資　　料

1. 調査団員・氏名

1.1 第 1 次現地調査時 (2014 年 5 月 24 日～2014 年 8 月 16 日)

	担当		氏名	所属	派遣期間
(1)	総括	:	杉山　茂	JICA パプアニューギニア事務所長	5/24 – 5/31
(2)	計画管理	:	戸根川　泰規	JICA 社会基盤・平和構築部	5/24 – 5/31
(3)	業務主任／橋梁計画	:	森　雅彦	(株)長大	5/24 – 6/21
(4)	橋梁設計・道路設計	:	中村　仁司	(株)長大	5/24 – 6/21
(5)	自然条件調査（地形・地質）	:	和田　昌大	(株)長大（基礎地盤コンサルタンツ）	6/14 – 6/21, 7/19 – 8/16
(6)	水理・水文・河川計画	:	赤川　嘉幸	(株)アンジェロセック	6/21 – 7/12
(7)	施工計画／積算	:	林　建宗	(株)長大	6/07 – 7/05
(8)	環境社会配慮	:	原田　邦彦	(株)長大	6/14 – 7/12
(9)	道路設計Ⅱ	:	小板橋　慶成	(株)長大	5/24 – 6/14
(10)	道路設計Ⅱ	:	野村　幸司	(株)長大	6/07 – 6/21

1.2 第 2 次現地調査時 (現地説明時) (2014 年 10 月 11 日～2014 年 10 月 18 日)

	担当		氏名	所属	派遣期間
(1)	総括	:	杉山　茂	JICA パプアニューギニア事務所長	10/11 – 10/18
(2)	計画管理	:	戸根川　泰規	JICA 社会基盤・平和構築部	10/11 – 10/18
(3)	業務主任／橋梁計画	:	森　雅彦	(株)長大	10/11 – 10/18
(4)	橋梁設計／道路設計	:	中村　仁司	(株)長大	10/11 – 10/18
(5)	施工計画／積算	:	林　建宗	(株)長大	10/11 – 10/18

2. 調査日程

2.1 第 1 次現地調査時 (2014 年 5 月 24 日～2014 年 8 月 16 日)

			総括 Team Leader 杉山　茂 Mr. Shigeru Sugiyama	計画管理 Planning Coordinator 戸根川　泰規 Mr. Yasunori Tonegawa	業務主任/橋梁計画 Chief Consultant/ Bridge Planner 森　雅彦 Mr. Masahiko Mori	橋梁設計/道路設計 Bridge Designer/Road Designer 中村　仁司 Mr. Hitoshi Nakamura	自然条件調査（地形・地質） Natural Condition Surveyer (Topography & Geology) 和田　昌大 Mr. Masao Wada	水理・水文・河川計画 Hydrology Specialist 赤川　嘉幸 Mr. Yoshiyuki Akagawa	積算/調達計画 Procurement Planner/ Cost Estimator 林　建宗 Mr. Tatsumune Hayashi	環境社会配慮 Environment & Social Impact Specialist 原田　邦彦 Mr. Kunihiko Harada	道路設計Ⅱ Road Designer Ⅱ 小板橋　慶成 Mr. Yoshinari Koitabashi	道路設計Ⅱ Road Designer Ⅱ 野村　幸司 Mr. Koji Nomura
1	5/24	Sat		NARITA(21:00)PX0055→	NARITA(21:00)PX0055→	NARITA(21:00)PX0055→					NARITA(21:00)PX0055→	
2	5/25	Sun		PORT MORESBY(04:55)	PORT MORESBY(04:55)	PORT MORESBY(04:55)					PORT MORESBY(04:55)	
3	5/26	Mon	Meeting with JICA PNG Office (08：30) Explanation of Inception Report to DoW and DNPM (10：30) Discussion with DoW (13:30)								Meeting with JICA PNG Office (08：30) Explanation of Inception Report to DoW and DNPM (10：30) Discussion with DoW	
4	5/27	Tue	PORT MORESBY (6:15) →HOSKINS (7:45) (PX840) Discussion with Provincial Works Office and inspection of heavy equipment(10:00) Visit to NBPOL HQs and bio fuel plant(13:30)								PORT MORESBY (6:15) →HOSKINS (7:45) (PX840) Discussion with Provincial Works Office and inspection of heavy equipment(10:00) Visit to NBPOL HQs and	
5	5/28	Wed	Site Visit to 2 target bridges and go up to Ala Bridge (boundary of NBPOL and Hargy Oil Palm) Discussion with Provincial Works Office								Site Visit to 2 target bridges and go up to Ala Bridge (boundary of NBPOL and Hargy Oil Palm) Discussion with	
6	5/29	Thu	HOSKINS (8:10) →PORT MORESBY (9:40) (PX841) M/D Discussion with DoW								HOSKINS (11:10) →PORT MORESBY (12:20) (PX841) M/D Discussion with DoW	
7	5/30	Fri	Signing on the M/D (AM) Report to EOJ (15：00)								Signing on the M/D (AM) Report to EOJ (15：00)	
8	5/31	Sat		PORT MORESBY(14:00)PX0054→ NARITA(19:55)	Data collecting						Data collecting	
9	6/1	Sun			Arrangement of data						Arrangement of data	
10	6/2	Mon			Preparation of survey Agreement preparation of subcontract						Preparation of survey Agreement preparation of subcontract	
11	6/3	Tue										
12	6/4	Wed			Agreement of subcontract						Agreement of	
13	6/5	Thu			Data collecting, Study for the project implementation						Data collecting, Study for the project	
14	6/6	Fri			Meeting with DoW and DNPM				NARITA(21:00)PX0055→		Arrangement of data	NARITA(21:00)PX0055→
15	6/7	Sat			Arrangement of data				PORT MORESBY(04:55)			PORT MORESBY(04:55)
16	6/8	Sun			Data collecting, Study for the project implementation 13:30 CHODAI Office SAIM TONE Meeting 10:30 JICA Office SAIM TONE CONTRACT				Meeting with JICA, DoW, DNPM		Data collecting, Study for the project implementation Meeting with DoW and	Data collecting, Study for the project implementation Meeting with DoW and
17	6/9	Mon										
18	6/10	Tue										
19	6/11	Wed										
20	6/12	Thu			PORT MORESBY (06:15) →HOSKINS (7:45) (PX840) 10:30 DOW WNB, 13:00 Site, 15:00 NBPOL, 16:00 Traffic Suvey consultant at site, Axel c				Data collecting Arrangement of data		Arrangement of data	PORT MORESBY (09:30) →HOSKINS (10:40) (PX840)
21	6/13	Fri										
22	6/14	Sat			6:00 Bridge Inventry Survey, Siranga Check		NARITA(21:00)PX0055→			NARITA(21:00)PX0055→	PORT MORESBY(14:00)PX0054→ NARITA(19:55)	Same as MORI, NAKAMURA
23	6/15	Sun			6:00 Traffic Survey Start,9:35 Harada, Hayashi Pick up at Hoskins Air Port,		PORT MORESBY(04:55) PORT MORESBY(08:05)PX840 →HOSKINS (09:35)		PORT MORESBY(08:05)PX840 →HOSKINS (09:35)	PORT MORESBY(04:55) PORT MORESBY(08:05)PX840 →HOSKINS (09:35)		Implementation of axle load survey and traffic count
24	6/16	Mon			6:00 Trffic Survey and Axel Count Survey Start		Topographic Survey		Site Survey			
25	6/17	Tue			DOW WNB, NBPOL, SBLC Meeting		Topographic Survey					Site Survey
26	6/18	Wed			Meeting DOW WNB, HOSKINS (16:55) →PORT MORESBY (18:25) (PX845)				HOSKINS (16:55) →PORT MORESBY (18:25) (PX845)			HOSKINS (16:55) →PORT MORESBY (18:25) (PX845)
27	6/19	Thu			Arrangement of data							Arrangement of data
28	6/20	Fri			Report to DoW,DNPM,JICA							Report to DoW,DNPM,JICA
29	6/21	Sat			PORT MORESBY(14:00)PX0054→NARITA(19:55)			NARITA(21:00)PX0055→	Data collecting Arrangement of data			PORT MORESBY(14:00)PX0054→ NARITA(19:55)
30	6/22	Sun						PORT MORESBY(04:55)	Arrangement of data, Materials			
31	6/23	Mon								Meeting with		
32	6/24	Tue						Data collecting	Data collecting	Data collecting		
33	6/25	Wed										
34	6/26	Thu										
35	6/27	Fri										
36	6/28	Sat										
37	6/29	Sun						Arrangement of data	Arrangement of data	Arrangement of data		
38	6/30	Mon						PORT MORESBY(06:15)PX840		PORT MORESBY(06:15)PX840		
39	7/1	Tue							Data collecting			
40	7/2	Wed						Site Survey		Site Survey		
41	7/3	Thu						HOSKINS (8:10) →PORT MORESBY (9:40) (PX841)		HOSKINS (8:10) →PORT MORESBY (9:40) (PX841)		
42	7/4	Fri							Arrangement of data			
43	7/5	Sat							PORT MORESBY(14:00) PX0054→NARITA(19:55)			
44	7/6	Sun						Data collecting		Data collecting		
45	7/7	Mon						Arrangement of data		Arrangement of data		
46	7/8	Tue										
47	7/9	Wed										
48	7/10	Thu										
49	7/11	Fri						Report to DoW,DNPN, JICA and EOJ		Report to DoW,DNPN, JICA and EOJ		
50	7/12	Sat						PORT MORESBY(14:00) PX0054→NARITA(19:55)		PORT MORESBY(14:00) PX0054→NARITA(19:55)		
51	7/13	Sun										
52	7/14	Mon										
53	7/15	Tue										
54	7/16	Wed										
55	7/17	Thu										
56	7/18	Fri										
57	7/19	Sat					NARITA(21:00)PX0055→					
58	7/20	Sun					PORT MORESBY(04:55) PORT MORESBY(08:05)PX840 →HOSKINS (09:35)					
59	7/21	Mon										
60	7/22	Tue										
61	7/23	Wed										
62	7/24	Thu										
63	7/25	Fri										
64	7/26	Sat										
65	7/27	Sun										
66	7/28	Mon										
67	7/29	Tue										
68	7/30	Wed										
69	7/31	Thu										
70	8/1	Fri										
71	8/2	Sat					Geo Technical Survey					
72	8/3	Sun										
73	8/4	Mon										
74	8/5	Tue										
75	8/6	Wed										
76	8/7	Thu										
77	8/8	Fri										
78	8/9	Sat										
79	8/10	Sun										
80	8/11	Mon										
81	8/12	Tue										
82	8/13	Wed										
83	8/14	Thu										
84	8/15	Fri					HOSKINS (8:10) →PORT MORESBY (9:40) (PX4841)					
85	8/16	Sat					PORT MORESBY(14:00) PX0054→NARITA(19:55)					

2.2 第 2 次現地調査時 (現地説明時) (2014 年 10 月 11 日～2014 年 10 月 18 日)

			総括 Team Leader 杉山　茂 Mr. Shigeru Sugiyama	計画管理 Planning Coordinator 戸根川　泰規 Mr. Yasunori Tonegawa	業務主任/橋梁計画 Chief Consultant/ Bridge Planner 森　雅彦 Mr. Masahiko Mori	橋梁設計/道路設計 Bridge Designer/Road Designer 中村　仁司 Mr. Hitoshi Nakamura	積算/調達計画 Procurement Planner/ Cost Estimator 林　建宗 Mr. Tatsumune Hayashi
1	10/11	Sat			NARITA(21:00)PX0055→		
2	10/12	Sun		NARITA → MNL	PORT MORESBY(04:55)		
3	10/13	Mon		MNL → POM Project team Meeting	Project team Meeting		
4	10/14	Tue	Meeting with JICA, DoW, DNPN,DEC, etc				
5	10/15	Wed	Meeting with JICA, DoW, DNPN,DEC, etc				
6	10/16	Thu	Meeting with JICA, DoW, DNPN,DEC, etc				
7	10/17	Fri	Signing on the M/M Report to DoW,DNPN,JICA and EOJ				
8	10/18	Sat		PORT MORESBY(14:00) PX0054→NARITA(19:55)			
9	10/19	Sun					

3. 関係者（面会者）リスト

Organization	Position / Occupation	Name
Department of Works：DoW（公共事業省）	First Assistant Secretary	Mr. Eric Sikam
	Assistant Secretary	Mr. Wilfred Peko
	Bridge Advisor	Mr. Keith Denyer
	Provincial Works Acting Manager	Mr. John Shitapai
Department of Works Environmental Unit	Manager	Mr. William Asigau
	Senior Environmental Monitoring Officer	Mr. Diro.G.GABI
	Environmental Monitoring Officer	Mr. OKO NOlA
Department of National Planning & Monitoring :DNPM（国家計画・モニタリング省）	Assistant Secretary	Mr. Casper Auntaki
	First Assistant Secretary	Mr. Reichert Jonathan Thanda
	Aid Coordinator	Mr. Dan Lyanda
	Advisor	Mr. Hideo Kobayashi
West New Britain Province	West New Britain Province Governor	Mr. Hon Sasindran Muthuvel
New Britain Palm Oil Limited：NBOPL	General Manager	Mr. Harry Brock
	Head of Transport & Workshops	Mr. John Benseman
	Head of Mini Estates	Mr. Ashley Barnes
HARGY	General Manager	Mr. Graham King
Stettin Bay Lumber Company Limited：SBLC	General Manager / Director	Mr. Peter SC Yiu
Department of Transport：DoT National Weather Service	Quolity Control Cfficer	Ms. Ruth Wari Apuqahe
在パプアニューギニア日本大使館	1 等書記官	畦地　勇
	1 等書記官	松本　信二
	2 等書記官	迫腰　理
JICA パプアニューギニア事務所	所長	杉山　茂
	企画調査員	谷口　賀一
	企画調査員	釘本　尚正

4. 討議議事録(M/D)

4.1 第 1 次現地調査時 (2014 年 05 月 30 日)

MINUTES OF DISCUSSIONS
ON
THE PREPARATORY SURVEY
ON
THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON NEW BRITAIN HIGHWAY
IN
THE INDEPENDENT STATE OF PAPUA NEW GUINEA

In response to a request from the Government of the Independent State of Papua New Guinea (hereinafter referred to as "PNG"), Japan International Cooperation Agency (hereinafter referred to as "JICA") in consultation with the Government of Japan decided to conduct a Preparatory Survey (hereinafter referred to as "the Survey") on the Project for Reconstruction of Bridges on New Britain Highway (hereinafter referred to as "the Project").

JICA sent the Preparatory Survey Team (hereinafter referred to as "the Team") to PNG, headed by Mr. Shigeru SUGIYAMA, Chief Representative of JICA Papua New Guinea Office, from May 26 to July 19, 2014.

The Team held discussions with officials concerned of the Government of PNG and conducted a field survey in the Project area.

In the course of discussions and the field survey, both sides confirmed the main items described in the attached sheets. The Team will continue further studies and prepare the Preparatory Survey Report.

Port Moresby, May 30, 2014

杉山 茂

Mr. Shigeru SUGIYAMA
Leader
Preparatory Survey Team
Japan International Cooperation Agency
Japan

Mr. Reicher THANDAI
First Assistant Secretary, Foreign Aid Division
Department of National Planning and Monitoring
Independent State of Papua New Guinea

Mr. David WEREH
Secretary
Department of Works
Independent State of Papua New Guinea

ATTACHMENT

1. Title of the Project
   The both sides confirmed that the title of the project shall be "the Project for Reconstruction of Bridges on New Britain Highway".

2. Objective of the Project
   The both sides confirmed that the objective of the Project is to reconstruct Kapiura and Aum bridges to ensure smooth and safe traffic on the bridges.

3. Project Site
   The sites of the Project are shown in Annex-1.

4. Objective of the Survey
   4-1. To understand the back ground and objective of the Project and examine its impacts and appropriateness.
   4-2. To identify the components, outline design and cost estimation of the Project based on the data and information collected from and the results of meetings with PNG side.
   4-3. To study the issues of environmental and social considerations through the site survey.

5. Responsible and Implementing Organizations
   5-1. The responsible organization is the Department of Works (DOW).
   5-2. The organization chart of DOW is as shown in Annex-2.
   5-3. After completion, DOW will be responsible for maintenance and management of the bridges and the roads constructed by the Project.

6. Components of the Project
   6-1. The project include the following components
      6-1-1. Construction of the new two bridges with two vehicle lanes and pedestrian sidewalks,
      6-1-2. Construction of approach roads,
      6-1-3. Construction and removal of the temporary bridges if deemed necessary,
      6-1-4. Construction of scouring and erosion protection for the new bridges
   6-2. Technical matters
      6-2-1. The new bridges should be carefully planned with a consideration of earthquake resistance, high water level, and approach roads linearity.
      6-2-2. Other technical matters including the outline design of the new bridge will be considered by the Team and explained to PNG side around October 2014.

7. Japan's Grant Aid Scheme
   7-1. PNG side understands the Japan's Grant Aid scheme explained by the Team, as described in Annex-3 and Annex-4.
   7-2. PNG side will take the necessary measures, as described in Annex-5, to facilitate the smooth

implementation of the Project, as a condition for the Japan's Grant Aid to be implemented, according to the existing agreement between the Government of Japan and the Government of PNG.

8. Environmental and Social Considerations

8-1. The Team explained the Project is categorized as "Category B" according to the JICA Guideline, since the Project is reconstructing the two bridges and approach roads, and its impact on the environmental may be expected.

8-2. PNG side understands the Project needs to follow the JICA guideline. Therefore the initial environmental examination (IEE) shall be done through the survey.

8-3. In case of the Project Affected Persons (PAPs) within the Project sites, PNG 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 an Abbreviated Resettlement Action Plan (Abbreviated RAP) will be prepared and approved by the responsible authorities beforehand and PNG side will take necessary measures to PAPs according to an Abbreviated RAP in close communication with JICA.

9. Schedule of the Study

9-1. The Team will continue further studies in PNG until July 19, 2014.

9-2. JICA will prepare the draft Preparatory Survey Report and send a mission team to explain its contents to PNG side around October 2014. JICA will explain details of the Project including the final components and cost estimation to PNG side.

9-3. When the contents of the draft Preparatory Survey Report are accepted in principle by the Government of PNG, JICA will complete the final report and send it to the Government of PNG around January 2015.

9-4. The above schedule is tentative and subject to change.

10. Proper Use

PNG side shall secure enough budget and personnel necessary for operation and maintenance of the facilities implemented by the Project, including the periodical maintenance work after the completion of the Project.

11. Other Relevant Issues

11-1. PNG side shall, at its own expense, provide the Team with the following items in cooperation with other organizations concerned

(1) security-related information as well as measures to ensure the safety of the survey team;
(2) information as well as support in obtaining medical service;
(3) data and information necessary for the Survey;
(4) counterpart personnel;
(5) credentials or identification cards if necessary;
(6) entry permits necessary for the survey team members to conduct field surveys;
(7) permission for the implementation of traffic survey;

(8) necessary arrangement for exemption of the taxes, duties, and any charges on equipment, machinery and other materials brought into PNG for the implementation of the Survey; and

(9) support in obtaining other privileges and benefits if necessary.

11-2. PNG side agreed that the following undertakings should be taken by PNG side at the PNG's expenses under the Project if implementation of the Project is approved by the Government of Japan;

(1) to secure the lots of land necessary for the implementation of the Project including land for site office, plant yards, material storing yard, motor pool, temporary construction yard and waste disposal site;

(2) to relocate existing utilities within the Project site;

(3) to relocate existing buildings and facilities if necessary;

(4) to arrange issuance of license, permission and other necessary procedures for the Project;

(5) to obtain the royalties/permission for taking raw materials such as stone/rock/filling materials from the quarry/river-bed/borrow pit; and

(6) to provide security measures for all concerned working for the Project.

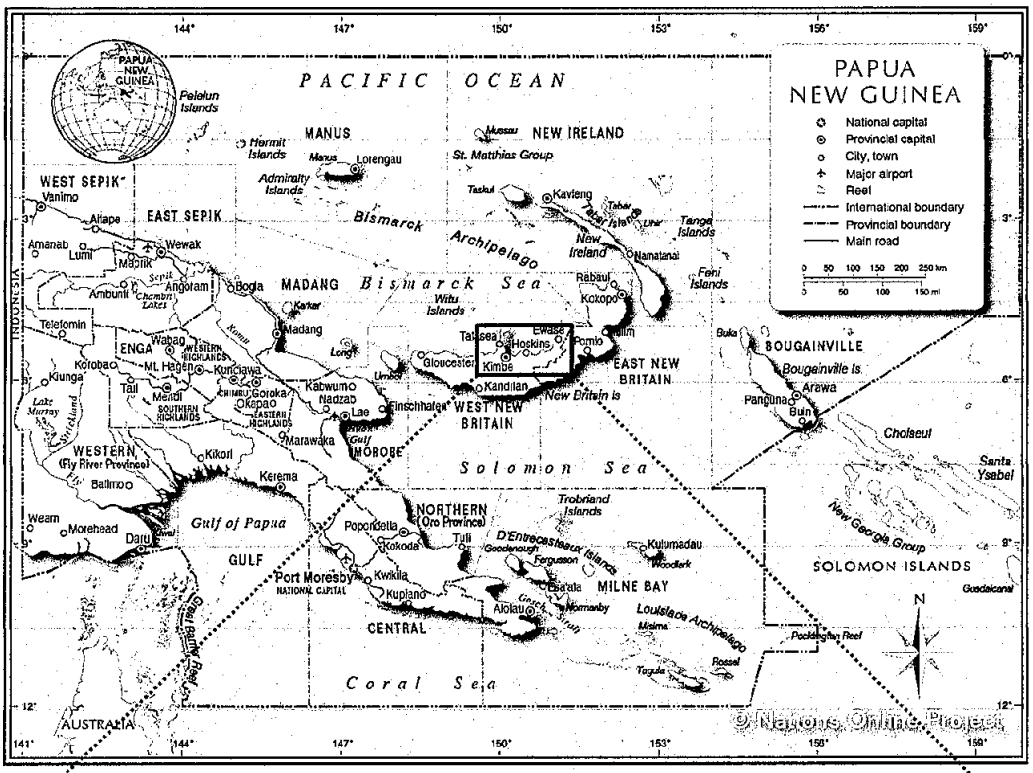
11-3. After being explained the methodology and techniques of the demolition of the existing bridges, PNG side requested to include it into the scope of the Project because of a lack of their capacity. The Team acknowledged the request and explained that it will bring the request back to Japan to examine such possibility, and will respond before the draft Report explanation.

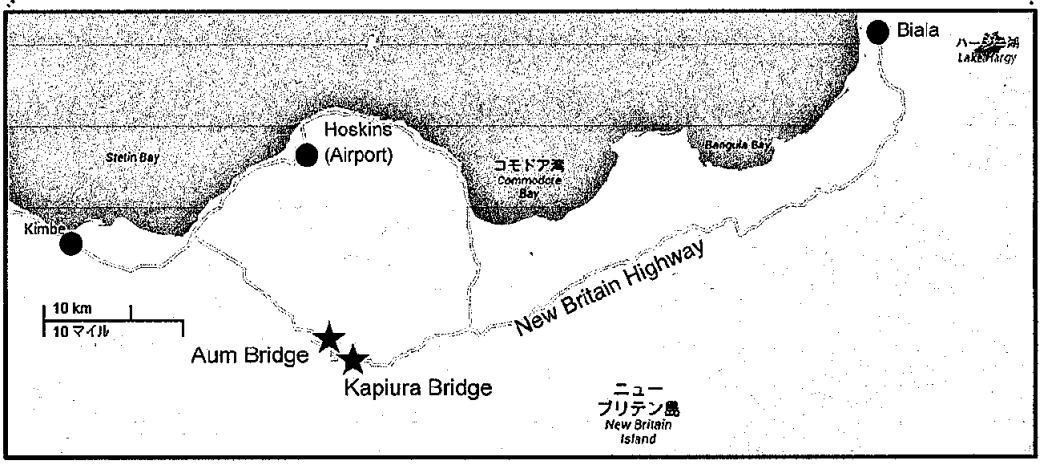
12. Disclosure of Information

Both sides confirmed that the study results excluding the Project cost will be disclosed to the public after the completion of the Survey. All the study results including the Project cost will be disclosed to the public after all the verification of contracts for the Project by JICA are concluded.

