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1. 調査団員氏名、所属

(1) 第1次現地調査 (2012年1月18日～2012年3月30日)

- 業務主任／道路計画 山宿 壮 (片平エンジニアリング インターナショナル (KEI))
- 道路設計 I / 埋設物調査 村上 啓一 (KEI)
- 道路設計 II / 排水計画 三宅 清孝 (八千代エンジニアリング (YEC))
- 橋梁設計 青木 康司 (KEI)
- 自然条件調査 土屋 俊秋 (KEI)
- 環境配慮／社会配慮 I 向井 潔 (KEI)
- 社会配慮 II 柴田 護 (YEC)
- 施工・調達計画／積算 藤原 英勝 (KEI)
- 業務調整／自然条件調査補助 鷹島 一久 (KEI)

(2) 第2次現地調査 (2012年3月31日～2012年6月3日)

- 団長 芦野 誠 (JICA 経済基盤開発部)
- 計画管理 福沢 大輔 (JICA 経済基盤開発部)
- 協力企画 櫻井 理 (JICA ガーナ事務所)
- 業務主任／道路計画 山宿 壮 (KEI)
- 道路設計 I / 埋設物調査 村上 啓一 (KEI)
- 道路設計 II / 排水計画 三宅 清孝 (YEC)
- 橋梁設計 青木 康司 (KEI)
- 環境配慮／社会配慮 I 向井 潔 (KEI)
- 社会配慮 II 柴田 護 (YEC)
- 施工・調達計画／積算 藤原 英勝 (KEI)

(3) 第3次現地調査 (2012年10月6日～2012年10月16日、10月22日～10月29日)

- 業務主任／道路計画 山宿 壮 (KEI)
- 環境配慮／社会配慮 I 向井 潔 (KEI)

(4) 概略設計概要説明調査 (2012年11月25日～2012年12月8日)

- 団長 芦野 誠 (JICA 経済基盤開発部)
- 計画管理 金子 祐太郎 (JICA 経済基盤開発部)
- 環境社会配慮 植松 京子 (JICA 審査部)
- 業務主任／道路計画 山宿 壮 (KEI)
- 道路設計 I / 埋設物調査 村上 啓一 (KEI)

2. 調査工程
第1次現地調査 (2012年1月18日～3月30日)

Schedule of Preparatory Survey Team for Somalia Drive re-construction project-1st Term (18,January, 2012-30,March, 2012)

Name			Mr.Tsuyoshi YAMAJUKU	Mr.Keiichi MURAKAMI	Mr.Kiyotaka MIYAKE	Mr.Yasushi AOKI	Mr.Toshiaki TSUCHIYA	Mr.Kiyoshi MUKAI	Mr.Mamoru SHIBATA	Mr.Hidekatsu FUJIWARA	Mr.Kazuhisa TAKASIMA
Position			Chief Consultant / Road Planner. (Katahira & Engineers International)	Road Designer 1/ Burial things investigator. (Katahira & Engineers International)	Road Designer 2/ Drainage Designer. (Yachiyo Engineering Co.LTD)	Bridge Designer. (Katahira & Engineers International)	Natural Condition Surveyor. (Katahira & Engineers International)	Environment Specialist / Social Specialist 1. (Katahira & Engineers International)	Social Specialist 2. (Yachiyo Engineering Co.LTD)	Construction, Procurement Planner / Cost Estimator. (Katahira & Engineers International)	Office of liaison / Natural Condition Survey assistant. (Katahira & Engineers International)
No.	Date	Day									
1	18-Jan-12	Wed	Narita → Amsterdam					Narita → Amsterdam	Narita → Amsterdam		
2	19-Jan-12	Thu	Amsterdam → Accra					Amsterdam → Accra	Amsterdam → Accra		
3	20-Jan-12	Fri	Visit to EOJ, JICA					Visit to EOJ, JICA	Visit to EOJ, JICA		
4	21-Jan-12	Sat	Accra → Monrovia					Accra → Monrovia	Accra → Monrovia		
5	22-Jan-12	Sun	Meeting with Investigation team Site Survey					Meeting with Investigation team Site Survey	Meeting with Investigation team Site Survey		Narita → Frankfurt → Brussels
6	23-Jan-12	Mon	Meeting with MPW					Meeting with MPW	Meeting with MPW		Brussels → Monrovia
7	24-Jan-12	Tue	Meeting with GIZ, WB, MCC					Meeting with GIZ, WB, MCC	Meeting with GIZ, WB, MCC		Meeting with MPW
8	25-Jan-12	Wed	Meeting with MOT, Land Commission					Meeting with MOT, Land Commission	Meeting with MOT, Land Commission		Meeting with MCC / Site survey
9	26-Jan-12	Thu	Kickoff Meeting					Kickoff Meeting	Kickoff Meeting		Meeting with MOT, Land Commission
10	27-Jan-12	Fri	Site Survey					Site Survey	Site Survey		Site Survey
11	28-Jan-12	Sat	Site Survey					Site Survey	Site Survey		Site Survey
12	29-Jan-12	Sun	Meeting with Investigation team Site Survey					Meeting with Investigation team Site Survey	Meeting with Investigation team Site Survey		Meeting with Investigation team Site Survey
13	30-Jan-12	Mon	Site Survey					Site Survey	Site Survey		Site Survey
14	31-Jan-12	Tue	Meeting with Local Consultant					Meeting with Local Consultant	Meeting with Local Consultant		Site Survey
15	01-Feb-12	Wed	Site Survey					Site Survey	Site Survey		Site Survey
16	02-Feb-12	Thu	Site Survey					Site Survey	Site Survey		Site Survey
17	03-Feb-12	Fri	Site Survey					Site Survey	Site Survey		Site Survey
18	04-Feb-12	Sat	Site Survey					Site Survey	Site Survey		Site Survey
19	05-Feb-12	Sun	Meeting with Investigation team Site Survey					Meeting with Investigation team Site Survey	Meeting with Investigation team Site Survey		Meeting with Investigation team Site Survey
20	06-Feb-12	Mon	Site Survey					Meeting with Local Consultant	Meeting with Local Consultant		Site Survey
21	07-Feb-12	Tue	Meeting with EU					Meeting with Local Consultant	Meeting with Local Consultant		Site Survey
22	08-Feb-12	Wed	Site Survey					Site Survey	Site Survey		Site Survey
23	09-Feb-12	Thu	Meeting with MPW					Site Survey	Site Survey		Site Survey
24	10-Feb-12	Fri	Meeting with MPW					Meeting with MPW	Meeting with MPW		Site Survey
25	11-Feb-12	Sat	Site Survey					Site Survey	Site Survey		Site Survey
26	12-Feb-12	Sun	Meeting with Investigation team Site Survey					Meeting with Investigation team Site Survey	Meeting with Investigation team Site Survey		Meeting with Investigation team Site Survey
27	13-Feb-12	Mon	Site Survey					Meeting with Local Consultant	Meeting with Local Consultant		Site Survey
28	14-Feb-12	Tue	Meeting with LWSC					Site Survey	Site Survey		Site Survey
29	15-Feb-12	Wed	Meeting with MPW					Meeting with Local Consultant	Meeting with Local Consultant		Site Survey
30	16-Feb-12	Thu	Meeting with Local Contractor					Meeting with Local Consultant	Meeting with Local Consultant		Site Survey
31	17-Feb-12	Fri	Site Inspection with MPW					Site Inspection with MPW	Site Inspection with MPW		Site Survey
32	18-Feb-12	Sat	Meeting with Local Contractor	Narita → Frankfurt → Brussels				Site Survey	Site Survey		Site Survey
33	19-Feb-12	Sun	Meeting with Investigation team Site Survey	Brussels → Monrovia				Meeting with Investigation team Site Survey	Meeting with Investigation team Site Survey		Meeting with Investigation team Site Survey
34	20-Feb-12	Mon	AM Visit to JICA PM-Site Survey					Site Survey	Site Survey		Site Survey
35	21-Feb-12	Tue	Stake holder meeting					Stake holder meeting	Stake holder meeting		Site Survey
36	22-Feb-12	Wed	AM Visit to JICA PM-Monrovia → Accra					AM Visit to JICA PM-Monrovia → Accra	AM Visit to JICA PM-Monrovia → Accra		Site Survey
37	23-Feb-12	Thu	Report Preparation					Report Preparation	Report Preparation		Site Survey
38	24-Feb-12	Fri	Visit to EOJ, JICA					Visit to EOJ, JICA	Visit to EOJ, JICA		Site Survey
39	25-Feb-12	Sat	AM-Report Preparation PM-Accra →					AM-Report Preparation PM-Accra →	AM-Report Preparation PM-Accra →		Report Preparation
40	26-Feb-12	Sun	→ Amsterdam →	Meeting with Investigation team Site Survey				→ Amsterdam →	→ Amsterdam →		Meeting with Investigation team Site Survey
41	27-Feb-12	Mon	→ Narita	Site Survey				→ Narita	→ Narita		Report Preparation
42	28-Feb-12	Tue		Site Survey							Report Preparation
43	29-Feb-12	Wed		Site Survey							Site Survey
44	01-Mar-12	Thu		Site Survey	Narita → Frankfurt → Brussels			Site Survey			Site Survey
45	02-Mar-12	Fri		Site Survey	Brussels → Monrovia			Site Survey			Site Survey
46	03-Mar-12	Sat		Site Survey				Site Survey			Site Survey
47	04-Mar-12	Sun		Meeting with Investigation team Site Survey	Meeting with Investigation team Site Survey			Meeting with Investigation team Site Survey			Meeting with Investigation team Site Survey
48	05-Mar-12	Mon		Site Survey	Site Survey			Site Survey			Site Survey
49	06-Mar-12	Tue		Site Survey	Site Survey			Site Survey			Site Survey
50	07-Mar-12	Wed		Site Survey	Site Survey			Site Survey			Site Survey
51	08-Mar-12	Thu		Site Survey	Site Survey			Site Survey			Site Survey
52	09-Mar-12	Fri		Site Survey	Site Survey			Site Survey			Site Survey
53	10-Mar-12	Sat		Site Survey	Site Survey			Site Survey			Site Survey
54	11-Mar-12	Sun		Meeting with Investigation team Site Survey	Meeting with Investigation team Site Survey			Meeting with Investigation team Site Survey			Meeting with Investigation team Site Survey
55	12-Mar-12	Mon		Site Survey	Site Survey			Site Survey			Site Survey
56	13-Mar-12	Tue		Site Survey	Site Survey			Site Survey			Site Survey
57	14-Mar-12	Wed		Site Survey	Site Survey			Site Survey			Site Survey
58	15-Mar-12	Thu		Site Survey	Site Survey			Site Survey			Narita → Frankfurt → Brussels
59	16-Mar-12	Fri		Site Survey	Site Survey			Site Survey			Brussels → Monrovia
60	17-Mar-12	Sat		Site Survey	Site Survey			Report Preparation			Site Survey
61	18-Mar-12	Sun		Meeting with Investigation team Site Survey	Meeting with Investigation team Site Survey			AM-Report Preparation PM-Monrovia →			Meeting with Investigation team Site Survey
62	19-Mar-12	Mon		Site Survey	Site Survey			→ Brussels → Frankfurt →			AM-Report Preparation PM-Monrovia →
63	20-Mar-12	Tue		Site Survey	Site Survey						→ Brussels → Frankfurt →
64	21-Mar-12	Wed		Site Survey	Site Survey			→ Narita			→ Narita
65	22-Mar-12	Thu		Meeting with MPW	Meeting with MPW						Site Survey
66	23-Mar-12	Fri		Meeting with MPW	Meeting with MPW						Meeting with MPW
67	24-Mar-12	Sat		Site Survey	Site Survey						Site Survey
68	25-Mar-12	Sun		Meeting with Investigation team Site Survey	Meeting with Investigation team Site Survey						Meeting with Investigation team Site Survey
69	26-Mar-12	Mon		Meeting with MPW	Meeting with MPW						Report Preparation
70	27-Mar-12	Tue		Report Preparation	Report Preparation						Report Preparation
71	28-Mar-12	Wed		AM-Report Preparation PM-Monrovia →	AM-Report Preparation PM-Monrovia →						AM-Report Preparation PM-Monrovia →
72	29-Mar-12	Thu		→ Brussels → Frankfurt →	→ Brussels → Frankfurt →						→ Brussels → Frankfurt →
73	30-Mar-12	Fri		→ Narita	→ Narita						→ Narita

EOJ:Embassy of Japan
EPA:Environmental Protection Agency

MPW:Ministry of Public Works
MOT:Ministry of Transport

GIZ:Deutsche Gesellschaft für Internationale Zusammenarbeit
MCC:Monrovia City Corporation
LWSC:Liberia Water and Sewer Corporation

第2次現地調査（2012年3月31日～6月3日）

Schedule of Preparatory Survey Team for Somalia Drive re-construction project - 2nd Term (31, March, 2012-3, June, 2012)

Name			Mr.Makoto ASHINO	Mr.Daisuke FUKUZAWA	Mr.Tsuyoshi YAMAJUKU	Mr.Keiichi MURAKAMI	Mr.Kiyotaka MIYAKE	Mr.Yasushi AOKI	Mr.Kiyoshi MUKAI	Mr.Mamoru SHIBATA	Mr.Hidekatsu FUJIWARA
Position			Leader (Japan International Cooperation Agency)	Project Coordinator (Japan International Cooperation Agency)	Chief Consultant / Road Planner. (Katahira & Engineers International)	Road Designer 1/ Burial things investigator. (Katahira & Engineers International)	Road Designer 2/ Drainage Designer. (Yachiyo Engineering Co.LTD)	Bridge Designer. (Katahira & Engineers International)	Environment Specialist / Social Specialist 1. (Katahira & Engineers International)	Social Specialist 2. (Yachiyo Engineering Co.LTD)	Construction, Procurement Planner / Cost Estimator. (Katahira & Engineers International)
No.	Date	Day									
1	31-Mar-12	Sat									
2	01-Apr-12	Sun									
3	02-Apr-12	Mon									
4	03-Apr-12	Tue									
5	04-Apr-12	Wed									
6	05-Apr-12	Thu									
7	06-Apr-12	Fri									
8	07-Apr-12	Sat									
9	08-Apr-12	Sun									
10	09-Apr-12	Mon									
11	10-Apr-12	Tue									
12	11-Apr-12	Wed									
13	12-Apr-12	Thu									
14	13-Apr-12	Fri									
15	14-Apr-12	Sat									
16	15-Apr-12	Sun									
17	16-Apr-12	Mon									
18	17-Apr-12	Tue									
19	18-Apr-12	Wed									
20	19-Apr-12	Thu									
21	20-Apr-12	Fri									
22	21-Apr-12	Sat									
23	22-Apr-12	Sun									
24	23-Apr-12	Mon									
25	24-Apr-12	Tue									
26	25-Apr-12	Wed									
27	26-Apr-12	Thu									
28	27-Apr-12	Fri									
29	28-Apr-12	Sat									
30	29-Apr-12	Sun									
31	30-Apr-12	Mon									
32	01-May-12	Tue									
33	02-May-12	Wed									
34	03-May-12	Thu									
35	04-May-12	Fri									
36	05-May-12	Sat									
37	06-May-12	Sun									
38	07-May-12	Mon									
39	08-May-12	Tue									
40	09-May-12	Wed									
41	10-May-12	Thu									
42	11-May-12	Fri									
43	12-May-12	Sat									
44	13-May-12	Sun									
45	14-May-12	Mon									
46	15-May-12	Tue									
47	16-May-12	Wed									
48	17-May-12	Thu									
49	18-May-12	Fri									
50	19-May-12	Sat									
51	20-May-12	Sun									
52	21-May-12	Mon									
53	22-May-12	Tue									
54	23-May-12	Wed									
55	24-May-12	Thu									
56	25-May-12	Fri									
57	26-May-12	Sat									
58	27-May-12	Sun									
59	28-May-12	Mon									
60	29-May-12	Tue									
61	30-May-12	Wed									
62	31-May-12	Thu									
63	01-Jun-12	Fri									
64	02-Jun-12	Sat									
65	03-Jun-12	Sun									

EOJ:Embassy of Japan

MPW:Ministry of Public Works

NTA:National Transit Authority

EPA:Environmental Protection Agency

MOT:Ministry of Transport

**Schedule of Preparatory Survey Team for Somalia Drive re-construction project
3rd time Survey (6,October, 2012-28,October, 2012)**

Name			Mr.Tsuyoshi YAMAJUKU	Mr.Kiyoshi MUKAI
Position			Chief Consultant / Road Planner. (Katahira & Engineers International)	Environment Specialist / Social Specialist 1. (Katahira & Engineers International)
No.	Date	Day		
1	06-Oct-12	Sat		Narita → Frankfurt → Brussels
2	07-Oct-12	Sun		Brussels → Monrovia
3	08-Oct-12	Mon		Meeting with MPW, WB and Local Consultant
4	09-Oct-12	Tue		Meeting with EPA, MPW and Local Consultant
5	10-Oct-12	Wed		Meeting with EPA, MPW and Local Consultant
6	11-Oct-12	Thu		Meeting with EPA, MPW and Local Consultant
7	12-Oct-12	Fri		Meeting with MPW and WB, Site Survey
8	13-Oct-12	Sat		Report Preparation
9	14-Oct-12	Sun		AM: Report Preparation PM: Monrovia →
10	15-Oct-12	Mon		→ Brussels → Frankfurt →
11	16-Oct-12	Tue		→ Narita
1	22-Oct-12	Mon	Narita → Europe	
2	23-Oct-12	Tue	Europe → Monrovia	
3	24-Oct-12	Wed	Meeting with MPW	
4	25-Oct-12	Thu	Meeting with MPW, Site investigation	
5	26-Oct-12	Fri	AM:Meeting with MPW , PM:Monrovia →	
6	27-Oct-12	Sat	→ Europe →	
7	28-Oct-12	Sun	→ Narita	

MPW:Ministry of Public Works

概略設計概要説明調査（2012年11月25日～12月9日）

Schedule of Preparatory Survey Team for Somalia Drive re-construction project - DBD (25,November, 2012-9,December, 2012)

Name			Mr.Makoto ASHINO	Mr.Yutaro KANEKO	Ms. Kyoko Uematsu	Mr.Tsuyoshi YAMAJUKU	Mr.Keiichi MURAKAMI
Position			Leader (Japan International Cooperation Agency)	Project Coordinator (Japan International Cooperation Agency)	Environmental and Social Considerations (Japan International Cooperarion Agency)	Chief Consultant / Road Planner. (Katahira & Engineers International)	Road Designer 1/ Burial things investigator. (Katahira & Engineers International)
No.	Date	Day					
1	25-Nov-12	Sun			Tokyo→Frankfurt→Brussels →Monrovia	Narita → Amsterdam	
2	26-Nov-12	Mon			Meeting with EPA	Amsterdam → Accra	Tokyo → Paris
3	27-Nov-12	Tue			Meeting with MPW	Visit to JICA in Accra	Paris → Monrovia
4	28-Nov-12	Wed			Meeting with MPW	Accra → Monrovia (KQ)	Meeting with MPW, WB
5	29-Nov-12	Thu			Meeting Investigation team, Site survey with MPW		
6	30-Nov-12	Fri			Meeting with EPA	Meeting with MPW	
7	01-Dec-12	Sat			Site Survey	Site Survey	
8	02-Dec-12	Sun	Tokyo→Frankfurt→Brussels→Monrovia			Meeting with Investigation team , Site Survey	
9	03-Dec-12	Mon	Site Survey, Meeting with MPW			Site Survey, Meeting with MPW	
10	04-Dec-12	Tue	Meeting with MPW, Stakeholder Meeting			Meeting with MPW, Stakeholder Meeting	
11	05-Dec-12	Wed	AM:Meetg with MPW , PM:Signing of MD			AM:Meetg with MPW , PM:Signing of MD	
12	06-Dec-12	Thu	Monrovia→Accra→			Site Survey	
13	07-Dec-12	Fri	→London→			AM:Meeting with MPW , PM:Monrovia →	
14	08-Dec-12	Sat	→Tokyo			→ Amsterdam →	→ Paris →
15	09-Dec-12	Sun				→ Narita	→ Tokyo

EOJ:Embassy of Japan

MPW:Ministry of Public Works

EPA:Environmental Protection Agency

MOT:Ministry of Transport

3. 関係者（面会者）リスト

在ガーナ日本大使館

- 特命全権大使 : 二階 尚人
- 参事官 : 望月 寿信
- 一等書記官 : 斉藤 俊亮

JICA ガーナ事務所

- ガーナ事務所 所長 : 稲村 次郎
- ガーナ事務所 次長 : 木藤 耕一
- ガーナ事務所 次長 : 相良 冬木
- ガーナ事務所 次長 : 佐藤 仁
- 所員 : 白倉 紀
- 所員 : 福原 一郎
- 企画調査員 : 櫻井 理

JICA リベリア フィールド事務所

- 企画調査員 : 三浦 慕
- カントリーマネージャー : 大草 真紀

Ministry of Public Works

- Minister : ATTY. Samuel Kofi Woods, II
- Deputy Minister for Technical services : Mr. Victor B. Smith
- Acting Assistant Minister : Mr. Edsel Edward Smith
- Technical Assistant, Office of the Minister : Mr. I. Richmond W. K. Harding
- Head Engineer : Mr. A. D. E. Jackson
- Chef Engineer : Mr. Lasana Sesay
- Environmental Consultant : Prof. David L. Wiles, M. Phil
- Program Director : Mr. A. G. Beckley
- Deputy Program Director : Mr. Emmanuel K. Baker

Ministry of Transport

- Minister : Hon. Willard A. Russell, I
- Technical assistant Minister : Mr. Gabriel S. Tarplah
- Sr. Research/Policy Officer : Mr. D. Erasmulr Grngar
- Sr. Research/Policy Advisor : Mr. Julius D. Dennis, Jr

City Government of Monrovia

- Mayor, Chairman : Ms. Mary T. Broh

Environmental Protection Agency of Liberia

- Executive Director : Ms. Anyaa Vahiri
- Deputy Executive Director : Mr. Nathaniel T. Blama
- Assistant Manager : Mr. Varney L. Conneh
- Supervisor, Environmental Quality & Standard : Mr. Earl A.R. Neblett
- Statistician : Sete F. Marshall

Land Commission

- Chairman : PhD. Cecil T.O. Brandy
- Vice Chairman : Mr. Walter Y. Wisner
- Adm. Assistant / Land Commission : Ms. Daniel Warner

National Transit Authority

- Quality Control Manager : Mr. E. Cosby Pelham
- Internal Audit Manager : Mr. Edmond Forh Forh
- Financial Comptroller / CFO : Mr. J. Willy Moore ESQ

Liberia Water & Sewer Corporation

- Managing Director : Mr. Nortu Jappah
- Deputy Managing Director for Technical Service : Mr. Elmos B. Glay

Liberia Institute of Statistics &

Geo-Information Services

- Director General : PhD T. Edward Liberty
- Sr. Demographer : Ms. Dorothy D. Johnson

World Bank

- Senior Highway Engineer Transport Section : Mr. Kulwinder Singh Rao
 - Sr. Operations Officer : Ms. Coleen R. Littlejohn
 - Urban Development Specialist : Ms. Jenny Hasselsten
- Africa Region Urban and Water Unit (ERTWU)

GIZ

- Project Manager for Capacity Building for the : Ms. Claudia Hermes
Transport Sector in Liberia
- Road Maintenance Advisor : Mr. Walter Frankenberger

4. 討議議事録 (M/D)

(1) 概略設計概要説明 (2012年12月5日)

Minutes of Discussions
on
the Preparatory Survey
on
the Project for Reconstruction of Somalia Drive in Monrovia
in
the Republic of Liberia

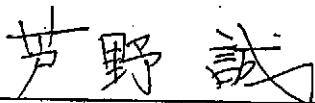
(Explanation on Draft Final Report)

In April 2012, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Preparatory Survey Teams on the Project for Reconstruction of Somalia Drive in Monrovia to the Republic of Liberia. Through the discussions, field surveys and technical examination in Japan, JICA finally prepared a Draft Final Report of the study.

In order to explain and consult with the concerned officials of the Government of the Republic of Liberia on the contents of the Draft Final Report, JICA dispatched the Preparatory Survey Team headed by Mr. Makoto Ashino (hereinafter referred to as "the Team") to Republic of Liberia scheduled to stay from November 26 to December 6, 2012.

As a result of the discussions, both sides confirmed the main item described in the attached sheets.

Monrovia, December 5, 2012



Makoto Ashino
Leader, Preparatory Survey Team
Japan International Cooperation Agency



Victor B. Smith
Deputy Minister for Technical Services
Ministry of Public Works



Yancon-Dargbe Nimley
Assistant Minister for Economic
Cooperation & Integration
Ministry of Planning & Economic Affairs

ATTACHMENT

1. Project Component

After the explanation of the contents of the Draft Final Report by the Team, Liberian side agreed in principle to the project contents below.

- Expansion of the Somalia Drive (from Sta. 0+0125 to Sta. 13+000) from 2-lanes to 4-lanes (Construction of new additional 2-lane roads) including necessary facilities such as pedestrian walkway, traffic signs etc.
- Construction and rehabilitation of Stockton Bridge (Totally 4-lane).

2. Cost Estimation

- 2-1. Both sides agreed that the Project Cost Estimation as attached in Annex- 1 should never be duplicated nor disclosed to any third parties before the signing of all the contract(s) with contractor(s) for the Project.
- 2-2. The Team explained to Liberian side that the rough estimate of the Project Cost described in Annex- 1 includes the contingency, however, the final Project Cost including the contingency described in E/N would be appraised by the Government of Japan. The contingency would cover the additional cost due to natural disaster, unexpected natural conditions, etc.

3. Japan's Grant Aid Scheme

Liberian side understood the Japan's Grant Aid scheme and the necessary measures to be taken by the recipient country as explained by the Team and described in Annex-3, Annex-4 and Annex-5 of the Minutes of Discussions signed on August 31, 2011.

Liberian side also understood that the Preparatory Survey Team is not in the position to guarantee implementation of the Project, this position is the responsibility of the Government of Japan.

4. Schedule of the Study

JICA will complete the final report in accordance with the confirmed items and send it to Liberian side around February, 2013.

5. Environmental and Social Considerations

General

5-1. Environmental Guidelines and Environmental Category

The Team explained that "JICA Guidelines for Environmental and Social Considerations dated April 2004" (hereinafter referred to as "the Environmental Guidelines") is applied to the Project.

The Team further explained that the Project is categorized as "A" in accordance with the



Environmental Guidelines, because the project falls into the road sector located in a sensitive area (adjacent to the Mesurado Wetland registered under the Ramsar Convention) and is likely to have significant adverse impact due to its characteristic (large-scale involuntary resettlement) under the Environmental Guidelines.

The environmental and social considerations including major impacts and mitigation measures for the Project are summarized in the Environmental Checklist (Annex-2).

5-2. Consultations with stakeholders

The Team confirmed that the Ministry of Public Works (hereinafter referred to as "MPW") has conducted public consultations regarding the Environmental Impact Assessment (the EIA) and the Resettlement Action Plan (the RAP) in the Project area at scoping stage and draft report's preparation stage.

MPW assured to continue consultations and information disclosure with stakeholders including Project Affected Persons (PAPs).

5-3. Information Disclosure

MPW assured that as soon as the EIA (including the RAP) is approved by the Environmental Protection Agency (hereinafter referred to as "EPA"), MPW will disclose the approved EIA report and the RAP written in English, which is an official language of Liberia, at the offices of MPW, EPA, Monrovia City Corporation (hereinafter referred to as "MCC"), Paynesville City Corporation (hereinafter referred to as "PCC") and administrative buildings in New Georgia and Gardnersville, and at the same time, it will post summary of the RAP, which includes the key impacts, entitlements and grievance procedures, on each community center in the affected area.

MPW also assured that it will notify the disclosure of the EIA report and the RAP on local newspapers prior to the disclosure and that the EIA report and the RAP will be available for photocopying for anyone who is interested in.

5-4. Monitoring for Environmental and Social considerations

5-4-1. Environmental Monitoring

MPW and the Team confirmed that environmental monitoring will be conducted by the Infrastructure Implementation Unit of MPW (hereinafter referred to as "MPW/IIU") in accordance with the Monitoring Plan described in the EIA report.

MPW agreed to submit the results of the monitoring to JICA Liberia field office on a quarterly basis during construction. After the completion of the Project, MPW confirmed it will submit the monitoring result to JICA Liberia field office semiannually for two (2) years.

The monitoring form to be submitted to JICA is Annex- 3 for construction stage and Annex- 4 for operation stage. Monitoring items shall be reviewed if necessary, under agreement between MPW and JICA.



5-4-2. Internal Monitoring of RAP Implementation

MPW and the Team confirmed that internal monitoring will be conducted by RAP Implementation Committee, together with MPW/IIU, based on the RAP.

MPW agreed to submit the result of the internal monitoring to JICA Liberia field office on a quarterly basis until the completion of RAP implementation.

The monitoring form to be submitted to JICA is Annex- 5.

5-4-3. External Monitoring of RAP Implementation

MPW confirmed external monitoring on involuntary resettlement including the status of livelihood restoration will be conducted for at least three (3) times in 2 years after the completion of RAP implementation by an independent agency hired by MPW. Criteria and indicators for external monitoring are envisaged in the RAP (Table 15.2).

MPW agreed to check the external monitoring reports submitted from the agency and send it to JICA Liberia field office as soon as each report is finalized.

5-4-4. Extension of Monitoring Report period

In case JICA finds that there is a remaining issue that needs to be addressed (e.g. insufficient restoration of livelihood of displaced PAPs and/or there is a need for improvement in a situation with respect to environmental/social considerations after the agreed monitoring period, JICA may request to extend the period of monitoring and reporting until JICA confirms the issues have been properly addressed and solved in accordance with the agreement between MPW and JICA.

Environmental considerations

5-5. Requirement of EIA under Liberian legislation

Liberian legislation "Environmental Impact Assessment Procedural Guidelines (2006)" stipulates that EIA shall be conducted and approved by EPA for the Project.

MPW explained that it submitted the EIA report including the RAP to EPA in October 2012, and the EIA will be approved by December 10, 2012.

MPW stated that as soon as the EIA is approved, it will submit to JICA a photocopy of the approval letter and the approved EIA report including the RAP.

5-6. Required Permission

MPW explained that no other environmental official permission is required as long as construction and operation comply with the contents of the EIA. However, if any other permission is required for the Project, MPW ensures that contractor(s) for civil works follow appropriate procedures to acquire the permits.

5-7. Consideration of Alternatives

MPW confirmed that the Project design including construction of Stockton Bridge and repair of Double Bridge is proposed considering the impact on Mesurado wetland located on the south of the Project road, magnitude of involuntary resettlement, project cost,



construction period, technical aspect, economic impact, etc.

5-8. Environmental Mitigation Measures

MPW assured that possible negative impacts during construction and operation phase will be mitigated to appropriate level. Mitigation measures to be taken for the Project include but not limited to the ones described in the EIA.

Regarding the situation of storm water channel which is clogged by garbage, MPW is committed to work with relevant authorities to do the followings;

- Improve the drainages which lead collected storm water into Mesurado Wetland before the completion of the Project road and at its own cost,
- Continuously facilitate anti-littering campaign for local people held by EPA, MCC and PCC, and
- Monitor the condition of storm water discharge every two (2) weeks, and take timely appropriate measures accordingly during the operation stage.

In Addition, regarding the garbage dumped and accumulated along the road, MPW agreed to monthly monitor the garbage around the road, and take measures accordingly in collaboration with MCC and PCC to maintain the best sanitary condition.

