources on or beneath the land.

Article 24 provides for the expropriation of private property for public use; and set the conditions upon which compensation can be made for said properties.

County Act 1969

This Act instituted official distribution and demarcation of land boundaries in Liberia into political subdivisions known as counties. At the time of independence, there were only three counties in Liberia - Montserrado, Grand Bassa and Sinoe. Later, other counties along the coast were annexed and the regions in the hinterland were declared as provinces. However, by this Act, all of the provinces were declared counties.

Land Acquisition Act 1929

The Act outlines procedure for obtaining rights to any piece of land in Liberia through purchase. It distinguishes land in Liberia into two categories: the hinterland and the county area. The procedure for obtaining land located in the hinterlands is as follows:

- Obtain consent of Tribal Authority to have a parcel of land deeded to the individual by the Government;
- Pay a sum of money as a token of one's intention to live peacefully with the tribesmen;
- Paramount or clan chief signs a certificate which purchaser forwards to the office of the District Commissioner (who also acts as the Land Commissioner for the area);
- The District Commissioner, after ascertaining that the land is not encumbered in anyway, approves that the land be deeded to the applicant and he issues a certificate to the applicant.

The procedure for obtaining land located in the county is as follows:

- Application to the Land Commissioner in the county in which the land is located.
- The applicant obtains a certificate from the Land Commissioner, if he is satisfied that the land is unencumbered.

Revised Law and Administrative Regulations for Governing the Hinterland (RLARGH), 2001

Article 66 of the RLARGH states that, "title to the territory of the Republic of Liberia is vested in the sovereign state". The right and title of the respective tribes to land of an adequate area for farming and other enterprises essential to the necessities of the tribe main interest in the land to

be utilized by them for their purposes; and whether or not they have procured deeds from Government, delimiting by notes and bounds such reserves, their rights and interests in and to such areas, are a perfect reserve and give them title to the land against any person or persons whomsoever. The article further states that when the tribe should advance, they should petition the Government for the division of the land into family holdings and the Government should grant deeds to each family in fee simple.

Article 67 of the RLARGH states, among other things, that individuals not member of a tribe may enter a tribal land for the purpose of using said land. However, said person should obtain permission from the Tribal Authority prior to commencing his activities and agree to pay some token in the nature of rent.

The Independent National Commission on Human Rights Act of 2005

This Act establishes the framework upon which complaint of the violation of the human rights of persons can be received and investigated. The Commission is authorized to review existing national legislation and recommend provisions to ensure that they are harmonized with international human rights standards and instruments. The Commission is also authorized to draw to national attention, the violation of the human rights of persons in any part of the country.

Mineral and Mining Law

This Law provides for mineral ownership, administration, eligibility for rights regarding exploration, mine and quarry operation, environmental protection, common licensing provisions, protected zones, occupant and owner rights, public use of infrastructure, environmental considerations, trade, inspections, fiscal and other provisions.

(2) JICA's Policy on Involuntary Resettlement

JICA's policy on involuntary resettlement is shown below;

The key principle of JICA policies on involuntary resettlement is summarized below.

- I. Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives.
- II. When, population displacement is unavoidable, effective measures to minimize the impact and to compensate for losses should be taken.
- III. People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels.
- IV. Compensation must be based on the full replacement cost² as much as possible.

² Description of "replacement cost" is as follows.

- V. Compensation and other kinds of assistance must be provided prior to displacement.
- VI. For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. It is desirable that the resettlement action plan includes elements laid out in the World Bank Safeguard Policy, OP4.12, Annex A.
- VII. In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. When consultations are held, explanations must be given in a form, manner and language that are understandable to the affected people.
- VIII. Appropriate participation of affected people must be promoted in planning, implementation and monitoring of resettlement action plan.
- IX. Appropriate and accessible grievance mechanisms must be established for the affected people and their communities.

Above principals are compensated by World Bank OP4.12, since it is stated in JICA Guideline that “JICA confirms that projects do not deviate significantly form the World Bank’s Safeguard Policies”. Additional key principle based on World Bank OP4.12 is as follows.

- X. Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves an eligibility cut-off date, asset inventory, and socio-economic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits.
- XI. Eligibility of benefits include, the PAHs/PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAHs/PAPs who don’t have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying.
- XII. Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based.
- XIII. Provide support for the transition period (between displacement and livelihood restoration).

Land	Agricultural Land	The pre-project or pre-displacement, whichever is higher, market value of land of equal productive potential or use located in the vicinity of the affected land, plus the cost of preparing the land to levels similar to those of the affected land, plus the cost of any registration and transfer taxes.
	Land in Urban Areas	The pre-displacement market value of land of equal size and use, with similar or improved public infrastructure facilities and services and located in the vicinity of the affected land, plus the cost of any registration and transfer taxes.
Structure	Houses and other Structures	The market cost of the materials to build a replacement structure with an area and quality similar or better than those of the affected structure, or to repair a partially affected structure, plus the cost of transporting building materials to the construction site, plus the cost of any labor and contractors’ fees, plus the cost of any registration and transfer taxes.

XIV. Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, land led, elderly, woman and children, ethnic minorities etc.

XV. For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared.

In addition to the above core principles on the JICA policy, it also laid emphasis on a detailed resettlement policy inclusive of all the above points; project specific resettlement plan; institutional framework for implementation; monitoring and evaluation mechanism; time schedule for implementation; and , detail Financial Plan etc.

(3) Comparison between Liberian Registrations and JICA Guideline

The Table 1.3-20 shows the comparison between the Liberian registrations and JICA Guidelines.

Table1.3-20 Comparison between Liberian Legislations and JICA Guidelines for Environmental and Social Considerations,2010

No.	JICA Guidelines	Laws and Regulations of Liberia	Gap between JICA Guidelines and Laws and Regulations of Liberia	Policy for the Project to Bridge the Gap
1.	Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. (JICA GL)	L. C.* - Art. 11 (a) provides that all persons are born equally free and independent and have certain natural, inherent and in alien-able rights, among which are the right of enjoying and defending life and liberty, of pursuing and maintaining the security of the person and of acquiring, possessing and protecting property.	Current Constitutional provisions and ESIA/SIA guidelines do not make explicit reference to the need for avoidance or limiting of physical or economic displacement.	In order to avoid and/or minimize Involuntary resettlement and loss of means of livelihood, feasible alternatives shall be examined.
2.	When population displacement is unavoidable, effective measures to minimize impact and to compensate for losses should be taken. (JICA GL)	M.M.L.* - S 11.3 provides that "landowner or occupants of land shall be entitled to just, prompt and adequate compensation for any diminution in the value of land caused by disturbance, disfigurement or other factor.	There is no big difference between JICA Guidelines and Laws and Regulations of Liberia.	The best design to minimize impact shall be selected. Also the same compensation standard for PAHs/PAPs as WB shall be applied.

No.	JICA Guidelines	Laws and Regulations of Liberia	Gap between JICA Guidelines and Laws and Regulations of Liberia	Policy for the Project to Bridge the Gap
3.	People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels. (JICA GL)	Same as above.	There is no laws and regulations that describe improvement or restoration of PAHs/'PAPs' standard of living, income opportunities and production levels	The same compensation standard for PAPs as WB shall be applied. Also measures to improve or restore PAHs/'PAPs' standard of living, income opportunities and production levels shall be taken into consideration.
4.	Compensation must be based on the full replacement cost as much as possible. (JICA GL)	Same as above.	There is no law and regulation that describe full replacement cost.	Compensation shall be based on the full replacement cost.
5.	Compensation and other kinds of assistance must be provided prior to displacement. (JICA GL)	—	There is no laws and regulations which describe exact schedule of payment of compensation.	Compensation and other kinds of assistance shall be provided prior to displacement.
6.	For projects that entail large-scale involuntary resettlement, RAP must be prepared and made available to the public. (JICA GL)	—	There is no laws and regulations which describe RAP.	RAP shall be prepared in accordance with JICA and WB guidelines.
7.	In preparing a RAP, consultations must be held with the PAPs and their communities based on sufficient information made available to them in advance. (JICA GL)	ESIA Procedure Guidance describe that an important part of the Environmental Impact Assessment process is the public consultation that is carried out by the proponent.	There is no big gap between laws and regulations of Liberia and JICA Guidelines.	Sufficient stakeholder meetings shall be held by MPW. Also MPW shall provide adequate information to PAPs in advance of the meetings.
8.	When consultations are held, explanations must be given in a form, manner and language that are understandable to the PAPs. (JICA GL)	—	There is no laws and regulations which describe manner and language that are understandable to the PAPs.	When consultations are held, explanations shall be given in a form, manner and language that are understandable to the PAPs.
9.	Appropriate participation of PAPs must be promoted in planning, implementation and monitoring of resettlement action plans. (JICA GL)	—	There is no laws and regulations which describe public participation in planning, implementation and monitoring.	Adequate stakeholder meetings shall be held from planning, implementation and monitoring stage to obtain consensus from PAPs.

No.	JICA Guidelines	Laws and Regulations of Liberia	Gap between JICA Guidelines and Laws and Regulations of Liberia	Policy for the Project to Bridge the Gap
10.	Appropriate and accessible grievance mechanisms must be established for the affected people and their communities. (JICA GL)	L. C.* - Art. 26 provides where any person or any association alleges that any of the rights granted under this Constitution or any legislation or directives are constitutionally contravened, that person or association may invoke the privilege and benefit of court direction.	Liberian Law does not require the proponent to establish their own grievance mechanism for this purpose.	MPW shall establish a third party grievance process to manage grievances including those relating to the resettlement process.
11.	PAPs are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory and socio-economic survey), preferably at the Project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits. (WB OP4.12 Para.6)	M.M.L. - S 11.3 provides that "landowner or occupants of land shall be entitled to just, prompt and adequate compensation for any diminution in the value of land caused by disturbance, disfigurement or other factors.	Laws and regulations of Liberia do not explain the relationship between a 'land-owner identification study' and a census. There is also no specify cut-off dates for eligibility of land-owners to receive compensation or assistance from the proponent.	The Project shall ensure the conduct of people and asset censuses. This will be conducted for each resettlement affected area. Commencement of this census will mark the "cut-off date" after which time any new houses, gardens, or other fixed assets will no longer be eligible for resettlement assistance package options and/or compensation. Public disclosure and engagement shall be undertaken to appraise land-owners of the cut-off date and information on resettlement.
12.	Eligibility of benefits includes, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying. (WB OP4.12 Para.15)	Laws and regulations of Liberia recognize a broad distinction between the holders of: - Freehold titles over land (L.C.) - Customary land Rights (RLARGH – Art. 66)	Laws and regulations of Liberia do not prescribe compensation for anyone without recognizable legal title to land.	The Project shall provide for compensation and assistance to households affected by the Project resettlement regardless of any prevailing or prospective status.

No.	JICA Guidelines	Laws and Regulations of Liberia	Gap between JICA Guidelines and Laws and Regulations of Liberia	Policy for the Project to Bridge the Gap
13.	Provide support for the transition period (between displacement and livelihood restoration). (WB OP4.12 Para.6)	—	There is no laws and regulations which describe provision of support for the transition period.	Support for the transition period shall be taken into considerations.
14.	Particular attention must be paid to the needs of vulnerable group among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc. (WB OP4.12 Para.12)	—	There is no laws and regulations which describe particular attention to vulnerable groups.	Vulnerable groups shall be paid damage and deprivation compensation, as well as an assistance of livelihood restoration.

Remark: *) L.C : Liberian Constitution 1986
M.M.L : Minerals and Mining Law

(4) Land Acquisition and Resettlement Policy of the Project

<p>I. The Government of Liberia will use the Project Resettlement Policy (the Project Policy) for “the Preparatory Survey on the Project for Reconstruction of Somalia Drive in Monrovia in the Republic of Liberia” specifically because existing national laws and regulations have not been designed to address involuntary resettlement according to international practice, including JICA’s policy. The Project Policy is aimed at filling-in any gaps in what local laws and regulations cannot provide in order to help ensure that PAHs/PAPs are able to rehabilitate themselves to at least their pre-project condition. This section discusses the principles of the Project Policy and the entitlements of the PAHs/PAPs based on the type and degree of their losses. Where there are gaps between the Liberian legal framework for resettlement and JICA’s Policy on Involuntary Resettlement, practicable mutually agreeable approaches will be designed consistent with Government practices and JICA’s Policy.</p> <p>II. Land acquisition and involuntary resettlement will be avoided where feasible, or minimized by identifying possible alternative project designs that have the least adverse impact on the communities in the project area.</p> <p>III. Where displacement of households is unavoidable, all PAHs/PAPs (including communities) losing assets, livelihood or resources will be fully compensated and assisted so that they can improve, or at least restore, their former economic and social conditions.</p> <p>IV. Compensation and rehabilitation support will be provided to any PAHs/PAPs, that is, any person or household or business which on account of project implementation would have his, her or their:</p> <ul style="list-style-type: none"> • Standard of living adversely affected; • Right, title or interest in any house, interest in, or right to use, any land (including premises,
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- agricultural and grazing land, commercial tenancy, or right in annual or perennial crops and trees or any other fixed or movable assets, acquired or possessed, temporarily or permanently;
- Income earning opportunities, business, occupations, work or place of residence or habitat adversely affected temporarily or permanently; or
 - Social and cultural activities and relationships affected or any other losses that may be identified during the process of resettlement planning.
- V. All affected people will be eligible for compensation and rehabilitation assistance, irrespective of tenure status, social or economic standing and any such factors that may discriminate against achievement of the objectives outlined above. Lack of legal rights to the assets lost adversely affected tenure status and social or economic status will not bar the PAPs from entitlements to such compensation and rehabilitation measures or resettlement objectives. All PAHs/PAPs residing, working, doing business and/or cultivating land within the project impacted areas as of the date of the latest census and inventory of lost assets (IOL), are entitled to compensation for their lost assets (land and/or non-land assets), at replacement cost, if available and restoration of incomes and businesses and will be provided with rehabilitation measures sufficient to assist them to improve or at least maintain their pre-project standards, income-earning capacity and production levels.
- VI. PAHs/PAPs that lose only part of their physical assets will not be left with a portion that will be inadequate to sustain their current standard of living. The minimum size of remaining land and structures will be agreed during the resettlement planning process.
- VII. People temporarily affected to be considered PAHs/PAPs and resettlement plans address the issue of temporary acquisition.
- VIII. Where a host community is affected by the development of a resettlement site in that community, the host community shall be involved in any resettlement planning and decision-making. All attempts shall be made to minimize the adverse impacts of resettlement upon host communities.
- IX. The resettlement plans will be designed in accordance with Liberia law and JICA's Policy on Involuntary Resettlement.
- X. The Resettlement Plan will be translated into local languages and disclosed for the reference of PAHs/PAPs as well as other interested groups.
- XI. Payment for land and/or non-land assets will be based on the principal of replacement cost.
- XII. Compensation for PAHs/PAPs dependent on agricultural activities will be land-based wherever possible. Land-based strategies may include provision of replacement land, ensuring greater security of tenure, and upgrading livelihoods of people without legal land titles. If replacement land is not viable, other strategies may be built around opportunities for re-training, skill development, wage employment, or self-employment, including access to credit. Solely cash compensations will be avoided as an option if possible, as this may not address losses that are not easily quantified, such as access to services and traditional rights, and may eventually lead to those populations being worse off than without the Project.
- XIII. Replacement lands, if the preferred option of PAHs/PAPs should be within the immediate vicinity

of the affected lands wherever possible and be of comparable productive capacity and potential³. As a second option, sites should be identified that minimize the social disruption of those affected; such lands should also have access to services and facilities similar to those available in the lands affected.

- XIV. Resettlement assistance will be provided not only for immediate loss, but also for a transition period needed to restore livelihood and standards of living of PAHs/PAPs. Such support could take the form of short-term jobs, subsistence support, salary maintenance, or similar arrangements.
- XV. The resettlement plan must consider the needs of those most vulnerable to the adverse impacts of resettlement (including the poor, those without legal title to land, ethnic minorities, women, children, elderly and disable) and ensure they are considered in resettlement planning and mitigation measures identified. Assistance should be provided to help them improve their socio-economic status.
- XVI. PAHs/PAPs will be involved in the process of developing and implementing resettlement plans.
- XVII. PAHs/PAPs and their communities will be consulted about the project, the rights and options available to them, and proposed mitigation measures for adverse effects, and to the extent possible be involved in the decisions that are made concerning their resettlement.
- XVIII. Adequate budgetary support will be fully committed and made available to cover the costs of land acquisition (including compensation and income restoration measures) within the agreed implementation period. The funds for all resettlement activities will come from the Government.
- XIX. Displacement does not occur before provision of compensation and of other assistance required for relocation. Sufficient civic infrastructure must be provided in resettlement site prior to relocation. Acquisition of assets, payment of compensation, and the resettlement and start of the livelihood rehabilitation activities of PAHs/PAPs, will be completed prior to any construction activities, except when a court of law orders so in expropriation cases. (Livelihood restoration measures must also be in place but not necessarily completed prior to construction activities, as these may be ongoing activities.)
- XX. Organization and administrative arrangements for the effective preparation and implementation of the resettlement plan will be identified and in place prior to the commencement of the process; this will include the provision of adequate human resources for supervision, consultation, and monitoring of land acquisition and rehabilitation activities.
- XXI. Appropriate reporting (including auditing and redress functions), monitoring and evaluation mechanisms, will be identified and set in place as part of the resettlement management system. An external monitoring group will be hired by the project and will evaluate the resettlement process and final outcome. Such groups may include qualified NGOs, research institutions or universities.

³ Agricultural land for of equal productive capacity means that the land provided as compensation should be able to produce the same or better yield the AP was producing on his/her land prior to the project. The production should be in the planting season immediately following the land acquisition. It can be for a future period if transitional allowance equal to the household's previous yield is provided to the AP household while waiting for the land to get back to the same productivity as the previous land.

Cut-off Date of Eligibility

The Cut-off Date of eligibility refers to the date prior to which the occupation or use of the project area makes residents/users of the same eligible to be categorized as PAHs/PAPs and be eligible to Project entitlements. In the Project, Cut-off dates for titleholders will be the date of notification under the Land Acquisition Act and for non-titled holders will be the beginning date of the population census; 1st March, 2016). This date has been disclosed to each affected communities by MPW. The establishment of the eligibility Cut-off Date is intended to prevent the influx of ineligible non-residents who might take advantage of Project entitlements

Principle of Resettlement Cost

All compensation for land and non-land assets owned by households/shop owners who meet the Cut-off Date will be based on the principle of replacement cost. Replacement cost is the amount calculated before displacement which is needed to replace an affected asset without depreciation and without deduction for taxes and/or costs of transaction as follows:

- a. Sale/Market Comparison Method: This method is based on data provided from recent sales of properties that are highly comparable to the subject property in the vicinity.
- b. Contingent Valuation Method: This method is based on the willingness to accept (WTA) and willingness to pay (WTP) between the affected person and project proponent. This method is mainly used for land price estimation.
- c. Income Approach: This method considers the value of a property relative to the property ability to produce cash flow. This method is mainly used for estimating the prices of crops and trees on agricultural land.
- d. Replacement Cost Approach: This method was useful for structure cost estimation. The value of the structure is based on the current cost for building/constructing the affected structure and labor cost^{*1}. For the purpose of this RAP, the value of structures and labor cost was based on market value without depreciation.

Remarks: *1) Regulation of the Real Estate Division of the Ministry of Finance

1-3-2-3 Magnitude and Scope of Land Acquisition and Resettlement

The Cut-off Date was declared by utilizing mass media such as newspapers, Daily Inquire, and radio stations, Truth FM, Sky FM, LBS FM. In addition, the notice of the Cut-off Date was posted along the Project road in order for local residents around the Project area and Liberians to obtain necessary information. Moreover in order to prevent the inflow of new residents and/or workers in the Project area after the Cut-off Date, following measures were taken.

- ✓ Awareness campaign through the local communities
- ✓ Request for the cooperation of the local residents
- ✓ Posting the notice in public facilities along the Project site

In case the land acquisition and resettlement are implemented within 2 years after the socio-economic survey, the data shall be renewed.

(1) Population Censuses Survey

Population censuses survey was carried out targeting all persons occupying the Project area in order to obtain the information of PAHs/PAPs. As a result of the survey, it was confirmed that 26 households (25 structures) were affected in the Project area, ROW 50feet. However, about 39.6 % of total households (the owner of structure), or 9 households were un-surveyed due to absence, and therefore the number of households surveyed was 17. The number of PAPs was 40 in total and the average number of persons per household was turned out to be 2.35. Table 1.3-21 shows the details of PAHs and PAPs.

Table 1.3-21 Population, Gender of PAPs

Male	12	18 – 32 years old	3
Female	5	32 – 64 years old.	14
Total	17	Total	17

In addition, MPW continues to confirm the whereabouts of the 9 households un-surveyed by utilizing stakeholder meetings and mass media such as radios.

(2) Asset and Land Survey

Asset and land survey was carried out in order to obtain the information of assets and land which PAHs own in the Project area. Since all Project site, ROW 50 feet, belongs to MPW, new land acquisition is not required. Table 1.3-22 shows the structure type of occupied structure.

Table 1.3-22 Structure Type of Occupied Structures

Nature of Structures	Number	%
Concrete Blocks – Single Storey	7	26.9%
Fence – barbed wire	2	7.7%
Fence - concrete	3	11.5%
Petrol Stations	3	11.5%
Wood Frame (makeshift)	6	23.1%
Kiosks	2	7.7%
Containers	3	11.5%
Total	26	100.0%

(3) Livelihood Survey

It was carried out household-life survey of all of the PAPs Although hearing surveys to PAHs were conducted in order to obtain the information of PAHs' average income, all PAHs rejected to disclose their incomes, no matter how many times MPW persuaded PHHs. This is the same in the project by the World Bank in the past not only this project was conducted, this is because suspicions such as tax imposition by authorizes exist. Generally it is difficult to acquire the PAHs' incomes in Liberia.

1-3-2-4 Measures of Compensation and Assistance

(1) Compensation of Loss

A result of economic and social survey, about 100 percent of the affected residents are hoping the compensation in money. All of PAPs got agreed to receive the compensation in cash.

(2) Income Restoration Measures

One of the purposes for preparing RAP is for PAHs/PAPs to restore their standard of living, income opportunities and production levels to at least pre-project levels as soon as possible. In order to achieve the purpose, following measures are taken in the Project.

- a. Compensation shall be paid prior to acquisition or displacement.
- b. Compensation for structures shall include the full cost of materials and labor required for reconstructing a building of similar and preferably better quality and standing. In other words, the affected person must be able to have their structure rebuilt in a different location using the compensation paid for the old building. Depreciation will not be taken into account while calculating the cost of affected structures. The Compensation package will also include cost of moving, such as transport costs as well as any associated land titling or transfer fees.
- c. In case of movable and tentative kiosks/vendors, their operations in the area in or outside of ROW where newly constructed road structures are not disturbed are allowed.
- d. PAHs/PAPs will be given priority to be employed for construction works.
- e. To consult stakeholders, including communities and ensure their participation in the compensation policy for loss.
- f. MPW together with other related organizations shall consider carrying out software measures such as vocational trainings for PAHs/PAPs especially the vulnerable persons/groups.

(3) Entitlement Matrix

Table 1.3-23 shows the entitlement matrix for the Project.

Table 1.3-23 Entitlement Matrix for the Project

#	Type of Loss	Entitled Persons (Beneficiaries)	Entitlement (Compensation Package)	Implementation Issues/Guidelines	Responsible Organization
1	Loss of Structures	Owners of Structure (illegal)	Replacement Cost	<ul style="list-style-type: none"> ✓ Assessment of quality of structures. ✓ Assessment of Market Value ✓ Assessment of Cash Compensation ✓ Payment of Cash Compensation ✓ Affected Persons will be fully informed of the entitlements and the procedures regarding payments. ✓ Permission to continue business within ROW which does not destruct road facilities. ✓ Advance notice to vacate. 	GOL/MPW
		Owner of Container (illegal)	Replacement Cost	<ul style="list-style-type: none"> ✓ Payment of Cash Compensation ✓ Payment of moving fee ✓ Additional assistances such as relocation. ✓ Affected Persons will be fully informed of the entitlements and the procedures regarding payments. ✓ Permission to continue business within ROW which does not destruct road facilities. Advance notice to vacate. 	GOL/MPW
2	Loss of Income	Owners of Businesses	Assistance for Loss of Business Income	<ul style="list-style-type: none"> ✓ Assessment of Loss Income ✓ Assessment of Cash Assistance ✓ Payment of Cash Compensation ✓ Affected Persons will be fully informed of the entitlements and the procedures regarding payments. ✓ Advance notice to vacate. 	GOL/MPW
		Wage Earners	Assistance for Loss of Wage	<ul style="list-style-type: none"> ✓ Assessment of income loss ✓ 3 month cash hand-out worth of wages paid, if employment is lost by the Project. 	GOL/MPW
3	Loss of Accommodation	Lessor	Special Assistance	<ul style="list-style-type: none"> ✓ Rent of the remaining contract period is MPW pay to the owner. ✓ Additional assistances such as transportation, etc. ✓ Payment of Cash Compensation 	GOL/MPW

#	Type of Loss	Entitled Persons (Beneficiaries)	Entitlement (Compensation Package)	Implementation Issues/Guidelines	Responsible Organization
				<ul style="list-style-type: none"> ✓ Affected Persons will be fully informed of the entitlements and the procedures regarding payments. ✓ Advance notice to vacate. 	
		Tenants	Special Assistance	<ul style="list-style-type: none"> ✓ Re-imbusement of remaining worth of lease or tenancy deposit ✓ Moving assistance such as house replacement, assistance of rent for 3-month period and moving cost ✓ Affected Persons will be fully informed of the entitlements and the procedures regarding payments. ✓ Advance notice to vacate. 	GOL/MPW
		Vulnerable Persons	Special Measures and Assistance	<ul style="list-style-type: none"> ✓ Assessment of Loss ✓ Assessment of Assistance ✓ Payment of Cash Assistance ✓ Affected Persons will be fully informed of the entitlements and the procedures regarding payments. ✓ Provision of materials to help them build a higher standard replacement unit, assistance to acquire vocational training or income generating scheme. (done on a case-by-case basis) ✓ Additional assistances such as transportation, etc. ✓ Advance notice to vacate. 	GOL/MPW

Remarks) For unknown 9 structures, MPW is in search of the owner. It is assumed not to be a structurally rental facility building. However, it is also described on the assumption that it is leased facility.

1-3-2-5 Grievance Redress Mechanism

To ensure that grievances that may result over compensation are dealt with in timely and transparent way, to address complaints arising from the implementation of the RAP. Functions of the grievance redress committee includes

- a. Provision of support to affected persons on problems arising from loss of residence and business area, and loss of income
- b. Recording grievance of PAHs/PAPs, categorizing and prioritizing the grievance that need to be resolved by the committee; and
- c. Reporting to the aggrieved parties about the developments regarding their grievances and the decision of the Project authorities.

Grievance related to any aspect of the Project is handled through negotiation, which aims at achieving an amicable and consensus settlement.

Table 1.3-24 Grievance Redress Mechanism in Liberia

Stage	Organization	Description
First Stage	Grievance Redress Committee	Aggrieved person(s) may file compliant with the Grievance Redress Committee which will act on it within 7 working days on receipt. In order to address the compliant, a meeting in attendance with the aggravated person(s) and Grievance Committee members will be held.
Second Stage	Minister of MPW	If there is no resolution to the problem or the affected person does not receive a response from the MPW within a timely manner, the affected person may appeal to the Minister of MPW, which should act on the complaint/grievance within 5 working days as of the day of filing the complaint.
Third Stage	RAP External Committee	If the case is not resolved to the satisfaction of the complainant or the affected person does not receive a response from the Minister of Public Works, he/she may advance the matter to the RAP External Monitoring body for redress.
Last Stage	Court	If, at this level, the case remains unresolved, the aggrieved party may resort to legal actions in the Court of Law.

Grievance redress mechanism in Liberia has works smoothly without big problems in projects sponsored by donors such as WB and USAID and thus the Project introduces the same grievance redress mechanism as well. The grievance redress committee which plays key role of the mechanism is set directly under the Assistant Minister for Technical Services of MPW. The detail of the Grievance Redress Committee member (Draft) is shown in Table 1.3-25.

Table 1.3-25 Member of Grievance Redress Committee (Draft)

No	Name	Institution	Function in Institution	Role in the Committee
1	Daniel Socree	MPW	Assistant Minister	Chairman of the Committee
2	Samuel Kpakio	MPW	Zoning Officer	Zoning Expert
3	Michael Diggs	MPW	Legal Officer	Legal Expert
4	Stephen Colee	MPW	Safeguard Officer	Safeguard Expert
5	Aloysius Kotee	EPA	Environmental Officer	Environmental Expert
6	James Walker	MPW	Environmental Officer	Environmental Expert
7	Nicholas Perkins	LRRRC	Resettlement Officer	Resettlement Expert
8.	Musa Mansaray	PAPs	PAPs Representative	PAPs Representative
9.	Farfini Kamara	PAPs	PAPs Representative	PAPs Representative

1-3-2-6 Implementation Structure

Implementation of the RAP involves relevant institutions with mandates on Resettlement, land acquisition, infrastructure, environment and implementation of the Project. These institutions include MPW, EPA, JICA, RAP Implementation Committee and CDRI. However, the Infrastructure Implementation Unit (IIU) of MPW takes initiatives in the overall conduct of this exercise.

Infrastructure Implementation Unit (IIU) / Ministry of Public Works (MPW)

The IIU within the MPW will coordinate and supervise all activities for this project. The legal officer will ensure that all legal issues are addressed. For effective implementation of this RAP the IIU should recruit environmental social safeguard specialists to coordinate implementation of the ARAP. The environmental health and social specialists will:

- Ensure that the IIU complies with all applicable national, JICA, and World Bank policies;
- Liaise with other government agencies and prepare periodic monitoring reports; and
- Monitor RAP implementation.

Liberia Refugees Repatriation and Resettlement Commission

The commission has the responsibility to ensure that displaced persons are resettled in a favorable location. The commission will also ensure that benefits due the displaced persons are provided.

Environmental Protection Agency (EPA)

EPA is responsible to assess the environmental suitability of proposed actions including choice of resettlement areas and benefits to affected persons.

Japan International Cooperation Agency (JICA)

JICA is the entity financing the Project. JICA has the responsibility of ensuring that all of its and the WB Guidelines are in compliance during the implementation of the Project.

Center for Development & Resettlement Initiatives (CDRI)

The role and responsibility is to supervise the external monitoring of the implementation of the RAP. Figure 1.3-8 shows a matrix of the key implementing agencies of the RAP.

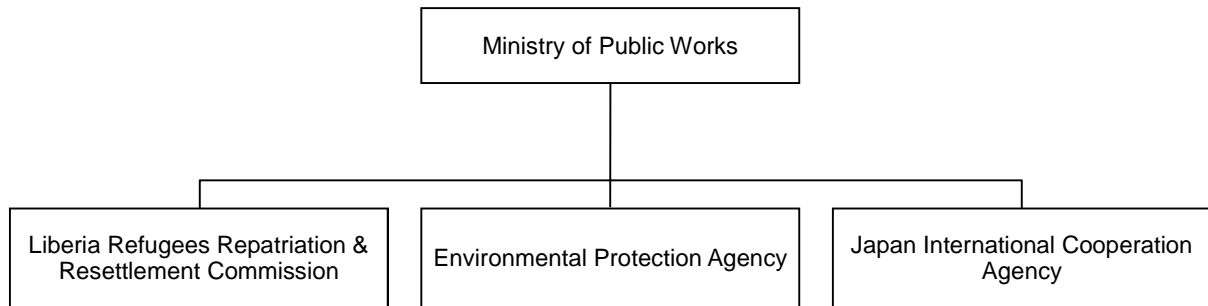


Figure 1.3-8 Organizational Chart for the Implementation of the Resettlement Action Plan

1-3-2-7 Implementation Schedule

This RAP is planned to be implemented over a period of twelve (12) months. During this period, all PAPs are expected to be fully compensated and resettled. The plan also takes into account important variables such as resolution of conflicts and grievances; cash flow from GOL to the consultant monitoring of the resettlement process. The proposed Implementation Schedule is presented in Table 1.3-26.

Table 1.3-26 Proposed Schedule of Implementation

Action	2016						2017					
	7	8	9	10	11	12	1	2	3	4	5	6
Approval of Draft ARAP												
Confirm Assets												
Handling Grievance												
Payment of Compensation												
Relocation of PAPs												
Demolition/removal of structures												
Internal Monitoring												
External Monitoring												
Post-evaluation												

1-3-2-8 Budget and Source

The expected cost for the implementation of the RAP is US\$78,138.00. Table 1.3-27 shows the breakdown of the cost for RAP implementation. Security costs are in accordance with the compensation standards of World Bank, other donors and Phase 1 in Monrovia.

Table 1.3-27 Budget for the Implementation of Resettlement Action Plan

						(USD)
No	Item	Unit	Q'ty	Estimated Cost(USD)	Source of Funding	
Compensation for Affected Structure						
1	Concrete Blocks – single storey	HH	7	23,217.00	GOL/MPW	
2	Fence-barb wire	HH	2	2,025.00	GOL/MPW	
3	Fence-concrete	HH	3	12,466.50	GOL/MPW	
4	Petrol Stations	HH	3	6,255.00	GOL/MPW	
5	Wood-frame (makeshift)	HH	6	6,462.00	GOL/MPW	
	Sub-Total (= A)			50,425.50	-	
Compensation and Other Assistance						
6	Compensation for Loss of Income (USD200 for formal businesses and USD50 for informal businesses)	HH	25	3,200.00	GOL/MPW	
7	Relocation Assistance (USD300 per Container x 3, USD150 per other removable structure (kiosks) x 4)	HH	7	1,500.00	GOL/MPW	
8	Disturbance Assistance (USD400 per HH for formal businesses and USD150 per HH for informal businesses)	HH	25	4,750.00	GOL/MPW	

No	Item	Unit	Q'ty	Estimated Cost(USD)	Source of Funding
9	Assistance to Vulnerable People (USD50 per HH with female heads)	HH	5	250.00	GOL/MPW
	Sub-Total (= B)			9,7000.00	-
	Total (C = A + B)			60,125.50	-
Administration, Implementation, Monitoring and Evaluation					
10	RAP Implementation Logistics and Administration	L.S	1	5,000.00	GOL/MPW
11	Cost for RAP Implementation Committee	L.S	1	4,000.00	GOL/MPW
12	Consultancy Service (Implementation & Monitoring)	L.S	1	3,000.00	GOL/MPW
	Sub-Total (= D)			12,000.00	-
13	Contingency (E = 10% of C)* ¹	L.s	1	6,012.50	-
	Grand Total (F = C + D + E)			78,138.00	-

Remark) *1: Contingency includes inflation rate and other unpredictable cost.

1-3-2-9 Monitoring Structure of the Proponent

Monitoring and evaluation of RAP implementation is highly important and is needed to be properly designed and implemented. Monitoring involves the collection and analysis of data on project activities, ensuring project implementation and management towards target project objectives. Monitoring also allows PAPs to review project activities, to determine whether project objectives are being achieved and to suggest revision where necessary. There are both internal and external monitoring for the implementation of the RAP.

(1) Internal Monitoring

The MPW shall constitute an internal monitoring team for the RAP implementation. The monitoring team shall prepare a Project Implementation Manual, which will detail the monitoring frequency and content of monitoring reports. The result of monitoring shall be reported to JICA and EPA on quarterly basis, during the implementation of the RAP and project. Table 1.3-28 shows the criteria and indicators for the internal monitoring.

Table 1.3-28 Criteria and Indicators for Internal Monitoring

Criteria	Indicator for Monitoring
Budget and Time Frame	1. Have all resettlement staff been appointed and mobilized for the field and office work on schedule?
	2. Have capacity building and training activities been completed on schedule?
	3. Are resettlement implementation activities being achieved against agreed implementation plan?
	4. Are funds for resettlement being allocated on time?
	5. Have resettlement offices received the scheduled funds?
	6. Have funds been disbursed according to ARAP?
	7. Has the social preparation phase taken place as scheduled?

Criteria	Indicator for Monitoring
Delivery of PAPs Entitlements	8. Have all PAPs received entitlements according to numbers and categories of loss set out in the Entitlement Matrix?
	9. Are assistance measures being implemented as planned for host communities?
	10. Have affected businesses received entitlements including transfer and payments for income losses resulting from lost business?
Consultations, Grievance and Special Issues	11. Have consultations taken place as scheduled including meetings and community activities?
	12. Have disclosure meetings taken place?
	13. How many PAPs know their entitlements? How many know if they have been received?
	14. Has Grievance Redress Committee been set up?
	15. Have any PAPs used the grievance redress procedures? What were the outcomes?
	16. Have conflicts been resolved?
Benefit Monitoring	17. Was the social preparation phase implemented?
	18. What changes have occurred in patterns of occupation and production compared to the pre-project situation?
	19. What changes have taken place in key social parameters relating to living standards?
	20. What changes have occurred for vulnerable groups?

(2) External Monitoring

Due to the impact the project is expected to have on the communities within the project area, it is important that external monitoring is also undertaken. External monitoring shall be conducted by the Liberia Refugees Repatriation and Resettlement Commission (LRRRC).

As strategic partner for the implementation of the project, LRRRC shall routinely field monitoring teams who will screen the project for overall adherence to conditions set in the ARAP. And in order to determine the final impacts of this ARAP, LRRRC shall prepare and submit a final evaluation impact assessment within 12 months after the conclusion of resettlement to evaluate whether the intended objectives were realized. The criteria for the external monitoring are detailed in Table 1.3-29.

Table 1.3-29 Criteria and Indicators for External Monitoring

Criteria	Indicators for Monitoring
Basic Information on PAPs Households	1. Location
	2. Composition and structure, ages, educational and skill levels and gender of household head
	3. Access to health, education, utilities and other social services
	4. Land and other resource owning
	5. Participation in neighborhood or community groups
	6. Value of all assets forming entitlements and resettlement entitlements
Livelihood Restoration	7. Were structure compensation payments made free of depreciation, fees or transfer costs to the PAP?
	8. Were other compensation payments free of deductions for depreciation, fees or transfer costs to the AP?
	9. Were compensation payments sufficient to replace lost assets?
	10. Did income substitution allow for re-establishment of enterprises?
	11. Have vulnerable groups been provided income earning opportunities? Are these effective and sustainable?
Levels of Satisfaction	12. How much do PAPs know about resettlement procedures and entitlements? Do PAPs know their entitlements?
	13. Do they know if these have been met?
	14. How do APs assess the extent to which their own living standards and livelihoods have been restored?
	15. How much do PAPs know about grievance procedures and conflict resolution procedures?
Effectiveness of Resettlement Planning	16. Were the PAPs and their assets correctly enumerated?
	17. Was the time frame and budget sufficient to meet objectives?
	18. How did resettlement implementers deal with unforeseen problems?
	19. Were there unintended environmental impacts?

1-3-2-10 Public Participation

In order to exchange opinions among stakeholders and share information in terms of the preparation of RAP and environmental & social considerations, 8 in total stakeholder meetings were taken place. Table 1.3-30 shows the outline of the stakeholder meetings.

Table 1.3-30 Outline of the Stakeholder Meetings

Date	3 rd June 2016
Method	Public Assembly
Participant	13
Venue	James N.Davis SDA School

The subjects in the main target of the PAPs, was announced to target the district representative and the road surrounding residents. Phase 1 were often PAPs number to create a new two-lane. Interest of the residents was high. This project is a small PAPs number is a renovation of an existing road. Interest of the residents is low.

MPW is regard to transfer before the implementation of this project, to make the same degree of assurance and Phase 1 was a description to the residents. The interest level of residents was low. There was no dissent, because road maintenance is desired, and because PAPs will get to the Phase 1 similar guarantee. Next time Stakeholder Meetings is scheduled to be held in determining the final transfer amount. It is expected to be notified to the district representatives and stakeholders but not limited to the PAPs. Planning of this project as much as possible, comments received from participants in the consultation residents, it has been reflected in the creation of the RAP.

The main questions, comments, and answers the MPW for it is as follows.

Concern / Question	Answer
We understand that there is a two-lane road currently under construction.	Yes, it is the construction of the existing two-lane.
We understand that there is a two-lane road presently undergoing construction on the left side of the Somalia drive, will there be another two-lane constructed on the right side as well?	Yes, the right side will also be constructed to a two-lane road to have (4) four lanes, should the Japanese Government agree to the request of the Government of Liberia. But before that, the Japanese's Government through, JICA, has commissioned studies to ascertain the impact the project will have. Hence, our firm, Earth Environmental Consultancy, was contracted to do an environmental impact assessment and a resettlement action plan to ascertain the environmental impact and actual number of Liberian citizens that might be affected by the project, and to make recommendation to the Liberian Government and JICA.
If the Liberian Government will be making some compensation to all project affected persons (PAPs), with in the 50ft measurement of the right-off way, will that entirely be based on your studies report?	Absolutely. Should there be any compensation of any kind that has to be implemented based on the reports presented by Earth Environmental Consultancy (EEC), the local firm that was hired.
During your presentation, you spoke of a study conducted, where your consultancy firm captured structures along the right-off –way in 50ft, 60ft and 75ft. What is it, this meeting only concentrates on structures in 50ft?	Our terms of reference indicated that we conduct our studies within 50 ft., 60 ft. and 75 ft. However so as to reduce the impact of the project, JICA has decided to undertake the construction within 50 ft. from the median of the new road. Within this area, there will be limited impact as only 26 structures might be affected, according to our report.

Concern / Question	Answer
You mentioned that the Japanese agency JICA said that they are able to do the road construction within 50ft. So, why structures within 60ft and 75ft marked?	According to Liberian laws, all roads in Liberia should have a side walls or a path along the road for pedestrians. This area is called the right-of-way (ROW) in some areas, it is 75 ft. from the median. In other areas, it is 150 ft. However, since people have moved into major portion of the RW and to reduce the project impact, JICA has proposed to work in 50 ft. of the median.
What is the actual distance required for right of ways in Liberia?	According to the Liberian Government laws, the right off ways should be 75 ft. or 150ft, on both left and right sides of the road, from the median.
You spoke of 50ft in your presentation, that the government owns a right-of-way of 75 ft. or 150ft, while the studies was one for 50ft, 60ft, and 75ft. If so, why didn't EEC restrict the exercise to 50ft, knowing that the project can be undertaken in 50ft?	It is obvious that JICA is able to work within 50ft. of the median, but the Japanese government is also interested to know the likely impact the project would have if the project is undertaken within 60 ft. or 75 ft. of the median. The Japanese government does not want the project to affect many persons, that is why the studies were done to ascertain information across the three distances and the 50ft distance impact is less.
You said that your company EEC was hired to conduct the social economic survey, and you were to make recommendations as an independent entity. Is demolition exercise going to be one of EEC's recommendations?	Development comes with pain. The essence of undertaking the studies is to ascertain if the project can be undertaken without anyone being displaced. If people are to be displaced, the studies also wish to ascertain how the least number of persons can be affected. The last resort is that if structures are to be demolished, there should be no other better alternatives, and the owners of structures to be affected must be compensated and provided other assistance so that their livelihood is not adversely affected.
Is it compulsory that all project affected persons (PAPs) within the 50 ft. measurement be compensated?	Yes, all of those identified within the 50 ft. will be compensated.



Photo 1.3-1 Stakeholder Meetings

At the time the RAP is approved by EPA and the cost for resettlement for PAHs/PAPs respectively is confirmed, other stakeholder meetings will be taken place by MPW. When to hold a stakeholder meeting, MPW is contact in advance to the PAPs and local communities continue as project implementation responsibility institutions, take measures to encourage the participation of many stakeholders.

CHAPTER 2 CONTENTS OF THE PROJECT

2-1 Basic Concept of the Project

2-1-1 Upper Objective and Project Objective

The government of Liberia (GoL) formulated the Economic Stabilization and Recovery Plan (ESRP) for the economic and social restoration after the outbreak of Ebola. In the aforementioned plan, the government of Liberia recognized that the delay of infrastructure development led to the delay in the provision of public services including medical services. The government of Liberia places the transport and traffic sector as one of the most urgent issues to be tackled in the future.

The government of Japan conducted Master Plan Study on Urban Facilities Restoration and Improvement in Monrovia in November 2008, and the project for reconstruction of Somalia drive in Monrovia has been proposed as a high priority project

Overall goal: To activate the social economic activities in the metropolitan area of Monrovia

Objectives of the Project: To mitigate the traffic congestion and secure traffic safety through widening of the Somalia drive

Outcomes:

- ✓ 4-lane road including the two widening lanes by phase-1 are reconstructed

2-1-2 Scope of the Requested Japanese Assistance

For the completion of 4-lane road, reconstruction 2-lane road should be designed parallel with widening 2-lane new road by phase-1 on the 13.2 km stretch from Free Port Intersection to Red Light Intersection.

The width of Right of Way (ROW) on the left side of the existing road is 75 feet (22.9m). However, the road space for this planning was agreed at 50 feet (15.24m) width by the Technical Note on 4th March 2016, because roadside has been developed and a lot of buildings, houses and other structures have been located within the ROW.

The concerned section for Japanese assistance was agreed to be from Free Port Intersection to Station 13+200 through the discussion with MPW.

2-2 Outline Design of the Japanese Assistance

2-2-1 Design Policy (Construction Plan)

(1) Design Standard

Liberia does not have own design standard of the road. In general, American standard such as AASHTO and ASTM are commonly used. AASHTO Guidelines provide unspecified design standard in some points. Therefore, the Team also refers Japanese standard supplementary. The unit of length is converted from feet/inch to metric unit.

(2) Geometric Structure

The horizontal alignment is designed based on the centerline survey of existing road to adjust and follow the existing alignment. The vertical alignment is designed with minor improvement to provide vertical curves. The changes of the alignment are very limited in order to maintain the widening road drainage system by phase-1 project.

(3) Natural Condition

The design should reflect to the natural condition based on the results of investigation on meteorology, topography, geology, hydrology and so on. In particular, the drainage facilities are designed to be proper size structures based on the hydrological analysis.

(4) User of Public Transport

The roadside has been developed and a lot of vendors, shops and markets are doing the business within the ROW. There are many people waiting buses and taxies, parking bike taxies at around intersections, and the activities are mixed up and disorder situation. This situation should be improved for the convenience of road users. The facilities of the public transport such as bus stops, waiting zones of the taxies and bikes should be provided and properly used. The sidewalk should be provided.

(5) Land use of Roadside

Access ways from the project road to the roadside shops, facilities and communities should be provided properly. Road drainage facilities should be provided properly in order to drain rainy water from the widening road by phase-1 and the new road to the proper outlets.

2-2-2 Basic Plan

2-2-2-1 Design Criteria

Road

MPW and the Team made several discussions on the engineering matters based on the result of site survey. The both parties agreed the design criteria of this project as follows.

General Matter

Design Speed : 60 km/hr

Cross Slope : 2.5%

Super elevation : 4.0%

Pavement Type : Flexible Pavement (Improved Asphalt Concrete)

Performance Period : 10years

Standard Axle Load : 11.5 ton (ECOWAS Standard)

Cross Section Element

Width of Median : 2.5m

Lane Width : 3.3m

Pavement Width : 8.6m

Width of Sidewalk : Raised Sidewalk : 2.5m

Road Space

50 feet (15.2m) on south sides from centerline of median

2-2-2-2 Geometric Design

New construction part of the project road is designed to be combined with the existing part of the project road. The improvement of horizontal and vertical alignment is not considered and new part is designed to adjust to existing road. However present geometric values are reviewed whether those satisfied design criteria, and it confirms that the alignment is appropriate.

The geometric design criteria agreed with MPW as follows;

Maximum Cross Slop	4.0%
Minimum radius	R=135 m
Sharpest curve without super elevation	R>1,310 m
Super elevation runoff	1/167
Maximum grade	I=7%
Minimum vertical curve	Crest K=11, Sag K=18

The horizontal alignment is basically not improved any alignment elements due to new part constructing contiguity with existing pavement.

Regarding vertical alignment, the present alignment is kept also on new construction part. However the vertical curve is provided on the change at points of grade for the smooth alignment.

The surface elevation near Station 0+025 around Free Port Intersection is lower than roadside land level. During rainfall, surface water on UN Drive flow toward Somalia Drive and lower portion on Somalia Drive is inundated constantly. Therefore the road surface elevation between Station 0+000 and 0+600 is raised by 80 cm to prevent the water flow from UN Drive and to let the surface water of Somalia Drive flows down to existing concrete ditch.

2-2-2-3 Cross Section Component

Road Cross Slope

Urban road maximum super elevation is generally 4%. There are negative factors such as the parking bike by increasing the super elevation. This project is adopted a maximum super elevation of 4% and the normal cross slope of 2.5%. The slope of the sidewalk it is desirable as small as possible in consideration of wheelchair or wheelbarrow. The slope of the sidewalk is adopted normal cross slope of 2.0%. Phase 1 road section has installed a central drainage system. Rainwater that falls to the new widened road section flows in the central drainage. Somalia Drive is planned in the super elevation of each lane. The project is planned a central drainage system (Phase 1) + shoulder drainage system (Phase 2) for the following reasons.

- ✓ By the two drainage systems, it is possible to support drainage in maintenance insufficient
- ✓ Rainwater from the kiosk in Somalia drive south side will be able to process by shoulder drainage system.
- ✓ Phase 2 road section directed from Free Port Intersection to the Red Light Intersection. The road section is often right curve. The road section that has the super elevation, increased traveling performance of the vehicle.

Table 2.2-1 Road Segmentation

Phase 1 road section (Including the bridge section)		Super elevation section (Central Drainage System)		Super elevation section (Central Drainage + Shoulder Drainage System)	
Sta.0+0-Sta.0+435	435m				
				Sta.0+435-Sta.1+250	815m
Sta.1+250-Sta.1+615	365m				
				Sta.1+615-Sta.4+760	3,145m
				Sta.4+760-Sta.8+225	3,465m
Sta.8+225-Sta.8+275	50m				
				Sta.8+275-Sta.8+460	185m
		Sta.8+460-Sta.8+960	500m		
				Sta.8+960-Sta.13+200	4,240m
Total: 850m		Total: 500m		Total: 11,850m	

Cross Section Component

The Somalia Drive is planned divided 4-lane road and the median is provided at edge of the widening pavement by phase-1. The width of medium is 2.5 m to secure the space for left turn lane, road drainage facilities and safety zone of crossing road.

A 3.3m lane width is adopted referring to the recommended value of urban arterial in AASHTO as the same phase-1. Left turn lane is 3.0 m wide. Median separator could not be provided at the left turn lane due to the lack of space, instead the centerlines are painted by double yellow lines to separate the opposing direction lanes.

Sidewalk is provided for the safety of pedestrian and it is 2.5 m wide width for securing the space for wheelbarrows to pass each other. It installs curbs and level of the sidewalk is raised 25 cm to clear the border of carriageway and walkway.

Green belt is provided at the outside of road and planted shrubs as a hedge. It makes clear the border of road space and prevents the occupation of road space by stalls and vendors.

These cross section composition are shown in Figure 2.2-1 as the typical cross section

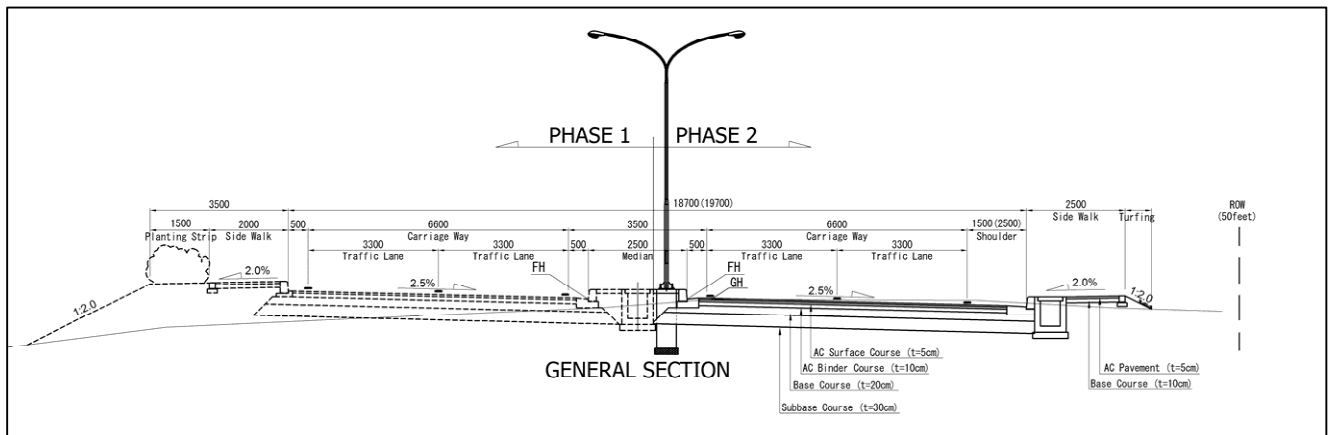


Figure 2.2-1 Typical Cross Section

2-2-2-4 Pavement Design

(1) Design Condition

Pavement design is carried out in accordance with AASHTO Guide for Design of Pavement Structures. AASHTO says that pavement, new or rehabilitated, are usually designed for the period ranging 10 to 20 years. The minimum performance period is desirable at least 10 years before some major rehabilitation operation. The maximum performance period is 20 years from their experience. However they say that the selection of longer time periods that can be achieved in the field will result in unrealistic designs.

In this project, it is difficult to obtain high accuracy for the future traffic trend and forecast due to the rapid restoration and development in Monrovia. So future traffic forecast may low accuracy for the periods longer than 10 years and it may bring the excessive or insufficient design. Therefore the performance period of initial pavement is set up at 10 years in this project as the same phase-1 project.

The result of traffic survey and traffic forecast are shown as below.

Table 2.2-2 Result of Traffic Survey and Traffic forecast

	1	2	3	4	5	6	7	8	9	10
	Sedan / Wagon / Pick-up	Taxi	Mini Bus	Large Bus	Light Truck (2-Axle)	Heavy Truck (> 2-Axle)	Trailer (Articulated Truck)	Motorbike	Bicycle	Pedestrian
ESAL			0.740	1.000	2.048	4.400	5.600			
3/29 Free Port⇒Red Light	3806	2758	1490	559	513	519	280	950	39	1288
3/29 Red Light⇒Free Port	4079	1699	1058	656	519	449	278	1027	53	900
3/29 Free Port⇒Red Light Growth Rate			1490	559	513	519	280			
2017	1.065		1587	595	546	553	298			
2018	1.065		1690	634	581	589	317			
2019	1.065		1800	675	619	627	338			
2020	1.050		1890	709	650	658	355			
2021	1.050		1985	744	683	691	373			
2022	1.050		2084	781	717	726	392			
2023	1.050		2188	820	753	762	412			
2024	1.050		2297	861	791	800	433			
2025	1.050		2412	904	831	840	455			
2026	1.050		2533	949	873	882	478			
2027	1.050		2660	996	917	926	502			
2028	1.050		2793	1046	963	972	527			
2029	1.050		2933	1098	1011	1021	553			
2030	1.050		3080	1153	1062	1072	581			
2031	1.050		3234	1211	1115	1126	610			
Total			26214	9819	9033	9127	4943			
10 years			19398	9819	18500	40159	27681			

$$W_{18} = 4.218 \times 10^7$$

The Master Plan of Grate Monrovia was secured the traffic forecast by 2019. Then, it is necessary to set up the rate of growth of the traffic volume a year for the traffic forecast volume after 10 years of the opening road. This traffic forecast is used the rate of growth of the Master Plan by 2019, then the traffic volume is forecasted to use the rate of growth 5.0 % a year from the rate of growth of GDP after 2019 year.

The result of ESAL is $w_{18_2} = 4.218 \times 10^7$. This value is compared to the value of phase-1.

Table 2.2-3 The comparison of the design load

	Design Load ESAL
Phase-1	$w_{18_1} = 4.019 \times 10^7$
Phase-2	$w_{18_2} = 4.218 \times 10^7$

The Design Load EASL is $w_{18_2} > w_{18_1}$, the ESAL is set up to $w_{18} = 4.218 \times 10^7$.

(2) Pavement Design

For the pavement design, the section is divided by traffic volume. The elements used in the design are shown below.

- Traffic Load : $w_{18}=4.218 \times 10^7$
- Bearing capacity of roadbed : CBR=12%
- Reliability (R) : 90%
- Terminal Serviceability Index : Initial $P_0=4.2$, Lowest allowable $P_t=2.5$
- Modifying the layer coefficient for drain : Base course – 1.0, Subbase course – 1.0

Calculations of Pavement Structures

The equation and constants given in AASHTO are referred to as follows:

$$\text{Log}_{10}(W_{18}) = Z_R \times S_0 + 9.36 \times \text{Log}_{10}(\text{SN}+1) - 0.20 + \{ \text{Log}_{10}[\Delta \text{PSI}/(4.2-1.5)] / [0.40 + 1094/(\text{SN}+1)^{5.19}] \} + 2.32 \times \text{Log}_{10}(\text{MR}) - 8.07$$

Where,

W_{18} : Total ESAL (2022 – 2031)

Z_R : Standard Deviation (= -1.282 in case reliability = 90%)

S_0 : Combined Standard Error (= 0.45 in case flexible pavement)

SN : Structural Number = $a_1 \times D_1 + a_2 \times m_2 \times D_2 + a_3 \times m_3 \times D_3$ (a : Layer Coefficient, m : Drainage Coefficient, D : Layer Thickness)

ΔPSI : $P_0 - P_t$

P_0 : Initial Serviceability Index (= 4.2 in case flexible pavement)

P_t : Terminal Serviceability Index (= 2.5 in case not arterial road)

MR : Resilient Modulus (= 1500 x CBR)

Layer Coefficient:

$a_1=0.39$ (Asphalt Concrete surface Course)

$a_2=0.135$ (Granular Base Course)

$a_3=0.108$ (Granular Subbase Course)

Drainage coefficient :

m_2 : Drainage Coefficient of Base Course (= 1.0 in case average condition)

m_3 : Drainage Coefficient of Subbase course (=1.0 in case average condition)

The necessary structure number (SN) was obtained by utilizing the above equation. The layer thickness of the proposed pavement is planned to satisfy the necessary SN. The proposed pavement thickness and their SN are shown in the Appendix A-118.

Pavement thickness

The structure numbers (N) were calculated in accordance with equation of flexible pavement by AASHTO and the pavement structures were studied respectively. The decided pavement structures were designed as follows.

Table 2.2-4 Result of Pavement Structure Design

	Material	Specification	Phase-1	Phase-2
Surface	AC	350,000psi	5cm	5cm
Binder	AC	350,000psi	10cm	10cm
Base	Mechanical stabilized gravel	CBR \geq 80	20cm	20cm
Subbase	Crusher run	CBR \geq 30	30cm	30cm

Pavement structure for the sidewalk was referred to Japanese standard and planned with surface 5 cm of AC and base 10cm of gravel.

(3) Asphalt Surface

The asphalt surface pavement is planed the modified asphalt type II for the heavy traffic.

Table 2.2-5 Standard Properties of Thermoplastic Resin Elastomer Asphalt

Penetration at 25 °C (1/10mm), Min	40
Softening point (°C), Min	56.0
Ductility (15 °C) cm, Min	30
Toughness (N·m), Min	8.0
Tenacity (N·m), Min	4.0
Weight change in thin film over test,(%), Max	0.6
Penetration change in thin film oven test, (%), Min	65
Flash point (°C), Min	260

(4) Pavement Modified Method

Replacement method (replacement of asphalt concrete surface (5cm), asphalt concrete of binder (10cm), crushed stone of base course (20cm), and crushed stone of sub-base course (30cm) by granular materials)

Refer the Appendix A-70, the cracking ratio between Sta.5+500 and Sta.9+000 is few.

- “The guideline for road maintenance and repairing” published by Japan Road Association (JRA) stipulates repairing measures in various cracking ratio as follows:
 - Cracking ratio > 30%: asphalt overlay or partial replacement; and
 - Cracking ratio > 50%: replacement for all layers including sub-base course.

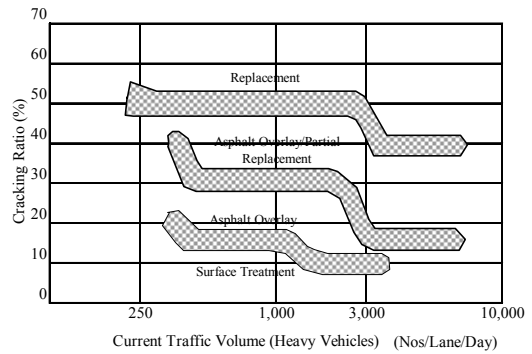


Figure 2.2-2 Cracking Ratio and Pavement Modified Method

All section without below section	Replacement for all layers including Subbase Course
Sta.5+500 - Sta.9+000	Replacement for Surface, Binder and Base Course without Subbase

2-2-2-5 Intersection plan

(1) Setting the target intersection

Somalia drive has large intersection at 14 point. Red Light Intersection, which is the end point of the Somalia drive has a renovation plan of the World Bank, it has been the subject outside the scope of this Project. 1) The results of the master plan study on urban facilities restoration and improvement in Monrovia in the republic of Liberia. 2) The traffic situation. 3) Results of discussions with the Liberian government on the basis of the traffic safety in the future.

For three reasons, it was the policy of the traffic signal of the following 5 intersection.

• Free Port intersection	• New Georgia intersection	• Bardnesville intersection
• Neezoe intersection	• 72nd intersection	

(2) Design speed, Lane width and Cross configuration

Design speed applied the 60 km / h in the same manner as phase 1. The standard lane widths of through lanes of at-grade intersections are set to 3.3m in the same manner as in the Phase 1. The standard lane widths of turn lanes of at-grade intersections are set to 3.0m in the same manner as in the Phase 1. The widths of shoulders, median, sidewalk and other cross-section elements comply with “2.2.3Cross section.” shows the typical cross section of at-grade.

(3) Traffic signal

The signalized intersection is distant enough not to interfere with each other. In addition, the difference between the traffic occurs in the morning peak and evening peak. Intersection is installed a multi-pattern traffic signal.