Annex-1: Project Sites
Annex-2: Organization Chart of DOW
Annex-3: Japan's Grant Aid Scheme
Annex-4: Flowchart of Japan's Grant Aid Procedure
Annex-5: Major Undertakings to be taken by Each Government

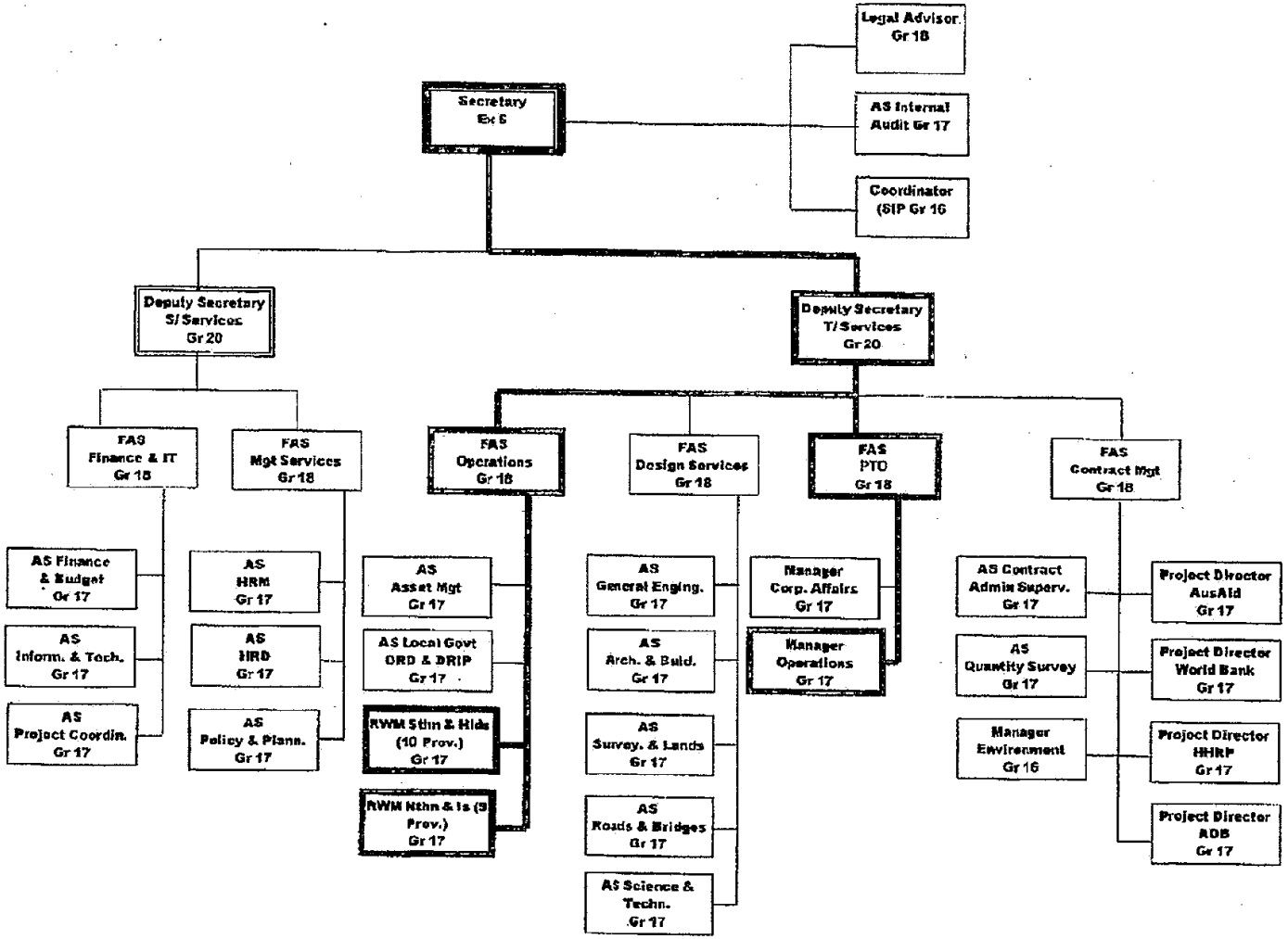
Annex-1: Project Site





Annex-2

Annex-2: Organization Chart of DOW



Annex-3: Japan's Grant Aid Scheme

JAPAN'S GRANT AID

The Government of Japan (hereinafter referred to as "the GOJ") is implementing the organizational reforms to improve the quality of ODA operations, and as a part of this realignment, a new JICA law was entered into effect on October 1, 2008. Based on this law and the decision of the GOJ, JICA has become the executing agency of the Grant Aid for General Projects, for Fisheries and for Cultural Cooperation, etc.

The Grant Aid is non-reimbursable fund provided to a recipient country to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedures

The Japanese Grant Aid is supplied through following procedures :

・Preparatory Survey
- The Survey conducted by JICA

・Appraisal &Approval
-Appraisal by the GOJ and JICA, and Approval by the Japanese Cabinet

・Authority for Determining Implementation
-The Notes exchanged between the GOJ and a recipient country

・Grant Agreement (hereinafter referred to as "the G/A")
-Agreement concluded between JICA and a recipient country

・Implementation
-Implementation of the Project on the basis of the G/A

2. Preparatory Survey

(1) Contents of the Survey

The aim of the preparatory Survey is to provide a basic document necessary for the appraisal of the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the recipient country necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, financial, social and economic point of view.

- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of a outline design of the Project.
- Estimation of costs of the Project.

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Grant Aid project. The Outline Design of the Project is confirmed based on the guidelines of the Japan's Grant Aid scheme.

JICA requests the Government of the recipient country to take whatever measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization of the recipient country which actually implements the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA employs (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the Report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the appropriateness of the Project.

3. Japan's Grant Aid Scheme

(1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes(hereinafter referred to as "the E/N") will be singed between the GOJ and the Government of the recipient country to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.

(2) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the recipient country to continue to work on the Project's implementation after the E/N and G/A.

Annex-3

(3) Eligible source country

Under the Japanese Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When JICA and the Government of the recipient country or its designated authority deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals".

(4) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by JICA. This "Verification" is deemed necessary to fulfill accountability to Japanese taxpayers.

(5) Major undertakings to be taken by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as Annex.

(6) "Proper Use"

The Government of the recipient country is required to maintain and use properly and effectively the facilities constructed and the equipment purchased under the Grant Aid, to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Grant Aid.

(7) "Export and Re-export"

The products purchased under the Grant Aid should not be exported or re-exported from the recipient country.

(8) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account under the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). JICA will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment

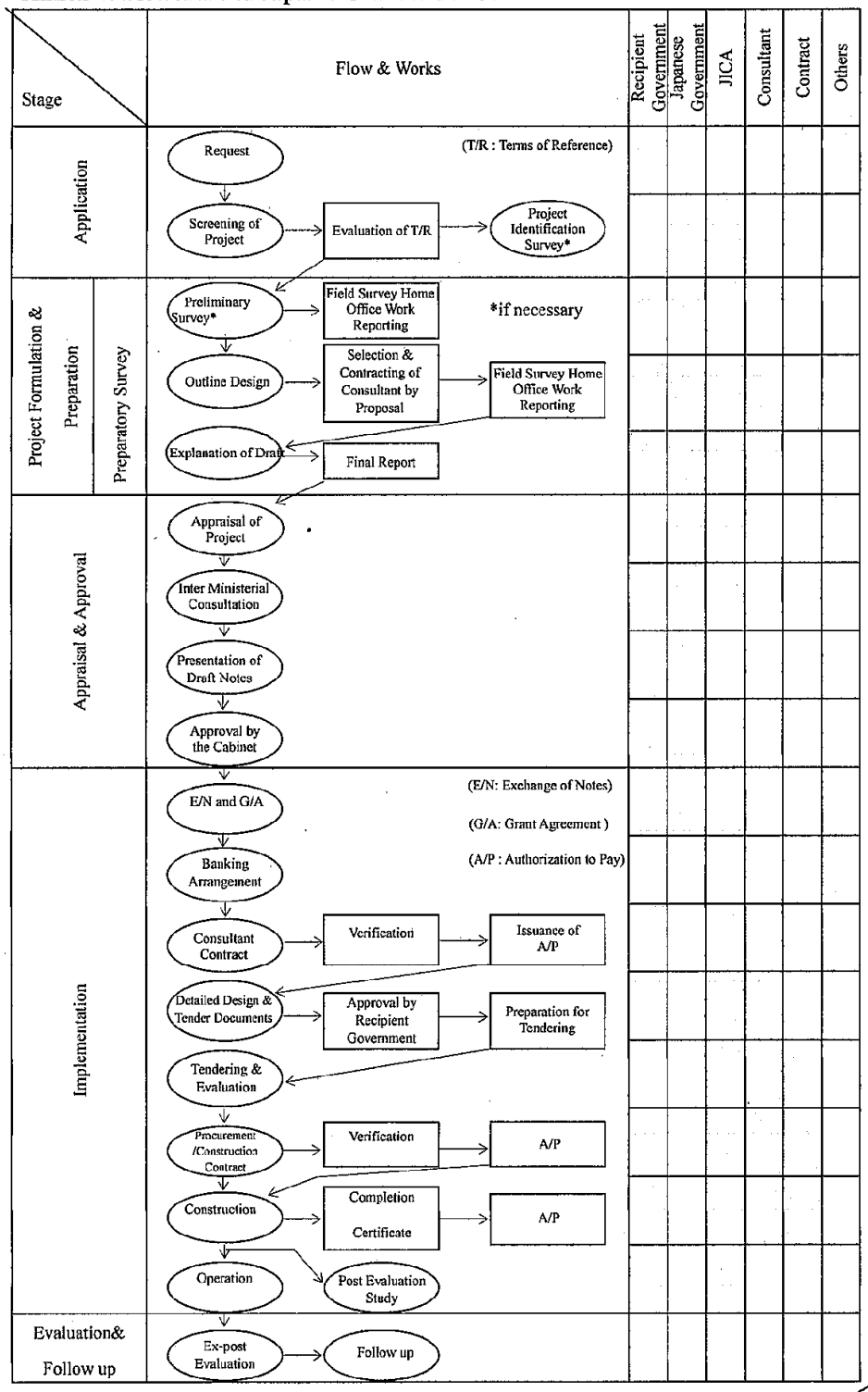
commissions paid to the Bank.

(10) Social and Environmental Considerations

A recipient country must carefully consider social and environmental impacts by the Project and must comply with the environmental regulations of the recipient country and JICA socio-environmental guidelines.

Annex-4

Annex-4: Flowchart of Japan's Grant Aid Procedure



Annex-5

Annex-5: Major Undertakings to be taken by Each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To secure lots of land necessary for the implementation of the Project and to clear the site		●
2	To ensure prompt unloading and customs clearance of the products at ports of disembarkation in the recipient country and to assist internal transportation of the products.		
	1) Marine (Air) transportation of the products from Japan to the recipient country	●	
	2) Internal transportation from the port of embarkation to the project site	(●)	(●)
3	To ensure that customs duties, internal taxes and other fiscal levies, which may be imposed in the recipient country with respect to the purchase of the products and the services be exempted.		●
4	To accord Japanese physical persons and / or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country and stay therein for the implementation of the Project.		●
5	To ensure that the Facilities be maintained and used properly and effectively for the implementation of the Project.		●
6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project.		●
7	To bear the following commissions paid to the Japanese bank for banking services based upon the B/A		●
	1) Advising commission of A/P		●
	2) Payment commission		●
8	3) To give due environmental and social consideration in the implementation of the Project.		●

(B/A: Banking Arrangement, A/P: Authorization to Pay)

4.2 第 2 次現地調査時 (2014 年 10 月 16 日)

MINUTES OF DISCUSSIONS
ON
THE PREPARATORY SURVEY
FOR
THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON NEW BRITAIN HIGHWAY
IN
THE INDEPENDENT STATE OF PAPUA NEW GUINEA

(Explanation of Draft Outline Design Report)

On the basis of the preparatory survey in the Independent State of Papua New Guinea (hereinafter referred to as "PNG") from May to September, 2014 and following technical examination in Japan, Japan International Cooperation Agency (hereinafter referred to as "JICA") prepared a Draft Outline Design Report (hereinafter referred to as "the Report") on the Project for Reconstruction of Bridges on New Britain Highway (hereinafter referred to as "the Project").

The Preparatory Survey Team, headed by Mr. Shigeru Sugiyama, Chief Representative of JICA Papua New Guinea Office (hereinafter referred to as "the Team") consulted with the Department of Works (hereinafter referred to as "DOW") and the concerned officials of the Government of the Independent State of Papua New Guinea (hereinafter referred to as "the Government") on the contents of the Report.

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

Port Moresby, October 16, 2014

Mr. Shigeru SUGIYAMA
Leader
Preparatory Survey Team
Japan International Cooperation Agency
Japan

Ms. Linda Taman - EKO
Acting First Assistant Secretary, Foreign Aid Division
Department of National Planning and Monitoring
Independent State of Papua New Guinea

Mr. David WEREH
Secretary
Department of Works
Independent State of Papua New Guinea

ATTACHMENT

1. Components of the Draft Outline Design Report

1.1. As a result of the Survey the Team identified four main components of the Project consisting of the following construction works. PNG side agreed and accepted in principle the contents of the Report explained by the Team.

a) Reconstruction of Kapiura and Aum bridges
b) Construction of the access roads for Kapiura and Aum bridges
c) Construction of revetment works for Kapiura and Aum bridges
d) Removing the existing bridges of Kapiura and Aum bridges

2. Cost Estimation for the Project

2.1. The Team explained to PNG side the estimate of the Project Cost described in Annex-1; while, the final Project Cost described in the Exchange of Note (hereinafter referred to as "E/N") will be appraised by the Government of Japan (hereinafter referred to as "GOJ").

2.2. Both sides further confirmed that the Project Cost in Annex-1, and details of the construction works in the Report should never be duplicated and/or disclosed to any third parties until all the contracts for the Project are concluded.

2.3. The Team explained and PNG side agreed that the cost for land acquisition is also subject to change but in principle it will be compensated at full replacement cost according to the JICA Guidelines for Environmental and Social Considerations (hereinafter referred to as "JICA Guidelines").

3. Undertaking by PNG Side

3.1. PNG side is responsible to undertake the activities for the Project listed in Annex-2 at its own expenses based on the contents of the Report.

3.2. PNG side confirmed that the customs duties, internal taxes and other fiscal levies, imposed in PNG with respect to the purchase of the products and the services shall be exempted in accordance with the regulations of E/N between the two governments.
In case the exemption would not be processed in a timely manner, anyhow, both sides confirmed such tentative payment(s) would be owed by PNG side.

3.3. PNG side confirmed to execute the undertakings listed in Annex-2 in time, duly understanding the possibilities of the suspension / termination of this Grant Aid assistance if there will be violations on the undertakings.

3.4. PNG side is responsible to secure necessary budget in time and to report its progress to JICA Papua New Guinea office (hereinafter referred to as "JICA office"). If the budget cannot be

secured in time and/or appropriately, there is a possibility that the Project might be suspended / terminated.

3.5. PNG side agreed that DOW will report to JICA office the progress of their undertakings by PNG side until all the works to be done. Reports to JICA office shall be submitted monthly with actual progress bar chart in Annex-2. Other than the monthly report, DOW shall reply when requested by JICA.

4. Operation and Maintenance of the Facilities

4.1. PNG side will secure enough staff and budgets necessary for operation and maintenance of the facilities constructed by the Project. The annual operation and maintenance costs are estimated and shown in the table below. Refer to the Report for further details.

Maintenance Item	Frequency	Location	Work Items	Annual Cost (Kina/year)
1. Inspection				
1) Approach Road	1 time/week	Pavement surface Inside of drainage	Inspection	2,160
2) Bridge	1 time/week	All parts of bridge	Inspection	4,320
3) Bank Protection	1 time/week	All parts of Revetment	Inspection	2,160
Subtotal of annual cost of inspection				8,640
2. Cleaning				
1)Approach Road	2 times /year	Inside of drainage Grass cut around shoulder	Cleaning	17,900
2)Bridge	2 times/year	All parts of bridge	Cleaning	1,200
Subtotal of annual cost of cleaning				19,100
3. Repair & Rehabilitation				
1) Approach Road	Once/2 year	Pavement	Repair	11,400
	Once/20 year		Replace	48,750
2) Bridge	Once/20 year	Expansion Joint	Replace	10,500
3) Bank Protection	Once/Month	All parts of Revetment	Repair	4,800
Subtotal of annual cost of repair and rehabilitation				75,450
Total				103,190

4.2. The Team stressed the following three points, and PNG side agreed;

(1) Although the project includes some facilities to ensure traffic safety such as sign posts, guardrail, etc., frequency of accidents might not be reduced due mainly to increased traffic volume.

(2) Passing the bridges by excessively overloaded vehicle will cause significant damage to the bridge structure which may lead to shorter lifespan.

(3) Proper asset management mainly for bridges will impact greatly to maintenance cost and lifespan.

5. Environment and Social Considerations

5.1. Both sides confirmed that information on environmental and social considerations including major impacts and relevant mitigation measures is summarized in the Environmental Checklist attached as Annex-3. DOW confirmed that they will inform JICA of any major changes, which may affect environmental and social considerations, by revising the Checklist in a timely manner.

5.2. Both sides confirmed continuous environmental monitoring will be conducted by DOW in accordance with the Environmental Checklist and Monitoring Form attached as Annex-3 and Annex-4.

5.3. DOW confirmed that the results of environmental monitoring will be provided to JICA by filling in Environmental Monitoring Form attached as Annex-4 on a quarterly basis until the completion of the Project, provided that there is no outstanding issue regarding the environmental and social considerations during implementation of the Project.
In case JICA finds that there is necessity for improvement in a situation with respect to environmental and social considerations after the agreed monitoring period, JICA can request to extend the period of monitoring and reporting until JICA confirms the issues have been properly addressed.

5.4. PNG side agreed JICA's disclosure of provided monitoring results in the Environmental Monitoring Form attached as Annex-4 on JICA's website.

6. Validity of the Previous Minutes of Discussions

Both sides confirmed that all the agreements in the Minutes of Discussions of the preceding Preparatory Survey signed on May 30, 2014 continue to be valid unless information is updated by the draft Preparatory Survey Report..

7. Japan's Grant Aid Scheme

7.1. PNG side fully understood and reconfirmed the scheme of the Japan's Grant Aid and the necessary measures to be undertaken by PNG side, which was explained by the Japanese side and agreed as the Minutes of Discussion signed on May 30, 2014.

8. Schedule of the Study

8.1. JICA will complete the Final Report of the Preparatory Survey both in Japanese and English, in accordance with the confirmed items and send it to PNG side around February, 2015.

8.2. The above schedule is tentative and subject to change.

9. Disclosure of Information

9.1. PNG side agreed to JICA's disclosure of the study results excluding the Project cost

after completion of the Preparatory Survey, and all the study results including the Project cost after all the contracts for the Project are concluded.

10. Misconduct

If JICA receives information concerning suspected corrupt or fraudulent practices, the Government shall take necessary measures in accordance with the Procurement Guidelines in the competition for, or in execution of, the contract funded by the Grant:

(1) to provide JICA with such information as JICA may reasonably request, including information related to any concerned official of the government and/or public organizations of PNG;
(2) not to treat unfairly or unfavorably the physical persons and juridical persons, that provide the information.

Annex-1: Project Cost Estimation
Annex-2: Activitiess to be undertaken by the Government of the Independent State of Papua New Guinea
Annex-3: Environmental Checklist
Annex-4: Environmental Monitoring Form

Annex-1: Project Cost Estimation

CONFIDENTIAL

(1) Cost Borne by the Government of Japan

Components		Cost Estimation (Million Yen)
Building Construction	Construction of Kapiura Bridge (including approach road , revetment and removing the existing bridge)	1,746
	Construction of Aum Bridge (including approach road , revetment and removing the existing bridge)	1,161
Detailed Design and Procurement Supervision		229
Total		3,136

(2) Cost Borne by the Government of the Independent State of Papua New Guinea

Items	Cost Estimation (Kina)
Land Lease Fee	400,000
Removal of Temporary Bridge at Aum Site	10,000
Payment of bank commission	40,000
Total	450,000

(3) Conditions of Cost Estimation

- Estimated timing: July 2014
- Exchange rates: USD1.00 =103.16 JPY
  Kina 1.00 = 40.23 JPY
- Others: The project is implemented in accordance with the system of Japan's Grant Aid. The above cost estimation is not final, and GOJ is responsible for finalizing the ceiling amount of the Grant Aid assistance of the Project.

Annex-2: Activities to be undertaken by the Government of the Independent State of Papua New Guinea

(1) Undertakings of which progress required to be shared with and to be reported to JICA in a timely manner

PNG side is required to implement following items described below and report to JICA Papua New Guinea office monthly and the times when the items marked " ▼" is done, as well as at the beginning and end points of the bar charts. Furthermore, DOW is also required to report to JICA on an ad hoc basis in response to JICA's inquiries.

Note : (P) means provisional

Undertaking		Month	2014 11	2014 12	2015 1	2015 2	2015 3	2015 4	2015 5	2015 6	2015 7	2015 8	2015 9	Remarks
Project Implementation	Exchange of Notes and Grant Agreement (P)				▼									
	Detailed design													
	Tender notice								▼					
	Construction Works													
Securing Budget *(See Annex-1 for items and estimated cost to be secured.)*	Request of budget for FY 2015	Plan												
		Actual												
	Request of budget for FY 2016	Plan							▼					To be prepared just after the detailed design will have finished.
		Actual												
	Approval of budget for FY 2015	Plan			▼									
		Actual												
	Available timing for payment	Plan				▼								In case of the delay, appropriation budget should be utilized.
		Actual												
Tax Exemption *(See 3. in the Attachemnt for exception)*	Submission and authorization of tax exemption from DOW	Plan			▬									Begin preparation of application and consultation with DOW referring to the existing E/Ns for the other projects.
		Actual												
	Submission of application for each tax payments	Plan												Application must be submitted each shipment time when the exemption will be required
		Actual												
Land Acquisition	Submission of letter about Replacement of Lease Land to Government	Plan				▬								
		Actual												
	Approval for Replacement of Lease Land	Plan						▼						
		Actual												
Environmental & Social Considerations	Submission of Project Implimentation Document from DOW to DEC	Plan				▬								
		Actual												
	Approval Level 2A Project from DEC	Plan					▼							
		Actual												
	Review and approval of Environmental Management Plan (EMP)	Plan										▬		EMP shall be submitted by the Contractor during the preparation of construction
		Actual												
	Submission Copy of Review EMP from DOW Environment Section to DEC	Plan											▼	
		Actual												
	Commencement of environmental monitoring	Plan										▬	▬	Monitoring report shall be submitted to JICA during construction
		Actual												
Provision of Temporary Work Yards include contractor's site office and plant yard	Negotiation with land owners	Plan										▬		Temporary work yards shall be at near Aum Bridge sites.
		Actual												
	Contracts for land rent	Plan											▬	
		Actual												
Provision of Borrow Pits and Quarry (ies)	Contract with borrow pits and quarry(ies) owners	Plan										▬	▬	Borrow pits and Quatties shall be near both bridges.
		Actual												
Provision of waste disposal area	Acquisition of approval of soil and construction waste disposal from the dump site owner	Plan										▬	▬	Dump site shall be near Temporary Work Yard.
		Actual												
Payment of bank commission	Openinng of bank account and arrange Authorization to Pay	Plan				▬								
		Actual												
	Payment commision	Plan					▪	▪	▪	▪	▪	▪	▪	
		Actual												

(2) Other Undertakings necessary for smooth implementation of the Project

Items
To ensure prompt unloading and customs clearance of the products at ports of disembarkation in the recipient country and to assist internal transportation of the products.
To accord Japanese physical persons and / or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country and stay therein for the implementation of the Project.
To ensure that the Facilities be maintained and used properly and effectively for the implementation of the Project.
To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project even other than the cost shown in Annex-1 if necessary.
To support ensuring security for the personnel assigned to the Project and ensuring security at the Project sites, e.g. security information sharing, coodination with police, etc.
To cooperate in solving potential troubles with the local people or any third party in connection with the execution of the Project with close consultation with JICA.