MPW and the Team assured that cost for conducting environmental mitigation measures and monitoring activities during construction phase (US\$ 54,000) is included in the Project cost, and cost for conducting environmental monitoring activities (US\$ 60,000 for the first two (2) years) and additional necessary budget during operation and maintenance phase will be allocated by MPW.

Social consideration

5-9. Scale of Resettlement

MPW explained that the scale of resettlement is as the followings;

- Number of PAPs; 918
- Number of structures to be affected; 449
(Commercial; 424, Residential; 11, Unclassified: 14)
- Number of the structures' owners; 456

5-10. Resettlement Action Plan

MPW confirmed that resettlement will be implemented in accordance with the RAP. MPW also confirmed that PAPs will be compensated in accordance with the entitlement matrix (Annex- 6). Such compensation policy has been explained to PAPs and agreed through satisfactory stakeholder consultations.

The RAP will be updated following the detailed asset survey to be conducted by MPW before implementation of RAP, taking into account the followings.

- The information of 89 structures' owners out of 456 who were absent during RAP preparation in 2012 will be followed up.
- Compensation rates mentioned in the entitlement matrix will be updated/recalculated

List of Annexes

- Annex-1 Project Cost Summary
- Annex-2 Environmental Checklist
- Annex-3 Environmental Monitoring Form for Construction Stage
- Annex-4 Environmental Monitoring Form for Operation Stage
- Annex-5 Monitoring Form for Resettlement
- Annex-6 Entitlement Matrix
- Annex-7 Implementation Schedule of Resettlement
- Annex-8 Responsibility Matrix

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Project Cost Summary

The total cost of the project which will be implemented under the financial assistance of Japanese Grant Aid and contribution from the Government of Liberia is about 4,779.2 Million Yen. Cost breakdown based on the division of work between the two countries is presented below. This figure however is provisional and does not necessarily mean the upper limit for the grant referred to in the Exchange of Notes (E/N) and will be further examined when the implementation of the requested Japanese assistance is examined in a concrete manner.

(1) Japanese Contribution

The table below shows the breakdown of costs of Japanese contribution.

Cost Summary of Japanese Contribution

			Project Cost (Million Yen)
Facility	Road Works	Earth Work	227.8
		Pavement Work	1,932.5
		Facility Structure Work	403.8
		Drainage Work	343.8
		Bridge Work	982.5
Detailed Design and Construction Supervision			169.9
Contingency			594.5
Total			4,654.8

(2) Liberia Contribution

Cost Summary of Liberia Contribution

Item	Amount US\$
1. Land acquisition and relocation of house	860,000
2. Utility Relocation Cost	600,000
3. Environmental Monitoring Cost	60,000
4. Advising Commission (Bank Charges)	25,000
Total	1,545,000

(3) Condition of Estimation

- ① Estimation Month/Year : June 2012
- ② Foreign Exchange Rate : US\$ 1.00 = 80.52 Yen (Exchange rate of Japanese Yen against American dollar)
- ③ Construction Period : Schedule of detailed design and construction supervision is shown in the schedule of implementation
- ④ Others : The project is to be carried out based on the Japanese Government's grant aid scheme.

Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) Y (b) N (c) - (d) -	(a) EIA/RAP reports were prepared. (b) EIA/RAP reports are under review by EPA. EIA license will be issued by December 2012. (c) Still unknown. (d) No license and/or permission is required except for EIA license issued by EPA. No construction work will not start until EPA approval which means EIA license (approval) of the Project is granted.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) Y	(a) At the stage of EIA/RAP preparation, sufficient stakeholder meetings were taken place and consensus/understanding from local stakeholders and authorities concerned to the Project was obtained. (b) Opinions raised from local resident were reflected to the Project design including Resettlement Action Plan (RAP) as much as possible.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) 5 alternatives including zero-action were examined with social and environmental considerations and most suitable alternative was selected.
	(1) Air Quality	(a) Is there a possibility that air pollutants emitted from the project related sources, such as vehicles traffic will affect ambient air quality? Does ambient air quality comply with the country's air quality standards? Are any mitigating measures taken? (b) Where industrial areas already exist near the route, is there a possibility that the project will make air pollution worse?	(a) Y (b) N	(a) Since the Project is to expand the existing road, the volume of traffic is expected to increase. However the total of emission volume from the traffic is going to decrease or be almost same as the zero-action due to speed-up of travel speed. Also ambient air quality is expected to be under Draft standard of ambient air quality in Liberia and that of WHO. (b) It is expected that ambient air quality will not exceed the standard above. However mitigation measures as follows will be taken, (1) periodical monitoring surveys for ambient air quality, (2) promotion of lead-free gasoline, (3) promotion of crackdown against ill-serviced vehicles.

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Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
2 Pollution Control	(2) Water Quality	(a) Is there a possibility that soil runoff from the bare lands resulting from earthmoving activities, such as cutting and filling will cause water quality degradation in downstream water areas? (b) Is there a possibility that surface runoff from roads will contaminate water sources, such as groundwater? (c) Do effluents from various facilities, such as parking areas/service areas comply with the country's effluent standards and ambient water quality standards? Is there a possibility that the effluents will cause areas not to comply with the country's ambient water quality standards?	(a) Y (b) Y (c) -	(a) It is possible. However it is expected that the water quality degradations in downstream water areas will be limited based on reasons that (1) large-scaled earth cutting and filling are not planned, (2) appropriate slope protections such as vegetation is taken. (b) It is expected that spilled oil on the road is flown out by rain water and contaminate groundwater etc. However it is also expected that the impact is limited based on reasons that (1) the amount of spilled oil on the road is a little, (2) crackdowns against ill-serviced vehicles is promoted. (c) No parking area/service is designed in the Project components. 35 bus stops in total are designed to be installed along the Project road, however no factor affecting water quality is expected.
	(3) Wastes	(a) Are wastes generated from the project facilities, such as parking areas/service areas, properly treated and disposed of in accordance with the country's regulations?	(a) -	(a) No parking area/service is designed in the Project components. Wastes arising from road maintenance/cleaning works and in/outside of ROW are disposed by MPW, those arising from cleaning works are disposed by Monrovia City Corporation (MCC). Swage are collected by the Liberia water and sewage corporation (LWSC).
2 Pollution Control	(4) Noise and Vibration	(a) Do noise and vibrations from the vehicle and train traffic comply with the country's standards?	(a) Y/N	(a) Draft standard for noise has been prepared but that for vibration does not exist. Therefore as for noise, Draft standard in Liberia and International Financial Corporation(IFC) standard and as for vibration Ghana standard are used to evaluate the current level in the Project site. Regarding noise, based on the baseline survey, 3 out of 4 survey points are over Draft Liberian standard and IFC standard. Regarding vibration, based on the baseline survey, most of points are below standard in Ghana. As mitigation measures in operation phase, (1) planted trees in green belt will be maintained well, (2) crackdown against ill-serviced vehicles is promoted, (3) crackdown against over-loaded vehicles is promoted, (4) periodical monitoring surveys for noise and vibration are done.
	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) The Project road is close to the Mesurado Wetland designated as Ramsar Convention however no direct impact is expected. However, as the possibility of indirect affect still exists, monitoring survey for ambient air quality, water quality, noise & vibration and ecosystem along the Project road will be conducted.

Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
3 Natural Environment	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Are adequate protection measures taken to prevent impacts, such as disruption of migration routes, habitat fragmentation, and traffic accident of wildlife and livestock? (e) Is there a possibility that installation of roads will cause impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystems due to introduction of exotic (non-native invasive) species and pests? Are adequate measures for preventing such impacts considered? (f) In cases the project site is located at undeveloped areas, is there a possibility that the new development will result in extensive loss of natural environments?	(a) N (b) N (c) - (d) N (e) N (f) N	(a) According to discussions with EPA who manages the Mesurado Wetland, it was confirmed that primeval forest, tropical rain forests, ecologically valuable habitats were not encompassed in the Project area. In addition, no mangrove is confirmed along the Project road including ROW. (b) According to discussions with EPA, it was confirmed that the protected habitats of endangered species by GoL and/or international treaties and conventions were not encompassed in the Project area. (c) Significant ecological impacts are not anticipated however in order to mitigate the impacts, the followings measures will be taken. (1) Trees which do not affect road structures in ROW remain. (2) Green belt is installed along the entire road length. (3) Monitoring surveys for ecosystem are conducted. (d) Since the Project road is situated in sub-industrial and residential area, measures such as disruption of migration routes, habitat fragmentation and traffic accident of wildlife and livestock are not necessary. (e) As a part of the Project, about 50 trees will be cut however trees co-habiting with surrounding nature is forested. (f) The Project site is already utilized as sub-industrial and residential area, therefore extensive loss of natural environment is not expected causing new area development.
	(3) Hydrology	(a) Is there a possibility that alteration of topographic features and installation of structures, such as tunnels will adversely affect surface water and groundwater flows?	(a) N	(a) Piers for new bridge will be constructed in Stockton Creek however type of piers and its construction method affecting water flow less is introduced.
3 Natural Environment	(4) Topography and Geology	(a) Is there any soft ground on the route that may cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides, where needed? (b) Is there a possibility that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides? (c) Is there a possibility that soil runoff will result from cut and fill areas, waste soil disposal sites, and borrow sites? Are adequate measures taken to prevent soil runoff?	(a) N (b) N (c) Y	(a) Since the existing road passes through relatively flat area, slope failures are less likely to happen. Also based on the geological survey, no soft ground area confirmed. (b) Large-scaled civil works are not expected. (c) It is possible. Protection measures against earth cutting and filling are appropriate slope and hydraulic seeding works. Also it was confirmed that waste soil disposal sites and borrow sites were maintained well.

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Environmental Checklist

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Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Are the compensations going to be paid prior to the resettlement? (e) Are the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	(a) Y (b) Y (c) Y (d) Y (e) Y (f) Y (g) Y (h) Y (i) Y (j) Y	(a) 918 Project Affected Persons (PAPs) (456 owner of structure) occupying 449 commercial and residential structures would be affected within 75 feet (or 22.86m) of the ROW. In order to minimize the involuntary resettlement, 5 alternatives were examined and most suitable alternatives was selected. (b) At the stage of RAP preparation, 9 stakeholder meetings were taken place and appropriate explanation on compensation and resettlement assistance was given to PAPs. (c) Resettlement cost study was carried out and appropriate resettlement cost was calculated based on the study. (d) RAP states that the compensations is going to be paid prior to the resettlement. (e) Compensation policies are shown in RAP and RAP will be disclosed to public after EPA approval. (f) Vulnerable groups are given particular attention and it is mentioned in RAP. (g) Based on the 8 stakeholder meetings, agreements from PAPs are expected to be obtained. However there are some unidentified PAPs, therefore MPW keeps trying to find out the PAPs by using mass medias and local communities. (h) Organizational framework with MPW's initiative to properly implement resettlement has been established. Also budget necessary will be allocated. (i) Monitoring surveys are expected to be implemented properly by both internal and external organizations. (j) Grievance redress mechanism is established by reference to past project implemented by World Bank.

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Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4 Social Environment	(2) Living and Livelihood	<p>(a) Where roads are newly installed, is there a possibility that the project will affect the existing means of transportation and the associated workers? Is there a possibility that the project will cause significant impacts, such as extensive alteration of existing land uses, changes in sources of livelihood, or unemployment? Are adequate measures considered for preventing these impacts?</p> <p>(b) Is there any possibility that the project will adversely affect the living conditions of the inhabitants other than the target population? Are adequate measures considered to reduce the impacts, if necessary?</p> <p>(c) Is there any possibility that diseases, including infectious diseases, such as HIV will be brought due to immigration of workers associated with the project? Are adequate considerations given to public health, if necessary?</p> <p>(d) Is there any possibility that the project will adversely affect road traffic in the surrounding areas (e.g., increase of traffic congestion and traffic accidents)?</p> <p>(e) Is there any possibility that roads will impede the movement of inhabitants?</p> <p>(f) Is there any possibility that structures associated with roads (such as bridges) will cause a sun shading and radio interference?</p>	<p>(a) N (b) N (c) Y (d) Y (e) N (f) N</p>	<p>(a) Since the Project is to expand the existing road, the existing means of transport is not expected to be affected.</p> <p>(b) The Project does not affect the local resident on living and livelihood except for PAPs above.</p> <p>(c) Diseases including infectious diseases are expected to be brought due to immigration of workers associated with the project. Workers involving the Project are educated by contractor.</p> <p>(d) The Project is expected to contribute mitigating traffic congestion however it is expected to affect traffic accidents because travel speed will be up.</p> <p>(e) Since the Project is to expand the existing road, the movement of inhabitants will not be impeded.</p> <p>(f) Since the Project road passes through almost ground level except for the bridges, a sun shading and radio interference does not be caused.</p>
	(3) Heritage	<p>(a) Is there a possibility that the project will damage the local archaeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?</p>	<p>(a) N</p>	<p>(a) No archaeological, historical, cultural, and religious heritage does exist along the Project road.</p>
	(4) Landscape	<p>(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?</p>	<p>(a) N</p>	<p>(a) No significant impact is expected.</p>
	(5) Ethnic Minorities and Indigenous Peoples	<p>(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples?</p> <p>(b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources to be respected?</p>	<p>(a) - (b) -</p>	<p>(a) No ethnic minority and indigenous people does exist.</p> <p>(b) Same above.</p>

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Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4 Social Environment	(6) Working Conditions	<p>(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project?</p> <p>(b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials?</p> <p>(c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.?</p> <p>(d) Are appropriate measures being taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?</p>	<p>(a) Y</p> <p>(b) Y</p> <p>(c) Y</p> <p>(d) Y</p>	<p>(a) Construction plan is in accordance with Labor Law of Liberia.</p> <p>(b) (c) As tangible measures, safety equipments are installed to prevent accidents. As intangible measures, suitable construction implementation plan for securing safety based on construction safety plan will be prepared. Also it is stated that appropriate education is provided to construction workers and related persons. Moreover monitoring is done to confirm if mentioned above is kept.</p> <p>(d) In order to prevent accidents, safety equipments will be installed. Also appropriate safety education to construction workers, security guards and traffic control staff are mobilized.</p>

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Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?	(a) Y (b) Y (c) Y	(a) Mitigation measures against pollution during construction are as follows. Regarding noise and vibration, (1) for the purpose of alleviate traffic congestion, existing 2-lane road is expanded into 4-lane road, (2) the number of surface layer joint on new additional 2-lane road is decreased as many as possible, (3) low-noise construction machineries are used. (4) construction machineries are used properly, also regular maintenance work is implemented. (5) green belt is constructed and trees are planted in the green belt, (6) construction work is done only daytime around schools and clinics, (7) monitoring is carried out regularly (8) in case night work is implemented, advance notice is given and permission is obtained. (9) crackdown against ill-serviced vehicles are promoted. Regarding water quality, (1) waste water from construction site is not discharged into the rivers directly. (2) construction machinery is not washed in the rivers. (3) during bridge construction, oil fence and anti-water pollution net are used. Regarding dust and emission; (1) construction machinery is used properly without unnecessary idling. Also regular maintenance work is implemented. (2) sprinkling of water is carried out regularly during dry season. (3) in case of placing backfilling and excavated soil temporarily, the soil is covered by anti-scattering sheets. (4) monitoring is carried out regularly. (5) lead free gasoline is used for construction machinery and vehicles. Regarding construction waste, (1) construction waste is recycled as much as possible. (2) in case recycle is not available, the waste is disposed in appropriate facilities. (b) As mitigation measures against natural environment, (1) trees which do not affect road structures in ROW remain. (2) green belt is installed along the entire road length. (3) ecosystem monitoring is conducted in Stockton Creek and Warner Creek. (c) As mitigation measures against social environment, (1) the poor is given priority to get construction works. (2) movable vendors are allowed to operate in ROW where construction work is not disturbed. (3) traffic control staff is allocated to smooth the traffic and avoid accidents (4) temporal busbays are installed in order to secure means of transport for local resident.
5 Others	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a) Y (b) Y (c) Y (d) Y	(a) Monitoring program for the environmental items was developed and stated in EIA report. (b) Monitoring items, methods and frequencies were determined in consideration of personnel, budget etc. of MPW/IIU. (c) MPW establishes IIU who is in charge of EIA issue. IIU applies budget necessary for the Project implementation in the next fiscal year. (d) EIA/RAP report states format and frequency of the reports.

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Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Forestry Projects checklist should also be checked (e.g., projects including large areas of deforestation). (b) Where necessary, pertinent items described in the Power Transmission and Distribution Lines checklist should also be checked (e.g., projects including installation of power transmission lines and/or electric distribution facilities).	(a) N (b) N	(a) No large areas of deforestation is expected in the Project. (b) No installation of power transmission lines and/or electric distribution facilities is expected in the Project.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed, if necessary (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) Y	(a) As transboundary or global issues, global warming arising from CO2 emission is expected. However the volume of CO2 emitted from traffic will decrease a bit or be the same level as Zero-option.

1) Regarding the term "Country's Standards" mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are required to be made.

In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).

2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.

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As of YYYY/MM/DD

Vegetation

		Submission of Monitoring Report	Number of trees planted	
			Young Trees	Old Trees
1	2013 (3rd qtr)	YYYY/MM/DD		
2	2013 (4th qtr)	YYYY/MM/DD		
3	2014 (1st qtr)	YYYY/MM/DD		
		YYYY/MM/DD		
		YYYY/MM/DD		
		YYYY/MM/DD		
		YYYY/MM/DD		
		YYYY/MM/DD		

Complaint

	Complaint received	Complaint resolved	Type of Complaint
1	YYYY/MM/DD	YYYY/MM/DD	
2	YYYY/MM/DD	YYYY/MM/DD	
3	YYYY/MM/DD	YYYY/MM/DD	
	YYYY/MM/DD	YYYY/MM/DD	
	YYYY/MM/DD	YYYY/MM/DD	
	YYYY/MM/DD	YYYY/MM/DD	
	YYYY/MM/DD	YYYY/MM/DD	
	YYYY/MM/DD	YYYY/MM/DD	
	YYYY/MM/DD	YYYY/MM/DD	

HIV/AIDS and other Sexually Transmitted Diseases <Campaign>

	Date	Place	Number of Safety Measures		Number of Participants		
			Contraceptive	Condoms	Male	Female	Total
1	YYYY/MM/DD						
2	YYYY/MM/DD						
3	YYYY/MM/DD						
	YYYY/MM/DD						
	YYYY/MM/DD						
	YYYY/MM/DD						
	YYYY/MM/DD						
	YYYY/MM/DD						

Accident

	Date	Place	Number of persons Injured		Type of Accident	Measure taken
			Project's Employee	Non-employee		
1	YYYY/MM/DD					
2	YYYY/MM/DD					
3	YYYY/MM/DD					
	YYYY/MM/DD					
	YYYY/MM/DD					
	YYYY/MM/DD					
	YYYY/MM/DD					
	YYYY/MM/DD					

Sanitary Situation (Garbage along the road)

<Monitoring Frequency> Monthly

	Date	Situation Observed	Measure Taken
1	YYYY/MM/DD		
2	YYYY/MM/DD		
3	YYYY/MM/DD		
	YYYY/MM/DD		
	YYYY/MM/DD		
	YYYY/MM/DD		
	YYYY/MM/DD		
	YYYY/MM/DD		

Air Quality, Water Quality, Noise & Vibration

Item	Parameter	Location	Result	Standard	Remarks	
Air Quality	PM10 (average 24h)	[A]		100 µg/m ³ (National) 50 µg/m ³ (WHO)		
		[B]				
		[C]				
	SO ₂ (average 24h)	[A]		80 µg/m ³ (National) 20 µg/m ³ (WHO) (average 24h)		
		[B]				
		[C]				
	NO ₂ (average 24h)	[A]		80 µg/m ³ (National) (average 24h)		
		[B]				
		[C]				
	CO (average 8h)	[A]		2,000 mg/m ³ (National) 1,000 mg/m ³ (WHO)		
		[B]				
		[C]				
Noise	Noise Level (Day Time 06:01 – 22:00)	[A]		50 dB (National, Residential Building)		
		[B]		45 dB (National, Hospital, School Area)		
		[C]		60 dB (National, Residential + Industry or small production)		
		[D]		50 dB (National, Mixed Residential Building)		
	Noise Level (Night Time 22:01 – 06:00)	[A]		35 dB (National, Residential Building)		
		[B]		35 dB (National, Hospital, School Area)		
		[C]		50 dB (National, Residential + Industry or small production)		
		[D]		35 dB (National, Mixed Residential Building)		
Vibration	Vibration Level (Day Time 06:01 – 22:00)	[A]		55 dB (Ghana, Residential Building)		
		[B]		55 dB (Ghana, Hospital, School Area)		
		[C]		65 dB (Ghana, Residential + Industry or small production)		
		[D]		60 dB (Ghana, Mixed Residential Building)		
	Vibration Level (Night Time 22:01 – 06:00)	[A]		48 dB (Ghana, Residential Building)		
		[B]		50 dB (Ghana, Hospital, School Area)		
		[C]		60 dB (Ghana, Residential + Industry or small production)		
		[D]		55 dB (Ghana, Mixed Residential Building)		
Water Quality	pH	[A]		6.5-8.5 (National, WHO)		
		[B]				
		[C]				
	Temperature	[A]				
		[B]				
		[C]				
	me	[A]		No Color (National)		
		[B]				
		[C]				
	Odor	[A]		No Odor (National)		
		[B]				
		[C]				
	SS	[A]		30 mg/L (WHO)		
		[B]				
		[C]				
	COD	[A]		30-50 mg/L (WHO)		
		[B]				
		[C]				
DO	[A]		< 5.0 mg/L (National, WHO)			
	[B]					
	[C]					
E. Coll	[A]					
	[B]					
	[C]					
Oil & Grease	[A]		0.1 mg/L (National, WHO)			
	[B]					
	[C]					

WHO: World Health Organization

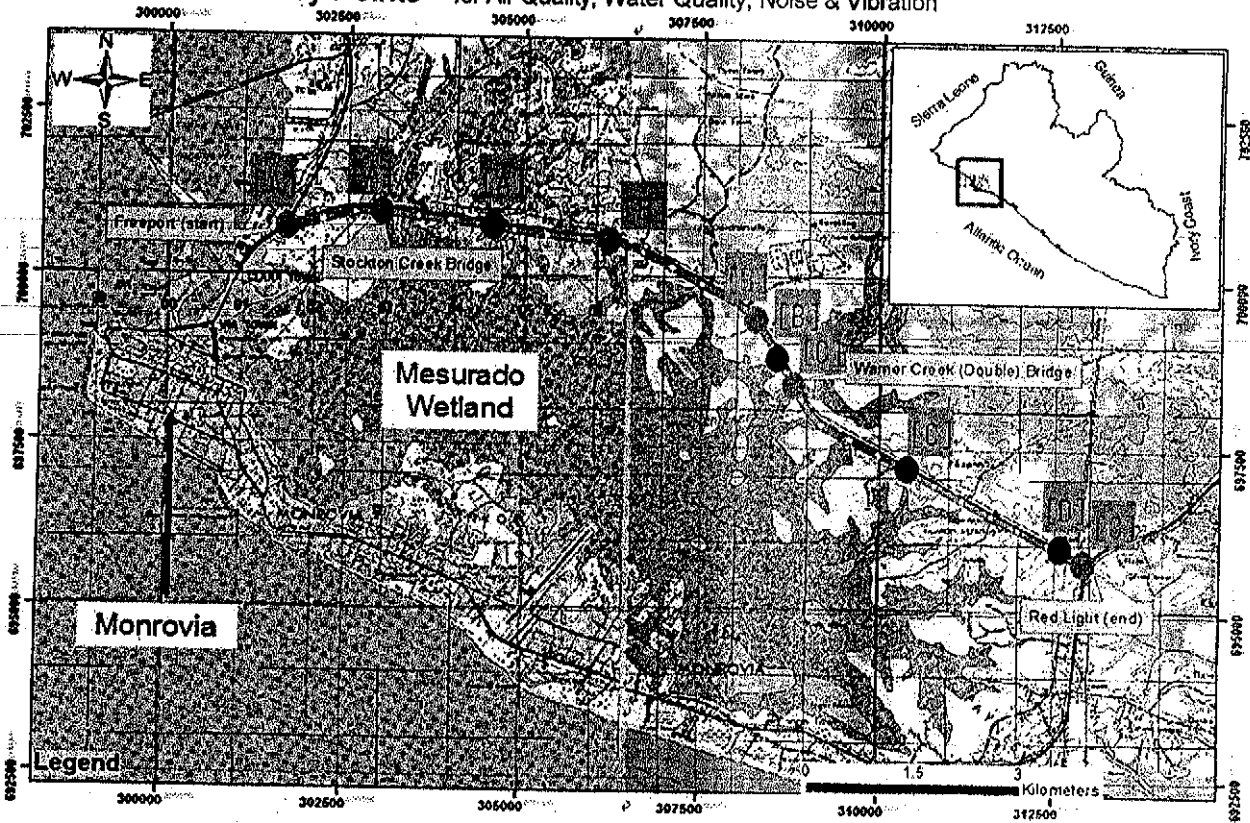
**Remarks; Past trend and current status including remedial measures if necessary

<Monitoring Frequency>

Air Quality, Noise & Vibration; Every three (3) months

Water Quality; Every six (6) months

< Location of Survey Points > for Air Quality, Water Quality, Noise & Vibration



Regend) ● : Air Quality ● : Water Quality ● : Noise & Vibration

Coordinates of each Survey Points

Survey Point	North: N West: W	Coordinates		
		Air Quality	Water Quality	Noise & Vibration
[A]	N	15° 04'	6° 18' 57.07"	6° 18' 33.90"
	W	10° 47' 33.54"	10° 43' 41.07"	10° 43' 28.35"
[B]	N	6° 19'	6° 20' 23.73"	6° 19' 06.11"
	W	10° 44' 02.20"	10° 46' 49.52"	10° 43' 42.61"
[C]	N	6° 17'	6° 20' 18.83"	6° 20' 21.85"
	W	10° 41' 27.29"	10° 46' 45.99"	10° 47' 15.87"
[D]	N	-	-	6° 17' 44.72"
	W	-	-	10° 41' 07.62"

Ecosystem <Visual observation of animals>

	Location	Date of Survey	Creatures Found	Threaten to Ecosystem (if any)	Root Cause	Measure Taken
1	Stockton Creek	2013 (Latter Half)				
		Warner Creek				
2	Stockton Creek	2014 (First Half)				
		Warner Creek				
3	Stockton Creek	2014 (Latter Half)				
		Warner Creek				
	Stockton Creek					
		Warner Creek				
	Stockton Creek					
		Warner Creek				

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As of YYYY/MM/DD

Submission of Monitoring Report		
1	2015 (First Half)	YYYY/MM/DD
2	2015 (Latter Half)	YYYY/MM/DD
3	2016 (First Half)	YYYY/MM/DD
4	2016 (Latter Half)	YYYY/MM/DD

Complaint

	Complaint received	Complaint resolved	Type of Complaint
1	YYYY/MM/DD	YYYY/MM/DD	
2	YYYY/MM/DD	YYYY/MM/DD	
3	YYYY/MM/DD	YYYY/MM/DD	
	YYYY/MM/DD	YYYY/MM/DD	
	YYYY/MM/DD	YYYY/MM/DD	
	YYYY/MM/DD	YYYY/MM/DD	
	YYYY/MM/DD	YYYY/MM/DD	
	YYYY/MM/DD	YYYY/MM/DD	
	YYYY/MM/DD	YYYY/MM/DD	

HIV/AIDS and other Sexually Transmitted Diseases <Campaign>

	Date	Place	Number of Safety Measures Distributed		Number of Participants		
			Contraceptive	Condom	Male	Female	Total
1	YYYY/MM/DD						
2	YYYY/MM/DD						
3	YYYY/MM/DD						
	YYYY/MM/DD						
	YYYY/MM/DD						
	YYYY/MM/DD						
	YYYY/MM/DD						
	YYYY/MM/DD						

Sanitary Situation <Garbage along the road>

<Monitoring Frequency> Monthly

	Date	Situation Observed	Measure Taken
1	YYYY/MM/DD		
2	YYYY/MM/DD		
3	YYYY/MM/DD		
	YYYY/MM/DD		
	YYYY/MM/DD		
	YYYY/MM/DD		
	YYYY/MM/DD		
	YYYY/MM/DD		

Drainage Situation

<Monitoring Frequency> Every two (2) weeks

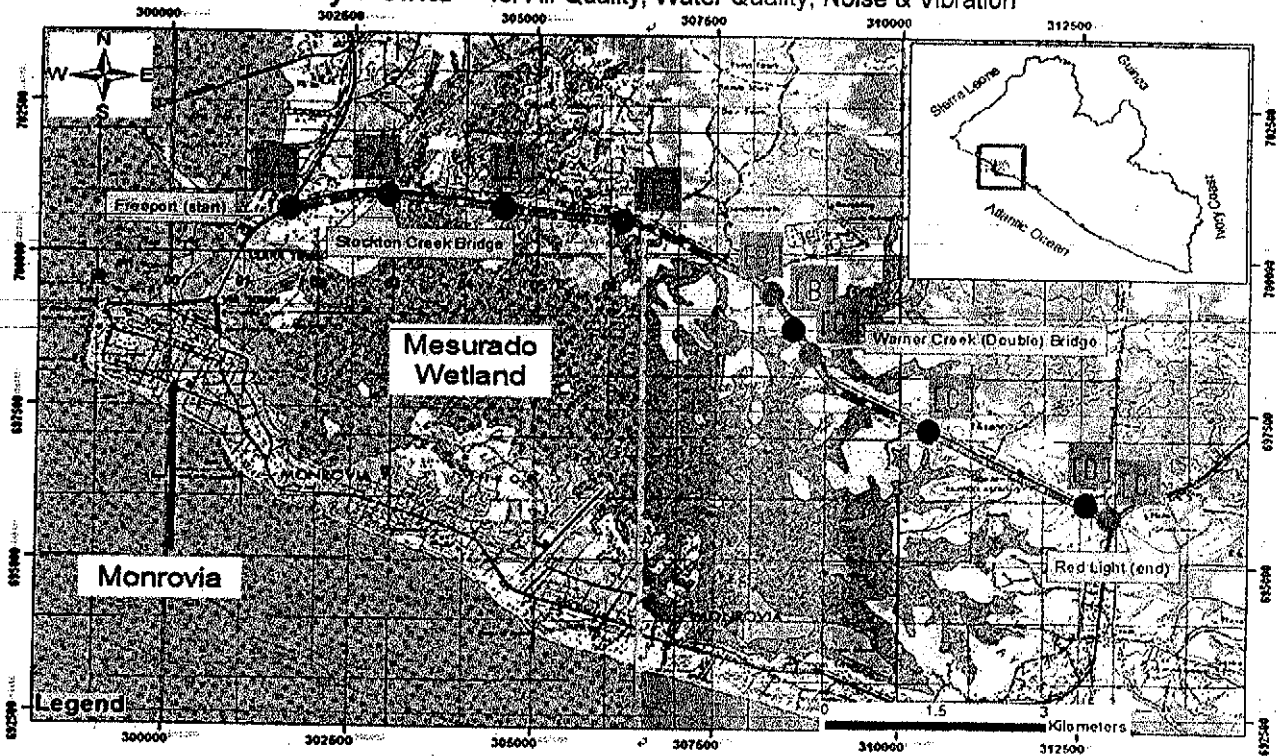
	Date	Situation Observed	Measure Taken
1	YYYY/MM/DD		
2	YYYY/MM/DD		
3	YYYY/MM/DD		
	YYYY/MM/DD		
	YYYY/MM/DD		
	YYYY/MM/DD		
	YYYY/MM/DD		
	YYYY/MM/DD		