(4) Intersection analysis

For based on the traffic demand forecast of the master plan, to reflect the traffic volume survey was carried out in this project was carried out in the future traffic demand forecast. In addition, economic indicators, adopted the data of the World Bank's data and the United States Census Bureau. Based on the traffic demand forecast result, it was calculated direction by traffic volume of the intersection.

Intersection analysis was compliant “Manual on Traffic Signal Control”(Japan Society of Traffic Engineers,2006).

Study time was carried out in traffic volume data (PCU / hour) of 18:00-19:00, which is thought that in the most crowded in the traffic volume survey.

i) Free Port intersection

Figure 2.2-3 shows the lane configuration and signal phasing adopted at this intersection, which is considered such that the left-turning demand can be controlled in several phases to maintain smooth traffic flow.

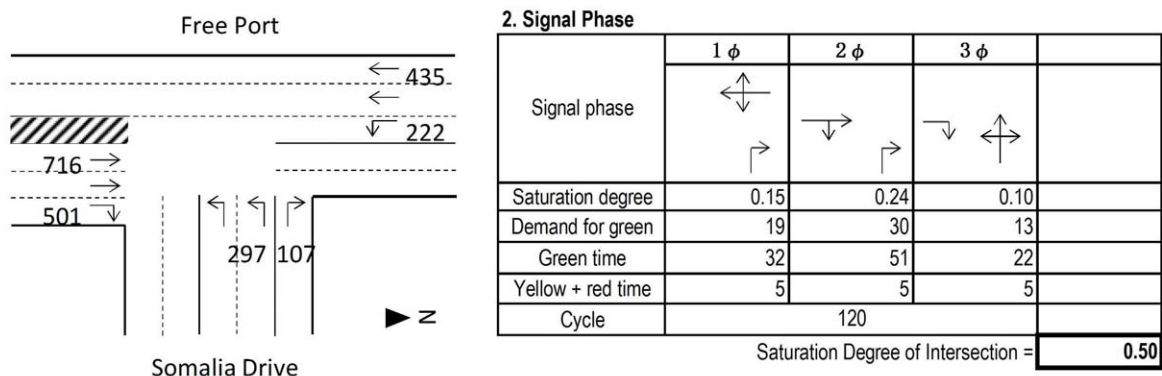


Figure 2.2-3 Lane Configuration and Signal Phasing

Table 2-2-6 shows the result of the analysis of intersection capacity adopting the above lane configuration and signal phasing. The saturation flow rate of the intersection is $0.50 < 0.90$ and the VCR (Volume Capacity Ratio) of each lane is less than 1.0. Thus, the planned lane configuration and signal phasing are adequate

Table 2.2-6 Saturation Flow Rate and VCR

Saturation Flow Rate of Intersection	VCR (Volume Capacity Ratio)					
	South Approach		East Approach		North Approach	
	Through	Right	Left	Right	Through	Left
0.50	0.52	0.56	0.56	0.07	0.50	0.57

ii) New Georgia intersection

Figure 2.2-4 shows the lane configuration and signal phasing adopted at this intersection, which is considered such that the left-turning demand can be controlled in several phases to maintain smooth traffic flow.

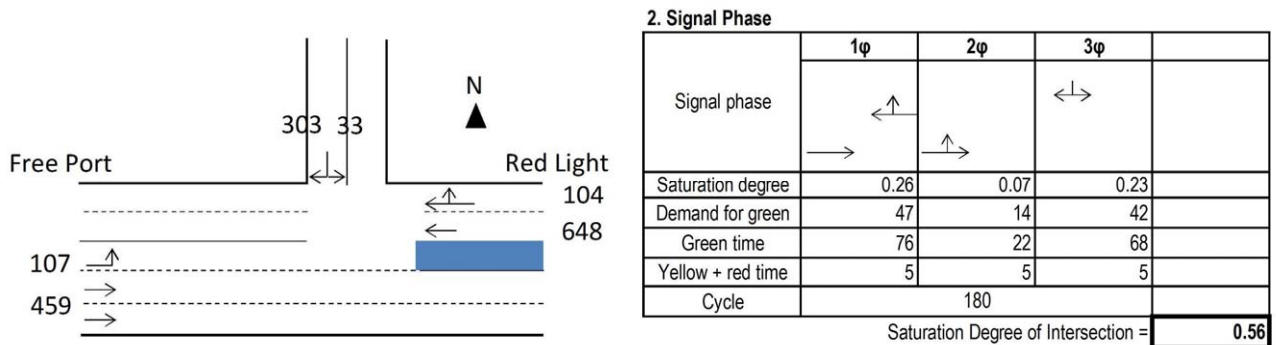


Figure 2.2-4 Lane Configuration and Signal Phasing

Table 2.2-7 shows the result of the analysis of intersection capacity adopting the above lane configuration and signal phasing. The saturation flow rate of the intersection is $0.56 < 0.90$ and the VCR (Volume Capacity Ratio) of each lane is less than 1.0. Thus, the planned lane configuration and signal phasing are adequate

Table 2.2-7 Saturation Flow Rate and VCR

Saturation Flow Rate of Intersection	VCR (Volume Capacity Ratio)				
	West Approach (Free Port)		North Approach	East Approach (Red Light)	
	Through	Left	Left/ Right	Through	Through/Right
0.56	0.26	0.60	0.61	0.55	0.61

iii) Bardnesville intersection

Figure 2.2-5 shows the lane configuration and signal phasing adopted at this intersection, which is considered such that the left-turning demand can be controlled in several phases to maintain smooth traffic flow.

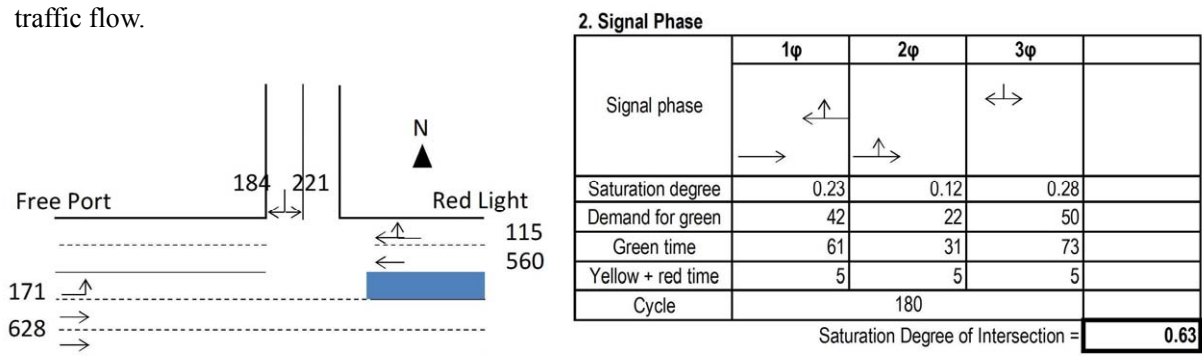


Figure 2.2-5 Lane Configuration and Signal Phasing

Table 2.2-8 shows the result of the analysis of intersection capacity adopting the above lane configuration and signal phasing. The saturation flow rate of the intersection is $0.63 < 0.90$ and the VCR (Volume Capacity Ratio) of each lane is less than 1.0. Thus, the planned lane configuration and signal phasing are adequate

Table 2.2-8 Saturation Flow Rate and VCR

Saturation Flow Rate of Intersection	VCR (Volume Capacity Ratio)				
	West Approach (Free Port)		North Approach	East Approach (Red Light)	
	Through	Left	Left/ Right	Through	Through/ Right
0.63	0.38	0.68	0.69	0.61	0.68

iv) Neezoe intersection

Figure 2.2-6 shows the lane configuration and signal phasing adopted at this intersection, which is considered such that the left-turning demand can be controlled in several phases to maintain smooth traffic flow.

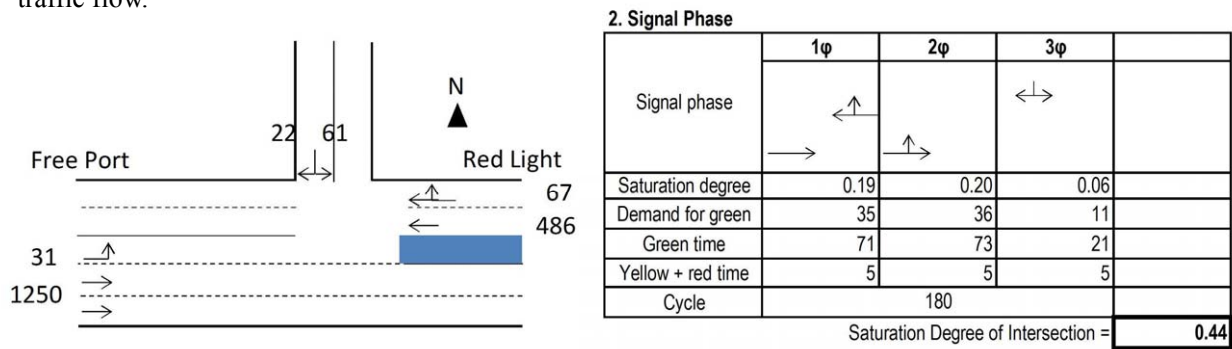


Figure 2.2-6 Lane Configuration and Signal Phasing

Table 2.2-9 shows the result of the analysis of intersection capacity adopting the above lane configuration and signal phasing. The saturation flow rate of the intersection is $0.44 < 0.90$ and the VCR (Volume Capacity Ratio) of each lane is less than 1.0. Thus, the planned lane configuration and signal phasing are adequate

Table 2.2-9 Saturation Flow Rate and VCR

Saturation Flow Rate of Intersection	VCR (Volume Capacity Ratio)				
	West Approach (Free Port)		North Approach	East Approach (Red Light)	
	Through	Left	Left/ Right	Through	Through/ Right
0.44	0.48	0.05	0.49	0.43	0.48

v) 72nd intersection

Figure 2.2-7 shows the lane configuration and signal phasing adopted at this intersection, which is considered such that the left-turning demand can be controlled in several phases to maintain smooth traffic flow.

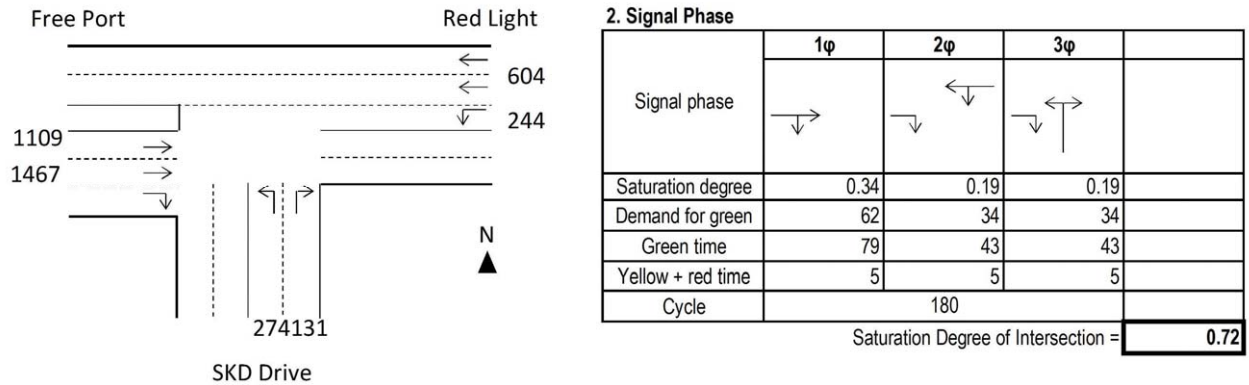


Figure 2.2-7 Lane Configuration and Signal Phasing

Table 2.2-10 shows the result of the analysis of intersection capacity adopting the above lane configuration and signal phasing. The saturation flow rate of the intersection is $0.72 < 0.90$ and the VCR (Volume Capacity Ratio) of each lane is less than 1.0. Thus, the planned lane configuration and signal phasing are adequate

Table 2.2-10 Saturation Flow Rate and VCR

Saturation Flow Rate of Intersection	VCR (Volume Capacity Ratio)					
	West Approach (Free Port)		South Approach		West Approach (Free Port)	
	Through	Right	Left	Right	Through	Left
0.72	0.78	0.99	0.79	0.38	0.78	0.70

(5) Evaluation index

Based on the results obtained by the “(4) Intersection analysis”, conducted traffic simulation for the future, was verified for the maintenance effect. Comparison case is a two-pattern with/without signal. Target intersection was two at the Free Port intersection and 72nd intersection. Incidentally, the number of lanes, additional lanes, and signal phase repeatedly examined the traffic simulation and intersection analysis, was set to be optimum traffic conditions. In addition, the simulation, was selected average travel time of a vehicle passing through the intersection, a plan to minimize the total storage length as the best proposal.

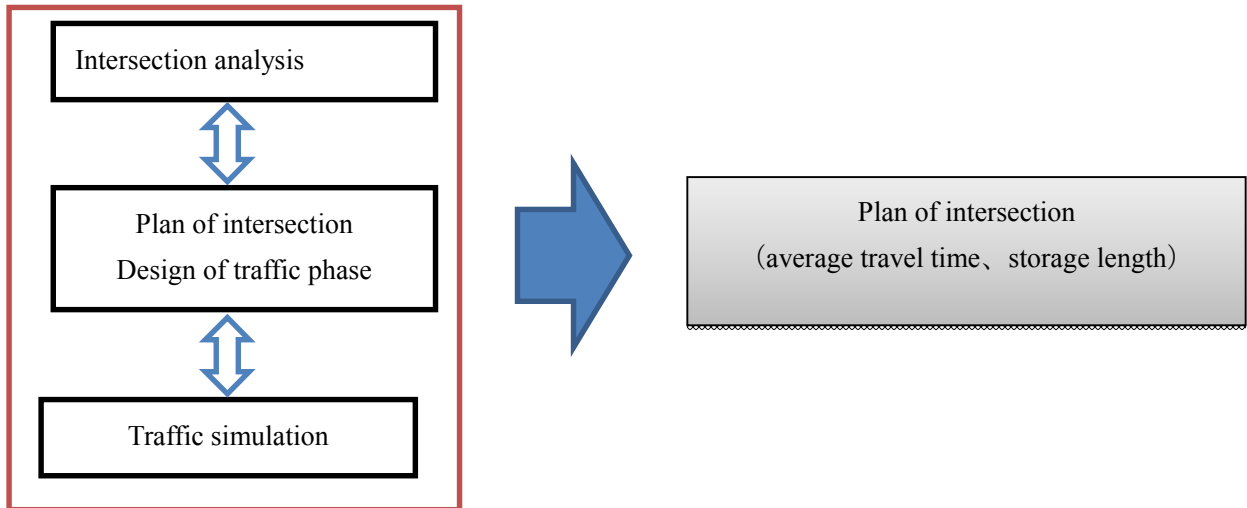


Figure 2.2-8 Plan of intersection flow

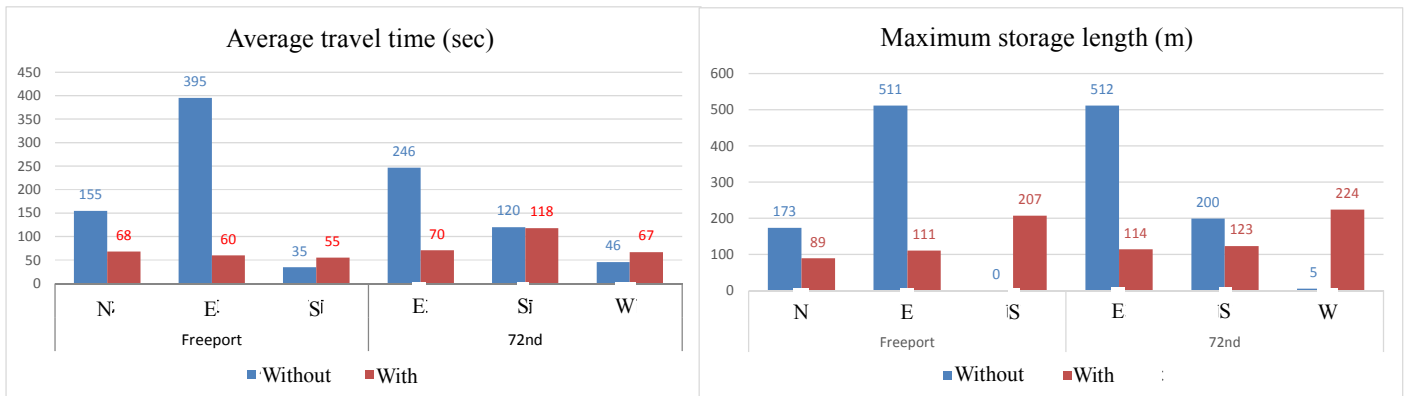


Figure 2.2-9 Intersection evaluation index

Vehicle flowing from the south side of the Free Port intersection and West side of the 72nd intersection, More of the without signal intersection the storage length and travel time is short. It is made up of a straight and right vehicle, because the traffic flow in the inhibition does not occur. The average travel time and the maximum storage length from the other inflow section the direction of signal there are shortened. When there is no signal, regardless of the time, because the headway distance can pass is required, transit time and dwell length becomes longer.

Maximum storage length : 511m ➔ 111m (Free Port intersection from Somalia Drive)

Maximum travel time: 6min 35sec ➔ 1min (Free Port intersection from Somalia Drive)

These results, when the signalized intersection, storage length of about 400 meters, average travel time should be expected around 5 minutes 30 seconds shortening effect.

2-2-2-6 Road Drainage System

(1) Drainage Plan

Road surface drainage system is comparatively studied with alternative types considering with much precipitation in Monrovia.

Table 2.2-11 Comparative Study for Surface Drainage System

	The Plan 1 Method of Center Drain	The Plan 2 Method of Center Drain + Road Shoulder Drain
Cross Section		
Drainage	<ul style="list-style-type: none"> ●The drainage water is collect to the drain of center medium, the drainage water is flow down to the end of the drainage by 1-system. 	<ul style="list-style-type: none"> ●The drainage water of phase-1 flow to the drain of center medium, the drainage water of phase-2 is flow to the road shoulder, and each water flow down to the end of the drainage by 2-system.
Drainage ability	<ul style="list-style-type: none"> ●The drainage ability is small to compare the plan 2. ●The drainage is 1 system, so it is easy to drop down the drainage ability for accumulating mud and rubbishu inside the drainage. 	<ul style="list-style-type: none"> ●The drainage ability is big to compare the plan 1. ●The drainage is 2 system, so it is not easy to drop down the drainage ability for accumulating mud and rubbishu inside the drainage.
Maintenance	<ul style="list-style-type: none"> ●The drainage is 1 system, it is easy to accumulate mud and rubbish inside the drainage, so there are many times of the drainage cleaing. ●The drainage is 1 system, it is easy to be short the cleaing distance. 	<ul style="list-style-type: none"> ●The drainage is 2 system, it is not easy to accumulate mud and rubbish inside the drainage, so there are few times of the drainage cleaing. ●The drainage is 2 system, it is easy to be long the cleaing distance.
Influence of the pedestrian	<ul style="list-style-type: none"> ●There are no influence to the pedestrian in usually. ●There are drainage in the center medium, so it is no influence to the pedestrian when the drainage is cleaing. 	<ul style="list-style-type: none"> ●The side walk is the part of the cover of the drainage. So it is a little influence to the pedestrian. ●There are drainage in the road shoulder, so the pedestrian become a narrow width when the drainage is cleaing.
Travelling Performance	<ul style="list-style-type: none"> ●If the drainage system is not working for accumulating the sand and the rubbish inside the drainage, it becomes the travelling performance badly on the road for the ponding. 	<ul style="list-style-type: none"> ●If the drainage system is not working for accumulating the sand and the rubbish inside the drainage, it becomes the travelling performance badly on the road shoulder of phase-2 side for the ponding.
Influence along the road	<ul style="list-style-type: none"> ●The end of drainage flow is joined together the road shoulder drain, the influence is as the plan 2 situation. 	<ul style="list-style-type: none"> ●The end of drainage flow is joined together the road shoulder drain, the influence is as the plan 1 situation.
Economy	<ul style="list-style-type: none"> ●It is economy to the comparison of the plan 2. 	<ul style="list-style-type: none"> ●It is expensive to the comparison of the plan 1 for adding the road shoulder drainage system.
Evaluation	<ul style="list-style-type: none"> ●It is economy to the comparison of the plan 2, it is easy to drop down the drainage ability, there are many times for the maintenance by 1 system of the drainage. It become problem to increase the burden of MPW. 	<ul style="list-style-type: none"> ●It is expensive to the comparison of the plan 1, it is not easy to drop down the drainage ability, there are few times for the maintenance by 2 the drainage system. It is possible to decrease the burden of MPW.

As the result of the study, the plan should be adopted the plan 2 (Method of Center drain + road shoulder drain). For the drainage water of phase 2 side flow down to center medium drain system at the curve section (Sta.8+460-Sta.8+960), The super elevation is plan to install to the center medium. The drainage of sidewalk is plan to flow to south side by the natural flow. The design conditions are as follows.

- Return period : 3 years
- Time concentration : 10 minutes
- Participation strength : 100mm/hr
- Runoff coefficient : 0.9 (asphalt pavement)
- Roughness coefficient : 0.015 (concrete ditch), 0.013(Concrete pipe)
- Effective depth : 80%

The concrete pipes are buried to secure the water flow where the drainage facilities crossing intersections and carriageway. At these locations, the pipes are protected 360 degrees by concrete to avoid the damage by traffic load.

The Drainage Calculation are shown in the Appendix A-125.

(2) The flow end of Drainage

The vertical curve of the Somalia Drive is flat, so many flow end of drainage are needed.

Connecting to the existing cross drainage facilities
The flow end of new drainage should be installed at South side of the road.

Table 2.2-12 The Location of the flow end of drainage

①Sta.0+225	②Sta.1+245	③Sta.1+625	④Sta.2+328	⑤Sta.4+632
⑥Sta.4+976	⑦Sta.6+135	⑧Sta.6+562	⑨Sta.7+841	⑩Sta.7+902
⑪Sta.8+150	⑫Sta.8+400	⑬Sta.8+741	⑭Sta.9+544	⑮Sta.10+829
⑯Sta.11+133	⑰Sta.11+453			

2-2-2-7 Ancillary Facility of Road

(1) Concrete Pavement

Sta.0+402 ~ Sta.0+522 : The Milling Factory
Sta.0+548 ~ Sta.0+656 : The Cement Factory

According to JICA Study team survey, the axial load of some heavy vehicle is measured over 11.5 ton (ECOWAS standard). The maximum axial load is 17.2 ton. The heavy vehicles give negative impact on the road. Then, the concrete pavement was.

(2) Retaining Wall

It has the difference of the elevation 3 m between the road planning height and the existing level. The embankment of approach is outside the ROW, if the embankment keeps the proper slope angle.

Gravity Retaining wall: Sta.6+101.7 ~ Sta.6+200 : L=82.3m

The retaining wall is adopted instead of head wall in case of high embankment to reduce the affected area by the embankment.

Gravity Retaining wall for the Drainage: 10 Places : L=108.6m

(3) Connecting Road, Entrance for Roadside Facility

The roads connecting with Somalia Drive are classified into five types, Type A to Type E, considered with the result of site investigation about importance, traffic volume and surrounding area.

Type E is the staircase for the pedestrian. Type E is installed at the location of the difference of the elevation.

Table 2.2-13 Classification of Connecting Road

	Priority	Corner cut	Median Open	Left Turn Lane	Number
Type A	Highest	Provide	Open	Provide	2 places
Type B	High	Provide	Open	None	5 places
Type C	Middle	Provide	Close	None	129 places
Type D	Low	None	Close	None	45 places
Type E	High	None	None	None	7 places

(4) Pedestrian Crossing

There are pedestrian crossings along the existing road. Present crossings are extended to the new road and raised median shall be cut down. The median has the role of safety waiting zone for pedestrians. In addition, road marking of yield is painted to make attention of pedestrian crossing ahead.

(5) Road Sign

The following types of road sign are installed.

- Stop Sign : At connecting major road
- A Pedestrian Crossing : At bus stop
- Yield Here to Pedestrian : At pedestrian crossing
- School Sign : At school

2-2-3 Outline Design Drawing

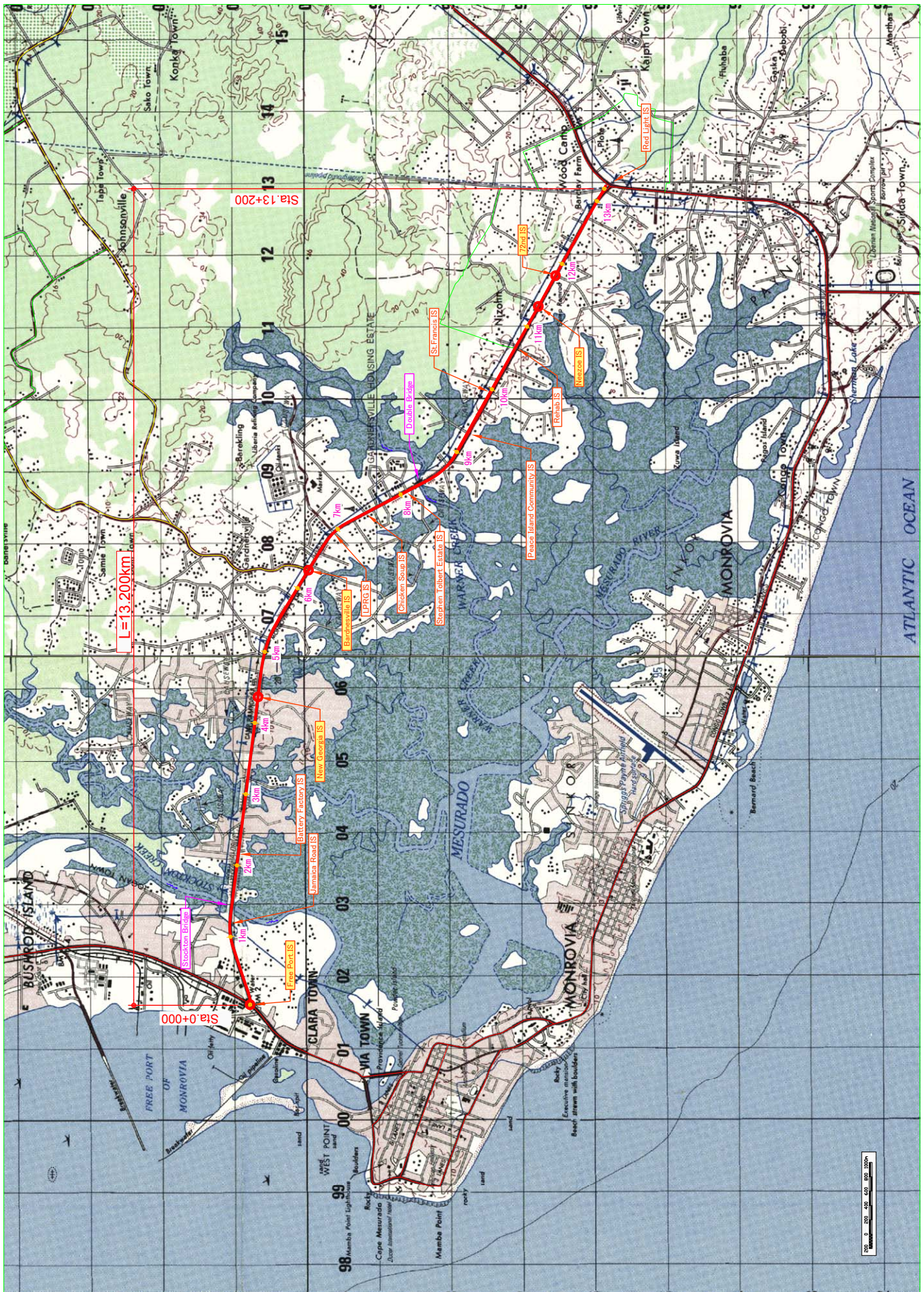
Outline design drawings are presented as follows,

**THE PREPARATORY SURVEY
ON
THE PROJECT FOR RECONSTRUCTION
OF
SOMALIA DRIVE
IN
MONROVIA (PHASE-2)
IN THE REPUBLIC OF LIBERIA**

DECEMBER 2016

DRAWINGS

JAPAN INTERNATIONAL COOPERATION AGENCY



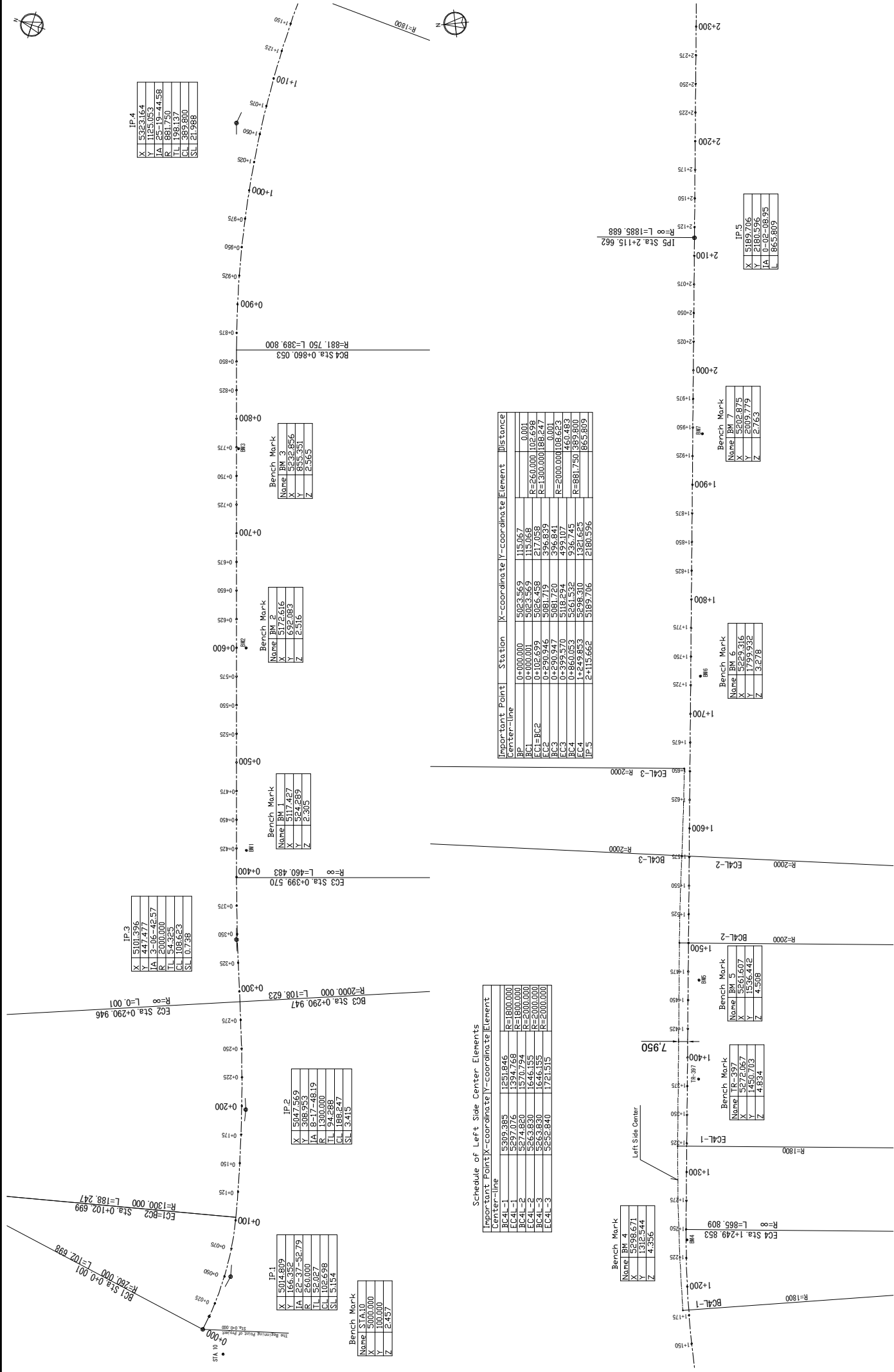
Drawing No.	LC-1
SCALE	S=1/50,000
DATE	DEC. 2016

TITLE:
LOCATION MAP
 (Sta.0+000-Sta.13+200)

THE PREPARATORY SURVEY ON
 THE PROJECT FOR
 RECONSTRUCTION (PHASE-2) OF
 SOMALIA DRIVE IN MONROVIA

JAPAN INTERNATIONAL COOPERATION AGENCY
 KATAHIRA & ENGINEERS INTERNATIONAL,
 YACHIYO ENGINEERING CO.,LTD.,
 INGÉROSEC CORPORATION

MINISTRY OF PUBLIC WORKS



Point	X	Y	Z
IP-4	5323.164	116505.3	44.58
IA	881.750	116505.3	44.58
LA	881.750	116505.3	44.58
TL	198.137	116505.3	44.58
CL	389.800	116505.3	44.58
SL	21.988	116505.3	44.58

Point	X	Y	Z
IP-3	5101.396	116505.3	44.57
IA	3-06-48.57	2000.000	44.57
LA	2000.000	116505.3	44.57
TL	108.623	116505.3	44.57
CL	10.738	116505.3	44.57
SL	0.000	116505.3	44.57

Point	X	Y	Z
IP-2	5047.569	116505.3	44.57
IA	22-37-56.79	260.000	44.57
LA	1330.000	116505.3	44.57
TL	94.288	116505.3	44.57
CL	188.247	116505.3	44.57
SL	3.415	116505.3	44.57

Point	X	Y	Z
IP-1	5014.809	116505.3	44.57
IA	22-37-56.79	260.000	44.57
LA	1330.000	116505.3	44.57
TL	94.288	116505.3	44.57
CL	188.247	116505.3	44.57
SL	3.415	116505.3	44.57

Point	X	Y	Z
Bench Mark	5100.000	116505.3	2.457
Name	STA.10	116505.3	2.457
Y	100.000	116505.3	2.457
Z	2.457	116505.3	2.457

Schedule of Left Side Center Elements

Center-line	Station	X-coordinate	Y-coordinate	Element	Distance
BP	0+000.000	5023.569	115.067		0.001
BC1	0+000.000	5023.569	115.068		0.001
EC1	0+102.699	5081.719	396.839		102.699
EC2	0+290.947	5081.719	396.839		188.247
BC2	0+290.947	5081.720	396.841		0.001
EC3	0+399.570	5118.294	499.107		108.623
BC3	0+399.570	5118.294	499.107		0.001
EC4	0+860.053	5261.532	936.745		460.483
BC4	0+860.053	5261.532	936.745		0.001
EC5	1+249.853	5298.300	1321.653		389.800
BC5	1+249.853	5298.300	1321.653		0.001
IP3	2+115.662	5189.706	2180.596		865.809

Center-line	Station	X-coordinate	Y-coordinate	Element	Distance
BP	0+000.000	5023.569	115.067		0.001
BC1	0+000.000	5023.569	115.068		0.001
EC1	0+102.699	5081.719	396.839		102.699
EC2	0+290.947	5081.719	396.839		188.247
BC2	0+290.947	5081.720	396.841		0.001
EC3	0+399.570	5118.294	499.107		108.623
BC3	0+399.570	5118.294	499.107		0.001
EC4	0+860.053	5261.532	936.745		460.483
BC4	0+860.053	5261.532	936.745		0.001
EC5	1+249.853	5298.300	1321.653		389.800
BC5	1+249.853	5298.300	1321.653		0.001
IP3	2+115.662	5189.706	2180.596		865.809

Point	X	Y	Z
Bench Mark	5298.571	1312.544	4.356
Name	BM 4	1312.544	4.356
Y	100.000	1312.544	4.356
Z	4.356	1312.544	4.356

Point	X	Y	Z
Bench Mark	5298.571	1312.544	4.356
Name	BM 4	1312.544	4.356
Y	100.000	1312.544	4.356
Z	4.356	1312.544	4.356

Point	X	Y	Z
Bench Mark	5298.571	1312.544	4.356
Name	BM 4	1312.544	4.356
Y	100.000	1312.544	4.356
Z	4.356	1312.544	4.356

Point	X	Y	Z
Bench Mark	5298.571	1312.544	4.356
Name	BM 4	1312.544	4.356
Y	100.000	1312.544	4.356
Z	4.356	1312.544	4.356

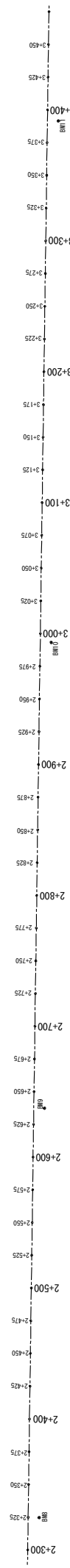
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Bench Mark	5298.571	1312.544	4.356
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Y	100.000	1312.544	4.356
Z	4.356	1312.544	4.356

Point	X	Y	Z
Bench Mark	5298.571	1312.544	4.356
Name	BM 4	1312.544	4.356
Y	100.000	1312.544	4.356
Z	4.356	1312.544	4.356

Point	X	Y	Z
Bench Mark	5298.571	1312.544	4.356
Name	BM 4	1312.544	4.356
Y	100.000	1312.544	4.356
Z	4.356	1312.544	4.356

Point	X	Y	Z
Bench Mark	5298.571	1312.544	4.356
Name	BM 4	1312.544	4.356
Y	100.000	1312.544	4.356
Z	4.356	1312.544	4.356

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				SCALE	S=1/3000
				DATE	DEC. 2016



Bench Mark

Name	BM 11
X	372.151
Y	372.151
Z	3.8955

Bench Mark

Name	BM 10
X	507.1839
Y	3050.290
Z	3.0743

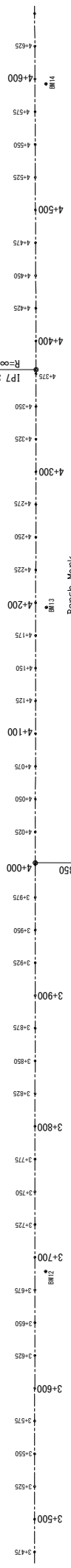
Bench Mark

Name	BM 9
X	516.507
Y	3025.27
Z	3.046

Bench Mark

Name	BM 8
X	5155.330
Y	2387.019
Z	3.175

Important Point	Station	X-coordinate	Y-coordinate	Element	Distance
IP 5	2+115.662	5189.706	2180.596		1885.688
IP 6	4+001.350	4954.341	4051.538		376.690
IP 7	4+378.040	4907.165	4425.262		



Bench Mark

Name	BM 12
X	4985.155
Y	3740.770
Z	3.895

Bench Mark

Name	BM 13
X	4921.884
Y	4244.031
Z	4.226

Bench Mark

Name	BM 14
X	4872.591
Y	4540.829
Z	3.673

IP 6

X	4954.341
Y	4051.538
Z	0-01-27.70
RA	1885.688

IP 7

X	4937.165
Y	4425.262
Z	0-18-03.86
RA	376.690

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Drawing No.	SCALE	DATE
KP-2	S=1/3000	DEC. 2016



IP 8	
X	4845.647
Y	4937.416
EA	1207.8419
EL	134.958
CL	269.339
SL	5.406

Bench Mark	
Name	BM 15
X	4814.887
Y	5008.660
Z	4.051

EC8=BC9 Sta. 5+028.304
R=1761.750 L=325.623

5+000
5+050
5+100
5+150
5+200

IP 9	
X	4762.694
Y	5253.998
EA	1763.750
EL	163.277
CL	325.623
SL	7.590

Bench Mark	
Name	BM 16
X	5348.102
Y	5302.4

IP 10	
X	4652.475
Y	5443.530
EA	4.42
R	2007.750
EL	82.418
CL	169.4

EC9=BC10 Sta. 5+353.927
R=2001.750 L=184.648

5+300
5+350
5+400
5+450
5+500

Bench Mark	
Name	BM 17
X	5648.409
Y	5189

5+600
5+650
5+700
5+750
5+800

Important Point	Station	X-coordinate	Y-coordinate	Element	Distance
IP 7	4+378.040	4907.165	4425.262		
BC8	4+758.965	4861.445	4803.433	R=1491.750	380.925
EC8=BC9	5+28.304	4807.890	5067.101	R=161.750	325.623
EC9=BC10	5+353.927	4689.434	5369.916	R=2001.750	164.648
EC10	5+318.373	4609.923	5313.958		
BC11	6+768.462	37267.86	65634.89		1184.847

IP 11	
X	3867.518
Y	6730.898
EA	30-54-57.95
R	870.000
EL	240.586
CL	469.441
SL	368.833

Bench Mark	
Name	BM 18
X	5069.572
Y	5336

5+800
5+850
5+900
5+950
6+000

Bench Mark	
Name	BM 19
X	6217.640
Y	6219.971
Z	4.572

6+300
6+350
6+400
6+450
6+500

Bench Mark	
Name	BM 20
X	6449.852
Y	6449.852
Z	4.494

6+600
6+650
6+700
6+750
6+800

Bench Mark	
Name	BM 21
X	3844.519
Y	6656.074
Z	6.149

6+800
6+850
6+900
6+950

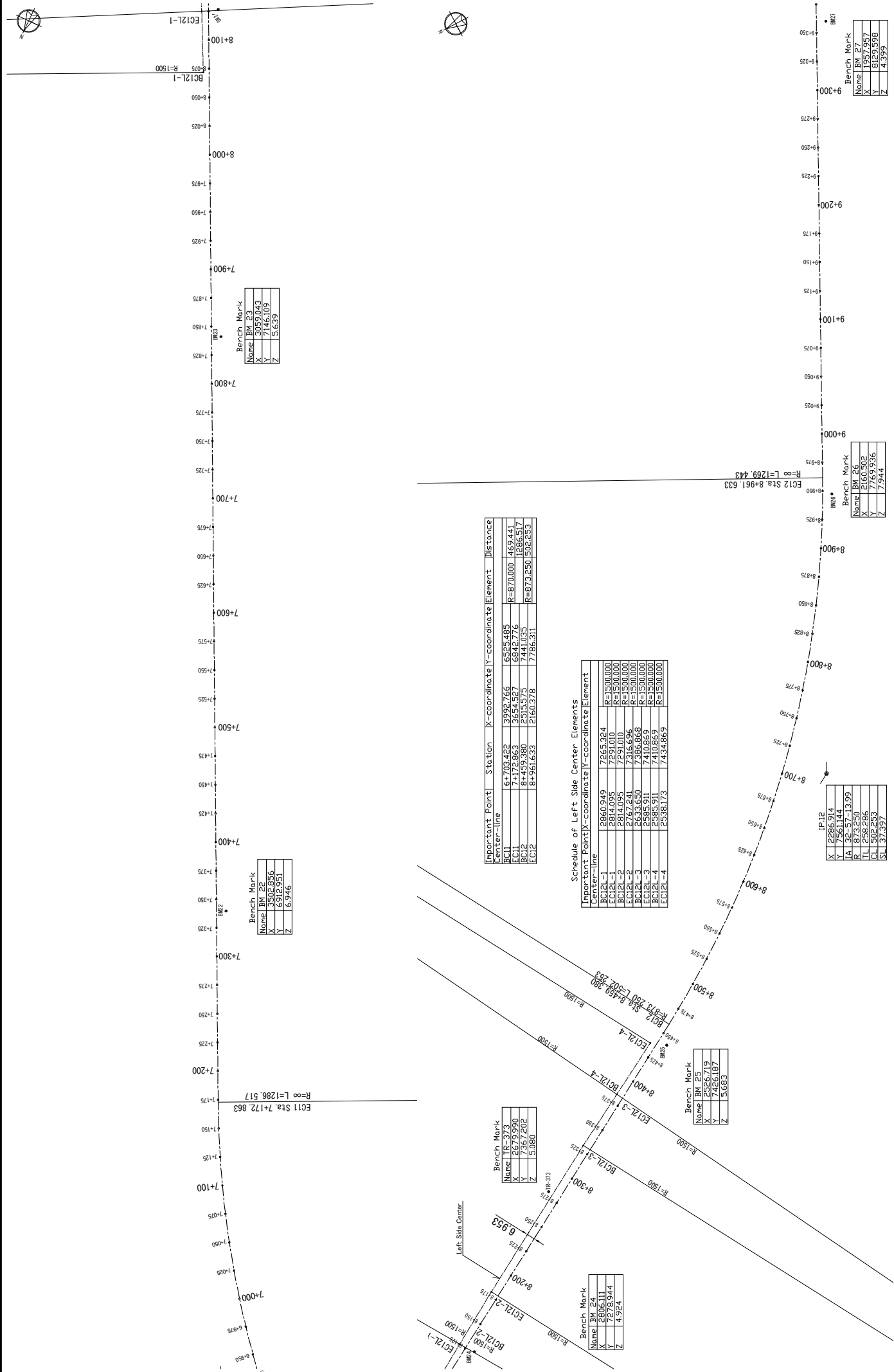
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SCALE	S=1/3000
DATE	DEC. 2016

TITLE:
KEY PLAN
(Sta.4+650+Sta.6+950)

**THE PREPARATORY SURVEY ON
THE PROJECT FOR
RECONSTRUCTION (PHASE-2) OF
SOMALIA DRIVE IN MONROVIA**

**JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL,
YACHIYO ENGINEERING CO.,LTD.,
INGEROSEC CORPORATION**

MINISTRY OF PUBLIC WORKS



Bench Mark

Name	BM 23
X	3059.043
Y	7146.109
Z	5.639

Bench Mark

Name	BM 25
X	3502.656
Y	6912.951
Z	6.946

Important Point	Station	X-coordinate	Y-coordinate	Element	Distance
Center-line	6+703.423	3892.746	4525.485		
EC11	7+172.663	3654.597	6842.716	R=870.000	469.441
BC12	8+459.380	2315.575	7441.035		1286.517
EC12	8+961.633	2160.378	7786.311	R=873.250	502.253

Schedule of Left Side Center Elements

Important Point	X-coordinate	Y-coordinate	Element
Center-line	2860.949	7565.324	
EC12L-1	2814.095	7591.010	R=1500.000
EC12L-2	2914.095	7591.010	R=1500.000
EC12L-3	2637.650	7386.869	R=1500.000
EC12L-3	2585.911	7410.869	R=1500.000
EC12L-4	2538.173	7434.869	R=1500.000

Bench Mark

Name	BM 27
X	1957.957
Y	8163.958
Z	4.337

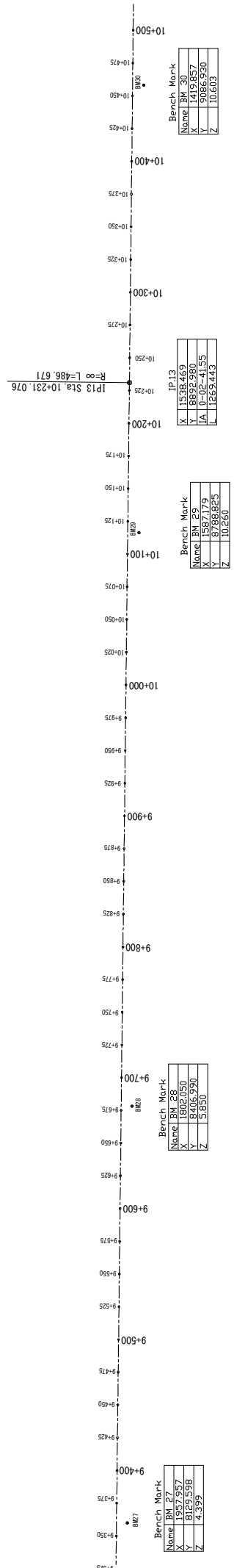
Bench Mark

Name	BM 26
X	7769.936
Y	7544

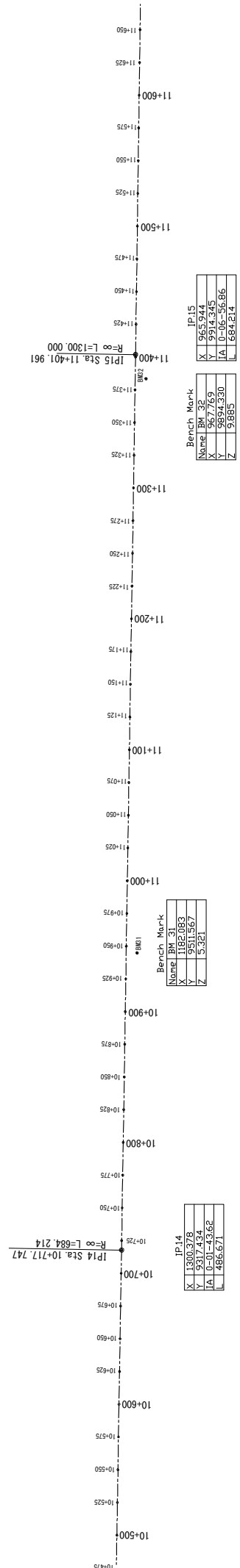
IP 12

X	2286.914
Y	7561.144
A	32-57-13.99
R	873.250
IL	235.286
SL	37.637

DRAWING No.	KEY PLAN	TITLE :	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA
DATE	DEC. 2016	MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGEROSEC CORPORATION



Important Point	Station	X-coordinate	Y-coordinate	Element	Distance
Center-line	8+861.623	2160.278	7786.311		
IP12	10+231.076	1538.469	8682.980		1263.443
IP13	10+717.747	1300.378	9317.434		486.671
IP14	11+401.961	965.944	9914.245		684.214



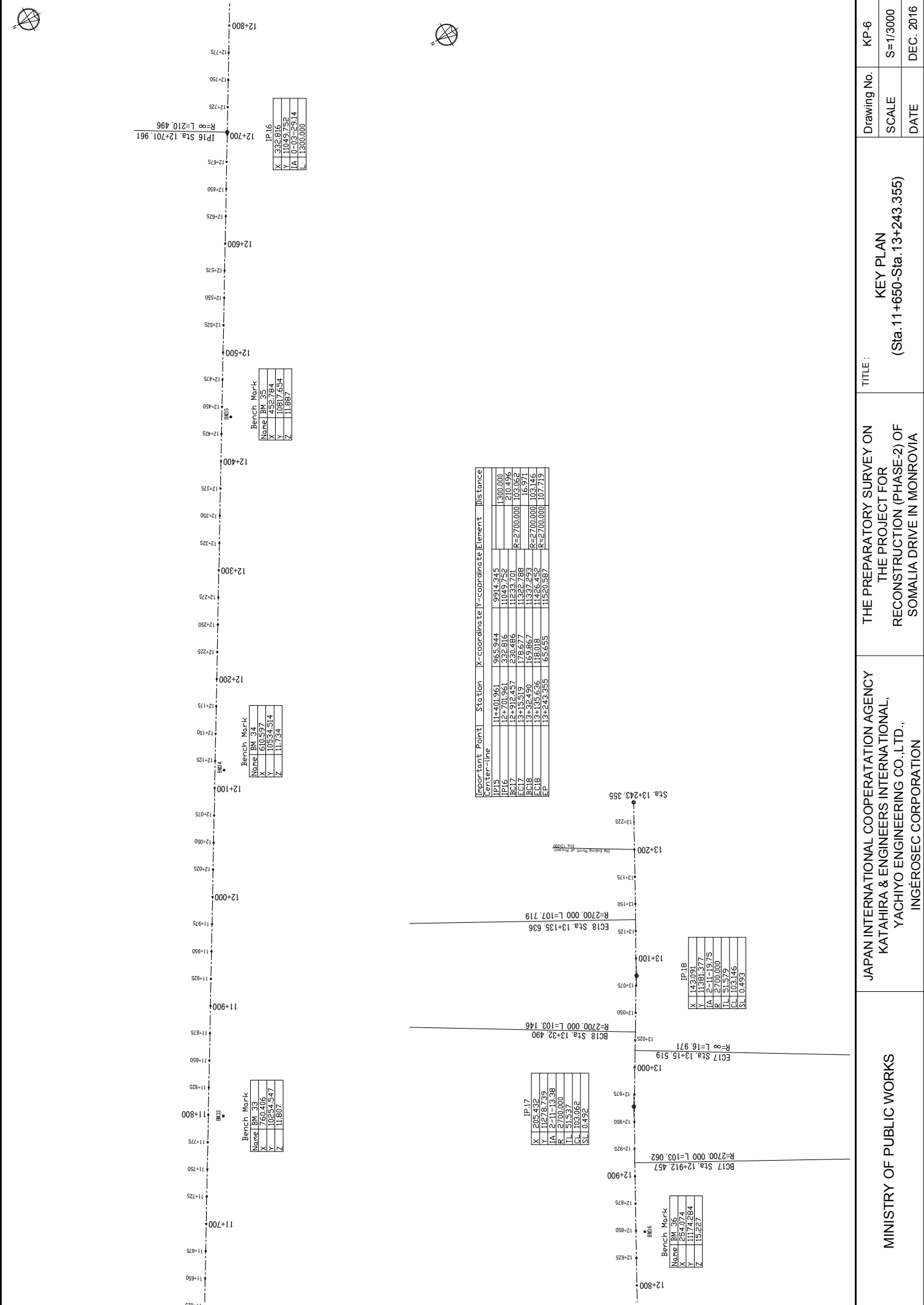
Drawing No.	KP-5
SCALE	S=1/3000
DATE	DEC. 2016

TITLE:
 KEY PLAN
 (Sta.9+350-Sta. 11+650)

THE PREPARATORY SURVEY ON
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JAPAN INTERNATIONAL COOPERATION AGENCY
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IP16

X	332.816
Y	11049.752
Z	111.867
EA	0-03-25914
EB	13000.000

Bench Mark

Name	BM 35
X	452.784
Y	10817.654
Z	11.867

Bench Mark

Name	BM 34
X	610.597
Y	10534.514
Z	11.734

Bench Mark

Name	BM 33
X	760.406
Y	10254.547
Z	11.807

Important Point	Station	X-coordinate	Y-coordinate	Element	Distance
IP15	11+401.961	965.944	9514.345		1300.000
IP16	12+701.961	332.816	11049.752		210.496
BC17	12+912.457	238.496	11237.293	R=2700.000	103.062
BC18	13+135.636	169.867	11337.293		16.971
EC18	13+135.636	118.018	11426.452	R=2700.000	103.146
EP	13+243.355	65.655	11520.567	R=2700.000	107.719

IP18

X	1143.091
Y	11361.377
Z	11.975
EA	2-11-1975
EB	2700.000
EC	103.146
ED	10.492

Bench Mark

Name	BM 36
X	254.074
Y	11174.254
Z	15.227

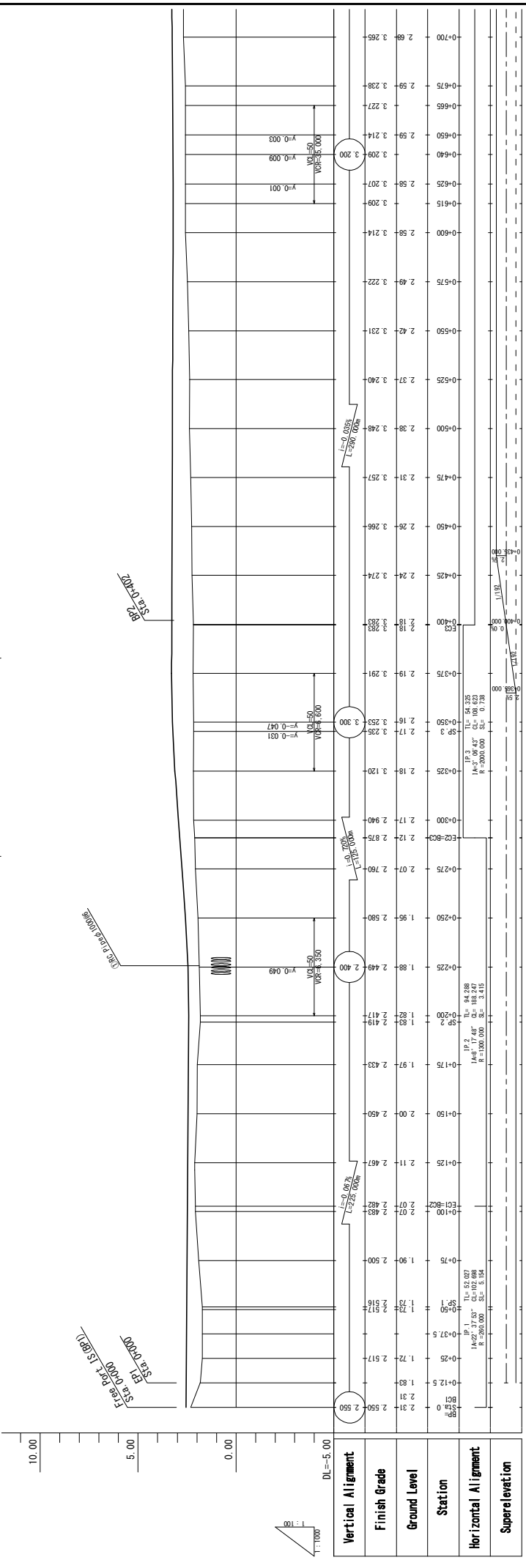
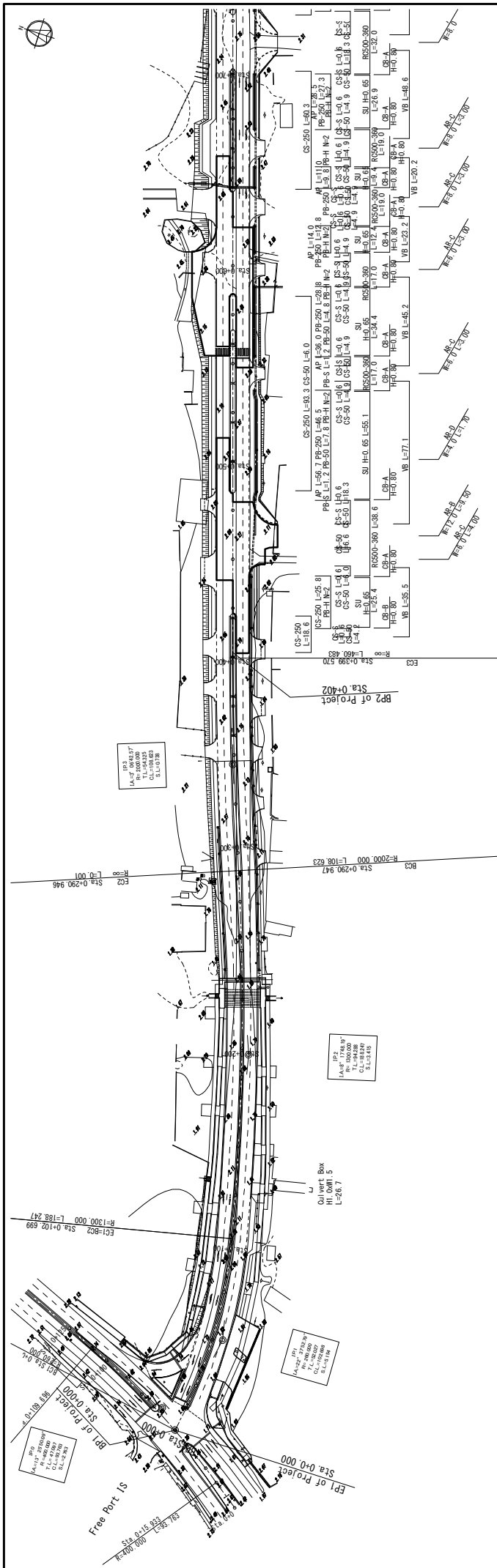
Drawing No.	KP-6
	SCALE
DATE	DEC. 2016

TITLE:

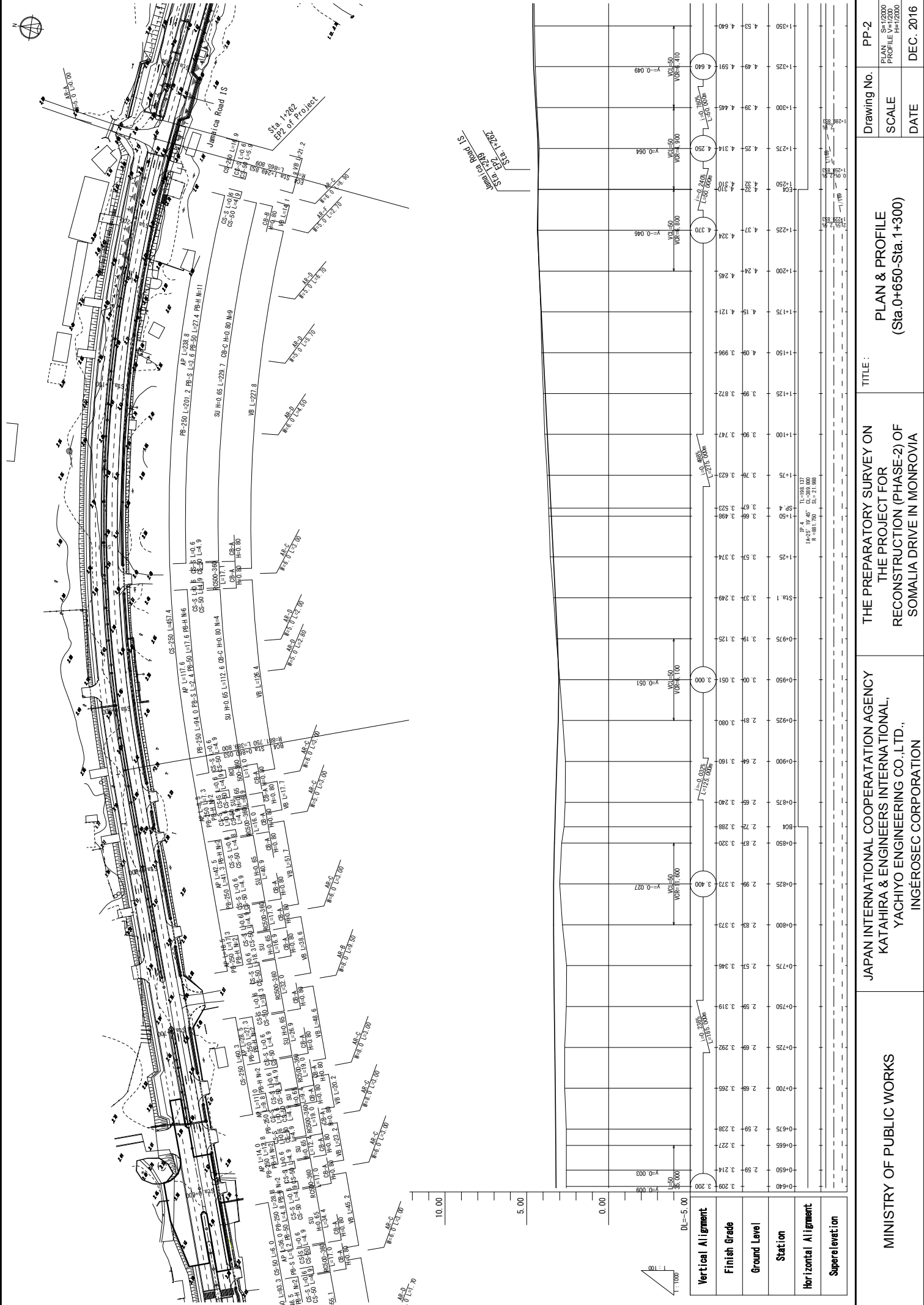
THE PREPARATORY SURVEY ON
THE PROJECT FOR
RECONSTRUCTION (PHASE-2) OF
SOMALIA DRIVE IN MONROVIA

JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL,
YACHIYO ENGINEERING CO.,LTD.,
INGÉROSEC CORPORATION

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Drawing No.		PP-1
PLAN PROFILE		
SCALE		DATE
DATE		
TITLE : THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOWALIA DRIVE IN MONROVIA		
JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION		
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Drawing No. PP-2
 PLAN S=1/2000
 PROFILE H=1/2000
 SCALE
 DATE DEC. 2016

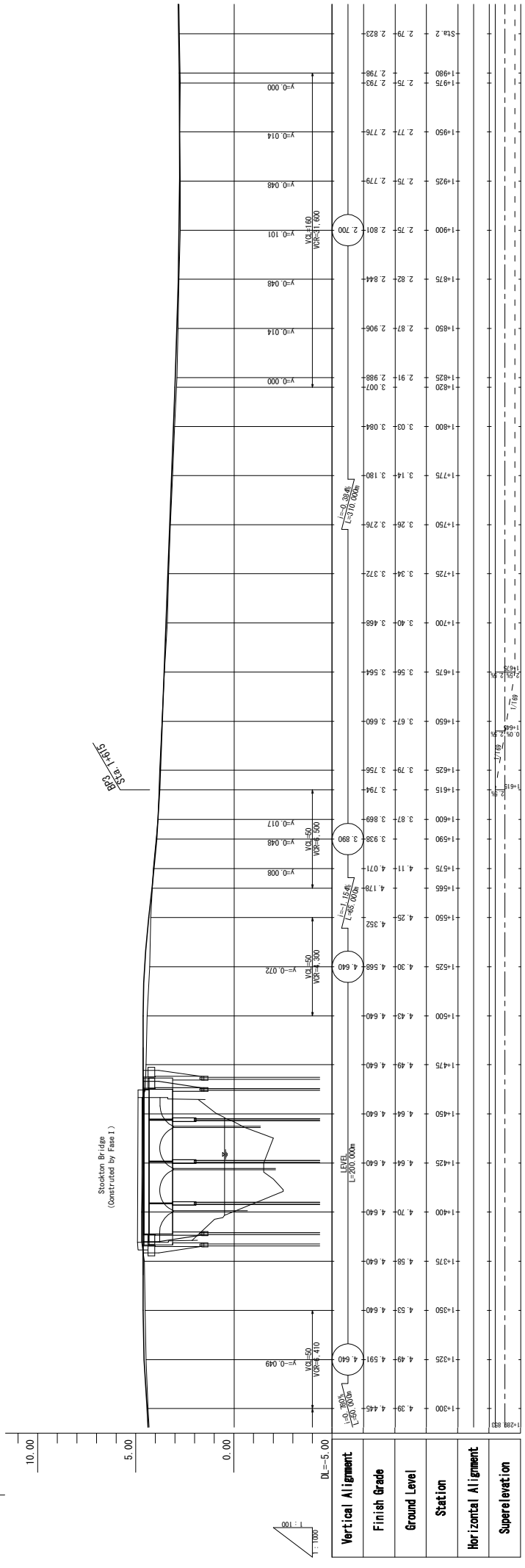
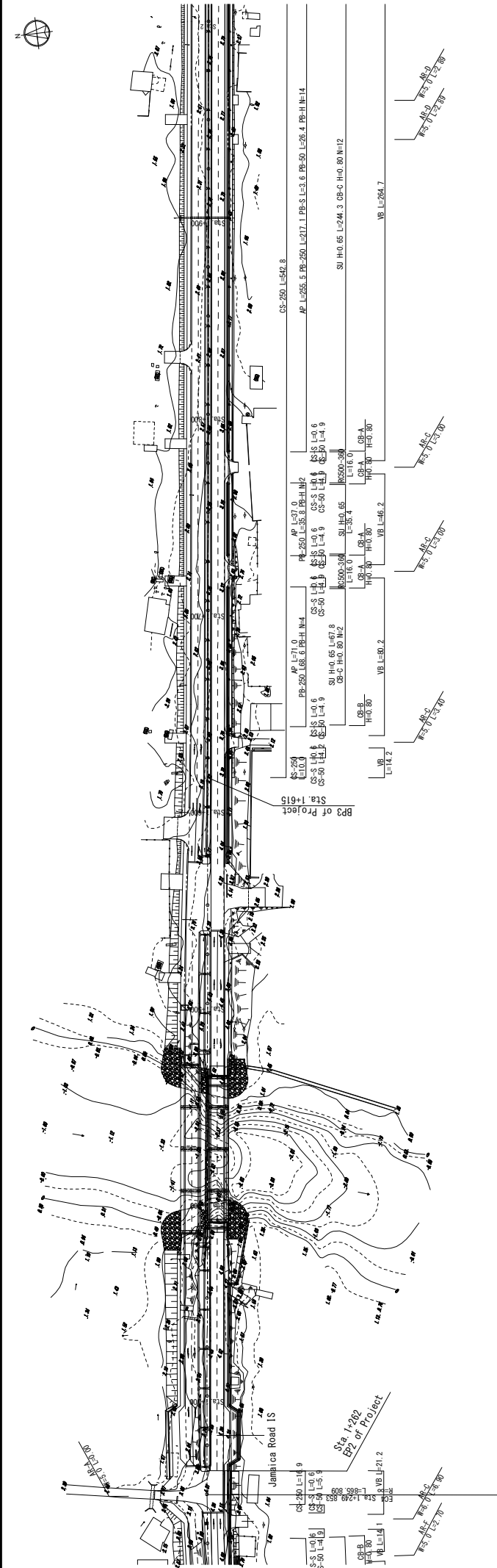
TITLE:
 THE PREPARATORY SURVEY ON
 THE PROJECT FOR
 RECONSTRUCTION (PHASE-2) OF
 SOMALIA DRIVE IN MONROVIA

JAPAN INTERNATIONAL COOPERATION AGENCY
 KATAHIRA & ENGINEERS INTERNATIONAL,
 YACHIYO ENGINEERING CO.,LTD.,
 INGÉROSEC CORPORATION

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PLAN & PROFILE
 (Sta.0+650-Sta.1+300)

Vertical Alignment	Station	Finish Grade	Ground Level
DL=-5.00	0+640	3.209	3.214
	0+650	2.594	3.214
V=0.003	0+650	2.594	3.214
	0+675	2.594	3.228
V=0.007	0+675	2.594	3.228
	0+700	2.668	3.265
V=0.027	0+700	2.668	3.265
	0+725	2.668	3.292
V=0.051	0+725	2.668	3.292
	0+750	2.958	3.319
V=0.064	0+750	2.958	3.319
	0+775	2.573	3.346
V=0.068	0+775	2.573	3.346
	0+800	2.833	3.373
V=0.072	0+800	2.833	3.373
	0+825	2.999	3.373
V=0.075	0+825	2.999	3.373
	0+850	2.873	3.320
V=0.078	0+850	2.873	3.320
	0+875	2.655	3.240
V=0.082	0+875	2.655	3.240
	0+900	2.646	3.160
V=0.086	0+900	2.646	3.160
	0+925	2.813	3.080
V=0.090	0+925	2.813	3.080
	0+950	3.000	3.051
V=0.094	0+950	3.000	3.051
	0+975	3.193	3.125
V=0.098	0+975	3.193	3.125
	0+1000	3.900	3.247
V=0.102	0+1000	3.900	3.247
	0+1025	3.993	3.872
V=0.106	0+1025	3.993	3.872
	0+1050	4.093	3.996
V=0.110	0+1050	4.093	3.996
	0+1075	4.153	4.121
V=0.114	0+1075	4.153	4.121
	0+1100	4.245	4.245
V=0.118	0+1100	4.245	4.245
	0+1125	4.324	4.324
V=0.122	0+1125	4.324	4.324
	0+1150	4.370	4.370
V=0.126	0+1150	4.370	4.370
	0+1175	4.445	4.445
V=0.130	0+1175	4.445	4.445
	0+1200	4.591	4.591
V=0.134	0+1200	4.591	4.591
	0+1225	4.640	4.640
V=0.138	0+1225	4.640	4.640
	0+1250	4.700	4.700
V=0.142	0+1250	4.700	4.700
	0+1275	4.750	4.750
V=0.146	0+1275	4.750	4.750
	0+1300	4.800	4.800
V=0.150	0+1300	4.800	4.800
	0+1325	4.850	4.850
V=0.154	0+1325	4.850	4.850
	0+1350	4.900	4.900



Vertical Alignment	Finish Grade	Ground Level	Station	Horizontal Alignment	Superelevation
DL = -5.00	4.45	4.39	1+000	Y=0.049	
	4.51	4.45	1+025	Y=0.049	
	4.59	4.53	1+350	Y=0.049	
	4.64	4.60	1+375	Y=0.049	
	4.64	4.64	1+400	Y=0.049	
	4.64	4.64	1+425	Y=0.049	
	4.64	4.64	1+450	Y=0.049	
	4.64	4.64	1+475	Y=0.049	
	4.64	4.64	1+500	Y=0.049	
	4.64	4.64	1+525	Y=0.049	
	4.64	4.64	1+550	Y=0.049	
	4.64	4.64	1+575	Y=0.049	
	4.64	4.64	1+600	Y=0.049	
	4.64	4.64	1+625	Y=0.049	
	4.64	4.64	1+650	Y=0.049	
	4.64	4.64	1+675	Y=0.049	
	4.64	4.64	1+700	Y=0.049	
	4.64	4.64	1+725	Y=0.049	
	4.64	4.64	1+750	Y=0.049	
	4.64	4.64	1+775	Y=0.049	
	4.64	4.64	1+800	Y=0.049	
	4.64	4.64	1+825	Y=0.049	
	4.64	4.64	1+850	Y=0.049	
	4.64	4.64	1+875	Y=0.049	
	4.64	4.64	1+900	Y=0.049	
	4.64	4.64	1+925	Y=0.049	
	4.64	4.64	1+950	Y=0.049	
	4.64	4.64	1+975	Y=0.049	
	4.64	4.64	1+980	Y=0.049	
	4.64	4.64	1+985	Y=0.049	
	4.64	4.64	1+990	Y=0.049	
	4.64	4.64	1+995	Y=0.049	
	4.64	4.64	2.000	Y=0.049	

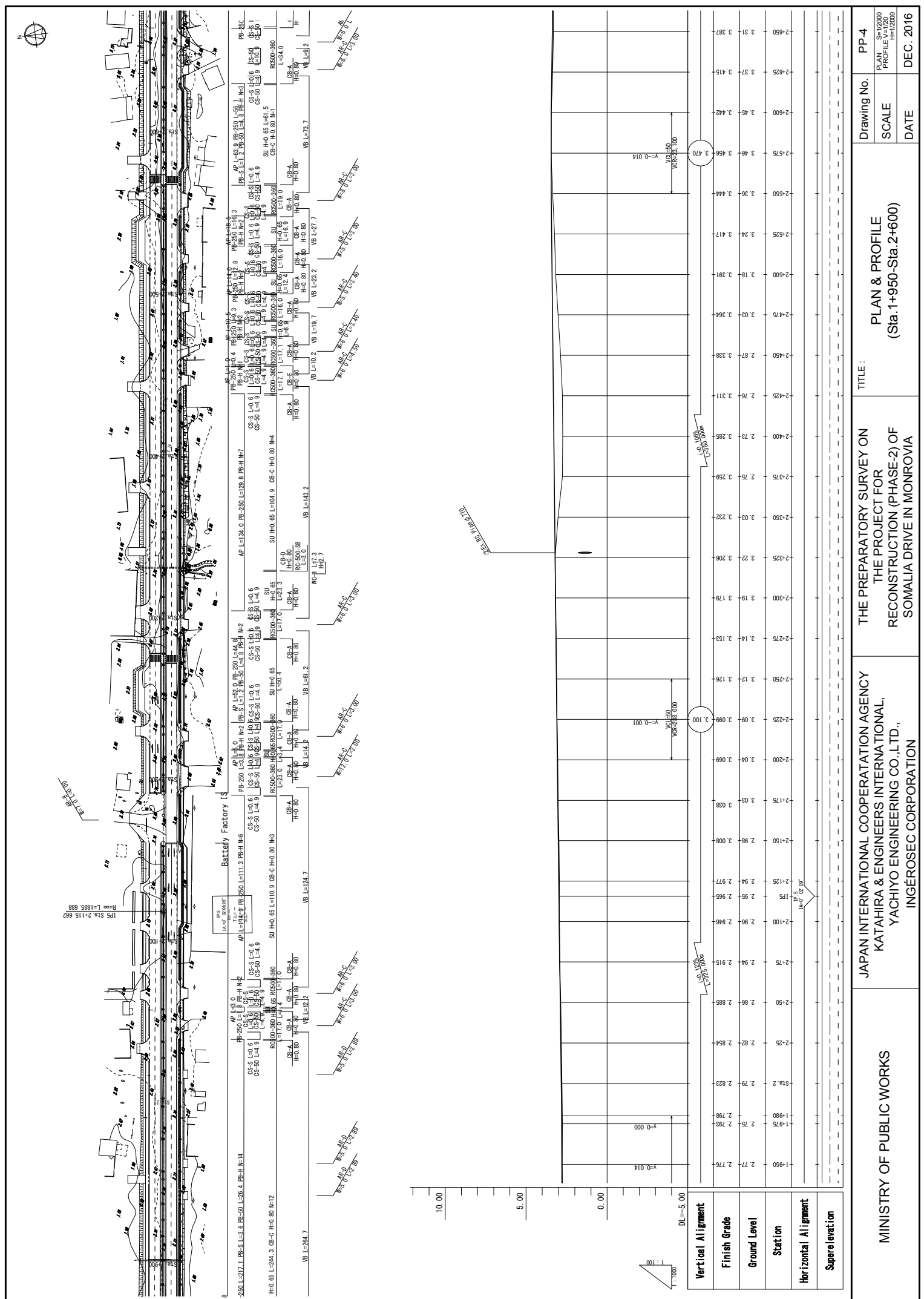
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INGÉROSEC CORPORATION

THE PREPARATORY SURVEY ON
THE PROJECT FOR
RECONSTRUCTION (PHASE-2) OF
SOMALIA DRIVE IN MONROVIA

PLAN & PROFILE
(Sta. 1+300-Sta. 1+950)

Drawing No. PP-3
SCALE
DATE DEC. 2016

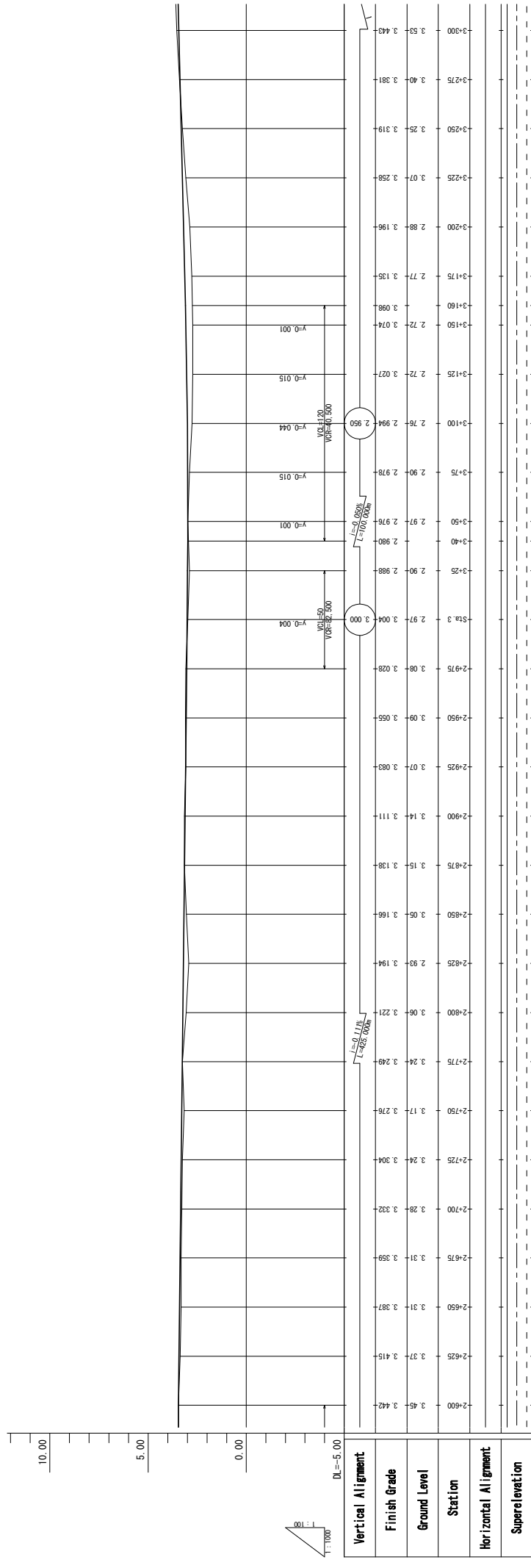
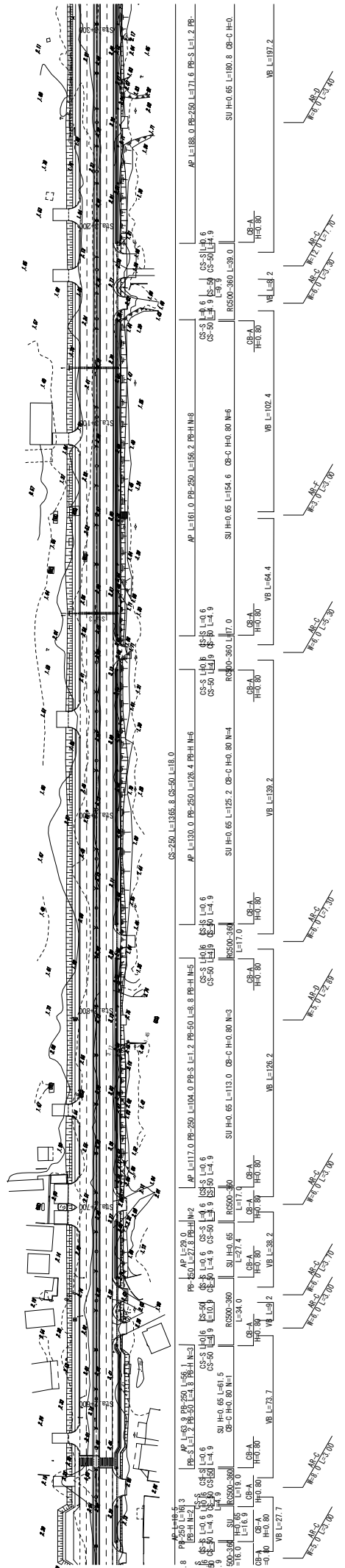


Drawing No.	PP-4
SCALE	PLAN S=1/2000 PROFILE H=1/2000
DATE	DEC. 2016

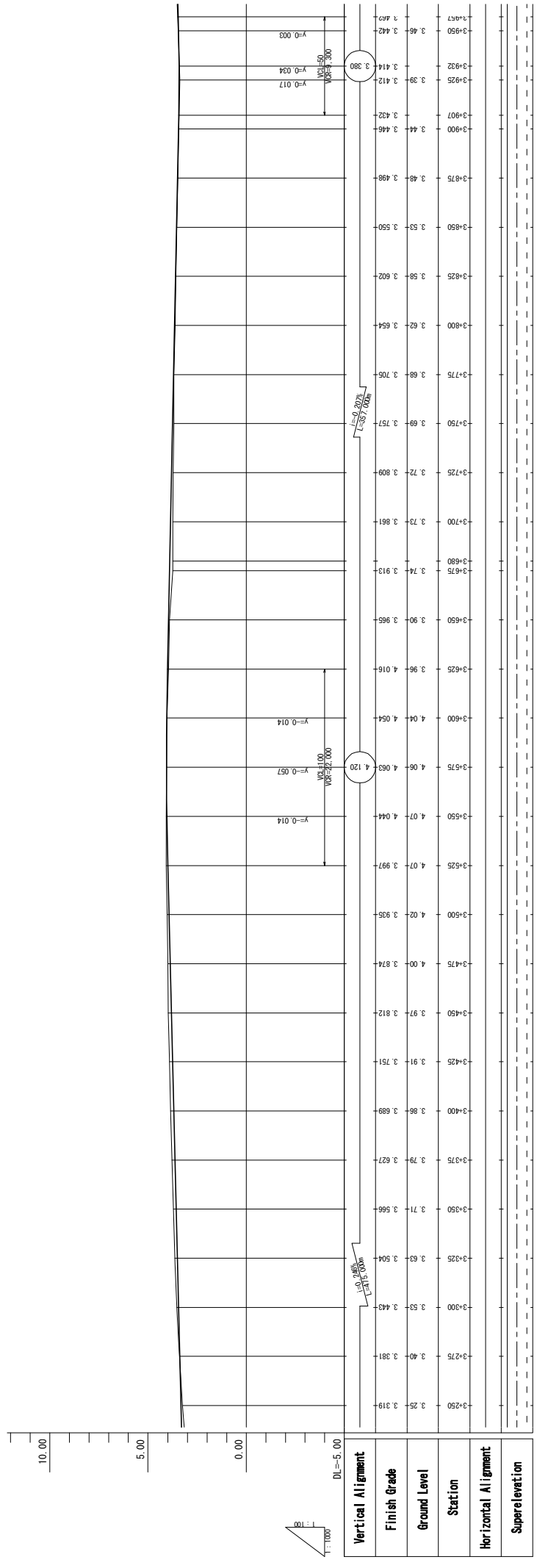
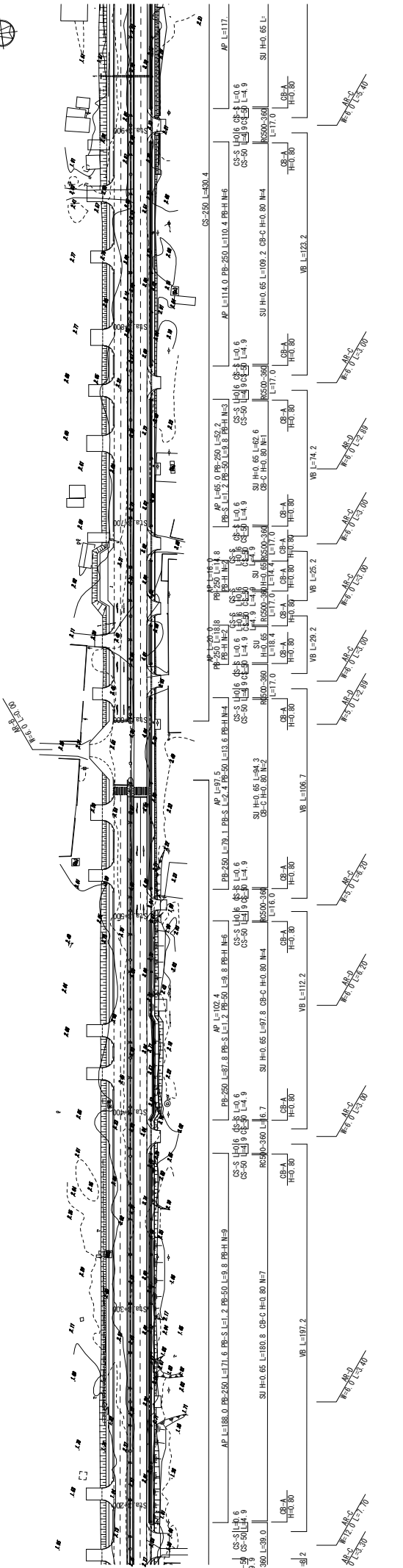
TITLE :
 THE PREPARATORY SURVEY ON
 THE PROJECT FOR
 RECONSTRUCTION (PHASE-2) OF
 SOMALIA DRIVE IN MONROVIA

JAPAN INTERNATIONAL COOPERATION AGENCY
 KATAHIRA & ENGINEERS INTERNATIONAL,
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Drawing No.		PP-5
SCALE	PLAN PROFILE H=1/2000	
DATE		DEC. 2016
TITLE :		PLAN & PROFILE (Sta.2+600-Sta.3+250)
THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA		
JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION		
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Vertical Alignment	Station	Finish Grade	Ground Level	Horizontal Alignment	Superelevation
	+250	3.25	3.25		
	+275	3.40	3.38		
	+300	3.53	3.43		
	+325	3.63	3.50		
	+350	3.71	3.56		
	+375	3.79	3.62		
	+400	3.86	3.69		
	+425	3.91	3.75		
	+450	3.97	3.82		
	+475	4.00	3.87		
	+500	4.02	3.93		
	+525	4.07	3.99		
	+550	4.07	4.04		
	+575	4.06	4.09		
	+600	4.04	4.14		
	+625	3.96	4.19		
	+650	3.90	4.25		
	+675	3.74	4.31		
	+700	3.73	4.36		
	+725	3.72	4.41		
	+750	3.69	4.46		
	+775	3.68	4.51		
	+800	3.62	4.56		
	+825	3.58	4.61		
	+850	3.53	4.66		
	+875	3.48	4.71		
	+900	3.44	4.76		
	+925	3.39	4.81		
	+950	3.46	4.86		
	+975	3.42	4.91		
	+1000	3.49	4.96		

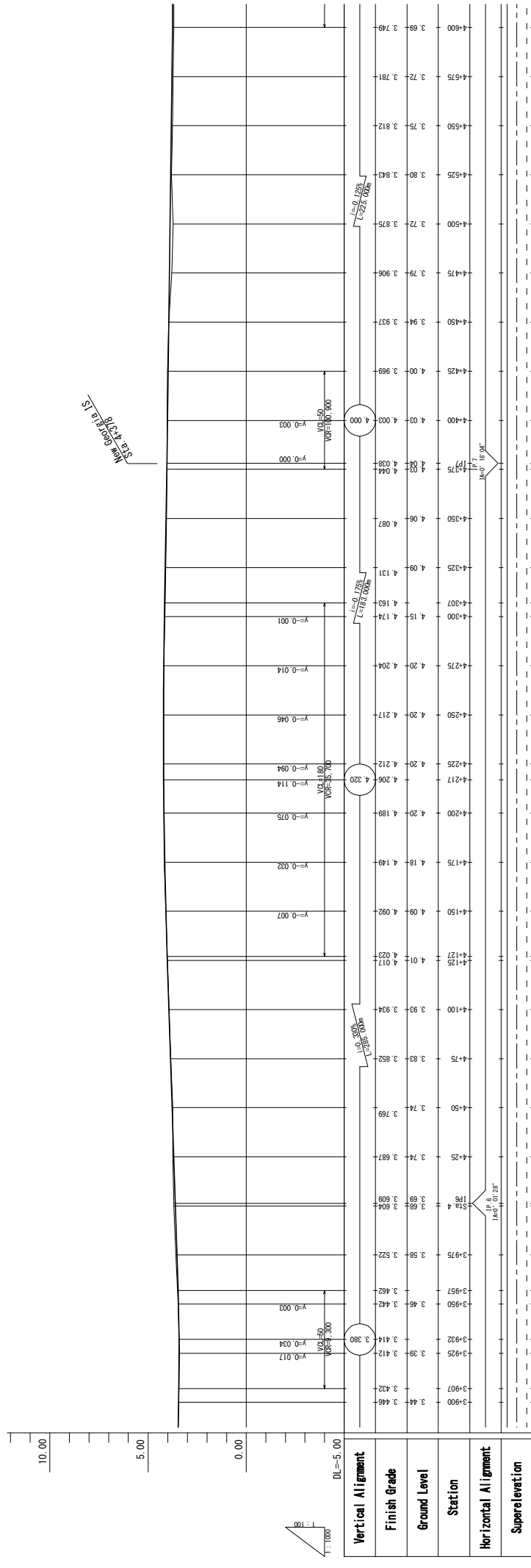
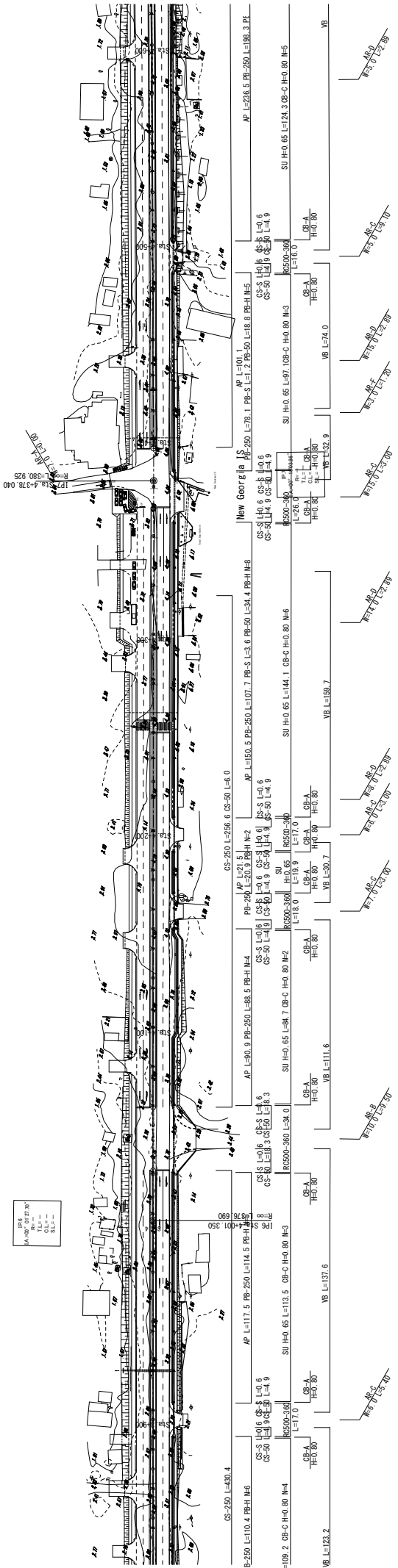
Drawing No. PP-6
 SCALE
 DATE DEC. 2016

TITLE:
 THE PREPARATORY SURVEY ON
 THE PROJECT FOR
 RECONSTRUCTION (PHASE-2) OF
 SOWALIA DRIVE IN MONROVIA

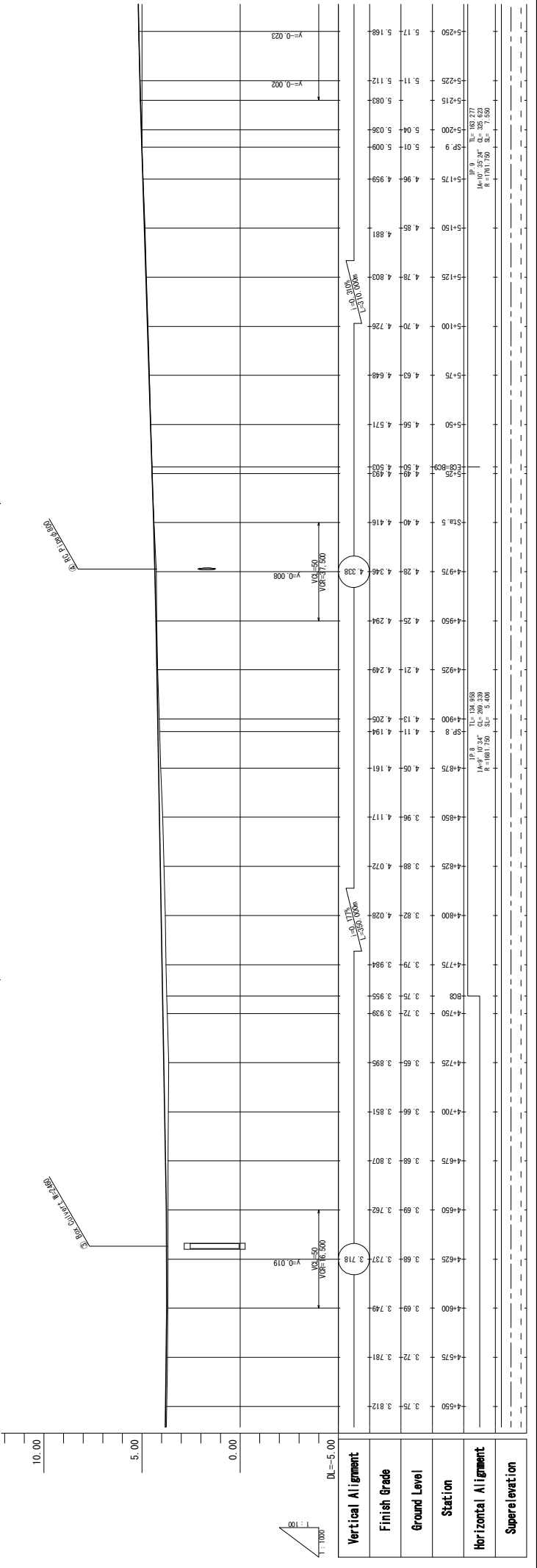
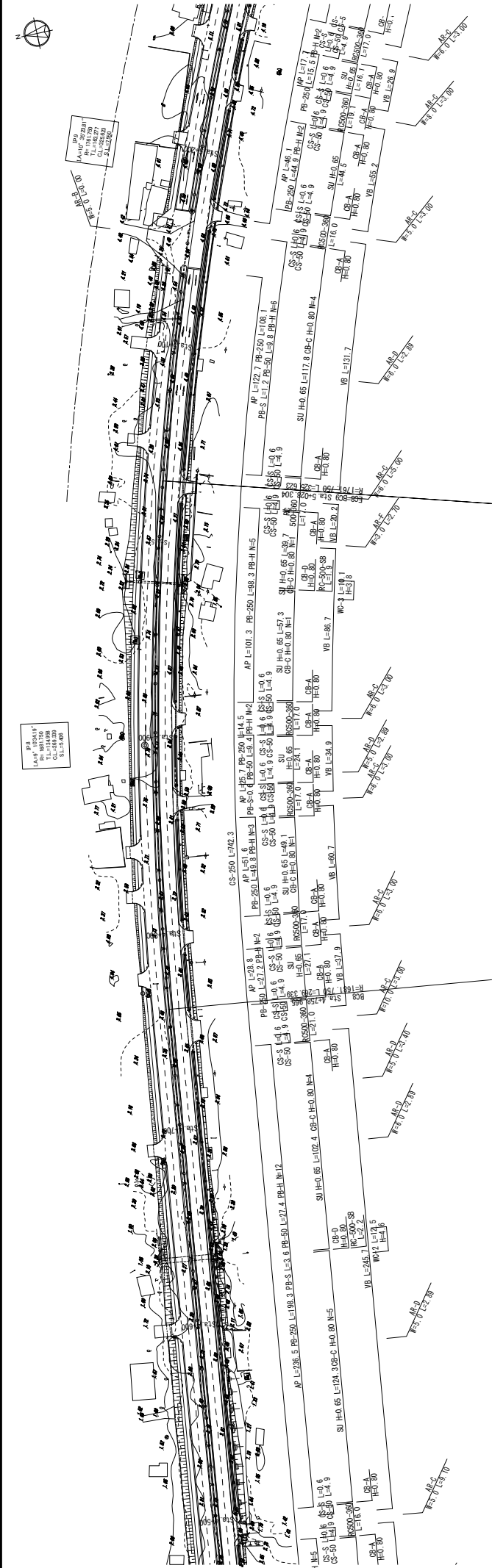
JAPAN INTERNATIONAL COOPERATION AGENCY
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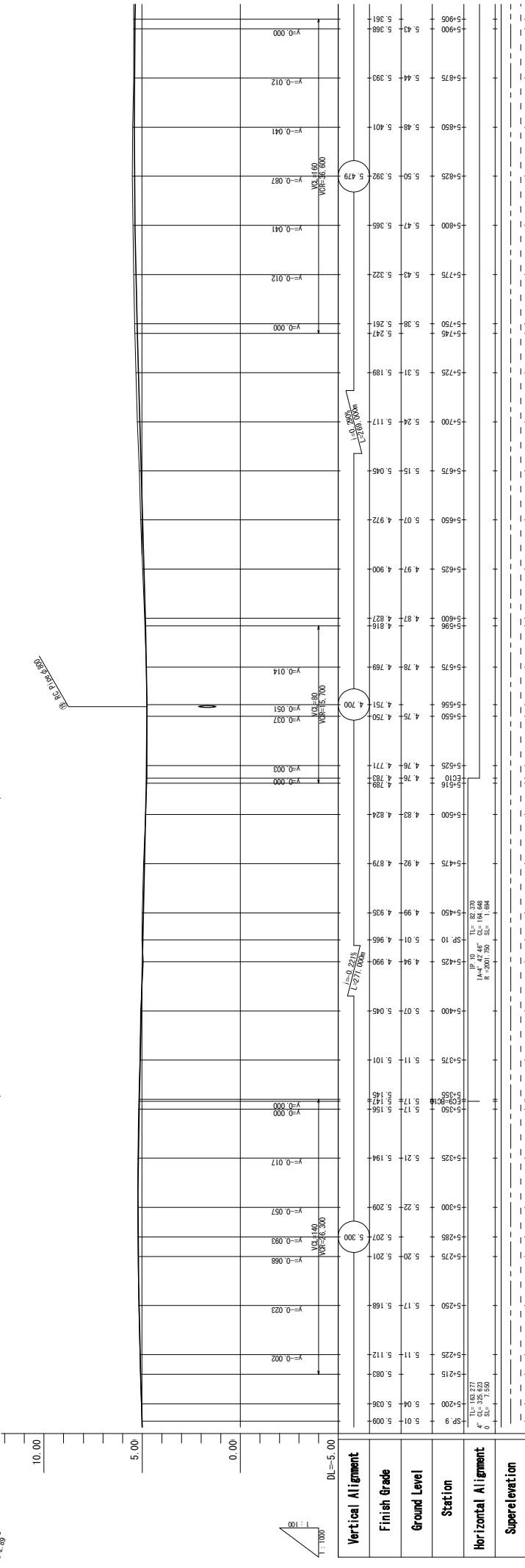
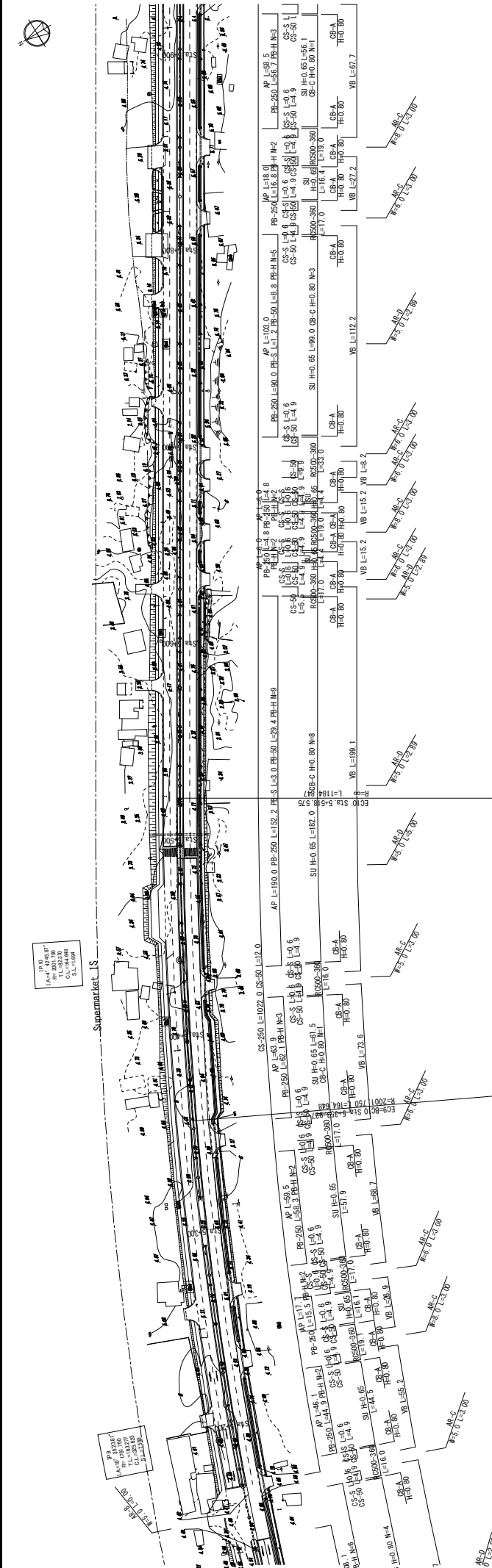
PLAN & PROFILE
 (Sta. 3+250-Sta. 3+900)



Drawing No.		PP-7
SCALE	DATE	
PLAN 1:2000		DEC. 2016
PROFILE 1:1200		
TITLE : THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA		
JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION		
MINISTRY OF PUBLIC WORKS		
PLAN & PROFILE (Sta.3+900-Sta.4+550)		



Drawing No.		PP-8	
SCALE		S-1/2000 PROFILE H-1/2000	
DATE		DEC. 2016	
MINISTRY OF PUBLIC WORKS		JAPAN INTERNATIONAL COOPERATION AGENCY	
KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO., LTD., INGÉROSEC CORPORATION		THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	
PLAN & PROFILE (Sta. 4+550-Sta. 5+200)		TITLE :	



Vertical Alignment	Finish Grade	Ground Level	Station	Horizontal Alignment	Superelevation
			5+009		
			5+015		
			5+025		
			5+035		
			5+045		
			5+055		
			5+065		
			5+075		
			5+085		
			5+095		
			5+105		
			5+115		
			5+125		
			5+135		
			5+145		
			5+155		
			5+165		
			5+175		
			5+185		
			5+195		
			5+205		
			5+215		
			5+225		
			5+235		
			5+245		
			5+255		
			5+265		
			5+275		
			5+285		
			5+295		
			5+300		
			5+310		
			5+325		
			5+335		
			5+345		
			5+355		
			5+365		
			5+375		
			5+385		
			5+395		
			5+405		
			5+415		
			5+425		
			5+435		
			5+445		
			5+455		
			5+465		
			5+475		
			5+485		
			5+495		
			5+505		
			5+515		
			5+525		
			5+535		
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			5+555		
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			5+685		
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			5+725		
			5+735		
			5+745		
			5+755		
			5+765		
			5+775		
			5+785		
			5+795		
			5+805		
			5+815		
			5+825		
			5+835		
			5+845		
			5+850		

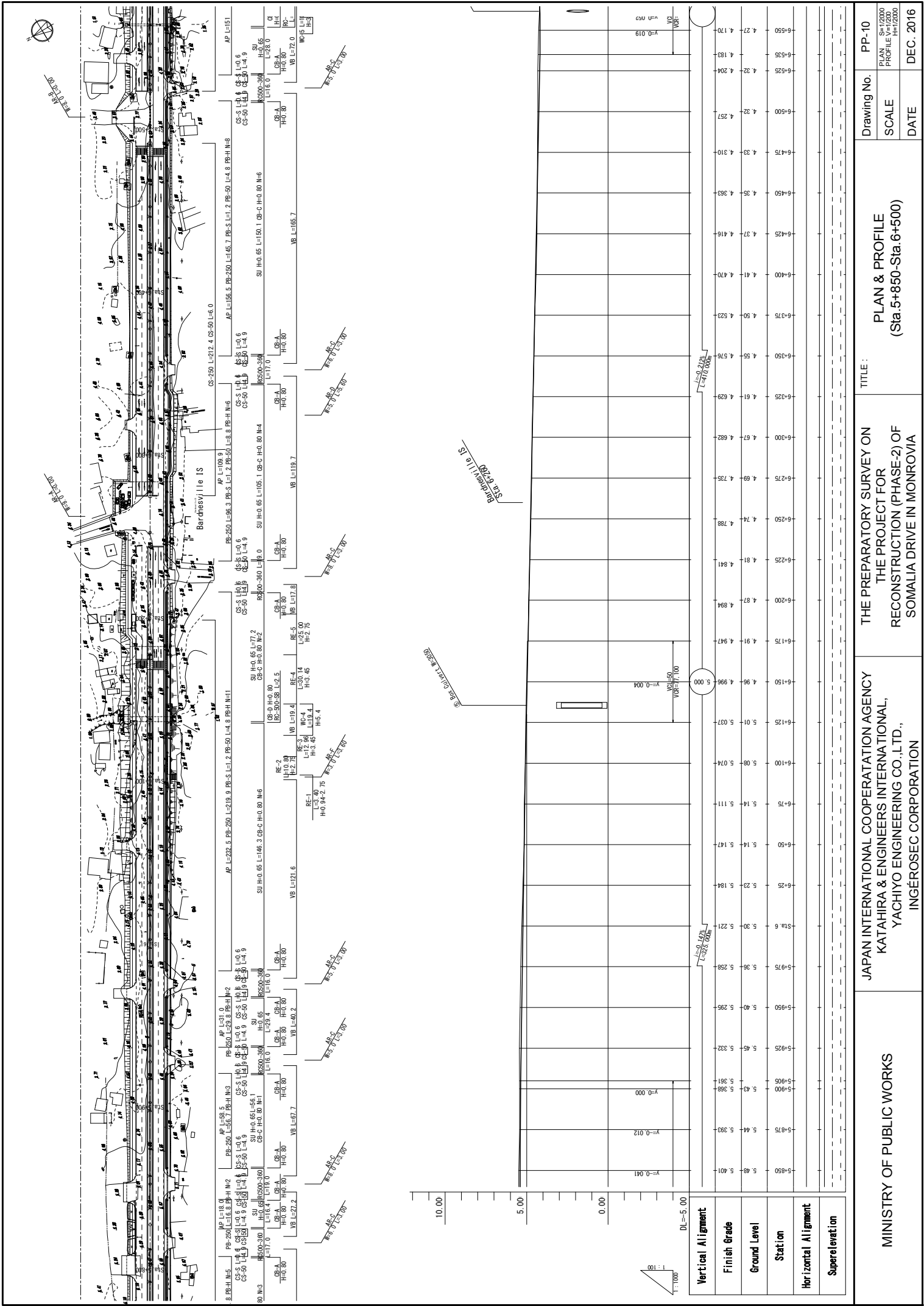
Drawing No. PP-9
 PLAN S-12000
 PROFILE H-12000
 SCALE
 DATE DEC. 2016

TITLE:
 THE PREPARATORY SURVEY ON
 THE PROJECT FOR
 RECONSTRUCTION (PHASE-2) OF
 SOMALIA DRIVE IN MONROVIA

JAPAN INTERNATIONAL COOPERATION AGENCY
 KATAHIRA & ENGINEERS INTERNATIONAL,
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PLAN & PROFILE
 (Sta.5+200-Sta.5+850)



Drawing No.	PP-10
SCALE	S=1/2000 PLAN PROFILE H=1/2000
DATE	DEC. 2016

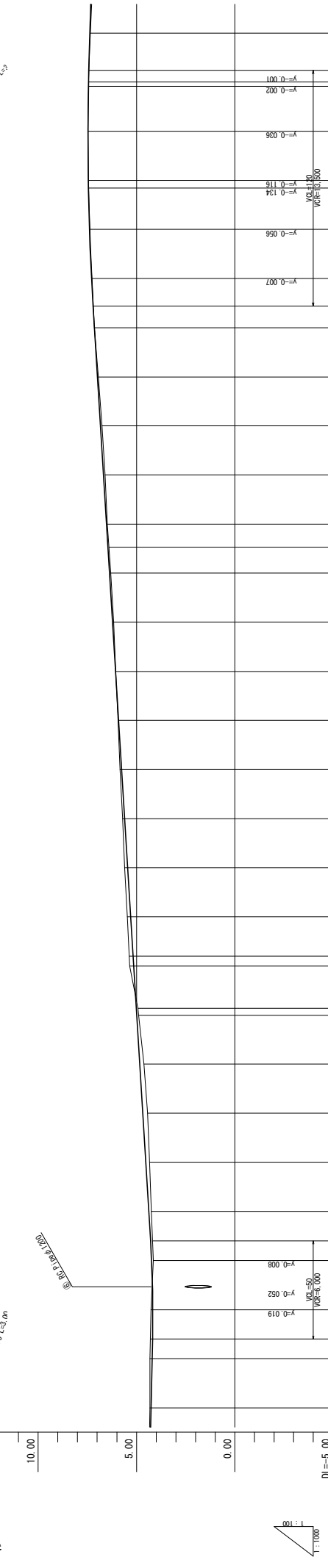
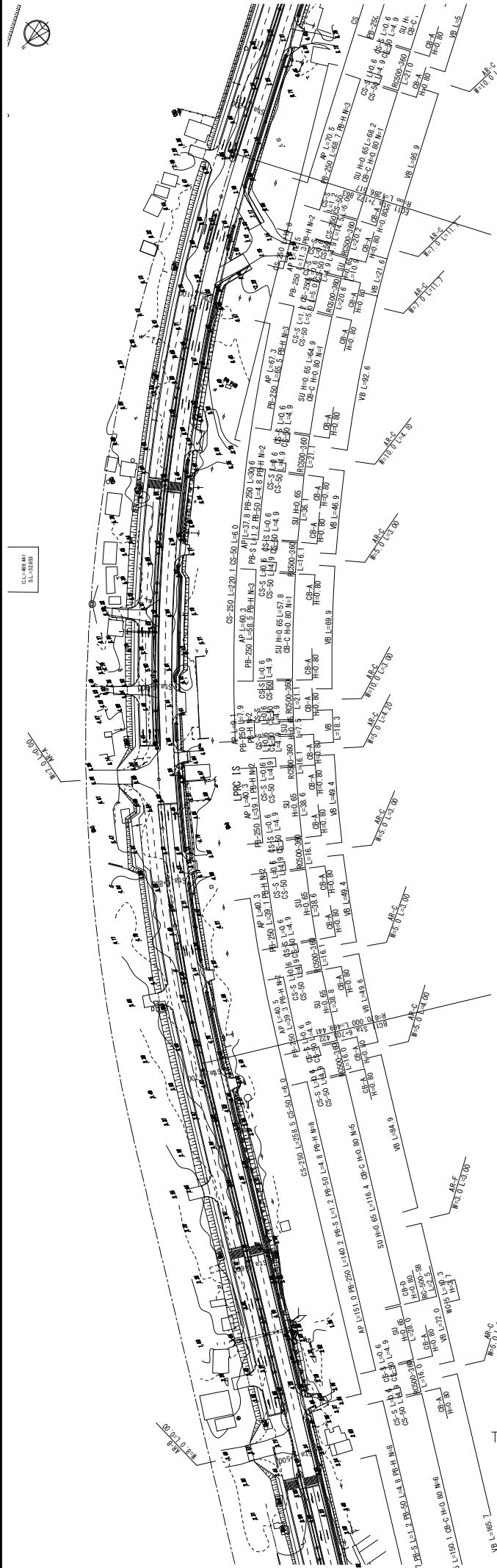
TITLE :

THE PREPARATORY SURVEY ON
THE PROJECT FOR
RECONSTRUCTION (PHASE-2) OF
SOMALIA DRIVE IN MONROVIA

JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL,
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Vertical Alignment	Station	Finish Grade	Ground Level	Horizontal Alignment	Superelevation
	5+480	5.480	5.480		
	5+485	5.445	5.445		
	5+490	5.388	5.388		
	5+495	5.361	5.361		
	5+500	5.443	5.443		
	5+505	5.322	5.322		
	5+510	5.455	5.455		
	5+515	5.295	5.295		
	5+520	5.386	5.386		
	5+525	5.322	5.322		
	5+530	5.184	5.184		
	5+535	5.147	5.147		
	5+540	5.111	5.111		
	5+545	5.074	5.074		
	5+550	5.037	5.037		
	5+555	4.996	4.996		
	5+560	4.966	4.966		
	5+565	4.947	4.947		
	5+570	4.884	4.884		
	5+575	4.841	4.841		
	5+580	4.814	4.814		
	5+585	4.788	4.788		
	5+590	4.758	4.758		
	5+595	4.692	4.692		
	5+600	4.632	4.632		
	5+605	4.576	4.576		
	5+610	4.523	4.523		
	5+615	4.470	4.470		
	5+620	4.416	4.416		
	5+625	4.363	4.363		
	5+630	4.310	4.310		
	5+635	4.257	4.257		
	5+640	4.204	4.204		
	5+645	4.153	4.153		
	5+650	4.102	4.102		
	5+655	4.051	4.051		
	5+660	4.000	4.000		
	5+665	3.949	3.949		
	5+670	3.898	3.898		
	5+675	3.847	3.847		
	5+680	3.796	3.796		
	5+685	3.745	3.745		
	5+690	3.694	3.694		
	5+695	3.643	3.643		
	5+700	3.592	3.592		
	5+705	3.541	3.541		
	5+710	3.490	3.490		
	5+715	3.439	3.439		
	5+720	3.388	3.388		
	5+725	3.337	3.337		
	5+730	3.286	3.286		
	5+735	3.235	3.235		
	5+740	3.184	3.184		
	5+745	3.133	3.133		
	5+750	3.082	3.082		
	5+755	3.031	3.031		
	5+760	2.980	2.980		
	5+765	2.929	2.929		
	5+770	2.878	2.878		
	5+775	2.827	2.827		
	5+780	2.776	2.776		
	5+785	2.725	2.725		
	5+790	2.674	2.674		
	5+795	2.623	2.623		
	5+800	2.572	2.572		
	5+805	2.521	2.521		
	5+810	2.470	2.470		
	5+815	2.419	2.419		
	5+820	2.368	2.368		
	5+825	2.317	2.317		
	5+830	2.266	2.266		
	5+835	2.215	2.215		
	5+840	2.164	2.164		
	5+845	2.113	2.113		
	5+850	2.062	2.062		



Vertical Alignment	Finish Grade	Ground Level	Station	Horizontal Alignment	Superelevation
			6+257		
			6+500		
			6+525		
			6+535		
			6+550		
			6+575		
			6+585		
			6+600		
			6+625		
			6+650		
			6+675		
			6+700		
			6+725		
			6+750		
			6+775		
			6+800		
			6+825		
			6+850		
			6+875		
			6+900		
			6+925		
			6+950		
			6+975		
			6+990		
			6+995		
			6+998		
			6+999		
			7+000		
			7+025		
			7+050		
			7+061		
			7+075		
			7+090		
			7+100		
			7+125		
			7+150		
			7+159		
			7+175		
			7+190		
			7+200		

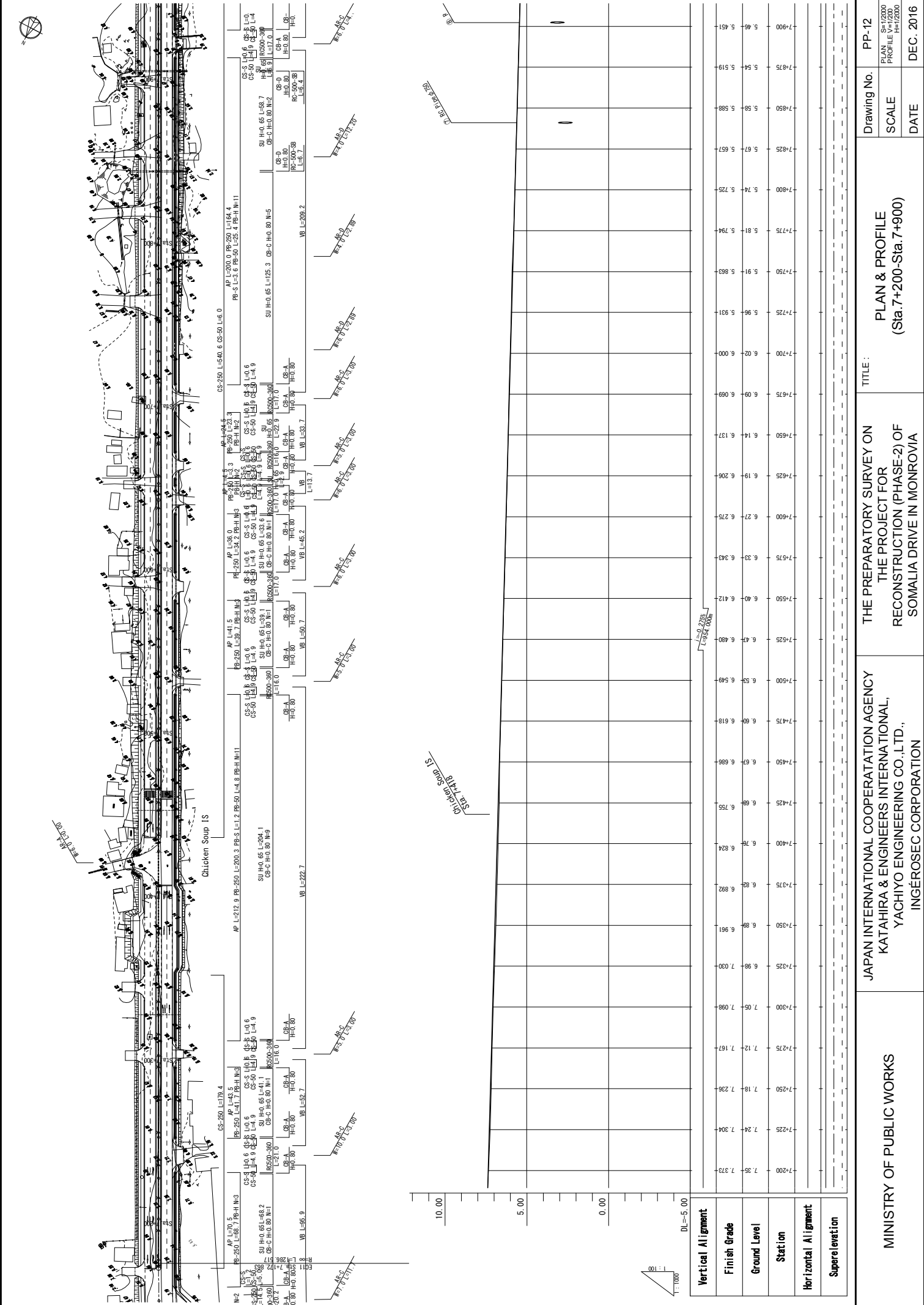
MINISTRY OF PUBLIC WORKS

**JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL,
YACHIYO ENGINEERING CO.,LTD.,
INGÉROSEC CORPORATION**

TITLE :
THE PREPARATORY SURVEY ON
THE PROJECT FOR
RECONSTRUCTION (PHASE-2) OF
SOMALIA DRIVE IN MONROVIA

PLAN & PROFILE
(Sta.6+500-Sta.7+200)

Drawing No.	PP-11	SCALE	DATE
PLAN S=1/2000 PROFILE H=1/2000			DEC. 2016



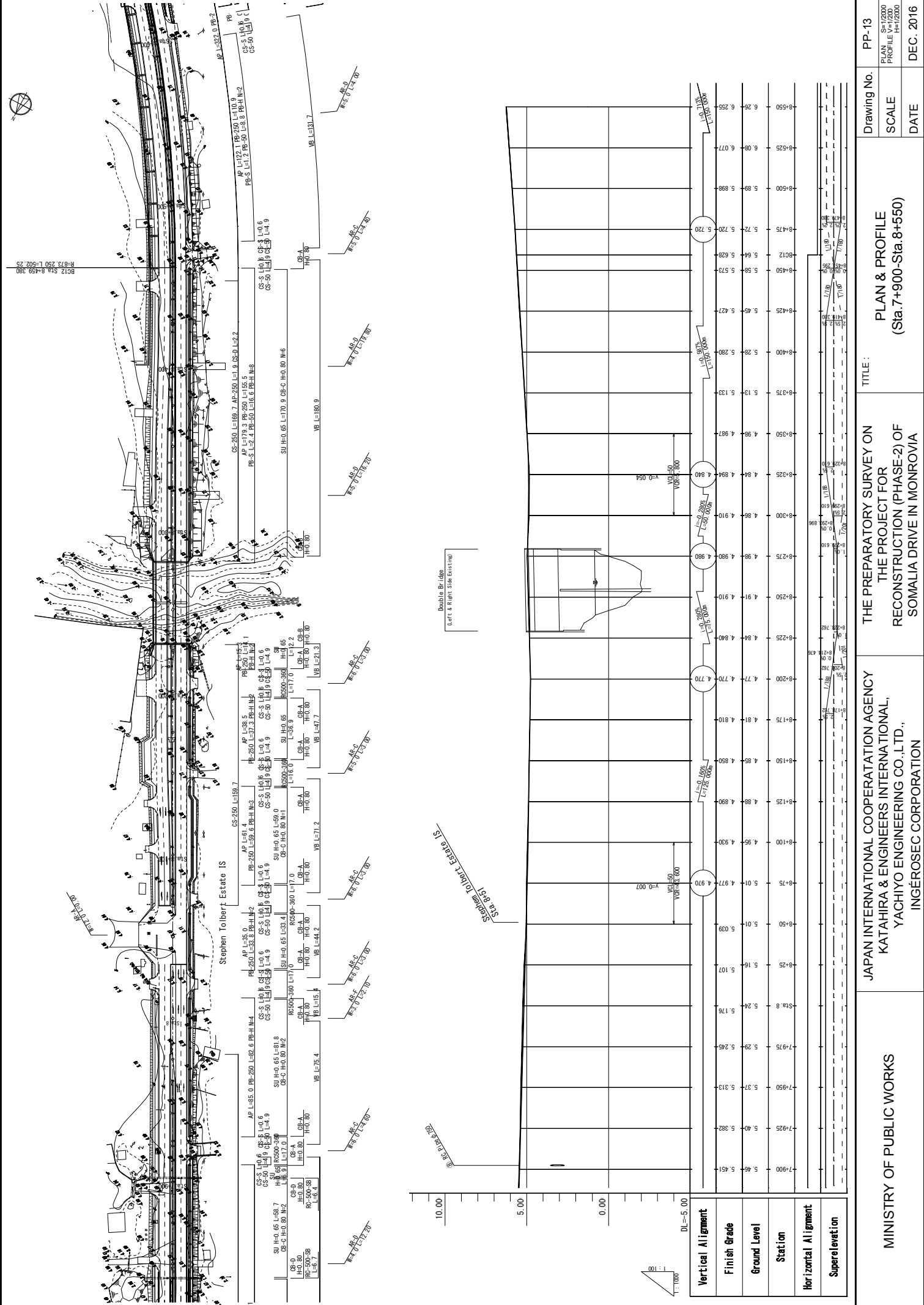
Chicken Soup IS

Chicken Soup IS

1:1000

Vertical Alignment	Finish Grade	Ground Level	Station	Horizontal Alignment	Superelevation
			7+200		
			7+204		
			7+250		
			7+275		
			7+300		
			7+325		
			7+350		
			7+375		
			7+400		
			7+425		
			7+450		
			7+475		
			7+500		
			7+525		
			7+550		
			7+575		
			7+600		
			7+625		
			7+650		
			7+675		
			7+700		
			7+725		
			7+750		
			7+775		
			7+800		
			7+825		
			7+850		
			7+875		
			7+900		