Annex-3: 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 assessment reports (EIA reports) been already prepared? (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) N (b) N (c) Y (d) N	(a) When the Project contents have been finalized, the Project proposal will be submitted from the DoW (Project proponent) to DEC. (b) (c) The bridge reconstruction Project corresponds to Category 2A in the Environmental Guidelines; thus its implementation will be approved. The DEC branch in the DOW requires preparation of the CEMP. (d)
	(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 comments from the stakeholders (such as local residents) been reflected to the Project design?	(a) Y (b) Y	(a) Direct hearings have been held with the stakeholders comprising WNB Province Office and bridge users NBPOL and SBLC in order to provide explanations and listen to requests. (b) The outline design results, etc. will be announced to the stakeholders as necessary. Clearance of Bridge girder during High water Level was considered in design based on user's information and request.
	(3) Examination of Alternatives	(a) Have multiple alternative plans of the Project been examined with social and environmental considerations?	(a) Y	(a) Zero option of reconstruction bridges is impossible because of no alternative road network. Road alignment and river management plans that entail changing the positions of the existing Aum Bridge and Kepiura Bridge are not feasible because they would entail acquisition of plantation and customary land and large-scale alteration of the riverside buffer zones. Reconstruction of Bridges on existing position is feasible.
2 Pollution Control	(1) Air Quality	(a) Is there a possibility that air pollutants emitted from the Project related sources, such as vehicle traffic, will affect ambient air quality? Does ambient air quality comply with the country's air quality standards? (b) If air quality already exceeds environmental standards near the route, is there a possibility that the Project will make air pollution worse? Are any mitigating measures for air quality taken?	(a) Y (b) N	(a) The generation of atmospheric polluting substances from passing vehicles is predicted to lead to air pollution, but the amount of DUST or other pollution substances generation over WNB is almost same with Project than without Project. (b) The emission gases will diffuse on the bridges, therefore, this Project will not lead to deterioration of air quality around the route.
	(2) Water Quality	(a) Is there a possibility that soil runoff from the bare land resulting from earth banking and cutting, etc. will cause water quality degradation in downstream water areas? (b) Is there a possibility that the Project will contaminate water sources, such as well water?	(a) N (b) N	(a) The planned approach roads are planned to be banked structures higher than the existing road due to flood water line constraints, etc. The case using banking structure for some part of the road also will be forecasted not cause water quality degradation(pH, Turbidity) with preventive measures against soil runoff such as early slope , greening. (b) When performing excavation for bridge foundations, use of the cofferdam method can minimize the impacts.
	(3) Noise and Vibration	(a) Do noise and vibrations from the vehicle and train traffic comply with the country's standards? (b) Do low frequency sounds from the vehicle and train traffic comply with the country's standards?	(a) Y (b) Y	(a) The noise on the bridges will be lower than noise on the flat road. If noise levels exceed the standard, There are no facilities that require protection in the local areas. (b) There are no houses near the bridges, so there will be little impact from low frequency vibration.
3 Natural Environment	(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 effect the protected areas?	(a) N	(a) The riverside band is designated as a buffer zone based on Logging Code Practice in the Project sites and surrounding area. Taking plants and hunting are prohibited in this area, however, the impact to ecological scheme will be negligible because the CEMP will be implemented during construction.
	(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 bridges and access 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?	(a) Y (b) N (c) N (d) N (e) N	(a) Aum Bridge and Kepiura Bridge are situated in an area of palm and eucalyptus plantations, but riverside bands of 50 meters on both sides are designated as buffer zone, where the hunting of flora and fauna is controlled in line with the objectives of river protection. (b) No valuable and protected habitats have been confirmed on the proposed route. (c) As the Project entails bridge replacement, it is expected that the impact to ecosystem will be small. (d) No large-size wildlife or farm animals have been confirmed in the Project area. (e) The Project is not expected to cause loss of existing swamp, however, when greening slopes and so on, indigenous species will be planted to ensure there is no influx of foreign species or pests.
	(3) Hydrology	(a) Is there a possibility that hydrologic changes due to the installation of structures will adversely affect surface water and groundwater flows?	(a) N	(a) Aum Bridge is planned with two spans and Kepiura Bridge with three spans. Increase in HWL due to installation of piers will be limited to 100mm, and since the cross section of piers will be negligible compared to the river cross sections, there will be hardly any increase in water line that affects upstream areas.
	(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 banking and cutting 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 bank and cut areas, waste soil disposal sites, and borrow sites? Are adequate measures taken to prevent soil runoff?	(a) N (b) N (c) N	(a) The Project area has such terrain that slope failures or landslides are not likely to be induced. Moreover, excavation works of the type that cause major topographical transformation will not be implemented. (b) The bridge approaches will basically be banked structures, which will be designed and constructed with steps to ensure that slope failures or landslides do not occur. Specifically, banking will be designed based on application of PNG's earthwork standards while also referring to Japanese standards. Up to the 100-year flood water line (HWL), banking will either comprise gabion (retaining wall) or be covered by gabion for slope protection. On surfaces above the HWL, slope protection will be provided by planting indigenous species (grass). (c) For the establishing and running the waste soil disposal sites and borrow sites, an CEMP for ensuring thorough safety measures such as assignment of safety guards at vehicle entrances will be compiled and implemented.

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) Is compensation going to be paid prior to the resettlement? (e) Is the compensation policy 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) N (b) N (c) N (d) N (e) N (f) N (g) N (h) N (i) N (j) N	(a) Aum and Kapiura bridges are located around land leased from the state and used for plantations, so there are no residents or inhabited buildings for a few kilometers in the surrounding area. (b) (c) (d) (e) (f) (g) (h) (i) (j)
	(2) Living and Livelihood	(a) Where bridges and access 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 unCEMPloyment? Are adequate measures considered for preventing these impacts? (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? (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? (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)? (e) Is there any possibility that Project will impede the movement of inhabitants? (f) Is there any possibility that bridges will cause a sun sheding and radio interference?	(a) N (b) N (c) Y (d) N (e) N (f) N	(a) The works will create CEMPloyment opportunities for local residents living over a few kilometers from the sites. (b) There are no inhabitants. (c) To prevent the immigration of infectious diseases such as HIV in line with the immigration of workers, measures will be planned and implemented through lectures, etc. at the phase of CEMP during construction. (d) During construction, there will basically be no impact on local traffic because the existing road will be secured, however, measures to counter congestion caused by the work and works vehicles will be examined and implemented in the CEMP. (e) (f)
	(3) Heritage	(a) Is there a possibility that the Project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a) There are no valuable heritage or historical sites of the archaeological, historical, cultural, or religious variety in the Project area, and no areas that are protected under domestic law.
	(4) Landscape	(a) Is there a possibility that the Project will adversely affect the local landscape? If that is the case, are necessary measures taken?	(a) N	(a) Both Aum Bridge and Kapiura Bridge will be designed to blend with the surrounding landscape through adopting appropriate color coating for girders and so on.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a) N (b) Y	(a) There are no residential areas of ethnic minorities and indigenous peoples in and around the Project area. (b) The rights of ethnic minorities and indigenous peoples are respected based on law, etc.
	(6) Working Conditions	(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? (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? (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.? (d) Are appropriate measures taken to ensure that security guards involved in the Project not violate safety of other individuals involved, or local residents?	(a) Y (b) Y (c) Y (d) Y	(a) The environment for workers will be upheld based on labor law ordinances concerning work times, break times, and worker health and safety. (b) In the works CEMP that is prepared in the D/D phase, safety measures will be considered. (c) In the works contract, it will be required to prepare a safety plan containing safety management measures such as appointment of a safety manager, and implementation will be thoroughly enforced. (d) In implementing the Project, stakeholder consultations will be frequently held, and the works contract will require appointments of an Environmental, Health and Safety Officer and Community Liaison Officer, etc. according to the PNG environmental guidelines.

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) N (c) N	(a) In the D/D phase, adequate pollution mitigation measures to reduce impact during the construction based on both national and international standards will be examined and stated in the CEMP and their implementation will be guaranteed. (b) In the case where tree cutting arises in the buffer zone in the upper reaches of Kapiura River, reforestation, etc. will be implemented as necessary. (c) In the D/D phase, the possibility of traffic congestion or maldistribution of benefits will be examined and countermeasures will be stated in the RAP or CEMP and their implementation will be guaranteed.
	(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 of the natural environment comprising air quality, noise, water quality, etc. during works will be planned in the CEMP and implemented. (b) The CEMP/MD will stipulate that the existence of variations in the natural environment comprising air quality, noise, surface water, groundwater, plant ecology, etc., should be grasped by sampling and visual inspection during and after construction for roughly 1 year. (c) The monitoring framework will be drafted in the CEMP and incorporated into the construction contract. (d) The CEMP/MD will stipulate that, except in emergencies, reports be given during works and once per year after works.
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Roads, Railways and 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) Because new bridges replacing the existing ones will be constructed on land adjoining the existing road, there will be no major deforestation. (b)
	Note on Using Environmental Checklist	(a) If necessary, the impacts to trans-boundary or global issues should be confirmed (e.g., the Project includes factors that may cause problems, such as trans-boundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N	(a) Being a small-scale Project, it will not have much of an impact.

Note 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 need 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).

Note 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 the Project is located.

Monitoring after construction of work shall be conducted by the DOW based on sampling and visual inspection for roughly 1 year. The monitoring result will be reported to JICA.

1. Pollution Countermeasures

—Water quality (wastewater measurements and environmental measurements in surrounding water bodies)

Item (unit)	Measurement (Mean value)	Measurement (Maximum value)	Local Standard	Reference International Standard	Remarks (Measurement location, frequency, method, etc.)
pH		-	Difference between upstream and downstream	-	Every month
Turbidity	-	-	There must be no difference of 25 NTU or more between the upstream and downstream.	-	Every month, Confirm by means of basic turbidity meter that uses electric conductivity.
Water temperature	-	-	Difference of 2°C or more between upstream and downstream	-	When measuring turbidity

2. Natural Environment

—Ecosystem

Monitoring Item	Conditions during the Report Period
Conditions of vegetation and biota around the sites	Monthly visual observations, record any changes and report as necessary.

3. Social Environment

—Traffic accidents, others

Monitoring Item	Conditions during the Report Period
Traffic accidents, Damage of facilities such as cracks of asphalt pavement or concrete structures, erosion of embankment etc. Contents of complaints from passers-by and other stakeholders.	Report to JICA according to necessity.

5. 参考資料

No.	Name of Document	Style	Published by
1	2013 NATIONAL BUDGET, Volume 1 Economic and Development Policies 31st December	Copy	2013, HON. DON POMB POLYE MP MNISTER FOR TREASURY
2	Daily data for Dami O P R S (2012-2014)	Copy	National Weather Service
3	Daily data for Hoskins Weather Office (2012-2014)	Copy	National Weather Service
4	Hydrology in Tropical Australia and Papua New Guinea	Copy	A. J. Hall, 1984
5	Seismicity Map of Papua New Guinea	Copy	USGS
6	Historical Earthquakes in Papua New Guinea	Copy	USGS
7	WEST NEW BRITAIN INTEGRATED PROVINCIAL DEVELOPMENT PLAN 2012-2015	Copy	WEST NEW BRITAIN PROVINCIAL ADMINISTRATION 2011
8	Guidelines for the Environmental Assessment of Road and Bridge Infrastructure Projects	Copy	Department of Works , September 2013
9	National Public Service: General Orders	Copy	Papua New Guinea. Department of Personnel Management, 2002

6. その他の資料・情報

6.1 第 1 次現地調査時 (2014 年 05 月 30 日)

Minutes of Understanding
on
Technical Issues on the Preparatory Survey
on
the Project for Reconstruction of Bridges on
New Britain Highway

JICA Study Team had carried out data collection and analyses as well as field investigation on technical issues related to design and construction of the bridges, Aum and Kapiura bridge. Based on the results from those activities, the Team and the DoW, representative of the Government of the Independent State of Papua New Guinea held discussions on several technical issues pertaining to the project and reached the following understandings;

1. Design Standards

Following standards, specifications and manuals shall be used because of consistency with the other ongoing bridge construction project (BRIRAP) funded by ADB.

Table-1 Design Standards and manuals issued in PNG

No	Name and contents	Issued	Remarks
1	Specification for Road and Bridge Works	1995.8	
2	Road Design Manual	1994.6	
3	Goods Procurement Manual Ver.3	2005.3	
4	Flood Estimation Manual	1990.12	Published by PNG DOE, CBOW
5	Earthquake Engineering for Bridge in Papua New Guinea	1985 Revision	DOW
6	River Training Manual	1987	DOW
7	Standard Engineering Drawings Bridge/Road	2008	DOW

Table-2 Reference Specification

No	Name and Contents	Issued	摘要
1	Specification for Highway Bridges	2012	Japan
2	AS5100 and supplements		

In Japanese grant aid projects, since materials are often procured from Japan, DOW agreed to adopt the Japanese Specifications for Highway Bridges based

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on adoption of JIS, which provides the technical specifications for material.

2. Design Live load

B-load defined in the Japanese specification is applicable to design of Aum bridge and Kapiura bridge because load effect of T44 and B-load are almost same or B-load is prevailing. DOW agreed to adopt B-load.

3. Standard Width of Road and Bridge

The proposal of the road and bridge width was agreed as shown on the Figure-1 and Figure-2 which is consistent with the BRIRAP one.

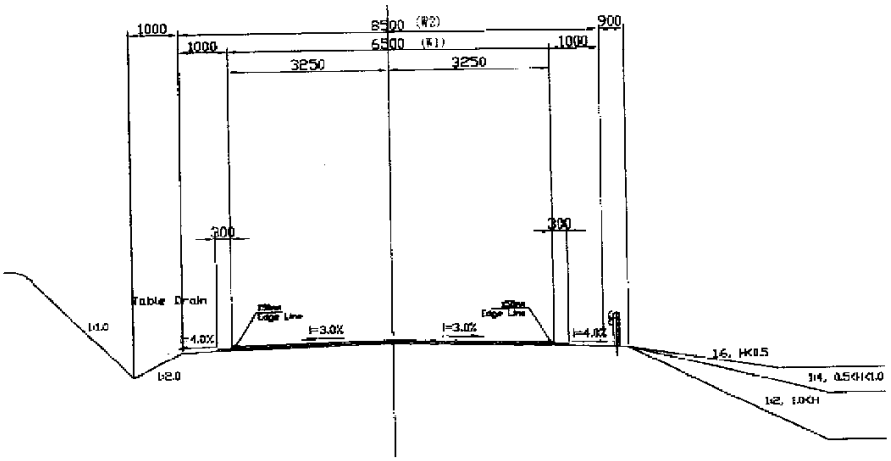

Figure-1 Road width

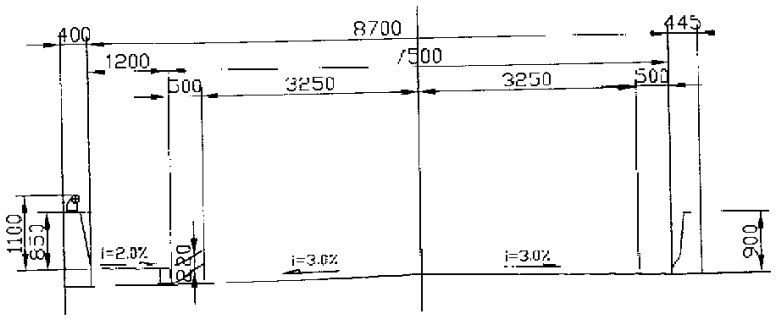

Figure-2 Bridge width

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4. Seismic Design

Japanese Specification, e.g. Specification for Highway Bridges V Seismic Design, shall be applied instead of the PNG's seismic design which was issued 30 years ago.

5. Hydraulics and Hydrology

Based on the BRIRAP Project, following restrictions shall be maintained.

- Clearance between soffit of the girder and H.W.L of 100-year return period shall be not less the 1.0m.

- Increase of HWL due to construction of the bridge should be within 100mm.

- Q_{2000} which is 2000-year return period shall be considered under ultimate loading.

  (Q_{2000} calculated as the Q100 discharge multiplied by 1.65. Refer to AS 5100)

  This Item is based on AS 5100 and applied to the BRIRAP bridge design criteria.

5. Removal of the old bridge structure

In the clause 7.7 of the proposal for Japanese Grant Request Application dated August, 2020, it was described that the removal of the old bridge structure is the item for which the costs will be borne by the requesting country.

Regarding this issue, followings were discussed.

- Removal of the existing bridges shall be implemented timely and harmony with construction of the new bridges in order to complete the project within the designated duration.
- Regarding Aum Bride, demolish of existing bridge may be implemented before the commencement of the new bridge construction.
- The existing log bridge at the Aum site shall be demolished just after the completion of the new bridge because it will be used as detour during construction term.
- Regarding Kapiura Bridge, existing bridge shall be dismantled quickly and

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safely after opening of the new bridge in order to construct river protection consecutively.
- If PNG side demolishes the both existing bridges, in order to lack of current division engineers and equipments, sequence of the construction activity for the new bridge implemented by the contractor will be disrupted.

Therefore, it is preferable that removal of the old bridge structure should be borne by Japanese grant.

30th June, 2010
Port Moresby

Mr. Wilfred PEKO
Department of Works
A / Assistant Secretary
Roads & Brides Design

Mr. Masahiko MORI
Chief Consultant
JICA Study Team

6.2 交通調査

6.2.1 交通量調査

(1) MAI JCT

1) 平日（2014 年 6 月 16 日）

① 方向別交通量

平日における方向別及び断面別の 12 時間交通量を表 6.2.1 及び表 6.2.2 に示す。

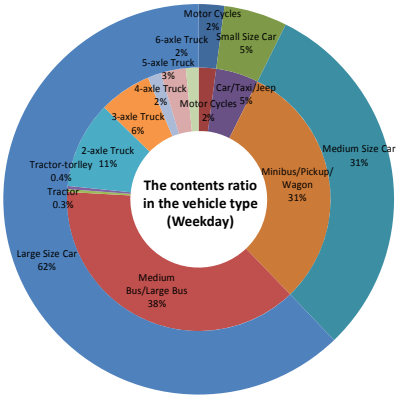
表 6.2.1 車種別交通量（平日 12 時間）

Zone / Type	Hoskins → Kinbe	Kinbe → Hoskins	Hoskins → Bialla	Bialla → Hoskins	Kimbe → Bialla	Bialla → Kimbe	Total
Moter Cycle	7	10	4	1	4	6	32
Car/Taxi/Jeep	45	9	7	1	16	2	80
Minibus/Pickup/Wagon	139	204	24	17	48	32	464
Medium Bus/Large Bus	149	178	5	7	121	120	580
Tractor	0	4	0	1	0	0	5
Tractor-torlley	0	6	0	0	0	0	6
2-axle Truck	38	60	5	6	34	19	162
3-axle Truck	33	34	0	0	15	16	98
4-axle Truck	1	14	0	4	5	1	25
5-axle Truck	1	2	6	2	13	23	47
6-axle Truck	2	1	2	1	13	5	24
Total	415	522	53	40	269	224	1,523
Total(Not include MoterCycle)	408	512	49	39	265	218	1491

表 6.2.2　断面交通量(平日 12 時間：二輪車を除く)

West NewBritain 国道		Kimbe-Hoskins 道路			
		Kimbe 側		Hoskins 側	
方向	交通量(台)	方向	交通量(台)	方向	交通量(台)
Bilalla	314	Kimbe	626	Kimbe	457
Kimbe	257	Hoskins	777	Hoskins	551
断面合計	571	断面合計	1,403	断面合計	1,008

② 車種別比率



二輪車を含む交通量の車種別比率は、中型車以上の車両が 93%を占めており、特に Minibus や Wagon を含む Bus の交通量が全体の 69%を占めており、沿線住民の生活を支える交通手段となっている。

また、地域の主要産業である Palm Oil の原料などを輸送するトラック及びトレーラ等の大型貨物車両が全体の 24%となっており、これらの車両は単体での重量が大きいため、道路に対する荷重の負荷は大きく、舗装の破損の要因の一つと考えられる。

図 6.2.1 車種別交通量の比率(平日 12 時間)

2)　休日（2014 年 6 月 15 日）

① 方向別交通量

休日における方向別及び断面別の 12 時間交通量を表 6.2.3 及び表 6.2.4 に示す。

表 6.2.3　車種別交通量（休日 12 時間）

Zone / Type	Hoskins → Kinbe	Kinbe → Hoskins	Hoskins → Bialla	Bialla → Hoskins	Kimbe → Bialla	Bialla → Kimbe	Total
Moter Cycle	12	12	3	0	7	8	42
Car/Taxi/Jeep	69	11	28	6	19	4	137
Minibus/Pickup/Wagon	106	47	47	1	14	15	230
Medium Bus/Large Bus	68	23	9	2	13	53	168
Tractor	1	3	0	1	0	0	5
Tractor-torlley	0	5	0	0	0	0	5
2-axle Truck	19	22	5	1	5	5	57
3-axle Truck	20	3	11	0	7	9	50
4-axle Truck	6	6	3	0	1	1	17
5-axle Truck	5	17	2	0	19	9	52
6-axle Truck	1	0	0	0	7	2	10
Total	307	149	108	11	92	106	773
Total(Not include MoterCycle)	295	137	105	11	85	98	731

表 6.2.4　断面交通量(休日 12 時間：二輪車を除く)

West NewBritain 国道		Kimbe-Hoskins 道路			
		Kimbe 側		Hoskins 側	
方向	交通量(台)	方向	交通量(台)	方向	交通量(台)
Bilalla	190	Kimbe	393	Kimbe	400
Kimbe	109	Hoskins	222	Hoskins	148
断面合計	299	断面合計	615	断面合計	548

② 車種別比率

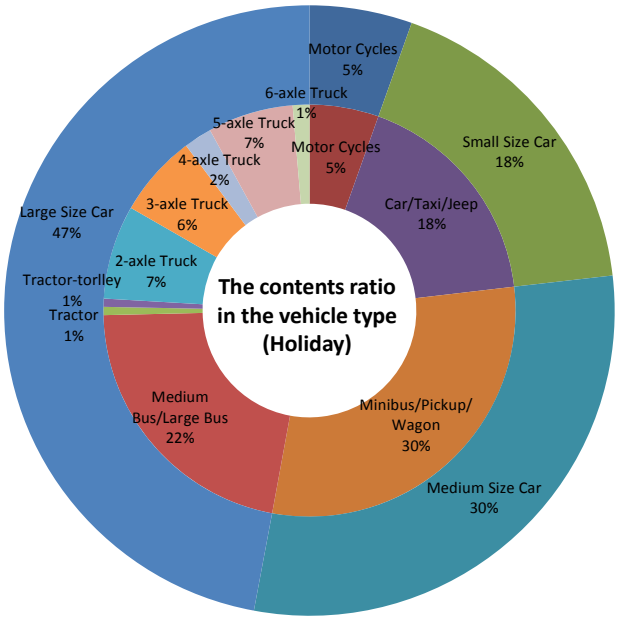


図 6.2.2　車種別交通量の比率(休日 12 時間)

休日の二輪車を含む交通量の車種別比率は、中型車以上の車両が 77%であり平日と比べて 16%少なく、その代わりに小型車が平日の 5%が 18%になり 13%増加している。また、Minibus や Wagon を含む Bus の交通量が平日の 69%に対して 52%で 17%少ない、これらは、通勤や通学の利用がないことを反映していると考えられる。一方、地域の主要産業である Palm Oil の原料などを輸送するトラック及びトレーラ等の大型貨物車両は全体の 25%を占めることから、休日にも一定の交通需要が生じていることがわかる。

(2)　Silanga

1)　平日（2014 年 6 月 16 日）

① 方向別交通量

平日における二輪車を除く両方向の交通量は、12 時間合計値で 142 台であり非常に少ない。

表 6.2.5　車種別交通量（平日 12 時間）

Zone / Type	Kimbe → Bialla	Bialla → Kimbe	Total
Moter Cycle	3	0	3
Car/Taxi/Jeep	11	6	17
Minibus/Pickup/Wagon	6	13	19
Medium Bus/Large Bus	37	41	78
Tractor	0	0	0
Tractor-torlley	0	0	0
2-axle Truck	13	8	21
3-axle Truck	0	0	0
4-axle Truck	2	2	4
5-axle Truck	0	2	2
6-axle Truck	1	0	1
Total	73	72	145
Total(Not include MoterCycle)	70	72	142