Air Quality, Water Quality, Noise & Vibration

Item	Parameter	Location	Result	Standard	Remarks	
Air Quality	PM10 (average 24h)	[A]		100 µg/m ³ (National) 50 µg/m ³ (WHO)		
		[B]				
		[C]				
	SO ₂ (average 24h)	[A]		80 µg/m ³ (National) 20 µg/m ³ (WHO) (average 24h)		
		[B]				
		[C]				
	NO ₂ (average 24h)	[A]		80 µg/m ³ (National) (average 24h)		
		[B]				
		[C]				
	CO (average 8h)	[A]		2,000 mg/m ³ (National) 1,000 mg/m ³ (WHO)		
		[B]				
		[C]				
Noise	Noise Level (Day Time: 06:01 – 22:00)	[A]		50 dB (National, Residential Building)		
		[B]		45 dB (National, Hospital, School Area)		
		[C]		60 dB (National, Residential + industry or small production)		
		[D]		50 dB (National, Mixed Residential Building)		
	Noise Level (Night Time: 22:01 – 06:00)	[A]		35 dB (National, Residential Building)		
		[B]		35 dB (National, Hospital, School Area)		
		[C]		50 dB (National, Residential + industry or small production)		
		[D]		35 dB (National, Mixed Residential Building)		
Vibration	Vibration Level (Day Time: 06:01 – 22:00)	[A]		55 dB (Ghana, Residential Building)		
		[B]		55 dB (Ghana, Hospital, School Area)		
		[C]		65 dB (Ghana, Residential + Industry or small production)		
		[D]		60 dB (Ghana, Mixed Residential Building)		
	Vibration Level (Night Time: 22:01 – 06:00)	[A]		48 dB (Ghana, Residential Building)		
		[B]		50 dB (Ghana, Hospital, School Area)		
		[C]		60 dB (Ghana, Residential + industry or small production)		
		[D]		55 dB (Ghana, Mixed Residential Building)		
Water Quality	pH	[A]		6.5-8.5 (National, WHO)		
		[B]				
		[C]				
	Temperature	[A]				
		[B]				
		[C]				
	me	[A]		No Color (National)		
		[B]				
		[C]				
	Odor	[A]		No Odor (National)		
		[B]				
		[C]				
	SS	[A]		30 mg/L (WHO)		
		[B]				
		[C]				
	COD	[A]		30-50 mg/L (WHO)		
		[B]				
		[C]				
DO	[A]		< 5.0 mg/L (National, WHO)			
	[B]					
	[C]					
E. Coll	[A]					
	[B]					
	[C]					
Oil & Grease	[A]		0.1 mg/L (National, WHO)			
	[B]					
	[C]					

WHO: World Health Organization*Remarks; Past trend and current status including remedial measures if necessary
 <Monitoring Frequency> Every six (6) months

< Location of Survey Points > for Air Quality, Water Quality, Noise & Vibration



Legend) ● : Air Quality ● : Water Quality ● : Noise & Vibration

Coordinates of each Survey Points

Survey Point	North N		Coordinates		
	West W		Air Quality	Water Quality	Noise & Vibration
[A]	N	6°20'15.61"	6°18'57.07"	6°18'33.90"	
	W	10°47'	10°43'41.07"	10°43'28.35"	
[B]	N	6°19'36.61"	6°20'23.73"	6°19'06.11"	
	W	10°47'	10°46'49.52"	10°43'42.61"	
[C]	N	6°17'33.10"	6°20'18.83"	6°20'21.85"	
	W	10°41'27.29"	10°46'45.99"	10°47'15.87"	
[D]	N	-	-	6°17'44.72"	
	W	-	-	10°41'07.52"	

Ecosystem <Visual observation of animals>

	Location	Date of Survey	Creatures Found	Threaten to Ecosystem (if any)	Root Cause	Measure Taken
1	2015 (First Half)	Stockton Creek YYYY/MM/DD				
		Warner Creek YYYY/MM/DD				
2	2015 (Latter Half)	Stockton Creek YYYY/MM/DD				
		Warner Creek YYYY/MM/DD				
3	2016 (First Half)	Stockton Creek YYYY/MM/DD				
		Warner Creek YYYY/MM/DD				
4	2016 (Latter Half)	Stockton Creek YYYY/MM/DD				
		Warner Creek YYYY/MM/DD				

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As of YYYY/MM/DD

Progress of Compensation for Affected Structure

Item	Total Number of Structures	Payment of Compensation	Vacation of Land	(Expected) Date of Completion
Concrete Flat/Zinc Roof	107	0%	0%	YYYY/MM
Concrete Storey/Zinc Roof	3	0%	0%	YYYY/MM
Container (with some development)	130	0%	0%	YYYY/MM
Fence-barb wire	8	0%	0%	YYYY/MM
Fence-concrete/barb wire	7	0%	0%	YYYY/MM
Fuel Stations	50	0%	0%	YYYY/MM
Kiosk	47	0%	0%	YYYY/MM
Mud Bricks/Zinc Roof	12	0%	0%	YYYY/MM
Round Poles/Zinc Roof	20	0%	0%	YYYY/MM
Zinc/Mat Round	10	0%	0%	YYYY/MM
Zinc/Plywood Round	45	0%	0%	YYYY/MM
Other (Well, Bus Stop etc.)	10	0%	0%	YYYY/MM
TOTAL	449	0	0	YYYY/MM

Progress of Assistance

Item	Total Number of Households	Payment of Assistance	(Expected) Date of Completion
Compensation for Loss of Income (US\$ 100)	431	0%	YYYY/MM
Relocation Assistance for Container (US\$ 250)	130	0%	YYYY/MM
Relocation Assistance for Residential Structure (US\$ 250)	11	0%	YYYY/MM
Transportation Assistance for Residential Structure (US\$ 100)	25	0%	YYYY/MM
Transportation Assistance for Others (US\$ 100)	25	0%	YYYY/MM
Assistance to Vulnerable People (US\$ 50)	92	0%	YYYY/MM

Procedures

Procedure	Date
Institutional Arrangement	
Establishment of RAP Implementation Committee	YYYY/MM/DD
Establishment of Grievance Redress Committee	YYYY/MM/DD
Detailed Asset Survey and Compensation Estimation	
Start of Survey	YYYY/MM/DD
Completion of Survey	YYYY/MM/DD
RAP Budget	
Submission	YYYY/MM/DD
Approval	YYYY/MM/DD

Submission of Monitoring Report

Internal Monitoring	
2013 (1st qtr)	YYYY/MM/DD
2013 (2nd qtr)	YYYY/MM/DD
2013 (3rd qtr)	YYYY/MM/DD
2013 (4th qtr)	YYYY/MM/DD
2014 (1st qtr)	YYYY/MM/DD
External Monitoring	
1st	YYYY/MM/DD
2nd	YYYY/MM/DD
3rd	YYYY/MM/DD

Grievance Redress

	Outline of Grievance and Remarks (if any)	Grievance received	Grievance resolved
1		YYYY/MM/DD	YYYY/MM/DD
2		YYYY/MM/DD	YYYY/MM/DD
3		YYYY/MM/DD	YYYY/MM/DD
		YYYY/MM/DD	YYYY/MM/DD
		YYYY/MM/DD	YYYY/MM/DD

Public Consultation

	Agenda	Place	Number of Participants	Date
1				YYYY/MM/DD
2				YYYY/MM/DD
3				YYYY/MM/DD
				YYYY/MM/DD
				YYYY/MM/DD

ENTITLEMENT MATRIX FOR PROJECT AFFECTED PERSONS

#	Type of Loss	Entitled Persons (Beneficiaries)	Entitlement (Compensation Package)	Implementation Issues/Guidelines
1	Loss of Land	Legal Owner of Land	Replacement Cost	<ul style="list-style-type: none"> ✓ Assessment of quantity and quality of land ✓ Assessment of Market Value ✓ Assessment of Cash Compensation ✓ Updating of titles of the affected persons ✓ Payment of Cash Compensation ✓ Affected Persons will be fully informed of the entitlements and the procedures regarding payments ✓ Advance notice to vacate
		Illegal Occupant of Land	No Compensation for Land	<ul style="list-style-type: none"> ✓ Cash compensation for assets such as structures and standing trees. ✓ Advance notice to vacate
2	Loss of Structures	Owner of Structure	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 ✓ In addition, US\$ 250 for relocation assistance and US\$ 100 for transportation assistance will be provided per Project Affected Household (PAH) for Residential Structure ✓ 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
		Owner of Container	US\$ 250 per PAH	<ul style="list-style-type: none"> ✓ Payment of Cash Compensation (US\$ 250 per PAH which is sufficient to rent a forklift to relocate container from original position to another) ✓ No compensation for container itself, because containers will not be demolished ✓ Additional assistances such as relocation ✓ Permission to continue business within ROW which does not destruct road facilities ✓ Advance notice to vacate

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#	Type of Loss	Entitled Persons (Beneficiaries)	Entitlement (Compensation Package)	Implementation Issues/Guidelines
3	Loss of Income	Owner of Business	US\$ 100 per PAH	<ul style="list-style-type: none"> ✓ Payment of Assistance (US\$ 100 per PAH for loss of business income during the period of relocation or demolition of the structures) ✳ All PAHs operating businesses in Project area wish to continue operating within ROW out of the proposed road facilities such as carriageways, greenbelt, and sidewalk. Therefore US\$ 100 per PAH is sufficient to compensate loss of business income during the period of relocation or demolition of the structures. The period between the relocation and restart of the business is anticipated as 7 days. ✓ Affected Persons will be fully informed of the entitlements and the procedures regarding payments ✓ Advance notice to vacate
		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.
4	Loss of Accommodation	Vulnerable Persons	US\$ 50 per PAH, 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
		Tenants	Special Assistance	<ul style="list-style-type: none"> ✓ Re-imbursement of remaining worth of lease or tenancy deposit ✓ Moving assistance such as house replacement, assistance of rent for 3-month period and moving cost ✓ Advance notice to vacate

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Implementation Schedule of Resettlement

Resettlement activities to be conducted by Liberian Government are described as following table:

Activity	Calendar YR	2012												2013											
	JP Fiscal-YR	24						25																	
	Responsible Agency	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12								
1. Approval of RAP	EPA				■																				
2. Stakeholder Meeting	MPW				■		■																		
3. Detailed Asset Survey and Compensation Estimation	MPW				■	■																			
4. RAP Budget																									
- Submission	MPW					■																			
- Approval	MPW						■																		
5. Resettlement																									
- Contracting for Compensation	MPW							■																	
- Compensation Payment	MPW							■																	
- Relocation of PAPs	MPW							■	■	■	■														
6. Completion of Relocation	MPW																								
7. Grievance Redressing	MPW																								
8. Site Clearing for Alignment ROW	MPW																								
9. Possible Bidding Date	-																								
10. Possible Date of the Commencement of Construction																									

Notes: 1. Abbreviations:

- YR - Year
 - JP - Japan
 - EPA - Environmental Protection Agency
 - MPW - Ministry of Public Works
 - PAPs - Project Affected Persons
 - JICA - Japan International Cooperation Agency
2. JICA will provide technical support for the RAP Activities.

**Project for Reconstruction of Somalia Drive in Monrovia
in the Republic of Liberia**

Responsibility Matrix

Items	Target Date	Responsible Agency					
		GOJ	ROL	MPW	EPA	Contractor	
1. Project Scope	• Road Construction	End of May, 2016	⊙				
	• Reconstruction of Stockton Bridge	End of May, 2016	⊙				
	• Repair of Double Bridge	End of May, 2016	⊙				
2. Project ROW and Permits/Clearances	• Secure Budget for ROW & RAP	End of February, 2013			⊙		
	• Project ROW Acquisition	Beginning of August, 2013			⊙	○	
	• Project Site Preparation and Clearance (removal of existing buildings, trees, obstacles, removal/relocation of utilities, etc.)	Mid of August, 2013		○	⊙	○	
	• Clearance for Temporary Construction Yard	Before Construction			⊙		
	• Permits for Disposal Area, etc.	Before Construction			⊙		
3. RAP	• RAP Approval	Beginning of December, 2012			○	⊙	
	• Detailed Asset Survey and Compensation Estimation	Mid of January, 2013			⊙	○	
	• RAP Budget (Preparation & Approval)	End of February, 2013		○	⊙	○	
	• Compensation Agreement with PAPs	Mid of March, 2013			⊙	○	
	• Payment of Compensation	Mid of March, 2013			⊙	○	
	• Relocation of PAPs	June, 2013			⊙	○	
	• RAP Monitoring	During RAP activities until two (2) years after Resettlement			⊙	○	
4. EIA	• EIA Approval	Beginning of December, 2012			○	⊙	
	• Monitoring for Environmental and Social Consideration	Before, During Construction			⊙	○	⊙
		After Construction			⊙	○	
5. Bank Arrangement	• Bank Account and Bank Charges for Grant (Commission for Banking Arrangement and Authorization to Pay)	Before and during Construction		⊙	○		
6. Tax Exemption and Clearances	• Customs clearance and tax exemption for imported items related to project	During Construction		⊙	○		
	• Tax exemption of Japanese nationals from customs duties, internal taxes and other fiscal levies for the supply of products and services	During Construction		⊙	○		

- Notes:**
- ⊙ - Major role/responsibility
 - - Secondary role/responsibility
 - GOJ - Government of Japan
 - ROL - Republic of Liberia
 - MPW - Ministry of Public Works, ROL
 - EPA - Environmental Protection Agency, ROL

4. 討議議事録 (M/D)
(2) 第2次現地調査 (2012年4月19日)

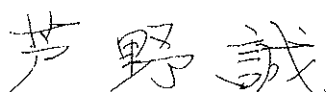
Minutes of Discussions
on the Preparatory Survey (Outline Design)
on the Project for Reconstruction of Somalia Drive in Monrovia
in the Republic of Liberia

In response to the request from the Government of the Republic of Liberia (hereinafter referred to as "Liberia"), the Government of Japan decided to conduct a Preparatory Survey on the Project for Reconstruction of Somalia Drive in Monrovia (hereinafter referred to as "the Project"), and entrusted the Survey to Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent the Preparatory Survey Team for the Outline Design (hereinafter referred to as "the Team") to Liberia. The Team is headed by Mr. Makoto ASHINO, Senior Advisor to the Director General, Economic Infrastructure Department, JICA, and is scheduled to stay in the country from January 21 to June 1, 2012.

The Team held a series of discussions with the officials concerned of the Government of Liberia and conducted a field survey in the Project area. In the course of the discussions, both sides have confirmed the main items described in the attached sheets. The Team will proceed to further works and prepare the Preparatory Survey Report.

Monrovia, April 19, 2012



Makoto Ashino
Leader
Preparatory Survey Team
Japan International Cooperation Agency



Victor B. Smith
Deputy Minister for Technical Services
Ministry of Public Works



Yancon -- Dargbe Nimley
Assistant Minister for Economic Cooperation
& Integration
Ministry of Planning & Economic Affairs

ATTACHMENT

1. Objective of the Project

The objective of the Project is to satisfy increasing transportation demand and contribute to the reduction of traffic jam in Greater Monrovia, through the Reconstruction of Somalia Drive.

2. Items Requested by the Government of Liberia

2-1. After the discussions with the Team, the items described below were requested by the Liberian side.

- Expansion of the Somalia Drive (from the Free Port junction to the Red Light junction) from 2-lanes to 4-lanes. (New additional 2-lane roads)
- Rehabilitation of existing Stockton Bridge (4-lane).
- Repair of existing Double Bridge (4-lane).
- Improvement of existing road junctions.
- Installation of bus stop and car parking.
- Installation of pedestrian walkway.
- Installation of curb stones.
- Installation of traffic signs and road marking.
- Installation of pedestrian crossings.

JICA will assess the appropriateness of the request through the Preparatory Survey and will report the findings to the Government of Japan. Implementation and components of the Project will be decided by the Government of Japan.

2-2. Both sides confirmed that the designing of the Red Light junction is not included as a Project component.

2-3. The Liberian side requested that the designing of existing road of Somalia Drive be considered in the overall design.

3. Environmental and Social Considerations

3-1. The Team explained the outline of JICA Guidelines for Environmental and Social Considerations (April 2004) (hereinafter referred to as "the JICA Guidelines") to the Liberian side. The Liberian side understood the concept of the JICA Guidelines and confirmed to conduct the necessary procedure.

3-2. The Liberian side confirmed that MPW shall conduct necessary procedure concerning Environmental Impact Assessment (EIA) based on the law of Liberia and acquire EIA License from Environment Protection Agency (EPA) and submit it to JICA Liberia Field Office by the middle of October 2012.

3-3. Regarding the Project Affected Persons (PAPs) within the Project sites, the Liberian



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side agreed to secure the appropriate budget to be allocated for resettlement and compensation and secure the land before the implementation of the Project. In this regard a Resettlement Action Plan (RAP) will be prepared and approved by the responsible authorities beforehand and MPW will take necessary measures to PAPs according to RAP in close communication with JICA.

3-4. The Liberian side agreed that Project Affected Persons (PAPs) shall be sufficiently compensated and supported to improve standard of living, income opportunities and production levels, or at least to restore them to pre-project levels.

4. Schedule of the Study

4-1. The Team will continue further studies in Liberia until June 1, 2012.

4-2. JICA will prepare a draft Preparatory Survey Report in English and dispatch a mission to Liberia in order to explain its contents around October 2012.

4-3. If the contents of the report is accepted in principle by the Liberian side, JICA will complete the final report in English and send it to Liberia around February 2013.

5. Other Relevant Issues

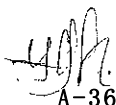
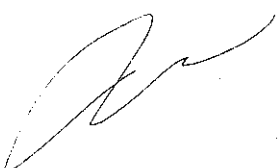
5-1. The Liberian side confirmed that the following undertaking should be taken by the Liberian side at the Liberian expenses.

- (1) To acquire the land for the Project site shown by the Team.
- (2) Removal/Relocation of existing utilities (water lines, power cable, telecommunication lines, etc.) including the underground facilities, advertisement boards and small gas stations within the Project site to designated area or out of the Project site.
- (3) Compensation for the PAPs (Project Affected Persons).
- (4) Securing of the temporary yard for the Project.
- (5) Securing site for borrowing pit, quarry and disposal area.
- (6) Necessary assistance for tax exemption and custom clearance for project related equipment, materials and facilities.

5-2. Both sides confirmed that all the agreements in the Minutes of Discussions of the preceding Preparatory Survey signed on August 31, 2011 continue to be valid.

5-3. Regarding the Free Port junction, the Team will continue further studies until the end of May 2012 in order to decide whether or not its improvement should be one of the project components.

5-4. The Liberian side shall share necessary data with the Team including the design of existing Double Bridge by the middle of May, 2012.

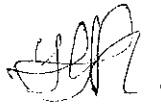
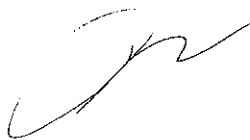
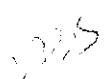


A-36



5-5. Regarding existing Double Bridge, the Team will continue further studies including X-ray survey and discuss measures with the Liberian side. When it turns out that there is no severe damage to the structure, the Team will consider simple repairs for the pavement, handrail and slab, which will not be warranty against defects to the bridge.

Annex : List of Attendants

A handwritten signature in black ink, appearing to be 'S.A.' or similar, located in the center of the page.A handwritten signature in black ink, appearing to be 'J.P.' or similar, located in the bottom left corner of the page.A handwritten mark or signature in black ink, appearing to be 'S.A.' or similar, located in the bottom right corner of the page.

List of Attendants

1. Ministry of Public Works

Victor B. Smith	Deputy Minister for Technical services
Edsel Edward Smith	Assistant Minister for Technical services
William L. Slour	Assistant Minister for Operations/Construction
Akindele George Beckley	Program Director/IIU
Bindu Brewer	Act. National Zoning Officer

2. Ministry of Planning and Economic Affairs

Yancon-Dargbe Nimley	Assistant Minister for Economic Cooperation & Integration
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3. JICA

Makoto Ashino	Team Leader
Osamu Sakurai	Team Member
Daisuke Fukuzawa	Team Member
Shitau Miura	Country Manager, JICA Liberia Office
Tsuyoshi Yamajuku	Chief Consultant

5. テクニカルノート

Technical Note

The Preparatory Survey on the Project for Reconstruction of Somalia Drive in Monrovia

Ministry of Public Works (MPW) and JICA Survey Team made technical discussions about design criteria of the project. The both parties confirmed and understood on the following matters.

Design Criteria

General

- Design Speed: MPW request to select appropriate design speed between 60 and 80km/hr based on the consideration of roadside condition.
- Maximum Superelevation: 4% for urban is acceptable.
- Cross Fall: 2.5% is acceptable.
- Pavement Type: Asphalt Concrete is acceptable.
- Pavement Design Period: JICA team proposes 10 years for pavement design but MPW requests 20 years. It will be discussed in Japan.
- Standard Axle Load: 11.5 ton for ECOWAS standard is adopted.
- Red light junction is not included in JICA project. The end point of JICA project shall be Sta. 13+000.
- MPW requests at least three (3) design options with adequate drainage provisions as well as the associated cost estimates for implementation.
- MPW and JICA team will review and agree on the design option to be implemented.

Cross Section

- Mountup Median Separator: 2.5 m is acceptable.
- Lane Width 3.25 m is requested to 3.65 by MPW.
- Pavement Width: 7.5 m is acceptable.
- Sidewalk: JICA team proposes flat sidewalk 4.0 m width but MPW requests mountup sidewalk 2.0 m. It shall be studied with comparative options including drainage system.
- Green belt: 1.5 m is acceptable.

Bridge

- Live Load: Equivalent with AASHTO HS-20 is acceptable. MPW additionally requests to analyze military tank load.
- Carriage Way: 7.5 m include shoulder as same with road section is acceptable.
- Seismic Coefficient: $K_h=0.1$ as minimum value
- High Water Level: 1.3 m below (Stockton Br.) and 1.5 m below (Double Br.) from existing girder

- Navigation Clearance: Existing span is kept (Stockton Br. 21 m, Double Br. 25 m).

ROW

- Construction limit set for the project is approximately 75 feet from the median centerline.

Other Requests

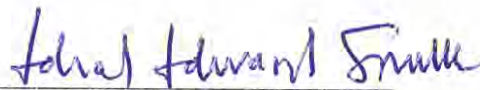
- MPW requests to make design for completed 4-lane road. JICA team may accept the request after the discussion with JICA head office.
- MPW requests to carry out cost estimation for completed 4-lane road and it will be discussed in Japan.

Noted by

30 May 2012



Keiichi Murakami
Road Designer
JICA Preparatory Survey Team



Edsel Edward Smith
Assistant Minister for Technical Services
Ministry of Public Works

6. 環境許可書

PERMIT NUMBER: EPA/EP/ESIA-RAP/001-1212

ISSUED DATE: 06/12/12

EXPIRATION DATE: 05/12/14

E N V I R O N M E N T A L P E R M I T

- 1.0 CONTACT : Hon. Edsel Edward Smith
ASSISTANT MINISTER FOR LANNING
Ministry of Public Works
Monrovia, Liberia
TEL: (00231) 04-914 012
Email: edselsmith@gmail.com
- 2.0 PROPONENT : Ministry of Public Works
Lynch Street
Monrovia, Liberia
- 3.0 PROJECT LOCATION : Somalia Drive -Red Light
Montserrado County
- 4.0 **TYPE OF WORK** : **ROAD RECONSTRUCTION**

In pursuance of the Environment Protection & Management Law of Liberia, 2003 Part III Sections 8 (1), 11 (1) 13 and on the basis of the submitted Environmental and Social Impact Assessment (ESIA); Preparatory Survey and Resettlement Action Plan, this permit is issued, authorizing the Ministry of Public Works of the Government of Liberia to commence road reconstruction works between the Freeport of Monrovia, Monrovia City through Somalia Drive up to Red-Light, City of Paynesville, Montserrado County.

5.0 CONDITIONS OF PERMIT

- 5.1 Permit does not cover Forest Reserves, Wildlife Reserves or Natural heritage area;

6.0 COMMITMENT TO PROJECT SPECIFICATIONS

Comply with all specifications in Environmental and Social Impact Assessment (ESIA); Preparatory Survey and Resettlement Action Plan

6.1 COMPLY WITH THE FOLLOWING GENERAL MEASURES:

- a. Adhere to terms and conditions of the submitted Resettlement Action Plan that identified Project Affected Persons (PAPs) within the Ministry of Public Works approved Right-of-Way, baseline and census of PAPs and

- b. their communities, institutional and implementation framework, schedule of implementation and grievance procedures before effectuating resettlement
- c. Demolition of any private asset along the road should only be executed after due compensation to PAPs in accordance with the RAP;
- d. Put in place dust mitigation measures as follows: water sprinkler system for dust mitigation on access road and other operating areas; cover trucks conveying spoil materials to prevent spills during haulage; fit crushers with dust suppression equipment
- e. Avoid pollution of surface water bodies in proximity to site
- f. Put in place measures to reduce noise including equipment maintenance, locate heavy equipment and operations away from any sensitive receptors: humans and water sources of communities/settlements
- g. Ensure that acquisition of private asset (quarries, borrow pits etc) are consistent with due process that guarantees the right and entitlements of property owner;
- h. Put in place measures for continuous engagement with project communities with respect to operational issues that impact community activities; including recording of grievances and measures to correct them
- i. Ensure that a comprehensive health and safety management system including training and inductions, supply of personal protective equipment, emergency preparedness etc
- j. Present a monthly environmental monitoring report to the EPA on existing environmental conditions in the project area and measures taken to ensure compliance to EMP

6.2 NOTIFICATIONS OF CHANGES

Notify EPA of any major changes in the planned development contrary to the information provided in the ESIA, Survey and Resettlement Action Plan.

- 6.3 *TRANSFERABILITY*: this permit is not transferable, except authorized and approved by the EPA.

PERMIT NUMBER: EPA/EP/ESIA-RAP/001-1212

ISSUED DATE: 06/12/12

EXPIRATION DATE: 05/12/14

6.4 *VALIDITY PERIOD*

This Permit is valid for two years commencing 06th December to 2012 to 05th December, 2014 renewable under new terms and conditions

6.5 *NOTWITHSTANDING THIS PERMIT*, the road rehabilitation is subject to other relevant regulations and permits pertaining to the sector and must be observed.

FAILURE TO COMPLY WITH OR OBSERVE ALL THE PERMIT CONDITIONS ABOVE MAY WARRANT THE REVOCATION OF THIS PERMIT.

Anyaa Vohiri
.....
Anyaa Vohiri
EXECUTIVE DIRECTOR

6/12/12
.....
DATE



収集資料リスト

調査名: リベリア国モンロビア首都圏ソマリアドライブ復旧計画準備調査

番号	資料の名称	形態 図書・ビデオ 地図・写真等	オリジナル・ コピー	発行機関	発行年
1	Resettlement Policy Framework for OPRC - Road infrastructure Development Associated with the Cotton Tree - Buchanan Corridor and Red Light to Gbarnga to Gunta to Guinea Border Road Rehabilitation Project	図書	コピー	Infrastructure Implementation Unit / World Bank	2009/10
2	National Transport Policy & Strategy	図書	オリジナル	MoT/MPW	2009/11
	Framework for Implementing the Transport Policy of Liberia	図書	オリジナル	MoT/MPW	2010/3
3	Liberia Social Studies Atlas	図書	オリジナル	MACMILLAN	-
4	Liberian Labor Jurisprudence	図書	オリジナル	GIZ	2005
5	Compilation of Relevant Liberian Laws Reference Materials for Magistrates, Volume 3	図書	オリジナル	USAID	2011/6
6	An Act Adopting the Environment Protection and Management Law of the Republic of Liberia	データ	コピー	Ministry of Foreign Affairs	2003/4
7	Draft National Wetland Policy	データ	コピー	EPA	2009
8	Resettlement Action Plan for Compound One Junction – Benson River	図書	コピー	MPW	2011/10
9	An Act to Establish the Land Commission (LC)	図書	オリジナル	Ministry of Foreign Affairs	2009/11
10	Topographic Mapping Data at Master Plan Study on Urban Facilities Restoration and Improvement in Monrovia	データ	コピー	AERO ASAHI CORPORATION (JICA FO より入手)	不明
11	Environmental Impact Assessment Guidelines, 2007 Guidelines for Infrastructure Development Projects	図書	オリジナル	EPA	2007/12
12	Labor Law, As Enacted by the National Legislature	図書	オリジナル	Ministry of Labor	不明
13	Constitution of the Republic of Liberia	図書	オリジナル	National Constitution Mission	1986

8. 技術資料

8-1 地質調查結果

1) SPT 試驗結果

Table 1.1: Ultimate Bearing Capacity Pressures

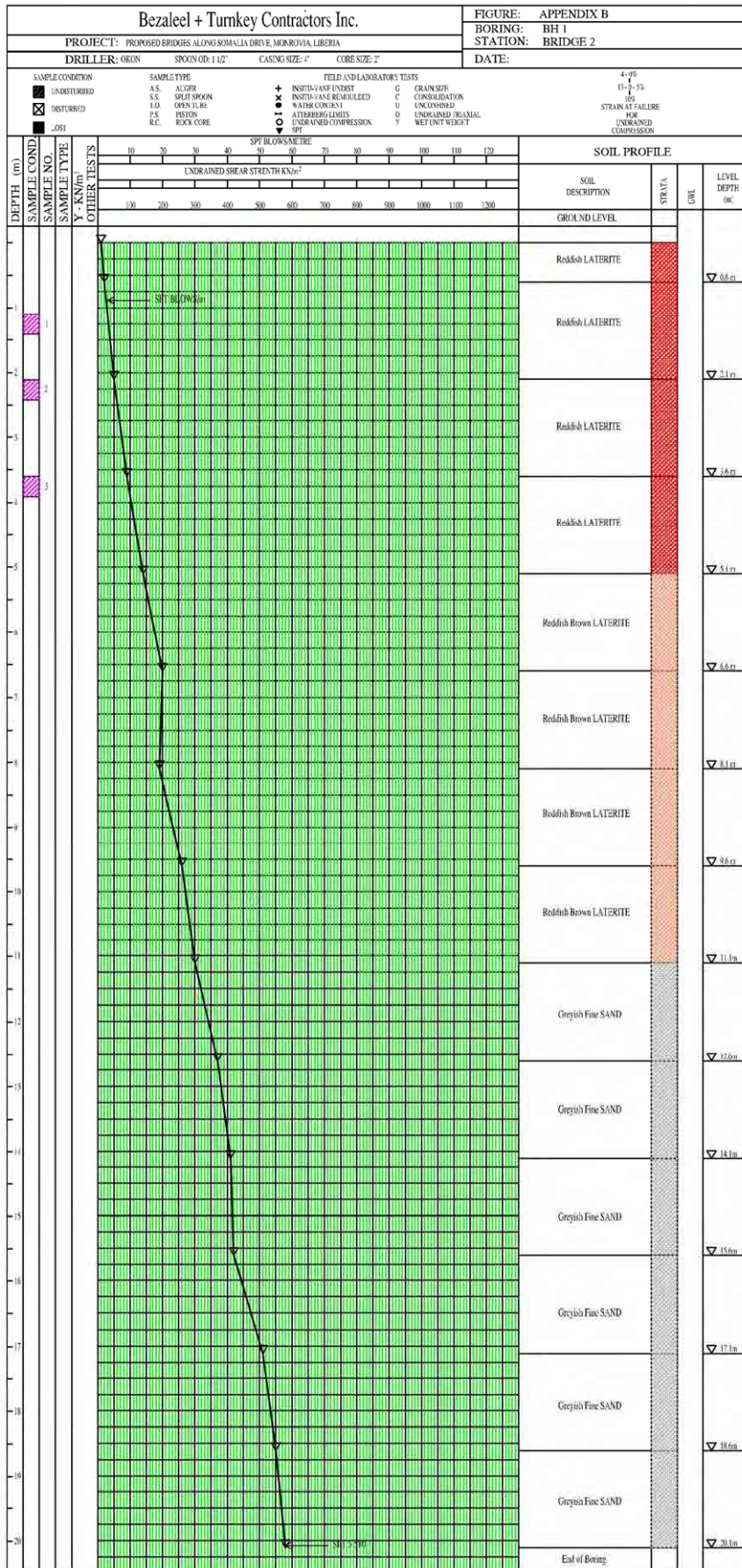
Depth (m)	Boring Locations							
	Bearing Capacity Values (kN/m ²)				SPT N-Values			
	Bridge #1		Bridge #2		Bridge #1		Bridge #2	
	BH1 Abutment A	BH2 Abutment B	BH1 Abutment A	BH2 Abutment B	BH1 Abutment A	BH2 Abutment B	BH1 Abutment A	BH2 Abutment B
0.0-0.6	20	20	20	60	2	2	2	6
1.5-2.1	20	50	50	90	2	5	5	9
3.0-3.6	40	40	90	90	4	4	9	9
4.5-5.1	50	70	140	130	5	7	14	13
6.0-6.6	50	80	200	150	5	8	20	15
7.5-8.1	190	110	190	190	19	11	19	19
9.0-9.6	280	140	260	230	28	14	26	23
10.5 – 11.1	230	220	300	320	23	22	30	32
12.0-12.6	290	320	370	360	29	32	37	36
13.5-14.1	240	400	410	360	24	40	41	36
15.0-15.6	470	430	420	370	47	43	42	37
16.5 – 17.1	470	470	510	460	47	47	51	46
18.0-18.6	510	490	550	520	51	49	55	52
19.5 – 20.1	520	520	580	550	52	52	58	55