Drawing No.	PP-12	TITLE :	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION	MINISTRY OF PUBLIC WORKS
	SCALE				
PLAN PROFILE	S-1/2000 H-1/2000				
DATE	DEC. 2016				



Drawing No. PP-13
 PLAN S=1/2000
 PROFILE H=1/2000
 SCALE
 DATE DEC. 2016

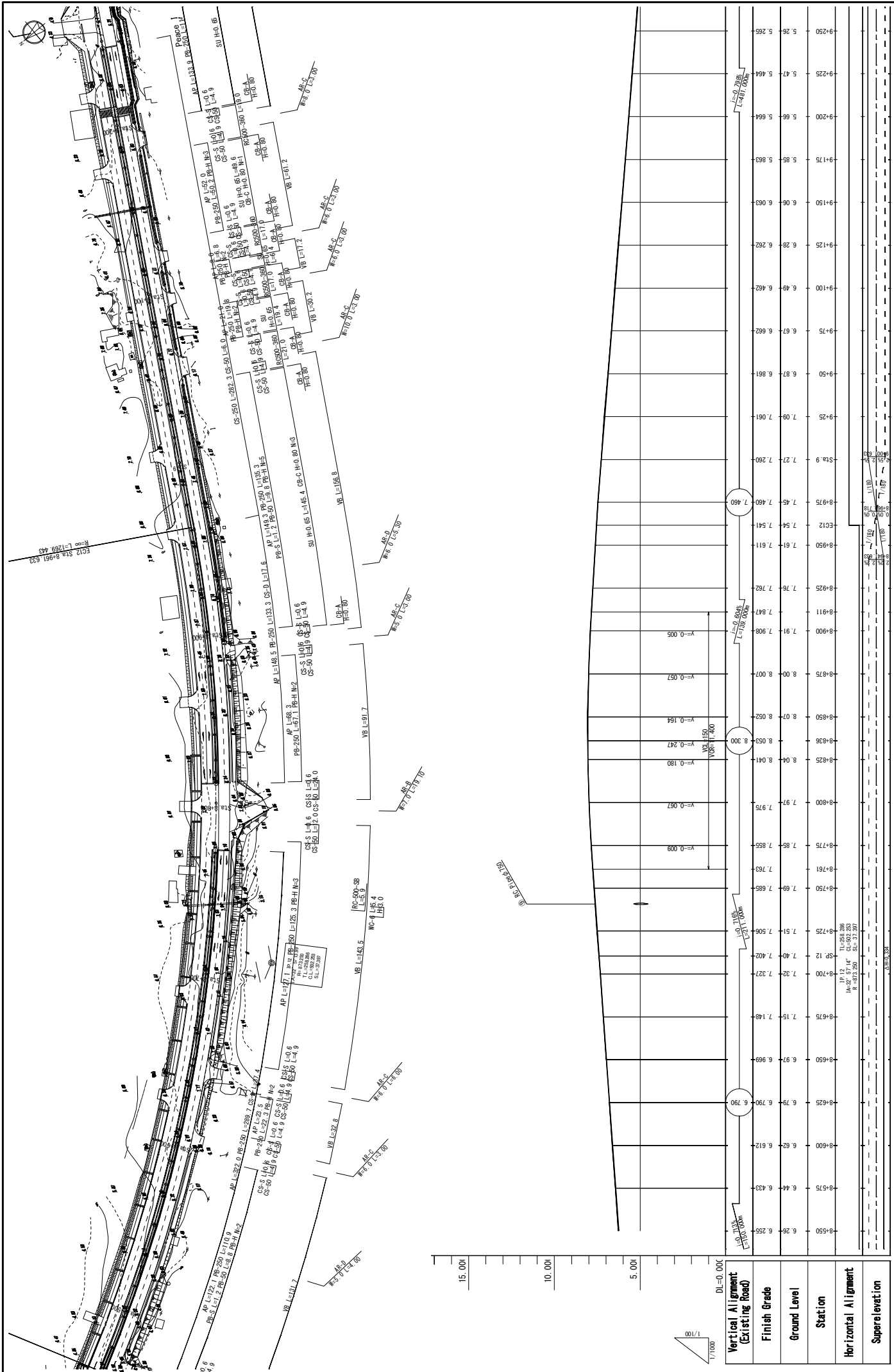
TITLE:
 THE PREPARATORY SURVEY ON
 THE PROJECT FOR
 RECONSTRUCTION (PHASE-2) OF
 SOMALIA DRIVE IN MONROVIA

JAPAN INTERNATIONAL COOPERATION AGENCY
 KATAHIRA & ENGINEERS INTERNATIONAL,
 YACHIYO ENGINEERING CO.,LTD.,
 INGÉROSEC CORPORATION

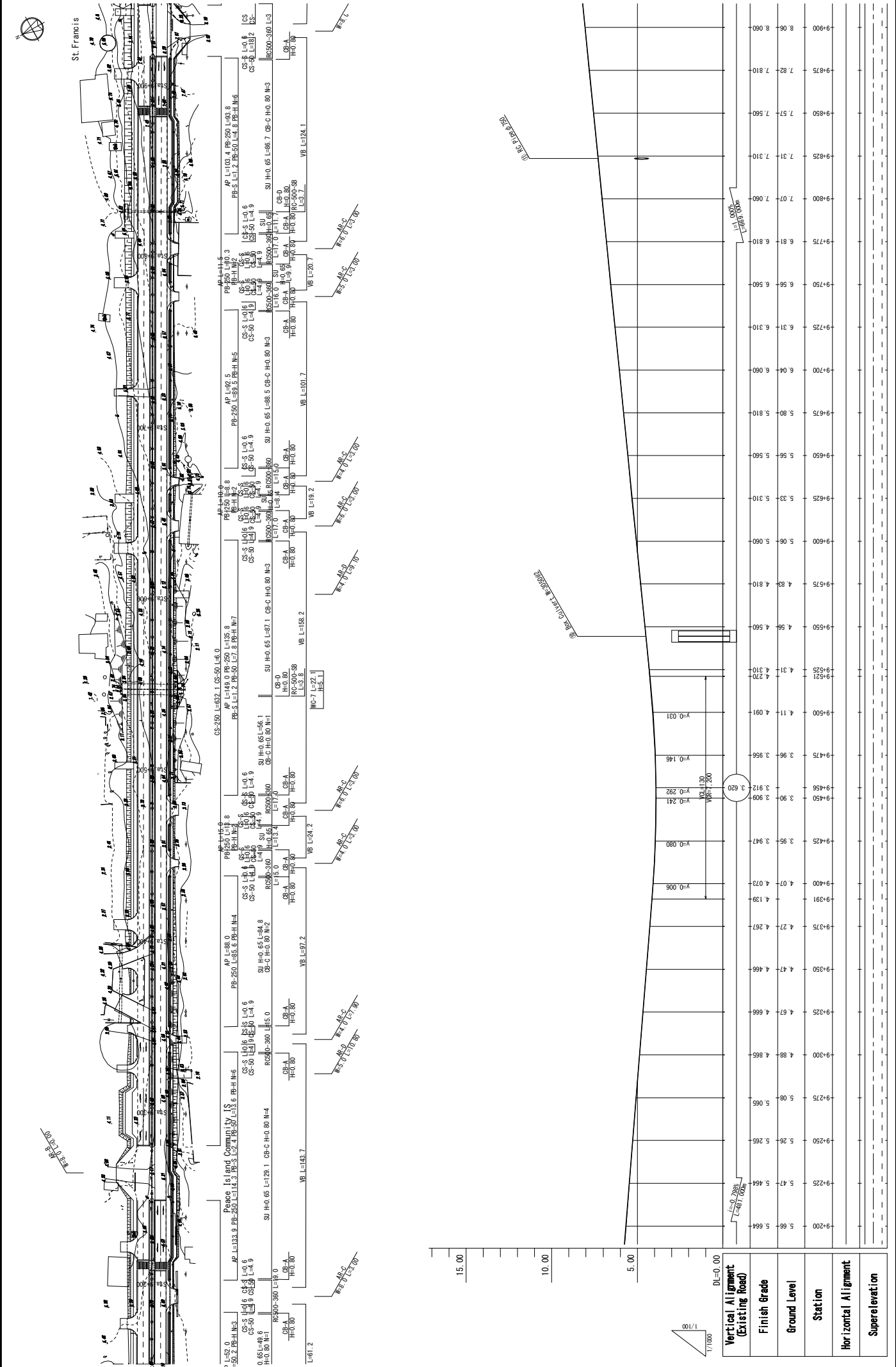
MINISTRY OF PUBLIC WORKS

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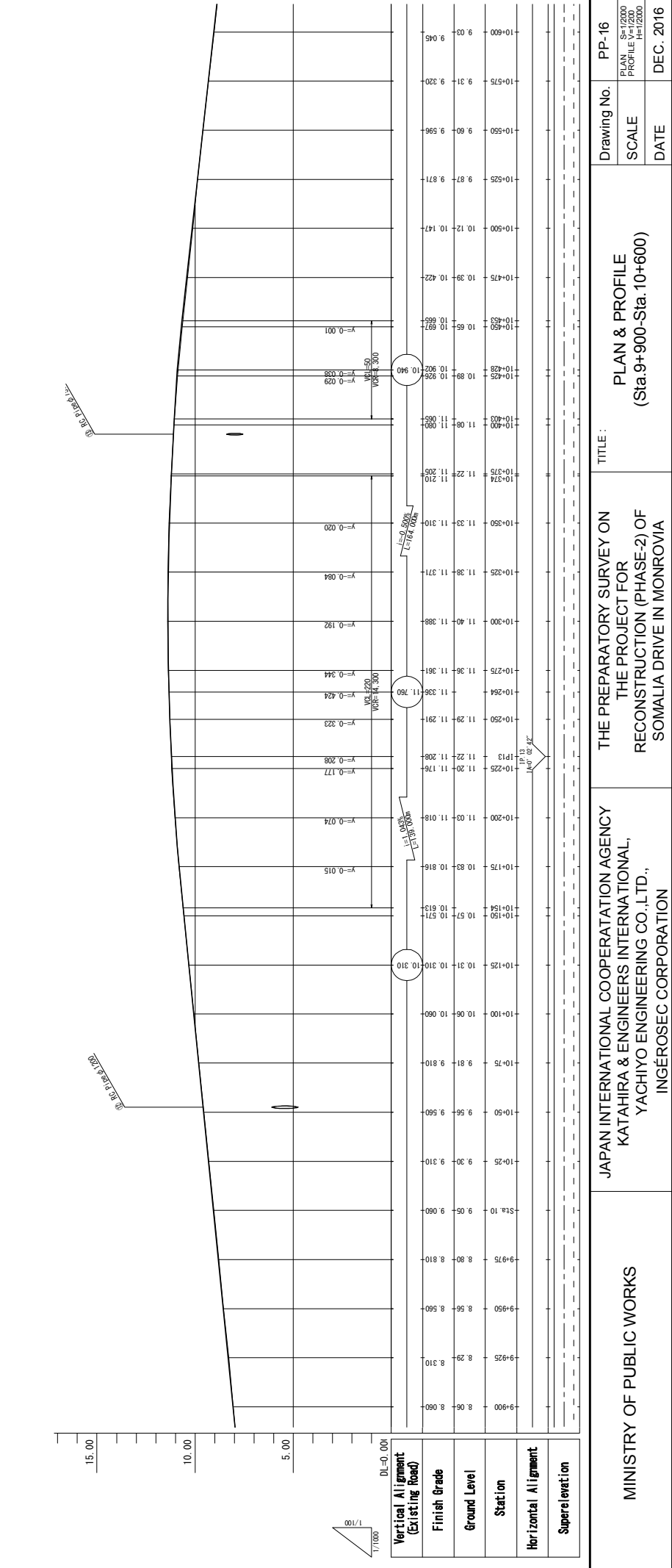
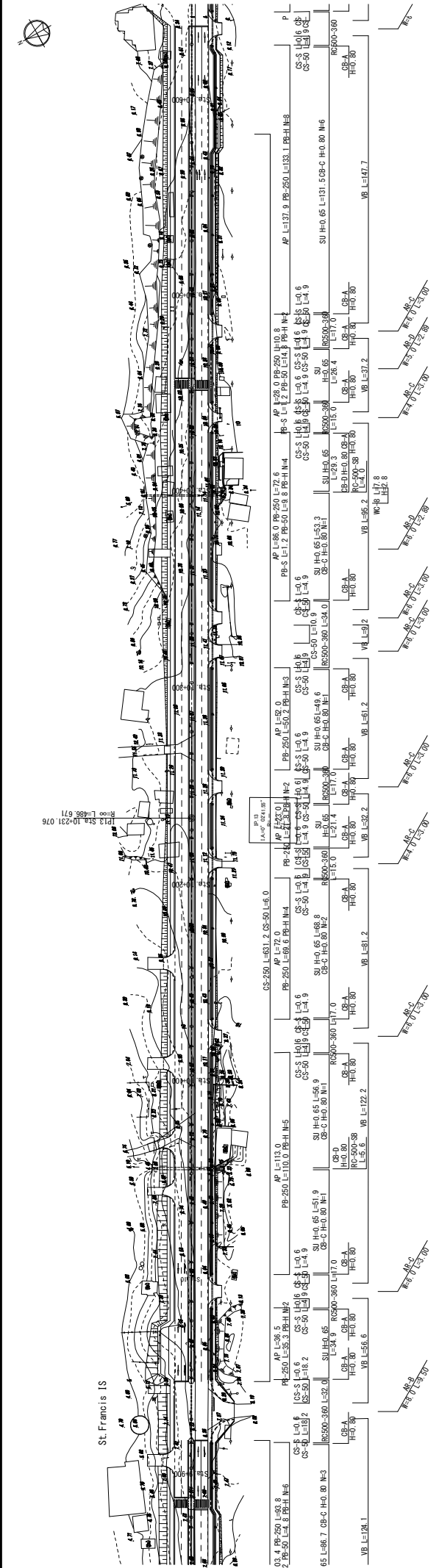
Vertical Alignment	Finish Grade	Ground Level	Station	Horizontal Alignment	Superelevation
			7+900		
			7+925		
			7+950		
			7+975		
			8+000		
			8+025		
			8+050		
			8+075		
			8+100		
			8+125		
			8+150		
			8+175		
			8+200		
			8+225		
			8+250		
			8+275		
			8+300		
			8+325		
			8+350		
			8+375		
			8+400		
			8+425		
			8+450		
			8+475		
			8+500		
			8+525		
			8+550		



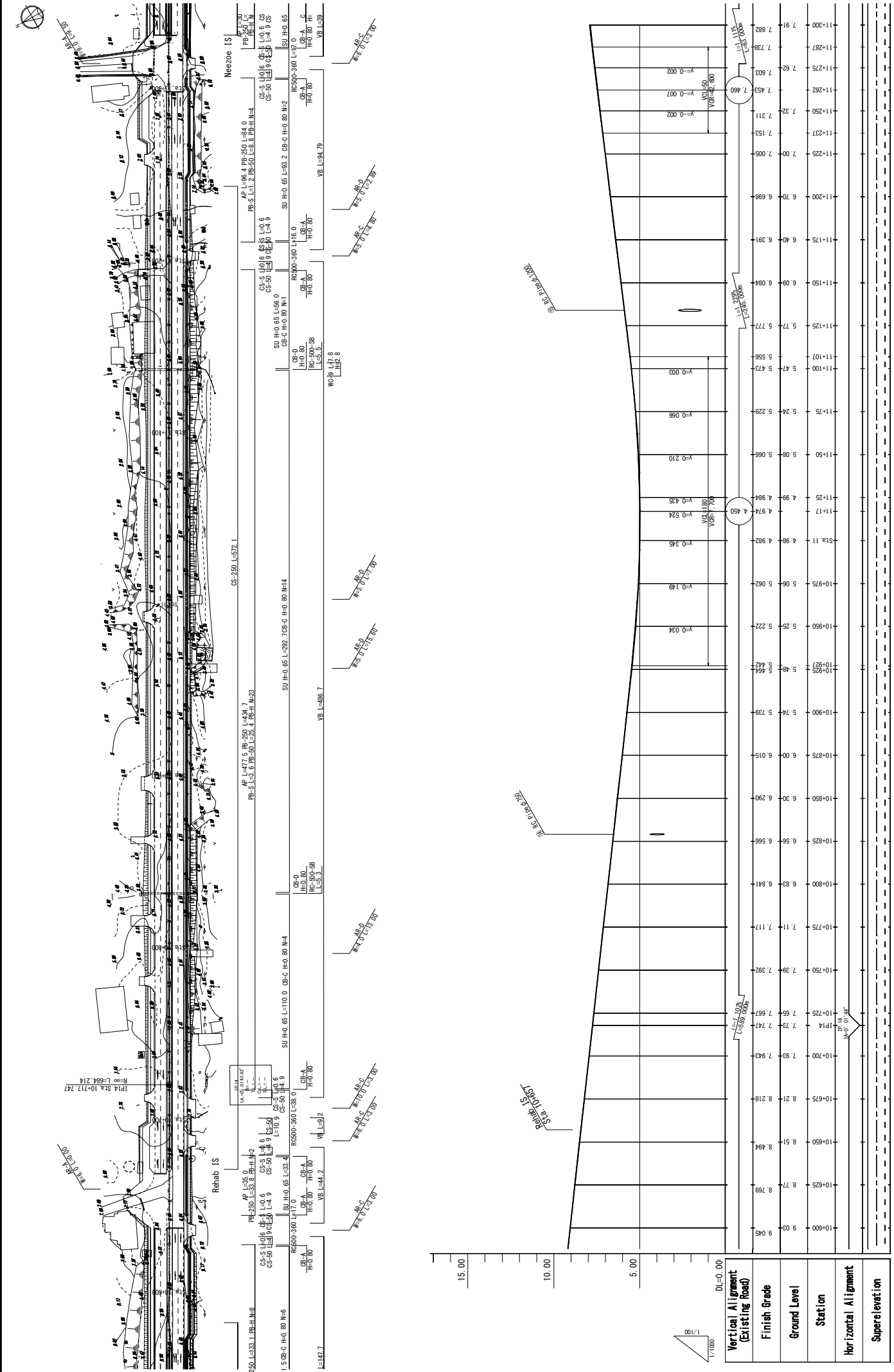
Drawing No.	PP-14	TITLE :	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	Drawing No.	PP-14
	SCALE				S=1/2000 PROFILE H=1/2000
MINISTRY OF PUBLIC WORKS		JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION		PLAN & PROFILE (Sta.8+550-Sta.9+200)	



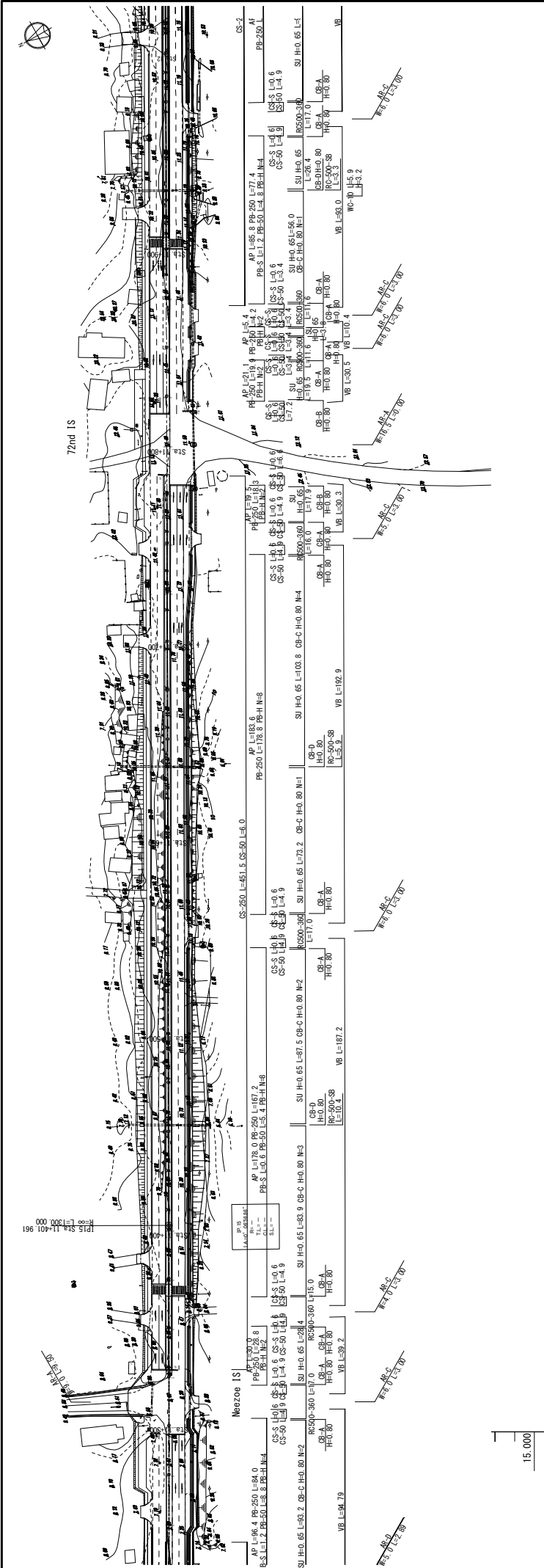
Drawing No.	PP-15
	S-1/2000 PROFILE H-1/2000
SCALE	
DATE	DEC. 2016
TITLE :	
THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	
JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION	
MINISTRY OF PUBLIC WORKS	



Drawing No. PP-16
 PLAN S=1/2000
 PROFILE H=1/2000
 SCALE DATE
 TITLE: THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA
 JAPAN INTERNATIONAL COOPERATION AGENCY
 KATAHIRA & ENGINEERS INTERNATIONAL,
 YACHIYO ENGINEERING CO.,LTD.,
 INGÉROSEC CORPORATION
 MINISTRY OF PUBLIC WORKS
 PP-16
 S=1/2000
 H=1/2000
 DEC. 2016



MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	PP-17 S-12000 PLAN PROFILE H=1/2000
TITLE :	PLAN & PROFILE (Sta. 10+600-Sta. 11+300)	SCALE	DATE
DECEMBER 2016			



Vertical Alignment (Existing Road)	Station	Ground Level	Finish Grade	Horizontal Alignment	Superelevation
	7.914	8.210	8.500	11+300	
	8.160	8.470	8.760	11+325	
	8.210	8.500	8.790	11+350	
	9.114	9.410	9.700	11+400	
	9.170	9.470	9.760	11+425	
	9.270	9.570	9.860	11+475	
	9.285	9.585	9.875	11+500	
	10.051	10.351	10.641	11+525	
	10.147	10.447	10.737	11+550	
	10.285	10.585	10.875	11+574	
	10.285	10.585	10.875	11+575	
	10.819	11.119	11.409	11+600	
	10.905	11.205	11.495	11+625	
	10.922	11.222	11.512	11+650	
	10.928	11.228	11.518	11+659	
	10.912	11.212	11.502	11+675	
	10.876	11.176	11.466	11+700	
	10.821	11.121	11.411	11+725	
	10.765	11.065	11.355	11+750	
	10.710	11.010	11.300	11+775	
	10.699	10.999	11.289	11+800	
	10.607	10.907	11.197	11+800	
	10.566	10.866	11.156	11+825	
	10.505	10.805	11.095	11+850	
	10.483	10.783	11.073	11+875	
	10.453	10.753	11.043	11+900	
	10.402	10.702	10.992	11+925	
	10.351	10.651	10.941	11+950	
	10.299	10.599	10.889	11+975	
	10.248	10.548	10.838	11+988	
	10.223	10.523	10.813	11+990	
	10.205	10.505	10.795	11+992	

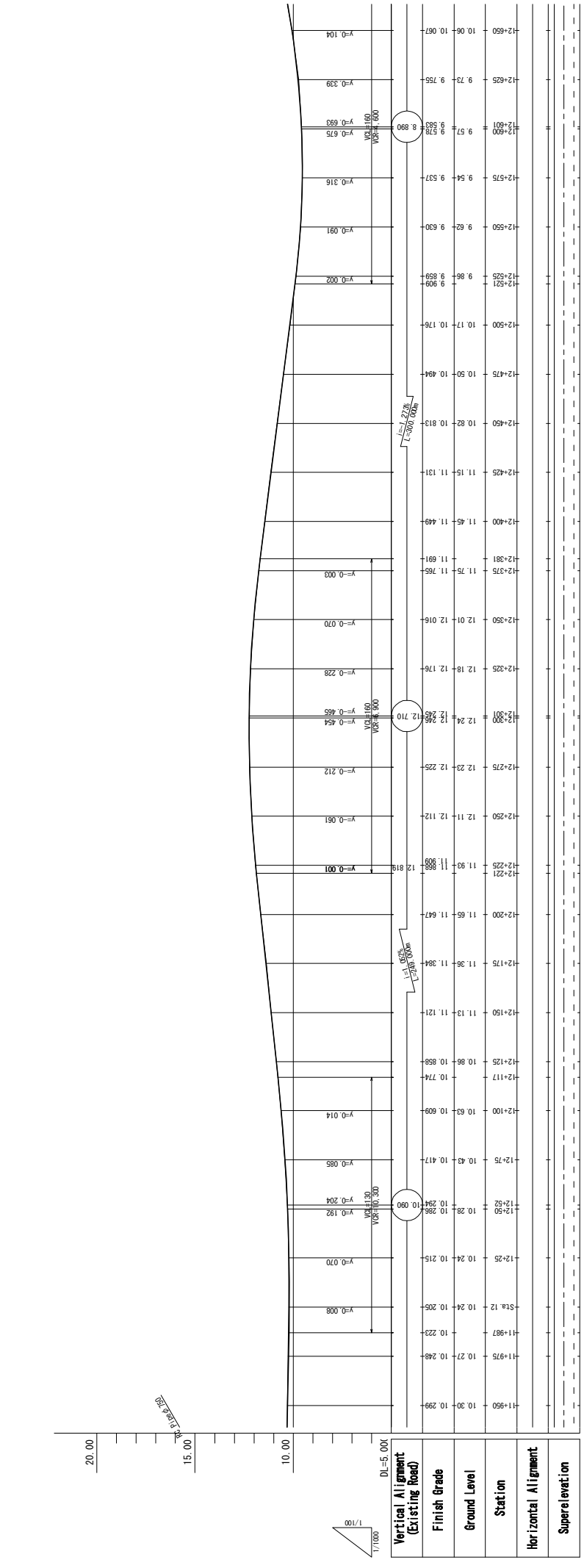
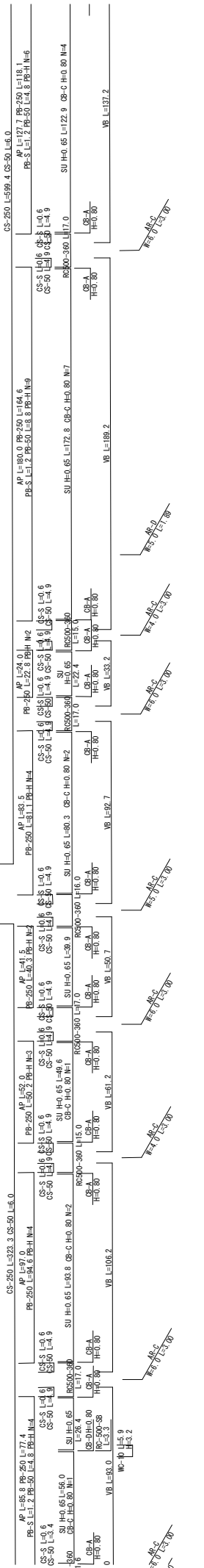
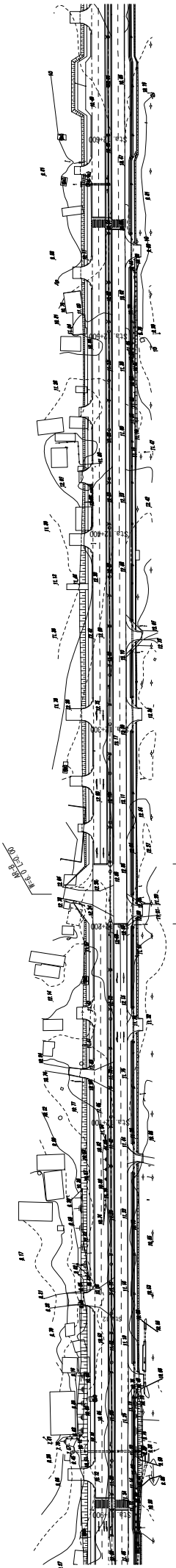
MINISTRY OF PUBLIC WORKS

**JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL,
YACHIYO ENGINEERING CO.,LTD.,
INGEROSEC CORPORATION**

**TITLE : THE PREPARATORY SURVEY ON
THE PROJECT FOR
RECONSTRUCTION (PHASE-2) OF
SOMALIA DRIVE IN MONROVIA**

Drawing No.	PP-18
SCALE	S=1/2000 PROFILE H=1/2000
DATE	DEC. 2016

**PLAN & PROFILE
(Sta. 11+300-Sta. 11+950)**



Vertical Alignment (Existing Road)	Finish Grade	Ground Level	Station	Horizontal Alignment	Superelevation
11-950	10.30	10.299	11-975	10.27	10.248
11-975	10.27	10.248	11-987	10.24	10.223
12-000	10.24	10.205	12-012	10.24	10.205
12-025	10.24	10.215	12-030	10.24	10.215
12-050	10.28	10.286	12-060	10.28	10.286
12-075	10.43	10.417	12-090	10.43	10.417
12-100	10.63	10.609	12-110	10.63	10.609
12-125	10.86	10.774	12-135	10.86	10.774
12-150	11.13	11.121	12-160	11.13	11.121
12-175	11.36	11.384	12-180	11.36	11.384
12-200	11.65	11.647	12-210	11.65	11.647
12-225	11.93	11.968	12-230	11.93	11.968
12-250	12.11	12.112	12-260	12.11	12.112
12-275	12.23	12.225	12-280	12.23	12.225
12-300	12.24	12.242	12-310	12.24	12.242
12-325	12.18	12.176	12-330	12.18	12.176
12-350	12.01	12.016	12-360	12.01	12.016
12-375	11.75	11.765	12-380	11.75	11.765
12-400	11.45	11.449	12-410	11.45	11.449
12-425	11.15	11.131	12-430	11.15	11.131
12-450	10.82	10.813	12-460	10.82	10.813
12-475	10.50	10.494	12-480	10.50	10.494
12-500	10.17	10.176	12-510	10.17	10.176
12-525	9.86	9.859	12-530	9.86	9.859
12-550	9.54	9.537	12-560	9.54	9.537
12-575	9.23	9.228	12-580	9.23	9.228
12-600	8.92	8.920	12-610	8.92	8.920
12-625	8.61	8.603	12-630	8.61	8.603
12-650	8.30	8.292	12-660	8.30	8.292
12-675	8.00	7.990	12-680	8.00	7.990
12-700	7.70	7.698	12-710	7.70	7.698
12-725	7.40	7.396	12-730	7.40	7.396
12-750	7.10	7.094	12-760	7.10	7.094
12-775	6.80	6.792	12-780	6.80	6.792
12-800	6.50	6.490	12-810	6.50	6.490
12-825	6.20	6.188	12-830	6.20	6.188
12-850	5.90	5.886	12-860	5.90	5.886
12-875	5.60	5.584	12-880	5.60	5.584
12-900	5.30	5.282	12-910	5.30	5.282
12-925	5.00	4.980	12-930	5.00	4.980
12-950	4.70	4.878	12-960	4.70	4.878
12-975	4.40	4.776	12-980	4.40	4.776
12-1000	4.10	4.674	12-990	4.10	4.674

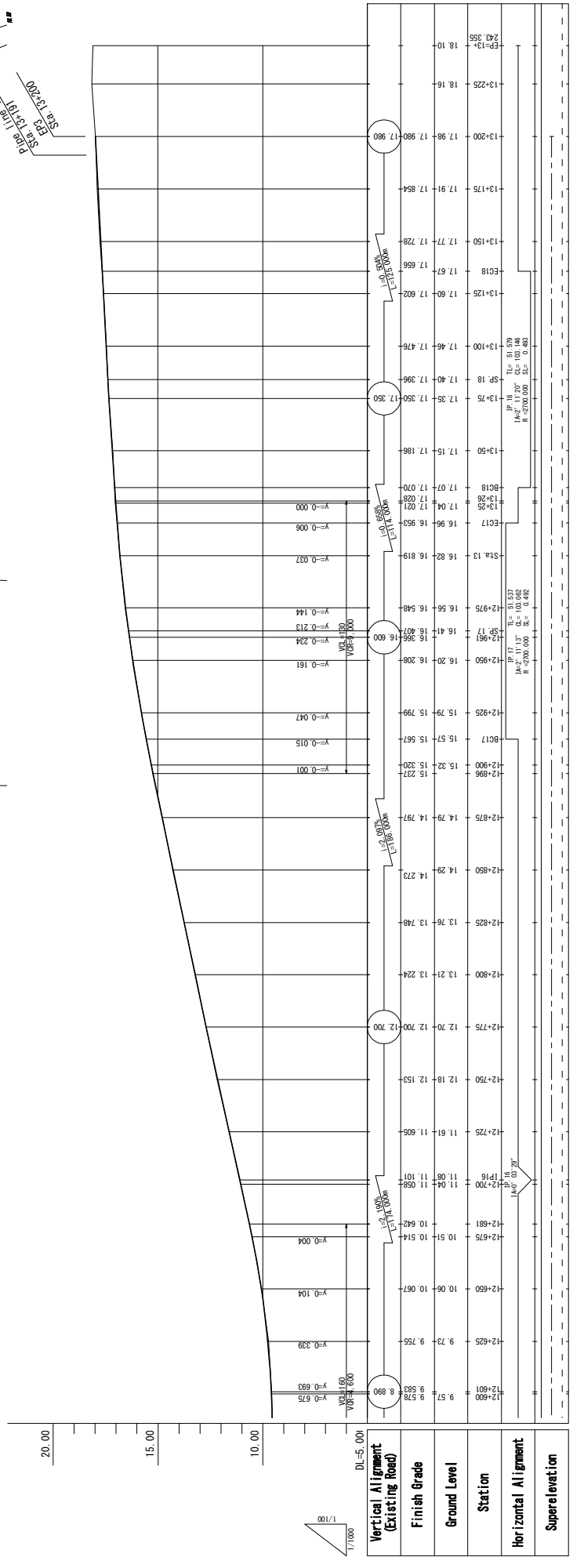
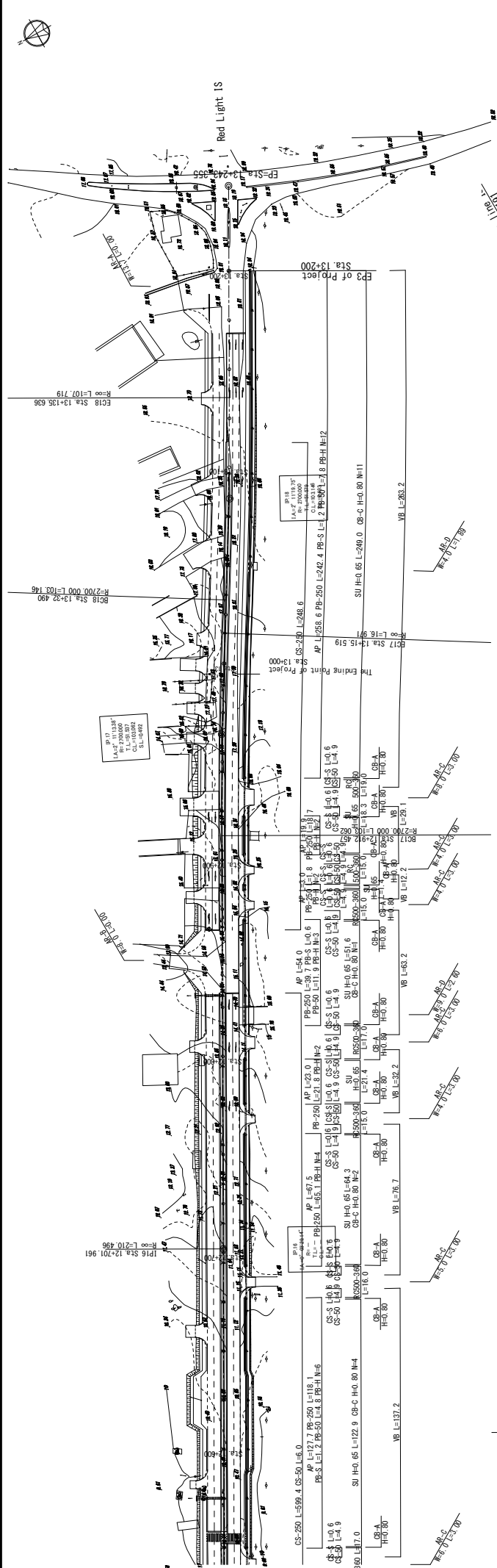
MINISTRY OF PUBLIC WORKS

**JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL,
YACHIYO ENGINEERING CO.,LTD.,
INGÉROSEC CORPORATION**

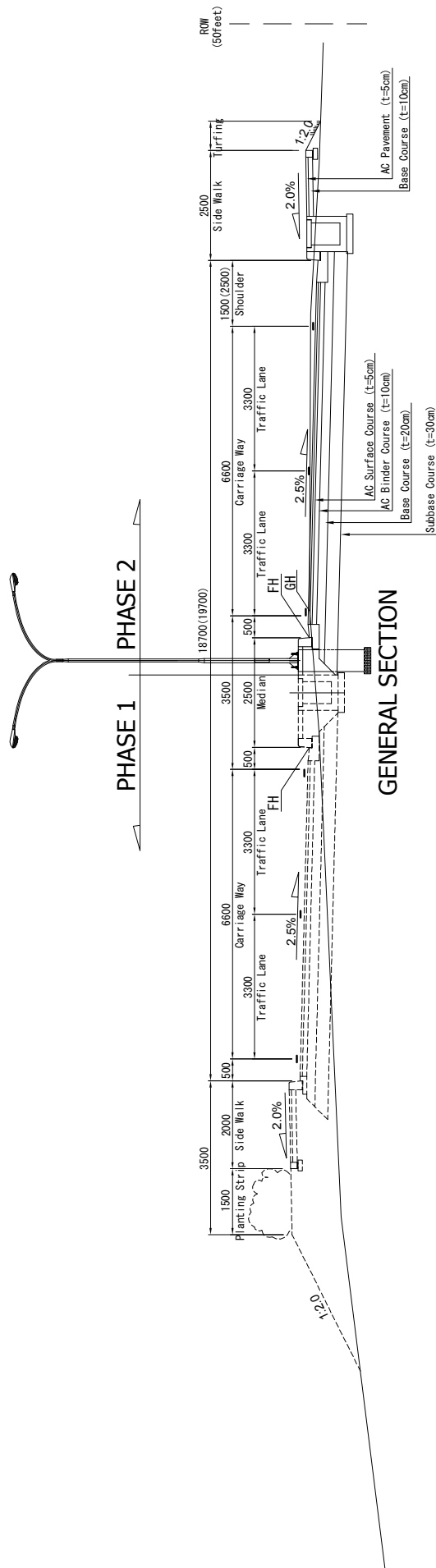
TITLE :
THE PREPARATORY SURVEY ON
THE PROJECT FOR
RECONSTRUCTION (PHASE-2) OF
SOMALIA DRIVE IN MONROVIA

PLAN & PROFILE
(Sta. 11+950-Sta. 12+600)

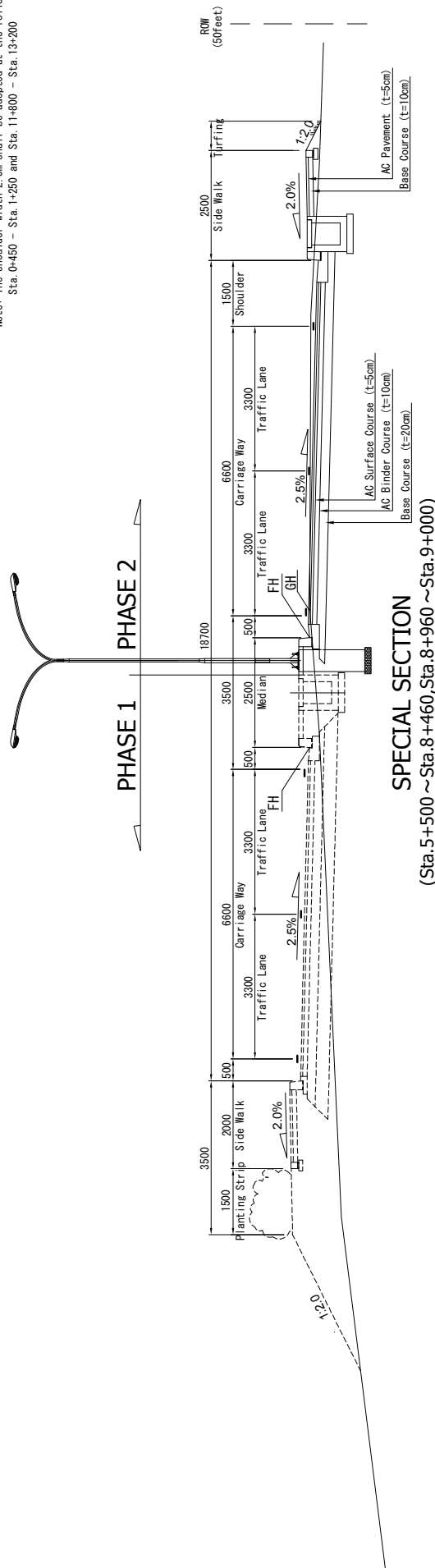
Drawing No. PP-19
SCALE S=1/2000
PROFILE H=1/200
DATE DEC. 2016



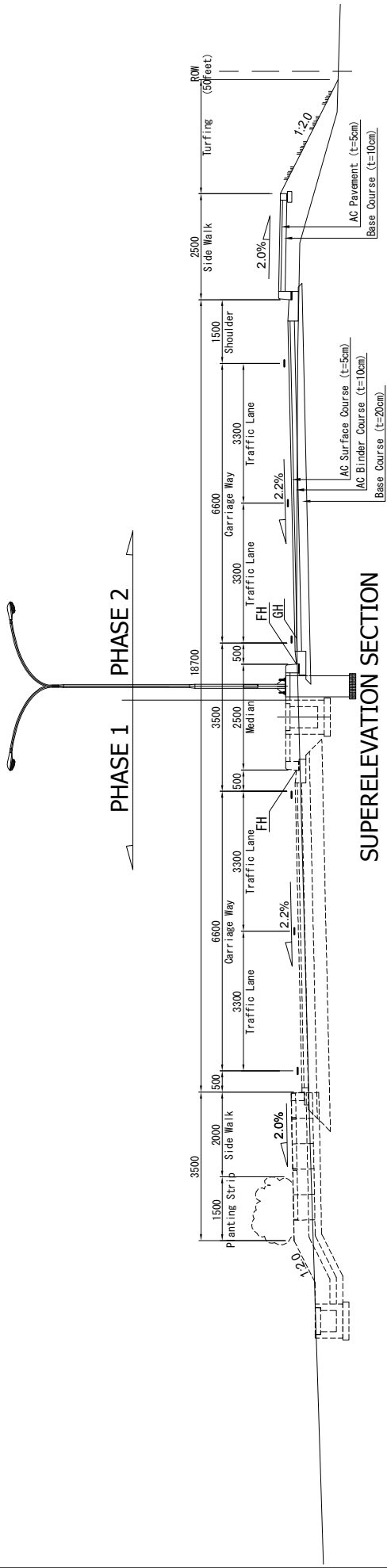
Drawing No.	PP-20
	PLAN S=1/2000 PROFILE H=1/2000
SCALE	PLAN & PROFILE (Sta. 12+600-Sta. 13+200)
DATE	DEC. 2016
TITLE :	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA
JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION	MINISTRY OF PUBLIC WORKS



Note: The shoulder width 2.5m shall be adopted at the following sections:
Sta. 0+450 ~ Sta. 1+250 and Sta. 11+800 ~ Sta. 13+200



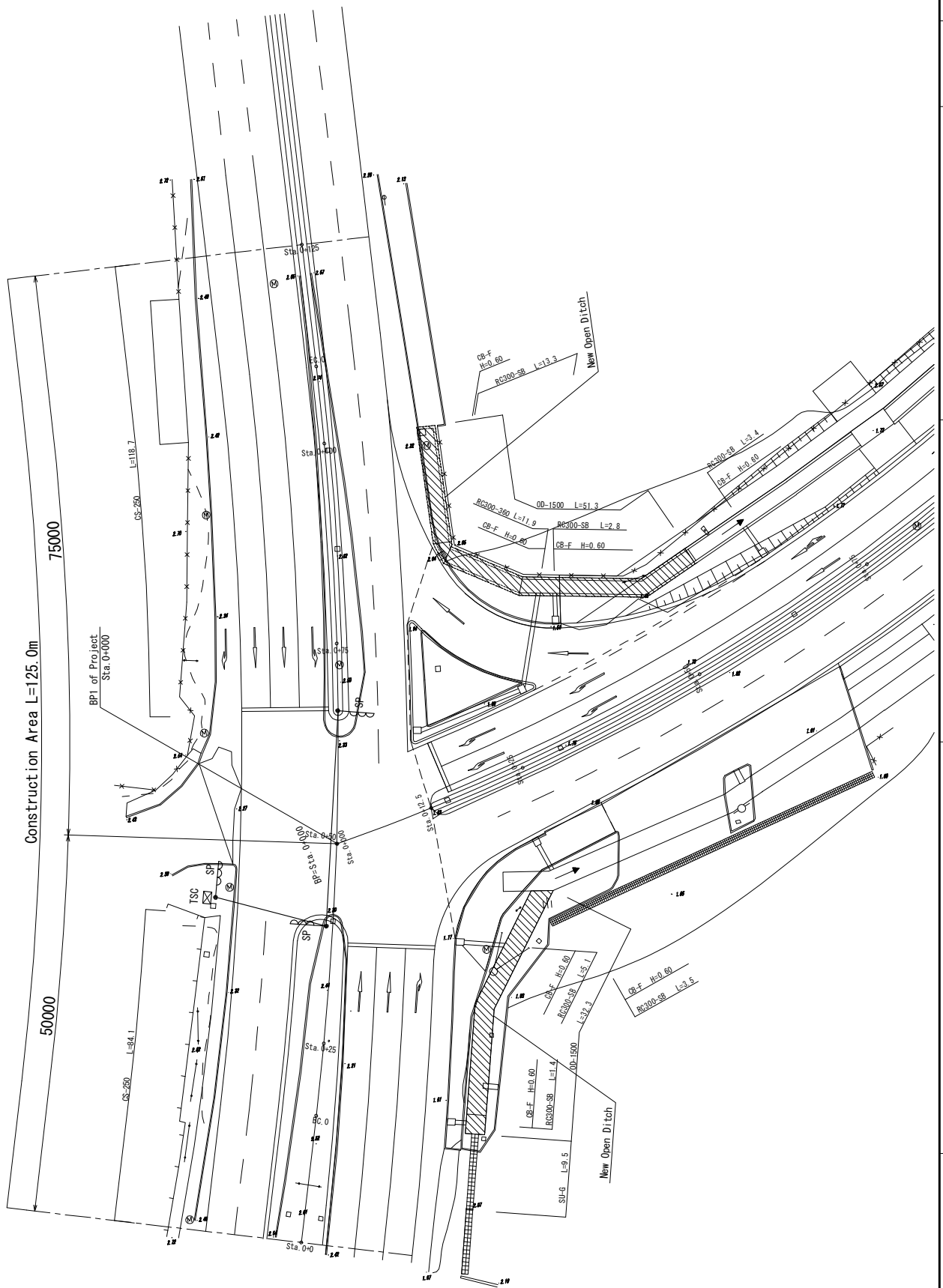
MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	TITLE:	TYPICAL CROSS SECTION (1/2)	Drawing No.	TC-1
			SCALE	S=1/100	SCALE	S=1/100
			DATE	DEC. 2016	DATE	DEC. 2016



SUPERELEVATION SECTION

(Sta. 8+460 ~ Sta. 8+960)

MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO., LTD., INGÉROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	TITLE:	
			TYPICAL CROSS SECTION (2/2)	
			Drawing No.	TC-2
		SCALE	S=1/100	
		DATE	DEC. 2016	



Drawing No.	IS-1
SCALE	S=1/500
DATE	DEC. 2016

TITLE: DETAILS OF INTERSECTION (FREE PORT IS)

THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA

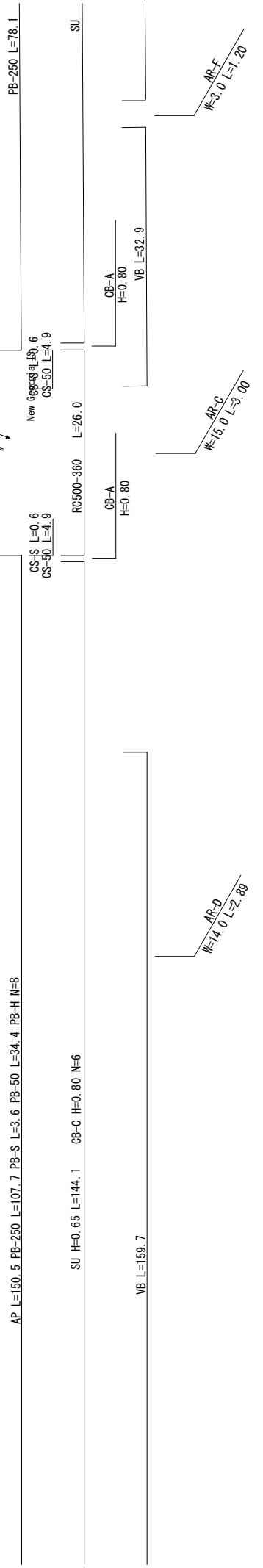
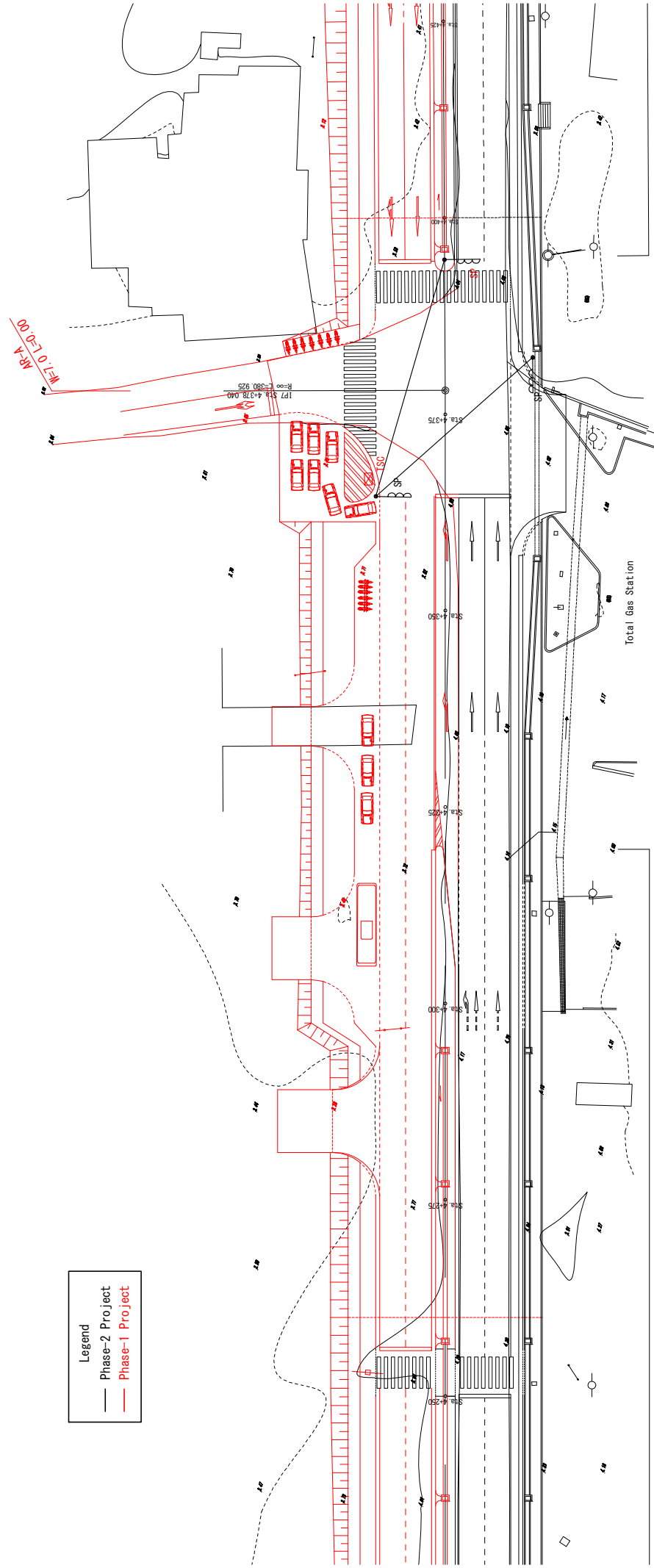
JAPAN INTERNATIONAL COOPERATION AGENCY, KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION

MINISTRY OF PUBLIC WORKS



Legend

	Phase-2 Project
	Phase-1 Project



Drawing No.	IS-2
SCALE	S=1/500
DATE	DEC. 2016

TITLE: DETAILS OF INTERSECTION (NEW GEORGIA IS)

THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA

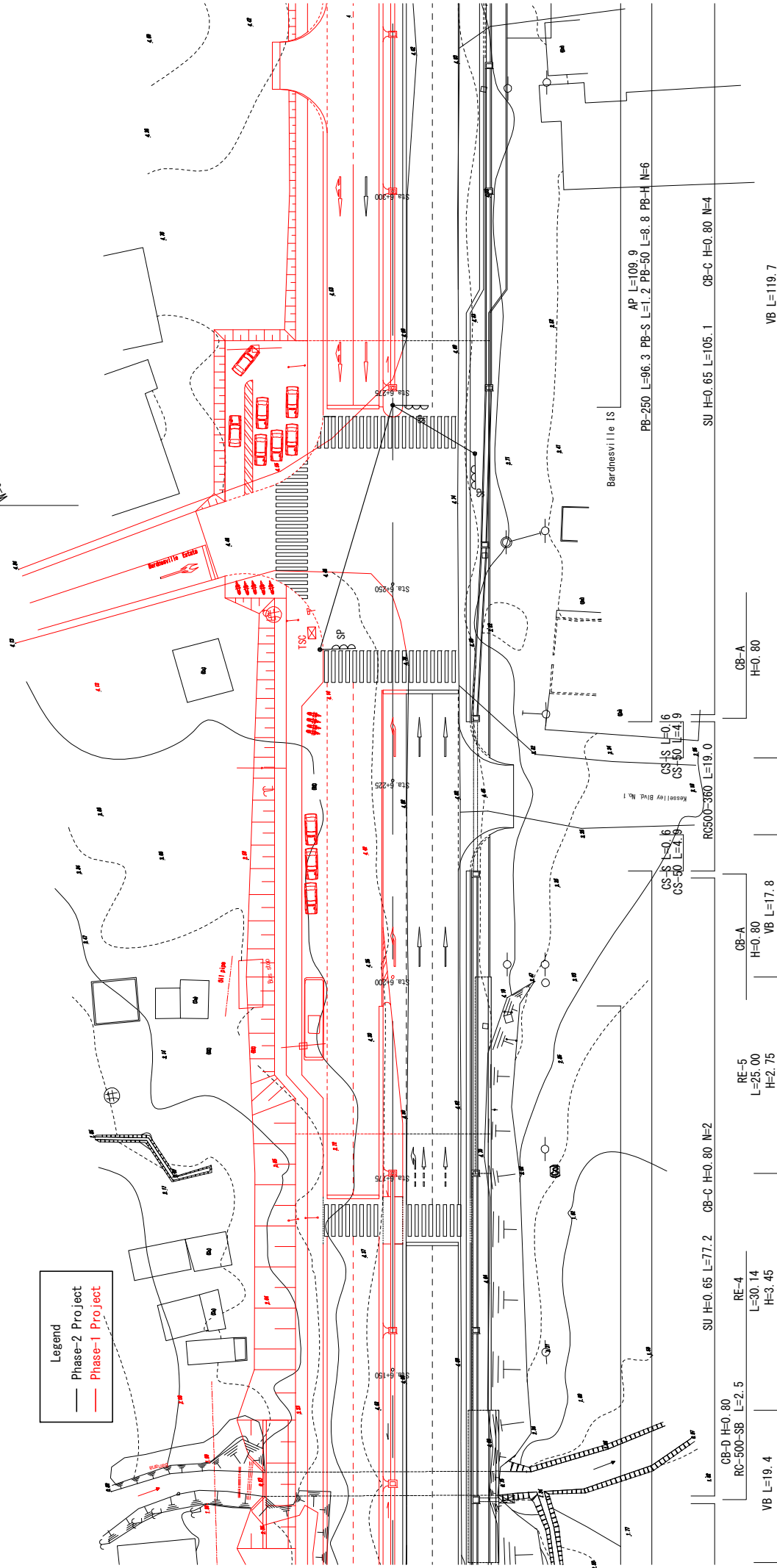
JAPAN INTERNATIONAL COOPERATION AGENCY
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AP-A
W=30.00 L=30.00

Legend
 — Phase-2 Project
 — Phase-1 Project



Bardnesville IS
 AP L=109.9
 PB-250 L=96.3 PB-S L=1.2 PB-50 L=8.8 PB-H N=6

CS-S L=0.6
 CS-H0 L=4.9
 CS-50 L=4.9
 RC500-360 L=19.0

SU H=0.65 L=77.2 CB-C H=0.80 N=2
 RE-5 L=23.00 H=2.75
 CB-A H=0.80 VB L=17.8

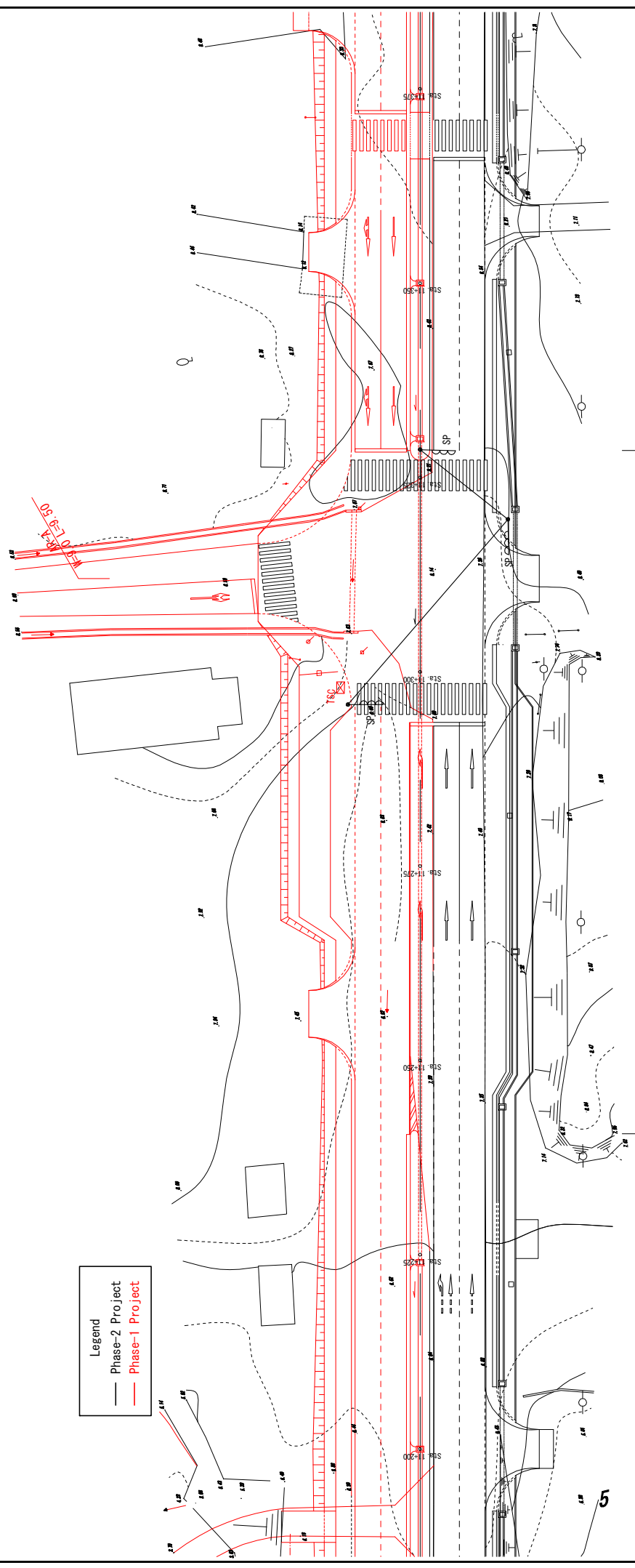
CB-D H=0.80
 RC-500-SB L=2.5
 VB L=19.4
 WO-4 L=19.4 H=5.4