② 車種別比率

二輪車を含む全体に対して大型車の占める割合は 73%と非常に高い混入率である。

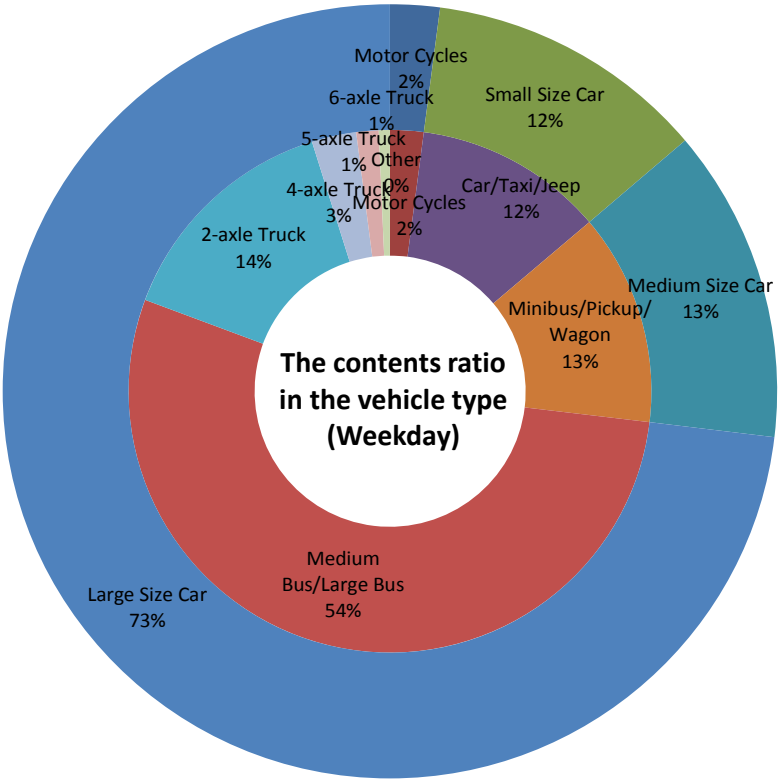


図 6.2.3　車種別交通量の比率(平日 12 時間)

2)　休日（2014 年 6 月 15 日）

① 方向別交通量

両方向の二輪車を除く交通量の 12 時間合計値は 86 台と非常に少なく、平日の 61%となっている。

表 6.2.6　車種別交通量（休日 12 時間）

Zone / Type	Kimbe → Bialla	Bialla → Kimbe	Total
Moter Cycle	1	1	2
Car/Taxi/Jeep	13	13	26
Minibus/Pickup/Wagon	9	17	26
Medium Bus/Large Bus	8	13	21
Tractor	0	0	0
Tractor-torlley	0	0	0
2-axle Truck	6	4	10
3-axle Truck	0	1	1
4-axle Truck	0	0	0
5-axle Truck	0	0	0
6-axle Truck	1	1	2
Total	38	50	88
Total(Not include MoterCycle)	37	49	86

② 車種別比率

二輪車を含めた全体に対して大型車の占める割合は 39%に留まっており、反面、小型および中型車両の割合は増加する。平日に比して業務用車両である大型車の運行が少ない状況を反映している。

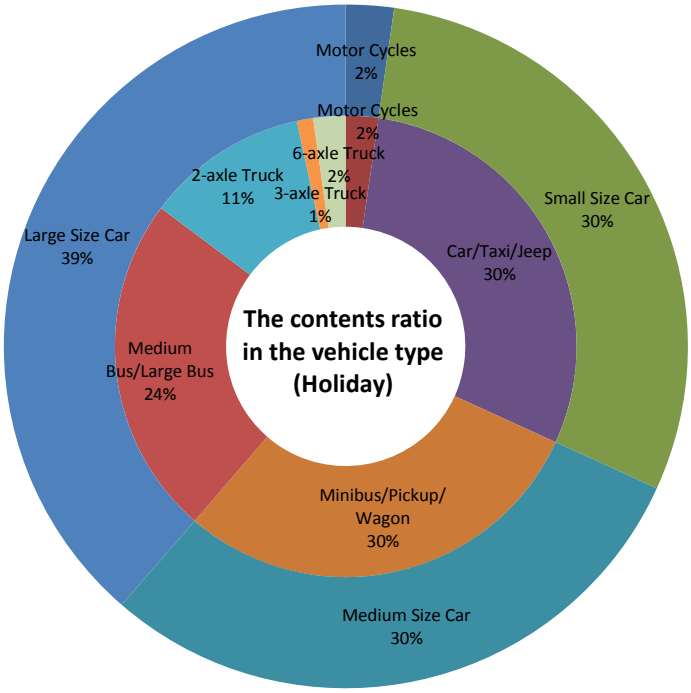
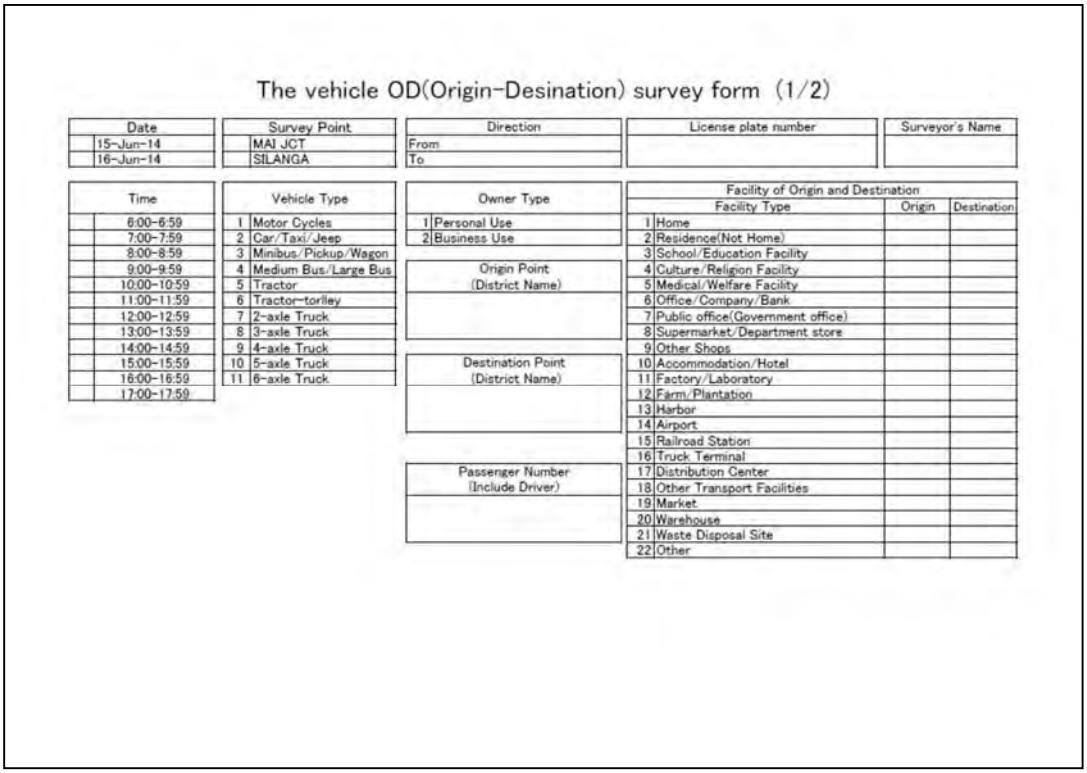


図 6.2.4　車種別交通量の比率(休日 12 時間)

6.2.2 OD 調査結果

(1) 調査シート

OD 調査は、交通量調査と同様に Mai JCT と Silanga の 2 箇所において実施した。調査は、事前に準備した以下の OD 調査シートを用いて、出発地、目的地のほか、移動目的、同乗者数、貨物種別及び積載量等について、ドライバーに直接聞き取りを行った。



The vehicle OD(Origin-Desination) survey form (1/2)

Date	Survey Point	Direction	License plate number	Surveyor's Name
15-Jun-14	MAI JCT	From		
16-Jun-14	SILANGA	To		

Time
6:00-6:59
7:00-7:59
8:00-8:59
9:00-9:59
10:00-10:59
11:00-11:59
12:00-12:59
13:00-13:59
14:00-14:59
15:00-15:59
16:00-16:59
17:00-17:59

	Vehicle Type
1	Motor Cycles
2	Car/Taxi/Jeep
3	Minibus/Pickup/Wagon
4	Medium Bus/Large Bus
5	Tractor
6	Tractor-torlley
7	2-axle Truck
8	3-axle Truck
9	4-axle Truck
10	5-axle Truck
11	6-axle Truck

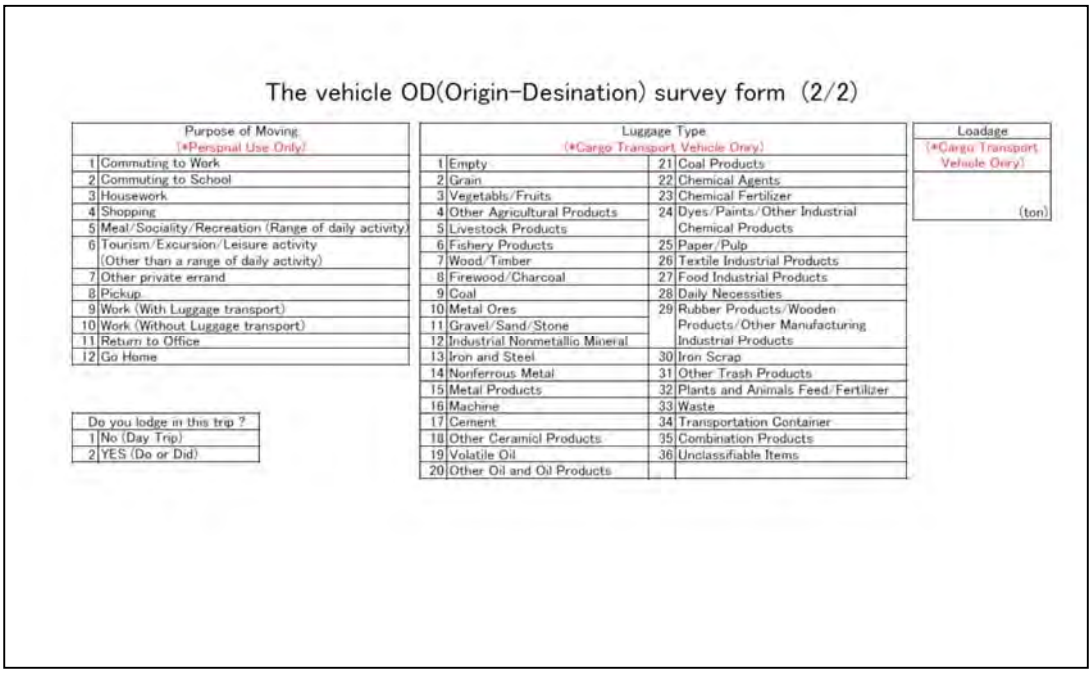
Owner Type
1 Personal Use
2 Business Use

Origin Point (District Name)

Destination Point (District Name)

Passenger Number (Include Driver)

	Facility of Origin and Destination: Facility Type	Origin	Destination
1	Home		
2	Residence(Not Home)		
3	School/Education Facility		
4	Culture/Religion Facility		
5	Medical/Welfare Facility		
6	Office/Company/Bank		
7	Public office(Government office)		
8	Supermarket/Department store		
9	Other Shops		
10	Accommodation/Hotel		
11	Factory/Laboratory		
12	Farm/Plantation		
13	Harbor		
14	Airport		
15	Railroad Station		
16	Truck Terminal		
17	Distribution Center		
18	Other Transport Facilities		
19	Market		
20	Warehouse		
21	Waste Disposal Site		
22	Other		



The vehicle OD(Origin-Desination) survey form (2/2)

Purpose of Moving (*Perspnal Use Only)
1 Commuting to Work
2 Commuting to School
3 Housework
4 Shopping
5 Meal/Sociality/Recreation (Range of daily activity)
6 Tourism/Excursion/Leisure activity (Other than a range of daily activity)
7 Other private errand
8 Pickup
9 Work (With Luggage transport)
10 Work (Without Luggage transport)
11 Return to Office
12 Go Home

Do you lodge in this trip ?
1 No (Day Trip)
2 YES (Do or Did)

Luggage Type (*Cargo Transport Vehicle Only)			
1	Empty	21	Coal Products
2	Grain	22	Chemical Agents
3	Vegetabls/Fruits	23	Chemical Fertilizer
4	Other Agricultural Products	24	Dyes/Paints/Other Industrial Chemical Products
5	Livestock Products		
6	Fishery Products	25	Paper/Pulp
7	Wood/Timber	26	Textile Industrial Products
8	Firewood/Charcoal	27	Food Industrial Products
9	Coal	28	Daily Necessities
10	Metal Ores	29	Rubber Products/Wooden Products/Other Manufacturing Industrial Products
11	Gravel/Sand/Stone		
12	Industrial Nonmetallic Mineral		
13	Iron and Steel	30	Iron Scrap
14	Nonferrous Metal	31	Other Trash Products
15	Metal Products	32	Plants and Animals Feed/Fertilizer
16	Machine	33	Waste
17	Cement	34	Transportation Container
18	Other Ceramicl Products	35	Combination Products
19	Volatile Oil	36	Unclassifiable Items
20	Other Oil and Oil Products		

Loadage (*Cargo Transport Vehicle Only)
(ton)

図 6.2.5　OD 調査票

(2)　調査結果

1)　MaiJCT

① 平日

平日の自動車の利用目的は、90%が業務利用で 10%が個人利用である。

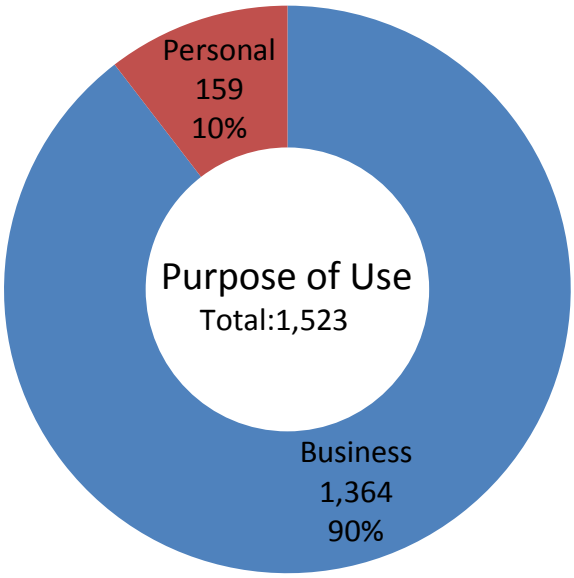


図 6.2.6　自動車の利用目的(平日)

業務利用車両の目的施設は、空港、港湾等が最も多く、全体の 25%、次いで、住居が 19%、その他の 17%の順となっている。

当地区の業務利用車両の特徴として、工場、農場を目的地とする交通が多く、工場が全体の 5%、農場が同 11%を占めている。

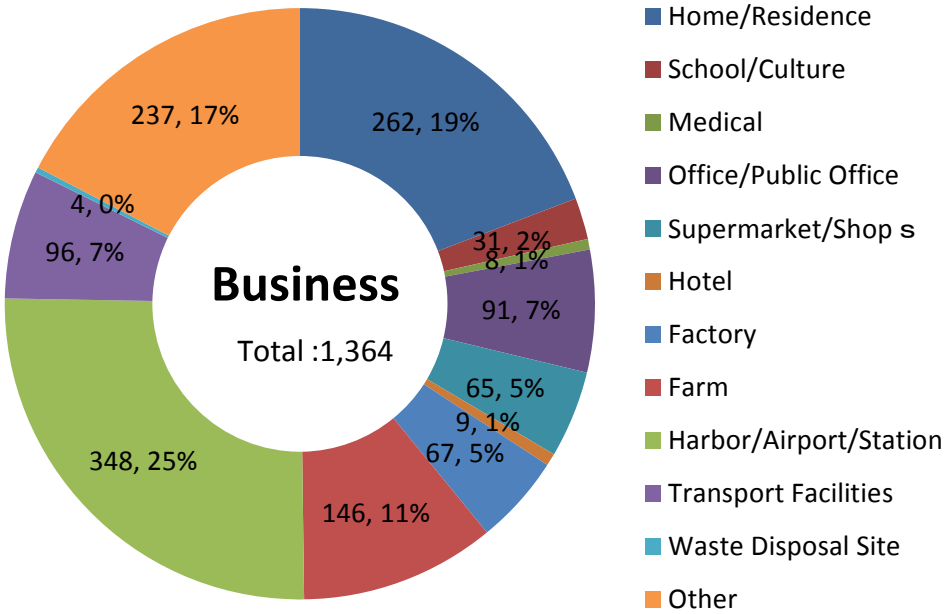


図 6.2.7　業務利用車両の目的施設(平日)

当地区では、目的施設分類がその他となっている交通が多く、ワゴン車やバスなどで、目的地を特定しない旅客移動用車両が多く含まれている。

平日の業務用車両では、同乗者数が複数以上の車両が全体の 71%、そのうち 4 名以上は 41%を占める。

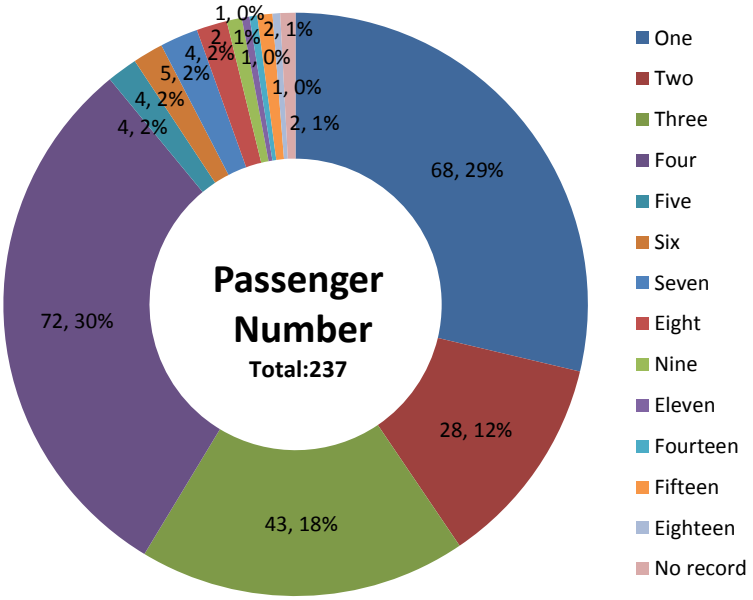


図 6.2.8　業務用車両のうち目的地がその他の車両の乗者人数(平日)

個人利用車両の目的施設は住宅が最も多く、次いで空港、港湾等が 21%、その他が 15%となっている。

当地区の個人利用車両の特徴として、学校及び文化施設、オフィス、スーパーマーケットを目的とする交通が存在し、順番に４%、11%、9%を占める状況から、少数であるが通勤、通学、買い物等での個人需要が存在する。

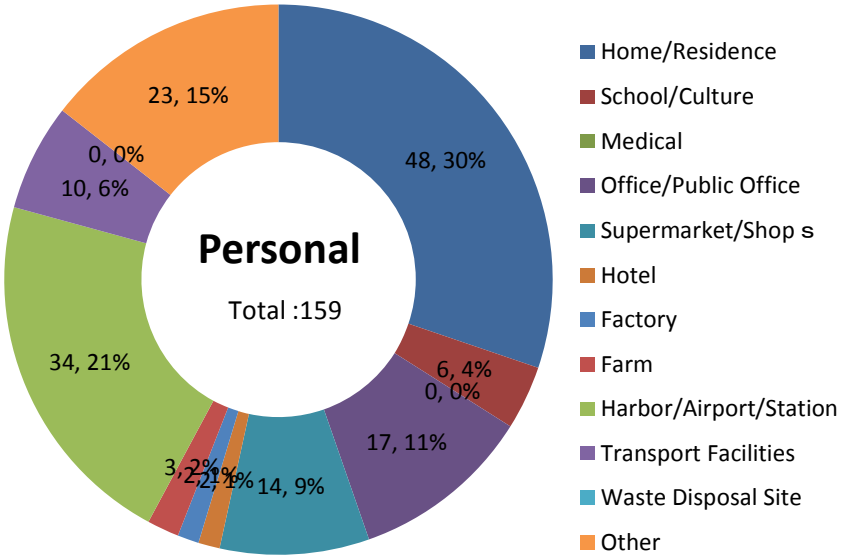


図 6.2.9　個人利用車両の目的施設(平日)

個人用車両のその他の利用は、業務用車両と異なり、87%が 2 人以下の乗車人数のため、回答できないもしくは複数の目的地があるなどで、調査員による施設の特定ができなかったものと考えられる。

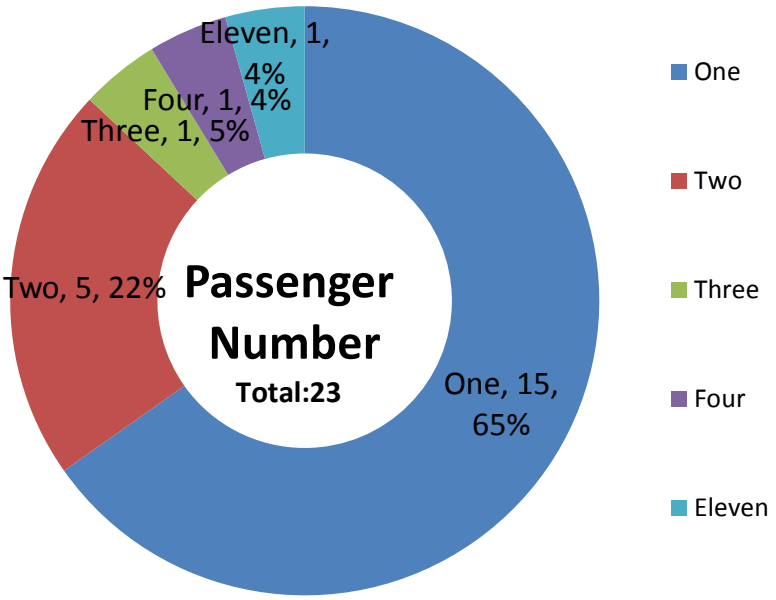


図 6.2.10　業務用車両のうち目的地がその他の車両の乗者人数(平日)

② 休日

休日の自動車の利用目的は、71%が業務利用で 29%が個人利用である。

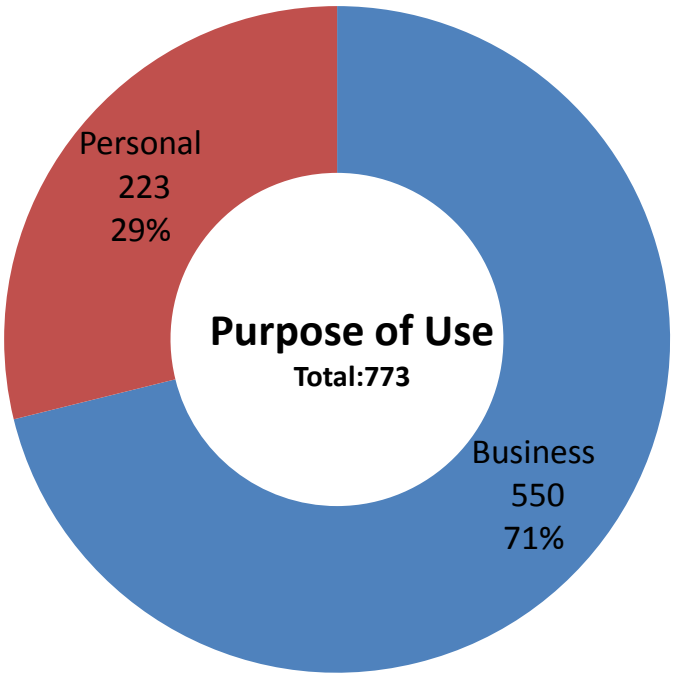


図 6.2.11　自動車の利用目的(休日)