2) 土質柱状図

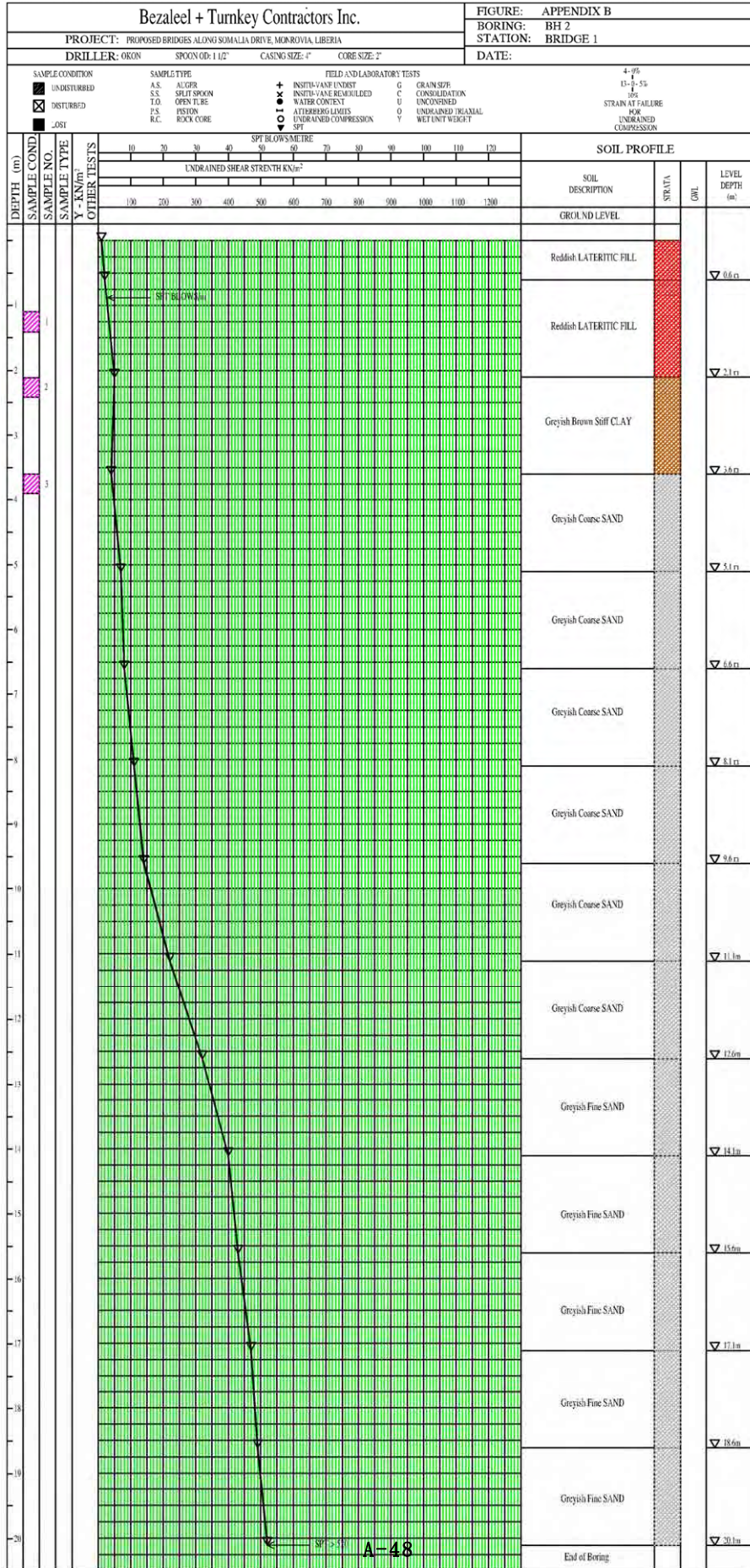
i) Bridge-1, BH-1 (ストックトン橋 フリーポート側橋台付近)



ii) Bridge-1, BH-2 (ストックトン橋 レッドライト側橋台付近)



iii) Bridge-2, BH-1(ダブル橋 フリーポート側橋台付近)



DETAILED LABORATORY TEST RESULTS FOR BRIDGE 1

(1 of 2)

3) 各種土質試驗結果

Borehole No.	Sample No.	Sample Depth (m)	Description of Sample	INDEX PROPERTIES				PARTICLE SIZE ANALYSIS										Direct Shear Strength		TRIAXIAL Shear Strength parameters		Bulk Density KN/m^3	Specific Gravity	Consolidation	
				EMC (%)	LL (%)	PL (%)	PI (%)	5 (5mm)	#7 (3.35mm)	#10 (2mm)	#14 (1.18mm)	#25 (600 μm)	#36 (425 μm)	#52 (300 μm)	#72 (212 μm)	#100 (150 μm)	#200 (75 μm)	C KN/m^2	ϕ	C KN/m^2	ϕ			Cv m^2/yrs	Mv m^2/KN
BH1	2	2.1	Brownish Grey Clay	23	50	31	19	-	-	97.60	90.11	80.39	64.28	61.39	56.4	50.99	44.68	-	-	32	17	18.61	2.86	2.84x10 ⁻²	1.46x10 ⁻⁴
BH1	3	3.6	Dark Brown coarse SAND mix with clay	15	Non - plastic			99.03	96.97	91.07	56.77	26.73	23.00	19.70	18.97	16.77	14.43	0	32	-	-	17.91	2.55	-	-
BH1	4	5.1	Brownish coarse SAND	12	Non - plastic			-	97.91	93.61	60.23	52.15	40.15	36.45	11.39	5.28	3.61	0	29	-	-	17.27	2.53	-	-
BH1	7	9.6	Brownish medium grained SAND	5	Non - plastic			-	99.70	99.00	57.20	17.77	11.00	4.30	3.40	2.03	1.20	0	30	-	-	17.86	2.55	-	-
BH1	9	12.6	Brownish medium grained SAND	9	Non - plastic			-	99.46	89.11	55.68	21.39	15.19	7.68	5.19	3.61	2.69	0	31	-	-	17.59	2.51	-	-
BH1	10	14.1	Greyish medium dense fine SAND	13	Non - plastic			-	-	98.11	80.15	70.91	61.45	22.39	17.41	16.15	5.78	1	29	-	-	18.21	2.60	-	-
BH1	11	15.6	Greyish fine grained SAND	11	Non - plastic			-	-	99.00	84.69	73.41	56.29	19.61	13.48	10.61	7.15	1	25	-	-	18.00	2.67	-	-
BH1	12	17.1	Greyish fine grained SAND	18	Non - plastic			-	-	-	97.78	79.46	62.96	30.47	12.97	9.65	3.15	0	28	-	-	17.61	2.75	-	-
BH1	14	20.1	Greyish fine grained SAND	17	Non - plastic			-	-	99.81	82.25	80.02	54.71	22.26	18.90	12.85	11.30	0	34	-	-	17.56	2.69	-	-
BH2	3	3.6	Greyish Brown stiff CLAY	16	46	29	17	-	-	96.15	86.17	73.36	70.59	64.28	60.35	52.61	48.76	-	-	36	18	18.97	2.84	3.96x10 ⁻²	3.68x10 ⁻⁴
BH2	5	6.6	Greyish coarse grained SAND	23	Non - plastic			-	97.61	89.76	79.41	50.61	39.11	24.83	17.85	11.69	7.41	0	31	-	-	18.61	2.51	-	-
BH2	7	9.6	coarse grained SAND	23	Non - plastic			-	98.14	95.06	85.42	48.87	37.62	21.72	19.47	13.31	7.88	0	27	-	-	17.50	2.74	-	-
BH2	8	11.1	coarse grained SAND	11	Non - plastic			-	99.98	89.61	83.11	52.68	39.41	34.15	28.51	11.61	5.41	0	30	-	-	17.69	2.50	-	-
BH2	9	12.6	Greyish dense coarse grained SAND	15	Non - plastic			-	98.46	92.39	87.15	75.26	63.15	47.98	21.96	18.15	7.26	0	32	-	-	17.79	2.53	-	-
BH2	11	15.6	Greyish dense fine grained SAND	17	Non - plastic			-	-	99.2	90.61	86.00	71.45	32.41	18.76	10.47	6.34	1	30	-	-	17.48	2.52	-	-

DETAILED LABORATORY TEST RESULTS FOR BRIDGE 1

(2 of 2)

Borehole No.	Sample No.	Sample Depth (m)	Description of Sample	INDEX PROPERTIES				PARTICLE SIZE ANALYSIS									Direct Shear Strength		TRIAXIAL Shear Strength parameters		Bulk Density kN/m ³	Specific Gravity	Consolidation			
				EMC (%)	LL (%)	PL (%)	PI (%)	5 (5mm)	# 7 (3.35mm)	# 10 (2mm)	# 14 (1.18mm)	# 25 (600µm)	# 36 (425µm)	# 52 (300µm)	# 72 (212µm)	# 100 (150µm)	# 200 (75µm)	C KN/m ²	ø	C KN/m ²			ø	Cv m ² /yrs	Mv m ² /KN	
BH2	13	18.6	Greyish very dense fine grained SAND	20	Non - plastic				-	-	-	99.09	92.46	79.86	44.71	15.91	8.63	3.49	1	27	-	-	17.61	2.60	-	-

DETAILED LABORATORY TEST RESULTS FOR BRIDGE 2

(1 of 2)

Borehole No.	Sample No.	Sample Depth (m)	Description of Sample	INDEX PROPERTIES				PARTICLE SIZE ANALYSIS										Direct Shear Strength		TRIAXIAL Shear Strength parameters			Bulk Density kN/m ³	Specific Gravity	Consolidation	
				EMC (%)	LL (%)	PL (%)	PI (%)	#5 (5mm)	#7 (3.35mm)	#10 (2mm)	#14 (1.18mm)	#25 (600µm)	#35 (425µm)	#52 (300µm)	#72 (212µm)	#100 (150µm)	#200 (75µm)	C (KN/m ²)	φ	C (KN/m ²)	φ	Cv			Mv	
																										Non - plastic
BH1	2	2.1	Reddish Pebbly LATERITE	15	Non - plastic				64.50	49.10	40.90	30.47	21.50	18.23	13.17	12.07	8.77	5.63	10	21	-	-	15.98	2.58	-	-
BH1	4	5.1	Reddish Pebbly LATERITE	14	Non - plastic				71.96	48.79	42.80	29.38	24.96	18.20	14.96	12.89	9.78	3.89	14	26	-	-	15.87	2.59	-	-
BH1	5	6.6	Reddish Brown LATERITE	16	30	14	16	98.23	95.67	89.37	67.4	51.47	45.63	34.53	32.10	22.93	14.97	18	23	-	-	16.40	2.61	1.46x10 ⁻³	4.96x10 ⁻⁶	
BH1	6	8.1	Reddish Brown LATERITE	18	32	13	19	99.14	94.40	90.89	69.34	53.56	45.78	39.79	33.40	26.19	18.38	-	-	16	22	16.26	2.64	2.87x10 ⁻³	3.96x10 ⁻⁶	
BH1	8	11.1	Reddish Brown LATERITE	19	30	16	14	98.20	95.40	82.60	73.95	49.76	43.29	41.00	33.89	24.67	17.96	-	-	18	23	16.57	2.66	4.40x10 ⁻³	5.40x10 ⁻⁶	
BH1	9	12.6	Greyish dense fine grained SAND	18	Non - plastic				-	99.78	87.96	85.60	74.89	45.80	38.4	19.87	16.78	10.89	1	28	-	-	17.10	2.68	-	-
BH1	11	15.6	Greyish dense fine grained SAND	22	Non - plastic				-	98.69	91.78	88.9	62.87	38.76	29.40	19.38	10.96	9.86	0	31	-	-	17.26	2.70	-	-
BH1	13	18.6	Greyish dense fine grained SAND	19	Non - plastic				-	99.48	99.18	96.81	87.40	59.38	26.78	17.03	15.89	14.96	0	30	-	-	17.49	2.69	-	-
BH1	14	20.1	Greyish very dense fine grained SAND	20	Non - plastic				-	-	99.40	89.80	67.48	48.96	20.84	14.36	12.89	10.00	1	29	-	-	17.60	2.71	-	-
BH2	3	3.6	Reddish LATERITE(fill material)	14	30	11	19	88.90	81.78	73.80	67.96	53.97	45.78	41.76	38.67	31.46	20.46	18	24	-	-	16.40	2.60	-	-	
BH2	4	5.1	Reddish Latentic CLAY	16	38	16	22	-	98.67	94.40	90.70	83.96	79.60	63.39	54.96	44.87	34.96	-	-	28	19	17.98	2.69	1.36x10 ⁻³	3.84x10 ⁻⁶	
BH2	5	6.6	Reddish Latentic CLAY	24	36	18	19	-	-	98.90	88.96	74.49	57.96	52.38	44.49	38.87	36.19	-	-	26	17	18.01	2.72	1.40x10 ⁻²	6.87x10 ⁻⁴	
BH2	6	8.1	Greyish fine grained SAND	12	Non - plastic				-	-	98.10	87.40	69.78	58.89	33.19	27.44	20.89	13.45	2	28	-	-	16.96	2.60	-	-
BH2	8	11.1	Greyish fine grained SAND	10	Non - plastic				-	-	97.40	88.40	74.96	70.89	30.97	23.67	19.49	12.60	0	30	-	-	17.01	2.64	-	-
BH2	9	12.6	Brownish dense fine grained SAND	14	Non - plastic				-	-	99.8	92.88	90.40	67.96	39.48	27.96	19.49	14.38	2	29	-	-	16.87	2.67	-	-

DETAILED LABORATORY TEST RESULTS FOR BRIDGE 2

Borehole No.	Sample No.	Sample Depth (m)	Description of Sample	INDEX PROPERTIES				PARTICLE SIZE ANALYSIS								Direct Shear Strength		TRIAXIAL Shear Strength parameters		Bulk Density kN/m^3	Specific Gravity	Consolidation			
				EMC (%)	LL (%)	PL (%)	PI (%)	5 (5mm)	#.7 (3.35mm)	#.10 (2mm)	#.14 (1.18mm)	#.25 (600 μm)	#.36 (425 μm)	#.52 (300 μm)	#.72 (212 μm)	#.100 (150 μm)	#.200 (75 μm)	C KN/m^2	ϕ			C KN/m^2	ϕ	m^2/yrs	Mv m^2/KN
BH2	12	17.1	Brownish dense fine grained SAND	18	Non - plastic			-	99.50	99.43	98.37	85.40	70.40	31.13	26.43	17.03	16.40	0	30	-	-	17.10	2.69	-	-
BH2	14	20.1	Greyish very dense fine grained SAND	20	Non - plastic			-	-	-	99.63	60.50	45.83	22.27	19.33	10.53	8.73	1	29	-	-	17.29	2.70	-	-

8-2 交通量調査結果

The Preparatory Survey on the Project for Reconstruction of Somalia Drive in Monrovia
(Road Side Traffic Counts)

Road									Key Map	
Name: <u>Somalia Drive</u>			Date: <u>2011/3/12</u>							
Location / <u>Point A: Stockton Bridge</u>			Surveyed by: <u>Taye, Konah and Kaba, Turay, Kun & Lardeindee</u>							
Direction / <u>From: Free Port To: Red Light Jct.</u>			Supervised by: <u>Milton S. Pajibo & Emmanuel King</u>							
No.	1	2	3	4	5	6	7	8	9	10
Category	Sedan / Wagon / Pick-up	Taxi	Mini Bus	Large Bus	Light Truck (2-Axle)	Heavy Truck (> 2-Axle)	Trailer (Articulated Truck)	Motorbike	Bicycle	Pedestrian
Hours										
8:00 ~ 9:00	143	347	46	14	11	24	7	630	0	333
9:00 ~ 10:00	130	347	62	8	11	11	4	601	6	107
10:00 ~ 11:00	137	377	64	17	22	43	9	566	6	120
11:00 ~ 12:00	60	60	18	110	10	110	20	110	3	60
12:00 ~ 13:00	210	200	64	160	30	160	27	170	0	210
13:00 ~ 14:00	160	160	90	10	37	41	12	180	0	60
14:00 ~ 15:00	140	216	61	7	22	20	9	344	1	130
15:00 ~ 16:00	179	185	78	130	26	76	50	365	0	208
16:00 ~ 17:00	120	70	38	240	21	180	140	330	0	120
17:00 ~ 18:00	213	480	155	84	46	63	30	390	2	356
18:00 ~ 19:00	120	210	45	410	12	270	190	410	3	120
19:00 ~ 20:00	163	231	86	420	20	210	180	450	0	250
20:00 ~ 21:00	75	260	171	120	20	11	108	300	0	230
21:00 ~ 22:00	68	220	70	200	23	90	7	480	3	77
22:00 ~ 23:00	29	164	34	0	9	0	2	320	0	35
23:00 ~ 0:00	9	15	5	3	0	0	0	58	1	7
0:00 ~ 1:00	19	16	0	0	2	2	1	60	0	1
1:00 ~ 2:00	9	2	1	0	0	0	0	15	0	2
2:00 ~ 3:00	5	0	3	0	0	0	0	3	0	1
3:00 ~ 4:00	3	1	0	0	0	2	0	5	0	0
4:00 ~ 5:00	4	3	0	0	0	1	0	2	0	3
5:00 ~ 6:00	18	34	27	7	4	10	5	21	1	30
6:00 ~ 7:00	69	282	112	20	22	45	4	140	40	160
7:00 ~ 8:00	128	380	76	37	10	39	8	610	4	285
Peak Hour Traffic	213	480	171	420	46	270	190	630	40	356
24-hr Traffic Total	2211	4260	1306	1997	358	1408	813	6560	70	2905
Peak Hour Ratio	0.096336	0.113	0.1309	0.210315	0.128492	0.191761	0.2337023	0.09604	0.571	0.122547

**The Preparatory Survey on the Project for Reconstruction of Somalia Drive in Monrovia
(Road Side Traffic Counts)**

Road									Key Map	
Name: <u>Somalia Drive</u>			Date: <u>2012/3/12</u>							
Location /			Surveyed by: <u>Blayon, Johnson, Ssonie, Turay, Harris & Dennis</u>							
Direction /			Supervised by: <u>Sawoh Lassana & Emmanuel King</u>							
From: <u>Redoight</u> To: <u>Freeport</u>										
No.	1	2	3	4	5	6	7	8	9	10
Category	Sedan / Wagon / Pick-up	Taxi	Mini Bus	Large Bus	Light Truck (2-Axle)	Heavy Truck (> 2-Axle)	Tractor (Articulated Truck)	Motorbike	Bicycle	Pedestrian
Hours										
8:00 ~ 9:00	104	830	319	20	86	11	—	650	3	380
9:00 ~ 10:00	88	800	466	118	170	32	2	571	3	290
10:00 ~ 11:00	119	190	80	11	22	28	5	362	7	560
11:00 ~ 12:00	40	60	33	4	20	11	21	40	4	60
12:00 ~ 13:00	80	330	152	70	36	113	0	260	1	170
13:00 ~ 14:00	110	40	40	0	29	5	0	140	0	110
14:00 ~ 15:00	90	200	94	5	20	24	3	230	0	90
15:00 ~ 16:00	213	324	157	14	40	20	4	130	3	280
16:00 ~ 17:00	105	270	140	19	30	27	7	320	0	200
17:00 ~ 18:00	90	330	142	17	21	20	5	20	0	0
18:00 ~ 19:00	88	320	214	26	38	21	2	580	0	0
19:00 ~ 20:00	80	280	160	23	36	22	5	475	1	110
20:00 ~ 21:00	11	190	150	240	50	0	0	420	0	180
21:00 ~ 22:00	50	370	190	10	37	10	1	297	0	120
22:00 ~ 23:00	4	100	70	7	50	10	1	160	1	120
23:00 ~ 0:00	31	60	60	1	48	2	—	63	2	38
0:00 ~ 1:00	33	41	50	—	—	3	—	66	—	32
1:00 ~ 2:00	5	4	10	1	—	3	—	25	—	13
2:00 ~ 3:00	4	4	10	—	—	4	1	4	1	9
3:00 ~ 4:00	4	6	10	—	—	—	—	2	—	1
4:00 ~ 5:00	3	4	10	—	—	—	1	2	—	3
5:00 ~ 6:00	12	20	20	8	—	2	3	25	—	36
6:00 ~ 7:00	29	160	160	20	—	18	1	84	2	223
7:00 ~ 8:00	140	430	270	8	50	4	—	561	6	457
Peak Hour Traffic	213	830	466	240	170	113	21	650	7	560
24-hr Traffic Total	1533	5363	3007	622	783	390	62	5487	34	3482
Peak Hour Ratio	0.138943	0.155	0.155	0.385852	0.217114	0.289744	0.3387097	0.11846	0.206	0.160827

**The Preparatory Survey on the Project for Reconstruction of Somalia Drive in Monrovia
(Road Side Traffic Counts)**

Road Name: <u>Somalia Drive</u> Date: <u>2012/3/12</u>									Key Map	
Location / Direction / Point B: <u>Double Bridge</u> Surveyed by: <u>Morris, Nyandibo, Turay, Nyenpan, Swen</u>										
From: <u>Free Port</u> To: <u>Red Light Jct.</u> Supervised by: <u>Othello Horrace</u>										
No.	1	2	3	4	5	6	7	8	9	10
Category	Sedan / Wagon / Pick-up	Taxi	Mini Bus	Large Bus	Light Truck (2-Axle)	Heavy Truck (> 2-Axle)	Trailer (Articulated Truck)	Motorbike	Bicycle	Pedestrian
Hours										
8:00 ~ 9:00	43	410	154	14	4	23	6	248	1	136
9:00 ~ 10:00	86	384	115	0	11	0	0	240	0	108
10:00 ~ 11:00	125	422	142	7	30	26	6	203	0	341
11:00 ~ 12:00	90	190	130	34	17	3	160	2	90	
12:00 ~ 13:00	130	311	56	7	22	29	4	250	4	130
13:00 ~ 14:00	110	300	71	4	16	42	6	189	1	191
14:00 ~ 15:00	60	240	90	4	27	30	10	133	2	60
15:00 ~ 16:00	80	245	109	9	21	15	4	196	3	80
16:00 ~ 17:00	80	312	65	5	40	32	6	194	3	80
17:00 ~ 18:00	112	201	70	7	24	26	5	220	0	100
18:00 ~ 19:00	90	290	57	3	31	33	13	211	2	90
19:00 ~ 20:00	110	266	50	3	18	20	9	144	1	139
20:00 ~ 21:00	60	211	31	23	17	12	3	260	0	90
21:00 ~ 22:00	70	145	18	20	8	11	3	145	0	60
22:00 ~ 23:00	44	83	9	14	7	4	0	87	1	50
23:00 ~ 0:00	11	30	2	2	2	10	2	104	0	23
0:00 ~ 1:00	13	9	5	0	1	0	0	25	0	4
1:00 ~ 2:00	2	4	0	0	2	0	0	9	0	2
2:00 ~ 3:00	1	2	0	0	0	0	0	3	0	3
3:00 ~ 4:00	3	1	0	0	0	0	0	2	0	1
4:00 ~ 5:00	3	5	0	0	0	5	1	4	0	2
5:00 ~ 6:00	16	68	17	9	3	4	0	13	0	12
6:00 ~ 7:00	63	260	73	24	3	31	0	80	1	70
7:00 ~ 8:00	135	411	120	25	7	23	2	225	5	160
Peak Hour Traffic	135	422	154	34	40	42	160	260	90	341
24-hr Traffic Total	1537	4800	1384	214	311	379	240	3187	114	1932
Peak Hour Ratio	0.087833	0.088	0.1113	0.158879	0.128617	0.110818	0.666667	0.08158	0.789	0.176501

**The Preparatory Survey on the Project for Reconstruction of Somalia Drive in Monrovia
(Road Side Traffic Counts)**

Road									Key Map	
Name: <u>Somalia Drive</u>			Date: <u>2012/3/12</u>							
Location / <u>Point B: Double Bridge</u>			Surveyed by: <u>Kongoison, Jallah, Zarr, Varflay, Taweh & Harris</u>							
Direction / From: <u>Redlight</u> To: <u>Freeport</u>			Supervised by: <u>Tee-Jem Mitchell & McArthur Ballah</u>							
No.	1	2	3	4	5	6	7	8	9	10
Category	Sedan / Wagon / Pick-up	Taxi	Mini Bus	Large Bus	Light Truck (2-Axle)	Heavy Truck (> 2-Axle)	Trailer (Artuculated Truck)	Motorbike	Bicycle	Pedestrian
Hours										
8:00 ~ 9:00	90	316	51	6	4	17	5	324	3	360
9:00 ~ 10:00	94	390	69	5	5	25	3	285	1	190
10:00 ~ 11:00	140	240	51	22	2	31	4	237	2	220
11:00 ~ 12:00	88	215	45	24	10	51	4	204	1	130
12:00 ~ 13:00	132	310	75	8	22	49	5	240	3	160
13:00 ~ 14:00	126	210	73	14	21	50	10	210	1	156
14:00 ~ 15:00	126	60	56	7	16	50	2	227	1	141
15:00 ~ 16:00	111	240	70	14	23	13	4	236	1	119
16:00 ~ 17:00	166	210	62	8	17	33	4	190	2	164
17:00 ~ 18:00	139	320	111	16	57	24	5	327	4	157
18:00 ~ 19:00	145	280	104	24	47	19	7	242	0	129
19:00 ~ 20:00	121	74	56	10	22	20	2	282	2	203
20:00 ~ 21:00	140	165	16	30	16	22	4	282	3	172
21:00 ~ 22:00	91	65	32	40	15	8	3	190	1	84
22:00 ~ 23:00	78	40	16	30	0	4	2	132	0	46
23:00 ~ 0:00	35	29	6	0	4	3	0	95	1	19
0:00 ~ 1:00	10	21	2	1	2	1	0	30	0	7
1:00 ~ 2:00	4	3	1	1	0	2	0	11	0	6
2:00 ~ 3:00	4	1	1	0	0	1	0	6	0	1
3:00 ~ 4:00	2	2	0	0	0	1	0	3	0	1
4:00 ~ 5:00	2	3	1	0	0	0	0	1	0	10
5:00 ~ 6:00	20	34	27	7	2	4	4	10	0	20
6:00 ~ 7:00	23	146	72	13	7	20	4	67	0	105
7:00 ~ 8:00	79	259	55	6	1	26	5	321	4	387
Peak Hour Traffic	166	390	111	40	57	51	10	327	4	387
24-hr Traffic Total	1966	3633	1052	286	293	474	77	4152	30	2987
Peak Hour Ratio	0.084435	0.107	0.1055	0.13986	0.194539	0.107595	0.1298701	0.07876	0.133	0.129561

**The Preparatory Survey on the Project for Reconstruction of Somalia Drive in Monrovia
(Road Side Traffic Counts)**

Road Name: <u>Somalia Drive</u>								Date: <u>March 12,2012</u>		Key Map	
Location / Direction /								Surveyed by: <u>Kaba, Paye, Tugbe, Browne, Keller & Wilson</u>			
From: <u>Free Port</u> To: <u>Red Light Jct.</u>								Supervised by: <u>Walter Stevens & Catherine Worgee</u>			
No.	1	2	3	4	5	6	7	8	9	10	
Category	Sedan / Wagon / Pick-up	Taxi	Mini Bus	Large Bus	Light Truck (2-Axle)	Heavy Truck (> 2-Axle)	Trailer (Articulated Truck)	Motorbike	Bicycle	Pedestrian	
Hours											
8:00 ~ 9:00	110	450	227	25	8	19	6	744	0	127	
9:00 ~ 10:00	90	320	102	0	0	0	0	752	0	70	
10:00 ~ 11:00	125	194	52	53	15	78	4	698	0	100	
11:00 ~ 12:00	107	237	63	7	31	32	3	198	1	110	
12:00 ~ 13:00	129	269	80	10	24	34	4	278	1	242	
13:00 ~ 14:00	132	321	91	14	12	41	5	273	1	185	
14:00 ~ 15:00	94	351	82	5	20	33	4	274	0	107	
15:00 ~ 16:00	131	390	76	6	18	28	8	336	2	146	
16:00 ~ 17:00	110	308	60	16	21	28	6	304	2	152	
17:00 ~ 18:00	98	340	50	4	14	32	5	170	1	190	
18:00 ~ 19:00	180	320	57	15	15	26	7	480	1	248	
19:00 ~ 20:00	138	240	50	17	5	21	8	480	1	373	
20:00 ~ 21:00	186	256	35	27	4	16	3	370	0	295	
21:00 ~ 22:00	135	73	12	20	5	12	3	290	1	126	
22:00 ~ 23:00	198	110	10	0	2	4	0	250	1	100	
23:00 ~ 0:00	30	97	14	4	7	4	0	134	0	26	
0:00 ~ 1:00	20	21	0	3	1	0	3	164	0	17	
1:00 ~ 2:00	6	6	1	0	2	1	0	46	0	9	
2:00 ~ 3:00	3	8	0	0	0	1	1	40	0	1	
3:00 ~ 4:00	5	5	3	0	1	0	0	23	0	0	
4:00 ~ 5:00	2	17	8	2	0	4	2	24	0	24	
5:00 ~ 6:00	2	80	57	16	8	12	8	104	0	14	
6:00 ~ 7:00	60	154	100	33	25	29	4	189	0	80	
7:00 ~ 8:00	87	55	265	19	63	18	2	312	2	115	
Peak Hour Traffic	198	450	265	53	63	78	8	752	2	373	
24-hr Traffic Total	2178	4622	1495	296	301	473	86	6933	14	2857	
Peak Hour Ratio	0.090909	0.097	0.1773	0.179054	0.209302	0.164905	0.0930233	0.10847	0.143	0.130557	