SU H=0.65 L=105.1 CB-C H=0.80 N=4
 VB L=19.7

CB-A H=0.80

AP-C
 W=30.00 L=30.00

MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGEROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	TITLE: DETAILS OF INTERSECTION (BARDNESVILLE IS)		Drawing No.	IS-3
			SCALE	S=1/500	DATE	DEC. 2016



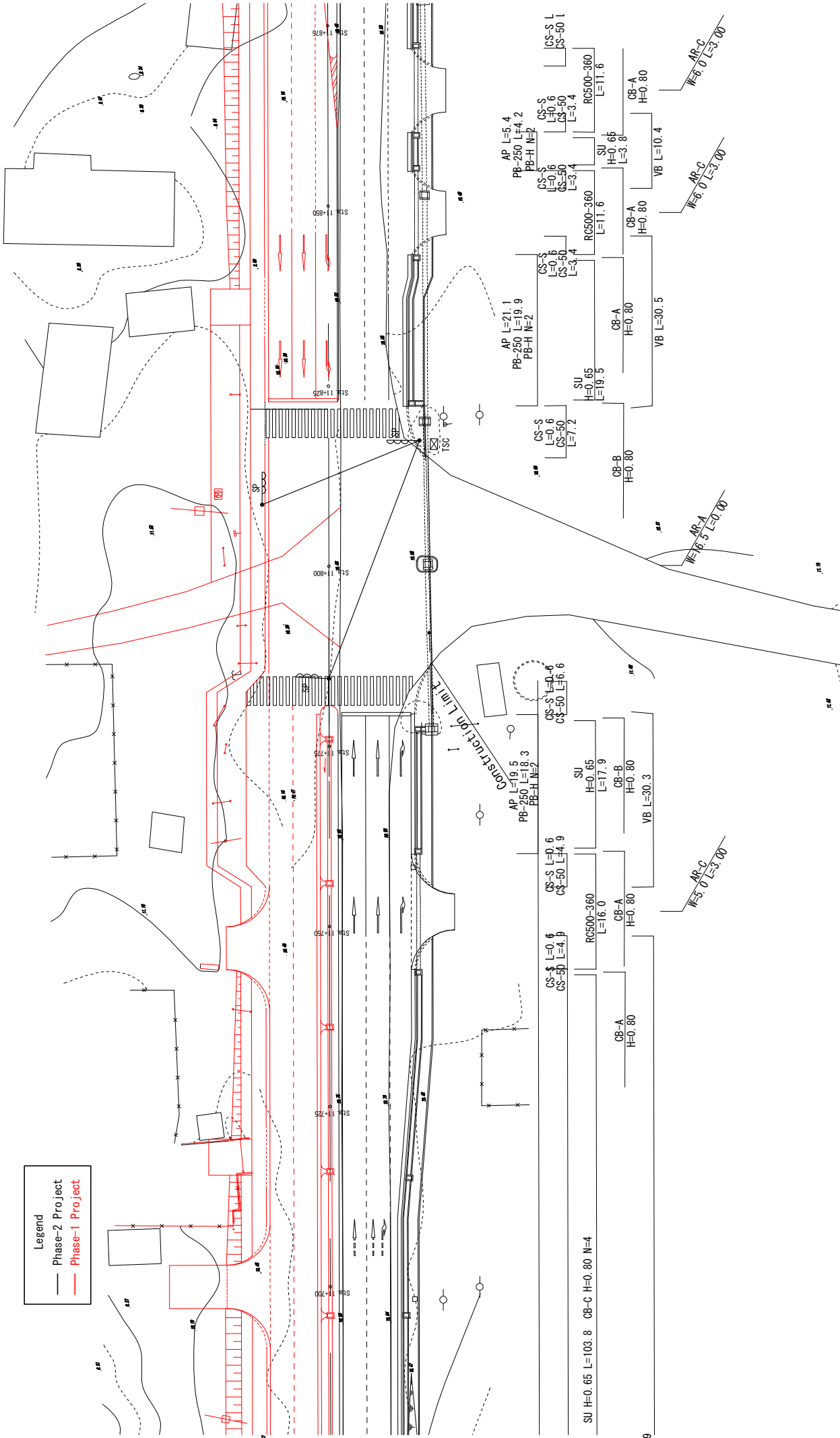
Legend
 — Phase-2 Project
 — Phase-1 Project

CS+S L=0.6 CS-50 L=4.9	CS+S L=0.6 CS-50 L=4.9	CS+S L=0.6 CS-50 L=4.9	AP L=30.0 PB-250 L=28.8 PB-H N=2	CS+S L=0.6 CS-50 L=4.9	CS+S L=0.6 CS-50 L=4.9
RC500-360 L=16.0	RC500-360 L=17.0	RC500-360 L=17.0	SU H=0.65 L=93.2 CB-C H=0.80 N=2	SU H=0.65 L=28.4	RC500-360 L=15.0
OB-A H=0.80	OB-A H=0.80	OB-A H=0.80	OB-A H=0.80	OB-A H=0.80	OB-A H=0.80
VB L=94.79	VB L=94.79	VB L=94.79	VB L=39.2	VB L=39.2	VB L=39.2
IR-D H=5.0 L=2.89	IR-C H=4.0 L=3.00	IR-D H=5.0 L=2.89	IR-C H=4.0 L=3.00	IR-C H=4.0 L=3.00	IR-C H=4.0 L=3.00

MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	DETAILS OF INTERSECTION (NEEZOE IS)	Drawing No.	IS-4
				SCALE	S=1/500
				DATE	DEC. 2016

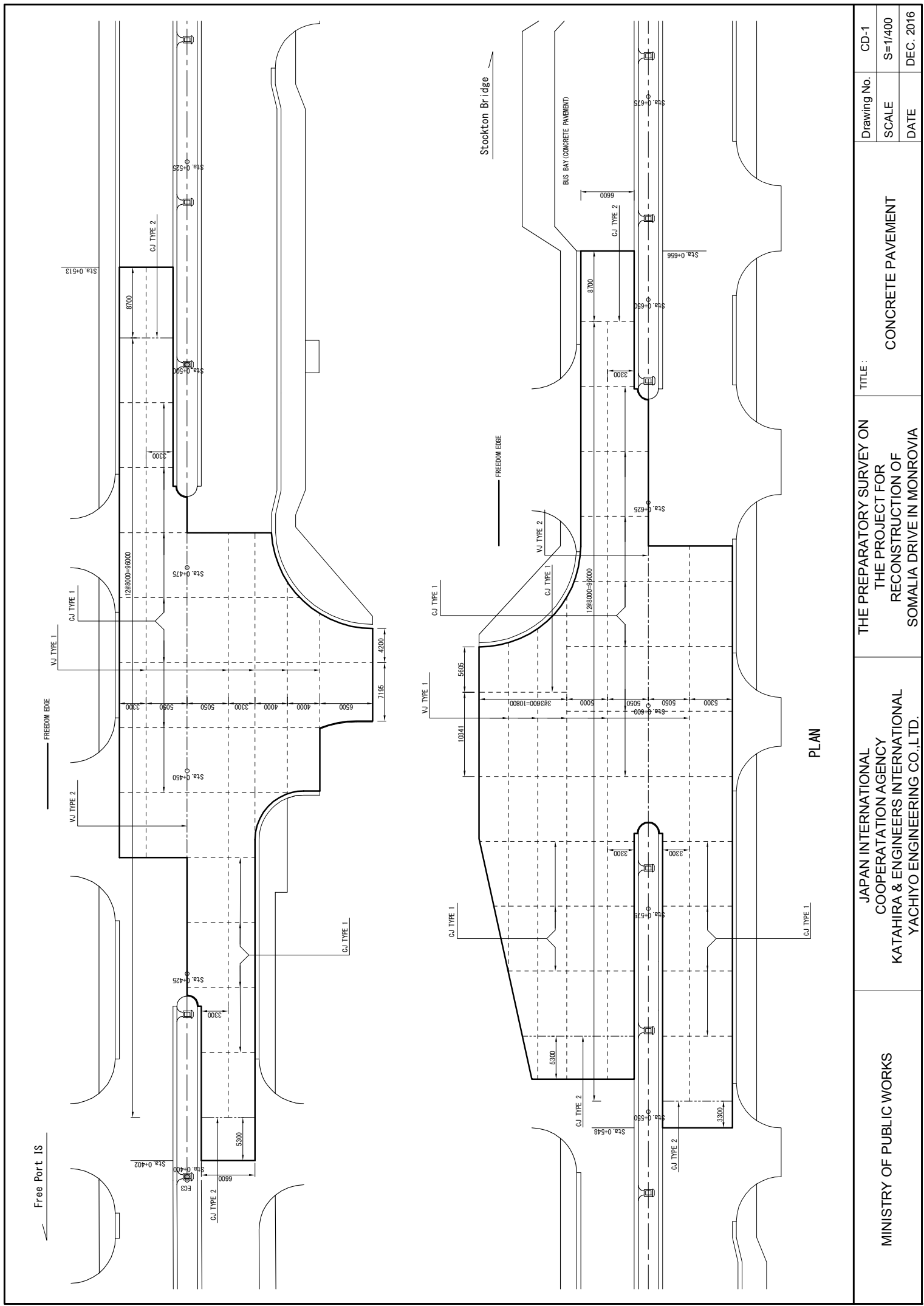


Legend
 — Phase-2 Project
 - - - Phase-1 Project

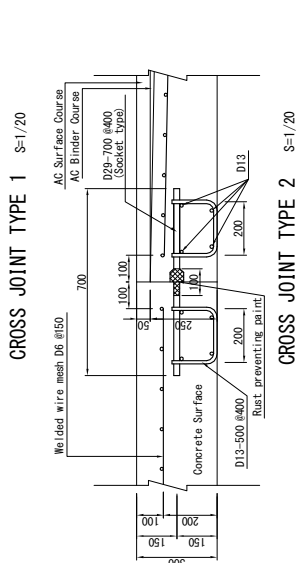
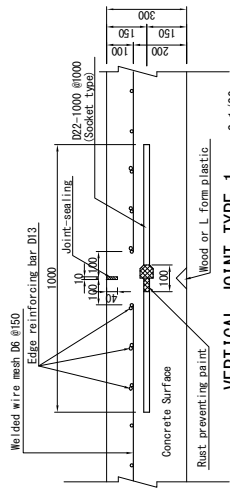
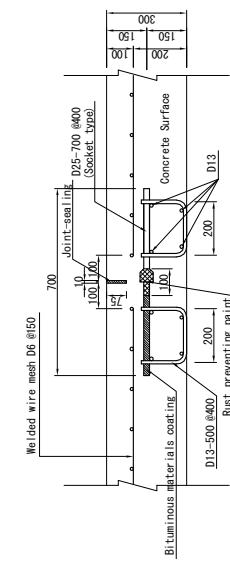
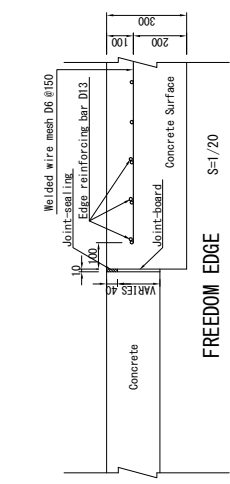


SU H=0.65 L=103.8 CB-C H=0.80 N=4	CS-S L=0.6 CS-50 L=4.9	RC500-360 L=16.0	SU H=0.65 L=17.9	AP L=5.4 PB-250 L=4.2 PB-H N=2	CS-S L=0.6 CS-50 L=3.4	RC500-360 L=11.6	SU H=0.65 L=3.8	CB-A H=0.80	VB L=10.4	AR-C H=6.0 L=3.00
	CS-S L=0.6 CS-50 L=4.9	CB-A H=0.80	CB-B H=0.80	AP L=21.1 PB-250 L=19.9 PB-H N=2	CS-S L=0.6 CS-50 L=3.4	CB-A H=0.80	CB-A H=0.80	VB L=30.5	AR-C H=6.0 L=3.00	
	CS-S L=0.6 CS-50 L=6.6	CB-A H=0.80	CB-B H=0.80		CS-S L=0.6 CS-50 L=3.4	CB-A H=0.80	CB-A H=0.80	VB L=30.5	AR-C H=6.0 L=3.00	

MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGEROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	TITLE:	DETAILS OF INTERSECTION (72ND IS)	Drawing No.	IS-5
					SCALE	S=1/500
					DATE	DEC. 2016



MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL YACHIYO ENGINEERING CO.,LTD.	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF SOMALIA DRIVE IN MONROVIA	TITLE :		CONCRETE PAVEMENT
			Drawing No.	CD-1	
			SCALE	S=1/400	
			DATE	DEC. 2016	



FREEDOM EDGE S=1/20

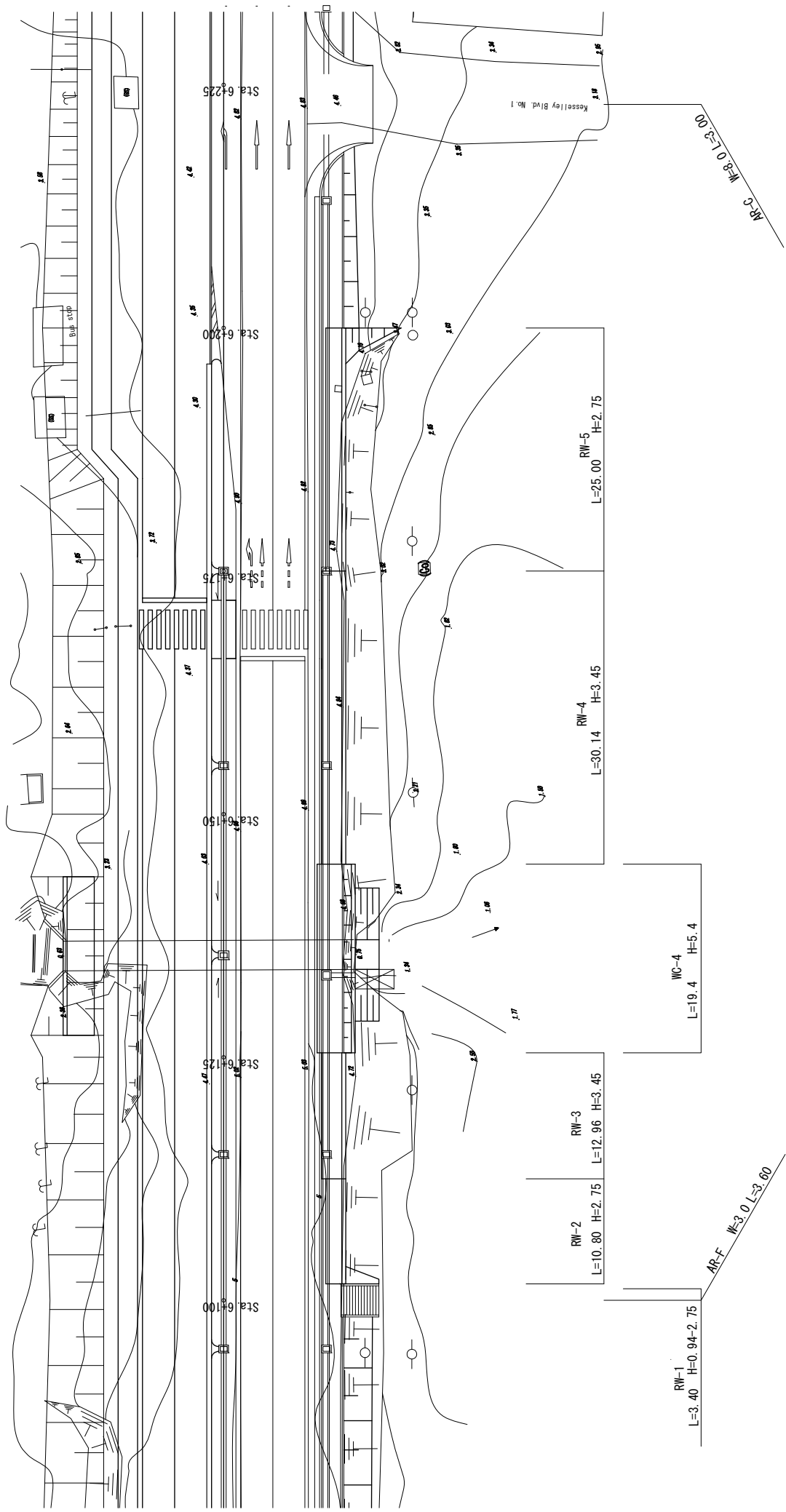
CROSS JOINT TYPE 1 S=1/20

CROSS JOINT TYPE 2 S=1/20

JOINT DETAILS

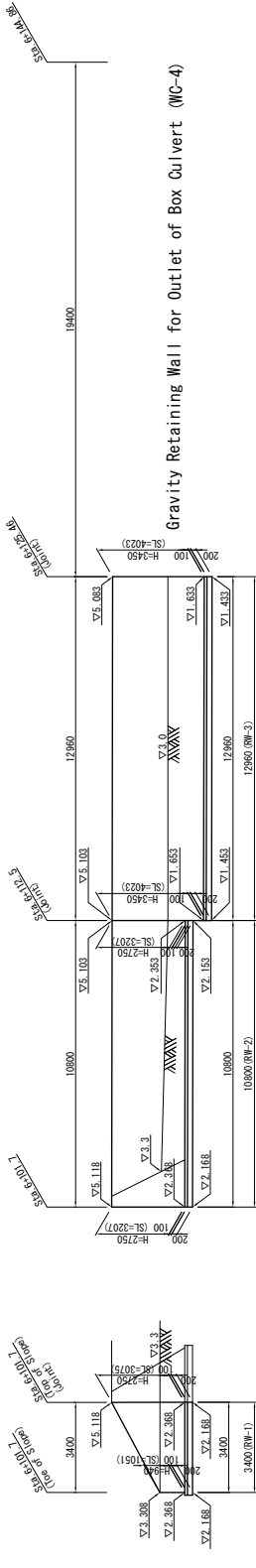
A-A S=1/40
CROSS SECTION

MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL YACHIYO ENGINEERING CO.,LTD.	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF SOMALIA DRIVE IN MONROVIA	TITLE :		CONCRETE PAVEMENT	CD-2
			Drawing No.	SCALE		
			DATE	As Shown		
					SEP. 2016	



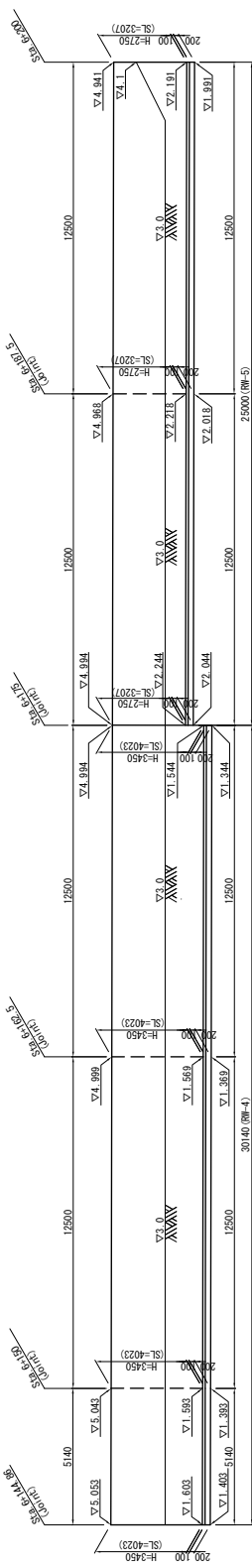
PLAN S=1/400

MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL YACHIYO ENGINEERING CO., LTD.	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF SOMALIA DRIVE IN MONROVIA	TITLE:	RETAINING WALL (1) (STA. 6+101.7 - STA. 6+200)	Drawing No.	RW-1
			SCALE	As Shown	DATE	AUG. 2016

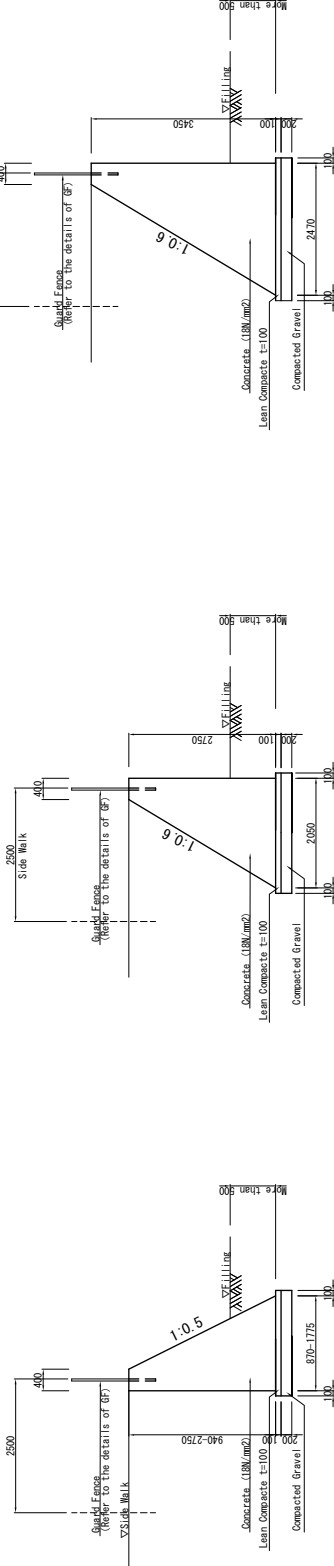


RW-1 DEVELOPMENT VIEW S=1/200
(Sta. 6+101. 7)

RW-2, 3 DEVELOPMENT VIEW S=1/200
(Sta. 6+101. 7-Sta. 6+125. 46)



RW-4, 5 DEVELOPMENT VIEW S=1/200
(Sta. 6+144. 86-Sta. 6+200)



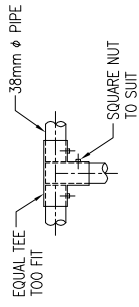
RW-1 TYPICAL SECTION S=1/100

RW-2, 5 TYPICAL SECTION S=1/100

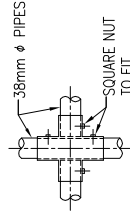
RW-3, 4 TYPICAL SECTION S=1/100

Note:
- The joint filler (t=20mm) shall be installed as shown the drawing.

MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL YACHIYO ENGINEERING CO.,LTD.	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF SOMALIA DRIVE IN MONROVIA	TITLE: RETAINING WALL (2) (STA.6+101.7-STA.6+200)	
			Drawing No.	RW-2
			SCALE	As Shown
			DATE	AUG. 2016

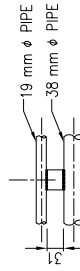


DETAIL 'A' S=1/10

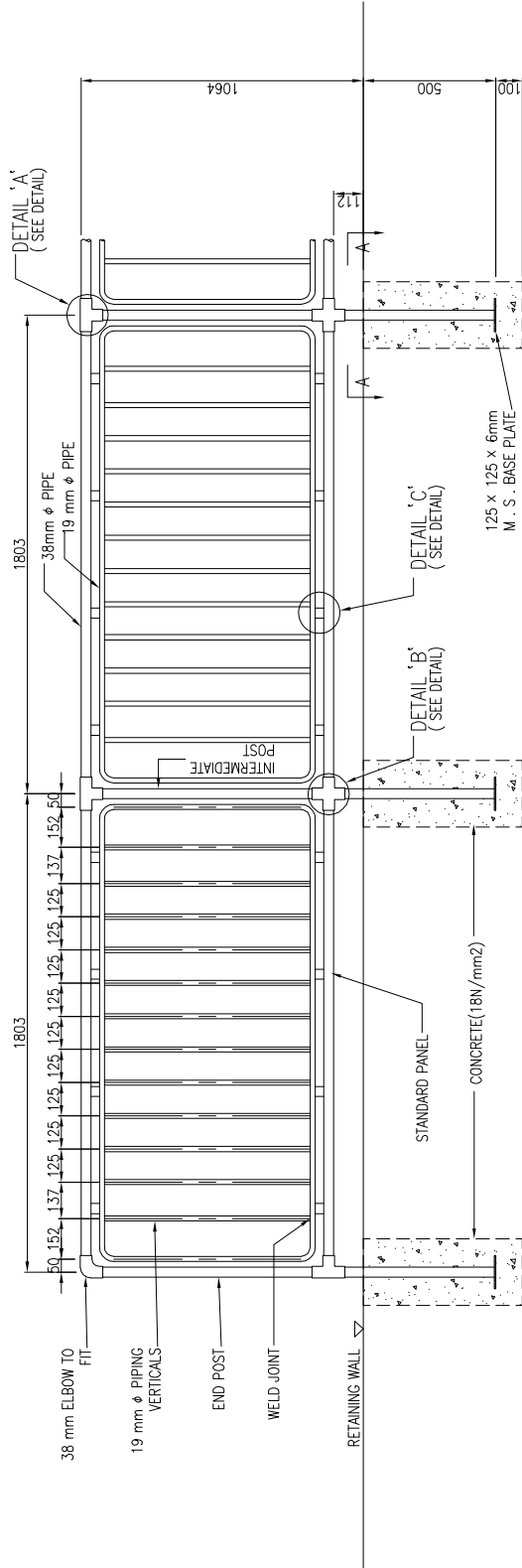


DETAIL 'B' S=1/10

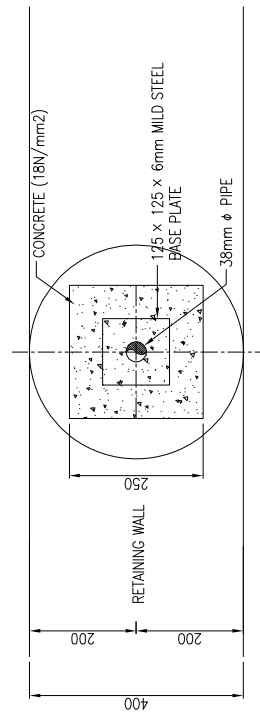
38 x 31mm M.S. LUGS WELDED TO 38mm φ & 19mm φ PIPES



DETAIL 'C' S=1/10



ELEVATION S=1/20

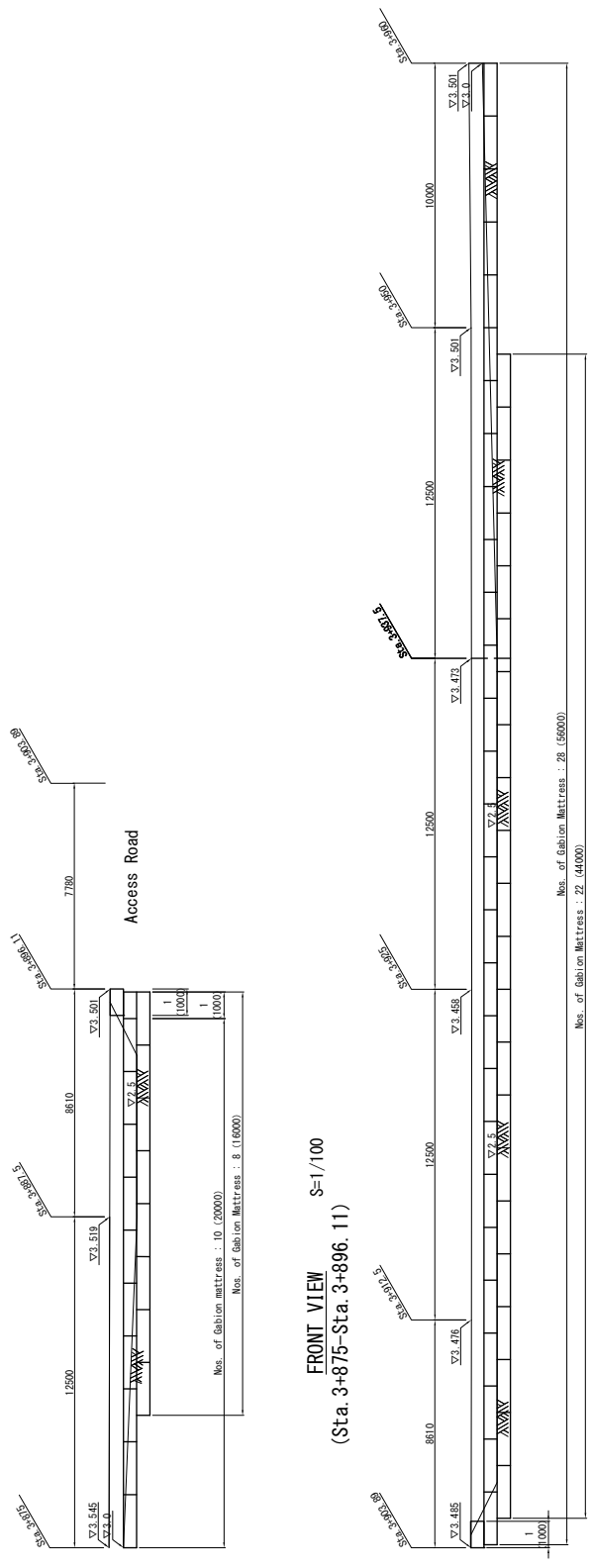


SECTION A-A S=1/10

NOTE:-

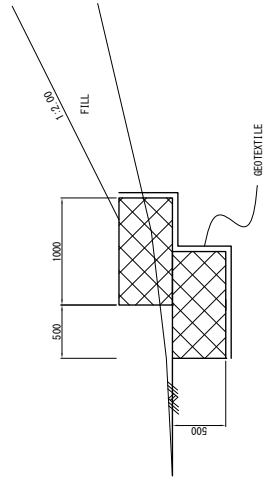
- 1 All materials and fabrication to latest edition of the appropriate British standard specification.
- 2 Alternative couplings on vertical posts to accommodate changes in direction of between 120° to 175°.
- 3 Rollings to be supplied with one coat of inhibited prime and one oil bound undercoat. Erection damage to be made good and one full gross oil bound finish coat applied after erection.
- 4 All welds to be done conveniently to suit the adjoining parts.

MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGEROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	TITLE:	RETAINING WALL	Drawing No.	RW-3
				GUARD FENCE (GF)	SCALE	AS SHOWN
				DATE		DEC. 2016

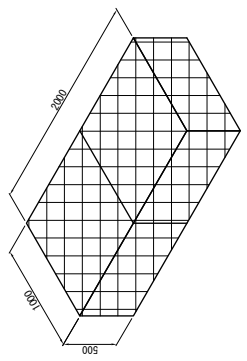


FRONT VIEW S=1/100
(Sta. 3+875-Sta. 3+896. 11)

FRONT VIEW S=1/200
(Sta. 3+903. 89-Sta. 3+960)

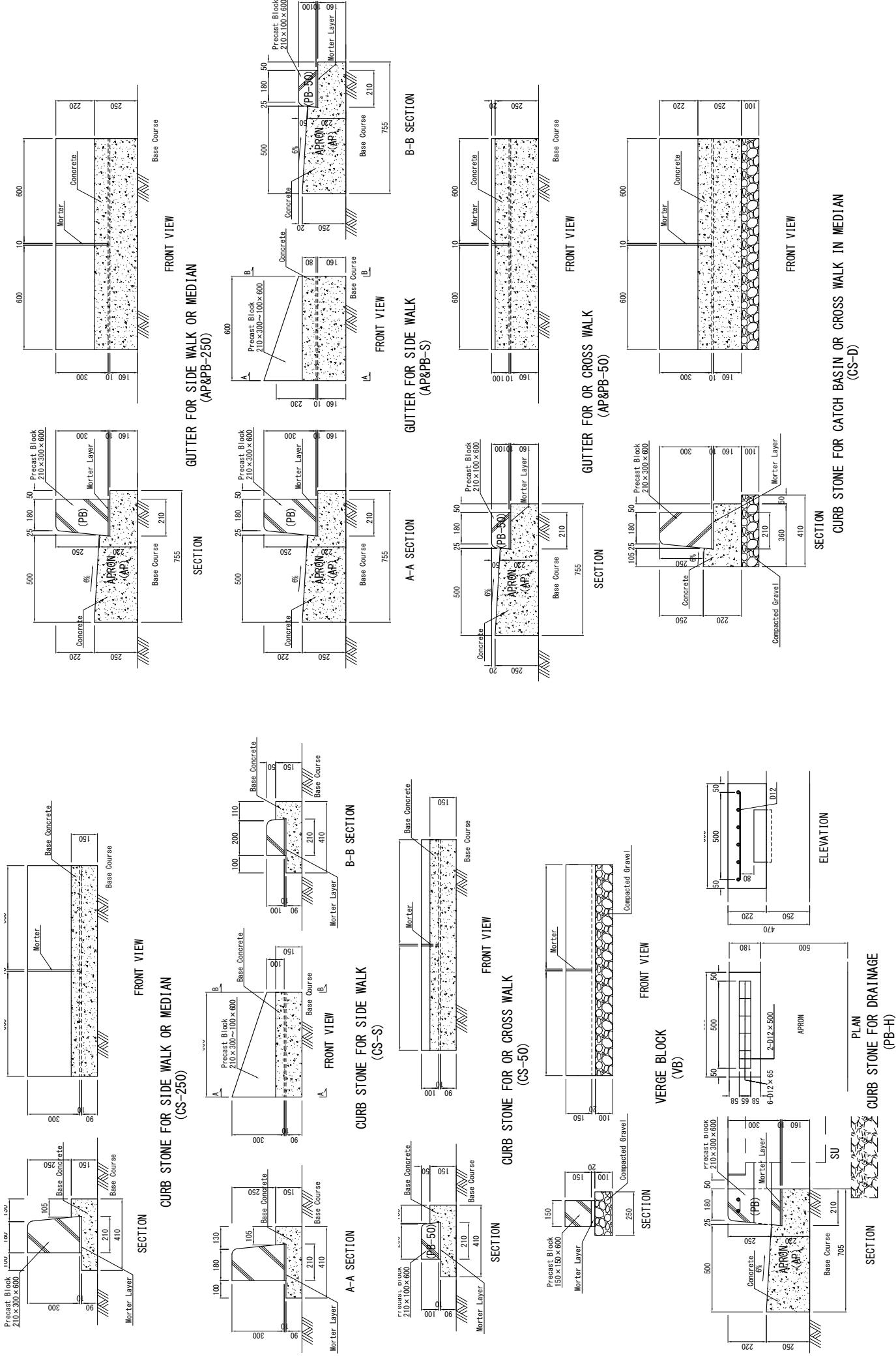


GROSS SECTION S=1/50



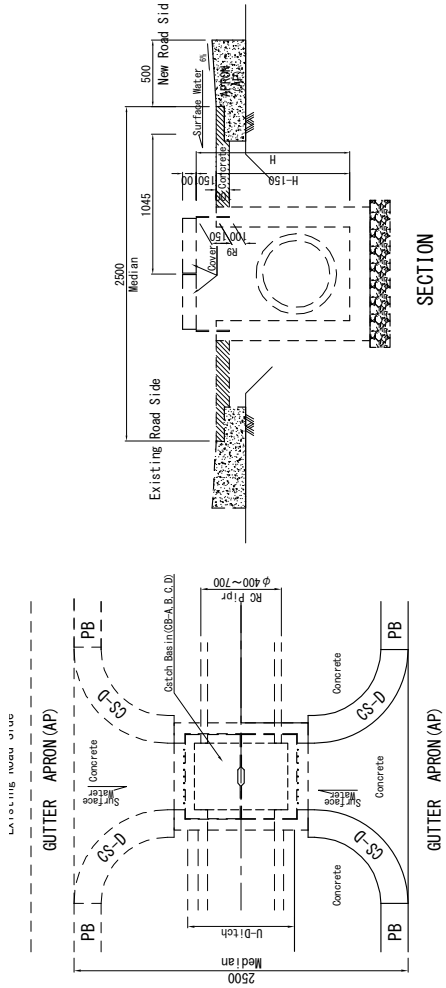
GABION MATTRESS (GM) S=1/50

MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL YACHIYO ENGINEERING CO.,LTD.	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF SOMALIA DRIVE IN MONROVIA	TITLE: GABION MATTRESS WALL (STA.3+875-STA.3+960)	
			Drawing No.	GM-1
			SCALE	As Shown
			DATE	AUG. 2016

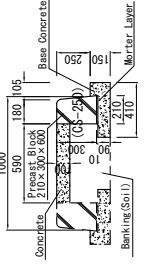


MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO., LTD., INGEROSEC CORPORATION	TITLE: THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	
		RS-1	RS-1
		SCALE 1/10	DATE DEC. 2016

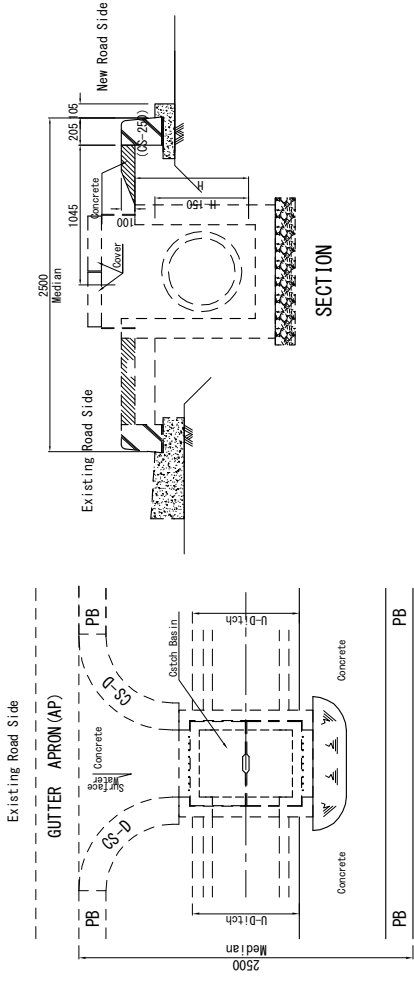
ROAD STRUCTURES (1/2)



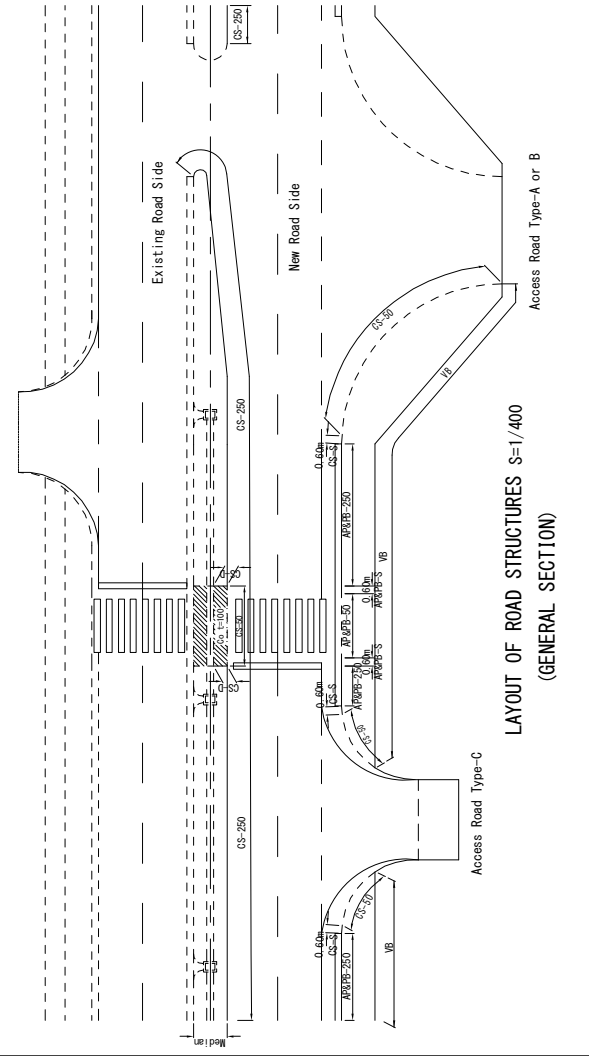
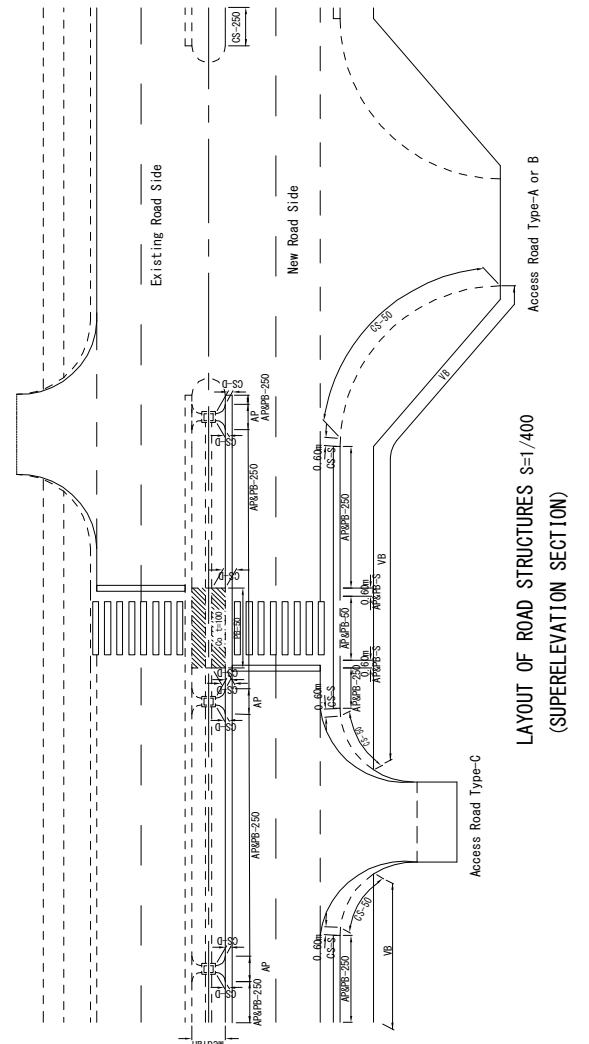
SECTION
 PLAN
 MEDIAN DETAILS S=1/40
 (SUPERELEVATION SECTION)



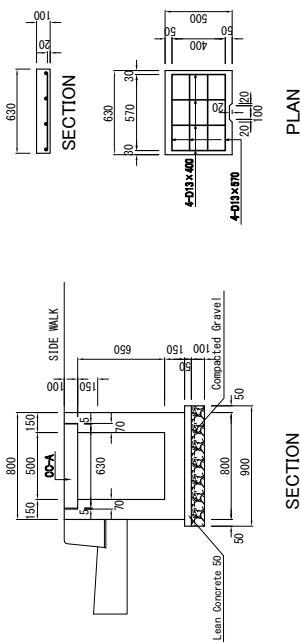
MEDIAN DETAILS S=1/40
 (GENERAL SECTION)



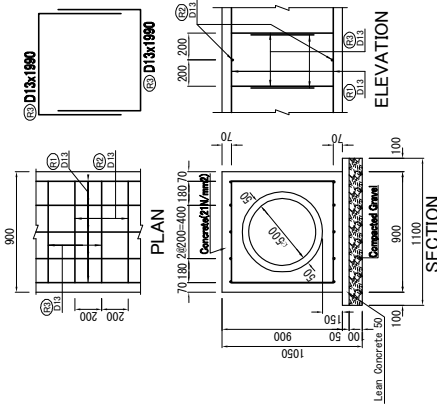
SECTION
 PLAN
 MEDIAN DETAILS S=1/40
 (GENERAL SECTION)



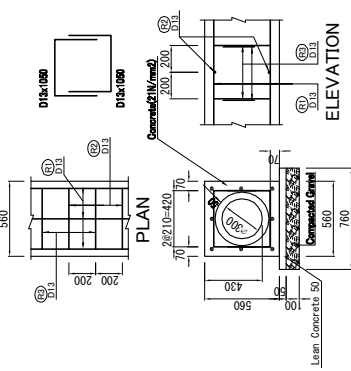
MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION	TITLE: THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	
		Drawing No.	RS-2
		SCALE	As Shown
		DATE	DEC. 2016



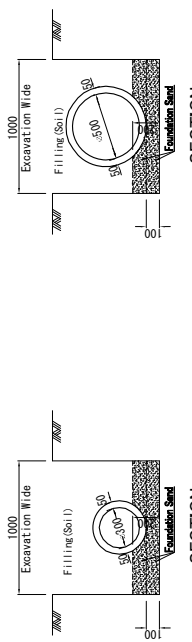
U-DITCH AT SIDE WALK (SU)
COVER FOR U-DITCH (CC-A)



RC PIPE ϕ 300(Co.360° Base) (RC300-360)

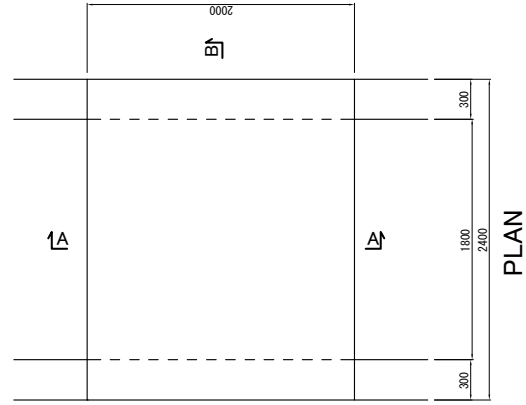


RC PIPE ϕ 500(Sand Base) (RC500-SB)

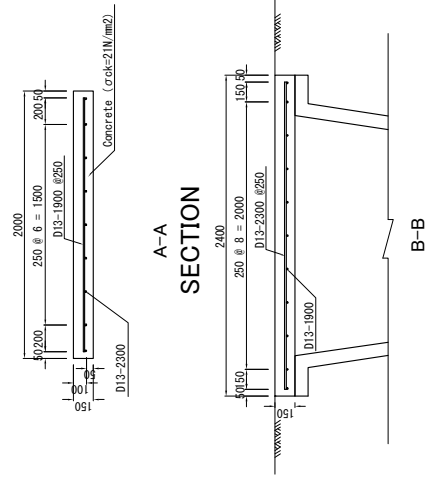


RC PIPE ϕ 300(Sand Base) (RC300-SB)

RC PIPE ϕ 500(Co.360° Base) (RC500-360)

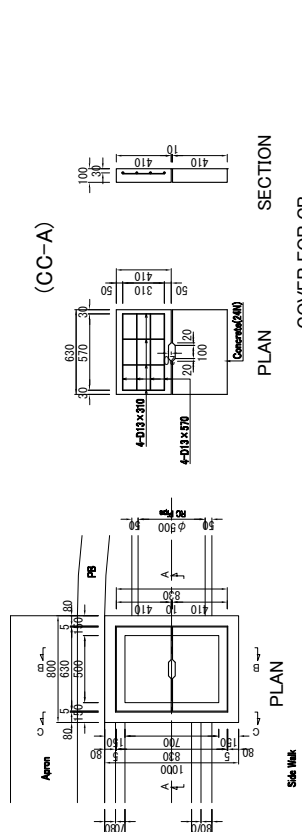
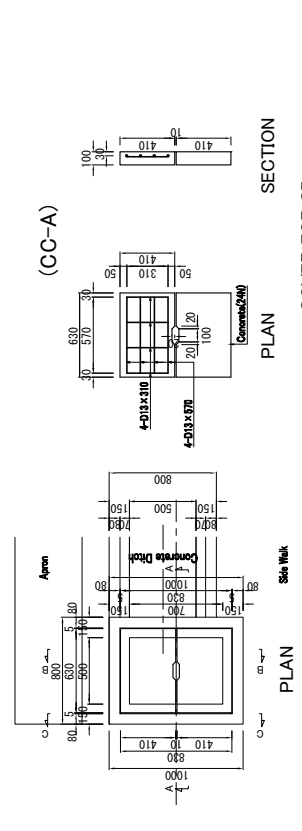
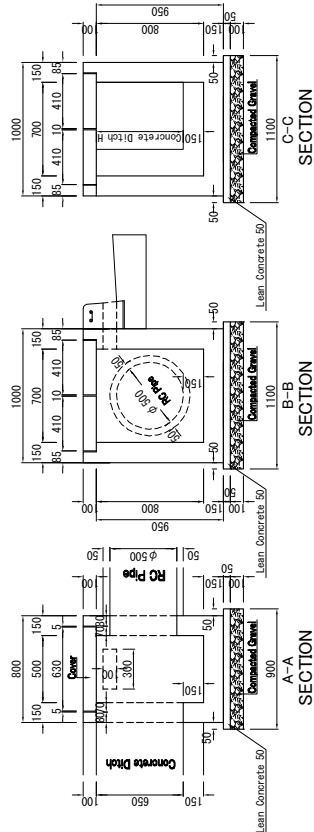
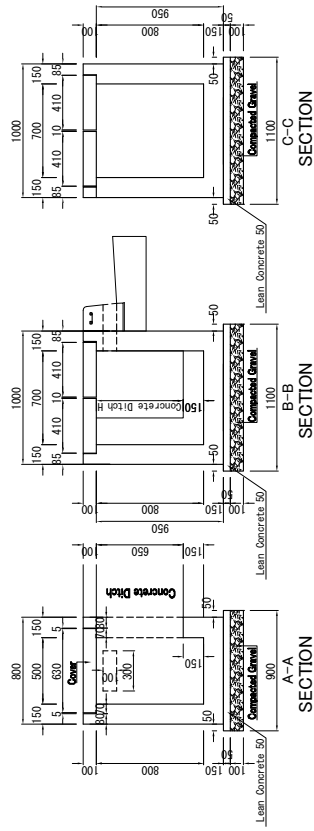


OPEN DRAINAGE D1500 (OD-1500)



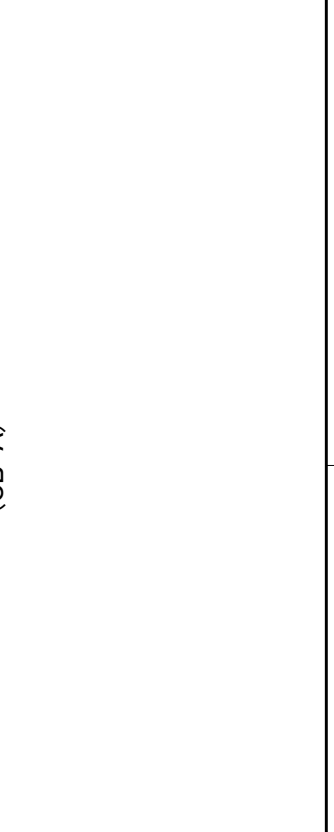
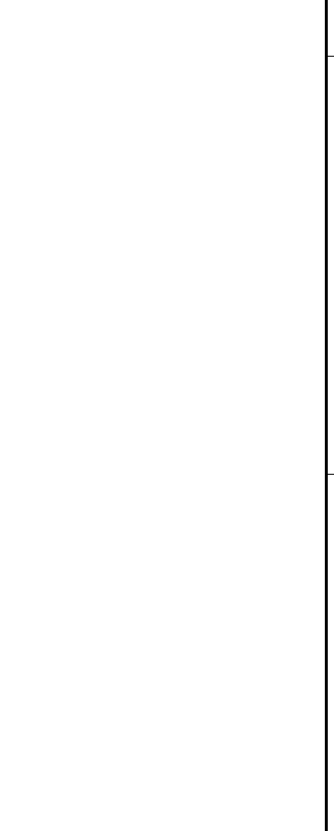
COVER FOR OPEN DRAINAGE D1500

MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION	TITLE :	
		DRAINAGE STRUCTURES (1/5)	
		Drawing No.	DS-1
		SCALE	1/20
		DATE	DEC. 2016



CATCH BASIN (CB-A)

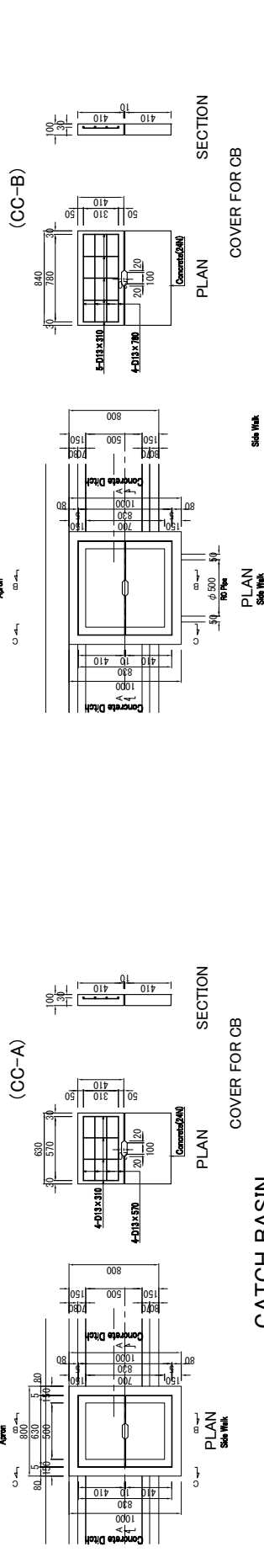
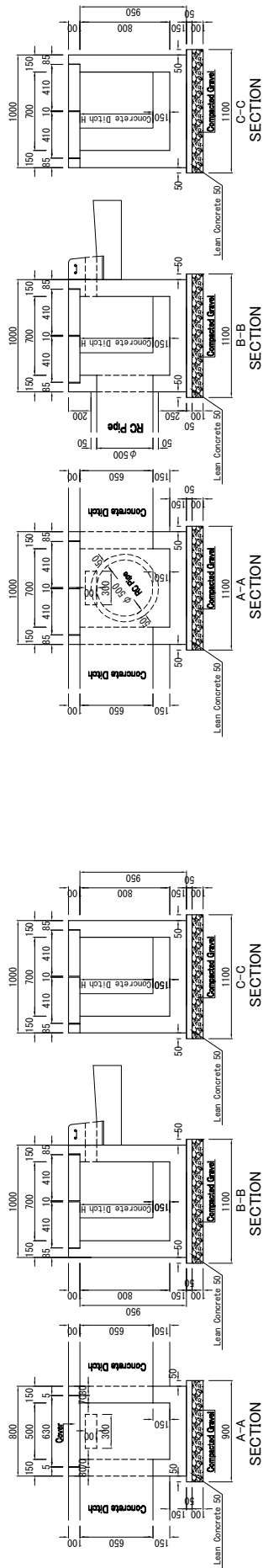
CATCH BASIN (CB-B)



CATCH BASIN (CB-A)

CATCH BASIN (CB-B)

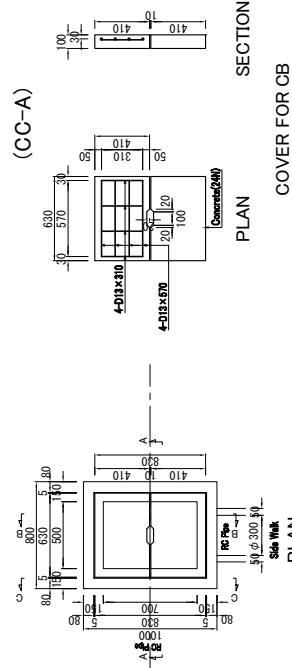
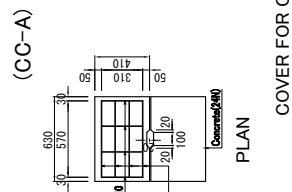
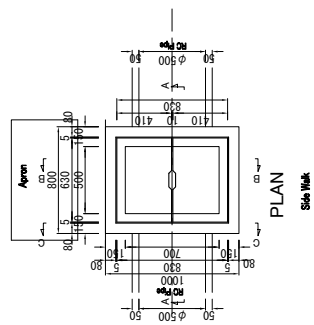
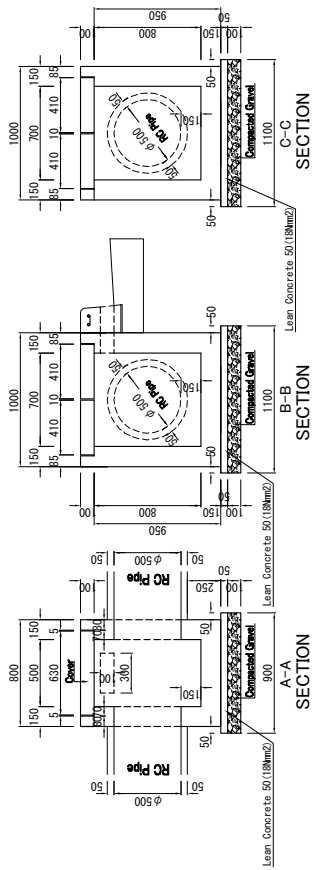
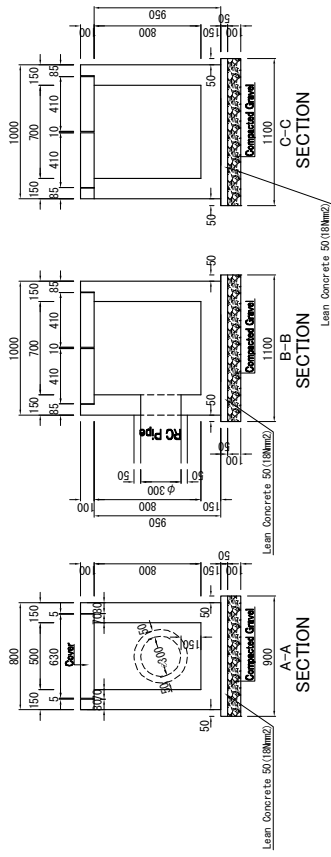
MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	TITLE: DRAINAGE STRUCTURES (2/5)		Drawing No.	DS-2
			SCALE	DATE	1/20	DEC. 2016



CATCH BASIN (CB-C)

CATCH BASIN (CB-D)

MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION	TITLE: DRAINAGE STRUCTURES (3/5)		Drawing No.	DS-3
		THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA		SCALE	1/20
				DATE	DEC. 2016



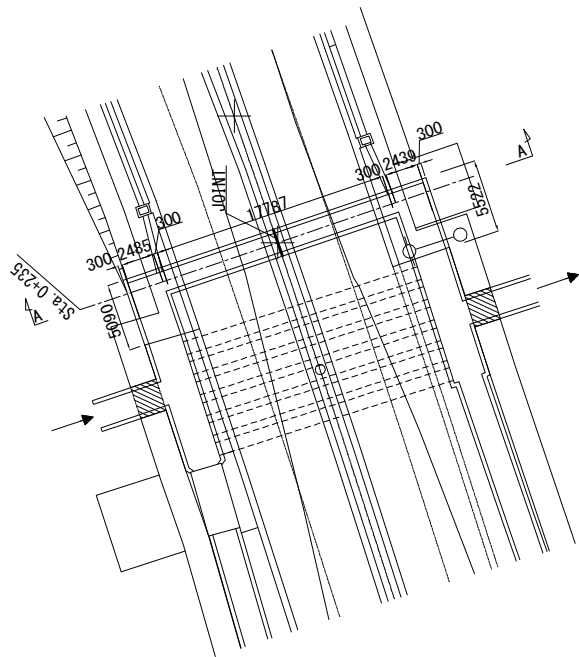
CATCH BASIN (CB-E)

CATCH BASIN (CB-F)

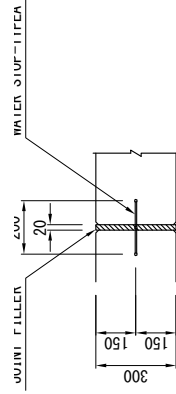
COVER FOR CB

COVER FOR CB

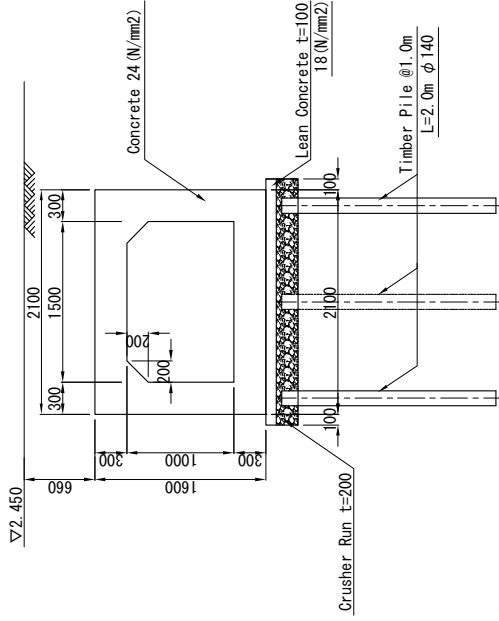
MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	TITLE: DRAINAGE STRUCTURES (4/5)		Drawing No.	DS-4
					SCALE	1/20
					DATE	DEC. 2016