休日の業務利用車両の目的施設は、住居が 27%、次いで、その他が 25%となっており、平日は 25%を有する空港、港湾等が 6%と大幅に少ない状況である。

多くがパームヤシ及びその関連と考えられる農場及び工場を目的地とする交通は、休日であってもそれぞれ 16%、13%となっている。

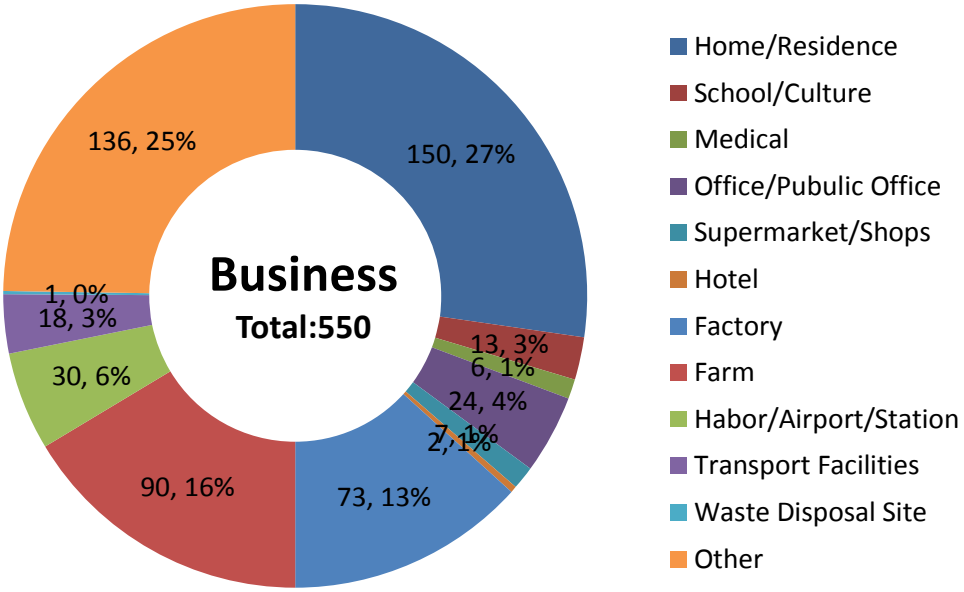


図 6.2.12　業務利用車両の目的施設(休日)

当地区では、目的施設分類がその他となっている交通が多く、ワゴン車やバスなどで、目的地を特定しない旅客移動用車両が多く含まれている。

休日においても、業務用車両では、同乗者数が複数以上の車両が全体の 48%、そのうち 4 名以上は 22%を占める。

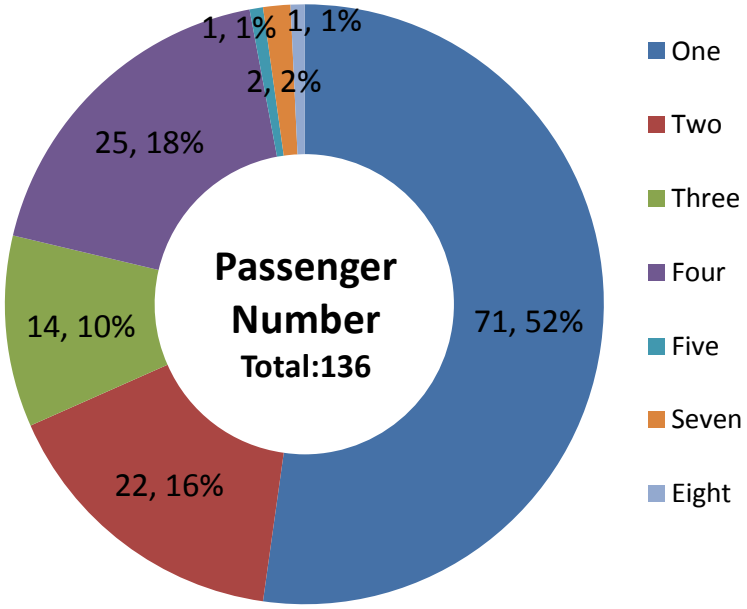


図 6.2.13　業務用車両のうち目的地がその他の車両の乗者人数(休日)

休日の個人利用車両の目的施設は住宅が最も多く 58%を占め、次いでその他が 20%、空港、港湾等が 7%となっている。

当地区の個人利用車両の特徴として、休日でも少数ながら学校及び文化施設、オフィス、農場を目的とする交通が存在し、順番に 5%、3%、2%となっており、宗教関連施設や少数の通勤などの個人需要が考えられる。

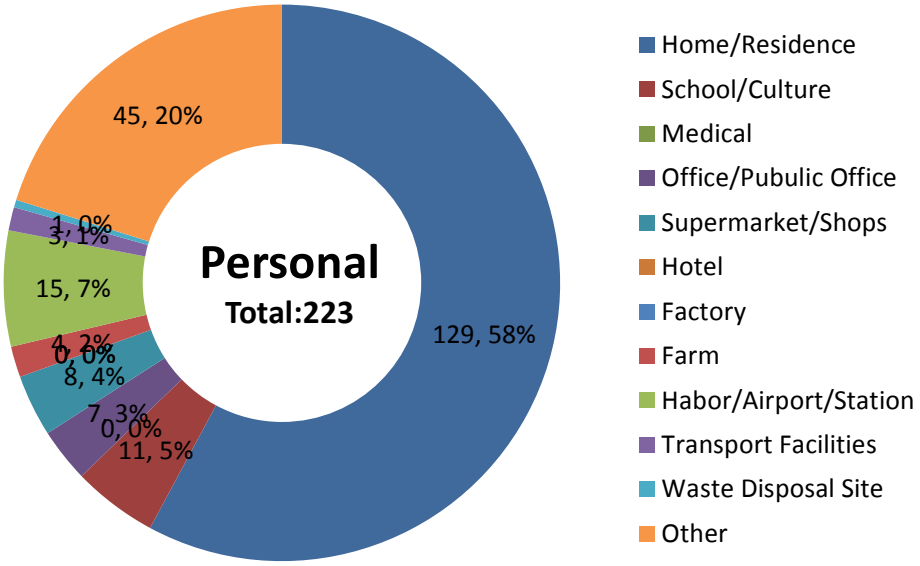


図 6.2.14　個人利用車両の目的施設(休日)

個人用車両のその他の利用は、平日と同様に 89%が 2 人以下の乗車人数のため、回答できないもしくは複数の目的地があるなどで、調査員による施設の特定ができなかったものと考えられる。

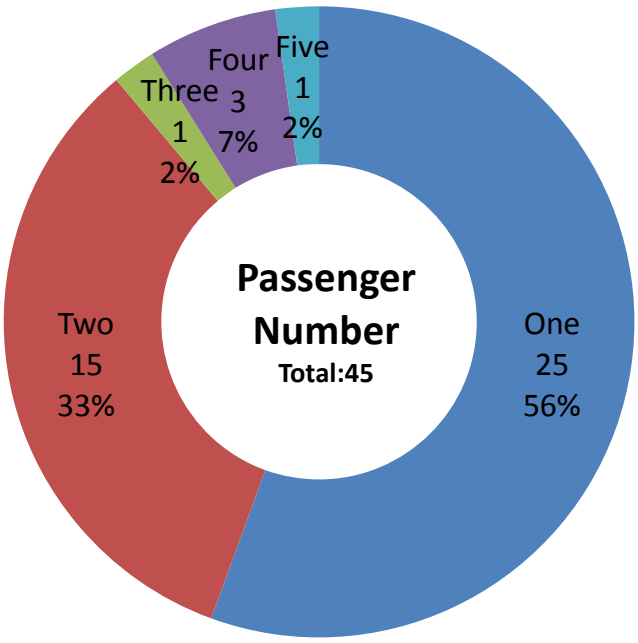


図 6.2.15　業務用車両のうち目的地がその他の車両の乗者人数(休日)

2)　Silanga

① 平日

平日の自動車の利用目的は、90%が業務利用で 10%が個人利用である。

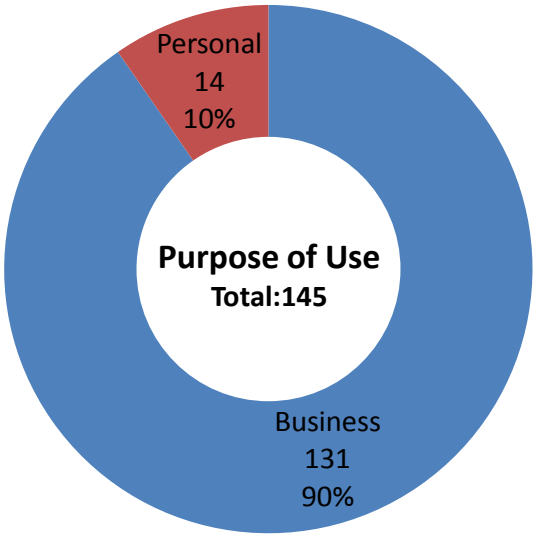


図 6.2.16　自動車の利用目的(平日)

業務利用車両の目的施設は、住居等が最も多く全体の 32%、次いで、商店 27%、物流系施設 18%の順となっている。

当地区の業務利用車両の特徴として、商業施設や物流系施設を目的地とする交通が多く全体の 45%を占めるとともに、Mai JCT で多数を占めた、その他（特定の目的地を持たない交通）は少ない。

また、オフィスは８%あるが、病院 5%が農場 4%よりも多い。

当地区は空港や港湾等から距離があるため、これらを目的地とする交通は少なく、わずかに 2%となっている。

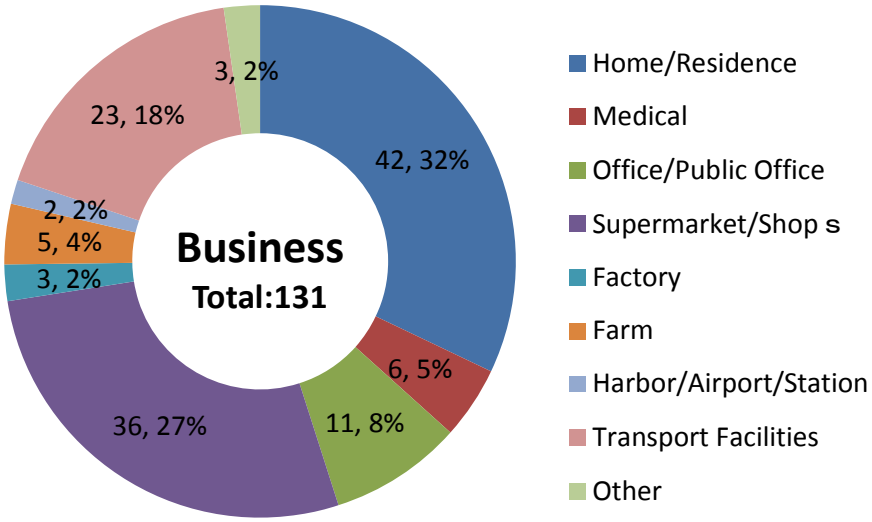


図 6.2.17　業務利用車両の目的施設(平日)

当地点の平日の業務利用車両の乗車人数は、1 人が最も多く 43%を占める。

2 人以上の複数人員乗車車両のうち、4 人以上の車両は 35%を占め、業務用のバス等の乗合車両も多く含まれる。

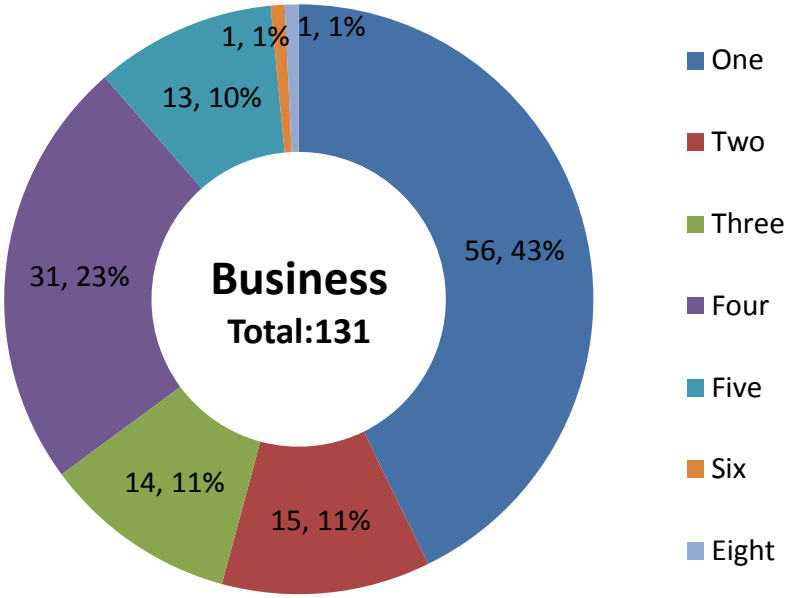


図 6.2.18　業務用車両の乗者人数(平日)

個人利用車両は総数 14 台と極めて少なく、目的施設は住宅が最も多く 36%、次いで商店等の 29%となる。

当地区の個人利用車両の特徴として、商店等を目的地とする交通が多く、さらに、病院、物流施設等を目的とする交通も見られる。

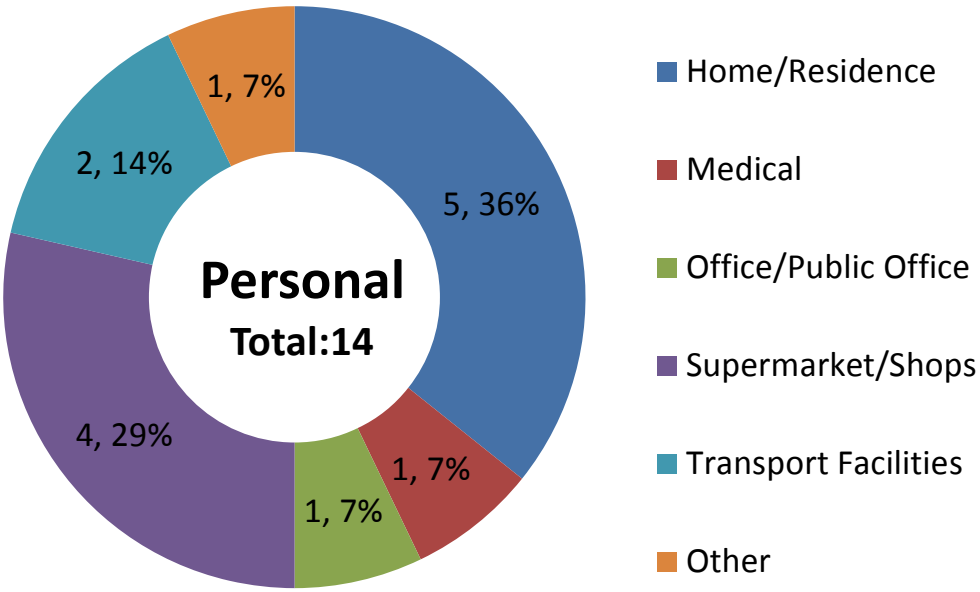


図 6.2.19　個人利用車両の目的施設(平日)

当地点の平日の個人利用車両の乗車人数は、1 人が最も多く 57%を占め、2 人の車両と合わせて全体の 86%を占めている。

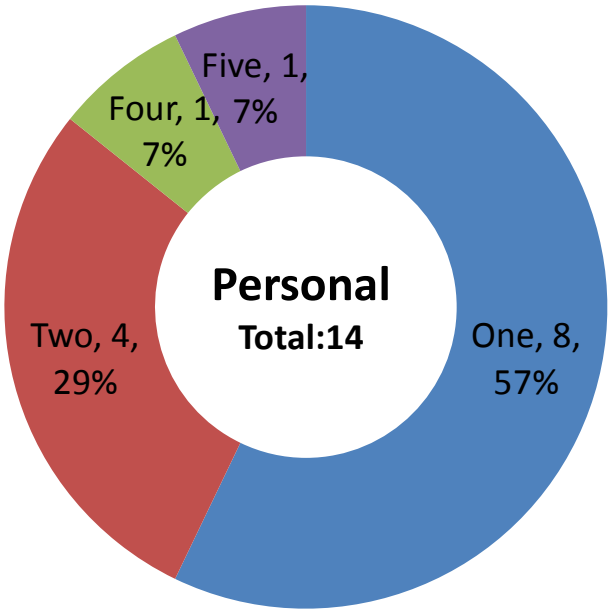


図 6.2.20　個人用車両の乗者人数(平日)

② 休日

休日の自動車の利用目的は、72%が業務利用で 28%が個人利用である。

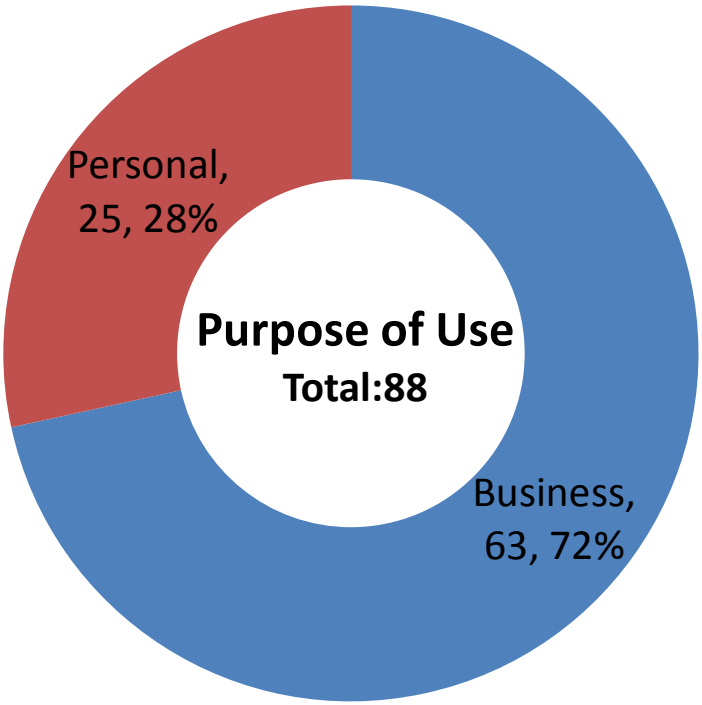


図 6.2.21　自動車の利用目的(休日)

業務利用車両の目的施設は、平日と同様に住居等が最も多く全体の 22%、を占めるが、次いで病院 18%、オフィス 17%となっており、商業施設及び物流施設よりも多い状況にある。

また、平日に見られなかった学校及び文化施設への交通が 5%みられ、キリスト教徒が多い地区であることから、日曜礼拝の交通と考えられる。

空港に向かう交通は平日同様にわずかながら存在しており、休日の長距離移動需要も存在する。

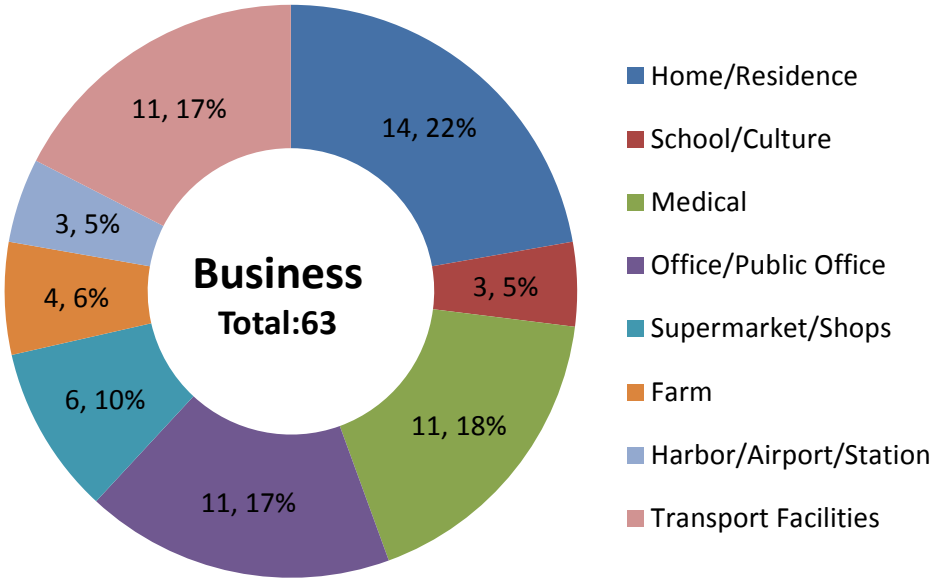


図 6.2.22　業務利用車両の目的施設(休日)

当地点の休日の業務利用車両の乗車人数は、1 人が最も多く 40%を占める。

2 人以上の複数人員乗車車両のうち、4 人以上の車両は 11%であり、平日と比べて、業務用のバス等の乗合車両が減少している状況と考えられる。

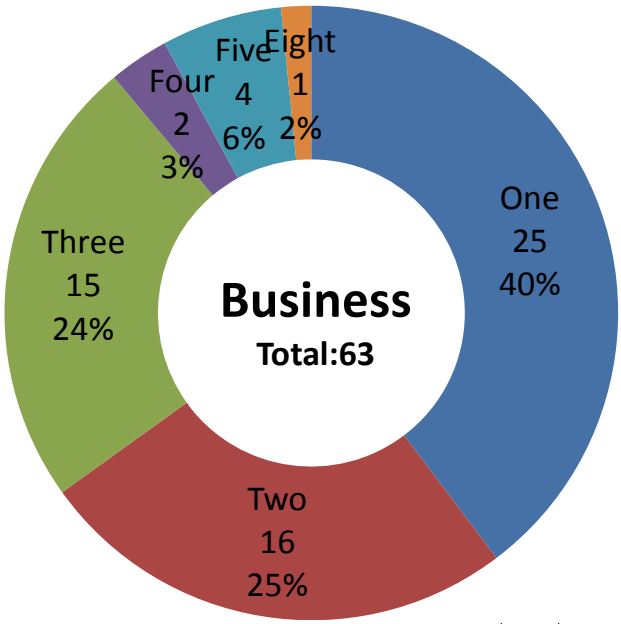


図 6.2.23　業務用車両の乗者人数(休日)

個人利用車両は平日より多い総数 25 台となっており、目的施設は平日と同様に住宅が最も多く 40%となっている。

当地区の休日交通の特徴として、商店や物流施設の割合が平日に比べて減少し、学校及び文化施設が増加することから、キリスト教の日曜礼拝を目的とする交通が多いことが考えられる。

また、平日に比してオフィスを目的地とする交通が多い特徴があることから、職場でのイベント等が開催された可能性も考えられる。

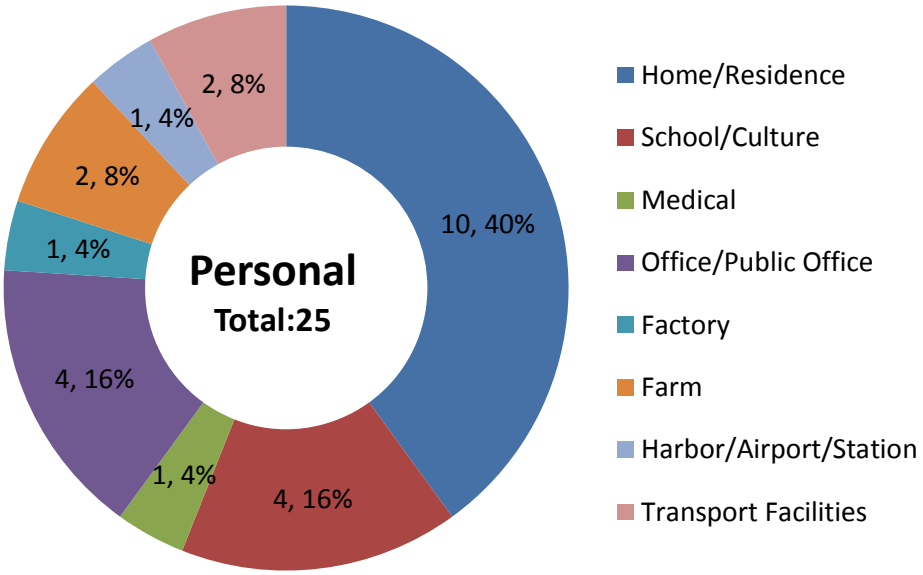


図 6.2.24　個人利用車両の目的施設(休日)