**The Preparatory Survey on the Project for Reconstruction of Somalia Drive in Monrovia
(Road Side Traffic Counts)**

Road									Key Map	
Name: <u>Somalia Drive</u>			Date: <u>March 12,2012</u>							
Location / <u>Point C: Barnersville Jct.</u>			Surveyed by: <u>Lewis,Natt, Matico, Kerkula, Worgee & Inepo</u>							
Direction / <u>From: Red light To: Freeport</u>			Supervised by: <u>G. Isaac Doe & Catherine Worgee</u>							
No.	1	2	3	4	5	6	7	8	9	10
Category	Sedan / Wagon / Pick-up	Taxi	Mini Bus	Large Bus	Light Truck (2-Axle)	Heavy Truck (> 2-Axle)	Trailer (Articulated Truck)	Motorbike	Bicycle	Pedestrian
Hours										
8:00 ~ 9:00	117	330	115	7	19	24	5	569	4	152
9:00 ~ 10:00	117	370	230	0	65	18	0	352	0	164
10:00 ~ 11:00	104	270	140	0	18	17	3	403	3	144
11:00 ~ 12:00	330	309	69	12	23	49	5	300	133	118
12:00 ~ 13:00	234	277	47	0	17	38	1	332	5	137
13:00 ~ 14:00	157	190	86	7	18	33	4	280	1	112
14:00 ~ 15:00	230	116	100	15	25	32	6	310	3	186
15:00 ~ 16:00	227	182	91	22	25	29	5	322	2	89
16:00 ~ 17:00	200	124	55	13	9	41	9	199	1	167
17:00 ~ 18:00	200	202	106	25	20	53	8	250	5	73
18:00 ~ 19:00	197	159	80	27	29	38	5	350	4	104
19:00 ~ 20:00	149	140	50	28	15	46	2	290	0	110
20:00 ~ 21:00	110	186	35	20	11	16	4	314	0	110
21:00 ~ 22:00	170	130	15	18	2	16	3	229	1	114
22:00 ~ 23:00	132	76	5	3	2	8	2	190	2	115
23:00 ~ 0:00	37	34	5	0	3	1	0	101	0	50
0:00 ~ 1:00	23	20	2	1	3	2	1	70	0	27
1:00 ~ 2:00	5	7	1	1	2	1	1	16	0	7
2:00 ~ 3:00	6	5	2	0	3	1	1	4	0	3
3:00 ~ 4:00	7	1	20	0	0	0	0	6	0	3
4:00 ~ 5:00	11	9	2	0	0	0	0	5	0	17
5:00 ~ 6:00	30	35	34	3	3	6	2	16	0	25
6:00 ~ 7:00	90	277	110	15	41	13	5	168	3	90
7:00 ~ 8:00	80	289	151	3	26	9	5	296	6	150
Peak Hour Traffic	330	370	230	28	65	53	9	569	133	186
24-hr Traffic Total	2963	3738	1551	220	379	491	77	5372	173	2267
Peak Hour Ratio	0.111374	0.099	0.1483	0.127273	0.171504	0.107943	0.1168831	0.10592	0.769	0.082047

**The Preparatory Survey on the Project for Reconstruction of Somalia Drive in Monrovia
(Road Side Traffic Counts)**

Road Name: <u>Somalia Drive</u> Date: <u>2012/3/16</u>									Key Map	
Location / Direction /										
Point A: <u>Stockton Bridge</u> Surveyed by: <u>Taye, Konah and Kaba, Turay, Kun & Lardeindee</u>										
From: <u>Free Port</u> To: <u>Red Light Jct.</u> Supervised by: <u>Milton S. Pajibo & Emmanuel King</u>										
No.	1	2	3	4	5	6	7	8	9	10
Category	Sedan / Wagon / Pick-up	Taxi	Mini Bus	Large Bus	Light Truck (2-Axle)	Heavy Truck (> 2-Axle)	Trailer (Articulated Truck)	Motorbike	Bicycle	Pedestrian
Hours										
8:00 ~ 9:00	67	198	77	196	17	9	5	490	0	280
9:00 ~ 10:00	99	270	126	21	19	13	6	480	0	166
10:00 ~ 11:00	147	310	97	12	30	43	14	425	5	220
11:00 ~ 12:00	137	170	75	7	36	35	16	300	0	140
12:00 ~ 13:00	110	310	101	8	34	55	23	378	7	100
13:00 ~ 14:00	130	248	105	4	32	28	12	370	0	137
14:00 ~ 15:00	190	380	169	110	32	123	125	190	0	170
15:00 ~ 16:00	220	330	144	25	30	30	15	400	2	150
16:00 ~ 17:00	210	332	90	22	44	40	20	380	0	150
17:00 ~ 18:00	277	290	73	17	19	40	10	380	1	392
18:00 ~ 19:00	116	202	66	16	8	5	1	380	4	200
19:00 ~ 20:00	105	260	150	190	20	110	70	380	2	160
20:00 ~ 21:00	41	160	121	12	80	8	3	70	1	300
21:00 ~ 22:00	133	620	240	45	140	18	11	396	0	470
22:00 ~ 23:00	170	510	420	10	120	10	2	260	0	74
23:00 ~ 0:00	52	130	130	2	0	0	0	90	6	84
0:00 ~ 1:00	20	11	10	0	0	0	0	20	0	20
1:00 ~ 2:00	2	8	1	0	0	0	0	40	0	16
2:00 ~ 3:00	4	2	1	2	0	1	0	6	0	20
3:00 ~ 4:00	10	3	2	2	0	1	2	8	0	10
4:00 ~ 5:00	10	5	10	22	0	10	5	10	0	20
5:00 ~ 6:00	16	35	50	2	0	0	0	90	0	43
6:00 ~ 7:00	13	30	30	20	0	12	5	100	7	210
7:00 ~ 8:00	20	690	330	13	110	6	2	166	2	330
Peak Hour Traffic	277	690	420	196	140	123	125	490	7	470
24-hr Traffic Total	2299	5504	2618	758	771	597	347	5809	37	3862
Peak Hour Ratio	0.120487	0.125	0.1604	0.258575	0.181582	0.20603	0.3602305	0.08435	0.189	0.121699

**The Preparatory Survey on the Project for Reconstruction of Somalia Drive in Monrovia
(Road Side Traffic Counts)**

Road									Key Map	
Name: <u>Somalia Drive</u>			Date: <u>March 16,2012</u>							
Location /			Surveyed by: <u>Blayon, Johnson, Ssonie, Turay, Harris & Dennis</u>							
Direction /			Supervised by: <u>Sawoh Lassana & Emmanuel King</u>							
From: <u>Redlight</u> To: <u>Freeport</u>										
No.	1	2	3	4	5	6	7	8	9	10
Category	Sedan / Wagon / Pick-up	Taxi	Mini Bus	Large Bus	Light Truck (2-Axle)	Heavy Truck (> 2-Axle)	Trailer (Articulated Truck)	Motorbike	Bicycle	Pedestrian
Hours										
8:00 ~ 9:00	175	140	102	41	30	46	10	667	2	400
9:00 ~ 10:00	200	440	200	22	6	40	7	600	6	327
10:00 ~ 11:00	150	340	117	17	2	44	9	480	0	230
11:00 ~ 12:00	153	220	230	23	33	27	10	495	3	370
12:00 ~ 13:00	170	264	114	3	22	29	16	382	10	240
13:00 ~ 14:00	186	230	80	6	0	25	7	390	0	340
14:00 ~ 15:00	200	258	190	4	58	43	6	360	6	200
15:00 ~ 16:00	210	160	121	18	61	25	7	370	0	210
16:00 ~ 17:00	210	83	40	10	7	8	5	400	5	280
17:00 ~ 18:00	160	210	21	9	12	22	5	520	0	160
18:00 ~ 19:00	230	225	190	7	21	7	0	710	0	430
19:00 ~ 20:00	118	60	18	5	3	7	1	280	1	430
20:00 ~ 21:00	42	109	31	8	5	5	0	280	0	75
21:00 ~ 22:00	64	176	21	3	13	34	16	672	3	76
22:00 ~ 23:00	22	98	11	7	2	8	2	249	0	3
23:00 ~ 0:00	28	72	1	0	2	0	0	140	1	14
0:00 ~ 1:00	10	12	1	0	0	0	0	2	0	24
1:00 ~ 2:00	6	8	0	0	0	0	0	12	0	0
2:00 ~ 3:00	5	3	0	0	2	0	0	8	0	0
3:00 ~ 4:00	5	4	0	0	2	1	0	8	0	4
4:00 ~ 5:00	9	13	0	0	0	0	0	11	1	28
5:00 ~ 6:00	30	28	14	2	1	20	7	16	0	60
6:00 ~ 7:00	38	165	106	15	34	25	0	150	3	165
7:00 ~ 8:00	53	264	77	29	19	81	6	464	6	140
Peak Hour Traffic	230	440	230	41	61	81	16	710	10	430
24-hr Traffic Total	2474	3582	1685	229	335	497	114	7666	47	4206
Peak Hour Ratio	0.092967	0.123	0.1365	0.179039	0.18209	0.162978	0.1403509	0.09262	0.213	0.102235

**The Preparatory Survey on the Project for Reconstruction of Somalia Drive in Monrovia
(Road Side Traffic Counts)**

Road									Key Map	
Name: <u>Somalia Drive</u>			Date: <u>2012/3/16</u>							
Location / <u>Point B: Double Bridge</u>			Surveyed by: <u>Kaba, Paye, Tugbe, Browne, Keller & Wilson</u>							
Direction /										
From: <u>Free Port</u> To: <u>Red Light Jct.</u>			Supervised by: <u>Walter Stevens & Catherine Worgee</u>							
No.	1	2	3	4	5	6	7	8	9	10
Category	Sedan / Wagon / Pick-up	Taxi	Mini Bus	Large Bus	Light Truck (2-Axle)	Heavy Truck (> 2-Axle)	Trailer (Articulated Truck)	Motorbike	Bicycle	Pedestrian
Hours										
8:00 ~ 9:00	100	410	100	13	14	34	12	252	3	130
9:00 ~ 10:00	80	361	104	7	23	22	8	130	1	87
10:00 ~ 11:00	156	307	92	8	22	25	5	172	4	154
11:00 ~ 12:00	104	300	68	3	35	30	19	188	2	230
12:00 ~ 13:00	108	267	86	5	26	34	10	167	1	140
13:00 ~ 14:00	83	303	88	1	35	46	13	169	3	90
14:00 ~ 15:00	90	335	71	8	38	48	9	161	2	120
15:00 ~ 16:00	86	226	59	7	24	29	7	120	2	95
16:00 ~ 17:00	90	310	68	3	27	38	8	207	4	74
17:00 ~ 18:00	93	310	52	10	24	26	9	260	1	110
18:00 ~ 19:00	127	306	70	22	32	42	3	265	3	150
19:00 ~ 20:00	194	215	43	3	14	11	6	200	1	157
20:00 ~ 21:00	120	186	102	13	71	7	7	201	0	130
21:00 ~ 22:00	87	166	31	16	8	23	9	190	2	72
22:00 ~ 23:00	70	97	13	0	6	0	1	146	1	62
23:00 ~ 0:00	62	54	12	1	5	1	1	93	0	47
0:00 ~ 1:00	50	27	7	0	3	0	0	35	0	10
1:00 ~ 2:00	15	9	1	0	0	1	0	19	0	7
2:00 ~ 3:00	6	4	1	0	0	2	0	12	0	0
3:00 ~ 4:00	2	2	0	0	0	0	0	5	0	1
4:00 ~ 5:00	8	6	2	0	0	6	0	15	0	0
5:00 ~ 6:00	13	57	12	3	1	4	1	10	0	7
6:00 ~ 7:00	126	260	93	16	5	19	11	72	3	78
7:00 ~ 8:00	274	367	129	15	7	38	1	180	1	
Peak Hour Traffic	274	410	129	22	71	48	19	265	4	230
24-hr Traffic Total	2144	4885	1304	154	420	486	140	3269	34	1951
Peak Hour Ratio	0.1278	0.08	0.099	0.1429	0.16905	0.09877	0.13571	0.0811	0.12	0.11789

**The Preparatory Survey on the Project for Reconstruction of Somalia Drive in Monrovia
(Road Side Traffic Counts)**

Road									Key Map	
Name: <u>Somalia Drive</u>			Date: <u>March 16,2012</u>							
Location / <u>Point B:Double Bridge</u>			Surveyed by: <u>Lewis,Natt, Matico, Kerkula, Worgee & Inepo</u>							
Direction / From: <u>Red light</u> To: <u>Freeport</u>			Supervised by: <u>G. Isaac Doe & Catherine Worgee</u>							
No.	1	2	3	4	5	6	7	8	9	10
Category	Sedan / Wagon / Pick-up	Taxi	Mini Bus	Large Bus	Light Truck (2-Axle)	Heavy Truck (> 2-Axle)	Trailer (Artuculated Truck)	Motorbike	Bicycle	Pedestrian
Hours										
8:00 ~ 9:00	76	310	60	6	12	9	9	301	10	172
9:00 ~ 10:00	95	325	73	4	18	46	1	259	0	190
10:00 ~ 11:00	110	277	63	8	7	8	8	247	2	110
11:00 ~ 12:00	160	278	68	9	9	7	7	212	0	42
12:00 ~ 13:00	56	172	51	11	13	12	6	244	4	120
13:00 ~ 14:00	22	157	47	5	15	5	0	219	6	197
14:00 ~ 15:00	62	277	54	3	26	12	0	284	3	119
15:00 ~ 16:00	53	304	74	6	22	4	2	184	3	79
16:00 ~ 17:00	101	309	64	9	29	12	6	217	1	107
17:00 ~ 18:00	82	371	75	11	46	8	1	254	1	90
18:00 ~ 19:00	148	334	112	14	67	14	3	357	1	150
19:00 ~ 20:00	133	343	113	16	47	9	6	304	1	118
20:00 ~ 21:00	138	221	101	5	10	17	3	227	0	91
21:00 ~ 22:00	140	210	44	6	7	18	4	234	1	109
22:00 ~ 23:00	90	145	30	0	2	0	1	215	0	110
23:00 ~ 0:00	60	71	10	4	2	1	0	101	0	50
0:00 ~ 1:00	25	19	2	0	1	3	0	33	0	14
1:00 ~ 2:00	12	14	2	0	1	1	0	12	0	2
2:00 ~ 3:00	5	5	0	0	1	1	0	8	0	1
3:00 ~ 4:00	3	4	2	0	0	0	0	1	0	0
4:00 ~ 5:00	5	5	1	1	0	0	0	0	0	6
5:00 ~ 6:00	10	32	19	0	1	1	3	11	1	10
6:00 ~ 7:00	40	150	76	42	4	42	16	66	0	120
7:00 ~ 8:00	220	322	80	4	1	26	18	317	3	310
Peak Hour Traffic	220	371	113	42	67	46	18	357	10	310
24-hr Traffic Total	1846	4655	1221	164	341	256	94	4307	37	2317
Peak Hour Ratio	0.119177	0.08	0.0925	0.256098	0.196481	0.179688	0.1914894	0.08289	0.27	0.133794

**The Preparatory Survey on the Project for Reconstruction of Somalia Drive in Monrovia
(Road Side Traffic Counts)**

Road									Key Map	
Name: <u>Somalia Drive</u>			Date: <u>2012/3/16</u>							
Location /			Surveyed by: <u>Kaba, Paye, Tugbe, Browne, Keller & Wilson</u>							
Direction /			Supervised by: <u>Walter Stevens & Catherine Worgee</u>							
From: <u>Free Port</u> To: <u>Red Light Jct.</u>										
No.	1	2	3	4	5	6	7	8	9	10
Category	Sedan / Wagon / Pick-up	Taxi	Mini Bus	Large Bus	Light Truck (2-Axle)	Heavy Truck (> 2-Axle)	Trailer (Articulated Truck)	Motorbike	Bicycle	Pedestrian
Hours										
8:00 ~ 9:00	37	250	72	4	7	9	0	298	0	112
9:00 ~ 10:00	87	347	116	8	13	13	2	438	3	155
10:00 ~ 11:00	104	359	87	4	13	16	4	457	2	197
11:00 ~ 12:00	61	328	64	2	27	31	3	356	3	247
12:00 ~ 13:00	102	364	85	8	20	21	7	398	0	219
13:00 ~ 14:00	108	359	83	7	15	39	5	294	3	166
14:00 ~ 15:00	111	336	74	4	13	28	8	304	1	158
15:00 ~ 16:00	138	349	83	4	20	32	10	302	3	201
16:00 ~ 17:00	115	360	66	9	20	26	8	355	2	228
17:00 ~ 18:00	109	357	64	20	21	32	10	43	1	256
18:00 ~ 19:00	80	317	65	16	10	20	3	594	1	339
19:00 ~ 20:00	57	191	21	10	7	11	0	751	0	353
20:00 ~ 21:00	90	170	110	12	29	5	1	78	0	80
21:00 ~ 22:00	90	140	60	30	47	6	3	200	0	80
22:00 ~ 23:00	100	262	70	13	24	3	1	240	0	68
23:00 ~ 0:00	60	120	13	0	12	1	0	180	0	35
0:00 ~ 1:00	8	46	0	0	0	4	0	118	0	0
1:00 ~ 2:00	6	46	12	0	0	1	1	68	0	0
2:00 ~ 3:00	2	27	8	0	0	0	1	48	0	0
3:00 ~ 4:00	10	22	4	0	0	1	0	42	0	0
4:00 ~ 5:00	15	19	2	0	0	0	0	46	0	10
5:00 ~ 6:00	27	55	22	2	0	5	2	158	0	17
6:00 ~ 7:00	35	144	78	17	12	26	2	238	0	39
7:00 ~ 8:00	100	317	30	15	16	26	1	620	0	80
Peak Hour Traffic	138	364	116	30	47	39	10	751	3	353
24-hr Traffic Total	1652	5285	1289	185	326	356	72	6626	19	3040
Peak Hour Ratio	0.083535	0.069	0.09	0.162162	0.144172	0.109551	0.138889	0.11334	0.158	0.116118

**The Preparatory Survey on the Project for Reconstruction of Somalia Drive in Monrovia
(Road Side Traffic Counts)**

Road Name: <u>Somalia Drive</u>								Date: <u>2012/3/16</u>			Key Map
Location / <u>Point C: Bardnerville</u>								Surveyed by: <u>Lewis, Natt, Matico, Kerkula, Worgee & Inepo</u>			
Direction / From: <u>Redlight</u> To: <u>Freeport</u>								Supervised by: <u>G. Isaac Doe & Catherine Worgee</u>			
No.	1	2	3	4	5	6	7	8	9	10	
Category	Sedan / Wagon / Pick-up	Taxi	Mini Bus	Large Bus	Light Truck (2-Axle)	Heavy Truck (> 2-Axle)	Trailer (Articulated Truck)	Motorbike	Bicycle	Pedestrian	
Hours											
8:00 ~ 9:00	180	250	55	13	13	38	4	709	7	161	
9:00 ~ 10:00	132	287	66	10	8	32	2	492	6	151	
10:00 ~ 11:00	110	216	65	16	9	30	3	463	15	183	
11:00 ~ 12:00	175	228	65	10	4	30	12	475	25	218	
12:00 ~ 13:00	130	186	57	7	9	37	10	386	6	170	
13:00 ~ 14:00	100	235	63	6	4	22	2	313	15	138	
14:00 ~ 15:00	112	204	69	5	12	38	1	337	17	80	
15:00 ~ 16:00	90	179	66	16	6	26	4	391	13	82	
16:00 ~ 17:00	150	228	70	15	4	40	4	433	15	120	
17:00 ~ 18:00	85	250	99	21	13	51	4	530	0	80	
18:00 ~ 19:00	104	230	69	23	6	26	4	592	5	110	
19:00 ~ 20:00	85	194	41	14	12	18	7	467	0	142	
20:00 ~ 21:00	33	90	32	1	9	2	0	446	0	40	
21:00 ~ 22:00	78	211	38	0	10	8	2	294	1	110	
22:00 ~ 23:00	34	155	67	0	10	7	3	254	0	90	
23:00 ~ 0:00	38	78	5	0	1	3	0	122	0	53	
0:00 ~ 1:00	18	22	3	2	1	0	0	77	0	23	
1:00 ~ 2:00	11	12	2	0	2	0	0	33	0	26	
2:00 ~ 3:00	7	5	0	0	0	0	0	8	0	15	
3:00 ~ 4:00	6	3	2	0	1	0	0	7	0	14	
4:00 ~ 5:00	4	4	1	0	2	0	0	14	0	16	
5:00 ~ 6:00	7	40	27	0	1	6	2	28	0	10	
6:00 ~ 7:00	30	178	110	11	25	16	2	109	1	48	
7:00 ~ 8:00	51	300	120	10	17	20	8	220	1	44	
Peak Hour Traffic	180	300	120	23	25	51	12	709	25	218	
24-hr Traffic Total	1770	3785	1192	180	179	450	74	7200	127	2124	
Peak Hour Ratio	0.101695	0.079	0.1007	0.127778	0.139665	0.113333	0.1621622	0.09847	0.197	0.102637	

Table 2: Distribution of distresses on Pavement

Section Chainage	Concentration of Distresses According to Type and Severity (%)														
	Rutting (Average Depth, mm)			Potholes (Average Depth, mm)			Cracks (mean width, mm)			Corrugation (% of road way)			Patching (% Area per station)		
	6-13	13-18	18+	0-25	25-50	50+	1-6	6-12	12+	1-25	25-75	75+	1-5	6-25	25+
0+000 - 0+500	√										√		√		
0+500 - 1+000	√						√			√				√	
1+000 - 1+250		√											√		
1+250 - 1+500		√					√			√				√	
1+500 - 2+000	√						√			√				√	
2+000 - 2+500	√									√				√	
2+500 - 3+000	√												√		
3+000 - 3+500	√												√		
3+500 - 4+000	√			√							√			√	
4+000 - 4+500			√				√				√				√
4+500 - 5+000	√									√			√		
5+000 - 5+500	√									√					

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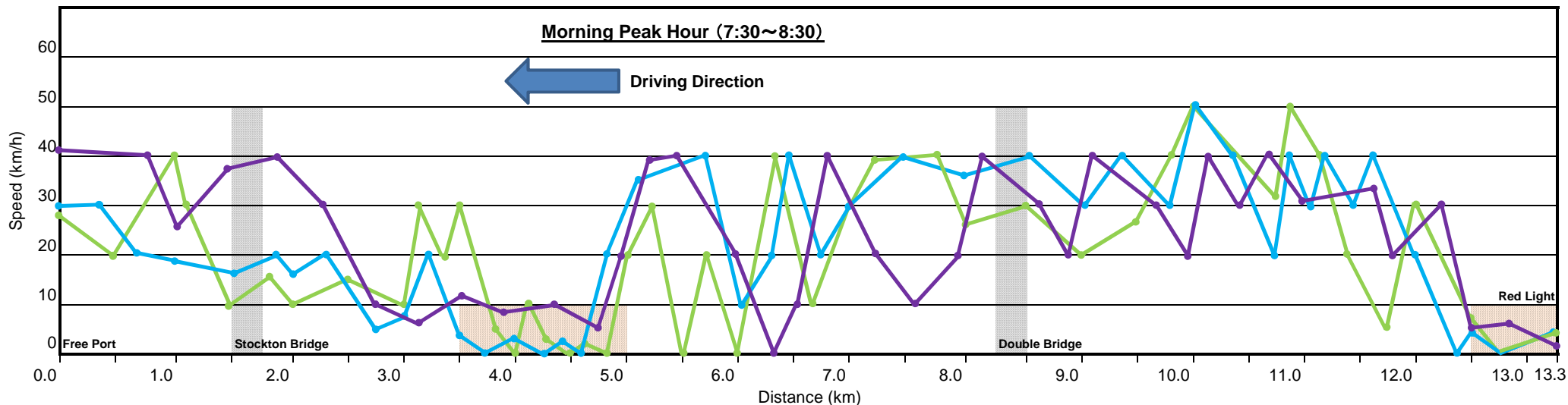
Table 2: Distribution of distresses on Pavement

Section Chainage	Concentration of Distresses According to Type and Severity (%)														
	Rutting (Average Depth, mm)			Potholes (Average Depth, mm)			Cracks (mean width, mm)			Corrugation (% of road way)			Patching (% Area per station)		
	6-13	13-18	18+	0-25	25-50	50+	1-6	6-12	12+	1-25	25-75	75+	1-5	6-25	25+
5+500 - 6+000	√												√		
6+000 - 6+500	√									√					
6+500 - 7+000	√						√			√					
7+000 - 7+500	√														
7+500 - 8+000	√														
8+000 - 8+500															
8+500 - 9+000	√												√		
9+000 - 9+500	√									√					
9+500 - 10+000	√						√			√			√		
10+000 - 10+500	√						√						√		

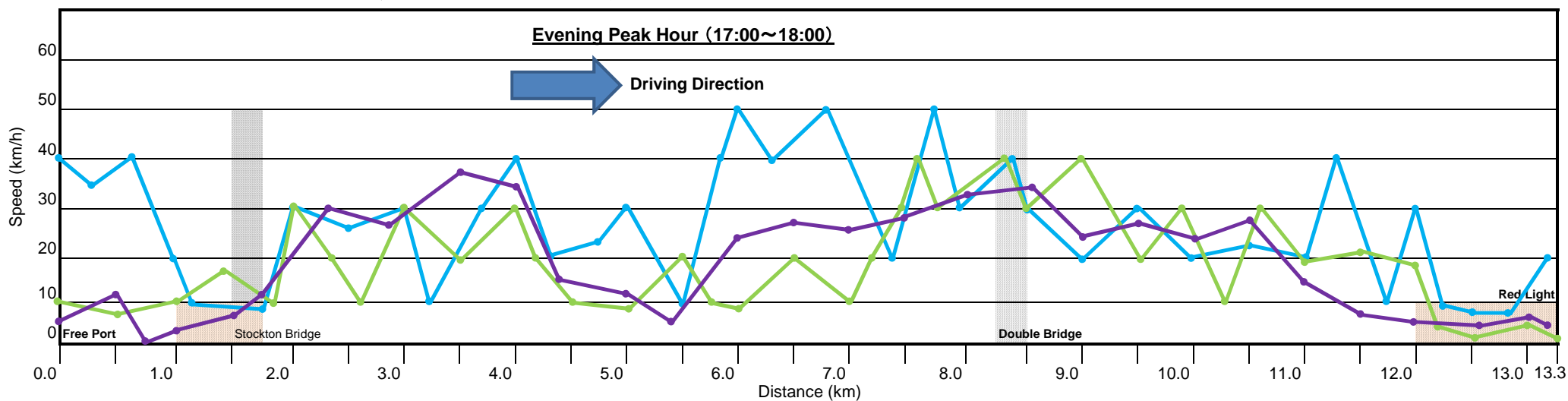
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Table 2: Distribution of distresses on Pavement

Section Chainage	Concentration of Distresses According to Type and Severity (%)														
	Rutting (Average Depth, mm)			Potholes (Average Depth, mm)			Cracks (mean width, mm)			Corrugation (% of road way)			Patching (% Area per station)		
	6-13	13-18	18+	0-25	25-50	50+	1-6	6-12	12+	1-25	25-75	75+	1-5	6-25	25+
10+500 - 11+000	√						√				√			√	
11+000 - 11+500	√						√				√			√	
11+500 - 12+000	√										√			√	
12+000 - 12+500	√						√				√			√	
12+500 - 13+000		√					√				√				



2月8日		全長13.3kmを62分	平均速度 12.9 km/h
2月9日		全長13.3kmを74分	平均速度 10.8 km/h
2月10日		全長13.3kmを61分	平均速度 13.1 km/h
平均		全長13.3kmを66分	平均速度 12.1 km/h



2月8日		全長13.3kmを45分	平均速度 17.7 km/h
2月9日		全長13.3kmを52分	平均速度 15.3 km/h
2月10日		全長13.3kmを57分	平均速度 14.0 km/h
平均		全長13.3kmを51分	平均速度 15.6 km/h

8-5 舖裝設計

Calculation of Traffic Load

	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	
2009											
Stokton Br	15825	14384	4148	441	253	342	216	4447	34		40056
Double Br	9532	12471	5589	3502	2977	1842	911	2125	333		38949
Bardnesvill	3645	4972	1933	532	422	745	77	4630	84		16956
2012											
Stokton Br	4656	9354	4308	1072	1123	989	348	12761	94	7227	34611
Double Br	3746	8986	2480	409	682	797	207	7457	67	4593	24764
Bardnesvill	4281	8715	2763	440	670	885	154	13065	33	5144	30973

Stokton Br growth rat	ESAL	0.74	1	2.048	4.4	5.6					
2013	1.078		4644	1155	1210	1066	375				
2014	1.078		5006	1245	1304	1149	404				
2015	1.065		5331	1325	1388	1223	430				
2016	1.065		5677	1411	1478	1302	457				
2017	1.065		6046	1502	1574	1386	486				
2018	1.065		6438	1599	1676	1476	517				
2019	1.065		6856	1702	1784	1571	550				
2020	1.05		7198	1787	1873	1649	577				
2021	1.05		7557	1876	1966	1731	605				
2022	1.05		7934	1969	2064	1817	635				
2023	1.05		8330	2067	2167	1907	666				
2024	1.05		8746	2170	2275	2002	699				
2025	1.05		9183	2278	2388	2102	733	Average No. of Large Vehicle		6047.4	
	10yr		54734	18361	39413	74549	33180			$w_{18} = 4.019E+07$	

Double Br growth rat	ESAL	0.74	1	2.048	4.4	5.6					
2013	1.078		2673	440	735	859	223				
2014	1.078		2881	474	792	926	240				
2015	1.065		3068	504	843	986	255				
2016	1.065		3267	536	897	1050	271				
2017	1.065		3479	570	955	1118	288				
2018	1.065		3705	607	1017	1190	306				
2019	1.065		3945	646	1083	1267	325				
2020	1.05		4142	678	1137	1330	341				
2021	1.05		4349	711	1193	1396	358				
2022	1.05		4566	746	1252	1465	375				
2023	1.05		4794	783	1314	1538	393				
2024	1.05		5033	822	1379	1614	412				
2025	1.05		5284	863	1447	1694	432	Average No. of Large Vehicle		3579.9	
	10yr		31497	6962	23908	60112	19605			$w_{18} = 2.593E+07$	

Subgrade Evaluation with CBR test result

1	0+000	22		
2	0+500	18		
3	1+000	38		
4	1+250	10		
5	1+500	40	n=12	g (12,0.05)=0.376
6	2+000	30	min	0.066667 < 0.376 OK
7	2+500	19	max	0.0625 < 0.376 OK
8	3+000	8	Average	21.75
9	3+500	21	Standard deviaton	9.88226
10	4+000	22	CBR=	11.8677 say 12
11	4+500	15		
12	5+000	18		
13	5+500	41		
14	6+000	14	n=9,8	g (9,0.05)=0.437,0.468
15	6+500	16	min	0.166667 < 0.468 OK
16	7+000	9	max	0.625 > 0.437 OUT
17	7+500	11		0.166667 < 0.468 OK
18	8+000	21	Average	14.625
19	8+500	18	Standard deviaton	4.62717
20	9+000	19	CBR=	9.99783 say 10
21	9+500	9		
22	10+000	10	n=7	g (7,0.05)=0.507
23	10+500	29	min	0.142857 < 0.507 OK
24	11+000	19	max	0.321429 < 0.507 OK
25	11+500	38	Average	20.1429
26	12+000	14	Standard deviaton	9.85611
27	12+500	16	CBR=	10.2867 say 10
28	13+000	15		