PILE LAYOUT PLAN S=1/50

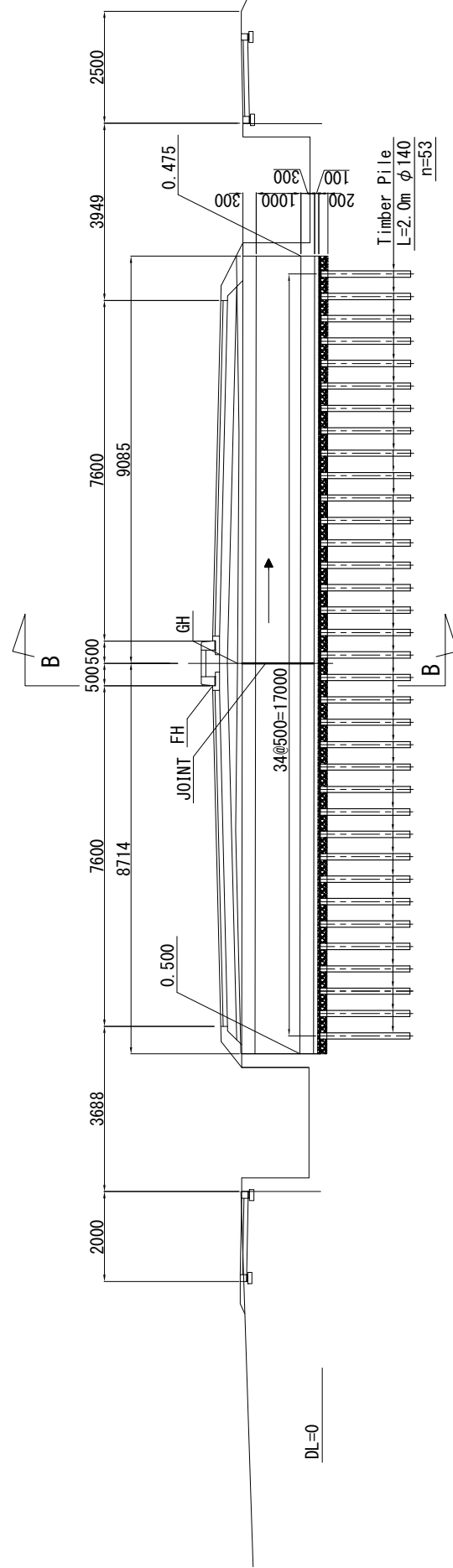


JOINT DETAIL S=1/20



B-B SECTION S=1/50

Sta. 0+235
FH=2.450
GH=1.89

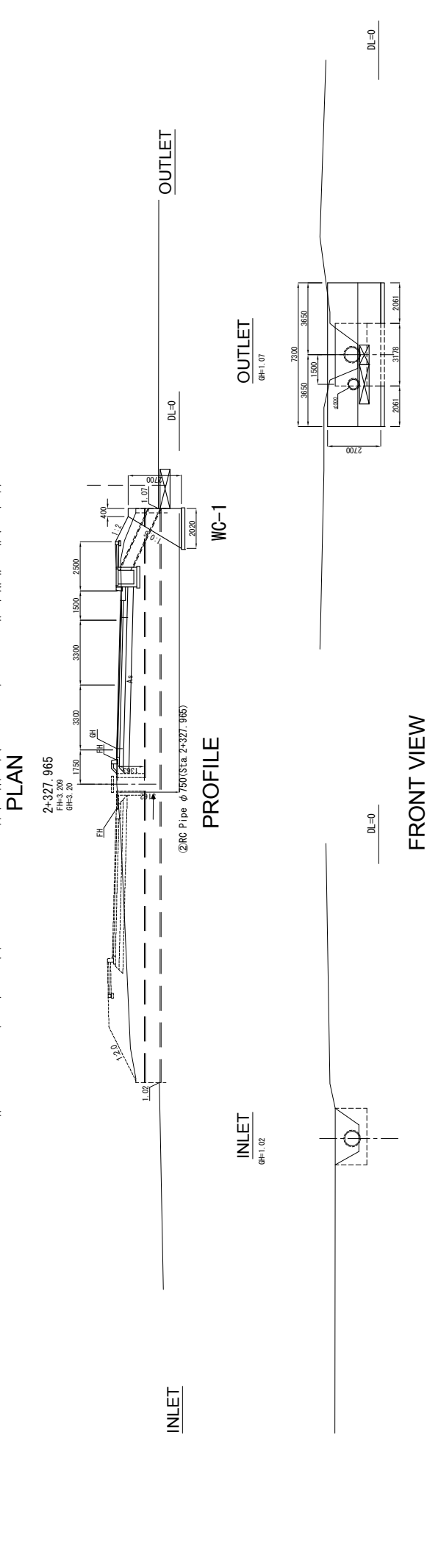
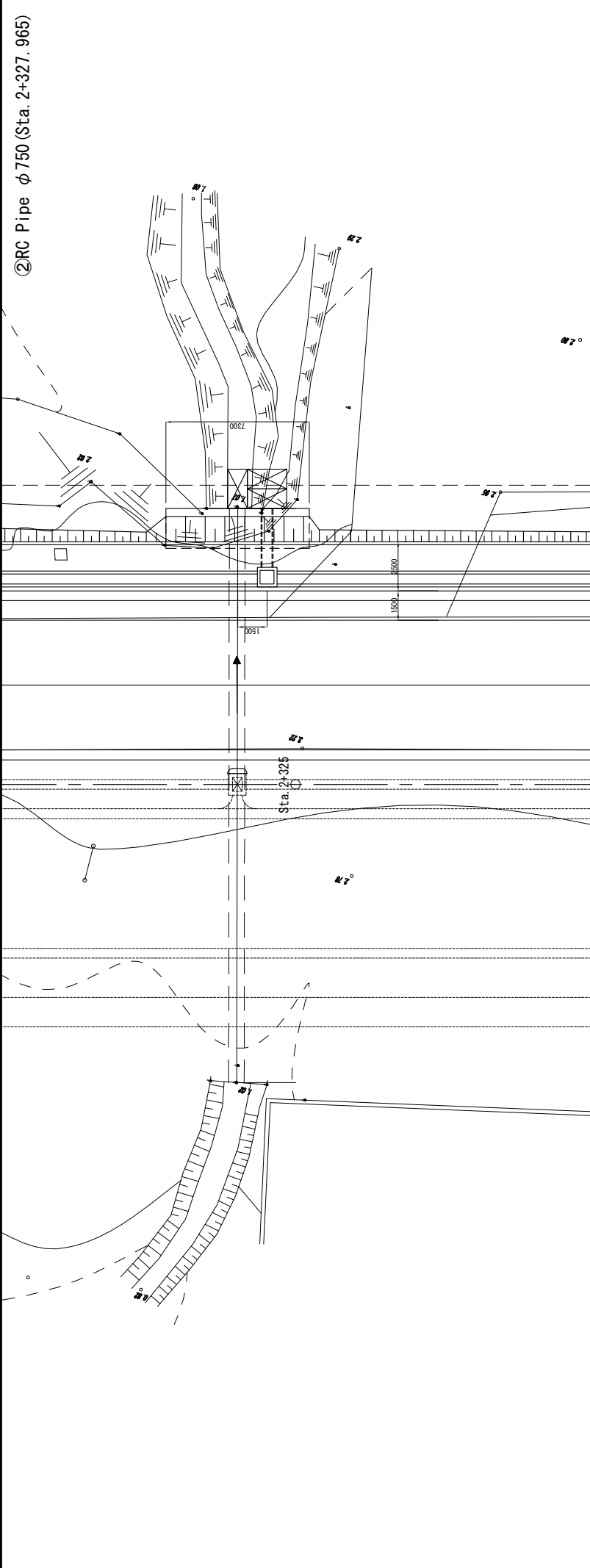


A-A CROSS SECTION S=1/100

PLAN S=1/400

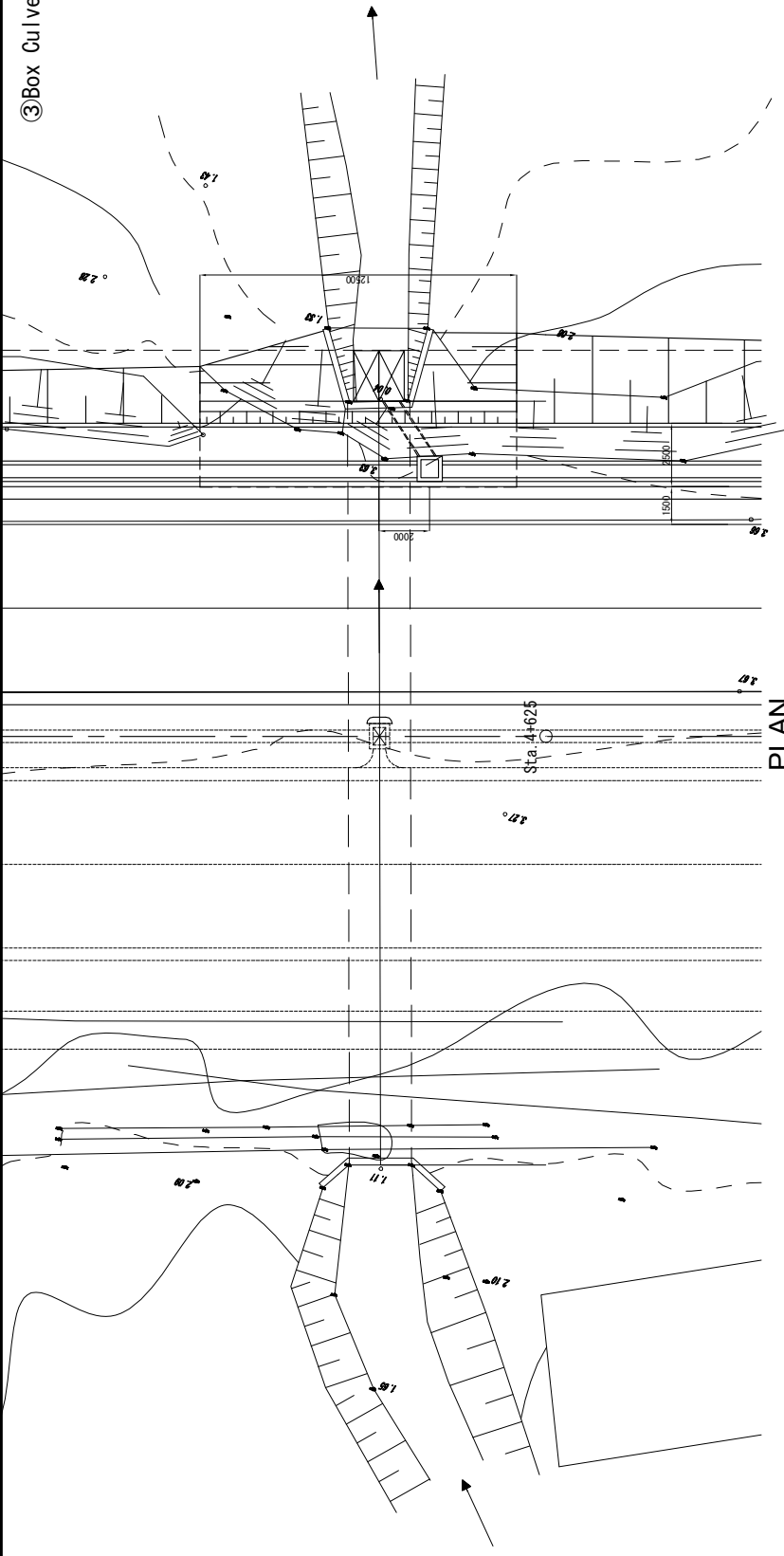
MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGEROSEC CORPORATION	TITLE: THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	DRAWING No. SCALE DATE	DS-5
				AS SHOWN DEC. 2016

DRAINAGE STRUCTURES (5/5)



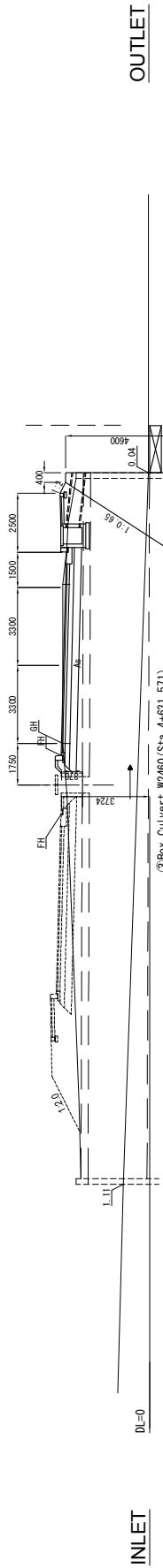
MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGEROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	TITLE:	INLET/OUTLET DETAILS OF EXISTING CROSSING DRAINAGE FACILITIES (STA. 2+327.965)	Drawing No.	BW-1
			SCALE		S=1/200	
			DATE	DEC. 2016		

③ Box Culvert W2460 (Sta. 4+631.571)



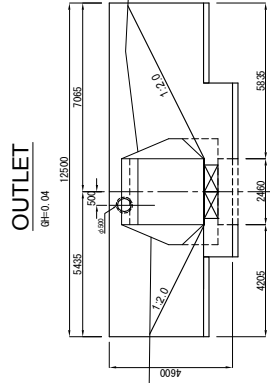
PLAN

4+631.571
FH=3.740
GH=3.66



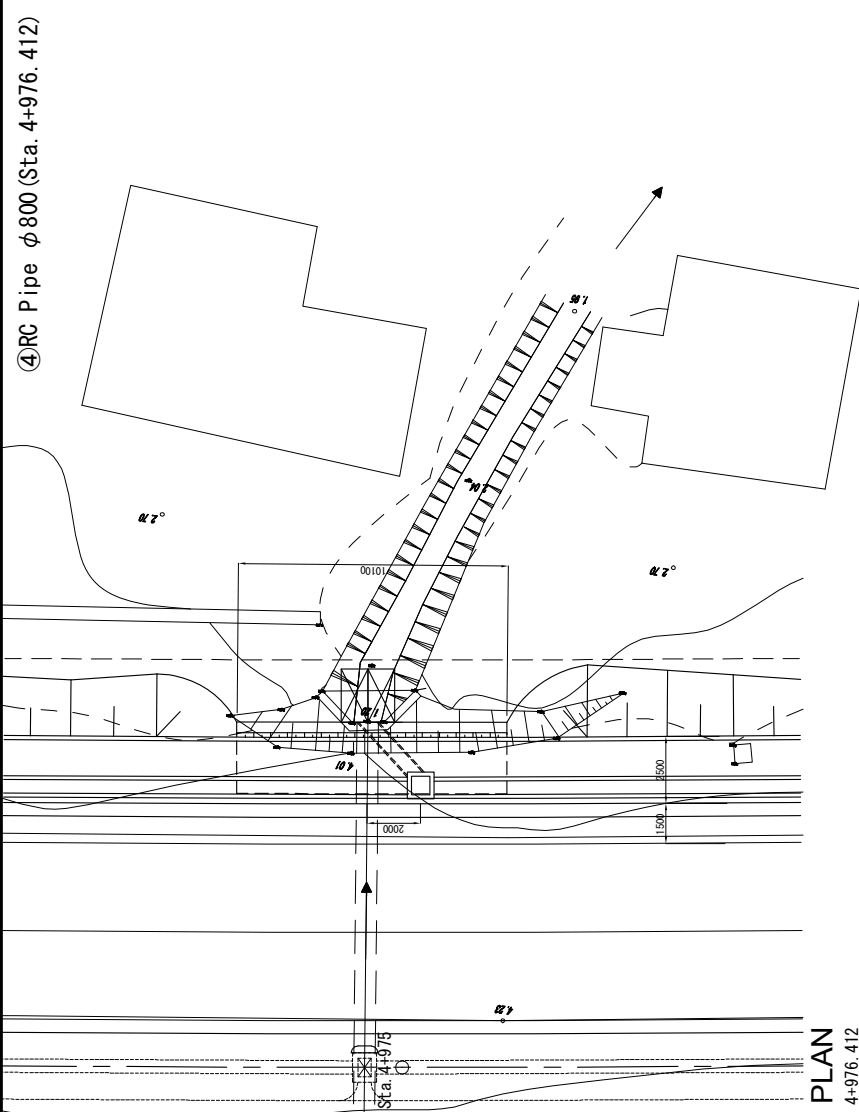
PROFILE

③ Box Culvert W2460 (Sta. 4+631.571)

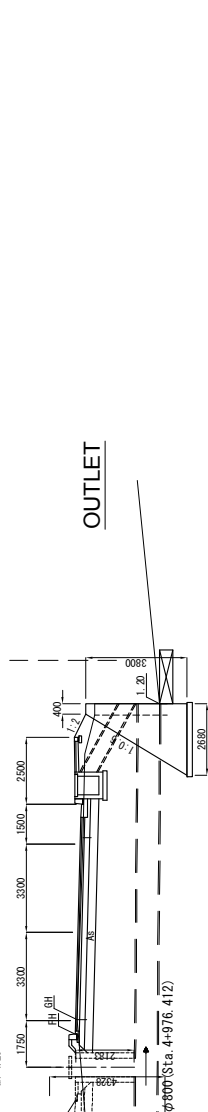


FRONT VIEW

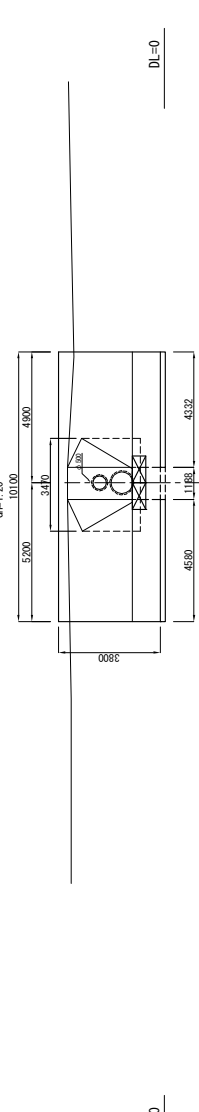
MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGEROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	TITLE: INLET/OUTLET DETAILS OF EXISTING CROSSING DRAINAGE FACILITIES (STA.4+631.571)	Drawing No.	BW-2
			SCALE	S=1/200	DATE



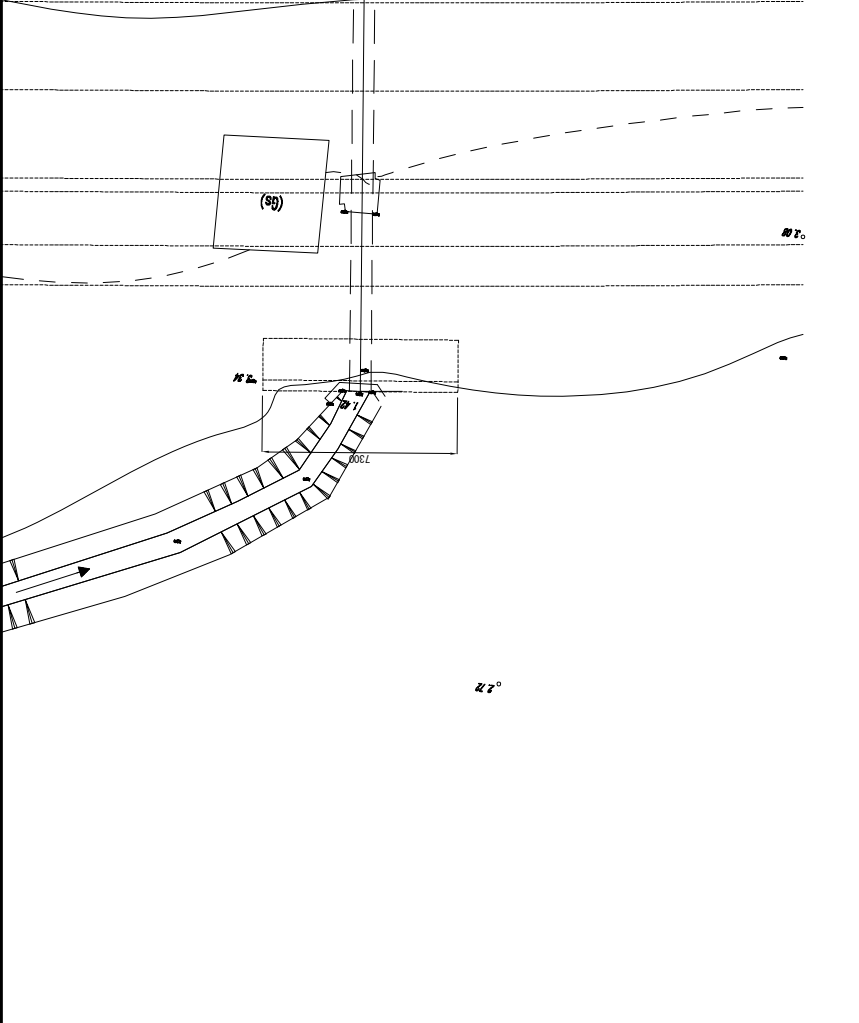
PLAN
4+976.412
GH=1.20
DL=0



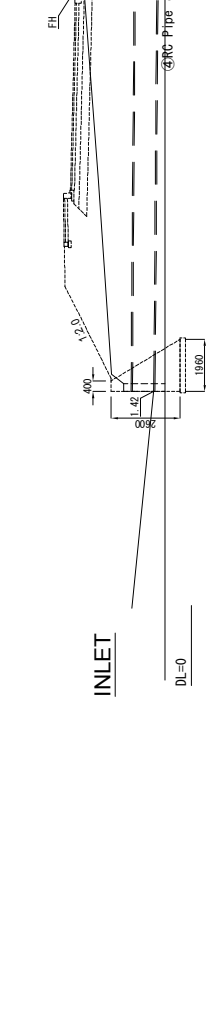
PROFILE
WC-3
GH=1.42
DL=0



FRONT VIEW
DL=0

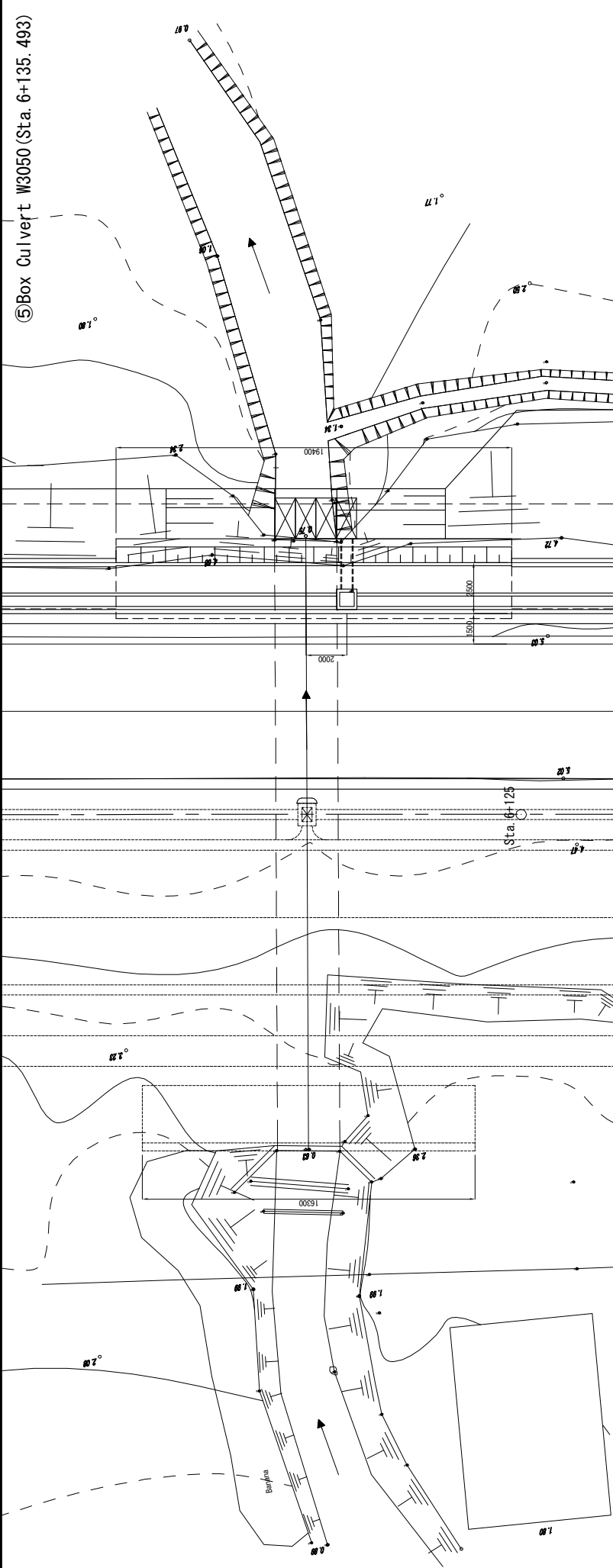


INLET
GH=1.42
DL=0

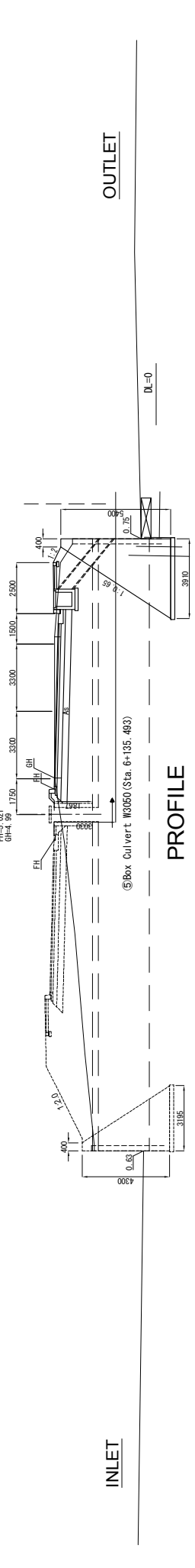


OUTLET
GH=1.20
DL=0

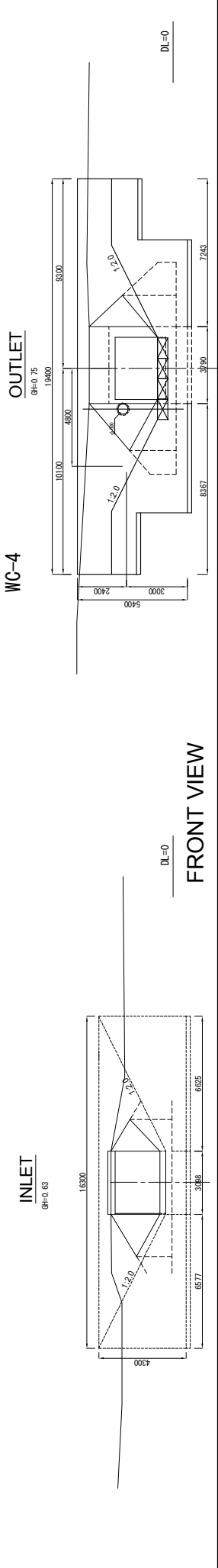
MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGEROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	TITLE: INLET/OUTLET DETAILS OF EXISTING CROSSING DRAINAGE FACILITIES (STA.4+976.412)	
			Drawing No. BW-3	SCALE S=1/200
			DATE DEC. 2016	



PLAN
6+135.493
GH=0.021
OH=4.99



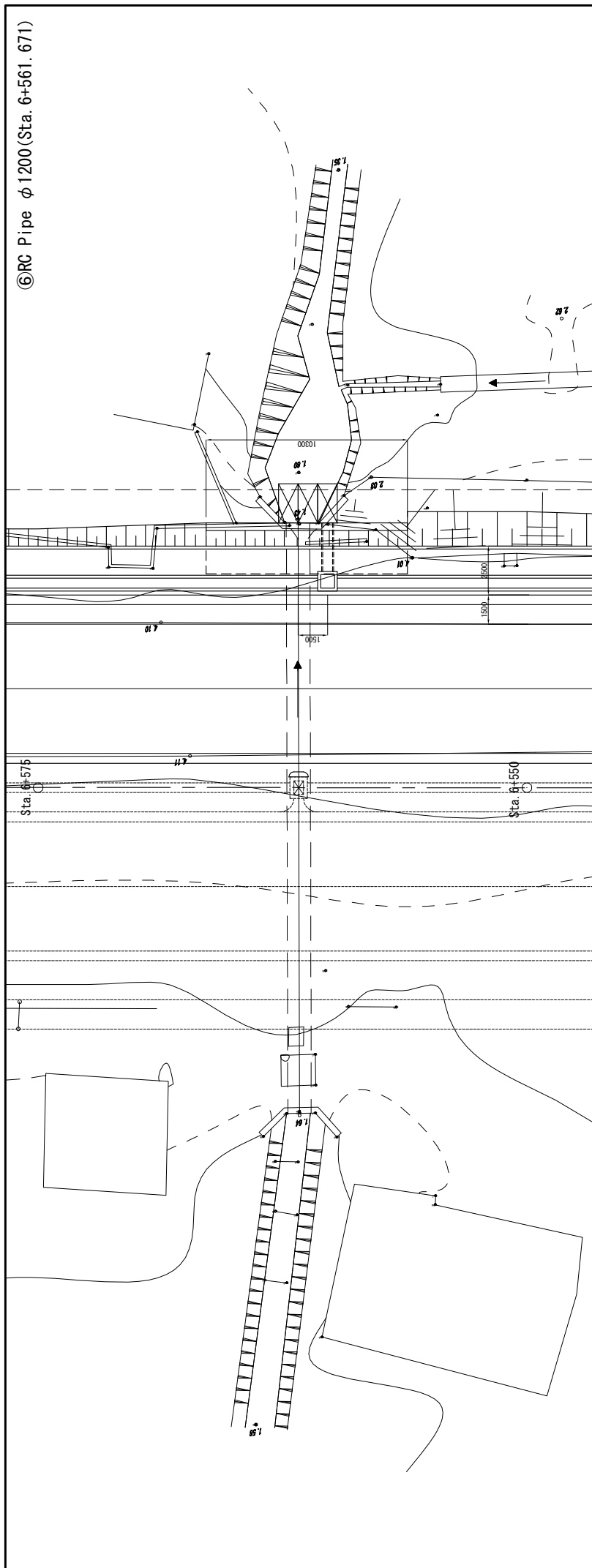
PROFILE



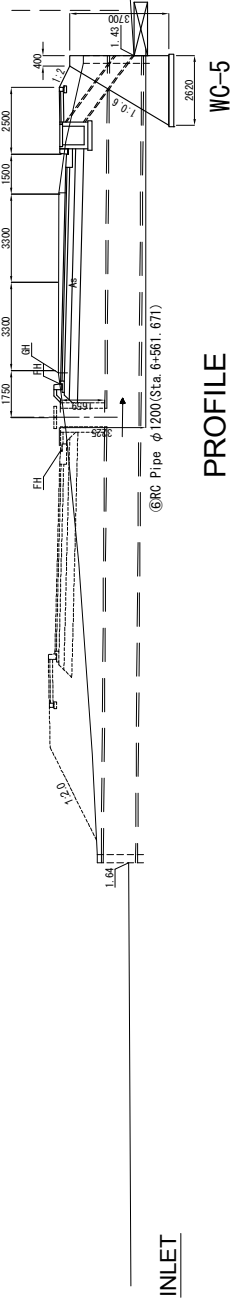
FRONT VIEW

MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGEROSEC CORPORATION	TITLE: INLET/OUTLET DETAILS OF EXISTING CROSSING DRAINAGE FACILITIES (STA. 6+135.493)	Drawing No. BW-4
		DATE DEC. 2016	SCALE S=1/200

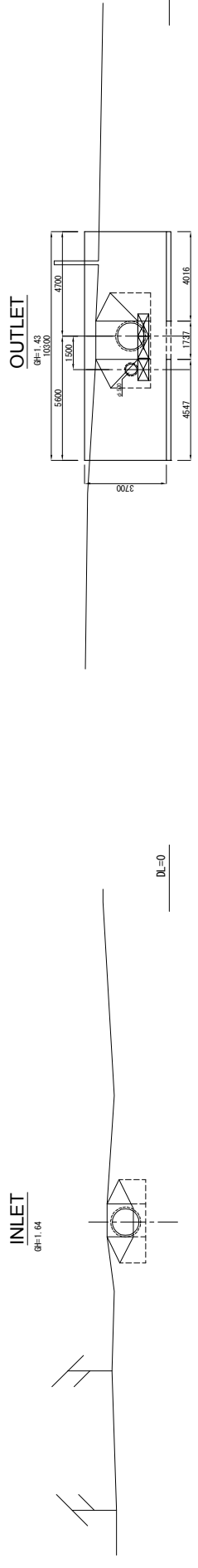
©RC Pipe ϕ 1200 (Sta. 6+561.671)



PLAN
6+561.671
GH=1.85
GH=1.50

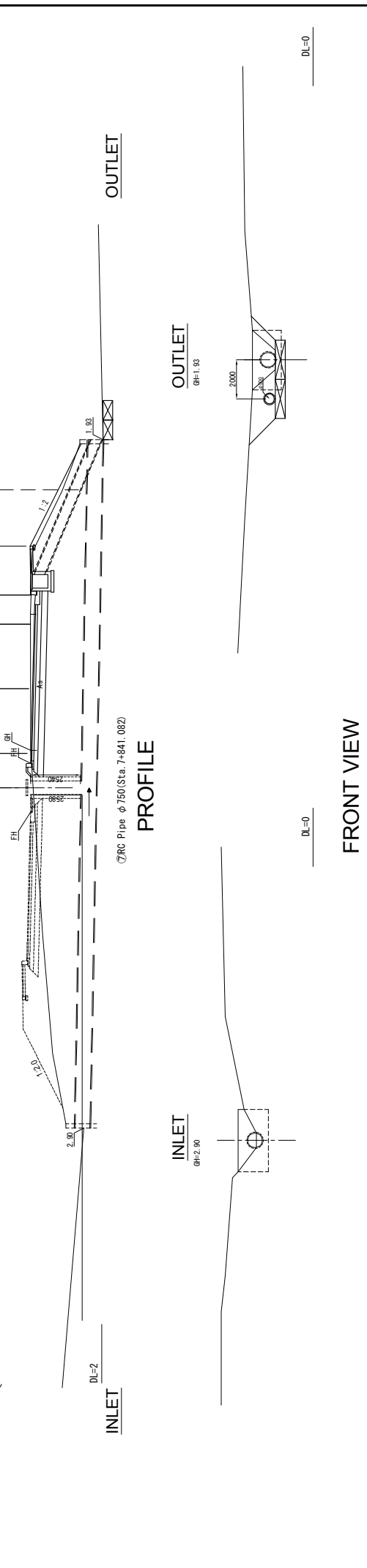
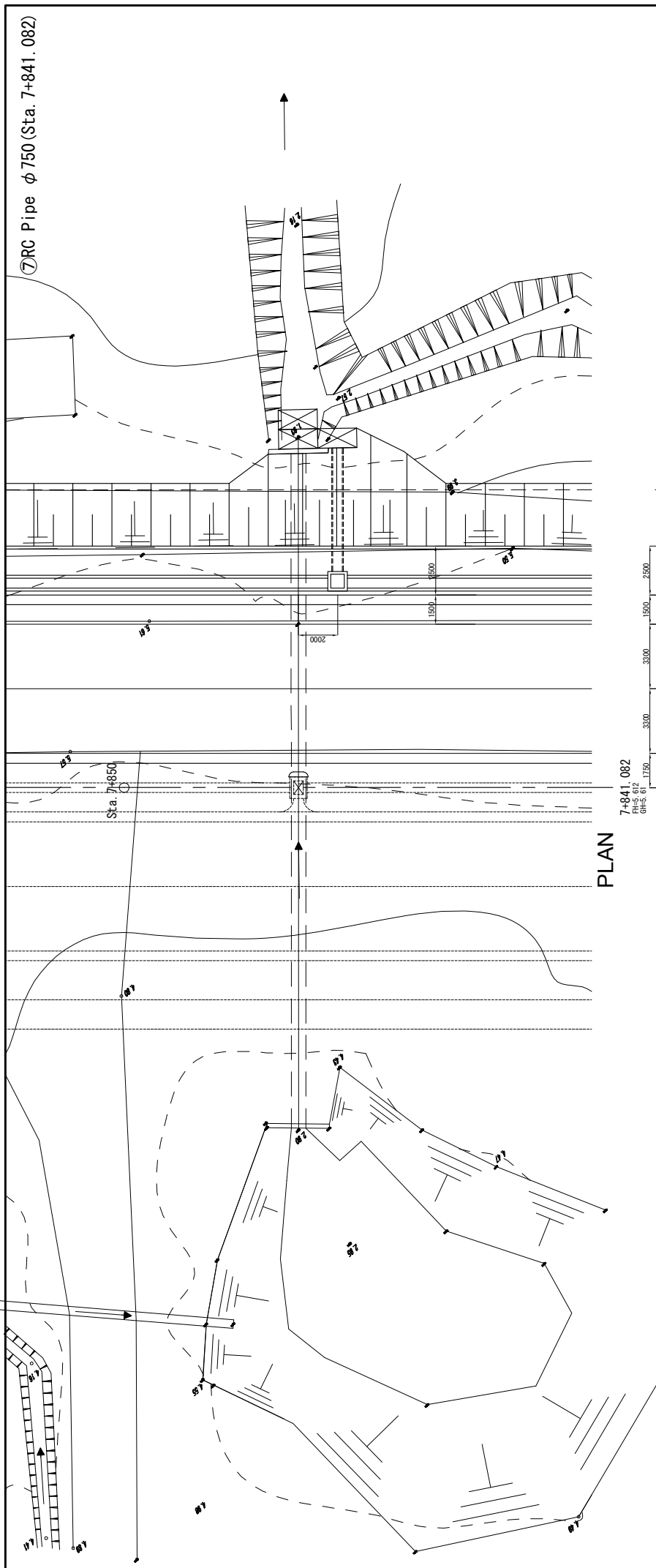


PROFILE
WC-5
©RC Pipe ϕ 1200 (Sta. 6+561.671)

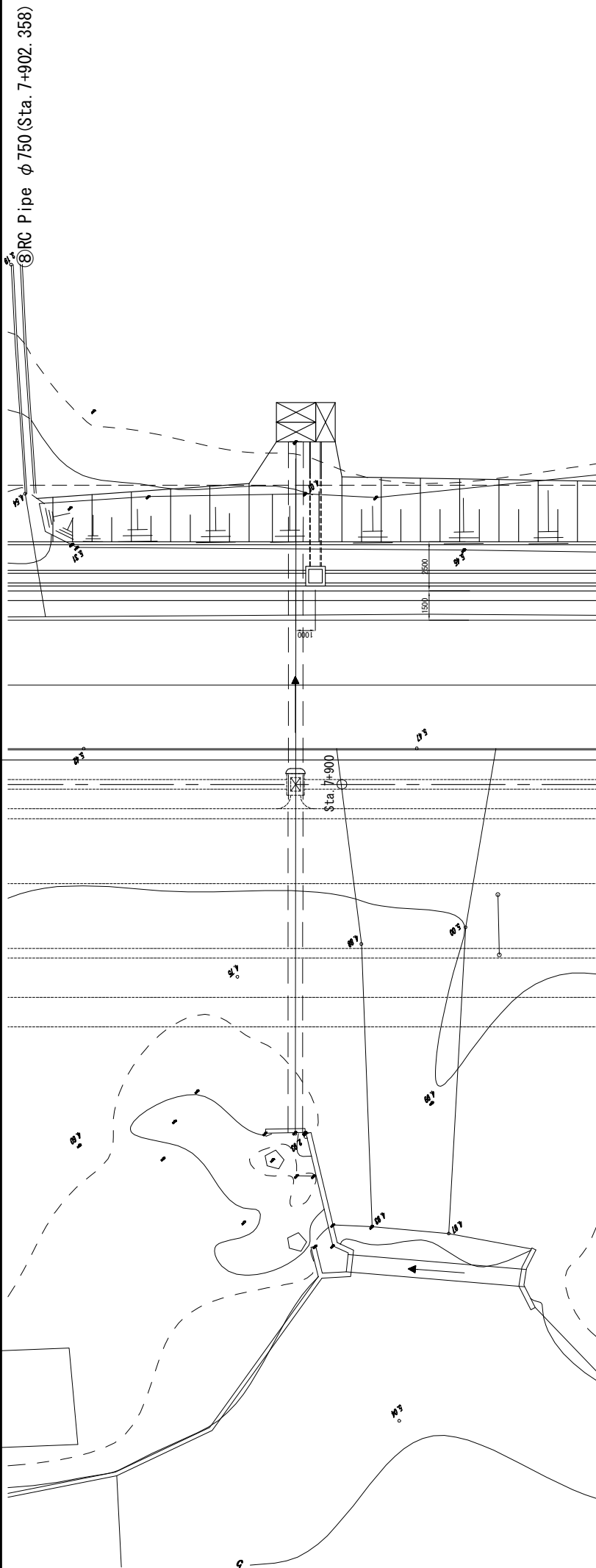


FRONT VIEW

MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGEROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONIROVIA	TITLE: INLET/OUTLET DETAILS OF EXISTING CROSSING DRAINAGE FACILITIES (STA. 6+561.671)			
			Drawing No.	BW-5	SCALE	S=1/200
			DATE	DEC. 2016		

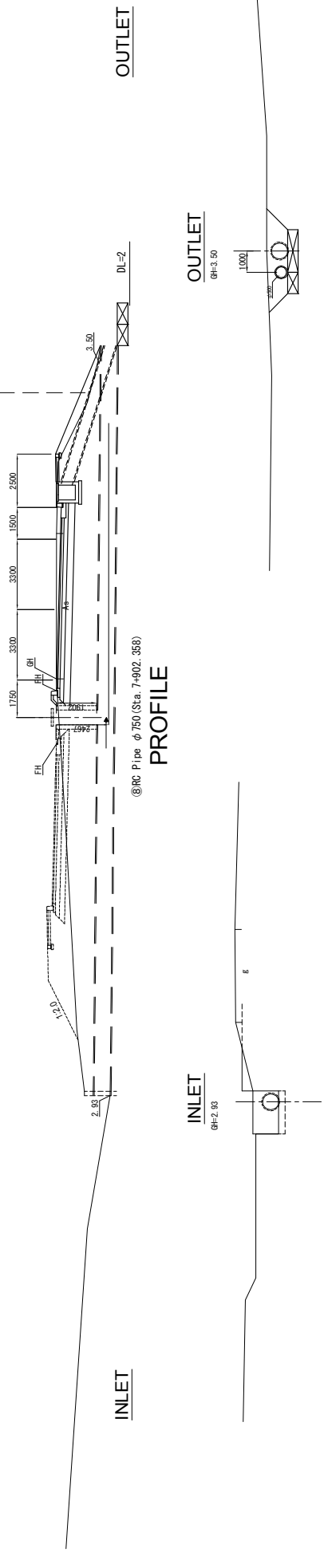


MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	TITLE:	INLET/OUTLET DETAILS OF EXISTING CROSSING DRAINAGE FACILITIES (STA. 7+841.082)	Drawing No.	BW-6
			SCALE		S=1/200	
			DATE	DEC. 2016		



PLAN

7+902.358
ØH=3.50



PROFILE

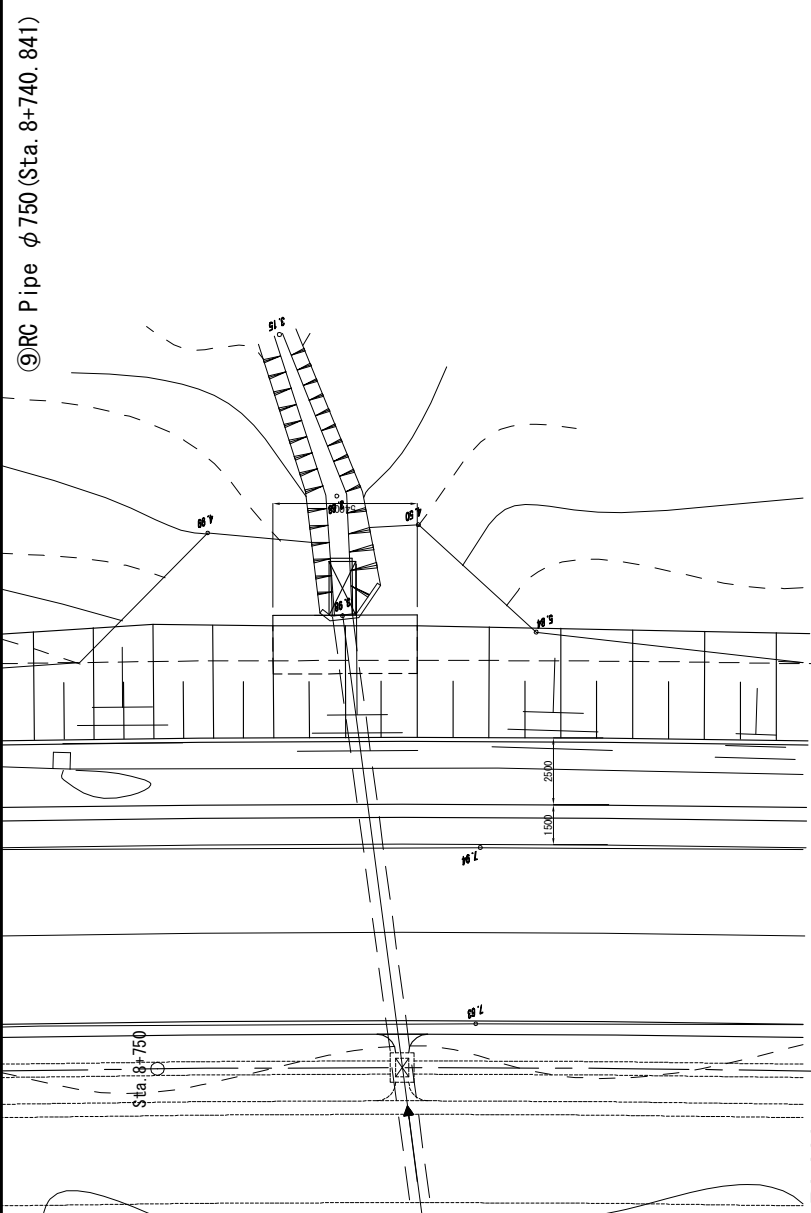
Ø RC Pipe φ 750 (Sta. 7+902.358)

DL=0

FRONT VIEW

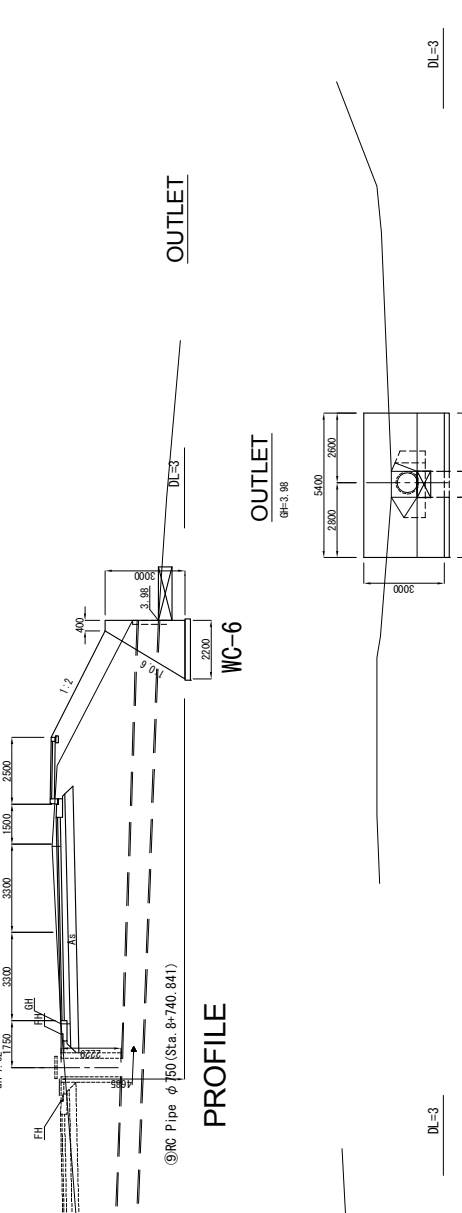
<p>MINISTRY OF PUBLIC WORKS</p>	<p>JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION</p>	<p>TITLE: INLET/OUTLET DETAILS OF EXISTING CROSSING DRAINAGE FACILITIES (STA. 7+902.358)</p>	<p>Drawing No. BW-7 SCALE S=1/200 DATE DEC. 2016</p>
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⑨RC Pipe ϕ 750 (Sta. 8+740. 841)



PLAN

8+740. 841
FH=7.619
GH=7.62750



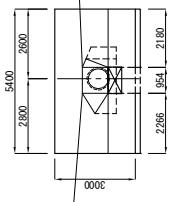
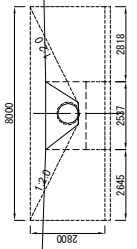
PROFILE

⑨RC Pipe ϕ 750 (Sta. 8+740. 841)

WC-6

INLET
GH=5.11

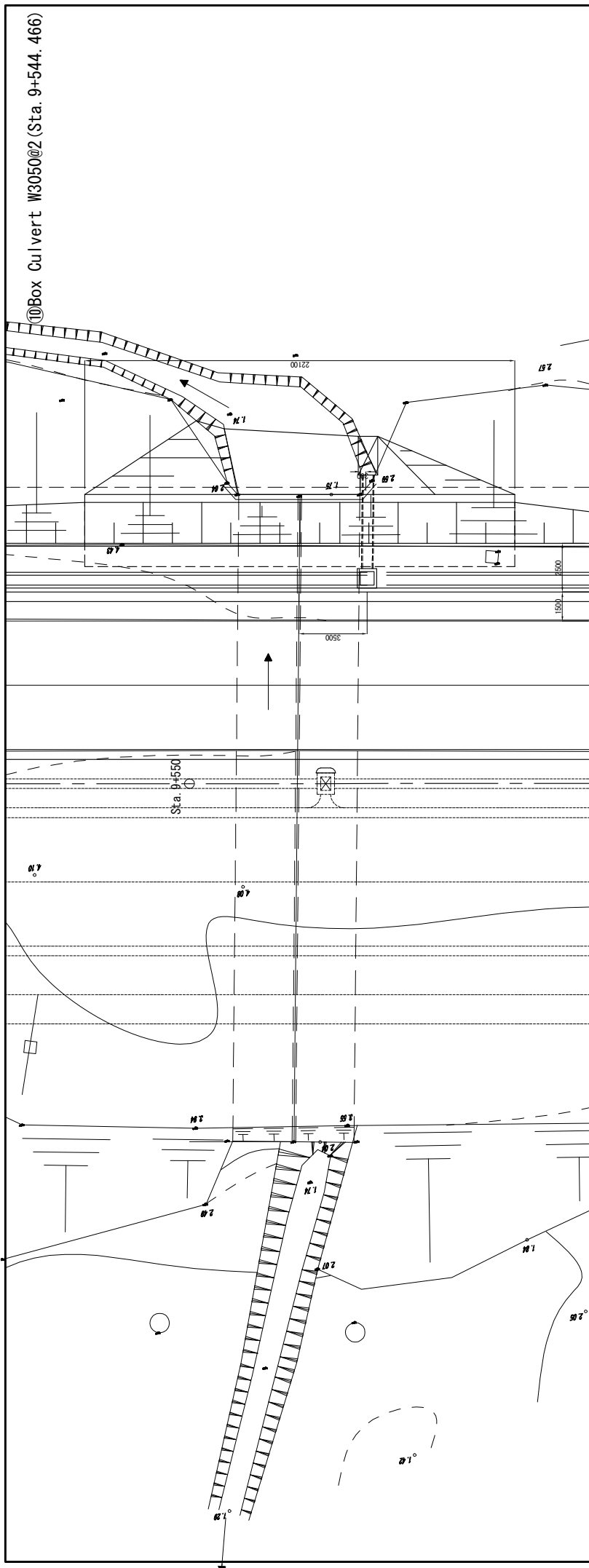
OUTLET
GH=3.98



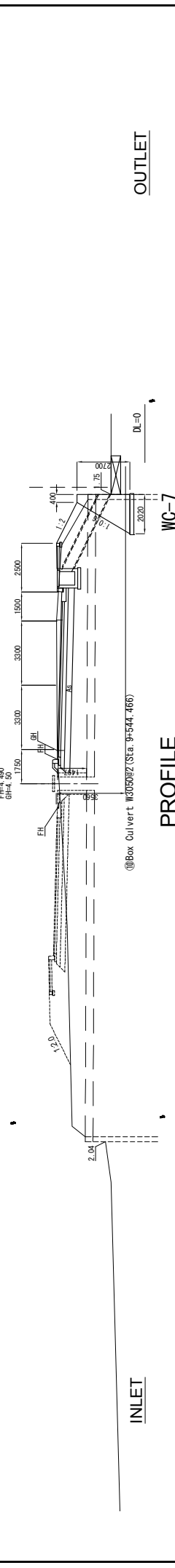
FRONT VIEW

<p>MINISTRY OF PUBLIC WORKS</p>	<p>JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGEROSEC CORPORATION</p>	<p>TITLE: INLET/OUTLET DETAILS OF EXISTING CROSSING DRAINAGE FACILITIES (STA. 8+740.841)</p> <p>THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA</p>	<p>Drawing No. BW-8</p> <p>SCALE S=1/200</p> <p>DATE DEC. 2016</p>
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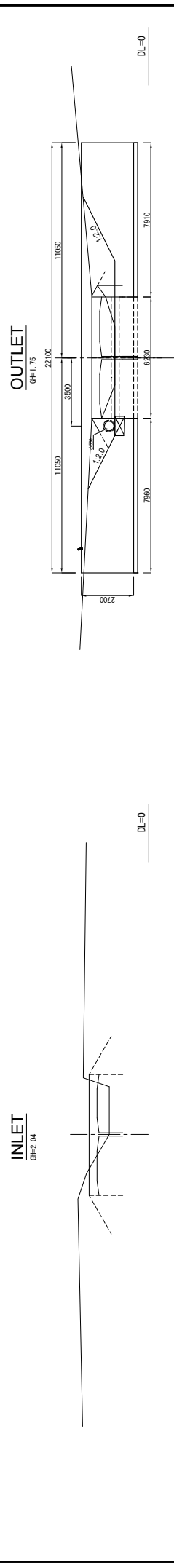
10 Box Culvert W3050@2 (Sta. 9+544. 466)



PLAN
9+543. 000
FH=4. 480
GH=4. 50



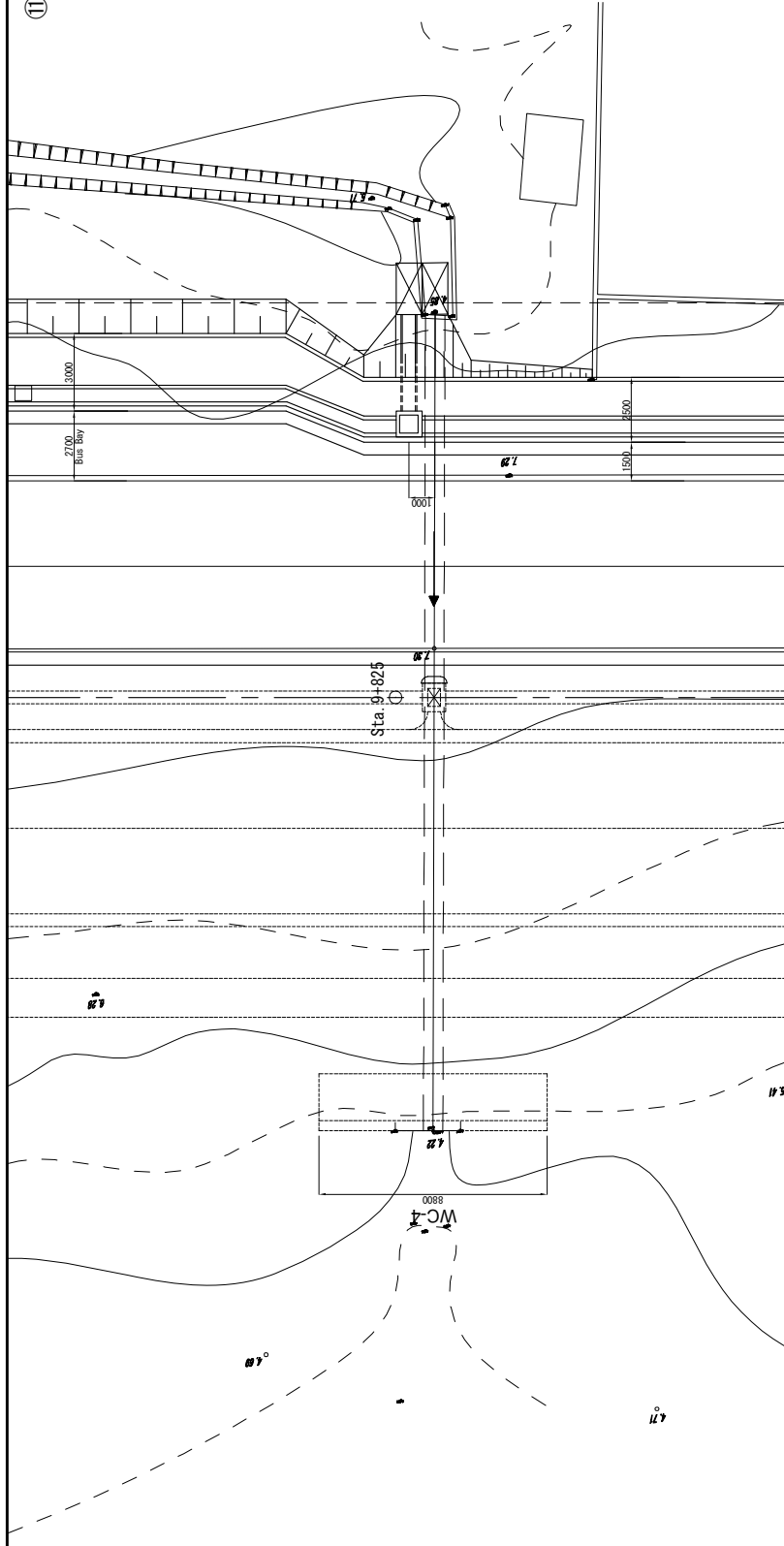
PROFILE



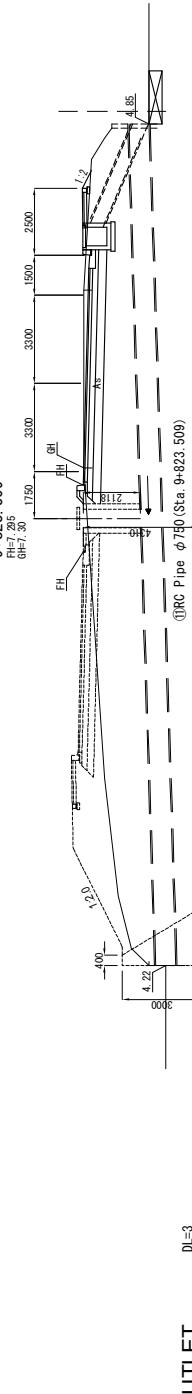
FRONT VIEW

MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGEROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONIROVIA	TITLE: INLET/OUTLET DETAILS OF EXISTING CROSSING DRAINAGE FACILITIES (STA. 9+544.466)	Drawing No.	BW-9
				SCALE	S=1/200
				DATE	DEC. 2016

①RC Pipe ϕ 750 (Sta. 9+823.509)



PLAN
9+823.509
FH=7.265
GH=7.30

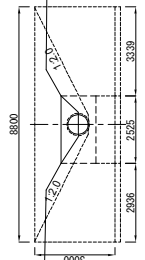


INLET

PROFILE

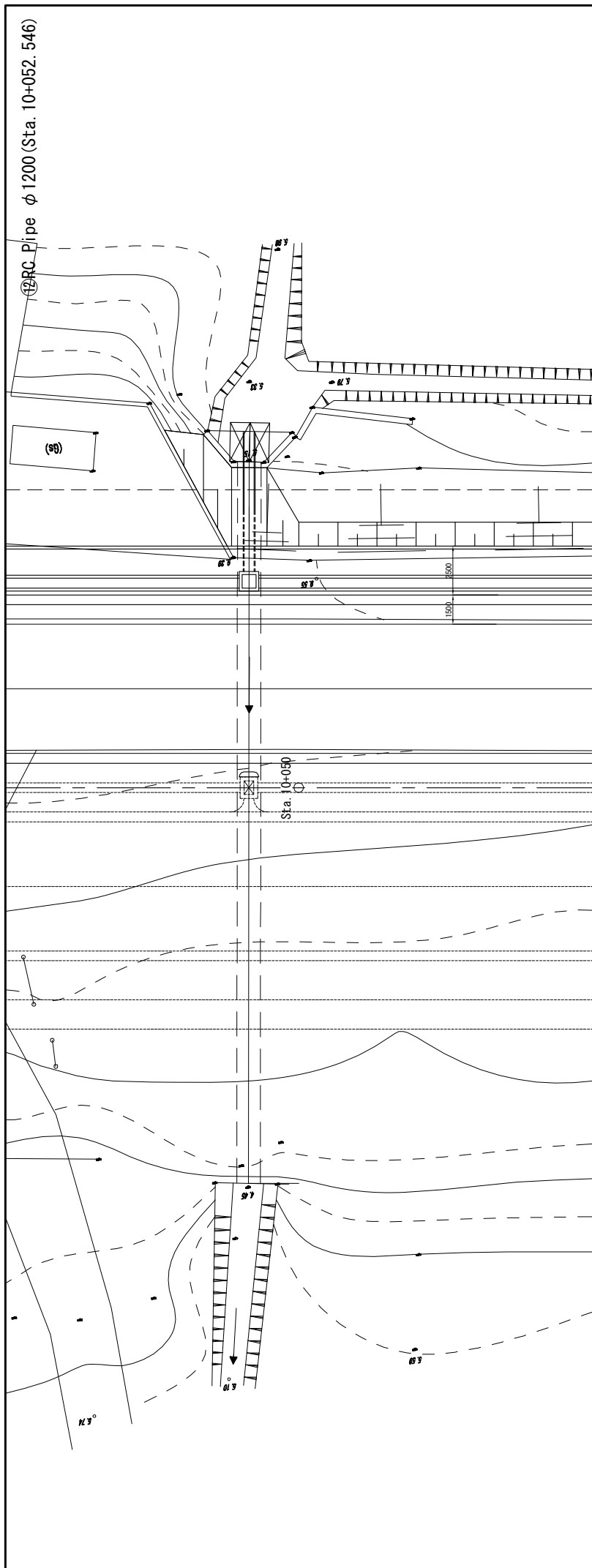
OUTLET
GH=4.22

INLET
GH=4.85

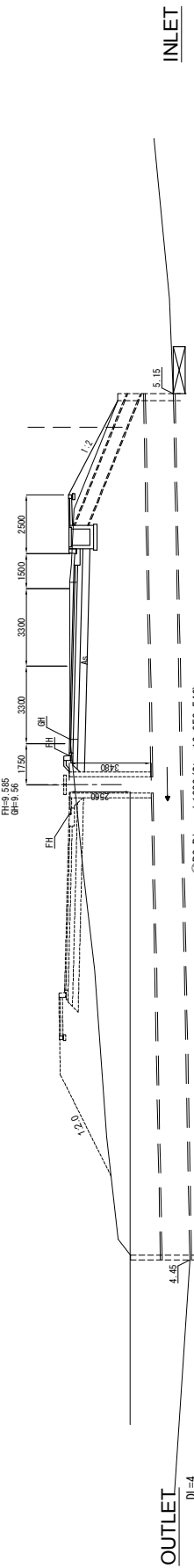


FRONT VIEW

MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGEROSEC CORPORATION	TITLE: INLET/OUTLET DETAILS OF EXISTING CROSSING DRAINAGE FACILITIES (STA. 9+823.509)	Drawing No. BW-10
			SCALE S=1/200
			DATE DEC. 2016