休日の個人利用車両の乗車人数は、平日と同様に 1 人が最も多く 56%を占め、2 人の車両と合わせて全体の 84%を占めている。

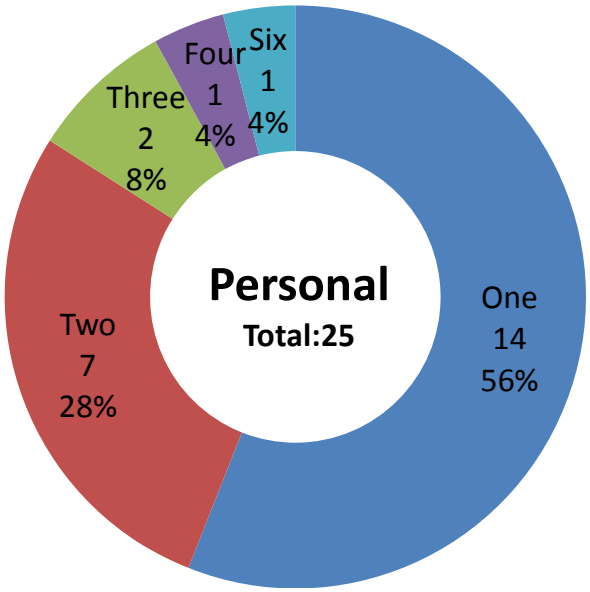


図 6.2.25　個人用車両の乗者人数(休日)

6.2.3 軸重調査

軸重調査は、交通結節点であるＭａｉ　ＪＣＴでの観測を予定していたが、現地調査の結果、道路幅員が狭く退避スペースが取れないことから、交通渋滞や事故の発生が懸念されたため、大型車両を所有するＮＢＰＯＬ、ＳＢＬＣの両社の協力の下、以下の３地点で実施した。

(1)　kimbe　Port

当該箇所は、ＮＢＰＯＬの輸出用貯蔵タンクが存在し、全ての箇所のタンクローリーが満載状態で到着する地点であり、港湾関係者以外の車両の進入が殆ど見られないことから安全性も高いため、貯蔵タンク基地へのアクセス道路をタンクローリーの計測地点とした。

(2)　Kumbango　Mill（NBPOL）

当該箇所は、ＮＢＰＯＬの製油工場であり、収穫されたパームヤシ果実の収集車両が到着する地点であり、一般車両の進入がなく安全性が高いため、収穫用大型トラックの計測地点とした。

(3)　ＳＢＬＣ本社前（前面道路）

当該箇所は、ＨＯＳＫＩＮＳとＫＩＭＢＥを結ぶ主要幹線道路上に位置するが、ＳＢＬＣの本社前に木材運搬車の待機スペースが確保されており、道路幅員も広く、直線で視界も良好であることから、一般車両に対する交通安全の確保が容易でると判断されたため、木材運搬車の計測値店とした。

軸重調査結果を、表 6.2.7 に示す。

表 6.2.7　軸重調査結果

NO	TIME	REGIST-RATION	ORIGIN	DISTINA-TION	AXLE CONFIG	LUGGAGE TYPE	AXLE LOADS (TON)							COMM ENTS
							1	2	3	4	5	6	TOTAL	
1	8:15	KAD583	Kumbango	Kimbe port	1.22-222	OIL	6.060	10.400	10.330	7.900	8.650	8.650	51.990	S13
2	8:20		Mosa	Kimbe port	1.22-222	OIL	6.000	10.150	9.880	7.560	7.940	8.080	49.610	S16
3	8:25	KAD856	Kumbango	Kimbe port	1.22-222	OIL	5.490	9.320	9.330	7.500	7.750	7.620	47.010	S15
4	8:30	KAE657	Wars Stone	Kimbe port	1.22-222	OIL	6.240	9.900	9.660	8.810	7.550	7.990	50.150	S25
5	8:40	KAE308	Mosa	Kimbe port	1.22-222	OIL	5.960	9.010	8.840	7.440	7.450	7.210	45.910	S20
6	9:32	GAB308	Kapiura	Kimbe port	1.22-222	OIL	6.150	10.200	9.590	8.560	7.850	8.100	50.450	S29
7	9:38	KAG104	-	Kumbango	11.22	Fruits	6.670	5.800	8.840	7.230			28.540	C190
8	9:45	KAE649	-	Kumbango	1.22	Fruits	6.340	10.160	8.880				25.380	C149
9	9:48	KAG108	Wasisi	Kumbango	11.22	Fruits	6.390	6.050	9.730	9.910			32.080	C186
10	9:51	KAE575	Kapiura	Kimbe port	1.22-222	OIL	5.760	9.470	7.640	7.780	7.500	7.820	45.970	S23
11	9:55	BCB434	Haella	Kumbango	1.22	Fruits	8.720	11.420	11.450				31.590	C172
12	9:58	BCB436	Koimumu	Kumbango	1.22	Fruits	8.610	11.120	11.140				30.870	C173
13	10:25	KAD342	-	Kumbango	1.22	Fruits	7.890	11.490	11.400				30.780	C153
14	10:33	KAF647	-	Kumbango	1.22	Fruits	8.170	11.660	11.670				31.500	C146
15	10:40	KAF650	-	Kumbango	1.22	Fruits	8.340	11.320	10.920				30.580	C148
16	10:43	KAD984	-	Kumbango	11.22	Fruits	5.900	6.500	10.870	9.340			32.610	C122
17	10:49	KAE648	-	Kumbango	1.22	Fruits	8.210	10.740	10.730				29.680	C147
18	10:59	KAG157	-	Kumbango	11.22	Fruits	6.570	6.030	10.520	10.510			33.630	C194
19	11:02	BCE895	-	Kumbango	11.22	Fruits	6.980	6.450	11.360	10.650			35.440	C182
20	11:04	KAD341	-	Kumbango	1.22	Fruits	8.090	11.130	11.040				30.260	C152
21	11:07	KAE652	-	Kumbango	1.22	Fruits	7.490	11.920	11.870				31.280	C150
22	11:10	KAD938	Kapiura	Kimbe Port	1.22-222	OIL	6.010	8.280	8.230	7.910	7.510	7.850	45.790	S17
23	13:40	KAD223	-	Baluma	1.22-22	Woods	8.770	13.690	14.660	11.960	11.500		60.580	
24	15:20	KAD993	Kimbe	Hoskins	1.22-222	CON	4.390	5.990	5.500	8.280	6.480	6.130	36.770	
25	15:40	KAD227	Buvusi	Baluma	1.22-22	Woods	8.520	14.970	14.820	8.760	8.610		55.680	

6.3 道路構造検討

6.3.1 舗装

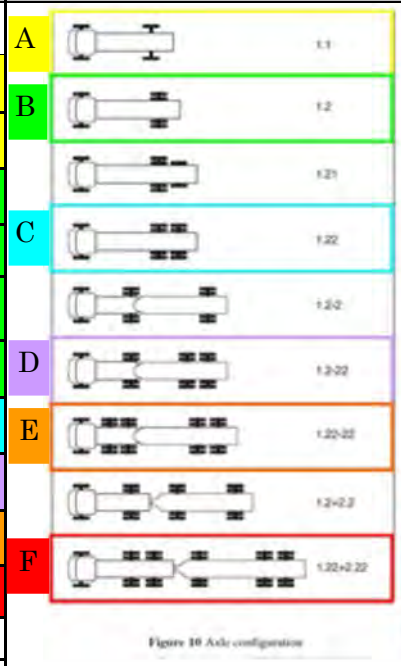
(1) 舗装構成の検討

舗装構造は、現地で実施した交通量調査と軸重調査の結果に基づき決定した。

1) 設計基準交通量及び設計軸重

設計基準交通量は、現地の夜間交通量が非常に少なく、特に大型車の走行が殆どみられないため、Mai JCT における Bialla 方面の 12 時間交通量とした。

表 6.3.1　Mai JCT の平日 12 時間車種別交通量（Bialla 側断面）

車種区分		方向別交通量			車種区分参考図
		Kimbe	Bialla	合計	
	Motor Cycles	7	8	15	
A	Car/Taxi/Jeep	3	23	26	
A	Minibus/Pickup/Wagon	49	72	121	
B	Medium Bus/Large Bus	127	126	253	
B	Tractor	1	0	1	
B	Tractor-torlley	0	0	0	
B	2-axle Truck	25	39	64	
C	3-axle Truck	16	15	31	
D	4-axle Truck	5	5	10	
E	5-axle Truck	25	19	44	
F	6-axle Truck	6	15	21	
	More than 7-axle	0	0	0	
	Other	0	0	0	
全車種合計		264	322	586	

現地の軸重調査結果では、木材運搬に係る大型車の重量が 60 t 超であり、軸重も最大 15 トン近くに達している状況にあり、走行規制の実施もなされていない状況であることから、これらの車両による荷重を考慮したうえで荷重計算を実施した。

表 6.3.2　軸重調査結果による大型車両の平均軸重（車軸別）

6-Axle(trailer)

Survey point	AXLE CONFIG	Axle number	LUGGAGE TYPE	AXLE LOADS (TON) 1	2	3	4	5	6	7	TOTAL	COMMENTS
Kimbe　Port	1.22-222	6	OIL	6.060	10.400	10.330	7.900	8.650	8.650		51.990	S13
Kimbe　Port	1.22-222	6	OIL	6.000	10.150	9.880	7.560	7.940	8.080		49.610	S16
Kimbe　Port	1.22-222	6	OIL	5.490	9.320	9.330	7.500	7.750	7.620		47.010	S15
Kimbe　Port	1.22-222	6	OIL	6.240	9.900	9.660	8.810	7.550	7.990		50.150	S25
Kimbe　Port	1.22-222	6	OIL	5.960	9.010	8.840	7.440	7.450	7.210		45.910	S20
Average				**6.00**	**9.80**	**9.60**	**7.80**	**7.90**	**7.90**		**48.90**	

4-axle(truck)

Survey point	AXLE CONFIG	Axle number	LUGGAGE TYPE	AXLE LOADS (TON) 1	2	3	4	5	6	7	TOTAL	COMMENTS
Kumbango Mill	11.22	4	Fruits	6.670	5.800	8.840	7.230				28.540	C190
Kumbango Mill	11.22	4	Fruits	6.390	6.050	9.730	9.910				32.080	C186
Kumbango Mill	11.22	4	Fruits	5.900	6.500	10.870	9.340				32.610	C122
Kumbango Mill	11.22	4	Fruits	6.570	6.030	10.520	10.510				33.630	C194
Kumbango Mill	11.22	4	Fruits	6.980	6.450	11.360	10.650				35.440	C182
Average				**6.50**	**6.20**	**10.30**	**9.50**	**0.00**	**0.00**		**32.50**	

3-axle(truck)

Survey point	AXLE CONFIG	Axle number	LUGGAGE TYPE	AXLE LOADS (TON) 1	2	3	4	5	6	7	TOTAL	COMMENTS
Kumbango Mill	1.22	3	Fruits	6.340	10.160	8.880					25.380	C149
Kumbango Mill	1.22	3	Fruits	8.720	11.420	11.450					31.590	C172
Kumbango Mill	1.22	3	Fruits	8.610	11.120	11.140					30.870	C173
Kumbango Mill	1.22	3	Fruits	7.890	11.490	11.400					30.780	C153
Kumbango Mill	1.22	3	Fruits	8.170	11.660	11.670					31.500	C146
Kumbango Mill	1.22	3	Fruits	8.340	11.320	10.920					30.580	C148
Kumbango Mill	1.22	3	Fruits	8.210	10.740	10.730					29.680	C147
Kumbango Mill	1.22	3	Fruits	8.090	11.130	11.040					30.260	C152
Kumbango Mill	1.22	3	Fruits	7.490	11.920	11.870					31.280	C150
Average				**8.00**	**11.20**	**11.00**					**30.20**	

5-axle(trailer)

Survey point	AXLE CONFIG	Axle number	LUGGAGE TYPE	AXLE LOADS (TON) 1	2	3	4	5	6	7	TOTAL	COMMENTS
SBLC HQ Front	1.22-22	5	Woods	8.770	13.690	14.660	11.960	11.500			60.580	
SBLC HQ Front	1.22-22	5	Woods	8.520	14.970	14.820	8.760	8.610			55.680	
Average				**8.60**	**14.30**	**14.70**	**10.40**	**10.10**			**58.10**	

表 6.3.3　軸重調査結果による大型車両の平均軸重（車軸別）

		Motor Cycles	Car/Taxi/Jeep	Minibus/Pick up/Wagon	Medium Bus/Large Bus	Tractor	Tractor-torlley	2-axle Truck	3-axle Truck	4-axle Truck	5-axle Truck	6-axle Truck	More than 7-axle	Other
PNG		-	1.1	1.1	1.2	1.2	1.2	1.2	1.22	1.2-22	1.22-22	1.22+2.22	-	1.2
Axle load (ton)	1		**1**	1	**2**	2	2	2	**8.0**	**6.5**	**8.6**	**6.0**		2
	2		**1**	1	**5**	5	5	5	**11.2**	**6.2**	**14.3**	**9.8**		5
	3								**11.0**	**10.3**	**14.7**	**9.6**		
	4									**9.5**	**10.4**	**7.8**		
	5										**10.1**	**7.9**		
	6											**7.9**		
	T		2	**2**	**7**	**7**	**7**	**7**	**30.2**	**32.5**	**58.1**	**49**	**0**	**7**

設計期間と設計交通量

舗装の設計期間は、パプアニューギニア及び日本の両国ともに 10 年～20 年が一般的な検討機関とされており、今回は最も一般的に使用されている 10 年とした。

設計交通量は、設計期間の走行台数の累積により決定される。

このとき、設定した設計期間に含まれる将来交通量は、設計基準交通量に経済成長による交通量の伸び率を考慮したものとし、想定する伸び率は同路線で実施されている BRIRAP プロジェクトと同様に算定した。

車種別の設計交通量（現在以降 10 年間の合計交通量）は表 6.3.4 の通りとする。

表 6.3.4　車両区分別平日 12 時間交通量(10 年間平均)

車種	現在			10 年間合計(成長率:10%/年)		
	Kinbe	Bialla	合計	Kinbe	Bialla	合計
A	52	95	147	771	1,408	2,179
B	153	165	318	2,268	2,446	4,713
C	16	15	31	237	222	459
D	5	5	10	74	74	148
E	25	19	44	371	282	652
F	6	15	21	89	222	311

2)　舗装構成の検討

舗装構成の検討に当たっては、海外におけるアスファルト舗装の施工及び材料調達等について、日本国内において、舗装施工業者及び瀝青材料業者の海外担当部門に対するヒアリングを行い、日本の舗装施工技術とパプアニューギニアにおける舗装工事の問題点等について確認した。

① 橋梁部

本プロジェクトの現地調査において、HMA の材料を精製するアスファルトプラント及び施工機械が現地に存在しないことが確認されていることから、これらの施設を使用せず、現地に既存するコンクリートミキサーを代用した小ロット施工の可能性について検討した。

コンクリートミキサーを用いた施工の実績では、ミキサーの容量からアスファルト加熱混合物の生成量に制約があるため、1 セット一日の施工面積が 60m²（厚さ 5ｃｍ）程度となる。今回の橋梁面積はカピウラ橋約 1,030m²、アウム橋約 680m² の車道舗装面積が必要となることから、各 17 日、11 日の分割施工となるため、1 セットでの施工では、車線上に多数の施工時継ぎ目が発生することが避けられず、接着力不足による分離やひび割れの発生とともに、浸水による破損などでの防水機能が低下し、鉄筋コンクリート床板の劣化など橋梁全体への悪影響は避けられない状況となる。

なお、これらの状況を避ける方法として、材料混合用の加熱ミキサーを 17 セット投入し同時施工を行うことが可能と考えられるが、機械調達及び混合材料の均質性など品質管理が非常に困難で現実的ではない。

したがって、橋梁における HMA の施工は、アスファルトプラント及び施工機械の導入による一括施工が橋梁全体に係る品質確保として必要不可欠と判断される。

② 一般部

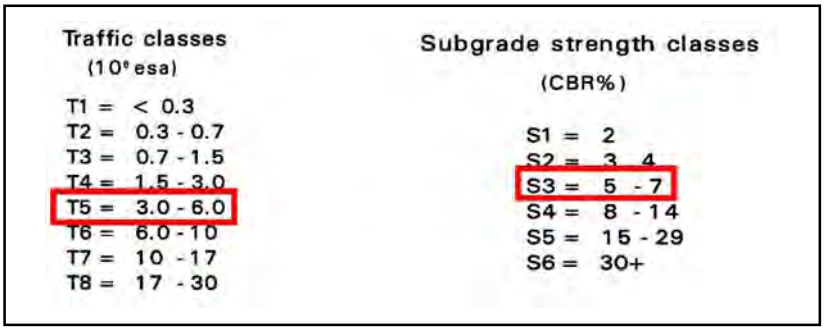
橋梁部を除く一般部の舗装構成は、現地での施工性を考慮し、現地基準（OVERSEAS ROAD　NOTE　31、以下「ORN31」とする）に基づき設定することを基本とし、比較案として、日本の舗装設計便覧に準拠した場合についても検討を実施した。ORN31 における舗装構成決定条件は下記の通り。

- 交通量区分：T5（3.0≦ESA≦6.0：表 6.3.5,図 6.3.1 参照）
- 路盤強度区分：S3（設計 CBR＝ 6%：盛土材料　図 6.3.1 参照）

表 6.3.5　ORN31　舗装交通カテゴリー算定表

車種(タイヤ数)	12h交通量* (/1方向)	軸重 (ton)	EF (軸重/8.16)^4.5	ESA	備考
Car/Taxi/Jeep(1.1)	1,408	1.4	0.0004	0.51	-
		2	0.0018	2.52	
Medium Bus/Large Bus/2-axle Truck(1.2)	2,446	2	0.0018	4.37	-
		5	0.1103	269.86	
3-axle Truck (1.22)	222	8	0.9147	203.37	Fruits
		11.2	4.1579	924.40	
		11	3.8341	852.41	
4-axle Truck (1.2-22)	74	6.5	0.3593	26.63	Fruits
		6.2	0.2905	21.53	
		10.3	2.8521	211.36	
		9.5	1.9822	146.90	
5-axle Truck (1.22-22)	282	8.6	1.2666	356.68	Woods
		14.3	12.4855	3516.04	
		14.7	14.1359	3980.79	
		10.4	2.9788	838.86	
		10.1	2.6112	735.34	
6-axle Truck (1.22-2.22)	222	6	0.2507	55.73	OIL
		9.8	2.2799	506.87	
		9.6	2.0779	461.96	
		7.8	0.8162	181.47	
		7.9	0.8644	192.18	
		7.9	0.8644	192.18	
交通量合計	4,654			13681.94	12h当たり
8.16t換算軸重　(10^6esa)				**4.99**	**T5　class**

*：12h 交通量は交通量の多い Kimbe 方向を使用する



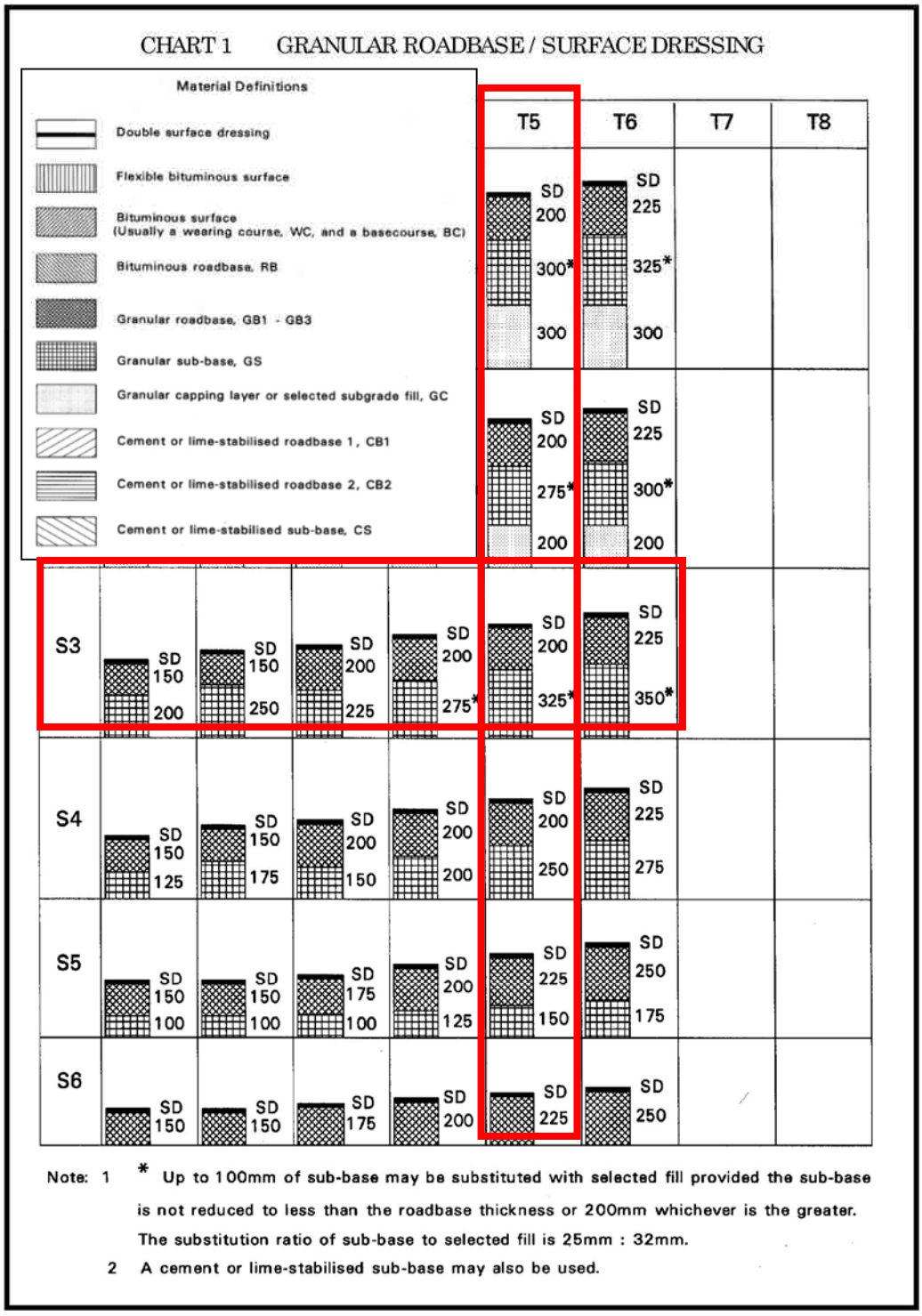
出典：Overseas Road Note 31(P9,P12)

図 6.3.1　舗装構成決定における交通量区分及び路盤強度区分

図 6.3.2 より、舗装構成は以下の通りとする。

- 舗装厚 52.5cm＋DBST

（表層 :DBST、上層路盤： 200 ㎜（Crushed Rock）、下層路盤 325 ㎜（Natural gravel）



出典：Overseas Road Note 31（P53）

図 6.3.2　砕石路盤における舗装構成

次に、日本における一般的な舗装構成手法(TA 法)に基づく舗装構成として、舗装設計便覧に準拠して舗装構成を決定する。

・　交通量区分：N5（表 6.3.6,図 6.3.3 参照）

表 6.3.6　TA 法における疲労破壊輪数の算定式

車種（タイヤ数）	12h交通量*（/1方向）	代表輪過重（ton）	換算係数（輪過重/5）^4	N49	備考
Car/Taxi/Jeep（1.1）	1,408	0.7	0.0004		適用外
		1.0	0.0016		適用外
Medium Bus/Large Bus/2-axle Truck（1.2）	2,446	1.0	0.0016	3.91	-
		2.5	0.0625	152.85	
3-axle Truck（1.22）	222	4.0	0.4096	91.06	Fruits
		5.6	1.5735	349.83	
		5.5	1.4641	325.50	
4-axle Truck（1.2-22）	74	3.3	0.1785	13.23	Fruits
		3.1	0.1478	10.95	
		5.2	1.1255	83.41	
		4.8	0.8145	60.36	
5-axle Truck（1.22-22）	282	4.3	0.5470	154.04	Woods
		7.2	4.1816	1177.58	
		7.4	4.6695	1314.97	
		5.2	1.1699	329.44	
		5.1	1.0406	293.04	
6-axle Truck（1.22-2.22）	222	3.0	0.1296	28.81	OIL
		4.9	0.9224	205.06	
		4.8	0.8493	188.83	
		3.9	0.3702	82.29	
		4.0	0.3895	86.60	
		4.0	0.3895	86.60	
交通量合計	4,654			5,038.38	12h当たり
N49換算輪数				1,839,009	回/10年