Design of Pavement structure

10 years	~5+000	~13+000		layer	thickness	thickness	drainage	
W_{18} =(cumulative 18kipESAL)	4.019E+07	2.593E+07	~5+000	coefficient	(cm)	(inch)	coefficient	SN
R=(Reliability)	0.9	0.9	Surface AC 350,000psi	0.390	5	1.969	-	0.768
z_R =(Standard Deviation)	-1.282	-1.282	Binder AC 350,000psi	0.390	10	3.937	-	1.535
S_0 =(total standard deviation)	0.45	0.45	Base CBR=80	0.135	20	7.874	1.000	1.063
p_0 =(Initial service index)	4.2	4.2	Subbase CBR=30	0.108	30	11.811	1.000	1.276
p_t =(final service index)	2.5	2.5			<u>t=65cm</u>		Total	4.642
ΔPSI =(gap of service index)	1.7	1.7						
CBR=	12	10	~13+000	layer	thickness	thickness	drainage	
M_R =(Resilient coefficient)	18000	15000	Surface AC 350,000psi	coefficient	(cm)	(inch)	coefficient	SN
SN=	4.51	4.50	Binder AC 350,000psi	0.390	5	1.969	-	0.768
			Base CBR=80	0.390	10	3.937	-	1.535
			Subbase CBR=30	0.135	20	7.874	1.000	1.063
				0.108	30	11.811	1.000	1.276
					<u>t=65cm</u>		Total	4.642

8-6 フリーポート交差点解析

交差点解析結果

流入方向	A	A	B	B	C	C
車線構成	左折+直進	直進	左折	右折	直進	右折+直進
車線数	1	1	2	1	1	1
飽和交通流率基本値(1車線)	2000	2000	1800	1800	2000	2000
車線幅員(m)	3	3	3	3	3	3
車線幅員による補正值	1	1	1	1	1	1
縦断勾配(%)	0	0	0	0	0	0
縦断勾配による補正率	1	1	1	1	1	1
大型車混入率(%)	0	0	0	0	0	0
大型車混入による補正率	1	1	1	1	1	1
青時間(秒)	50	50	36		50	50
サイクル長(秒)	90	90	90		90	90
右折車混入率(%)	0	0			0	0
歩行者交通量(人/サイクル)						
歩行者による低減率						
歩行者用青時間(秒)						
右折車当量						
直進・右折混入補正值						
右折専用車線補正值						
左折車混入率(%)	40.57	0	100		0	0
対向直進交通量(台/時)	763		0			
左折車の通過確率	0.47		1			
現示変り目のさばけ台数増分(台/サイクル)	2		2			
左折車当量	2.41					
直進・左折混入補正值	0.64					
左折車線の専用現示			専用なし			
バス停留所による補正率	1	1	1		1	1
飽和交通流率(台/時)	1274	2000	3600	1800	2000	1500
設計交通量(台/時)		1326	1428	794		1386
正規化交通量		0.405	0.352	0.441		0.396
可能交通容量(台/時)		1820	1680	1800		1946
必要現示率						
1 現示		0.405		0.245		0.396
2 現示			0.352	0.196		
交差点飽和度			0.757			
サイクル長(秒)			90			

交差点解析結果

流入方向	A	A	B	B	C	C
車線構成	左折+直進	直進	左折	右折	直進	右折+直進
車線数	1	2	2	1	2	1
飽和交通流率基本値(1車線)	2000	2000	1800	1800	2000	2000
車線幅員(m)	3	3	3	3	3	3
車線幅員による補正值	1	1	1	1	1	1
縦断勾配(%)	0	0	0	0	0	0
縦断勾配による補正率	1	1	1	1	1	1
大型車混入率(%)	0	0	0	0	0	0
大型車混入による補正率	1	1	1	1	1	1
青時間(秒)	50	50	40	90	50	50
サイクル長(秒)	90	90		90	90	90
右折車混入率(%)	0	0		0	0	100
歩行者交通量(人/サイクル)				0		0
歩行者による低減率				0		0
歩行者用青時間(秒)				0		0
右折車当量			90	1		0
直進・右折混入補正值						0.75
右折専用車線補正值						
左折車混入率(%)	60.86	0	100		0	0
対向直進交通量(台/時)	762		0			
左折車の通過確率	0.47		1			
現示変り目のさばけ台数増分(台/サイクル)	2		2			
左折車当量	2.24					
直進・左折混入補正值	0.57					
左折車線の専用現示				専用あり		
バス停留所による補正率	1	1	1	1	1	1
飽和交通流率(台/時)	1139	4000	3600	1800	4000	1500
設計交通量(台/時)		1326	1428	794		1386
正規化交通量		0.258	0.352	0.441		0.252
可能交通容量(台/時)		2856	1680	1800		3057
必要現示率						
1 現示		0.258		0.245		0.252
2 現示			0.352	0.196		
交差点飽和度			0.610			
サイクル長(秒)			90			

Flow Calculation

Rational: $Q=(1/(3.6*10^6))*C*I*a$		Manning: $V=(1/n)*R^{2/3}*i^{1/2}$	
discharge coefficient(AC)	0.9	roughness coefficient:(concrete)	0.015
rainfall intensity(3yr return period)	100mm/h	effective depth	0.8
catchment width	17.7m		

Median Drain

No.	Median Drain		Slope (%)	elevation		U-Ditch		discharge (m3/s)	Capacity						judge
	Station	Length (m)		start	end	Station	Outlet		depth (m)	width (m)	section area:A (m2)	Hydraulic radius:R (m)	velocity (m/s)	capacity (m3/s)	
1	0+225 ~ 0+360	135	0.059	1.350	1.406	pipe	crown slope	0.060	0.50	2.214	0.168	0.152	0.461	0.078	OK
2	0+360 ~ 0+640	280	0.030	1.782	1.697		0+640 inner wetland	0.124	0.90	0.500	0.450	0.196	0.391	0.176	OK
3	0+640 ~ 0+730	90	0.112	2.196	2.263		0+640 inner wetland	0.040	0.40	0.500	0.200	0.154	0.641	0.128	OK
4	0+730 ~ 0+900	170	0.076	2.278	2.149		0+905 inner wetland	0.075	0.50	0.500	0.250	0.167	0.556	0.139	OK
	0+900 ~ 1+025	125	0.737	2.249	3.170		0+905 inner wetland	0.144	0.40	0.500	0.200	0.154	1.643	0.329	OK
	1+025 ~ 1+225	200	0.400	3.170	3.818			0.089	0.40	0.500	0.200	0.154	1.211	0.242	OK
5	0+900 ~ 1+225	325	0.483	2.249	3.818			0.144	0.40	0.500	0.200	0.154	1.330	0.266	OK
6	1+225 ~ 1+380	155	0.039	3.896	3.850		Stokton river	0.069	0.45	0.500	0.225	0.161	0.389	0.088	OK
7	1+462 ~ 1+539	77	0.032	4.040	4.065		Stokton river	0.034	0.40	0.500	0.200	0.154	0.345	0.069	OK
	1+539 ~ 1+600	61	0.865	3.733	3.465		1+900 inner wetland	0.027	0.40	0.500	0.200	0.154	1.780	0.356	OK
	1+600 ~ 1+825	225	0.424	3.465	2.510			0.127	0.40	0.500	0.200	0.154	1.247	0.249	OK
	1+825 ~ 1+900	75	0.311	2.510	2.277			0.160	0.40	0.500	0.200	0.154	1.067	0.213	OK
8	1+539 ~ 1+900	361	0.403	3.733	2.277			0.160	0.40	0.500	0.200	0.154	1.216	0.243	OK
	1+900 ~ 1+975	75	0.120	2.277	2.367		1+900 inner wetland	0.127	0.50	0.500	0.250	0.167	0.699	0.175	OK
	1+975 ~ 2+100	125	0.154	2.367	2.560			0.094	0.40	0.500	0.200	0.154	0.752	0.150	OK
	2+100 ~ 2+187	87	0.102	2.560	2.620			0.038	0.40	0.500	0.200	0.154	0.610	0.122	OK
9	1+900 ~ 2+187	287	0.191	2.277	2.620			0.127	0.40	0.500	0.200	0.154	0.837	0.167	OK
10	2+187 ~ 2+328	141	0.035	2.649	2.600		2+328 pipe culvert	0.062	0.45	0.500	0.225	0.161	0.367	0.083	OK
	2+328 ~ 2+385	57	0.047	2.302	2.329		2+328 pipe culvert	0.109	0.60	0.500	0.300	0.176	0.456	0.137	OK
	2+385 ~ 2+425	40	0.195	2.329	2.407			0.084	0.40	0.500	0.200	0.154	0.845	0.169	OK
	2+425 ~ 2+575	150	0.442	2.407	3.070			0.066	0.40	0.500	0.200	0.154	1.273	0.255	OK
11	2+328 ~ 2+575	247	0.372	2.152	3.070			0.109	0.85	0.500	0.425	0.193	1.358	0.577	OK
	2+575 ~ 2+725	150	0.153	3.070	2.840		3+000 inner wetland	0.066	0.40	0.500	0.200	0.154	0.750	0.150	OK
	2+725 ~ 2+775	50	0.100	2.840	2.790			0.089	0.40	0.500	0.200	0.154	0.605	0.121	OK
	2+775 ~ 2+825	50	0.400	2.790	2.590			0.111	0.40	0.500	0.200	0.154	1.211	0.242	OK
	2+825 ~ 3+000	175	0.129	2.590	2.365			0.144	0.65	0.500	0.325	0.181	0.764	0.248	OK
12	2+575 ~ 3+000	425	0.166	3.070	2.365			0.188	0.65	0.500	0.325	0.181	0.867	0.282	OK
13	3+000 ~ 3+125	125	0.226	2.615	2.333		3+125 inner wetland	0.055	0.40	0.500	0.200	0.154	0.909	0.182	OK
	3+125 ~ 3+163	38	0.297	2.233	2.346		3+125 inner wetland	0.195	0.50	0.500	0.250	0.167	1.101	0.275	OK
	3+163 ~ 3+200	37	0.424	2.346	2.503			0.178	0.40	0.500	0.200	0.154	1.247	0.249	OK
	3+200 ~ 3+275	75	0.665	2.503	3.002			0.162	0.40	0.500	0.200	0.154	1.561	0.312	OK
	3+275 ~ 3+325	50	0.472	3.002	3.238			0.129	0.40	0.500	0.200	0.154	1.315	0.263	OK
	3+325 ~ 3+450	125	0.226	3.288	3.570			0.107	0.40	0.500	0.200	0.154	0.909	0.182	OK
	3+450 ~ 3+566	116	0.086	3.570	3.670			0.051	0.40	0.500	0.200	0.154	0.562	0.112	OK
14	3+125 ~ 3+566	441	0.326	2.233	3.670			0.195	0.50	0.500	0.250	0.167	1.153	0.288	OK

No.	Median Drain			Slope (%)	elevation		U-Ditch		discharge (m ³ /s)	Capacity					judge	
	Station	Length (m)	Station		start	end	Station	Outlet		depth (m)	width (m)	section area:A (m ²)	Hydraulic radius:R (m)	velocity (m/s)		capacity (m ³ /s)
	3+566	3+675	109	0.382	3.629	3.327			0.048	0.40	0.500	0.200	0.154	1.183	0.237	OK
	3+675	3+725	50	0.320	3.327	3.167			0.070	0.40	0.500	0.200	0.154	1.083	0.217	OK
	3+725	3+925	200	0.152	3.167	2.863			0.159	0.55	0.500	0.275	0.172	0.803	0.221	OK
15	3+566	~ 3+925	359	0.213	3.629	2.863		3+925 inner wetland	0.159	0.55	0.500	0.275	0.172	0.952	0.262	OK
	3+925	4+030	105	0.098	2.763	2.866			0.163	0.65	0.500	0.325	0.181	0.667	0.217	OK
	4+030	4+060	30	0.197	2.866	2.925	pipe		0.117	0.50	2.214	0.168	0.152	0.842	0.142	OK
	4+060	4+200	140	0.290	3.325	3.731			0.104	0.40	0.500	0.200	0.154	1.031	0.206	OK
	4+200	4+217	17	0.100	3.731	3.748			0.042	0.40	0.500	0.200	0.154	0.605	0.121	OK
	4+217	4+294	77	0.025	3.748	3.767			0.034	0.40	0.500	0.200	0.154	0.301	0.060	OK
16	3+925	~ 4+294	369	0.272	2.763	3.767		3+925 inner wetland	0.163	0.75	0.500	0.375	0.188	1.139	0.427	OK
	4+294	4+450	156	0.143	3.616	3.536			0.069	0.40	0.500	0.200	0.154	0.723	0.145	OK
	4+450	4+500	50	0.432	3.536	3.320			0.091	0.40	0.500	0.200	0.154	1.258	0.252	OK
	4+500	4+630	130	0.124	3.320	3.159			0.149	0.55	0.500	0.275	0.172	0.725	0.199	OK
17	4+294	~ 4+630	336	0.148	3.616	3.119		4+630 box culvert	0.149	0.55	0.500	0.275	0.172	0.793	0.218	OK
	4+630	4+750	120	0.132	3.159	3.317			0.153	0.55	0.500	0.275	0.172	0.748	0.206	OK
	4+750	4+975	225	0.272	3.317	3.928			0.100	0.40	0.500	0.200	0.154	0.997	0.199	OK
18	4+630	~ 4+975	345	0.223	3.159	3.928		4+630 box culvert	0.153	0.55	0.500	0.275	0.172	0.973	0.268	OK
	4+975	5+134	159	0.157	3.828	4.077			0.144	0.50	0.500	0.250	0.167	0.799	0.200	OK
	5+134	5+164	30	0.313	4.077	4.171	pipe		0.073	0.40	2.214	0.108	0.122	0.916	0.099	OK
	5+164	5+275	111	0.222	4.521	4.767			0.060	0.40	2.214	0.108	0.122	0.771	0.083	OK
	5+275	5+300	25	0.168	4.767	4.809			0.011	0.40	0.500	0.200	0.154	0.785	0.157	OK
19	4+975	~ 5+300	325	0.331	3.733	4.809		4+975 pipe culvert	0.144	0.75	0.500	0.375	0.188	1.257	0.471	OK
	5+300	5+355	55	0.116	4.809	4.745			0.024	0.40	0.500	0.200	0.154	0.653	0.131	OK
	5+355	5+516	161	0.221	4.745	4.389			0.096	0.40	0.500	0.200	0.154	0.900	0.180	OK
	5+516	5+555	39	2.644	4.389	3.358			0.113	0.40	0.500	0.200	0.154	3.112	0.622	OK
20	5+300	~ 5+555	255	0.177	4.809	4.358		5+555 pipe culvert	0.113	0.40	0.500	0.200	0.154	0.805	0.161	OK
	5+555	5+750	195	0.321	4.358	4.984			0.119	0.40	0.500	0.200	0.154	1.085	0.217	OK
	5+750	5+825	75	0.127	4.984	5.079			0.033	0.40	0.500	0.200	0.154	0.681	0.136	OK
21	5+555	~ 5+825	270	0.267	4.358	5.079		5+555 pipe culvert	0.119	0.40	0.500	0.200	0.154	0.989	0.198	OK
22	5+825	5+975	150	0.079	5.079	4.960			0.066	0.40	0.500	0.200	0.154	0.539	0.108	OK
	5+975	6+135	160	0.221	4.960	4.607		6+135 box culvert	0.137	0.40	0.500	0.200	0.154	0.899	0.180	OK
23	6+135	~ 6+175	40	0.032	4.607	4.620		6+135 box culvert	0.018	0.30	0.500	0.150	0.136	0.318	0.048	OK
	6+175	6+400	225	0.180	4.250	4.025			0.100	0.40	0.500	0.200	0.154	0.812	0.162	OK
	6+400	6+491	91	0.152	4.025	3.887			0.140	0.46	0.500	0.230	0.162	0.771	0.177	OK
	6+491	6+521	30	0.050	3.167	3.152	pipe		0.153	0.70	2.214	0.330	0.213	0.532	0.175	OK
	6+521	6+560	39	0.026	3.152	3.142			0.170	1.05	0.500	0.525	0.202	0.367	0.193	OK
24	6+175	~ 6+560	385	0.287	4.250	3.145		6+560 pipe culvert	0.170	1.05	0.500	0.525	0.202	1.229	0.645	OK
	6+560	6+675	115	0.385	3.792	4.235			0.136	0.40	0.500	0.200	0.154	1.188	0.238	OK
	6+675	6+725	50	1.342	4.235	4.906			0.085	0.40	0.500	0.200	0.154	2.217	0.443	OK
	6+725	6+868	143	0.584	4.906	5.157			0.063	0.40	0.500	0.200	0.154	1.462	0.292	OK
25	6+560	~ 6+868	308	0.443	3.792	5.157		6+560 pipe culvert	0.136	0.40	0.500	0.200	0.154	1.274	0.255	OK
26	6+868	~ 6+925	57	0.011	5.621	5.615		6+925 inner wetland	0.025	0.40	0.500	0.200	0.154	0.196	0.039	OK

No.	Median Drain			Slope (%)	elevation		U-Ditch		discharge (m ³ /s)	Capacity					judge	
	Station	Length (m)	Station		start	end	Station	Outlet		depth (m)	width (m)	section area:A (m ²)	Hydraulic radius:R (m)	velocity (m/s)		capacity (m ³ /s)
	6+925	7+025	100	0.609	5.915	6.524			0.097	0.40	0.500	0.200	0.154	1.494	0.299	OK
	7+025	7+088	63	0.089	6.524	6.580			0.053	0.40	0.500	0.200	0.154	0.571	0.114	OK
	7+088	7+118	30	0.347	6.580	6.684	pipe		0.025	0.40	2.214	0.108	0.122	0.964	0.104	OK
	7+118	7+145	27	0.107	7.034	7.063			0.012	0.40	0.500	0.200	0.154	0.627	0.125	OK
27	6+925 ~	7+145	220	0.285	4.090	7.063		6+925 inner wetland	0.097	0.40	0.500	0.200	0.154	1.022	0.204	OK
	7+145 ~	7+333	188	0.304	7.023	6.542			0.083	0.40	0.500	0.200	0.154	1.056	0.211	OK
	7+333	7+433	100	0.255	6.092	5.837	pipe		0.127	0.50	2.214	0.168	0.152	0.959	0.162	OK
	7+433	7+575	142	0.104	5.837	5.689			0.190	0.65	2.214	0.285	0.198	0.730	0.208	OK
	7+575	7+750	175	0.245	5.689	5.260			0.268	0.65	2.214	0.285	0.198	1.120	0.319	OK
	7+750	7+840	90	0.334	5.260	4.959			0.308	0.65	0.500	0.325	0.181	1.232	0.400	OK
28	7+145 ~	7+840	695	0.297	7.023	4.959		7+840 pipe culvert	0.308	0.65	0.500	0.325	0.181	1.161	0.377	OK
29	7+840 ~	7+902	62	0.239	5.209	5.061		7+902 pipe culvert	0.027	0.40	0.500	0.200	0.154	0.935	0.187	OK
30	7+902 ~	7+966	64	0.009	4.911	4.917		7+902 pipe culvert	0.028	0.40	0.500	0.200	0.154	0.185	0.037	OK
	7+966	8+200	234	0.178	4.608	4.370			0.104	0.40	0.500	0.200	0.154	0.807	0.161	OK
	8+200	8+229	29	0.238	4.370	4.301			0.116	0.55	0.500	0.275	0.172	1.005	0.276	OK
31	7+966 ~	8+229	263	0.117	4.608	4.301		double br	0.116	0.55	0.500	0.275	0.172	0.704	0.194	OK
	8+280	8+325	45	0.302	4.358	4.494			0.204	0.50	0.500	0.250	0.167	1.110	0.277	OK
	8+325	8+475	150	0.551	4.494	5.320			0.184	0.40	0.500	0.200	0.154	1.420	0.284	OK
	8+475	8+741	266	0.336	5.320	7.220			0.118	0.40	0.500	0.200	0.154	1.110	0.222	OK
32	8+280 ~	8+741	461	0.336	4.358	7.220		double br	0.204	0.60	0.500	0.300	0.176	1.216	0.365	OK
33	8+741 ~	8+803	62	0.697	7.220	7.443		8+741 pipe culvert	0.027	0.40	0.500	0.200	0.154	1.598	0.320	OK
	8+803	8+900	97	0.081	7.587	7.508			0.043	0.40	0.500	0.200	0.154	0.546	0.109	OK
	8+900	8+975	75	0.597	7.508	7.060			0.076	0.40	0.500	0.200	0.154	1.479	0.296	OK
	8+975	9+150	175	0.798	7.060	5.663			0.077	0.40	0.500	0.200	0.154	1.710	0.342	OK
34	8+803 ~	9+150	347	0.554	7.587	5.663		9+150 inner culvert	0.154	0.40	0.500	0.200	0.154	1.425	0.285	OK
	9+150	9+245	95	0.798	5.663	4.905			0.042	0.40	0.500	0.200	0.154	1.710	0.342	OK
	9+245	9+275	30	0.800	4.555	4.315	pipe		0.055	0.40	2.214	0.108	0.122	1.464	0.158	OK
	9+275	9+325	50	0.098	4.315	4.266			0.077	0.40	0.500	0.200	0.154	0.599	0.120	OK
	9+325	9+400	75	0.791	4.266	3.673			0.111	0.40	0.500	0.200	0.154	1.702	0.340	OK
	9+400	9+456	56	0.288	3.673	3.512			0.135	0.40	0.500	0.200	0.154	1.026	0.205	OK
	9+456	9+545	89	0.064	3.512	3.455			0.175	1.05	0.500	0.525	0.202	0.581	0.305	OK
35	9+150 ~	9+545	395	0.560	5.663	3.450		9+545 box culvert	0.175	1.05	0.500	0.525	0.202	1.717	0.902	OK
36	9+545 ~	9+825	280	0.996	4.105	6.895		9+545 box culvert	0.124	0.40	0.500	0.200	0.154	1.911	0.382	OK
	9+825	9+915	90	0.628	6.895	7.460			0.102	0.40	0.500	0.200	0.154	1.517	0.303	OK
	9+915	9+945	30	1.000	7.460	7.760	pipe		0.062	0.40	2.214	0.108	0.122	1.637	0.176	OK
	9+945	10+055	110	0.977	8.110	9.185			0.049	0.40	0.500	0.200	0.154	1.892	0.378	OK
37	9+825 ~	10+055	230	0.996	6.895	9.185		9+825 pipe culvert	0.102	0.40	0.500	0.200	0.154	1.910	0.382	OK
	10+055	10+200	145	0.988	9.185	10.618			0.108	0.40	0.500	0.200	0.154	1.903	0.381	OK
	10+200	10+264	64	0.497	10.618	10.936			0.044	0.40	0.500	0.200	0.154	1.349	0.270	OK
	10+264	10+300	36	0.144	10.936	10.988			0.016	0.40	0.500	0.200	0.154	0.727	0.145	OK
38	10+055 ~	10+300	245	0.736	9.185	10.988		10+055 pipe culvert	0.108	0.40	0.500	0.200	0.154	1.642	0.328	OK

No.	Median Drain		Slope (%)	elevation		U-Ditch		discharge (m3/s)	Capacity						judge	
	Station	Length (m)		start	end	Station	Outlet		depth (m)	width (m)	section area:A (m2)	Hydraulic radius:R (m)	velocity (m/s)	capacity (m3/s)		
	10+300	10+350	50	0.156	10.988	10.910		0.022	0.40	0.500	0.200	0.154	0.756	0.151	OK	
	10+350	10+395	45	0.458	10.910	10.704		0.042	0.40	0.500	0.200	0.154	1.295	0.259	OK	
39	10+300 ~	10+395	95	0.299	10.988	10.704		0.042	0.40	0.500	0.200	0.154	1.047	0.209	OK	
	10+395	10+428	33	0.612	10.704	10.502	pipe	0.015	0.40	0.500	0.200	0.154	1.498	0.300	OK	
	10+428	10+567	139	1.074	10.502	9.009		0.076	0.40	0.500	0.200	0.154	1.984	0.397	OK	
	10+567	10+667	100	1.102	8.659	7.557		0.120	0.40	2.214	0.108	0.122	1.718	0.185	OK	
	10+667	10+718	51	0.412	7.557	7.347		0.143	0.40	0.500	0.200	0.154	1.228	0.246	OK	
	10+718	10+830	112	1.094	7.347	6.122		0.192	0.40	0.500	0.200	0.154	2.002	0.400	OK	
40	10+395 ~	10+830	435	1.053	10.704	6.122			0.192	0.40	0.500	0.200	0.154	1.964	0.393	OK
	10+830	10+925	95	1.114	6.122	5.064	pipe	0.042	0.40	0.500	0.200	0.154	2.020	0.404	OK	
	10+925	10+975	50	0.804	5.064	4.662		0.064	0.40	0.500	0.200	0.154	1.716	0.343	OK	
	10+975	11+017	42	0.210	4.662	4.574		0.083	0.40	0.500	0.200	0.154	0.876	0.175	OK	
	11+017	11+135	118	0.044	4.574	4.522		0.135	1.55	0.500	0.775	0.215	0.503	0.390	OK	
41	10+830 ~	11+135	305	0.508	6.072	4.522			0.135	1.55	0.500	0.775	0.215	1.707	1.323	OK
	11+135	11+230	95	0.877	5.484	6.317		pipe pipe pipe pipe pipe	0.142	0.40	0.500	0.200	0.154	1.792	0.358	OK
	11+230	11+250	20	1.345	6.317	6.586	0.100		0.40	2.214	0.108	0.122	1.898	0.205	OK	
	11+250	11+275	25	1.920	6.586	7.066	0.091		0.40	2.214	0.108	0.122	2.268	0.244	OK	
	11+275	11+325	50	2.548	7.066	8.340	0.080		0.40	2.214	0.108	0.122	2.613	0.282	OK	
	11+325	11+330	5	1.000	8.340	8.390	0.058		0.40	2.214	0.108	0.122	1.637	0.176	OK	
	11+330	11+455	125	1.229	8.740	10.276	0.055		0.40	0.500	0.200	0.154	2.122	0.424	OK	
42	11+135 ~	11+455	320	1.498	5.484	10.276		0.142	0.40	0.500	0.200	0.154	2.342	0.468	OK	
	11+455	11+500	45	1.156	10.276	10.796	pipe	0.080	0.40	0.500	0.200	0.154	2.058	0.412	OK	
	11+500	11+550	50	0.836	10.796	11.214		0.060	0.40	0.500	0.200	0.154	1.750	0.350	OK	
	11+550	11+600	50	0.442	11.214	11.435		0.038	0.40	0.500	0.200	0.154	1.273	0.255	OK	
	11+600	11+636	36	0.103	11.435	11.472		0.016	0.40	0.500	0.200	0.154	0.614	0.123	OK	
43	11+455 ~	11+636	181	0.661	10.276	11.472			0.080	0.40	0.500	0.200	0.154	1.556	0.311	OK
44	11+636 ~	11+713	77	0.013	11.312	11.322			0.034	0.50	0.500	0.250	0.167	0.230	0.058	OK
45	11+713 ~	11+930	217	0.204	10.963	10.871		0.096	0.40	0.500	0.200	0.154	0.865	0.173	OK	
	11+930	12+052	122	0.207	10.571	10.824	pipe	0.164	0.50	0.500	0.250	0.167	0.919	0.230	OK	
	12+052	12+193	141	0.659	10.824	11.753		0.110	0.40	0.500	0.200	0.154	1.554	0.311	OK	
	12+193	12+223	30	1.053	11.753	12.069		0.048	0.40	2.214	0.108	0.122	1.680	0.181	OK	
	12+223	12+265	42	1.552	12.069	12.721		0.035	0.40	0.500	0.200	0.154	2.385	0.477	OK	
	12+265	12+301	36	0.150	12.721	12.775		0.016	0.40	0.500	0.200	0.154	0.741	0.148	OK	
46	11+930 ~	12+301	371	0.204	10.350	12.775			0.164	0.50	0.500	0.250	0.167	0.913	0.228	OK
	12+301	12+350	49	0.467	12.775	12.546	pipe	0.022	0.40	0.500	0.200	0.154	1.309	0.262	OK	
	12+350	12+381	31	1.048	12.546	12.221		0.035	0.40	0.500	0.200	0.154	1.960	0.392	OK	
	12+381	12+525	144	1.272	12.221	10.389		0.099	0.40	0.500	0.200	0.154	2.159	0.432	OK	
	12+525	12+550	25	0.916	10.389	10.160		0.110	0.40	0.500	0.200	0.154	1.832	0.366	OK	
	12+550	12+575	25	0.372	10.160	10.067		0.121	0.40	0.500	0.200	0.154	1.167	0.233	OK	
47	12+301 ~	12+575	274	0.988	12.775	10.067			0.121	0.40	0.500	0.200	0.154	1.903	0.381	OK

8-8 橋梁調查結果

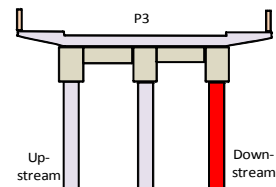
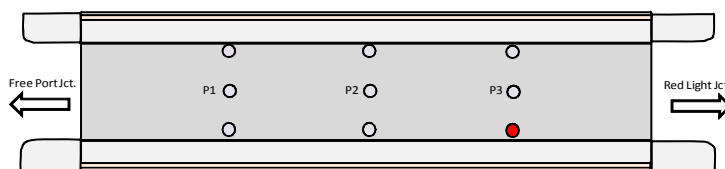
添付資料 1 橋梁目視調查結果

STOCKTON BRIDGE



Road	: Smalia Drive (appx. 1.5km from Free Port Jct.)
Super Str.	: RC Girder (Rigid Type) L= 15.5m+21.3m+21.3m+15.5m = 73.6m
Pier Type	: Columned Pile (D=760 X 3)
Foundation	: (Supposed to be) Pile foundation
Condition	: Passable (2-lane)
Width	: W=11.0m =0.9m + 9.2m + 0.9m
H.W.L.	: 1.3m below from bottom of Girder at Pier
Judgement	: Reconstruction There is serious damage at Pier 3 Needs urgent repair (See next page)
Others	: No Data for this Bridge (Refer next next page) (Drawing, Soil Investigation, Design Calculation Constructed before in 1974.

Problem Column





Americas, Europe, Africa
Engineering, Construction, Environmental Services, Worldwide

December 6, 2011

Atty. Samuel Kofi Woods, II, Minister
Ministry of Public Works
Lynch Street South
Monrovia, Liberia

Attention: Edsel Smith

Dear Sirs:

Subject: **Cost Estimate - Reprographics
Records for Somalia Drive (Formerly Monrovia By-Pass)
MPW REF.#: SKW-M/MPW-RI./0300/11**

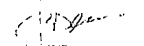
This letter is a followup to correspondence dated September 19, 2011 and September 28, 2011 requesting record drawings and documents relating to Somalia Drive (formerly Monrovia By-Pass) Improvements. We understand that the Government of Liberia (GOL) needs to supply the Japan International Cooperation Agency (JICA) with available information to enable them to implement the Somalia Drive Improvement Project.

After an exhaustive search by personnel in our archives group, we found about 500 pages of relevant documents relating to the design and construction supervision of highway improvements completed in the 1970s for Somalia Drive. These documents include the highway drawings shown in the attached indexes. We did not find any engineering reports, i.e., geotechnical investigations.