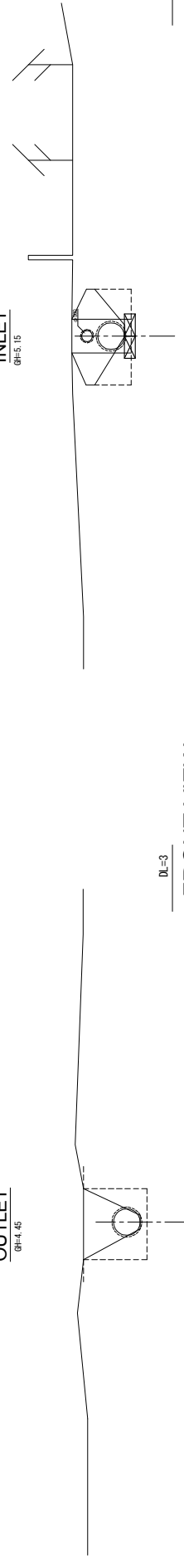
PLAN
10+52. 546
RH=9.585
GH=9.56



PROFILE

OUTLET
GH=4.45

INLET
GH=5.15

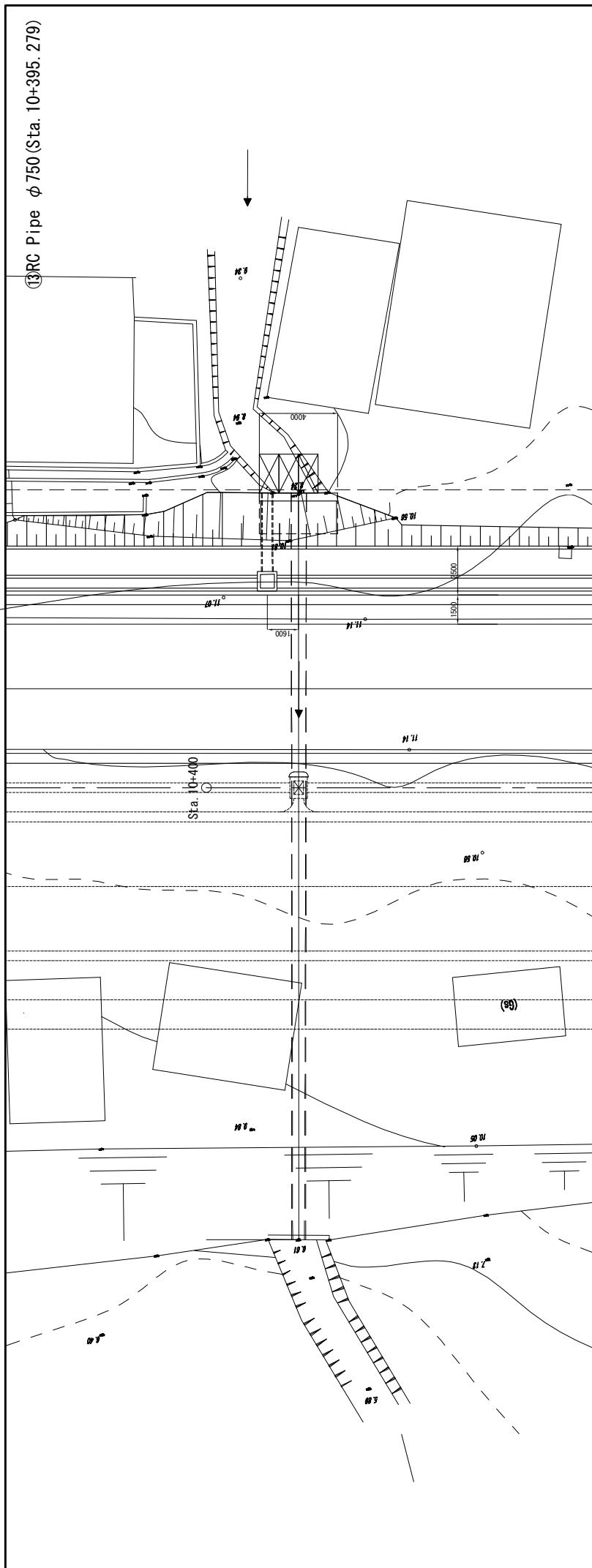


FRONT VIEW

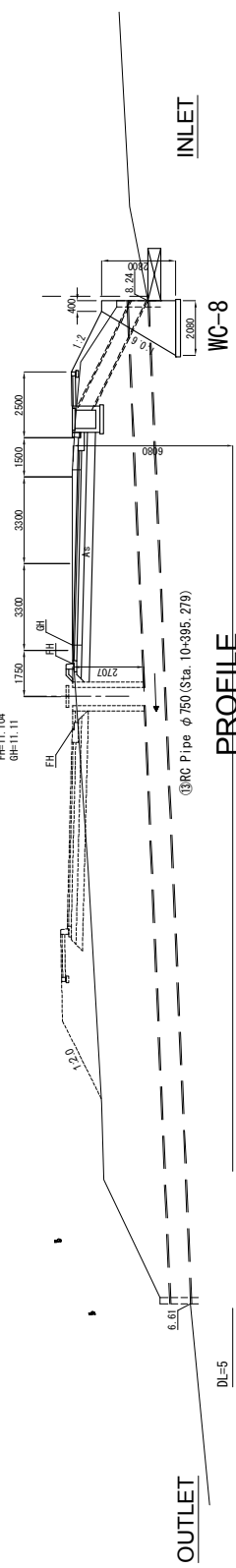
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DL=3

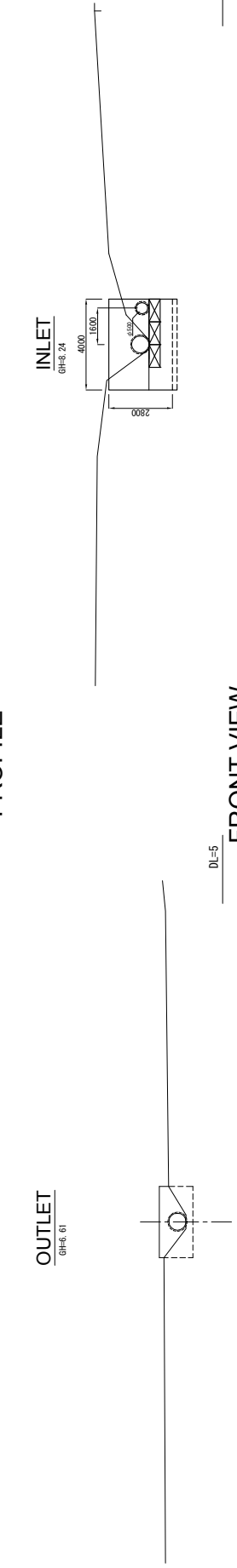
MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGEROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	TITLE: INLET/OUTLET DETAILS OF EXISTING CROSSING DRAINAGE FACILITIES (STA. 10+052.546)	Drawing No. BW-11
				SCALE S=1/200
				DATE DEC. 2016



PLAN
10+395.279
RH=11.04
GH=11.11



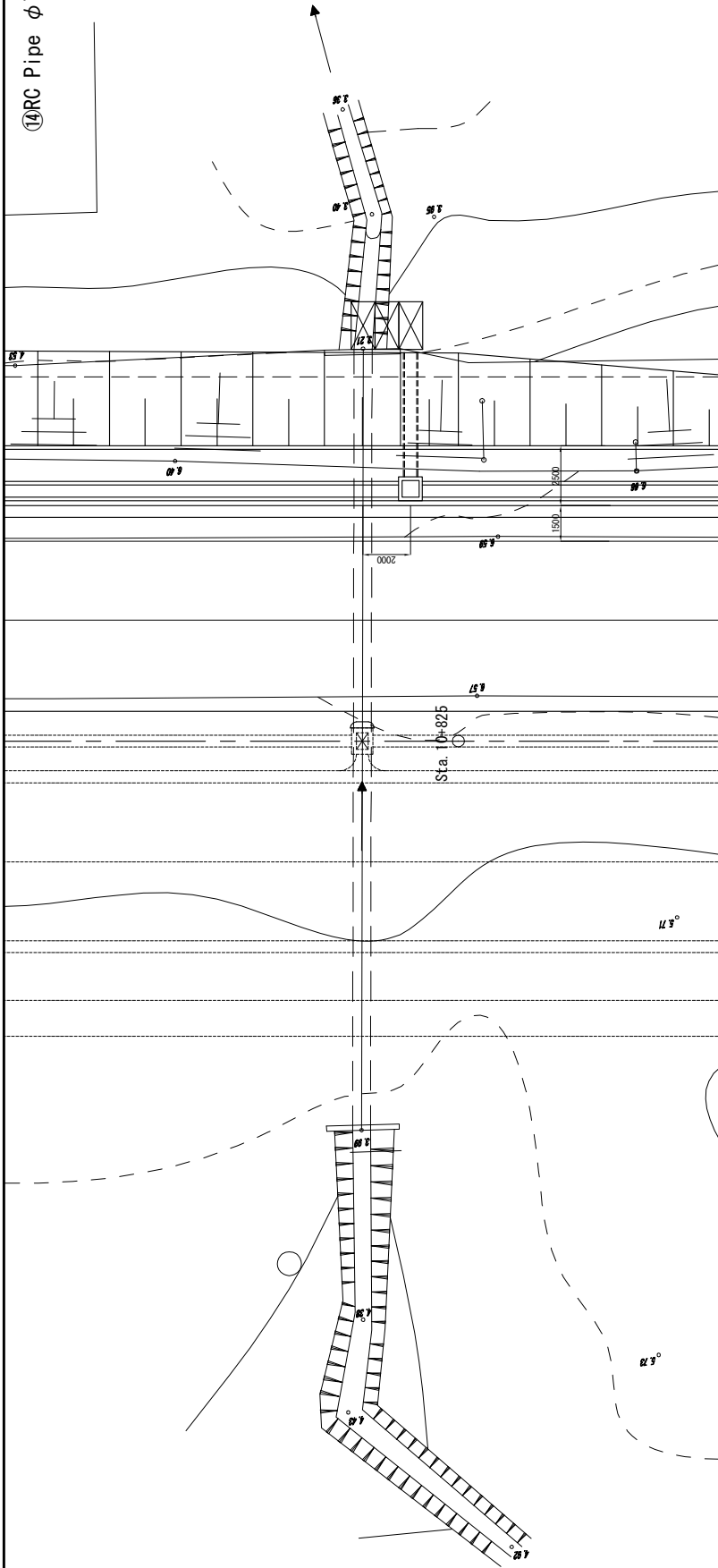
PROFILE



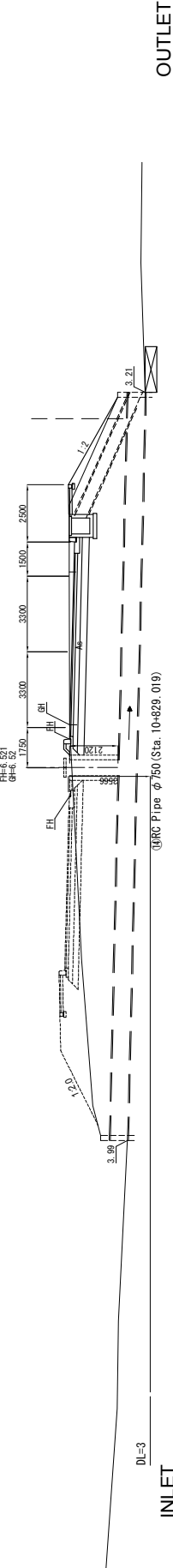
FRONT VIEW

MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	TITLE:	INLET/OUTLET DETAILS OF EXISTING CROSSING DRAINAGE FACILITIES (STA. 10+395.279)	Drawing No.	BW-12
			SCALE		S=1/200	
			DATE	DEC. 2016		

④ RC Pipe ϕ 750 (Sta. 10+829. 019)



PLAN
10+829. 019
R# 6.521
GF# 3.21



PROFILE

INLET
GF# 3.99

OUTLET
GF# 3.21

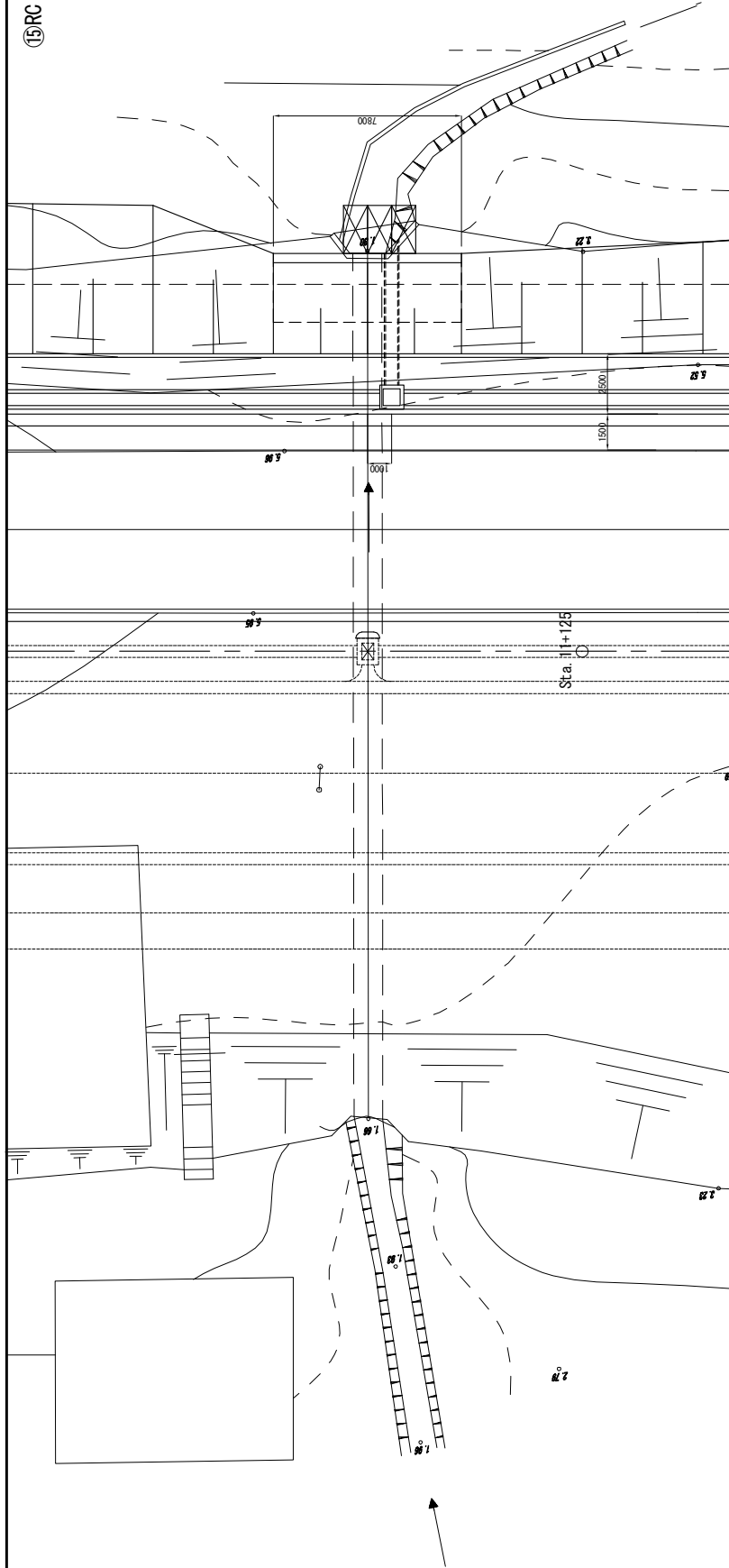
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DL=1

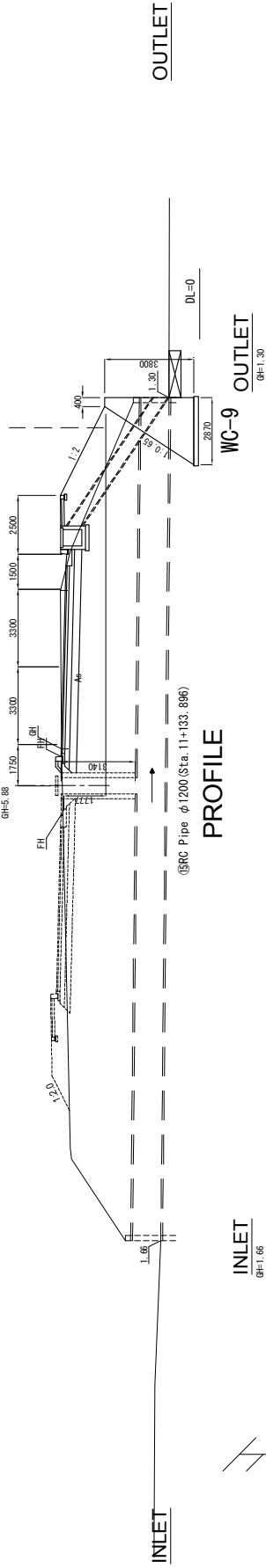
FRONT VIEW

MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGEROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	TITLE: INLET/OUTLET DETAILS OF EXISTING CROSSING DRAINAGE FACILITIES (STA. 10+829.019)		Drawing No. BW-13
			SCALE	DATE	S=1/200 DEC. 2016

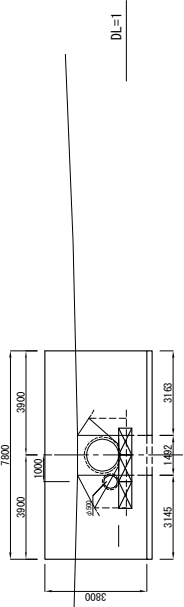
⑮ RC Pipe ϕ 1200 (Sta. 11+133.896)



PLAN
11+133.896
FH=5.896
GH=5.86

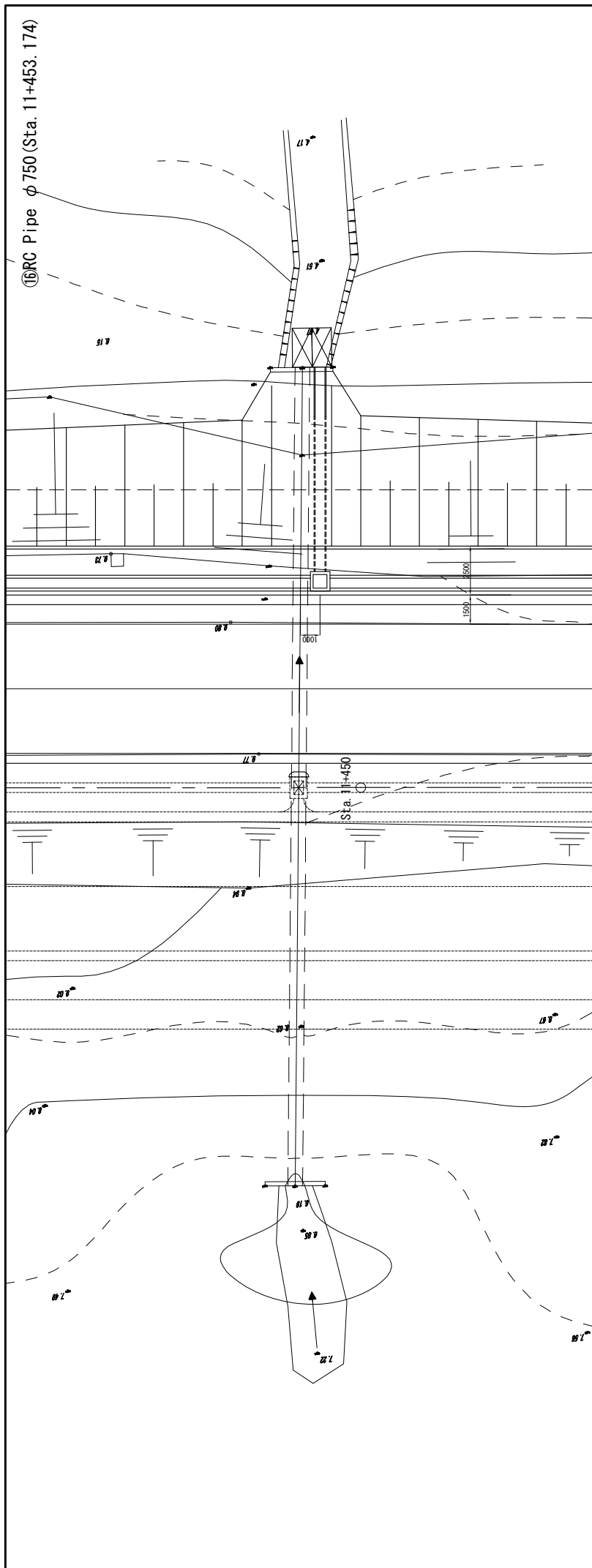


PROFILE
⑮ RC Pipe ϕ 1200 (Sta. 11+133.896)

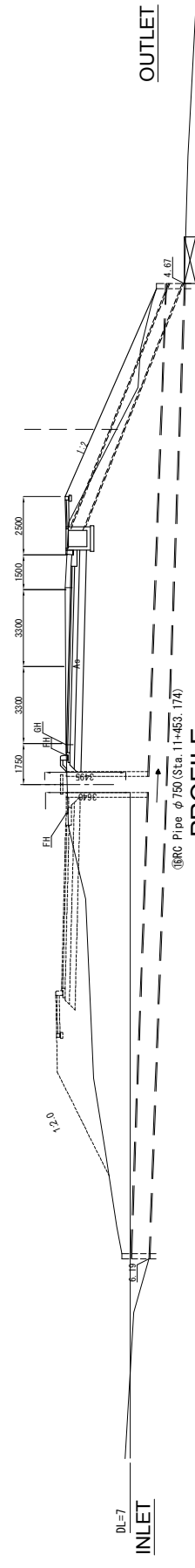


FRONT VIEW

MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGEROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	TITLE: INLET/OUTLET DETAILS OF EXISTING CROSSING DRAINAGE FACILITIES (STA. 11+133.896)		Drawing No.	BW-14
			SCALE	S=1/200	DATE	DEC. 2016

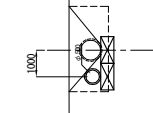


11+453.174
 RH=9.746
 GH=9.76



OUTLET
 GH=4.67

INLET
 GH=6.19

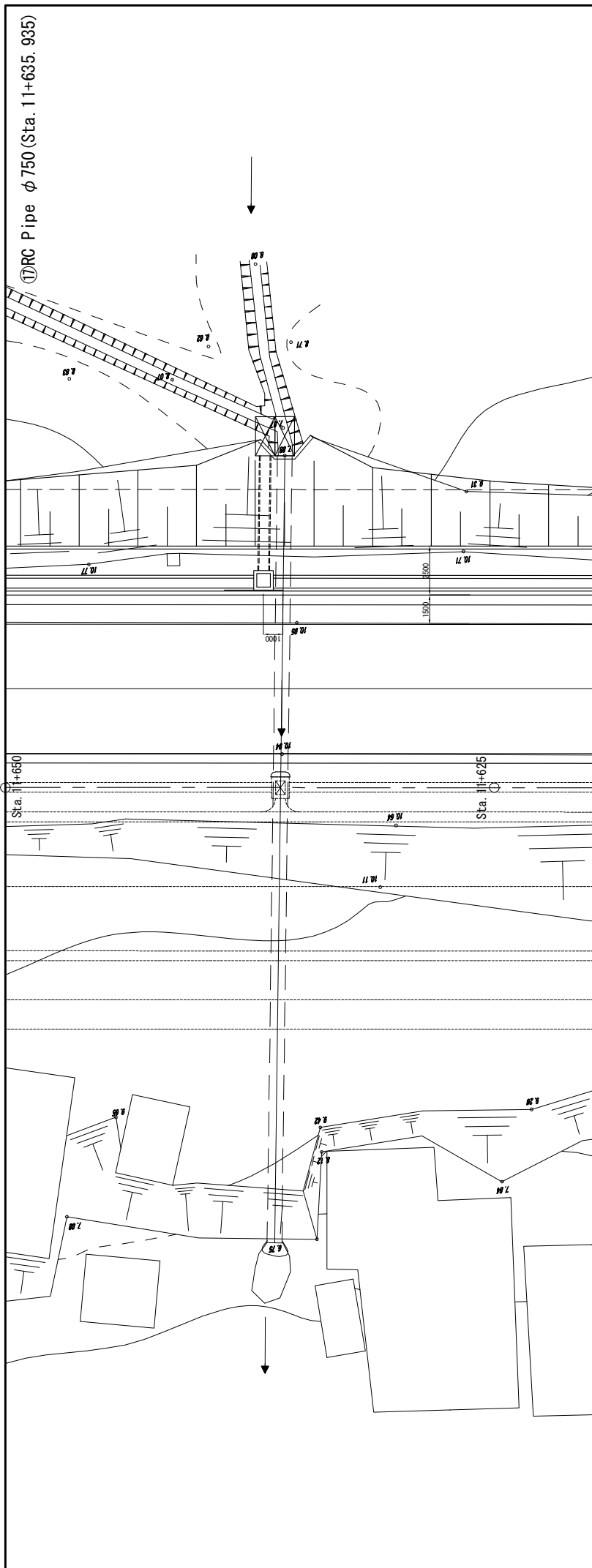


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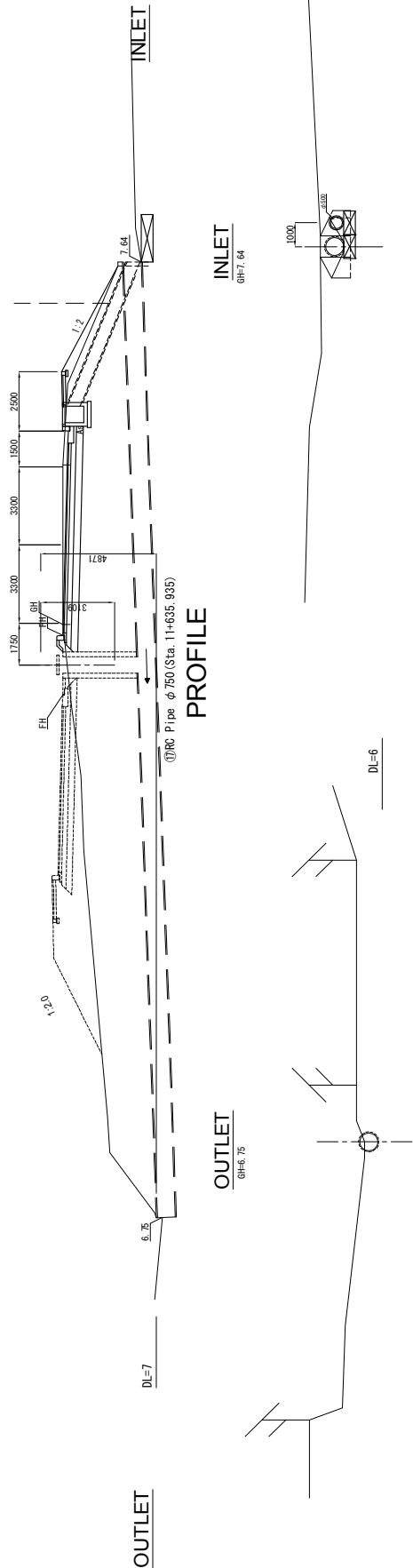
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FRONT VIEW

MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGEROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	TITLE:	INLET/OUTLET DETAILS OF EXISTING CROSSING DRAINAGE FACILITIES (STA. 11+453.174)	Drawing No.	BW-15
			SCALE		S=1/200	
			DATE	DEC. 2016		



PLAN
 11+635.935
 RH=10.942
 GH=10.94

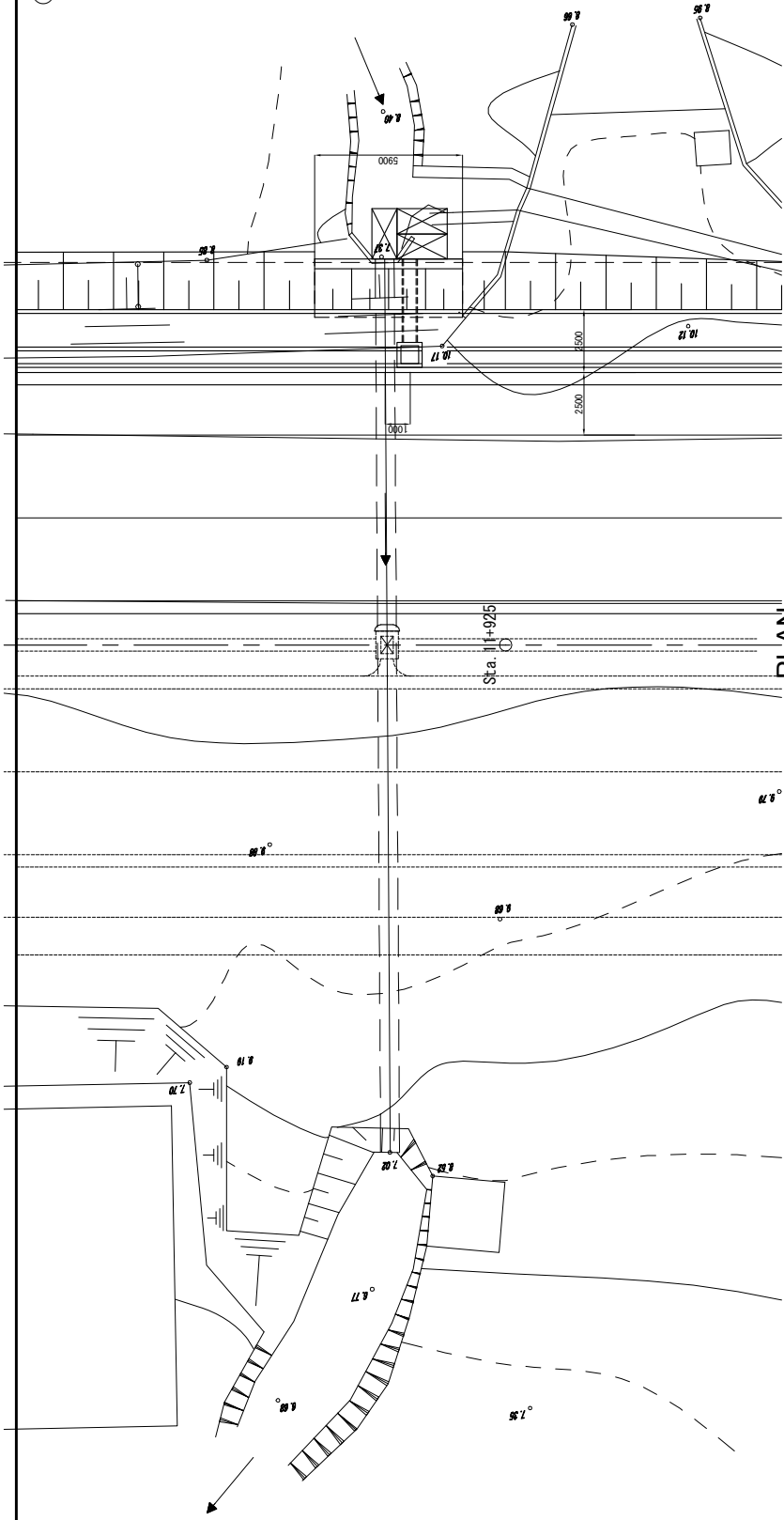


PROFILE

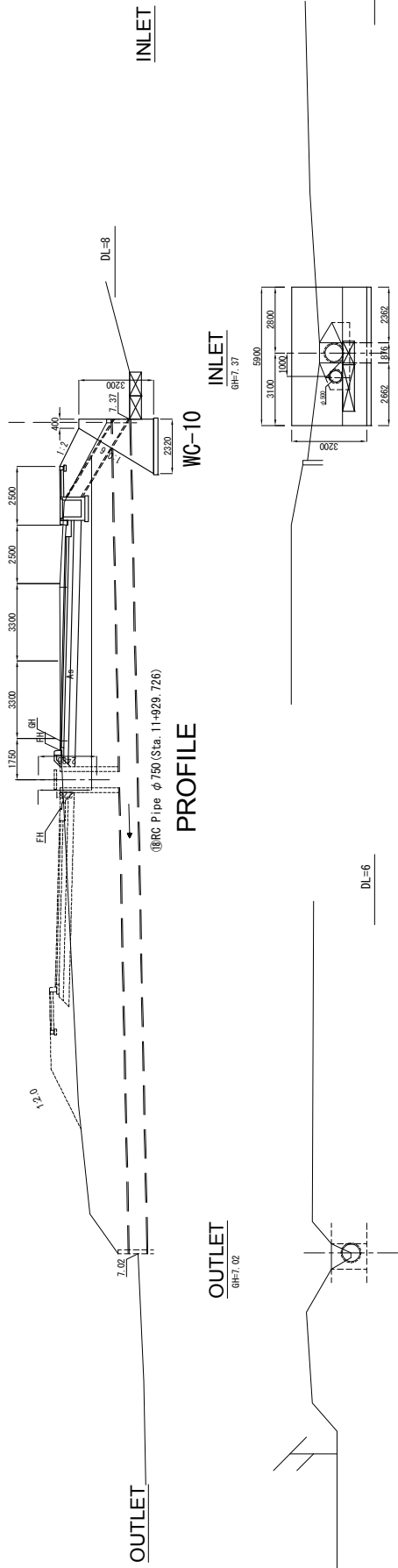
FRONT VIEW

<p>MINISTRY OF PUBLIC WORKS</p>	<p>JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGEROSEC CORPORATION</p>	<p>TITLE: INLET/OUTLET DETAILS OF EXISTING CROSSING DRAINAGE FACILITIES (STA. 11+635.935)</p>	<p>Drawing No. BW-16 SCALE S=1/200 DATE DEC. 2016</p>
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ØRC Pipe ϕ 750 (Sta. 11+929.726)



PLAN
11+929.726
FH=10.341
GH=10.33



PROFILE

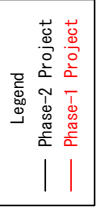
FRONT VIEW

MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGEROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONIROVIA	TITLE:	INLET/OUTLET DETAILS OF EXISTING CROSSING DRAINAGE FACILITIES (STA. 11+929.726)	Drawing No.	BW-17
			SCALE		S=1/200	
			DATE	DEC. 2016		

INTERSECTION TYPE-A

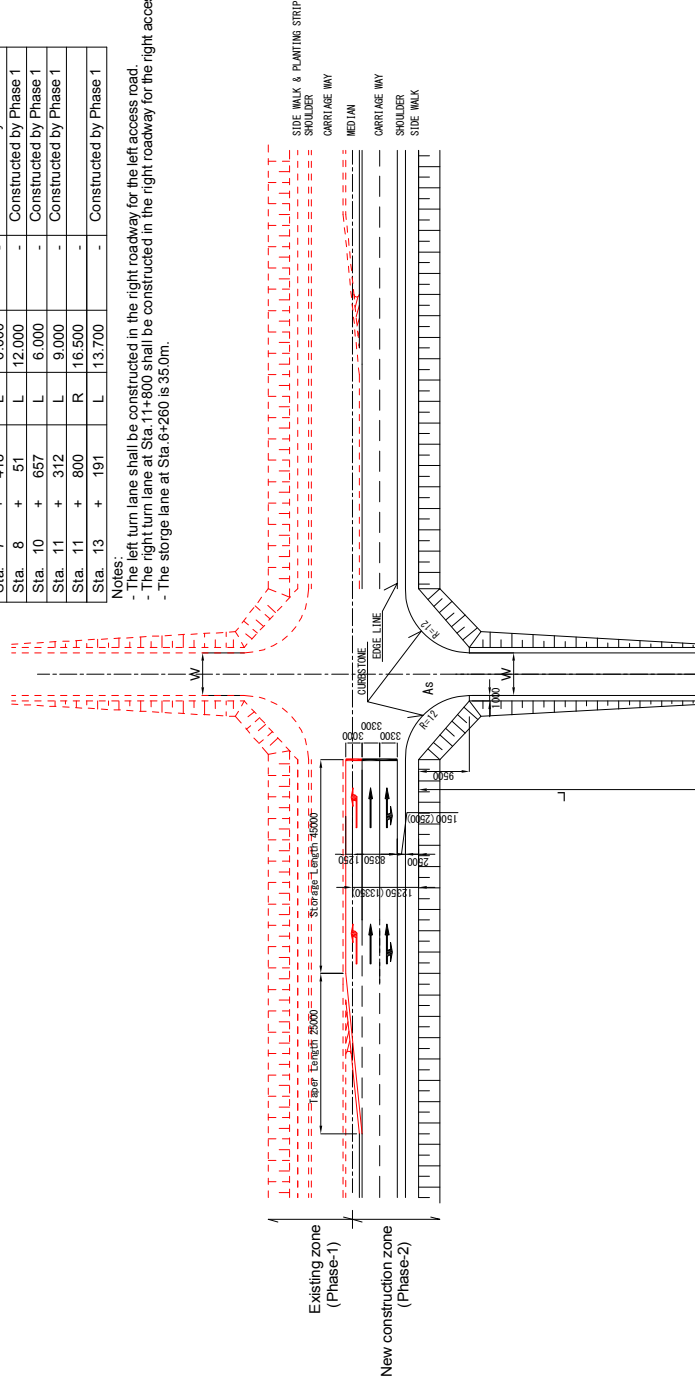
TYPE-A (m)

Station	L or R	W	L	Remark
Sta. 1 + 249	L	5,000	-	Constructed by Phase 1
Sta. 4 + 378	L	7,000	-	Constructed by Phase 1
Sta. 6 + 260	L	9,000	-	Constructed by Phase 1
Sta. 6 + 852	L	7,000	-	Constructed by Phase 1
Sta. 7 + 418	L	6,000	-	Constructed by Phase 1
Sta. 8 + 51	L	12,000	-	Constructed by Phase 1
Sta. 10 + 657	L	6,000	-	Constructed by Phase 1
Sta. 11 + 312	L	9,000	-	Constructed by Phase 1
Sta. 11 + 800	R	16,500	-	Constructed by Phase 1
Sta. 13 + 191	L	13,700	-	Constructed by Phase 1



Notes:

- The left turn lane shall be constructed in the right roadway for the left access road.
- The right turn lane at Sta. 11+800 shall be constructed in the right roadway for the right access road.
- The storage lane at Sta. 6+260 is 35.0m.



MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGEROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	TITLE: ACCESS ROAD TYPE-A	Drawing No.	AR-1
				SCALE	S=1/1000
				DATE	DEC. 2016

INTERSECTION TYPE-B

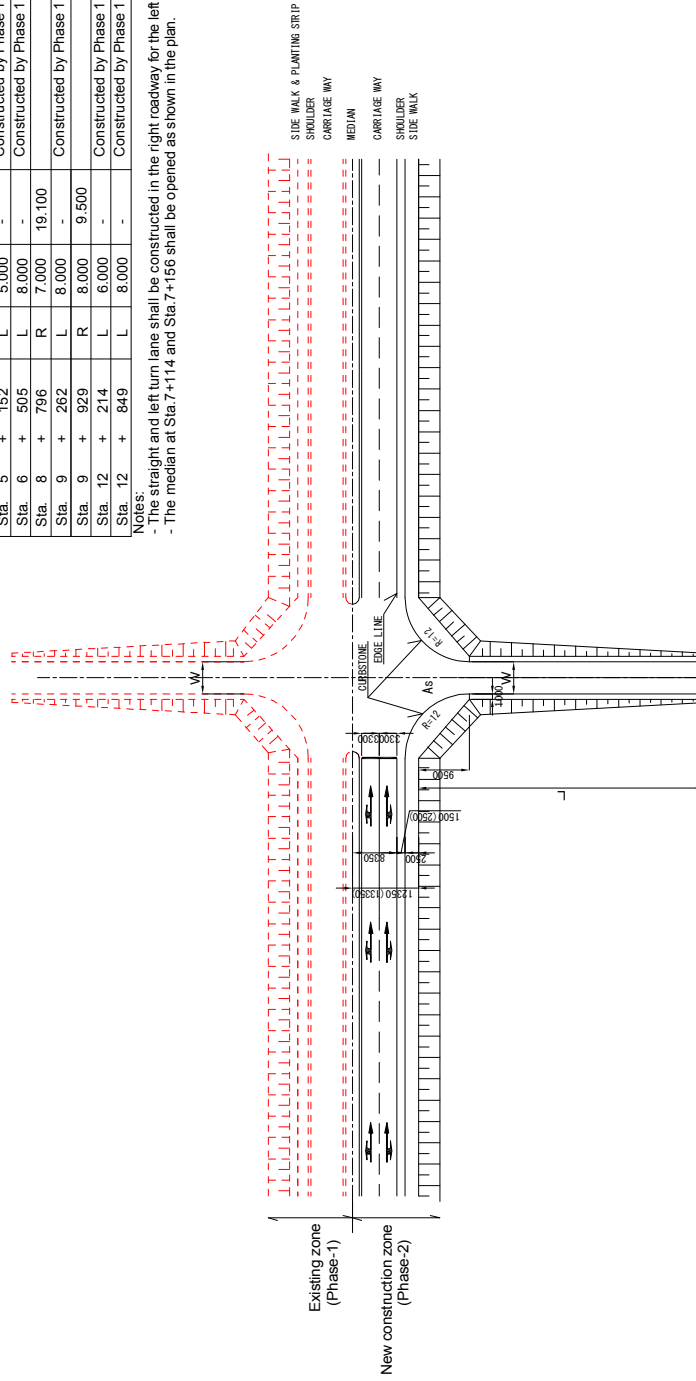
TYPE-B

Station	L or R	W	L	Remark
Sta. 0 + 462	R	12,000	9,500	Concrete pavement
Sta. 0 + 714	R	8,000	9,500	
Sta. 2 + 172	L	7,000	-	Constructed by Phase 1
Sta. 3 + 582	L	6,000	-	Constructed by Phase 1
Sta. 4 + 43	R	10,000	9,500	Constructed by Phase 1
Sta. 5 + 152	L	5,000	-	Constructed by Phase 1
Sta. 6 + 505	L	8,000	-	Constructed by Phase 1
Sta. 8 + 796	R	7,000	19,100	Constructed by Phase 1
Sta. 9 + 929	R	8,000	9,500	Constructed by Phase 1
Sta. 12 + 214	L	6,000	-	Constructed by Phase 1
Sta. 12 + 849	L	8,000	-	Constructed by Phase 1

Legend

—	Phase-2 Project
---	Phase-1 Project

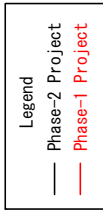
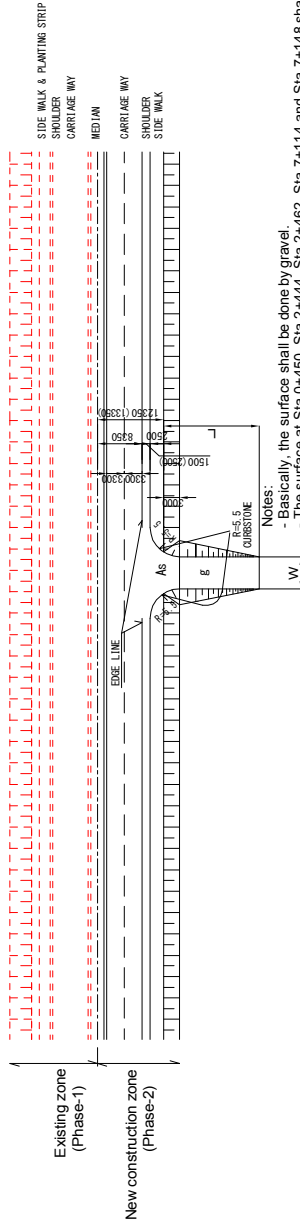
Notes:
 - The straight and left turn lane shall be constructed in the right roadway for the left access road.
 - The median at Sta.7+114 and Sta.7+156 shall be opened as shown in the plan.



MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	TITLE : ACCESS ROAD TYPE-B	
			Drawing No.	AR-2
			SCALE	S=1/1000
			DATE	DEC. 2016

TYPE-C S=1/1000

INTERSECTION TYPE-C



Notes:
 - Basically, the surface shall be done by gravel.
 - The surface at Sta.0+450, Sta.2+444, Sta.7+114 and Sta.7+148 shall be done by concrete.

TYPE-C	Station	L or R	W	L
Sta. 0	+ 450	R	6.000	4.000
Sta. 0	+ 545	R	6.000	3.000
Sta. 0	+ 598	R	6.000	3.000
Sta. 0	+ 630	R	8.000	3.000
Sta. 0	+ 660	R	8.000	3.000
Sta. 0	+ 757	R	6.000	3.000
Sta. 0	+ 816	R	5.000	3.000
Sta. 0	+ 841	R	6.000	3.000
Sta. 0	+ 977	R	6.000	3.000
Sta. 1	+ 168	R	5.000	6.700
Sta. 1	+ 236	R	6.000	6.900
Sta. 1	+ 720	R	5.000	3.000
Sta. 1	+ 773	R	5.000	3.000
Sta. 1	+ 45	R	6.000	3.000
Sta. 2	+ 65	R	6.000	3.000
Sta. 2	+ 199	R	12.000	3.000
Sta. 2	+ 224	R	6.000	3.000
Sta. 2	+ 293	R	6.000	3.000
Sta. 2	+ 444	R	6.000	4.500
Sta. 2	+ 462	R	6.000	3.400
Sta. 2	+ 489	R	5.000	3.400
Sta. 2	+ 519	R	5.000	3.000
Sta. 2	+ 555	R	8.000	3.000
Sta. 2	+ 636	R	6.000	3.000
Sta. 2	+ 653	R	6.000	3.700
Sta. 2	+ 689	R	6.000	3.000
Sta. 2	+ 833	R	6.000	7.300
Sta. 3	+ 158	R	6.000	3.300
Sta. 3	+ 177	R	12.000	7.700
Sta. 3	+ 385	R	6.000	3.000
Sta. 3	+ 613	R	5.000	6.200
Sta. 3	+ 617	R	6.000	3.000
Sta. 3	+ 654	R	6.000	3.000
Sta. 3	+ 687	R	6.000	3.000
Sta. 3	+ 769	R	6.000	3.000

TYPE-C	Station	L or R	W	L
Sta. 3	+ 900	R	6.000	5.400
Sta. 4	+ 159	R	7.000	3.000
Sta. 4	+ 198	R	6.000	3.000
Sta. 4	+ 370	R	15.000	3.000
Sta. 4	+ 492	R	5.000	9.100
Sta. 4	+ 747	R	10.000	3.000
Sta. 4	+ 795	R	6.000	3.000
Sta. 4	+ 864	R	6.000	3.000
Sta. 4	+ 907	R	6.000	3.000
Sta. 5	+ 26	R	6.000	5.000
Sta. 5	+ 166	R	5.000	3.000
Sta. 5	+ 230	R	8.000	3.000
Sta. 5	+ 266	R	6.000	3.000
Sta. 5	+ 343	R	6.000	3.000
Sta. 5	+ 423	R	5.000	3.000
Sta. 5	+ 630	R	6.000	3.000
Sta. 5	+ 654	R	8.000	3.000
Sta. 5	+ 678	R	6.000	3.000
Sta. 5	+ 694	R	6.000	3.000
Sta. 5	+ 814	R	6.000	3.000
Sta. 5	+ 850	R	8.000	3.000
Sta. 5	+ 926	R	5.000	3.000
Sta. 5	+ 973	R	5.000	3.000
Sta. 6	+ 223	R	8.000	3.000
Sta. 6	+ 350	R	6.000	3.000
Sta. 6	+ 523	R	5.000	3.000
Sta. 6	+ 690	R	5.000	4.000
Sta. 6	+ 747	R	5.000	3.000
Sta. 6	+ 804	R	5.000	3.000
Sta. 6	+ 861	R	5.000	4.200
Sta. 6	+ 889	R	10.000	3.000
Sta. 6	+ 968	R	5.000	3.000
Sta. 7	+ 25	R	10.000	4.100
Sta. 7	+ 114	R	7.000	11.700
Sta. 7	+ 148	R	7.000	11.700
Sta. 7	+ 239	R	10.000	3.000

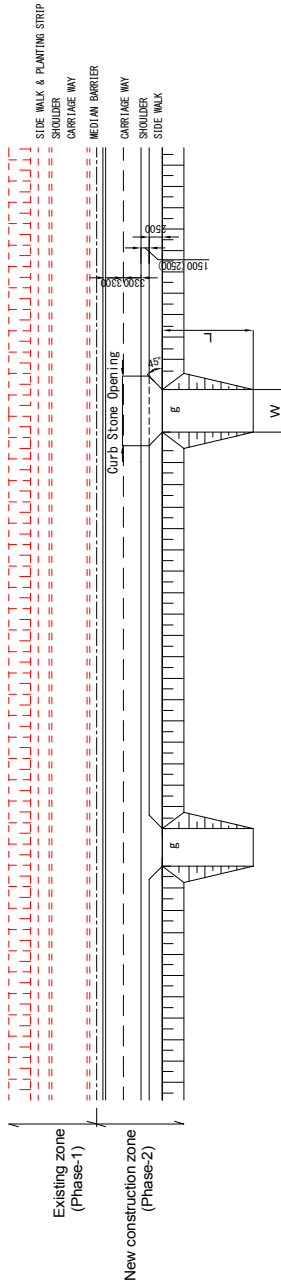
TYPE-C	Station	L or R	W	L
Sta. 7	+ 301	R	5.000	3.000
Sta. 7	+ 529	R	5.000	3.000
Sta. 7	+ 567	R	6.000	3.000
Sta. 7	+ 640	R	6.000	3.000
Sta. 7	+ 661	R	5.000	3.000
Sta. 7	+ 702	R	6.000	3.000
Sta. 7	+ 919	R	6.000	4.600
Sta. 8	+ 21	R	6.000	3.000
Sta. 8	+ 73	R	6.000	3.000
Sta. 8	+ 150	R	5.000	3.000
Sta. 8	+ 205	R	6.000	3.000
Sta. 8	+ 467	R	5.000	4.400
Sta. 8	+ 604	R	6.000	3.000
Sta. 8	+ 644	R	6.000	6.000
Sta. 8	+ 888	R	5.000	3.000
Sta. 9	+ 55	R	10.000	3.000
Sta. 9	+ 95	R	6.000	3.000
Sta. 9	+ 120	R	6.000	3.000
Sta. 9	+ 190	R	8.000	3.000
Sta. 9	+ 340	R	4.000	7.900
Sta. 9	+ 443	R	4.000	3.000
Sta. 9	+ 474	R	6.000	3.000
Sta. 9	+ 640	R	6.000	3.000
Sta. 9	+ 666	R	4.000	3.000
Sta. 9	+ 774	R	5.000	3.000
Sta. 9	+ 802	R	6.000	3.000
Sta. 9	+ 990	R	6.000	3.000
Sta. 10	+ 120	R	6.000	3.000
Sta. 10	+ 208	R	4.000	3.000
Sta. 10	+ 247	R	6.000	3.000
Sta. 10	+ 316	R	6.000	3.000
Sta. 10	+ 333	R	6.000	3.000
Sta. 10	+ 435	R	4.000	3.000
Sta. 10	+ 479	R	6.000	3.000
Sta. 10	+ 633	R	6.000	3.000
Sta. 10	+ 685	R	6.000	3.000

TYPE-C	Station	L or R	W	L
Sta. 10	+ 704	R	10.000	3.000
Sta. 11	+ 200	R	5.000	4.800
Sta. 11	+ 312	R	6.000	3.000
Sta. 11	+ 358	R	4.000	3.000
Sta. 11	+ 552	R	6.000	3.000
Sta. 11	+ 752	R	5.000	3.000
Sta. 11	+ 849	R	6.000	3.000
Sta. 11	+ 866	R	6.000	3.000
Sta. 11	+ 966	R	6.000	3.000
Sta. 12	+ 79	R	4.000	3.000
Sta. 12	+ 147	R	6.000	3.000
Sta. 12	+ 205	R	5.000	3.000
Sta. 12	+ 305	R	6.000	3.000
Sta. 12	+ 345	R	4.000	3.000
Sta. 12	+ 541	R	6.000	3.000
Sta. 12	+ 685	R	5.000	3.000
Sta. 12	+ 768	R	4.000	3.000
Sta. 12	+ 807	R	6.000	3.000
Sta. 12	+ 895	R	4.000	3.000
Sta. 12	+ 932	R	8.000	3.000

MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY, KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	TITLE : ACCESS ROAD TYPE-C	
			Drawing No.	AR-3
			SCALE	S=1/1000
			DATE	DEC. 2016

TYPE-D S=1/1000

ENTRANCE (FOR VEHICLE)



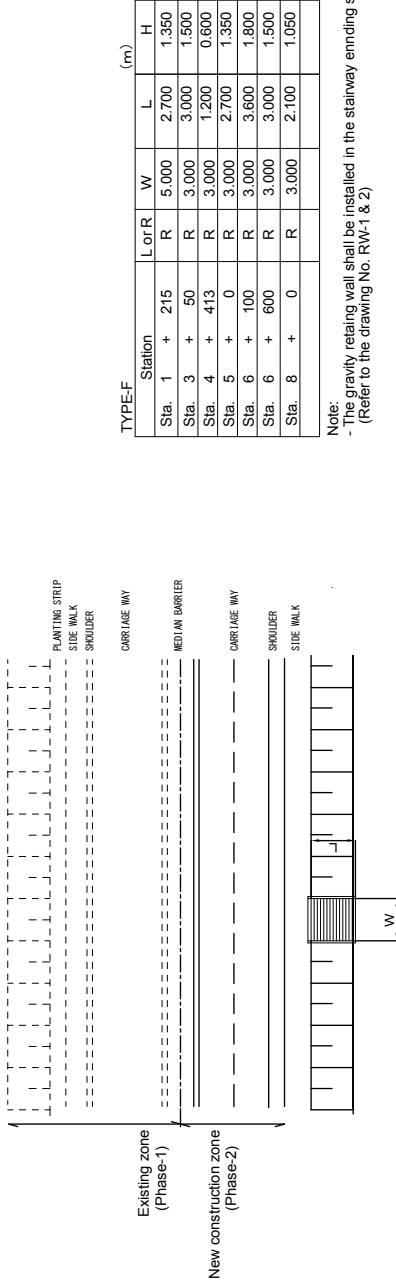
Notes:
 - Basically, the surface shall be done by gravel.
 - The surface at Sta.3+725, Sta.4+439, Sta.5+525, Sta.12+821 and Sta.13+50 shall be done by concrete.