＊：12h 交通量は交通量の多い Kimbe 方向を使用する

交通区区分	舗装計画交通量（単位：台／日・方向）	疲労破壊輪数（単位：回／10年）
N7	3,000以上	35,000,000
N6	1,000以上3,000未満	7,000,000
N5	250以上1,000未満	1,000,000
N4	100以上 250未満	150,000
N3	40以上100未満	30,000
N2	15以上40未満	7,000
N1	15未満	1,500

出典：舗装設計便覧（P30）

図 6.3.3　疲労破壊輪数の基準値

➢　必要等値換算厚 T_A：$3.84N^{0.16}／CBR^{0.3}＝22.55cm$（信頼度 90%,設計 CBR＝6%）

図 6.3.4 より、AS 層の最小厚さ 10cm を確保するものとし、必要等値換算厚 T_A を満足する舗装構成を表 6.3.7 の通り設定する。

交通区分	舗装計画交通量（台/日・方向）	表層と基層を加えた最小厚さ（cm）
N_7	3,000以上	20（15）〔注1〕
N_6	1,000以上 3,000未満	15（10）〔注1〕
N_5	250以上 1,000未満	10（5）〔注1〕
N_4	100以上　250未満	5
N_3	40以上　100未満	5
N_2，N_1	40未満	4（3）〔注2〕

〔注〕
1．（　）内は，上層路盤に瀝青安定処理工法およびセメント・瀝青安定処理工法を用いる場合の最小厚さを示す。
2．交通量区分N_1，N_2にあって，大型車交通量をあまり考慮する必要がない場合には，瀝青安定処理工法およびセメント・瀝青安定処理工法の有無によらず，最小厚さは 3 cmとすることができる。

出典：舗装設計便覧（P77）

図 6.3.4　AS 層の最小厚さ

表 6.3.7　T_A 法による舗装構成

区分	材料・工法	等値換算係数	舗装厚(cm)	TA 値(cm)
表層＋基層	HMA(5cm×2層)	1.00	10	10
上層路盤	粒調砕石	0.35	15	5.25
下層路盤	RC40	0.25	30	7.50
合計			55	22.55＜22.75

3)　概算工事費の検討

① 施工条件

橋梁部の舗装は、防水性能確保の機能的要件から、アスファルトプラント及びアスファルトフィニッシャを用いた HMA の一括施工が必要とされている。

一方、一般部では、現況交通量が少なく一般的な舗装の設計期間である 10 年間の増加を10%／年として見込んだ場合においても、機能面では一般的な DBST での対応が可能と判断される。

表 6.3.8 に、DBST と HMA の特徴を整理する。

表 6.3.8　DBST と HMA の特徴

工法	2 層瀝青表面処理 (Double Bituminеux Surface Treatment :DBST)	加熱アスファルト混合物 (Hot-Mix Asphalt:HMA)
舗装構成	路盤＋AS 表層（3.2cm）	路盤＋AS 混合物（表層＋基層：10cm）
特徴	・路盤以下への雨水等の進入を防止し道路本体の強度低下を防止する ・道路表面の平滑性を確保し走行性を向上させることが可能 ・施工が簡易であることから部分的な補修等に用いる場合も多く簡易的な舗装として位置付けられる ・ＤＢＳＴは表面保護工であり、単体での耐荷重強度は期待できない	・路盤以下への雨水等の進入を防止し、道路本体の強度低下を防止する ・道路表面の平滑性を確保し走行性を向上させることが可能 ・加熱混合物による現場施行に専用機械を使用し品質管理を行うことが必要 ・骨材粒度の調整や配合材料の利用により摩擦やわだちぼれ等への耐力の強化や、排水性の向上などが可能
適用条件	・路盤の強度が高く平坦で急発進や急停車が少ない区間や、排水処理に問題がない場合に対応が可能 ・長期の防水機能の維持が期待できないため、橋梁への適用が困難	・路盤の状態や交通の状況に合わせて適切な強度を有する構造体の施工が可能であり、基本的に施工場所を選ばない ・変形追従性が高いため、変位の生じる橋梁上の舗装にも適する
課題点	・施工費用は安価であるが、強度及び耐久性に劣るため、日常的なパトロールを行い、破損時の早期補修による損傷拡大防止が維持に必要	・現地に舗装材生成プラントを確保するとともに施工機械の搬入が必要となるため施工費用が高価となる
評価	・交通量が少なく雨水の浸透が致命的とならない土工部に適用が可能	・交通状態に係らず対応が可能であり、橋梁等の変位が大きく防水性機能が重要な場合には適用が不可欠

② 概算工事費

概算工事費の算出においては、DBST は施工時の資機材を現地調達することが可能であるが、HMA の施工に必要な施設（AS プラント及び施工機械）は、現地に存在しないため、日本もしくは近隣諸国からの調達コストを工事費に加算する必要がある。

AS プラント等の導入に際して、日本の舗装施工事業者に対するヒアリング調査によれば、移動式を含む小規模の AS プラントにおいても、概ね 200,000 ㎡が導入の採算ラインとされていることから、200,000 ㎡以下の施工面積の場合、施工面積が大きいほど単位面積当たりの施工コストが低減されるためより経済的となる。

以上を踏まえ、概算工事費は以下の 2 ケースについて比較検討を行うものとした。

- CASE 1.　橋梁区間：HMA＋土工区間：DBST
- CASE 2.　全区間 HMA

検討の結果、本プロジェクトの施工規模においては CASE 2.が約 7%経済性に勝ることが確認された。（表 6.3.9）

また、機能面及び構造面でも、橋梁部、土工部とも HMA は DBST より優れており、安全かつ高品質な走行性を提供することが可能と考えられるため、本プロジェクトでは、土工部も含めた全区間について HMA の採用が望ましいとの結果を得た。

表 6.3.9　概算工事費の比較

	CASE 1		CASE 2	
区分	橋梁部	土工部	橋梁部	土工部
舗装形式	HMA	DBST	HMA	HMA
施工面積	2,000	9,000	2,000	9,000
単価（円／㎡）	92,000	3,400	18,200	18,200
工事費(円)	184,000,000	30,600,000	36,400,000	163,800,000
概算工事費	214,600,000(1.07)		200,200,000(1.00)	

表 6.3.10　施工面積別単価

施工面積 2000 ㎡の場合

種別	施工費(2,000㎡当り)			機材			輸送費	合計	施工単価	摘　要
	材料費	作業費	小計	プラント	施工機械	試験機	(円/一式)	(円)	(円/㎡)	
HMA	3,419,149	92,000	3,511,149	27,400,000	58,020,000	15,000,000	80,000,000	183,931,149	91,966	
DBST	—	—	6,720,000					6,720,000	3,360	Dekenai見積

施工面積 11,000 ㎡の場合

種別	施工費(11,000㎡当り)			機材			輸送費	合計	施工単価	摘　要
	材料費	作業費	小計	プラント	施工機械	試験機	(円/一式)	(円)	(円/㎡)	
HMA	18,805,322	506,000	19,311,322	27,400,000	58,020,000	15,000,000	80,000,000	199,731,322	18,157	

4)　舗装構成の決定

比較検討の結果、本プロジェクトにおける土工部の舗装は HMA を採用するものとし、舗装構成は表 6.3.11 の通りとする。

表 6.3.11　T_A 法による舗装構成

区分	材料・工法	等値換算係数	舗装厚(cm)	TA 値(cm)
表層＋基層	HMA(5cm×2層)	1.00	10	10
上層路盤	粒調砕石	0.35	15	5.25
下層路盤	RC40	0.25	30	7.50
合計			55	22.55＜22.75

6.3.2 排水計画

(1) 降雨排水量の計算

1) 確率日雨量

排水量計算のベースとなる確率日雨量は、河川流量計算と同様に近傍観測所となるダミ観測所の降雨量データを用いて確率日雨量を決定した。

表 6.3.12　ダミ観測所の確率日雨量

Return Period	Daily Rainfall R_{24} (mm/day)
2-year	142.4
5-year	196.1
10-year	245.0
20-year	305.3
50-year	428.9

① 流達時間

対象となる集水エリアが道路周辺に限られることから、流入時間と流達時間の合計が 10 分以下となるため、流達時間（t）は 10 分とする。

② 降雨強度

排水量計算に用いる 10 分間降雨強度は、確率日雨量を使用し物部式により算定する。

物部式：$R = R_{24}/24 \times (24/T)^{0.6}$

このとき、T=流達時間(h)＝10／60

表 6.3.13　確率規模別の 10 分間降雨強度

Return Period	Rainfall intensity R (mm/10min)
2-year	117.1
5-year	161.2
10-year	201.4
20-year	251.0
50-year	352.6

③ 排水量計算

路側排水路の排水流量はラショナル式を用いて算出する。

ラショナル式：Q＝1／3.6×C×I×A

このとき、流出係数 C は路面及び緩勾配山地として 0.8 とする。

また、降雨確率年は 5 年（161.2 ㎜／10min）とする。

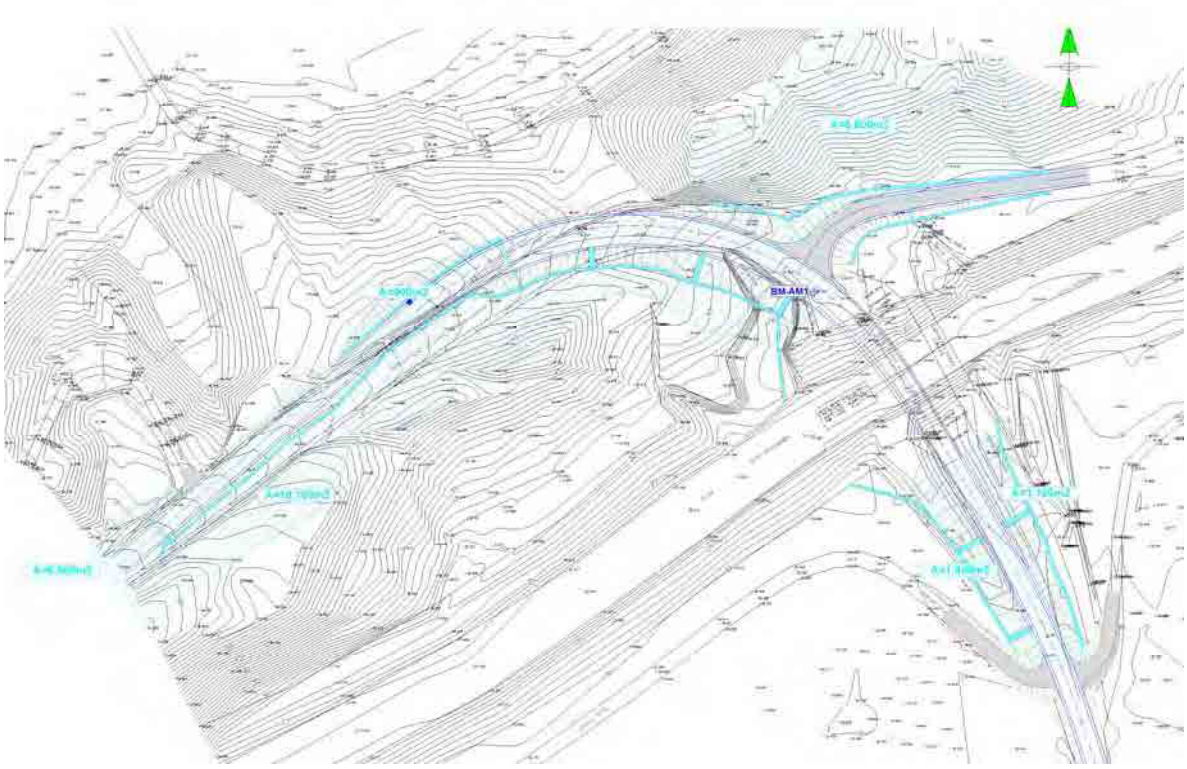


図 6.3.5　集水面積（アウム橋）

i)アウム橋左岸山側

測点	範囲	集水面積 (m²)	排水流量 (m³／s)	備考
№15＋16	道路左側	6,600	0.251	計画道路＋取付道路 (横断管渠)

ii)アウム橋左岸川側

測点	範囲	集水面積 (m²)	排水流量 (m³／s)	備考
№1＋15	道路左側	6,000	0.215	既存水路(横断管渠)
№9＋7	道路左側	900	0.032	計画道路（横断管渠）
№15＋16	道路右側	16,100	0.577	既存水路＋計画道路

iii)アウム橋右岸

測点	範囲	集水面積 (m²)	排水流量 (m³／s)	備考
№19＋12	道路左側	1,100	0.039	計画道路
№19＋12	道路右側	1,400	0.050	計画道路

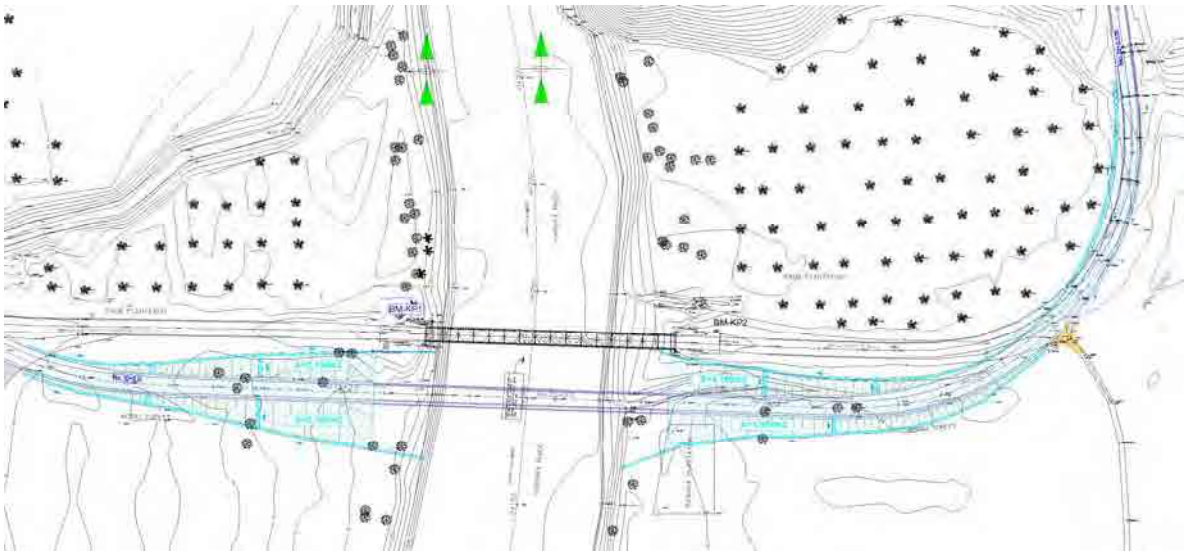


図 6.3.6　集水面積（カピウラ橋）

iv)カピウラ橋左岸

測点	範囲	集水面積 (m²)	排水流量 (m³／s)	備考
№15＋15	道路左側	2,100	0.075	計画道路
№15＋15	道路右側	2,100	0.075	計画道路

v)カピウラ橋右岸

測点	範囲	集水面積 (m²)	排水流量 (m³／s)	備考
№22＋13	道路左側	4,100	0.147	計画道路
№22＋13	道路右側	1,800	0.064	計画道路

④ 排水構造物の計画

排水構造物は、排水量及び許容最大流速に基づき断面形状を決定する。

排水構造物の断面形状は、日本道路協会の指針である道路土工要領および DOW の道路排水構造物マニュアル（MANUAL FOR THE DESIGN OF DRAINAGE STRUCTURES FOR RURAL ROADS）に基づき決定する。

許容最大流速は、以下の通りとする。

道路横断用コンクリート管＝3.0m／s(道路土工要領)

石張水路（コンクリート底面）＝4.6m／s（DOW 道路排水構造物マニュアル）

上記条件に従い、次の通り計画断面を決定した。

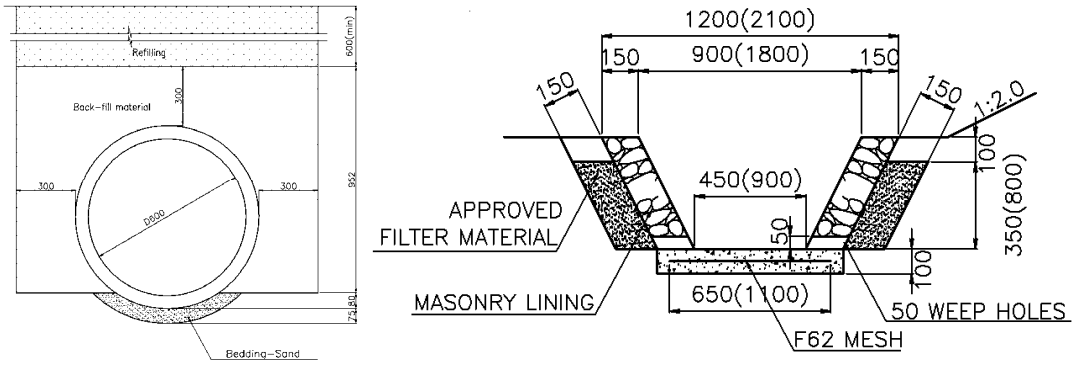


図 6.3.7　排水構造物

i)アウム橋左岸山側

測点	場所	計画流量 (m^3／s)	構造形式	必要断面積 (m^2)	計画断面積 (m^2)	備考
№15＋16	道路左側	0.251	石張水路 W＝900	0.055	0.227	80% 水深時
同上	同上	0.251	CON 管 (D600)	0.084	0.243	同上

ii)アウム橋左岸川側

測点	場所	計画流量 (m^3／s)	構造形式	必要断面積 (m^2)	計画断面積 (m^2)	備考
№1＋15	道 路左側	0.215	石張水路 W＝900	0.047	0.227	80% 水深時
同上	同上	0.215	CON 管 (D600)	0.072	0.243	同上
№9＋7	道路左側	0.032	石張水路 W＝900	0.007	0.227	同上
同上	同上	0.032	CON 管 (D600)	0.011	0.243	同上
№15＋16	道路右側	0.824	石張水路 W＝1800	0.179	0.907	同上

iii)アウム橋右岸

測点	場所	計画流量 (m^3／s)	構造形式	必要断面積 (m^2)	計画断面積 (m^2)	備考
№19＋12	道路左側	0.039	石張水路 W＝900	0.008	0.227	80% 水深時
№19＋12	道路右側	0.050	石張水路 W＝900	0.011	0.227	同上

iv)カピウラ橋左岸

測点	場所	計画流量 (m^3／s)	構造形式	必要断面積 (m^2)	計画断面積 (m^2)	備考
№15＋15	道路左側	0.075	石張水路 W＝900	0.016	0.227	80% 水深時
№15＋15	道路右側	0.075	石張水路 W＝900	0.016	0.227	同上

v)カピウラ橋右岸

測点	場所	計画流量 (m^3／s)	構造形式	必要断面積 (m^2)	計画断面積 (m^2)	備考
№22＋13	道路左側	0.147	石張水路 W＝900	0.032	0.227	80% 水深時
№22＋13	道路右側	0.064	石張水路 W＝900	0.014	0.227	同上

6.3.3 工事中の迂回路

アウム橋は現況位置での架け替えとなるため、工事期間中に現道を封鎖する必要があり、工事用道路による切り回しが必要となるため、工事段階に応じた迂回路の計画を実施する。なお、カピウラ橋の架け替え位置は現在の橋梁の上流側であり、工事期間中も現在の橋梁が利用できるため、工事に伴う現道の切り回しは必要とならない。

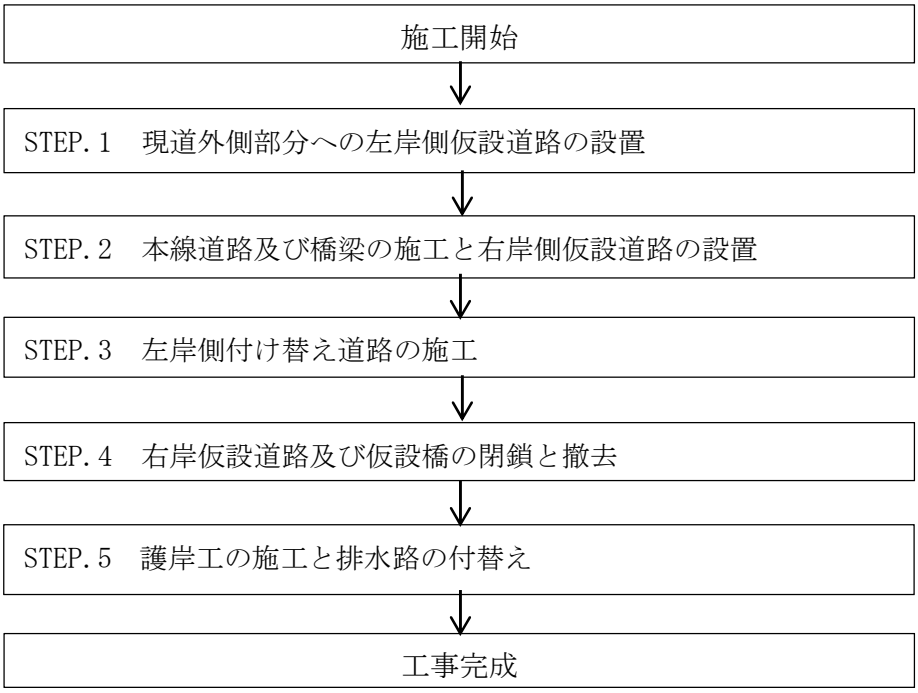
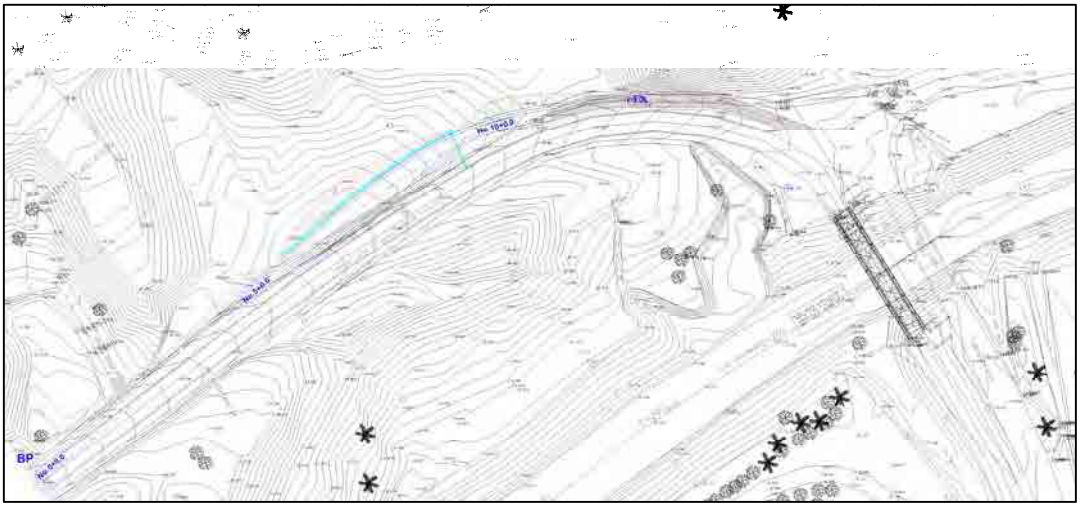