Please note that Stanley Consultants does not have record drawings of the bridges on this corridor. According to Jim McLellan, Resident Engineer, Stanley Consultants, the bridges were already constructed when he arrived in Monrovia in 1974 to begin the supervision of construction for Somalia Drive. Jim was the Resident Engineer on our project from 1974-1978 and returned to Monrovia to build the Bomu Hills Road, 1984-1988. We checked with other Stanley members who worked in Liberia in the 1970s and 1980s. It is our understanding that an Italian company, Vianini Construction Corp. (now Vianini Lavori SpA), constructed the bridges on Somalia Drive in the 1960s, before the highway was paved from Freeport to Red Light. Vianini and its related company, Porto Torre, constructed a number of works in Liberia in the 1960s - the Temple of Justice, the Lofa River Bridge, and Monrovia to Totota Highway. We hope this information is useful to you. http://www.vianinigroup.it/index_eng.php

Our estimate is \$2,794 to retrieve, print, and scan the documents requested. This cost includes the 28 hours spent to date by our records personnel to locate and identify this information. We would also provide you with electronic copies on a CD-ROM. Instructions for payment are shown on the following page.

Sincerely,
Stanley Consultants, Inc.


Tshaka E. Dennis, PE
Vice President

Attachments

Stanley Building 225 Iowa Avenue - Muscatine, IA 52761-3764 - phone 563 264 6600 - fax 563 264 6650
www.stanleyconsultants.com



Photo 1

Stockton Bridge Photo



Photo 2



Photo 3



Photo 4

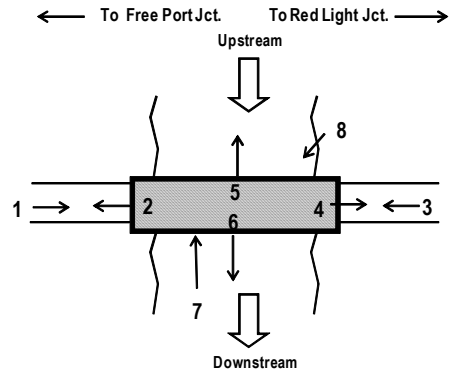


Photo 5



Photo 6



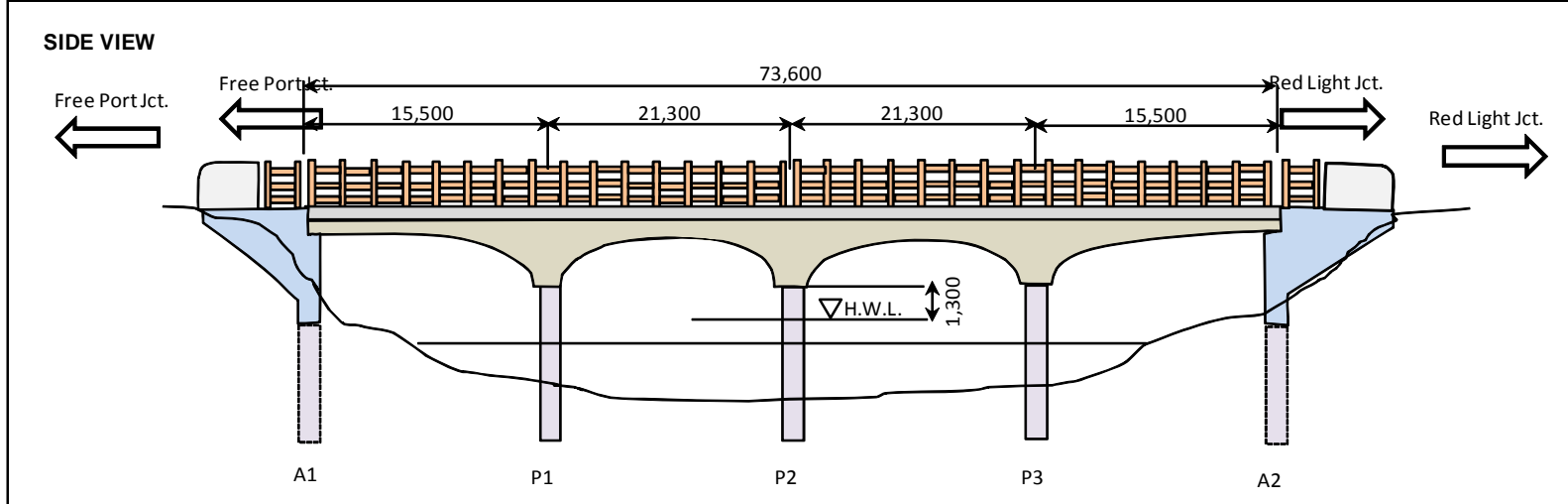
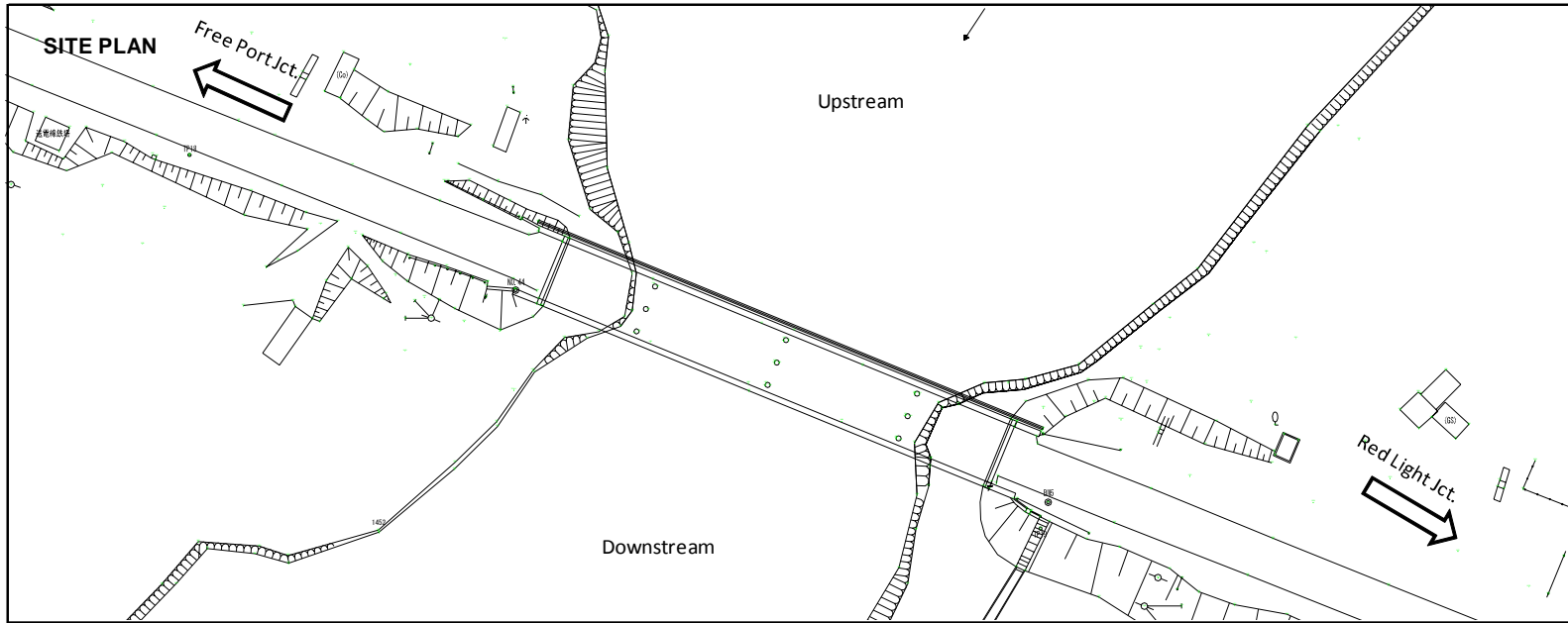
Photo 7



Photo 8

Bridge Name : Stockton Bridge

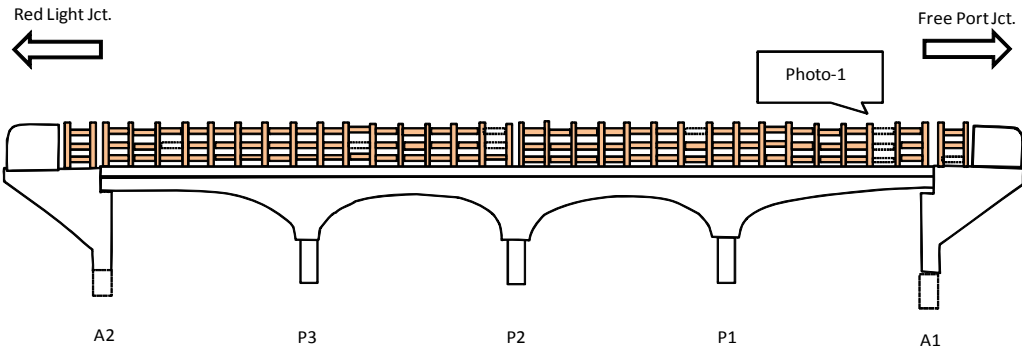
A-83



Stockton Bridge Inspection Sheet (1/6)

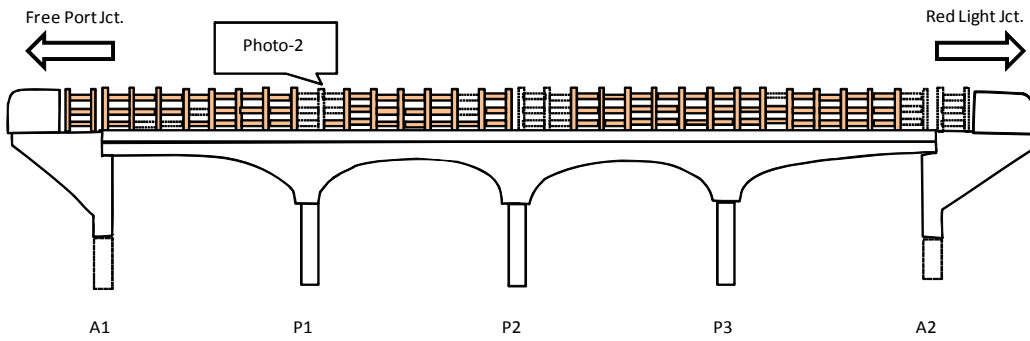
1. Railing

1-1 Upstream side





* 9 pipes are missing.

1-2 Downstream side



* 22 pipes and 6 posts are missing.

* Note:  : missing pipe
 : missing post

* Status of Railing :
 31 horizontal pipes and 6 poles are missing.



Photo-1 Missing Pipe (Upstream side)



Photo-2 Missing Pipe & Pole (Downstream side)

Stockton Bridge Inspection Sheet (2/6)

2. Slab

2-1 Surface

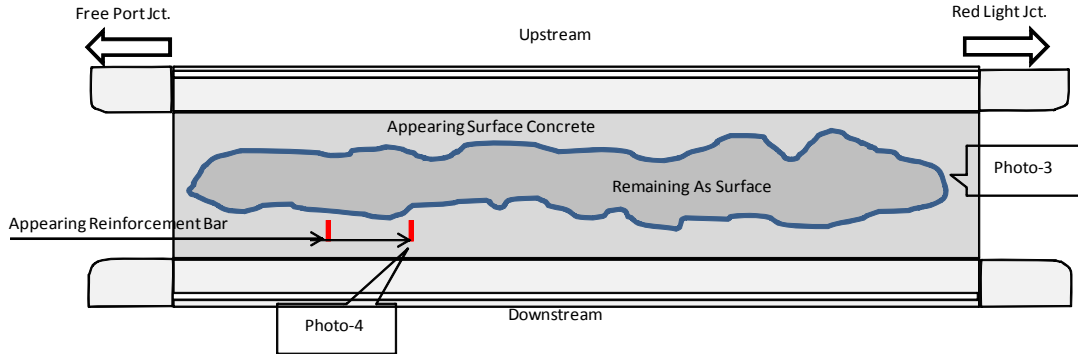


Photo-3 Condition of Surface



Photo-4 Appearing Reinforcement Bar

2-2 Bottom

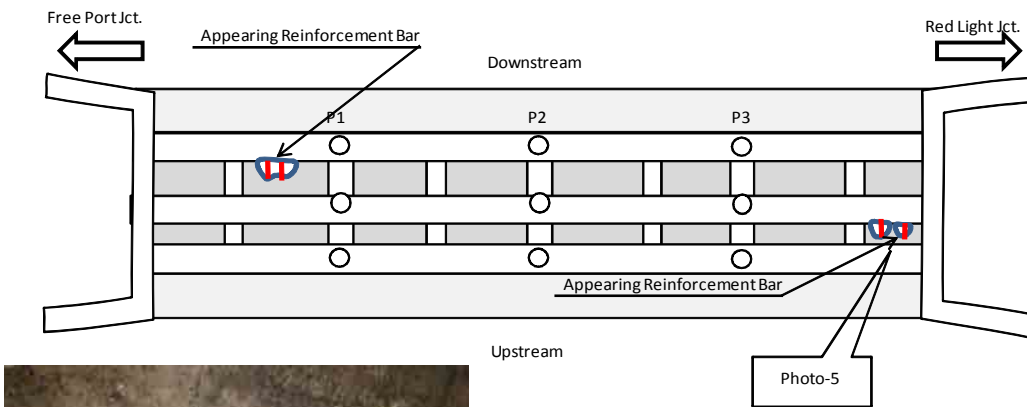


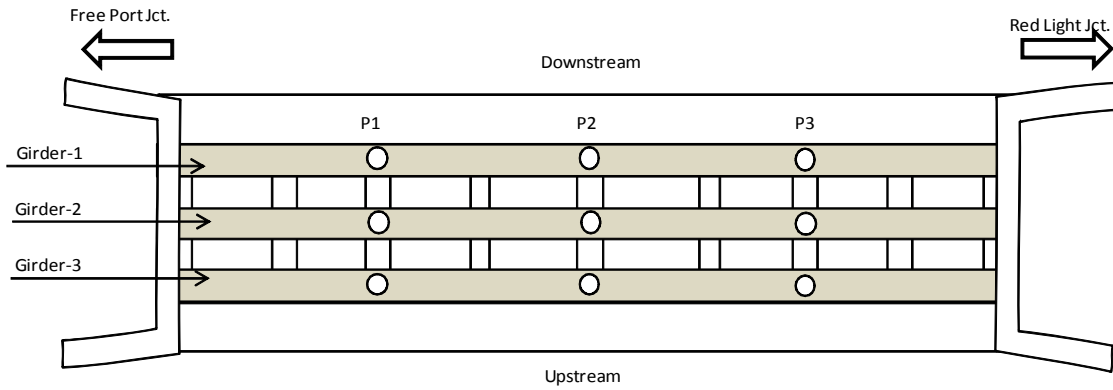
Photo-5 Appearing Reinforcement Bar

- * Status of Slab :
- Surface : Exfoliated As Surface.
 - Appearing Reinforcement bar.
 - Bottom : There ar 2 lacking concrete portions.

Stockton Bridge Inspection Sheet (3/6)

3. Main Girder

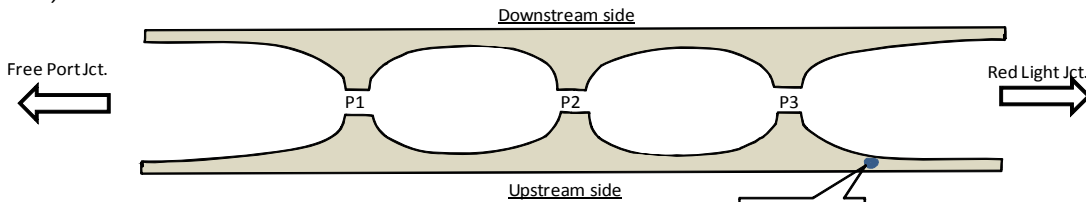
3.1. Bottom of Girder



* Status: No Problem

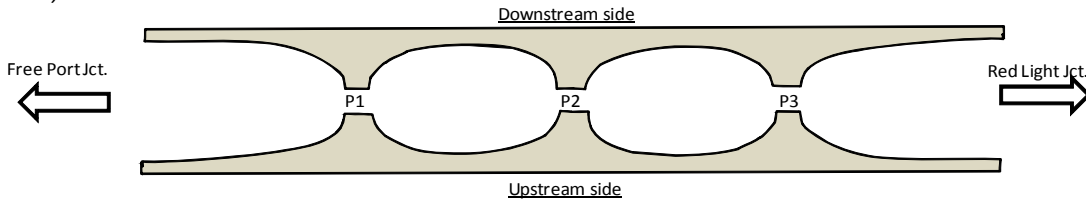
3.2. Side of Girder

a) Girder-1



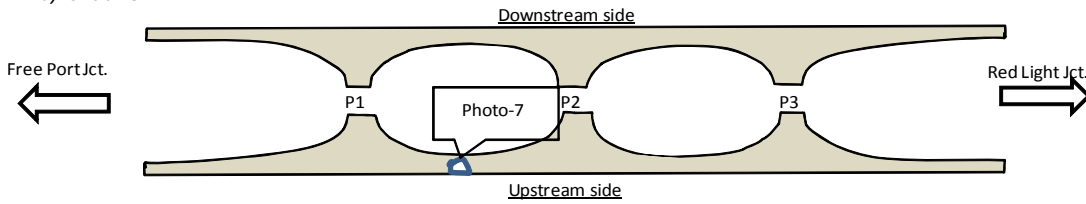
* Status: There is a damaged portion by shot

b) Girder-2



* Status: No Problem

c) Girder-3



* Status: There is a damaged portion by shot



Photo-6 Damage by Shot

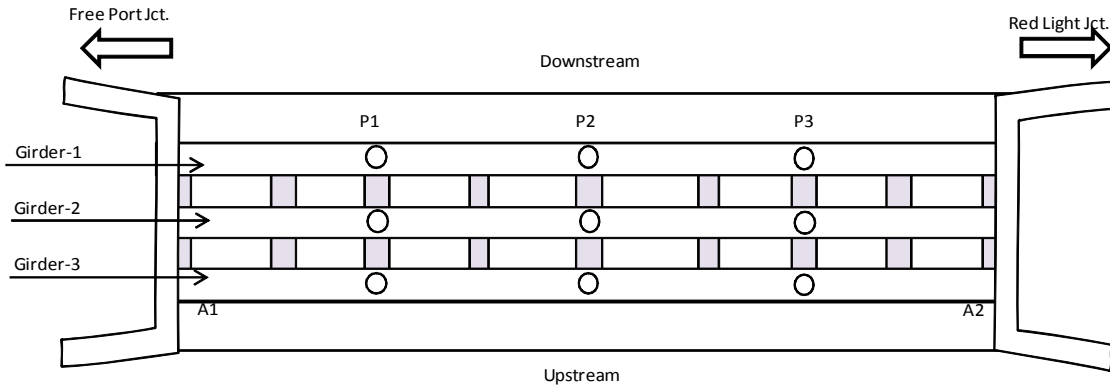


Photo-7 Damage by Shot

Stockton Bridge Inspection Sheet (4/6)

4. Horizontal Girder

4.1 Bottom of Girder



* Status: No Problem

4.2. Side of Girder

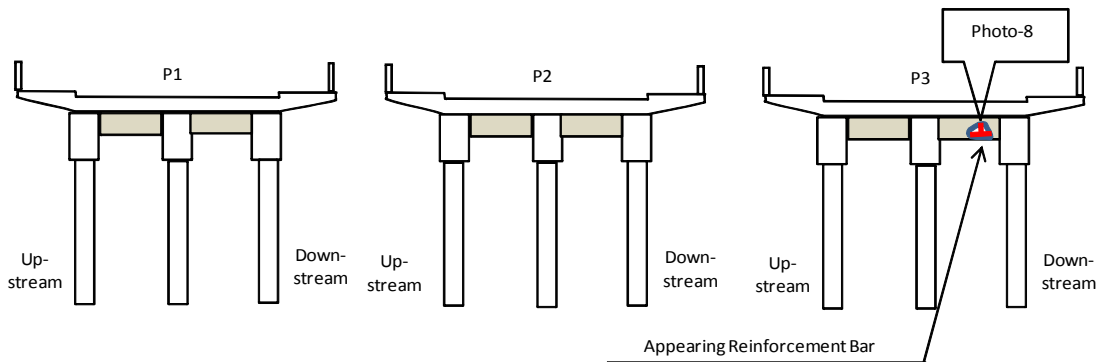


Photo-8 Appearing Reinforcement Bar

Status: There is a lacking concrete portion at P-3.

Stockton Bridge Inspection Sheet (5/6)

***Status: Serious Problem at Pier 3!!**

5. Pier

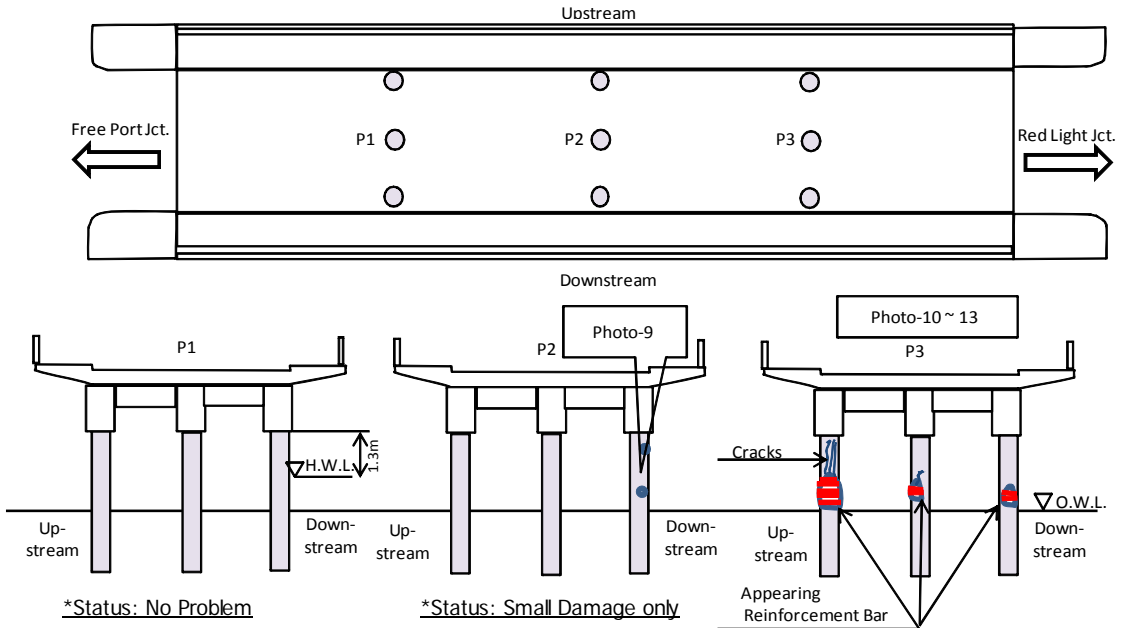


Photo-9 Damage by Shot (P-2)



Photo-10 Damage of P-3, Upstream side



Photo-11 Damage of P-3, Center



Photo-12 P-3, Downstream side (Upper)



Photo-13 P-3, Downstream side (Lower)

Stockton Bridge Inspection Sheet (6/6)

6. Abutment & Bearing

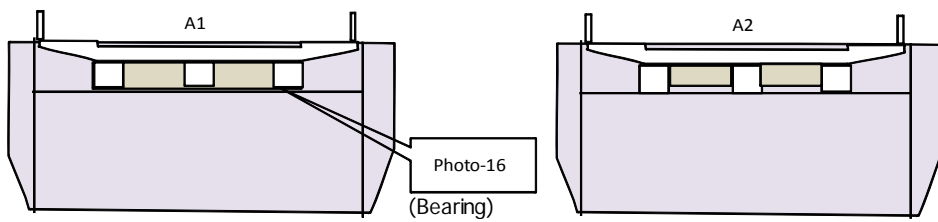
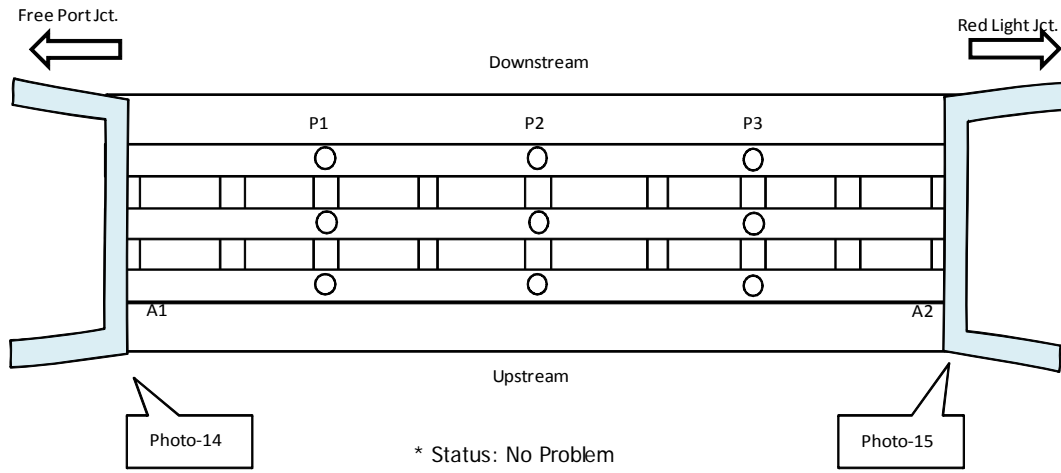


Photo-14 Abutment 1 (Free Port Jct. side)



Photo-15 Abutment 1 (Free Port Jct. side)



Photo-16 Bearing

DOUBLE BRIDGE



Road	: Smalia Drive (appx. 8.3km from Free Port Jct.)
Super Str.	: RC Box Girder L= 25.0m+25.0m = 50.0m
Pier Type	: Wall
Foundation	: (Supposed to be) Direct foundation
Condition	: Passable (2-lane)
Width	: W=11.0m =1.1m + 7.3m + 0.7m
H.W.L.	: 1.5m below from bottom of Girder
Judgement	: Keep Existing with repairment There are small damages to be repaired
Others	: No Data for this Bridge (Drawing, Soil Investigation, Design Calculation) Constructed before in 1974.



Photo 1



Double Bridge Photo

Photo 2



Photo 3



Photo 4

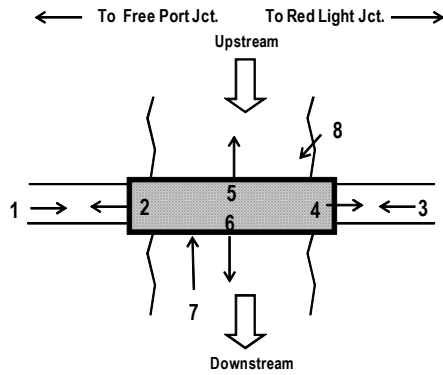


Photo 5



Photo 6



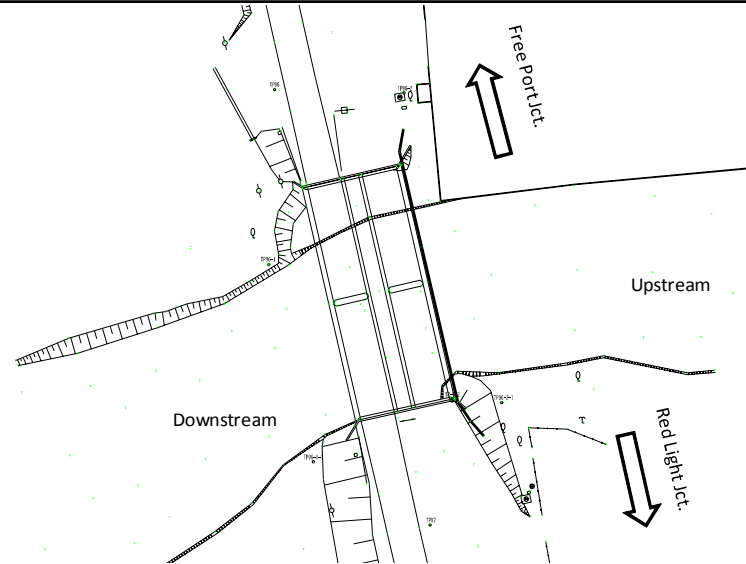
Photo 7



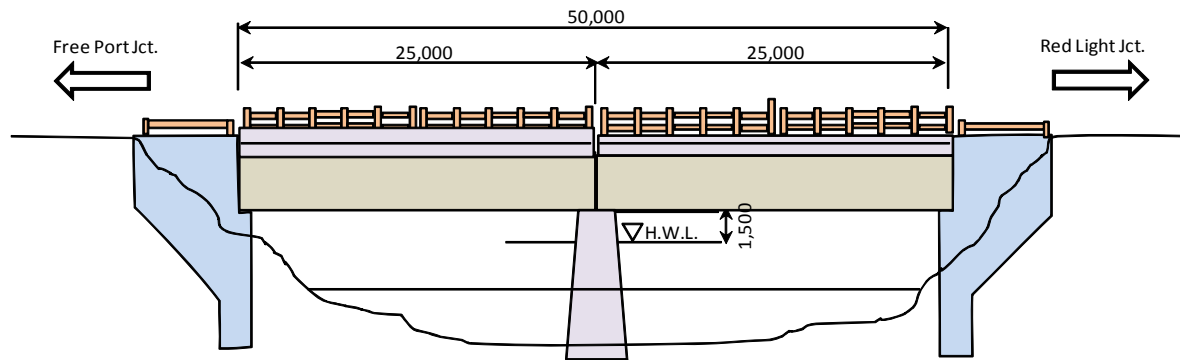
Photo 8

Bridge Name : Double Bridge

SITE PLAN



SIDE VIEW



Double Bridge Inspection Sheet (1/6)

1. Railing

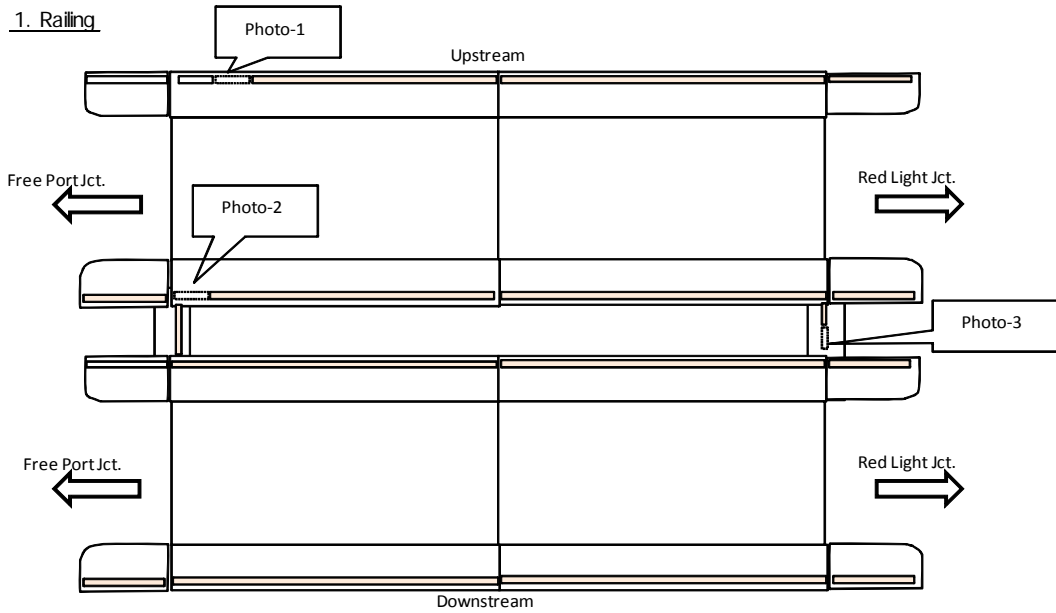


Photo-1 Broken Railing

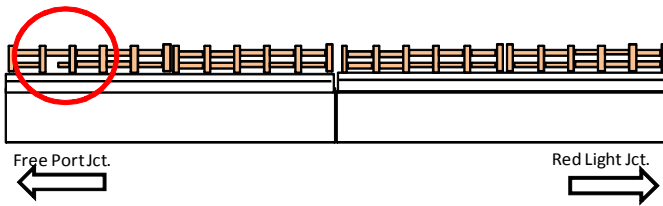


Photo-2 Broken Railing

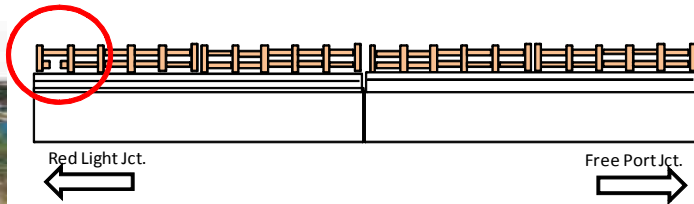
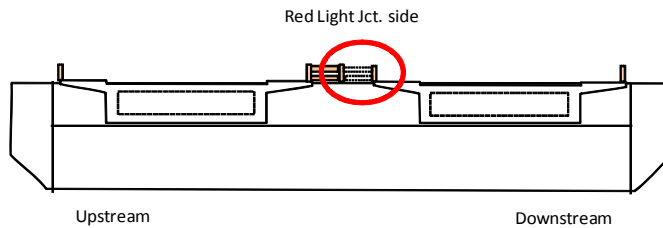


Photo-2 Broken Railing



*Status of Railing: 4 horizontal beam are missing at 3 portions.