TYPE-D				TYPE-D			
Station	L or R	W	L	Station	L or R	W	L
Sta. 0 + 501	R	4.000	1.700	Sta. 5 + 483	R	5.000	5.000
Sta. 0 + 910	R	5.000	2.800	Sta. 5 + 525	R	5.000	2.890
Sta. 0 + 931	R	5.000	2.000	Sta. 5 + 620	R	5.000	2.890
Sta. 1 + 73	R	6.000	4.500	Sta. 5 + 750	R	5.000	2.890
Sta. 1 + 123	R	5.000	5.700	Sta. 6 + 322	R	5.000	5.600
Sta. 1 + 633	R	5.000	3.400	Sta. 7 + 732	R	6.000	2.890
Sta. 1 + 940	R	5.000	2.890	Sta. 7 + 789	R	4.000	2.890
Sta. 1 + 960	R	5.000	2.890	Sta. 7 + 850	R	4.000	12.200
Sta. 2 + 15	R	5.000	2.890	Sta. 8 + 320	R	5.000	16.200
Sta. 2 + 793	R	5.000	2.890	Sta. 8 + 399	R	4.000	19.800
Sta. 3 + 250	R	6.000	3.400	Sta. 8 + 545	R	5.000	4.000
Sta. 3 + 452	R	6.000	6.200	Sta. 8 + 926	R	6.000	5.300
Sta. 3 + 595	R	5.000	2.890	Sta. 9 + 320	R	5.000	10.800
Sta. 3 + 725	R	6.000	2.890	Sta. 9 + 600	R	4.000	9.100
Sta. 4 + 216	R	8.000	2.890	Sta. 10 + 368	R	6.000	2.890
Sta. 4 + 306	R	14.000	2.890	Sta. 10 + 460	R	5.000	2.890
Sta. 4 + 439	R	15.000	2.890	Sta. 10 + 794	R	4.000	13.000
Sta. 4 + 582	R	5.000	2.890	Sta. 10 + 960	R	5.000	15.600
Sta. 4 + 684	R	6.000	2.890	Sta. 11 + 0	R	5.000	7.000
Sta. 4 + 715	R	5.000	3.400	Sta. 11 + 227	R	5.000	2.890
Sta. 4 + 878	R	5.000	2.890	Sta. 12 + 386	R	5.000	1.890
Sta. 5 + 89	R	6.000	2.890	Sta. 12 + 821	R	9.000	2.600
				Sta. 13 + 50	R	4.000	1.890

MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	TITLE: ACCESS ROAD TYPE-D		Drawing No. AR-4
					SCALE S=1/1000
					DATE DEC. 2016

TYPE-F

ENTRANCE (FOR PEDESTRIAN) S=1/1000

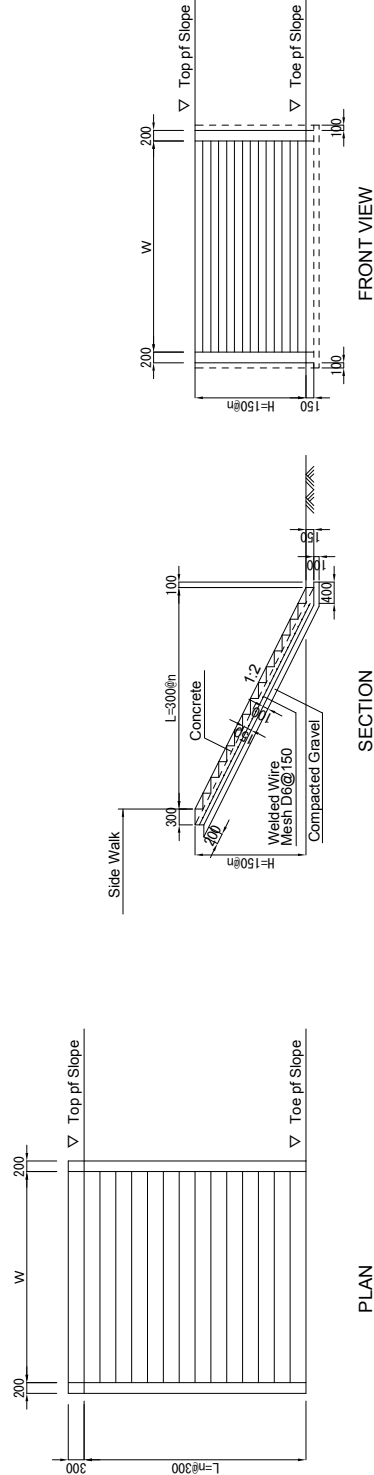


TYPE-F

Station	L or R	W	L	H
Sta. 1 + 215	R	5.000	2.700	1.350
Sta. 3 + 50	R	3.000	3.000	1.500
Sta. 4 + 413	R	3.000	1.200	0.600
Sta. 5 + 0	R	3.000	2.700	1.350
Sta. 6 + 100	R	3.000	3.600	1.800
Sta. 6 + 600	R	3.000	3.000	1.500
Sta. 8 + 0	R	3.000	2.100	1.050

Note:
 - The gravity retaining wall shall be installed in the stairway ending side of Sta.6+100.
 (Refer to the drawing No. RW-1 & 2)

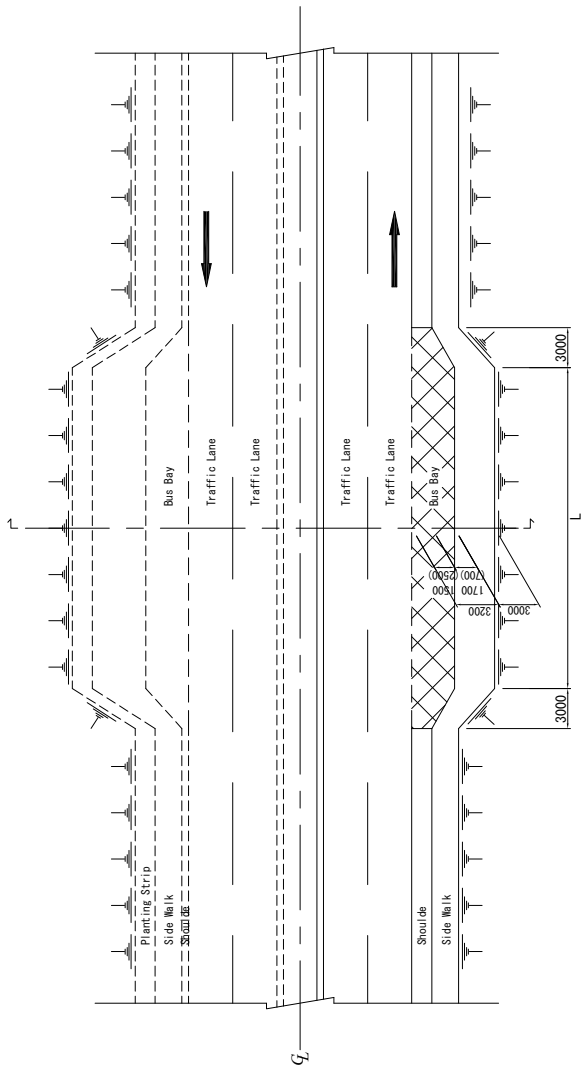
DETAILED OF STAIRWAY S=1/200



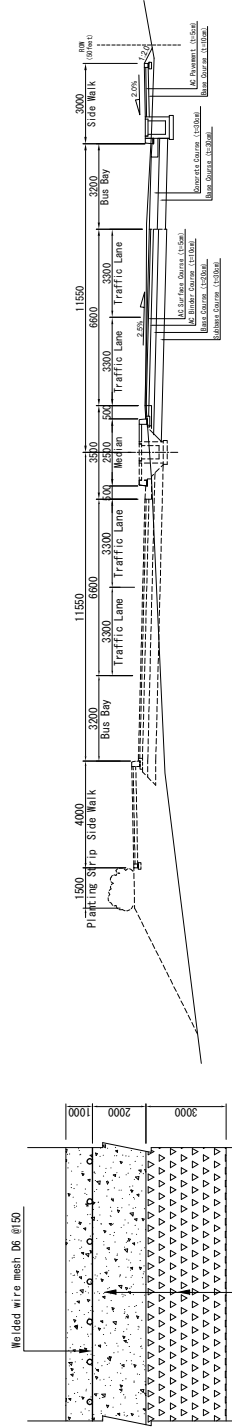
MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIO ENGINEERING CO.,LTD., INGEROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	TITLE : ACCESS ROAD TYPE-F	
			Drawing No. AR-5	AS SHOWN
			SCALE	DATE
				DEC. 2016

SCHEDULE OF BUS BAY

BUS STOP NAME	Right Side		REMARK
	L(m)		
Freetown/Old Plank Field	24		Constructed by Phase 1
CHMCO/Doe Community	47		
Jumbeo Road/Slaughter House	24		Constructed by Phase 1
Battery Factory	47		
TH7/Topoo Village	47		
Sethi Brothers/Iron Factory	47		
New Georgia Junction	47		
Supermarket Junction	47		
Bardnersville Estate Junction	47		
Former LPRG Refinery Junction	47		
Chicken Soup Factory Junction	47		
Stephen Toibert Estate	47		
New Hope Junction	47		
St. Francis Junction	47		
Lone Star Gas Station	47		
Mezoo Junction	47		
72nd Junction	47		
Plank Field	47		



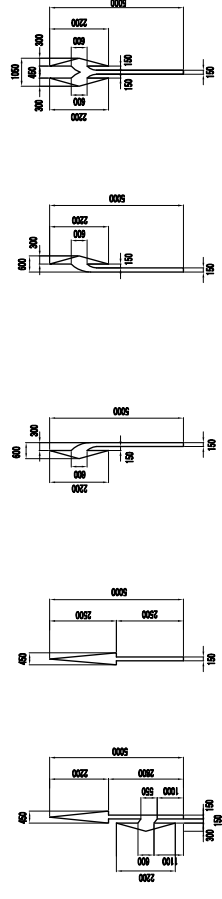
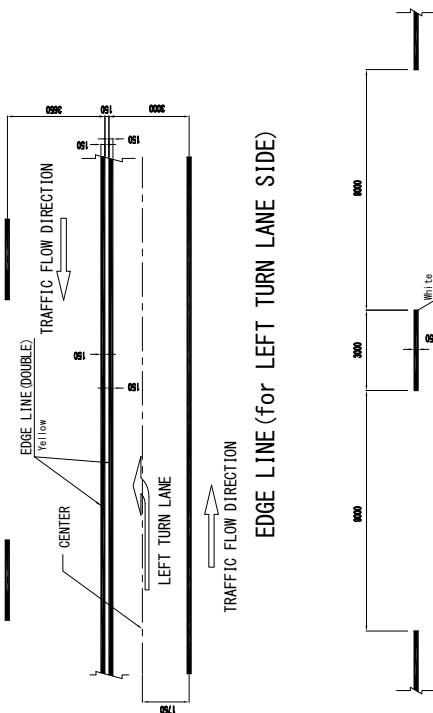
PLAN S=1/400



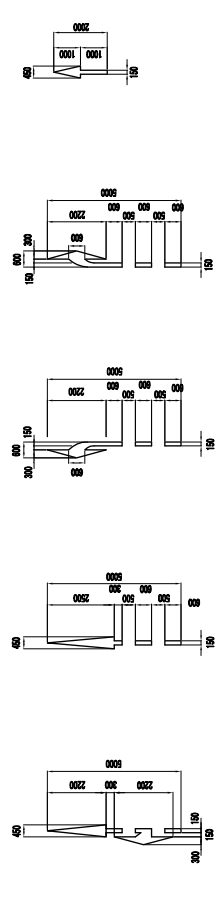
CROSS SECTION S=1/200

PAVEMENT TYPE S=1/20

MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGEROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	TITLE :	BB-1
			BUS BAY DETAIL	As Shown
			SCALE	DATE
				DEC. 2016

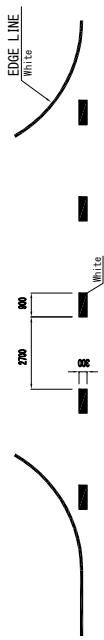


STRAIGHT AND LEFT
STRAIGHT
LEFT
RIGHT
LEFT AND RIGHT

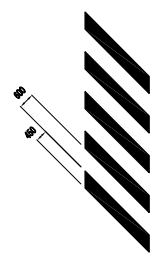


ADVANCE NOTICE STRAIGHT AND LEFT
A. N. STRAIGHT
A. N. LEFT
A. N. RIGHT
SPECIAL DIRECTION

DIRECTIONAL ARROWS



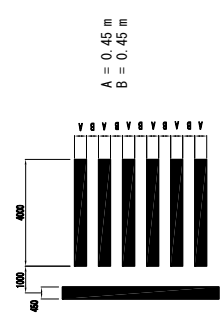
BROKEN LINE



ZEBRA

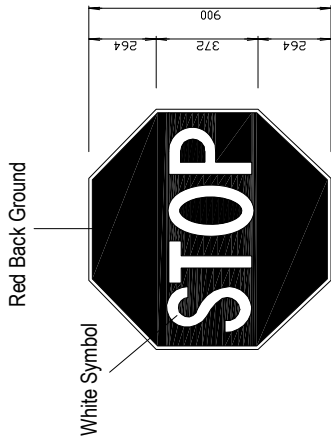
SCHEDULE OF CROSS WALK

No.	Sta.
1	0+565.5
2	2+272
3	2+568
4	2+661
5	4+252
6	5+483
7	6+109
8	6+484
9	6+655
10	7+000
11	7+460
12	9+208
13	9+822
14	10+452
15	11+389
16	11+903
17	12+555

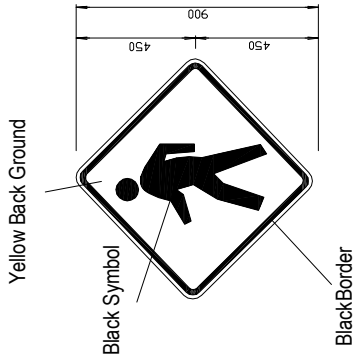


STOP LINE/CROSS WALK

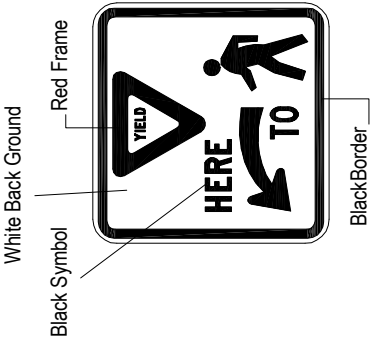
MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION	TITLE: THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA		Drawing No.	RM-1
				SCALE	S=1/200
				DATE	DEC. 2016



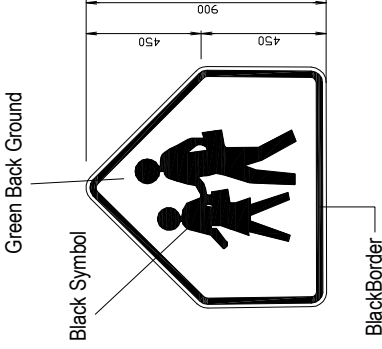
R1-1



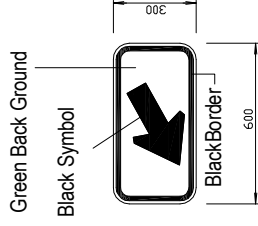
W11-2



R1-5

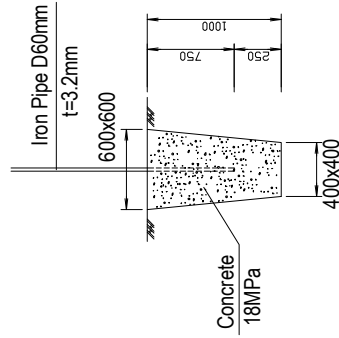


S1-1

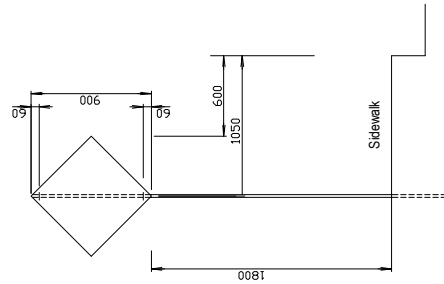


W16-7P

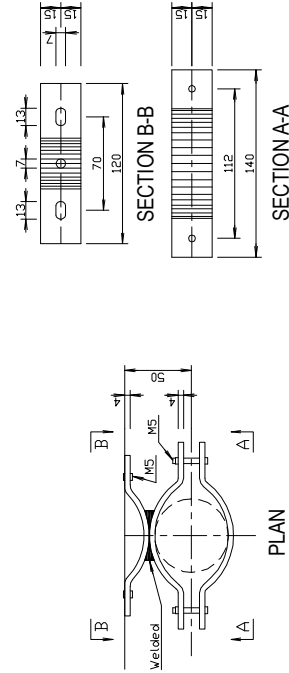
ROAD SIGN S=1/20



FOUNDATION DETAIL S=1/40

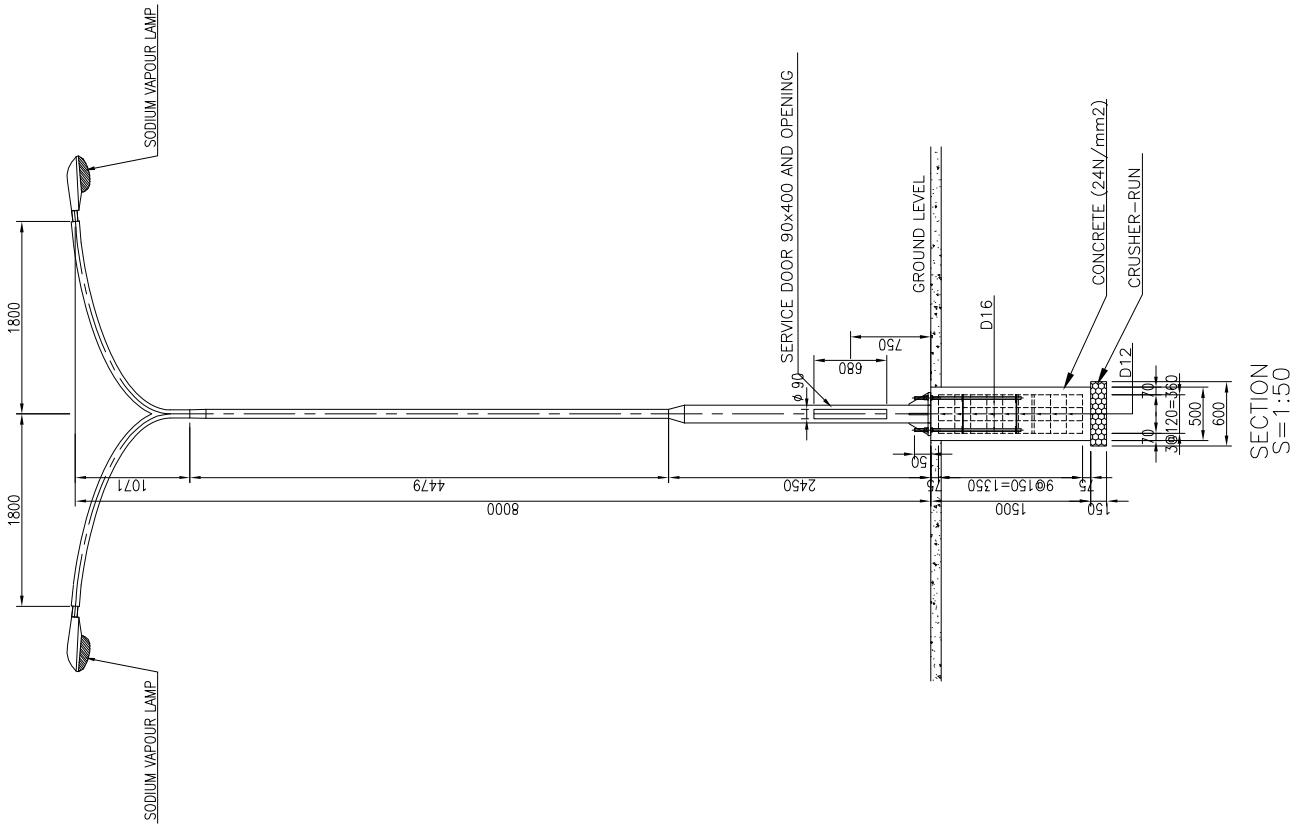


SIGN POST DETAIL S=1/40

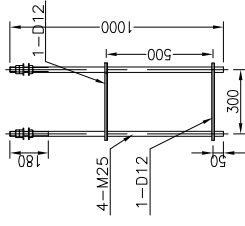
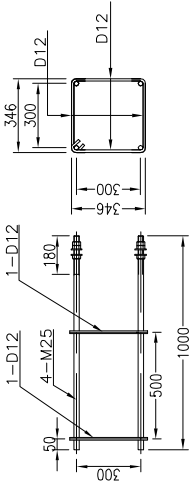


FIXING DETAIL S=1/4

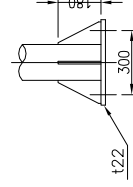
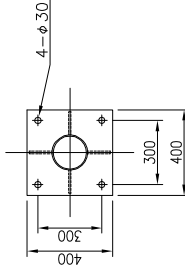
MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION		THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA		TITLE:	ROAD SIGN
					Drawing No.	RM-2
					SCALE	As Shown
				DATE	DEC. 2016	



SECTION
S=1:50



ANCHOR BOLTS
S=1:25



BASE PLATE
S=1:25

MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	TITLE:	
			DETAILED STRUCTURE OF STREET LIGHTING	
			Drawing No.	SL-1
		SCALE	AS SHOWN	
		DATE	DEC. 2016	

SCHEDULED LIST OF STREET LIGHTING

No.	MEDIAN	ROAD SIDE(L/R)	No.	MEDIAN	ROAD SIDE(L/R)	No.	MEDIAN	ROAD SIDE(L/R)	No.	MEDIAN	ROAD SIDE(L/R)
1	Sta. 0+018		121	Sta. 6+006		181	Sta. 9+003		241	Sta. 11+910	
2	Sta. 0+066		122	Sta. 6+056		182	Sta. 9+053		242	Sta. 11+960	
3	Sta. 0+116		123	Sta. 6+106		183	Sta. 9+103		243	Sta. 12+010	
4	Sta. 0+166		124	Sta. 6+156		184	Sta. 9+153		244	Sta. 12+060	
5	Sta. 0+216		125	Sta. 6+192		185	Sta. 9+203		245	Sta. 12+110	
6	Sta. 0+266		126	Sta. 6+239	L	186	Sta. 9+242		246	Sta. 12+160	
7	Sta. 0+314		127	Sta. 6+276		187	Sta. 9+282		247	Sta. 12+195	
8	Sta. 0+354		128	Sta. 6+328		188	Sta. 9+320		248	Sta. 12+233	
9	Sta. 0+385		129	Sta. 6+378		189	Sta. 9+370		249	Sta. 12+278	
10	Sta. 0+417		130	Sta. 6+428		190	Sta. 9+420		250	Sta. 12+328	
11	Sta. 0+489		131	Sta. 6+480		191	Sta. 9+470		251	Sta. 12+378	
12	Sta. 0+535		132	Sta. 6+525		192	Sta. 9+520		252	Sta. 12+428	
13	Sta. 0+581		133	Sta. 6+577		193	Sta. 9+570		253	Sta. 12+478	
14	Sta. 0+643		134	Sta. 6+627		194	Sta. 9+620		254	Sta. 12+528	
15	Sta. 0+695		135	Sta. 6+677		195	Sta. 9+670		255	Sta. 12+578	
16	Sta. 0+733		136	Sta. 6+727		196	Sta. 9+720		256	Sta. 12+628	
17	Sta. 0+783		137	Sta. 6+779		197	Sta. 9+770		257	Sta. 12+678	
18	Sta. 0+833		138	Sta. 6+831		198	Sta. 9+820		258	Sta. 12+728	
19	Sta. 0+883		139	Sta. 6+887		199	Sta. 9+870		259	Sta. 12+778	
20	Sta. 0+933		140	Sta. 6+955		200	Sta. 9+910		260	Sta. 12+828	
21	Sta. 0+983		141	Sta. 7+005		201	Sta. 9+948		261	Sta. 12+888	
22	Sta. 1+033		142	Sta. 7+055		202	Sta. 9+986		262	Sta. 12+918	
23	Sta. 1+083		143	Sta. 7+088		203	Sta. 10+036		263	Sta. 12+968	
24	Sta. 1+133		144	Sta. 7+132		204	Sta. 10+086		264	Sta. 13+018	
25	Sta. 1+183		145	Sta. 7+173		205	Sta. 10+136		265	Sta. 13+068	
26	Sta. 1+267		146	Sta. 7+210		206	Sta. 10+186		266	Sta. 13+108	
27	Sta. 1+320		147	Sta. 7+260		207	Sta. 10+236				
28	Sta. 1+373		148	Sta. 7+310		208	Sta. 10+286				
29	Sta. 1+479		149	Sta. 7+345		209	Sta. 10+336				
30	Sta. 1+532		150	Sta. 7+437		210	Sta. 10+386				
31	Sta. 1+576		151	Sta. 7+480		211	Sta. 10+436				
32	Sta. 1+615		152	Sta. 7+530		212	Sta. 10+486				
33	Sta. 1+665		153	Sta. 7+580		213	Sta. 10+536				
34	Sta. 1+715		154	Sta. 7+630		214	Sta. 10+575				
35	Sta. 1+765		155	Sta. 7+680		215	Sta. 10+622				
36	Sta. 1+815		156	Sta. 7+730		216	Sta. 10+705				
37	Sta. 1+865		157	Sta. 7+780		217	Sta. 10+755				
38	Sta. 1+915		158	Sta. 7+830		218	Sta. 10+805				
39	Sta. 1+965		159	Sta. 7+880		219	Sta. 10+855				
40	Sta. 2+015		160	Sta. 7+930		220	Sta. 10+905				
41	Sta. 2+065		161	Sta. 7+974		221	Sta. 10+955				
42	Sta. 2+115		162	Sta. 8+073		222	Sta. 11+005				
43	Sta. 2+154		163	Sta. 8+123		223	Sta. 11+055				
44	Sta. 2+193		164	Sta. 8+173		224	Sta. 11+105				
45	Sta. 2+228		165	Sta. 8+224		225	Sta. 11+155				
46	Sta. 2+278		166	Sta. 8+285		226	Sta. 11+205				
47	Sta. 2+328		167	Sta. 8+327		227	Sta. 11+236				
48	Sta. 2+378		168	Sta. 8+377		228	Sta. 11+303	L			
49	Sta. 2+428		169	Sta. 8+427		229	Sta. 11+332				
50	Sta. 2+478		170	Sta. 8+477		230	Sta. 11+380				
51	Sta. 2+528		171	Sta. 8+527		231	Sta. 11+430				
52	Sta. 2+578		172	Sta. 8+577		232	Sta. 11+480				
53	Sta. 2+628		173	Sta. 8+627		233	Sta. 11+530				
54	Sta. 2+678		174	Sta. 8+677		234	Sta. 11+580				
55	Sta. 2+728		175	Sta. 8+727		235	Sta. 11+630				
56	Sta. 2+778		176	Sta. 8+766		236	Sta. 11+680				
57	Sta. 2+828		177	Sta. 8+815		237	Sta. 11+730				
58	Sta. 2+878		178	Sta. 8+856		238	Sta. 11+780				
59	Sta. 2+928		179	Sta. 8+903		239	Sta. 11+823	L			
60	Sta. 2+978		180	Sta. 8+953		240	Sta. 11+875				

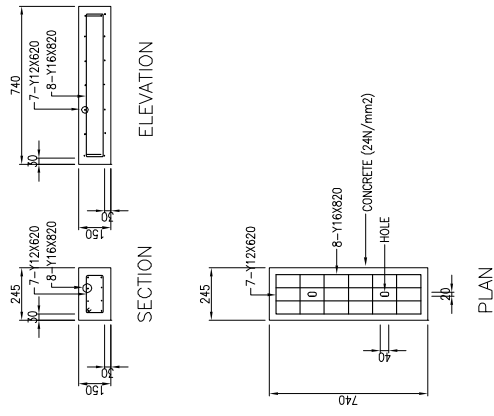
MINISTRY OF PUBLIC WORKS

JAPAN INTERNATIONAL COOPERATION AGENCY,
KATAHIRA & ENGINEERS INTERNATIONAL,
YACHIYO ENGINEERING CO.,LTD.,
INGÉROSEC CORPORATION

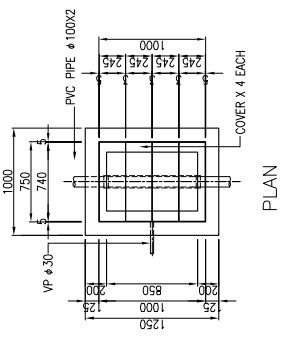
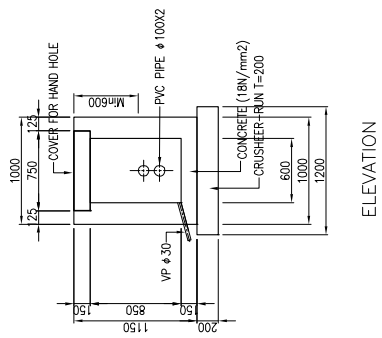
THE PREPARATORY SURVEY ON
THE PROJECT FOR
RECONSTRUCTION (PHASE-2) OF
SOMALIA DRIVE IN MONROVIA

TITLE :
SCHEDULED LIST OF
STREET LIGHTING

Drawing No. SL-2
SCALE NON SCALE
DATE DEC. 2016



COVER FOR HAND HOLE
S= 1/25



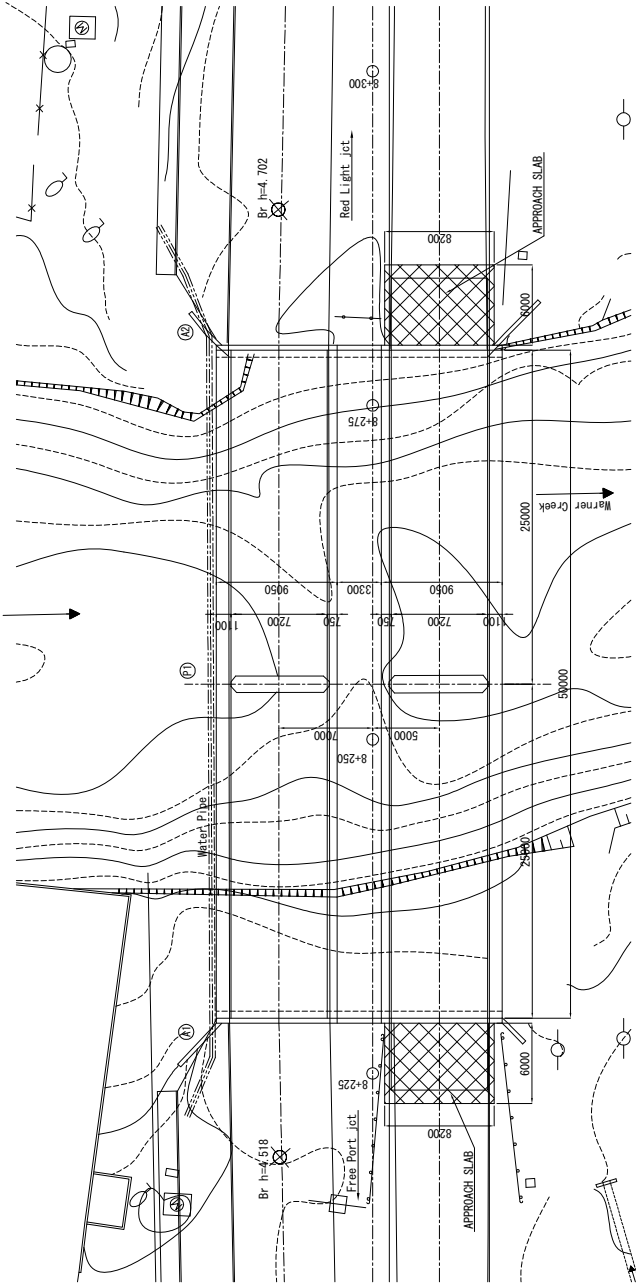
HAND HOLE (HH)
S= 1/50

- Notes:
- The duct pipes for street lighting shall be installed at median.
 - The hand hole shall be installed at every intersection.

MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO.,LTD., INGÉROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	TITLE:	HAND HOLE & DUCT PIPE	Drawing No.	HH-1
			SCALE		AS SHOWN	
			DATE		DEC. 2016	

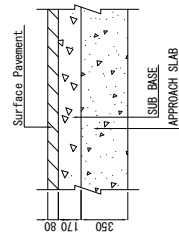
DETERIORATION OF STRIPPING AS PAVEMENT

KEY PLAN SCALE 1:400



SECTION SCALE 1:40

APPROACH SLAB



Drawing No.	BR-1
SCALE	AS SHOWN
DATE	DEC. 2016

TITLE:
DOUBLE BRIDGE
PLAN & SECTION OF APPROACH SLAB

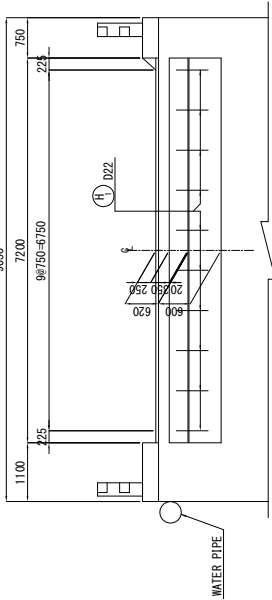
THE PREPARATORY SURVEY ON
THE PROJECT FOR
RECONSTRUCTION (PHASE-2) OF
SOMALIA DRIVE IN MONROVIA

JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL,
YACHIYO ENGINEERING CO.,LTD.,
INGEROSEC CORPORATION

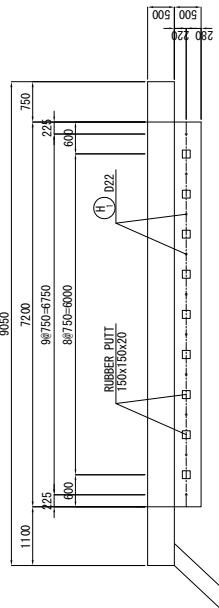
MINISTRY OF PUBLIC WORKS

BAR ARRANGEMENT OF A1(A2) APPROACH SLAB SCALE 1:100

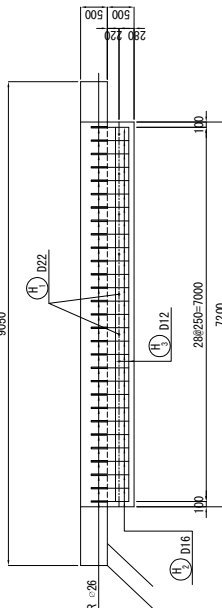
ELEVATION 1 - 1



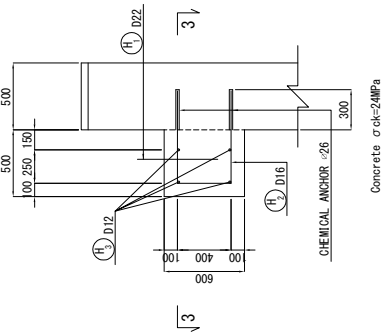
PLAN 2 - 2



3 - 3

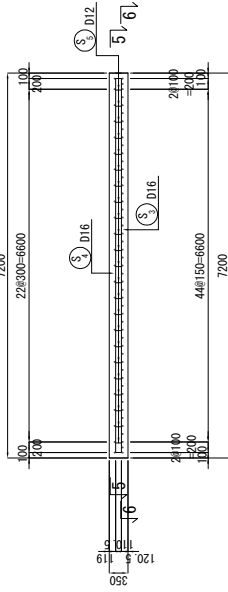


DETAIL SCALE 1:40

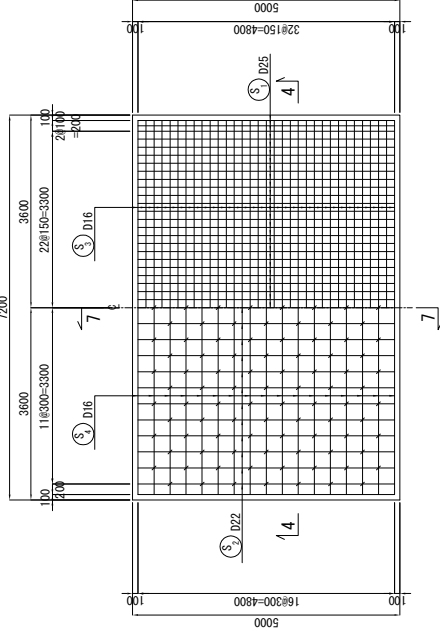


- Approach Slab for Southern Bridge
- Excavation at back side of Abutments
 - Attaching Corbel at Abutments
 - 2-1 Drilling Existing Abutment for Anchor bar
 - 2-2 Placing Reinforcing bar and setting Form
 - 2-3 Pouring Concrete
 - 2-4 Removal Form after curing the Concrete
 - Backfilling around Corbel and Compaction of Base course.
 - Making Approach Slab
 - 4-1 Placing Reinforcing bar
 - 4-2 Setting Form
 - 4-3 Pouring Concrete
 - 4-4 Removal Form after curing the Concrete
 - Asphalt concrete Surface

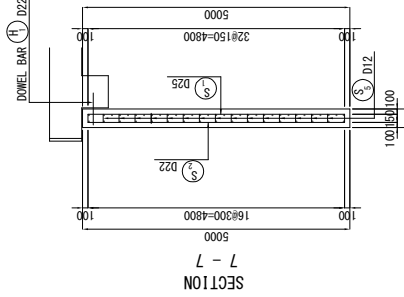
ELEVATION 4 - 4



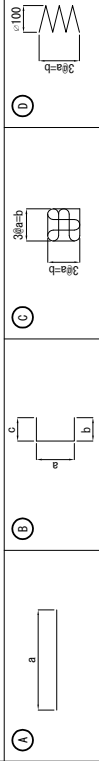
PLAN 6 - 6



SECTION 7 - 7



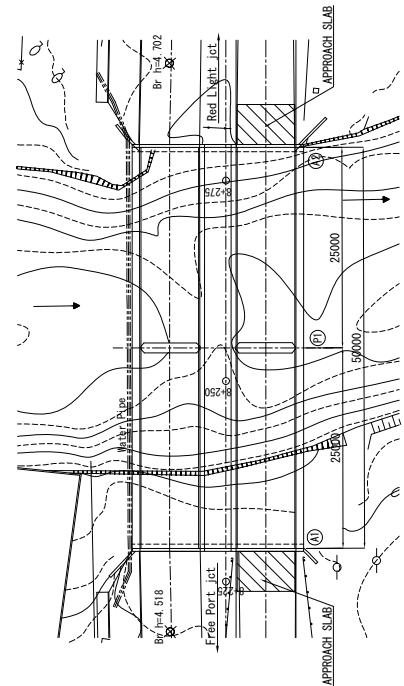
BAR BENDING DIAGRAM



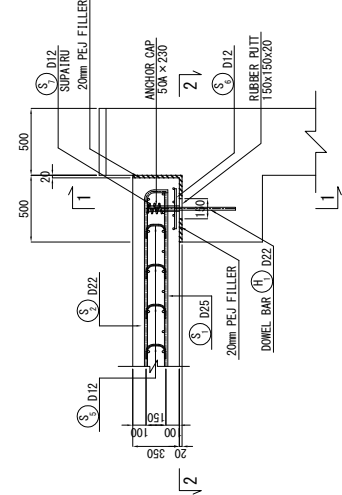
SCHEDULE OF REINFORCEMENT

STRUCTURE COMPONENT	BAR MARK	SIZE (mm)	QTY.	SPACING (mm)	BAR SHAPE	DIMENSION (mm)							TOTAL LENGTH (m)	UNIT WEIGHT (kg/m)	TOTAL WEIGHT (kg)	REMARKS	
						a	b	c	d	e							
APPROACH SLAB	S1	D25	49	AS SHOWN	A	4800							4800	235.20	3.653	906	
	S2	D25	25	AS SHOWN	B	4800	150	150					5100	127.50	2.984	380	
	S3	D16	33	AS SHOWN	A	7000							7000	231.00	1.578	365	
	S4	D16	17	AS SHOWN	B	7000	110	110					7200	122.74	1.578	194	
	S5	D12	172	AS SHOWN	B	139	100	100					340	58.48	0.888	52	
	S6	D12	20	AS SHOWN	C	100	300						1370	27.40	0.888	24	
	S7	D12	10	AS SHOWN	D	50	150						960	9.60	0.888	9	
	H1	D22	10	AS SHOWN	A	600						600	6.00	2.984	18		
	H2	D16	29	AS SHOWN	B	400	690	690				1790	51.62	1.578	81		
	H3	D12	4	AS SHOWN	D	7000						7000	28.00	0.888	112		
TOTAL 2141 kg x 2 = 4282 kg													SABTOTAL = 2141 kg				

KEY PLAN



DETAIL SCALE 1:40



MINISTRY OF PUBLIC WORKS	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL, YACHIYO ENGINEERING CO., LTD., INGEROSEC CORPORATION	THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION (PHASE-2) OF SOMALIA DRIVE IN MONROVIA	TITLE: DOUBLE BRIDGE BAR ARRANGEMENT OF A1(A2) APPROACH SLAB	Drawing No. BR-2 SCALE AS SHOWN DATE DEC. 2016
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2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

The basic concepts for implementation of the Project are as follows;

On reaching an agreement and signing the Exchange of Note by both Governments of Japan and Liberia, the Project will be implemented in accordance with the guideline of Japan's Grant Aid.

The Ministry of Public Works (MPW) of Government of Liberia (GoL) are responsible for the Project implementation.

Assistance in tendering and construction supervision will be undertaken by a Japanese consulting firm in accordance with a contract between the MPW and the consultant.

A Japanese pre-qualified tenderer who has been awarded the contract by the MPW will undertake the implementation of the Project.

Main concepts for the implementation are as follows;

Materials and labor for the project are procured in Liberia as many as possible. If required qualities and capacities are not enough, materials and labor can be procured effectively from third countries and/or Japan.

Implementation method and schedule for the Project should be planned on the basis of local meteorological, topographic and geological conditions as well as any natural conditions affected by the construction works.

General and easy method without specific equipment and technology shall be planned.

Appropriate standards and specifications for construction shall be proposed, and site organizations of both the contractor and consultant shall be arranged to comply abovementioned standards and specifications.

Facilities to strictly secure safety for construction staff and third parties shall be installed. Especially, educative training on environment and anti- HIV/AIDS, Ebola shall be carried out.

Protection against water pollution and flooding by the implementation and installation and operation of asphalt plants, quarry sites and borrow pits shall be done in order to preserve environment. Construction waste shall be treated and/or dumped in a proper site specified by the Government of Liberia.

2-2-4-2 Implementation Conditions

Construction plan and method should be prepared in order to secure the safety of the construction staff and the third parties first of all, and they should be selected to consider preservation of environment for the road users and the road side residents.

Present Road Conditions

The project road's condition is damaged due to increase traffic volume by a growth of economic. This subject road is main road for connecting Monrovia to east side area, and caused sever traffic jams especially during the peak hours in the morning and evening, and commuters to office, school, and/or clinic are suffering from such conditions every day.

Therefore, safety and traffic management for road users and mitigation measures of environment for road side residents shall be considered in line with the construction planning.

Present Road Side Facility Conditions

The project is intending to construct main road, which is going to connect to the center of Monrovia that are important for citizens in the Monrovia. Right of way of the proposed roads is secured since long time ago to minimize adverse impacts, such as massive land acquisitions, in the established residential and commercial areas.

There are many school and church along the Somalia Drive. Therefore, complete road blocks should be avoided during the construction stage by providing necessary accessibilities to all road users and residents as the first priority.

Climate and Natural Conditions

City of Monrovia is classified marine climate of tropical monsoon, and there are two seasons; relatively cool dry season (November to April) and relatively warm rainy season (May to October).

The dry season has little rain and parched, but the rain season has rain fall average 6,260mm/ year.

The average temperature throughout a year is 23 degree. The change of temperature is not big.

Average/month in Monrovia Average rain fall data/month (mm)	Rain fall data (mm)											
	2008	2009	2010	2011	2012	2013	2014	2015				
Jan	31.7	0.0	45.4	16.0	59.5	25.6	45.3	35.5	26.0			
Feb	69.9	223.3	5.2	73.1	54.4	34.6	55.7	42.5	70.6			
Mar	119.5	57.5	49.4	305.1	90.1	90.3	72.5	110.6	180.5			
Apr	204.8	137.1	23.4	363.8	167.3	200.4	248.0	190.4	308.0			
May	542.2	434.7	381.0	889.0	527.8	490.6	593.0	531.2	490.5			
Jun	1,189.2	784.0	1,510.6	1,481.5	2,182.4	778.6	908.3	983.1	890.4			
Jul	858.2	1,431.4	18.3	1,076.1	543.2	994.8	1,043.5	879.3	879.3			
Aug	985.5	1,089.7	668.7	1,597.8	1,076.4	903.7	848.0	809.2	890.3			
Sep	1,026.6	1,392.3	1,044.6	1,167.1	1,334.9	789.2	997.2	798.0	689.1			
Oct	863.7	886.9	1,104.6	842.9	813.8	869.3	849.7	679.3	863.4			
Nov	276.4	204.2	465.2	144.7	482.6	135.7	137.8	215.7	425.5			
Dec	92.0	143.2	22.1	262.5	12.6	98.9	13.3	68.9	114.5			
Average rain fall data /year (2008-2015)	6,260.4	6,784.3	5,338.5	8,219.6	7,345.0	5,411.7	5,812.3	5,343.7	5,828.1			

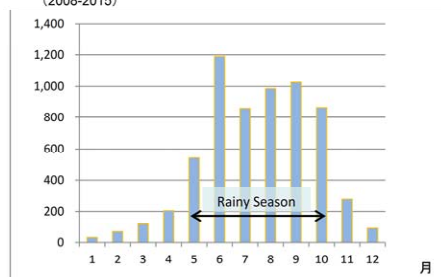


Figure 2.2-10 Rain fall data in Monrovia

Terrestrial formation is composed of the Edina Sandstone, Paynseville Sandstone and Fluvial & Deltac Deposits.

Construction should be concentrated during the total 6 months long dry seasons. Especially pavement works should be scheduled with some allowance, because the works will be troubled if it rains.

Safety Management for Road Side Residents, Road Users, and Construction Personnel

During the construction stage, carriageway and sidewalk will be provided within the right-of-way to secure smooth traffic flows on the roads under construction at particular important segments.

i. Safety for Road Side Residents:

- ✓ Construction yards will be clearly separated and off-limited from general public by using security facilities such as fences, barricades, safety cones, lighting signs, construction signboard, traffic control signboards, detour routes indication boards, and so on as well as traffic controllers.
- ✓ Prevention measures to the heavy machine drivers and operators shall be carried out through periodical traffic and construction safety educations.

ii. Safety Management to Construction Personnel:

- ✓ Guard persons will be provided to avoid collision between heavy machines and ordinary vehicles, pedestrians, and bicycles.

iii. Consideration for Environment

- ✓ Debris and waste from removal of the existing pavement and bridges should be treated with proper manner to mitigate the environmental adverse impacts.
- ✓ Selection of borrow pits will be made with consultation of the relevant authorities, and at the location with the least negative impacts to the environment.
- ✓ Construction methods causing vibration and noise should be avoided during early morning and night time.
- ✓ Dust control measures shall be carried by spraying water promptly.
- ✓ Provision of information and educative training on labour safety, public health (malaria, sex related disease, AIDS/HIV, Ebola, etc), natural environment preservation measures should be conducted for the construction work forces.

2-2-4-3 Scope of Works

Undertakings of both Governments of Japan and Liberia are listed in Table 2.2-14.

Table 2.2-14 Undertakings of the Both Governments

Items	Contents	Undertaken by		Remarks
		Japan	Liberia	
Procurement of Materials & Equipments	Procurement & Transportation	√		
Preparation Works	Lands & Right of Way Acquisitions		√	Including Spaces for Site Office, Stock Yard, Work Shop, etc.
	Relocation of Encroached Kiosks and Other Facilities		√	
	Provision of Borrow Pits and Quarry Sites		√	
	Provision of Waste Disposal Areas		√	
	Other Works	√		
Relocation & Removal of Various Obstacles	Relocation of Underground & Aerial Obstacles		√	Including Electric Poles & Wires, Telephone Poles & Cables, Water Pipes, Sewer Pipes, Optical Fibre Cables, Billboards & Signboards, etc.
	Removal of Existing Trees		√	
Main Works	Road & Intersection Improvement Works	√		
Supplemental Works	Underground Utility Ducts Installation Works		√	Except Hand Holes for Traffic Signals around Intersections
	Traffic Safety Facilities Installation	√		

2-2-4-4 Consultant Supervision

A Japanese consultant will carry out detailed design, assistance in tendering and construction supervision in accordance with the consultant contract agreed by the Government of Liberia and the Consultant.

(1) Detailed Design Services

The following services will be carried out as the Detailed Design Services by the Consultant;

- ✓ To confirm the contents of the Project with the Implementing Agencies in Liberia through discussions, detailed designs, and field investigations
- ✓ To prepare the detailed design and drawings, wherever necessary
- ✓ To review the procurement plan and project cost estimate, wherever necessary

Period for the Detailed Design Service will be as follows;

- ✓ 4.0 months from the verification of the agreement of the detailed design.

(2) Tender Related Services

The following services will be carried out as the Tender Related Services in the period from the tender notice to the construction contract by the Consultant;

- ✓ Preparation of Tender Documents (it will be prepared in the Detailed Design Services)
- ✓ Tender Notice
- ✓ Pre-Qualification
- ✓ Tendering
- ✓ Tender Evaluation
- ✓ Contract Facilitation

Period for the Tender Related Services will be as follows;

- ✓ 3.0 months from the completion of the detailed design.

(3) Construction Supervision Services

The following services will be carried out as the Construction Supervision Services of the construction to be executed by the Contractor according to the contract and implementation plan by the Consultant. Major items are as follows;

- ✓ Inspections and Approvals of the Site Surveys
- ✓ Inspections and Approvals of the Construction Plans
- ✓ Quality Control
- ✓ Progress Control
- ✓ Measurement of the Works
- ✓ Inspection of the Safety Aspects
- ✓ Final Inspection and Delivery

The Consultant will provide a Resident Engineer and an assistant Engineer. During the construction, the Consultant will coordinate with the officer-in-charge for work safety management of the Contractor to prevent any accidents at the site in advance.

2-2-4-5 Quality Control Plan

Quality control plans for concrete works and earth & pavement works are shown in Table 2.2-15 and Table 2.2-16, respectively;

Table 2.2-15 Quality Control Plan for Concrete Works

Item	Test Item	Test Method (Specification)	Frequency of Tests
Cement	Physical Property Test	AASHTO M85	Once before trail mix; thence once in every 500m ³ of concrete or when material is changed
Fine Aggregate	Physical Property Test	AASHTO M6	Once before trail mix; thence once in every 500m ³ or when material source is changed
	Sieve Analysis	AASHTO T27	Once a month
Course Aggregate	Physical Property Test	AASHTO M80	Once before trail mix; thence once in every 500m ³ or when material source is changed
	Sieve Analysis	AASHTO T27	Once a month
Water	Quality Test	AASHTO T26	Once before trail mix
Concrete	Slump Test	AASHTO T119	Twice a day
	Air Content Test	AASHTO T121	Twice a day
	Compressive Strength Test	AASHTO T22	6 specimens in each concreting. In case of large amount in each concreting, 6 specimens in every 75 m ³ (3 for 7-day strength and 3 for 28-day strength)
	Temperature Test	—	Twice a day
	Salinity Test	—	Twice a day

Table 2.2-16 Quality Control Plan for Earth & Pavement Works

Item	Test Item	Test Method (Specification)	Frequency of Tests
Embankment	Field Density Test	AASHTO T191	Once every 500 m ³
Subgrade & Base Course	Filed Compaction Test	AASHTO T180	Before trial execution, and when material is changed
	Modified CBR	AASHTO T193	Once before trial execution, and when material is changed
	Field Density Test	AASHTO T191	Twice every 1,000 m ²
Asphalt Concrete (Surface & Binder Course)	Sieve Analysis of Aggregate	AASHTO T27	Once before trial execution, and when material is changed
	Abrasion Test of Aggregate	AASHTO T96	Once before trial execution, and when material is changed
	Density Test of Asphalt Mixture	AASHTO T166	Once every 1,000 m ²
	Temperature of Asphalt Mixture	Temperatures while Carrying, Coating and Rolling	Once every 1 Truck

2-2-4-6 Procurement Plan

(1) Construction Materials Procurement Plan

All construction materials necessary for the Project such as sands, aggregates, crushed stones, ready-mixed concretes (including site production) and lumbers are usually available in Liberia markets either locally or through imports.

The procurement policies for major materials are as follows;

Procurement in Liberia when materials are available in domestic markets,

Procurement by importing from Japan and/or third countries when materials are not available in Liberia. The exporting countries will be decided by taking quality, price, availability and supply period into consideration.

Procurement plan for major materials is shown in Table 2.2-17.

Table 2.2-17 Procurement Plan for Major Materials

Item	Procured from			Remarks
	Liberia	Japan	Third Country	
Materials for Structures				
Crushed Stone (including for Footing)	√			
Cement	√			
Sand (for Concrete)	√			
Subgrade Material	√			
Ready Mixed Concrete	√			
Crushed Stone (for Asphalt Mixture)	√			
Straight Asphalt			√	
Modified Asphalt		√		
Re-bar ; D9 ~ D16 mm	√			
Section Steel			√	
Rubble (for Wet Masonry)	√			
PVC Pipe ; D = 150 ~ 200 mm	√			
RC Pipe ; D = 300 ~ 700 mm	√			
Plywood (for Form / without Waterproof)	√			
Timber (for Support) & Log (for Scaffold)	√			
Electric Welding Rod	√			
Fuel & Lubrication	√			
Gas Cutter	√			

(2) Equipment

Procurement policies for equipments are as follows;

Equipment available in Liberia will be procured.

Equipment owned by local contractors will be hired or leased.

Procurement plan for major equipments is shown in Table 2.2-18

Table 2.2-18 Procurement Plan for Major Equipment

Equipment	Size	Lease / Procurement	Procured from			Reason of Procurement
			Liberia	Japan	Third Country	
Backhoe	0.28m ³	Lease	√			
Backhoe	0.5m ³	Lease	√			
Backhoe	0.8m ³	Lease	√			
Bulldozer	15t	Lease	√			
Bulldozer	21t	Lease	√			
Motor Grader	3.7m	Lease	√			
Road Roller	10-12t	Lease	√			
Tire Roller	8-20t	Lease	√			
Vibration Roller	0.8-1.1t	Lease	√			
Wheel Loader	2.4m ³	Lease	√			
Wheel Loader	3.1m ³	Lease	√			
Asphalt Finisher	2.4-6.0m	Lease	√			
Concrete Finisher	3.0-7.5m	Procurement		√		Procurement
Sprinkler Truck	6.0kl	Lease	√			
Dump Truck	10t	Lease	√			
Truck Crane	20t	Lease	√			
Trailer Truck	20t	Lease	√			
Trailer Truck	30t	Lease	√			
Concrete Plant	30 m ³ /h	Lease	√			
Asphalt Plant	50 t/h	Procurement		√		Procurement
Generator	35kVA	Lease	√			
Generator	60kVA	Lease	√			
Generator	250kVA	Lease	√			
Submersible Pump	100mm	Lease	√			
Compressor	5m ³ /min	Lease	√			

2-2-4-7 Operation Guidance Plan

This project have no operation guidance plan.

2-2-4-8 Soft Component (Technical Assistance) Plan

This project have no soft component plan.

2-2-4-9 Implementation Schedule

Implementation schedule for detailed design, tender related services, and construction of the Project is shown in Table 2.2-19.

Table 2.2-19 Implementation Schedule

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	
Detailed Design	(Site Survey)																																						
	(Design in Japan)																																						
	(Tender Services)							(Total 7 month)																															
Construction	(Preparation Work)																																						
	(Earth Work, Subbase work)																								(Total 38 month)														
	(Drainage, Retaining Wall)																																						
	(Surface, Binder Course)																								(Total 38 month)														
	(Safety Facility Work)													(Total 38 month)																									
	(Cleaning)																																						

: Rainy Season

2-2-5 Greenhouse Gas (GHG) Mitigation Plan

2-2-5-1 GHG Mitigation Estimation Method

Emissions of CO₂ are estimated from the emission factors of vehicle class developed by the National Institute for Land and Infrastructure Management of Japan.¹

The daily emission of CO₂ is calculated based on the projected future traffic volume by the following equation.

$$Q_t = \sum_{i=1}^4 (N_i \times E_i) \quad (\text{eqn. 1.1})$$

where

Q_t : daily emission of CO₂ [kg-CO₂/km·day]

E_i : CO₂ emission factor of the i -th class of vehicle [g-CO₂/km]

N_i : daily vehicle km of the i -th class of vehicle [km/day]

The emission factor of the i -th class of vehicle, E_i is calculated by the following equation.

$$E_i = a/V + bV + cV^2 + d \quad (\text{eqn. 1.2})$$

where V is the average travel speed of the i -th class of vehicle and a , b , c , and d are regression coefficients given in Table 2.2-20. Table 2.2-20 also shows the calculated emission factors for 4 vehicle classes at the velocities of 20, 30, 40 and 45 [km/hr].

Table 2.2-20 CO₂ Emission Factors [g-CO₂/km] for Vehicle Types

Vehicle Size	Regression Coefficients				Average Speed of Vehicle [km/hr]			
	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	20	30	40	45
Car	1864.3	-2.3201	0.02007	166.85	221.7	177.5	152.8	144.5
Small Truck	528.18	-4.9862	0.03926	308.57	251.0	211.9	185.1	175.4
Truck	50.285	-27.312	0.20875	1592.7	1132.5	962.9	835.5	787.5
Bus	2784.6	-12.752	0.10590	854.18	780.7	659.8	583.2	556.7

2-2-5-2 Input Data

The CO₂ emissions were calculated based on the projected traffic flow. Average travel speeds by vehicle types at three sections are calculated in Table 2.2-21 and Average Daily Traffic Volume at three sections are in Table 2.2-22.

¹ Namikawa, Y., Takai Y. and Ohshiro, N. (2003), "Calculation Base of Motor Vehicle Emission Factors", Technical Note of the National Institute for Land and Infrastructure Management No.141.

Table 2.2-21 Average Travel Speed [km/hr]

Section	Vehicle Class	2016	2021		2031	
			With* ¹⁾	Without	With* ¹⁾	Without
Free Port Jct. - Red Light Jct.	Car	17.01	45.00	16.16	45.00	15.31
	Small Truck	16.45	45.00	15.63	45.00	14.80
	Truck	17.18	45.00	16.32	45.00	15.46
	Bus	16.62	40.00	15.79	40.00	14.96

Note: *1 Since traffic volume in 2018 and 2028 is estimated to be less than traffic capacity of dual lane, the average travel speed will be 45.0 km/hr for car, small truck and truck, and 40.0 km/hr for bus hypothetically. (Design speed is 60 km/hr.)

Source: JICA Study Team

Table 2.2-22 Average Daily Traffic Vehicle Volume • Distance [Nos. • km]

Section	Vehicle Class	2016	2021		2031	
			With* ¹⁾	Without	With* ¹⁾	Without
Free Port Jct. - Red Light Jct.	Car	99,330	133,682	139,831	202,381	211,690
	Small Truck	23,215	30,531	36,332	45,160	53,741
	Truck	12,771	22,443	23,834	41,792	44,383
	Bus	8,607	10,695	11,305	14,863	15,710

Source: JICA Study Team

2-2-5-3 CO₂ Emission Estimate

The annual CO₂ emissions calculated by eqn.1.1 based on average travel speeds in Table 2.2-21 and average daily traffic vehicle km reported in Table 2.2-22 are summarized in Table 2.2-23.

Table 2.2-23 Annual CO₂ Emission at Three Sections [tons/year]

Section	2016	2021			2031		
		With	Without	Difference	With	Without	Difference
Free Port Jct.- Red Light Jct.	19,259 (100%)	18,034 (94%)	30,412 (158%)	-12,378	27,956 (145%)	50,224 (261%)	-22,268

Source: JICA Study Team

The emissions of CO₂ for the without-project case in 2031 will increase by 161% due to the increase of the traffic volume and decrease of traffic speed. On the other hand, that for with-project case in 2031 will increase by 45% due to the increase of traffic volume and traffic speed. Therefore the Project will contribute to mitigating CO₂ emission.

The emission factors used in this study are based on the research conducted in 2003 in Japan. For the purpose of relative comparison, these estimates can provide the information for legitimate discussion. It should be re-evaluated CO₂ emissions when emission factors in the Liberia are available.

2-3 Obligation of Recipient Country

The Government of Liberia will undertake the following measures 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 secure the land necessary for the execution of the Project, such as the land for construction works, stock yards, work shops, field offices, and others
- ✓ To provide borrow pits, quarry sites and waste disposal areas
- ✓ To bear commissions to the bank in Japan for its banking service in connection with the Project
- ✓ To ensure prompt tax exemption, customs clearance, and effective inland transportations of materials and equipments
- ✓ To exempt Japanese nationals engaged in the Project from any customs duties for the supply of products and services necessary for the project.
- ✓ To accord Japanese nationals necessary legal rights for their entry and stay in Liberia.
- ✓ To provide all necessary permission, licenses and certificates in connection with environmental issues and earthwork for the Project (ESIA approved, construction permission, traffic control permission, detour permission, construction permission in river, earthwork permission etc.)
- ✓ To relocate all obstruction structures such as water pipes, optical fibre cables, billboards & signboards, etc. in the project road
- ✓ To arrange proper use and effective maintenance of the road after the completion of the project
- ✓ To coordinate and solve any issues related to the Project that may be raised from residents and/or third parties
- ✓ To bear all the expenses, other than covered by the Japanese Grant Aid, agreed and necessary for the Project
- ✓ To secure safety of the construction site

2-4 Project Operation Plan

(1) Organization for Road Management and Maintenance

- ✓ Road management and maintenance after the Project is under the responsibility of Ministry of Public Works (MPW). However, it is not enough to be management of maintenance with road maintenance system and machinery , technical skill, budget. Road surfaces of primary road have been relatively repaired regularly , however road surfaces of secondary road have not been relatively repaired. It is necessary to raise ability of road management and maintenance through this project.

(2) Road Maintenance Plan

Necessary road maintenance works are as follows;

Periodical Maintenance

- ✓ Routine inspection and cleaning of side ditches, culverts, supplemental facilities, etc

Ad-hoc Maintenance

- ✓ Repair for damaged parts, such as ceiling & patching pavement, repainting pavement marking, and any other damaged parts

(3) Present Road Maintenance Conditions and Recommendations

Recent road management & maintenance conditions observed are as follows;

- ✓ Road surfaces of Somalia Drive have been relatively repaired regularly
- ✓ Road side ditches and inlets have not been well maintained periodically. For instance, cleaning works of road surfaces and drainages are observed at various places in Monrovia, on the other hand, long time clogged drainage pipes and inlets as well as submerged points are also observed at several segments in the City

To achieve effective results of the Project and sustain good conditions of the road facilities, it is important to manage and maintain road facilities adequately by keeping in good condition of the pavements and other supplemental facilities and extending their life spans, so the following recommendations are proposed;

- ✓ To check facilities regularly for controlling their conditions
- ✓ To clean facilities up, especially drainage
- ✓ To secure necessary budget for maintenance

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

(1) Cost borne by the Government of Japan

The Project will be implemented in accordance with the Japan's Grant Aid scheme and the project cost will be fixed before concluding the Exchange of Note for the Project.

(2) Cost borne by the Government of the Republic of Liberia

Total Cost	:	190,000 US\$ (Approx.	22.7 Million Yen)
Compensation fee for relocation	:	80,000 US\$ (Approx.	9.5 Million Yen)
Environmental Assessment Cost	:	60,000 US\$ (Approx.	7.2 Million Yen)
Bank Commissions	:	50,000 US\$ (Approx.	6.0 Million Yen)

(3) Conditions in Cost Estimate

Time of Cost Estimate	:	March 2016
Exchange Rate	:	1 United States Dollar = 119.47 Yen
Construction Period	:	As shown in the Implementation Schedule
Other Conditions	:	Cost estimate is implemented in accordance with the guideline of Japan's Grant Aid

2-5-2 Operation and Maintenance Cost

Ministry of Public Works is in charge of maintenance for the road rehabilitated by the Project.

Annual maintenance cost necessary for the road is estimated at approximately US\$ 91,150.

Details are shown in Table 2.5-1.

Table 2.5-1 Maintenance Work and Annual Cost

✓ Routine Inspection (unit: US\$)

Facility	Inspection Item	Frequency	No. of Staff	Equipment	Quantity	Unit Price	Cost
Pavement	Crack, deformation, pothole, etc.	12 times a year	4 persons	Scoop, hammer,	48 man-day / year	37.5/day	1,800
Shoulder/slope	Rainwater erosion & collapse, etc.	1 day each time		sickle, barricade,			
Road marking	Injury, deformation, stain, splitting			pick-up truck	12 veh-day/ year =96 hours/year (8 hours/day)	75.0/hour	7,200
Drainage	Damage and obstruction						
						Total	9,000

✓ Daily Maintenance Work (unit: US\$)

Facility	Inspection Item	Frequency	No. of Staff	Equipment	Quantity	Unit Price	Cost
Cleaning	Cleaning soil, obstacles	4 times a year	10 persons	Scoop, hammer,	160 man-day / year	90.0/day	14,400
Drainage	Cleaning	4 days each time		sickle, barricade,			
Pavement	Cutting grass, cleaning			Pick-up truck (2 units)	20 veh-day/ year (10 hours/day)	80.0/day	6,000
Shoulder	Cleaning						
Road marking							
						Total	20,400

29,400

✓ Repair (unit: US\$)

Facility	Repair Item	Frequency	Unit Price (per Year, per km)	Road length
Pavement	Patching pothole	1 times / 5 years	2,200	13.2 km (2-Lane)
Shoulder/slope	Repairing damaged part	1 times / 5 years	300	
Drainage	Repairing damaged part	1 times / 2 years	1,800	
Road attached facilities	Repairing damaged part	1 times / 5 years	150	
Structure	Repairing damaged part	1 times / 10 years	300	
		Total	4,750	61,750

91,150

CHAPTER 3 PROJECT EVALUATION

3-1 Preconditions

“OBLIGATION OF RECIPIENT COUNTRY” shown in 2-3 has to be reliably conducted by MPW.

3-2 Necessary Inputs by Recipient Country

To fully secure and sustain the Project effects, Liberia shall execute the following issues.

- (1) Maintenance should be well carried out. Cleaning of drainage facilities is very critical so as to prevent early deterioration of the road. The maintenance for pipe drain is not enough in the present conditions, cleaning for pipe drain should be done in particular.
- (2) Road maintenance budget should be secured in accordance with the long-run program for operation and maintenance. In addition, capacity development should be carried out as well.

3-3 Important Assumptions

The road rehabilitation project on the international corridor from Monrovia to border of the Republic of Guinea is being put into effect by the World Bank donation at present. The road of this Project is the main road of international corridor from Freeport, main port in Monrovia, to border of the Republic of Guinea. With multiplier effect of the preceding project on road improvement to border of the Republic of Guinea, the efficient traffic / physical distribution of international corridor will be expected.

3-4 Project Evaluation

3-4-1 Relevance

- ① A number of people receive benefit from the Project; Direct beneficiary of the Project includes the road user and the resident whose population is 300 thousand people and indirect beneficiary of the Project includes 1.2 million people who live in Monrovia.
- ② Liberia can operate and maintain the project facilities by itself using its fund, labor and technology as excessively special techniques are not required.
- ③ This Project will reconstruct basic infrastructure, which is one of the important subjects among National Plan “the Economic Stabilization and Recovery Plan (ESRP) of Liberia.” As Monrovia’s population is growing rapidly, this Project is urgent to solve the traffic congestion.

- ④ As for the countermeasures against traffic accidents after effects of road improvement on environment and society are observed, measures such as the establishment of traffic safety facilities, improvement of junction and construction of sidewalk are fully taken.
- ⑤ It is expected that this project will be implemented without difficulties by the Japanese Grant Aid scheme.

3-4-2 Effectiveness

(1) Quantitative Effect

Expected effect	Standard Value (Present, 2016)	Target Value (After Implementation 3 years) 2024
Passenger Car Unit (Number / day)	24,713	39,263
Transport Volume		
Passenger Number (person / year)	71,742,188	79,332,655
Freight Volume (ton / year)	21,759,840	32,441,200
Travelling Hour (minutes)		
Moring Peak time	61	18
Free Port Jct – Red Light Jct		

(2) Qualitative Effect

- ✓ Safety securement
The safety for the pedestrian will be secured by separating sidewalk and carriage way by the construction of sidewalk and curb stone.
- ✓ Decrease in the frequency of maintenance by improvement of drainage facilities
The damage to the base course from rain water will be prevented by the improvement of drainage facilities, resulting in decrease in the frequency of maintenance.
- ✓ Smooth traffic by bus bay
The safety of passenger on the bus as well as smooth traffic will be secured by the construction of bus bay at the place which a large number of people get on and off.