Double Bridge Inspection Sheet (2/6)

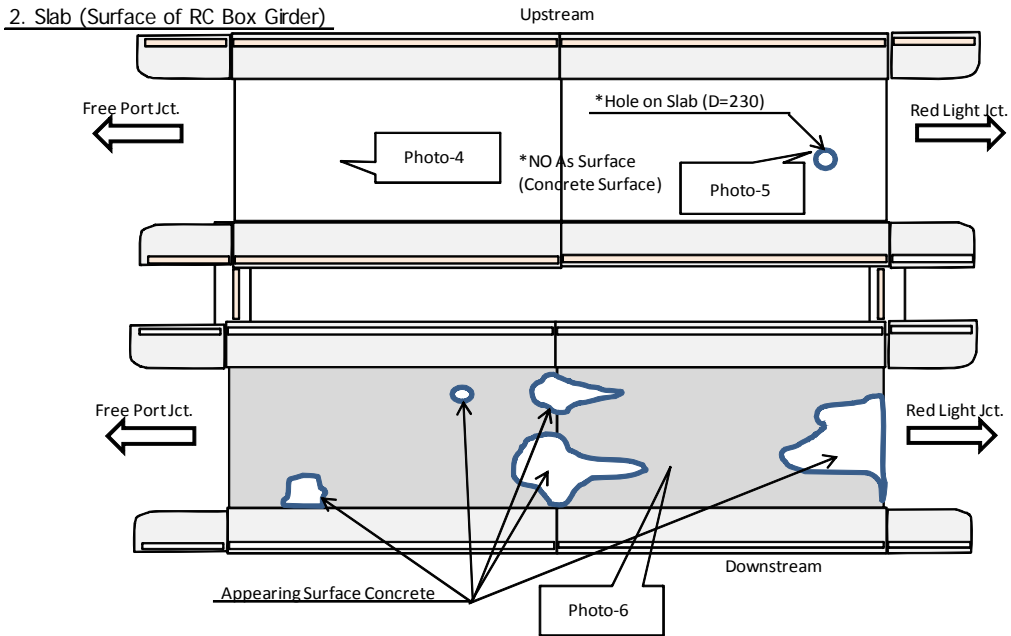


Photo-4 Hole on Slab (D=230mm)



Photo-5 Condition of Surface (Upstream side)



Photo-6 Condition of Surface (Downstream side)

*Status of Slab:

No As Surface with 1 hole (D=230mm)
at Upstream side Bridge

Exfoliated As Surface at Downstream side Bridge

Double Bridge Inspection Sheet (3/6)

3. Slab (Bottom of RC Box Girder)

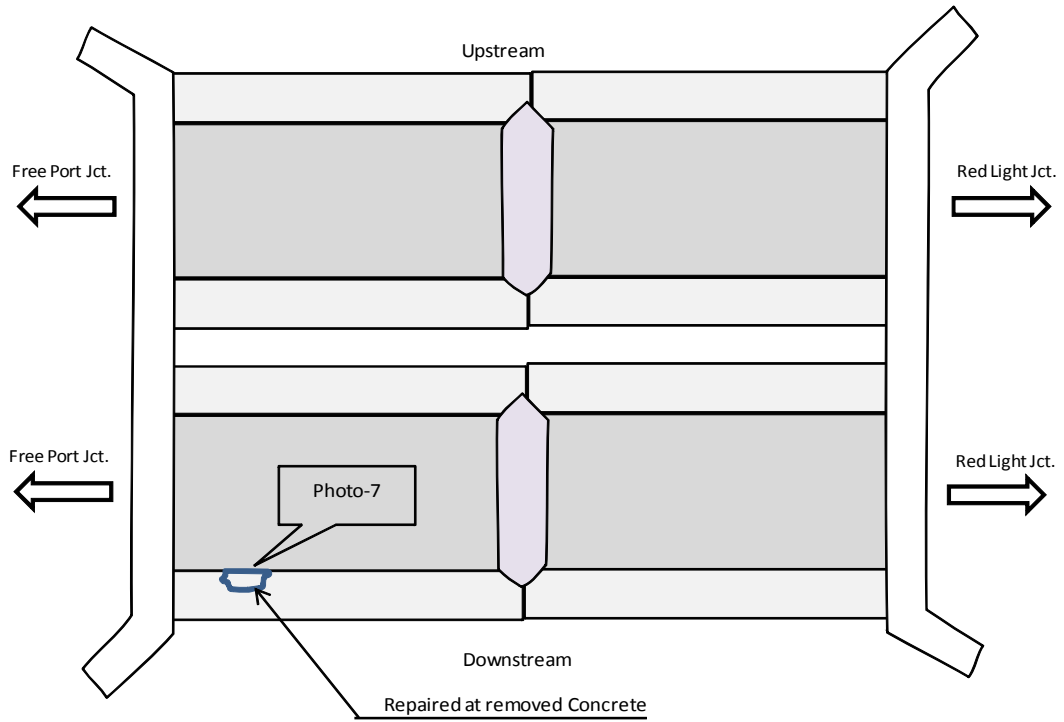


Photo-7 Repaired Portion

*Status of Slab: No Problem

Double Bridge Inspection Sheet (4/6)

4. Wall (Side Wall of RC Box Girder)

4. 1. North Side Bridge (Planned Widening Side)

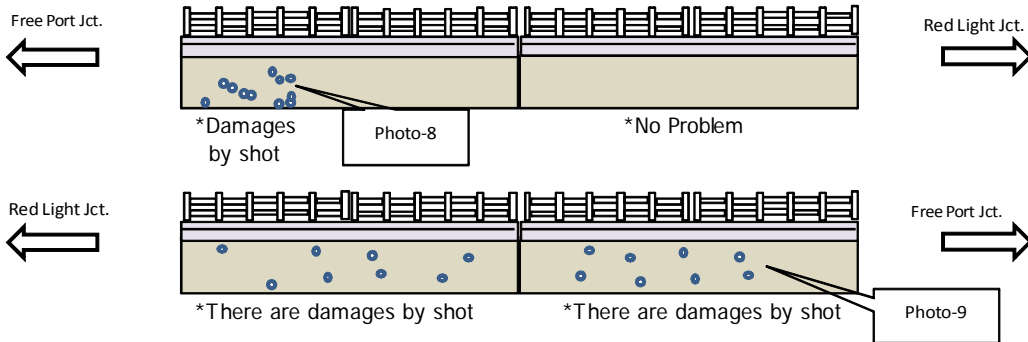


Photo-8 Damages by shot



Photo-9 Damages by shot

4. 2. South Side Bridge (Existing Road Side)

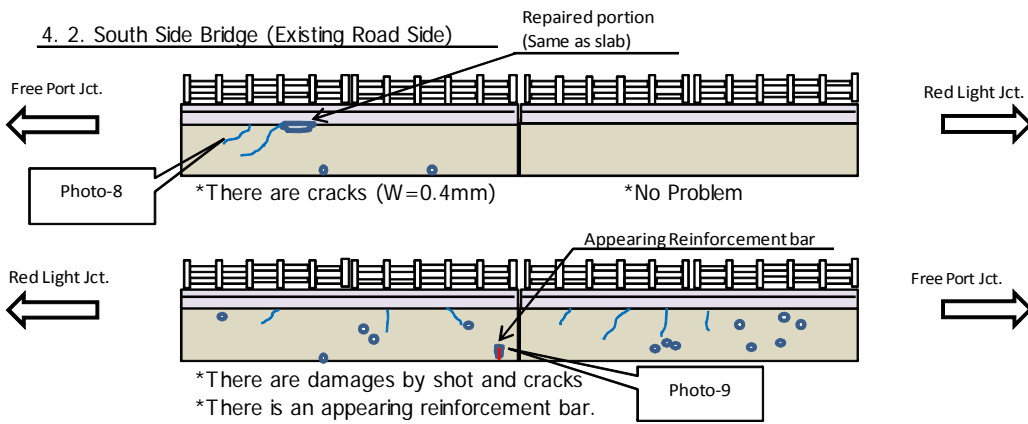


Photo-8 Crack Width (W=0.4mm)



Photo-9 Appearing Reinforcement bar

Double Bridge Inspection Sheet (5/6)

5. Pier

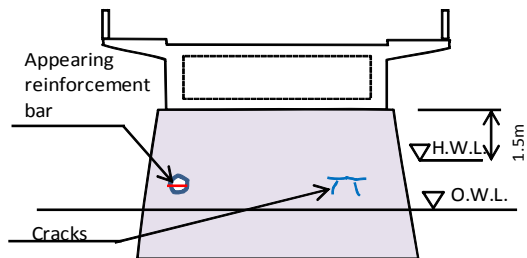
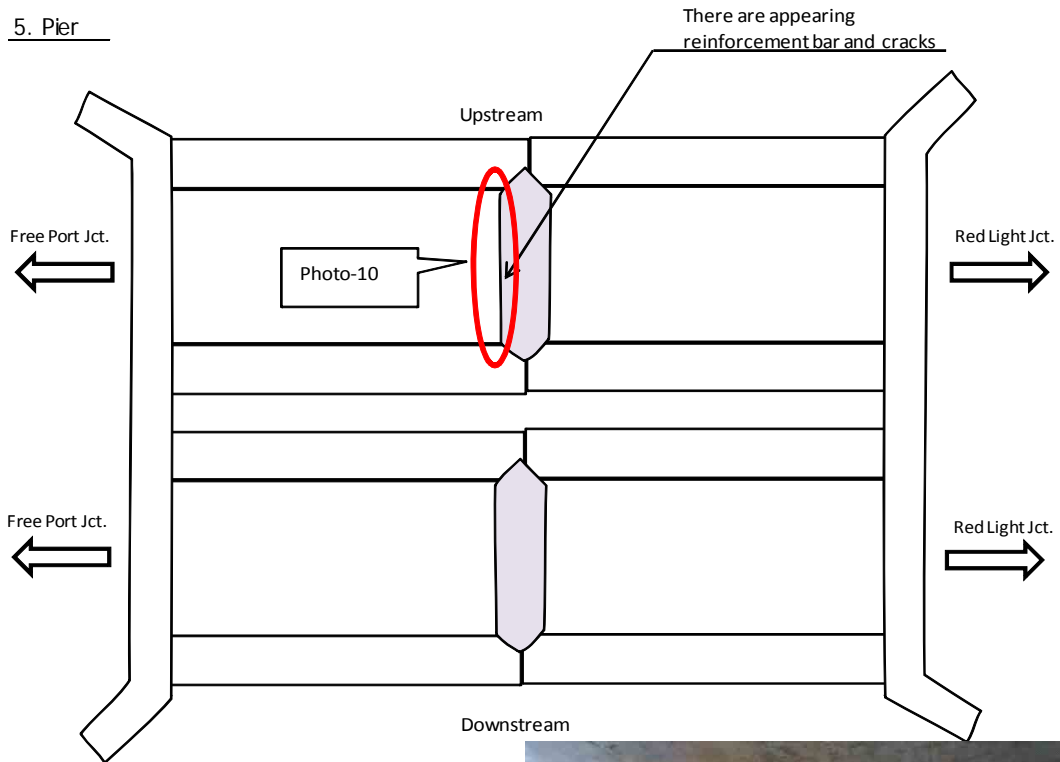


Photo-10 Status of Abutment (North Br., Free port side)

*Status of Pier:

There is an appearing reinforcement bar portion and some cracks at Free port side of North Bridge

Double Bridge Inspection Sheet (6/6)

6. Abutment and bearing

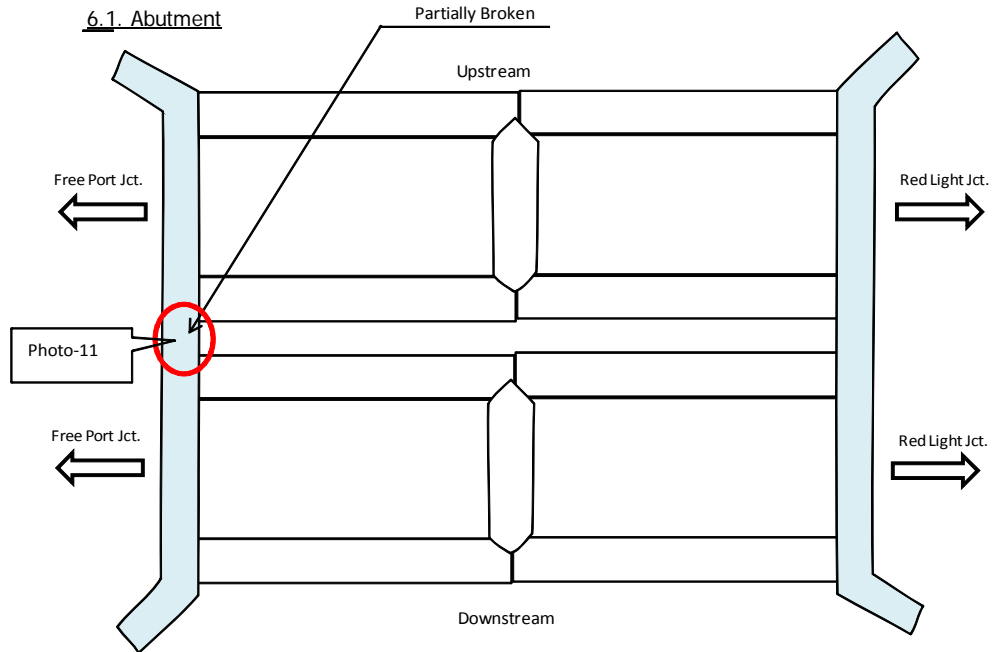
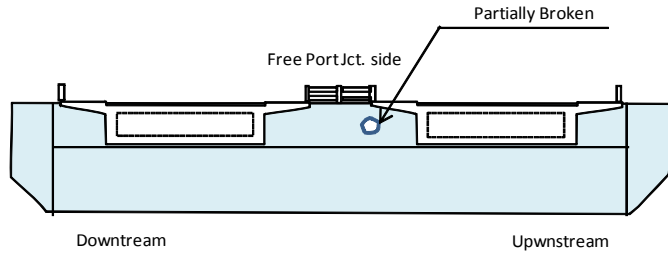


Photo-11 Broken Abutment (Free port side)



*Status of Slab:

Partially Broken at Free Port side between bridges

6.2. Bearing



Photo-12 Bearing Pad

*Status of Bearing:

All Bearing Pads are so old.

添付資料2 ダブル橋非破壊検査結果

A. 中性化試験

【試験概要】

コンクリートは長い年月と共に、元々のアルカリ性から中性に変化する。コンクリートの中性化は表面から徐々に内部にその範囲が広がっていく。中性化することによる問題は、中性化により中の鉄筋がさび（腐食）やすくなり、鉄筋腐食⇒引張抵抗力の減少⇒ひびわれ発生⇒破壊というステップを生じていく。



写真 1-フェノールフタレイン溶液



写真 2-スラブでの調査結果、上端部から朱色に変わっており、中性化は起こっていない

【試験方法】

- ①試験対象箇所のコンクリートをはつり（削り）、露出面をクリーニングする。
- ②1%フェノールフタレイン溶液を露出面に散布する。色変化が無い範囲が中性化しており（朱色に変わった部分はアルカリ性が保たれている）、表面からの中性化範囲の幅をノギス等で測定する。

【結果概要】

表 1- 中性化試験結果

測定箇所	中性化範囲 (cm)	推定材齢 (年) *
スラブ	0.0	0.00
橋台	0.2	0.29
桁（下コーナー）	0.3	0.65
橋脚	0.2	0.29

*)推定材齢は下式により算出した。

水セメント比が60%以上のとき

$$t = \frac{0.3(1.15 + 3w)}{R^2(w - 0.25)^2} x^2$$

水セメント比が60%以下のとき

$$t = \frac{7.2}{R^2(4.6w - 1.76)^2} x^2$$

(4.2.2)³⁾

ここで、 w ：水セメント比

x ：中性化深さ (cm)

t ：期間 (年)

R ：中性化比率 ($R = \gamma_c \times \gamma_a \times \gamma_s$ —

表 4.2.2 参照)

表 4.2.2 中性化比率³⁾

セメントの種類 (γ_c)	ポルトランドセメント		高炉セメント		シリカセメント (1.7)	フライアッシュセメント (FA 20%) (1.9)
	普通 (1)	早強 (0.6)	スラグ 30~40% (1.4)	スラグ 60% (2.2)		
骨材の種類 (γ_a)	川砂・川砂利 (1)		川砂・軽砂利 (1.2)		軽砂・軽砂利 (2.9)	石炭殻(細・粗) (3.3)
表面活性剤の有無 (γ_s)	ブレーン (1)		AE 剤 (0.6)		分散剤 (0.4)	

(注) 川砂・軽砂利(ブレーン)は川砂・軽砂利(AE)0.8と AE 剤 0.6 より推定。

【考察】

調査結果に推定材齢は1年未満となり、「中性化はほとんど起きていない」という結果となった。一般的に密実なコンクリートほど中性化はしにくく、本ダブル橋は長い年月を経ても中性化が起こっていないことから密実な品質の良いコンクリートを使用していると推定される。

B. X線検査

【試験概要】

X線により、コンクリート内部の鉄筋位置、配置のみならずコンクリートの空隙ができていないかを検査する。検査目的は、目視不可能な箇所に手抜き工事や施工不良が無いかを確認することである。



写真 3- X線測定器



写真 4- 測定状況

【結果概要】

表 2- X 線検査結果（北側橋梁：拡幅側）

測定箇所		鉄筋かぶり (cm)	主鉄筋ピッチ(cm) ^{※1)}	空隙	
箱桁	上面	断面方向	6.0	15.5	無し
		軸方向	7.5	45.0	無し
	側面	断面方向	4.0	20.0	無し
		軸方向	7.0	36.0	無し
	下面	断面方向	4.5	19.5	無し
		軸方向	5.0	42.0	無し
橋台	軸方向	4.5	30.0	無し	
橋脚	軸方法	4.5	50.0	無し	

表 3- X 線検査結果（南側橋梁：供用側）

測定箇所		鉄筋かぶり (cm)	主鉄筋ピッチ(cm) ^{※)}	空隙	
箱桁	上面	断面方向	12.5 ^{※2)}	15.0	無し
		軸方向	13.0 ^{※2)}	41.0	無し
	側面	断面方向	4.0	17.0	無し
		軸方向	7.0	37.0	無し
	下面	断面方向	3.5	20.0	無し
		軸方向	4.0	41.0	無し
橋台	軸方向	4.0	29.5	無し	
橋脚	軸方向	4.5	50.0	無し	

※) 鉄筋ピッチはかなりのばらつきがあったが、測定範囲の平均値を採用した。

※2) 北側は未舗装、南側はアスファルト舗装済であり、かぶりの差はアスファルト舗装厚の差である。

【考察】

調査結果により鉄筋がしかるべき位置に配置されていること、コンクリートの空隙は無いことを確認し、コンクリート内部の施工不良等は無いと判断された。

なお、上記結果が適正であるかどうかの判断は、図面・設計計算書が無いことや鉄筋の直径までは確認できないため難しい。しかし、供用している南側の結果とこれから開放する北側の結果に大きな差は見られないことから北側の橋梁を開放しても問題無いと推定できる。

C. シュミットハンマー検査

【試験概要】

シュミットハンマーという計測器を使用し、先端金具を対象構造物に押しつけるときの抵抗力から対象構造物の強度を測定（推定値）できる。ダブル橋の現時点でのコンクリート強度を測定し、品質不良等によるコンクリートの劣化の有無を確認する。



写真 5- シュミットハンマー



写真 6- 測定状況

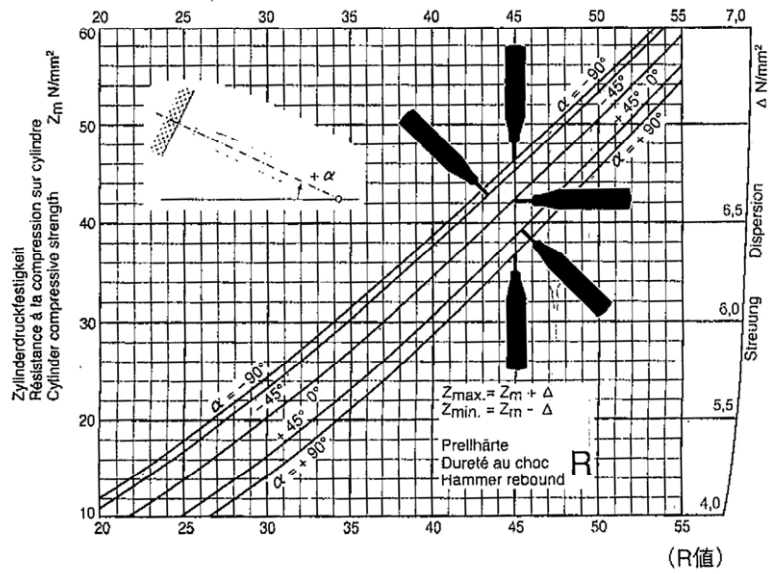
【結果概要】

表 4- シュミットハンマー試験結果

測定箇所	計測方向	シュミットハンマー読み値の平均値	推定コンクリート強度※ (N/mm ²)
桁（上面）	上⇒下	46.2	40.0
桁（側面）	横	50.0	50.5
桁（下面）	下⇒上	49.3	44.5
橋台	横	49.2	50.0
橋脚	※測定不可能（ボート上からでは踏ん張りがきかないため）		

*)コンクリート強度は下表により推定した。

1) 反発度 (R値) と圧縮強度の換算曲線……N/mm²



【考察】

コンクリートの設計基準強度は通常箱桁の場合 21~24N/mm² である。したがって今回のシュミットハンマー試験結果から、ダブル橋コンクリートは設計基準強度の2倍強の強度を有しているという結果となった。この結果からも施工時のコンクリートの品質管理は十分であったと推定され、年月や環境によるコンクリートの劣化問題は無いことがわかった。

【付属資料】

1) X線検査結果詳細

表 5- 北側上部工(1/2)

Location	Measured Direction	NO.	Main-Re-bar		Air Void	Drawing
			Covering Depth (cm)	Spearing pitch (cm)		
North Bridge (Upstream side)	Section	1	6.0	14.0	None	
		2	6.0	15.5	None	
		3	6.0	16.0	None	
		4	5.5	15.0	None	
		5	6.0	15.5	None	
		6	6.0	14.5	None	
		7	6.0	15.0	None	
		8	6.5	17.0	None	
		9	6.0	15.0	None	
		10	6.0	16.0	None	
		11	6.0	16.5	None	
		12	6.0	16.0	None	
		13	6.0	16.0	None	
		14	5.5	14.5	None	
		15	6.5	18.0	None	
		16	6.0	14.5	None	
		17	6.0	15.5	None	
		18	6.0	15.5	None	
				Ave	6.0	
Surface	Distribution	1	8.0	47.5	None	
		2	7.5	46.5	None	
		3	8.0	47.5	None	
		4	7.5	44.0	None	
		5	7.0	46.0	None	
		6	7.5	44.5	None	
		7	8.0	45.0	None	
		8	6.5	46.5	None	
		9	7.0	43.5	None	
		10	7.0	45.5	None	
		11	7.5	45.0	None	
		12	8.0	44.5	None	
		13	7.5	45.0	None	
		14	7.0	44.5	None	
		15	6.5	44.5	None	
		16	7.5	42.5	None	
		17	7.5	45.5	None	
		18	8.0	43.5	None	
				Ave	7.4	

表-6 北側上部工(2/2)

Location	Measured Direction	NO.	Main-Re-bar		Air Void	Drawing	
			Covering Depth	Spearing pitch			
			(cm)	(cm)			
North Bridge (Upstream side)	Section	1	4.0	21.5	None		
		2	4.5	21.0	None		
		3	4.0	18.5	None		
		4	4.0	18.0	None		
		Ave	4.1	19.8	-		
	Side	Distribution	1	7.5	36.0	None	
			2	7.0	36.0	None	
			3	7.0	37.0	None	
			4	7.0	35.5	None	
			Ave	7.1	36.1	-	
North Bridge (Upstream side) Bottom	Section	1	4.5	18.5	None		
		2	4.5	19.0	None		
		3	4.5	19.0	None		
		4	4.0	20.5	None		
		5	4.5	20.0	None		
		6	4.5	19.5	None		
		Ave	4.4	19.4	-		
	Distribution	Distribution	1	5.5	43.5	None	
			2	5.0	44.5	None	
			3	5.0	45.0	None	
			4	5.0	38.0	None	
			5	4.5	39.0	None	
			6	5.0	40.5	None	
Ave	5.0	41.8	-				

表 7- 南側上部工(1/2)

Location	Measured Direction	NO.	Main-Re-bar		Air Void	Drawing
			Covering Depth	Spearing pitch		
			(cm)	(cm)		
South Bridge (Downstream side)	Section	1	12.0	15.5	None	
		2	12.0	15.5	None	
		3	12.5	15.5	None	
		4	12.5	15.0	None	
		5	13.0	15.5	None	
		6	13.0	15.0	None	
		7	12.5	15.0	None	
		8	12.5	16.0	None	
		9	13.0	15.0	None	
		10	13.5	15.0	None	
		11	13.5	15.5	None	
		12	13.0	15.5	None	
		13	12.5	15.5	None	
		14	12.5	14.5	None	
		15	12.0	15.0	None	
		16	12.0	14.0	None	
		17	12.0	15.0	None	
		18	12.5	15.0	None	
				Ave	12.6	
Surface	Distribution	1	12.5	41.5	None	
		2	12.5	40.5	None	
		3	12.0	41.5	None	
		4	12.5	41.0	None	
		5	13.0	40.5	None	
		6	12.5	41.5	None	
		7	13.0	42.5	None	
		8	13.0	41.0	None	
		9	13.5	39.5	None	
		10	13.5	40.5	None	
		11	12.5	40.5	None	
		12	13.0	40.5	None	
		13	13.0	41.5	None	
		14	13.0	44.5	None	
		15	12.5	42.0	None	
		16	13.5	41.0	None	
		17	13.0	39.5	None	
		18	13.5	42.0	None	
				Ave	12.9	

表 8- 南側上部工(2/2)

Location	Measured Direction	NO.	Main-Re-bar		Air Void	Drawing	
			Covering Depth (cm)	Spearing pitch (cm)			
South Bridge (Downstream side)	Section	1	4.0	17.5	None		
		2	4.5	17.5	None		
		3	4.0	16.5	None		
		4	4.0	17.0	None		
		Ave	4.1	17.1	-		
	Side	Distribution	1	7.5	37.0	None	
			2	7.0	37.0	None	
			3	7.0	37.0	None	
			4	7.0	36.0	None	
			Ave	7.1	36.8	-	
South Bridge (Downstream side) Bottom	Section	1	4.0	21.0	None		
		2	3.0	20.5	None		
		3	3.5	20.0	None		
		4	3.5	19.5	None		
		5	3.5	20.0	None		
		6	3.5	19.5	None		
		Ave	3.5	20.1	-		
	Bottom	Distribution	1	5.0	41.0	None	
			2	4.5	42.5	None	
			3	5.0	41.0	None	
			4	3.5	39.5	None	
			5	3.0	39.5	None	
6			3.5	41.0	None		
Ave	4.1	40.8	-				

表-9 北側橋台

Location	Measured Direction	NO.	Main-Re-bar		Air Void	Drawing
			Covering Depth	Spearing pitch		
			(cm)	(cm)		
North Brige (Upstream side) Abutment	Section	1	4.0	29.5	None	
		2	4.5	30.5	None	
		3	4.0	31.0	None	
		4	5.0	29.5	None	
		5	4.5	29.5	None	
		6	4.0	29.5	None	
		7	4.5	29.0	None	
		8	4.5	29.5	None	
Ave		4.4	29.8	-		

表-10 南側橋台

Location	Measured Direction	NO.	Main-Re-bar		Air Void	Drawing
			Covering Depth	Spearing pitch		
			(cm)	(cm)		
South Brige (Downstream side) Abutment	Section	1	3.5	29.5	None	
		2	4.5	28.5	None	
		3	4.0	30.0	None	
		4	4.5	29.5	None	
		5	4.5	29.5	None	
		6	4.0	29.5	None	
		7	4.0	29.0	None	
		8	4.0	30.5	None	
Ave		4.1	29.5	-		

表-11 北側橋脚

Location	Measured Direction	NO.	Main-Re-bar		Air Void	Drawing
			Covering Depth	Spearing pitch		
			(cm)	(cm)		
North Brige (Upstream side) Pier	Section	1	4.5	53.0	None	
		2	4.0	49.0	None	
		3	4.0	45.0	None	
		4	5.0	52.0	None	
Ave		4.4	49.8	-		

表-12 南側橋脚

Location	Measured Direction	NO.	Main-Re-bar		Air Void	Drawing
			Covering Depth	Spearing pitch		
			(cm)	(cm)		
South Brige (Downstream side) Pier	Section	1	5.0	51.5	None	
		2	4.5	49.0	None	
		3	4.5	46.0	None	
		4	4.0	53.5	None	
Ave		4.5	50.0	-		

2) シュミットハンマー試験結果

シュミットハンマー計測値は、1箇所につき20点計測し、その平均値を求め、その平均値より±20%を越える値を異常値とみなして削除、残った測定値の平均を測定値として採用する。

表 13 シュミットハンマー試験結果

		Girder			Abutment
		Surface	Side	Bottom	
Measured Value	1	53	56	49	51
	2	51	52	56	38
	3	33	58	63	49
	4	39	44	40	48
	5	44	44	44	61
	6	42	63	44	44
	7	35	46	51	50
	8	53	49	35	47
	9	45	51	53	62
	10	47	55	52	44
	11	62	53	48	48
	12	43	39	45	48
	13	45	49	60	53
	14	59	44	47	49
	15	47	50	49	53
	16	52	55	56	47
	17	40	47	57	51
	18	43	41	48	53
	19	44	51	50	39
	20	51	55	39	52
	Ave.	46.4	50.1	49.3	49.4
Upper range (Ave.+20%)		55.7	60.1	59.2	59.2
Lower range (Ave.-20%)		37.1	40.1	39.4	39.5
Ave. of White cell		46.2	50.0	49.3	49.2

* Out of range: it should be excluded as outlier