図 6.3.8　アウム橋の施工に係る迂回道路切り回し手順

(1)　STEP.1　現道外側部分への左岸側仮設道路の設置

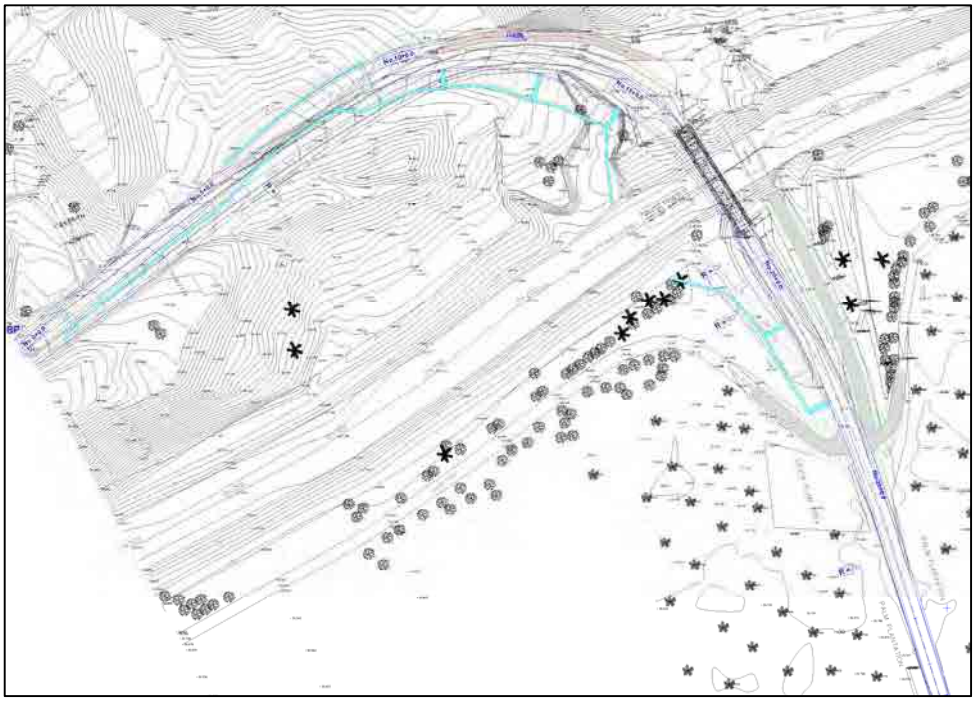
起点から№11 付近まで、現況道路の通行に影響のない山側に計画道路を構築し、№11 付近から計画道路の外側に仮設道路を築造し仮設橋に接続する。



STEP.1　左岸側工事用道路の設置

(2)　STEP.2　本線道路及び橋梁の施工と右岸側仮設道路の設置

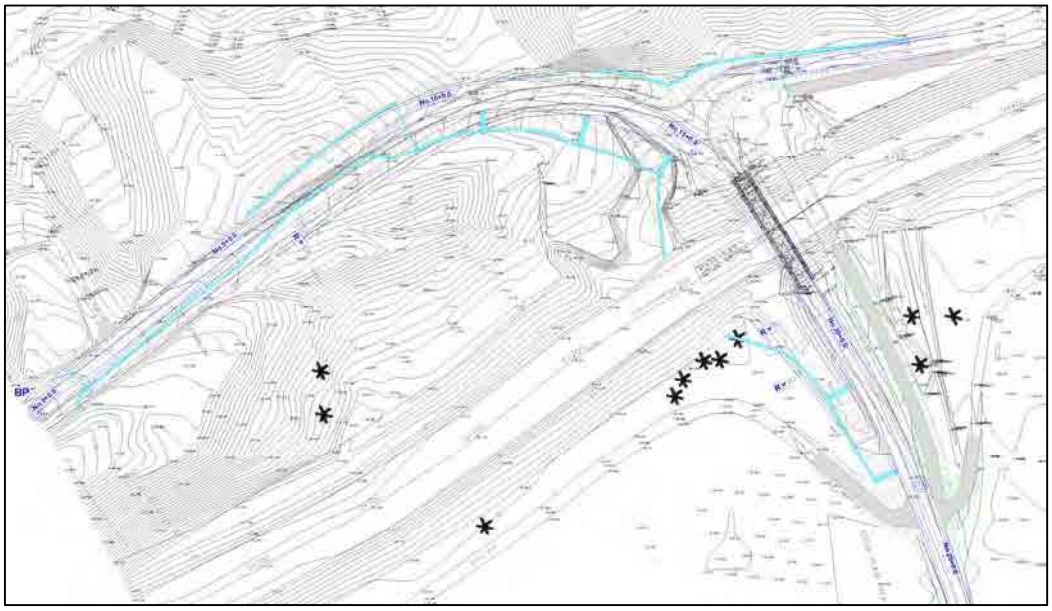
左岸側工事用道路の設置完了に伴い現道を封鎖、仮設道路に影響しない範囲で本線道路及び橋梁を施工、右岸側についても本線道路の盛土と並行して現在の仮設道路を盛り上げて工事用道路を築造する。



STEP.2　本線工事と右岸側工事用道路の設置

(3)　STEP.3　左岸側付け替え道路の施工

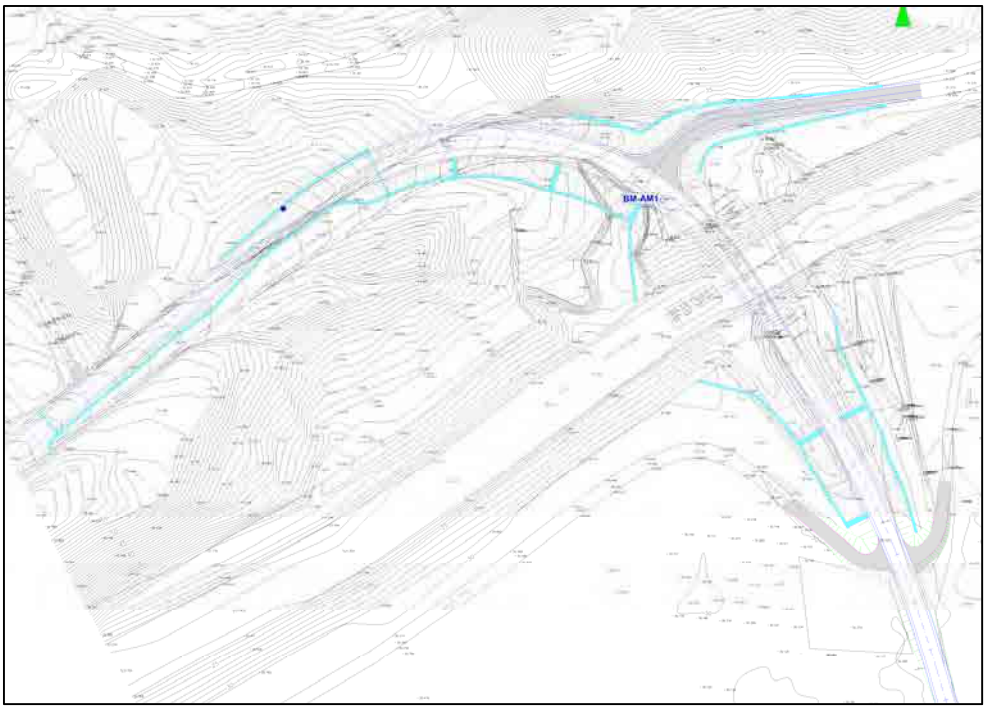
本線道路及び橋梁の施工完了後に、左岸側の工事用道路の封鎖に伴う仮設道路の付替えと残りの本線盛土を実施、付け替え道路の完成までの期間は、左岸側の下流道路に対しては、右岸側の工事用道路を経由してアクセスを行う。



STEP.3　左岸側付け替え道路の施工

(4)　STEP.4　右岸仮設道路及び仮設橋の閉鎖と撤去(道路本体の施工完了)

左岸側の付け替え道路の完成に伴い右岸側の工事用道路を閉鎖し仮設橋を撤去、護岸工の施工に着手する。



STEP.4　右折側仮設道路及び仮設橋の撤去

(5)　STEP.5　護岸工の施工と排水路の付替え(全工事の完了)

本線道路及び橋梁の完成後に護岸工事及びそれに伴う排水工の付替えを実施。

STEP.5　護岸工の施工（完成図）

6.3.4 線形計画

本稿では、計画道路に係る線形計算書を添付する。

(1) アウム橋

1) 主要点計算書

① 本線道路

主要点座標一覧表

曲線名称[AUM Planning Road]

主要点名称	測　点	追加距離	X 座 標	Y 座 標	始点半径	パラメータ	終点半径	要素長	接 線 角
BP	0 + 0.0000	0.0000	1,810.4010	476.1900	0.0000	0.0000	0.0000	125.7824	49-13-15.83
KA1-1	6 + 5.7824	125.7824	1,892.5548	571.4368	0.0000	-80.0000	-115.0000	55.6522	49 13 15.83
KE1-1	9 + 1.4345	181.4345	1,925.3066	616.2520	-115.0000	0.0000	-115.0000	146.3935	63- 5- 4.90
KE1-2	16 + 7.8280	327.8280	1,902.6185	751.0634	-115.0000	-80.0000	0.0000	55.6522	136- 1-17.23
KA1-2	19 + 3.4802	383.4802	1,857.0020	782.6896	0.0000	0.0000	0.0000	27.4040	149-53- 6.29
KA2-1	20 + 10.8842	410.8842	1,833.2969	796.4392	0.0000	-125.0000	-300.0000	52.0833	149-53- 6.29
KE2-1	23 + 2.9675	462.9675	1,787.5220	821.2487	-300.0000	0.0000	-300.0000	13.5122	154-51-31.23
KE2-2	23 + 16.4797	476.4797	1,775.1648	826.7120	-300.0000	-125.0000	0.0000	52.0833	157-26-21.52
KA2-2	26 + 8.5631	528.5631	1,726.0084	843.8733	0.0000	0.0000	0.0000	84.1612	162 24 46.45
EP	30 + 12.7242	612.7242	1,645.7810	869.3030					162 24 46.45

円曲線の半径、クロソイドのパラメータに関する符号は、－：上に凸（右回り）
＋：下に凸（左回り）

主要点要素一覧表

曲線名称[AUM Planning Road]

要素番号	要素種別
1	直線

主要点名称	測　点	X 座 標	Y 座 標	接 線 角	要 素 長
BP	0 + 0.0000	1,810.4010	476.1900	49-13-15.83	125.7824
KA1-1	6 + 5.7824	1,892.5548	571.4368		

要素番号	要素種別
2	クロソイド

主要点名称	測　点	X 座 標	Y 座 標	接 線 角	要 素 長	始点半径	パラメータ	終点半径
KA1 1	6 + 5.7824	1,892.5548	571.4368	49 13 15.83	55.6522	0.0000	-80.0000	-115.0000
KE1 1	9 + 1.4345	1,925.3066	616.2520	63 5 4.90				
X	Y	τ	／R	XM	YM	σ	TK	TL
55.3272	4.4699	13-51-49.06	1.1198	27.7719	116.1198	4-37- 8.10	18.6548	37.2159
So	N	U	V	T				
55.5075	4.6040	18.1114	1.1032	56.4304				

要素番号	要素種別
3	円曲線

主要点名称	測　点	X 座 標	Y 座 標	接線角／中心角	要 素 長	半　径	TL	SL
KE1-1	9 + 1.4345	1,925.3066	616.2520	63- 5- 4.90				
KE1-2	16 + 7.8280	1,902.6185	751.0634	136- 1-17.23	146.3935	-115.0000	84.9973	28.0019
中心点		1,822.7637	668.3094	72 56 12.33				

円曲線の半径、クロソイドのパラメータに関する符号は、　：上に凸（右回り）
－：下に凸（左回り）

主要点要素一覧表

曲線名称[AUM Planning Road]

要素番号	要素種別
4	クロソイド

主要点名称	測　点	X 座 標	Y 座 標	接 線 角	要 素 長	始点半径	パラメータ	終点半径
KE1-2	16 + 7.8280	1,902.6185	751.0634	136- 1-17.23	55.6522	-115.0000	-80.0000	0.0000
KA1-2	19 + 3.4802	1,857.0020	782.6896	149-53- 6.29				
X	Y	τ	／R	XM	YM	σ	TK	TL
55.3272	4.4699	13-51-49.06	1.1198	27.7719	116.1198	4-37- 8.10	18.6548	37.2159
So	N	U	V	T				
55.5075	4.6040	18.1114	1.1032	56.4304				

要素番号	要素種別
5	直線

主要点名称	測　点	X 座 標	Y 座 標	接 線 角	要 素 長
KA1 2	19 + 3.4802	1,857.0020	782.6896	149-53- 6.29	27.4040
KA2 1	20 + 10.8842	1,833.2969	796.4392		

要素番号	要素種別
6	クロソイド

主要点名称	測　点	X 座 標	Y 座 標	接 線 角	要 素 長	始点半径	パラメータ	終点半径
KA2-1	20 + 10.8842	1,833.2969	796.4392	149-53- 6.29	52.0833	0.0000	-125.0000	-300.0000
KE2-1	23 + 2.9675	1,787.5220	821.2487	154-51-31.23				
X	Y	τ	／R	XM	YM	σ	TK	TL
52.0441	1.5062	4-58-24.93	0.3767	26.0351	300.3767	1-39-27.93	17.3736	34.7359
So	N	U	V	T				
52.0659	1.5119	17.3082	0.1311	52.1752				

円曲線の半径、クロソイドのパラメータに関する符号は、－：上に凸（右回り）
＋：下に凸（左回り）

主要点要素一覧表

曲線名称[AUM Planning Road]

要素番号	要素種別
7	円曲線

主要点名称	測　点	X 座 標	Y 座 標	接線角／中心角	要 素 長	半 径	TL	SL
KE2-1	23 + 2.9675	1,787.5220	821.2487	154-51-31.23				
KE2-2	23 + 16.4797	1,775.1648	826.7120	157-26-21.52	13.5122	-300.0000	6.7572	0.0761
中心点	—	1,660.0662	549.6699	2-34-50.29				

要素番号	要素種別
8	クロソイド

主要点名称	測　点	X 座 標	Y 座 標	接 線 角	要 素 長	始点半径	パラメータ	終点半径
KE2-2	23 + 16.4797	1,775.1648	826.7120	157-26-21.52	52.0833	-300.0000	-125.0000	0.0000
KA2-2	26 + 8.5631	1,726.0084	843.8733	162-24-46.45				
X	Y	τ	⊿R	XM	YM	σ	TK	TL
52.0441	1.5062	4 58 24.93	0.3767	26.0351	300.3767	1 39 27.93	17.3736	34.7359
So	N	U	V	T				
52.0659	1.5119	17.3082	0.1311	52.1752				

要素番号	要素種別
9	直線

主要点名称	測　点	X 座 標	Y 座 標	接 線 角	要 素 長
KA2-2	26 + 8.5631	1,726.0084	843.8733	162-24-46.45	84.1612
EP	30 + 12.7242	1,645.7810	869.3030		

円曲線の半径、クロソイドのパラメータに関する符号は、－：上に凸（右回り）
＋：下に凸（左回り）

⑤ 左岸取付け道路

主要点座標一覧表

曲線名称[AUM Access Road]

主要点名称	測　点	追加距離	X 座 標	Y 座 標	始点半径	パラメータ	終点半径	要素長	接 線 角
BP	0 + 0.0000	0.0000	1,920.1221	729.5169	0.0000	0.0000	0.0000	11.2720	32- 9-24.73
BC1	0 + 11.2720	11.2720	1,929.6649	735.5163	-35.0000	0.0000	-35.0000	30.3781	32- 9-24.73
EC1	2 + 1.6501	41.6501	1,945.6862	760.2075	0.0000	0.0000	0.0000	78.3499	81 53 11.66
EP	6 + 0.0000	120.0000	1,956.7439	837.7731	—	—	—	—	81-53-11.66

円曲線の半径、クロソイドのパラメータに関する符号は、－：上に凸（右回り）
＋：下に凸（左回り）

主要点要素一覧表

曲線名称[AUM Access Road]

要素番号	要素種別
1	直線

主要点名称	測　点	X 座 標	Y 座 標	接 線 角	要 素 長
BP	0 + 0.0000	1,920.1221	729.5169	32 9 24.73	11.2720
BC1	0 + 11.2720	1,929.6649	735.5163		

要素番号	要素種別
2	円曲線

主要点名称	測　点	X 座 標	Y 座 標	接線角／中心角	要 素 長	半 径	TL	SL
BC1	0 + 11.2720	1,929.6649	735.5163	32- 9-24.73				
EC1	2 + 1.6501	1,945.6862	760.2075	81-53-11.66	30.3781	-35.0000	16.2204	3.5759
中心点	—	1,911.0365	765.1471	49-43-16.92				

要素番号	要素種別
3	直線

主要点名称	測　点	X 座 標	Y 座 標	接 線 角	要 素 長
EC1	2 + 1.6501	1,945.6862	760.2075	81-53-11.66	78.3499
EP	6 + 0.0000	1,956.7439	837.7731		

円曲線の半径、クロソイドのパラメータに関する符号は、－：上に凸（右回り）
＋：下に凸（左回り）

2)　IP 点計算書

① 本線道路

IP座標一覧表

曲線名称[AUM Planning Road]

IP点名称	X 座 標	Y 座 標	接 線 長	接 線 角	交 角
BP	1,810.4010	476.1900	293.5803	49-13-15.83	
IP-1	2,002.1507	698.4994	254.2075	149-53- 6.29	100-39-50.46
IP-2	1,782.2559	826.0444	143.1667	162-24-46.45	12-31-40.15
EP	1,645.7810	869.3030			

曲線名称[AUM Planning Road]

IP点名称 [IP-1] 基本型							
X =	2,002.1507	Y =	698.4994	CL =	257.6978	IA =	100-39-50.46
A1 =	-80.0000	R =	-115.0000	A2 =	-80.0000		
L1 =	55.6522	Lc =	146.3935	L2 =	55.6522		
⊿R1 =	1.1198	Xo =	1,822.7637	⊿R2 =	1.1198		
τ1 =	13-51-49.06	Yo =	668.3094	τ2 =	13-51-49.06		
IP-1-1		X =	1,916.8620	Y =	599.6180		
IP-1-C		X =	1,963.7826	Y =	692.0422		
IP-1-2		X =	1,889.1945	Y =	764.0171		

主要点名称	測点	X座標	Y座標	始点半径	パラメータ	終点半径	要素長	接線角
KA1-1	6 + 5.7824	1,892.5548	571.4368	0.0000	80.0000	115.0000	55.6522	49-13-15.83
KE1-1	9 + 1.4345	1,925.3066	616.2520	-115.0000	0.0000	-115.0000	146.3935	63- 5- 4.90
KE1-2	16 + 7.8280	1,902.6185	751.0634	-115.0000	-80.0000	0.0000	55.6522	136- 1-17.23
KA1-2	19 + 3.4802	1,857.0020	782.6896					149-53- 6.29

円曲線の半径、クロソイドのパラメータに関する符号は、－：右に凸（右回り）
　　＋：左に凸（左回り）

曲線名称[AUM Planning Road]

IP点名称 [IP-2] 基本型							
X =	1,782.2559	Y =	826.0444	CL =	117.6788	IA =	12-31-40.15
A1 =	-125.0000	R =	-300.0000	A2 =	-125.0000		
L1 =	52.0833	Lc =	13.5122	L2 =	52.0833		
⊿R1 =	0.3767	Xo =	1,660.0662	⊿R2 =	0.3767		
τ1 =	4-58-24.93	Yo =	549.6699	τ2 =	4-58-24.93		
IP-2-1		X =	1,803.2196	Y =	813.8675		
IP-2-C		X =	1,781.4049	Y =	824.1195		
IP-2-2		X =	1,759.1207	Y =	833.3776		

主要点名称	測点	X座標	Y座標	始点半径	パラメータ	終点半径	要素長	接線角
KA2-1	20 + 10.8842	1,833.2969	796.4392	0.0000	125.0000	300.0000	52.0833	149-53- 6.29
KE2-1	23 + 2.9675	1,787.5220	821.2487	-300.0000	0.0000	-300.0000	13.5122	154-51-31.23
KE2-2	23 + 16.4797	1,775.1648	826.7120	-300.0000	-125.0000	0.0000	52.0833	157-26-21.52
KA2-2	26 + 8.5631	1,726.0084	843.8733					162-24-46.45

円曲線の半径、クロソイドのパラメータに関する符号は、－：右に凸（右回り）
　　＋：左に凸（左回り）

② 左岸取付け道路

IP座標一覧表

曲線名称[AUM Access Road]

IP点名称	X 座 標	Y 座 標	接 線 長	接 線 角	交 角
BP	1,920.1221	729.5169	27.4923	32 9 24.73	
IP-1	1,943.3969	744.1494	94.5702	81-53-11.66	49-43-46.92
EP	1,956.7439	837.7731			

曲線名称[AUM Access Road]

IP点名称 [IP-1] 単 円							
X =	1,943.3969	Y =	744.1494	CL =	30.3781	IA =	49-43-46.92
R =	-35.0000						
Lc =	30.3781						
Xo =	1,911.0365						
Yo =	765.1471						
IP-1-C		X =	1,943.3969	Y =	744.1494		

主要点名称	測点	X座標	Y座標	始点半径	パラメータ	終点半径	要素長	接線角
BC1	0 + 11.2720	1,929.6649	735.5163	-35.0000	0.0000	-35.0000	30.3781	32- 9-24.73
EC1	2 + 1.6501	1,945.6862	760.2075					81-53-11.66

円曲線の半径、クロソイドのパラメータに関する符号は、－：右に凸（右回り）
　　＋：左に凸（左回り）

3)　曲線要素計算書

① 本線道路

曲線要素　一覧表

曲線名称[AUM Planning Road]

NO	要素種別	測　点	X　座　標	Y　座　標	接　線　角	要　素　長
1	直線		1,810.4010	476.1900	49 13 15.83	125.7824
			1,892.5548	571.4368		

離れ / 折れ角　0.0000 / 0 0 0.00

NO	要素種別	測　点	X　座　標	Y　座　標	接　線　角	始点半径	パラメータ	終点半径	要　素　長
2	クロソイド		1,892.5548	571.4368	49-13-15.83	0.0000	80.0000	115.0000	55.6522
			1,925.3066	616.2520	63- 5- 4.90				

離れ / 折れ角　0.0000 / 0- 0- 0.00

NO	要素種別	測　点	X　座　標	Y　座　標	接　線　角	半　径	要　素　長	円中心X座標	円中心Y座標
3	円曲線		1,925.3066	616.2520	63 5 4.90	115.0000	146.3935	1,822.7637	668.3094
			1,902.6185	751.0634	136- 1-17.23				

離れ / 折れ角　0.0000 / 0 0 0.00

NO	要素種別	測　点	X　座　標	Y　座　標	接　線　角	始点半径	パラメータ	終点半径	要　素　長
4	クロソイド		1,902.6185	751.0634	136- 1-17.23	-115.0000	-80.0000	0.0000	55.6522
			1,857.0020	782.6896	149 53 6.29				

離れ / 折れ角　0.0000 / 0- 0- 0.00

NO	要素種別	測　点	X　座　標	Y　座　標	接　線　角	要　素　長
5	直線		1,857.0020	782.6896	149-53- 6.29	27.4040
			1,833.2969	796.4392		

円曲線の半径、クロソイドのパラメータに関する符号は、－：上に凸（右回り）
＋：下に凸（左回り）

曲線要素　一覧表

曲線名称[AUM Planning Road]

離れ / 折れ角　0.0000 / 0 0 0.00

NO	要素種別	測　点	X　座　標	Y　座　標	接　線　角	始点半径	パラメータ	終点半径	要　素　長
6	クロソイド		1,833.2969	796.4392	149-53- 6.29	0.0000	-125.0000	-300.0000	52.0833
			1,787.5220	821.2487	154 51 31.23				

離れ / 折れ角　0.0000 / 0- 0- 0.00

NO	要素種別	測　点	X　座　標	Y　座　標	接　線　角	半　径	要　素　長	円中心X座標	円中心Y座標
7	円曲線		1,787.5220	821.2487	154 51 31.23	-300.0000	13.5122	1,660.0662	549.6699
			1,775.1648	826.7120	157-26-21.52				

離れ / 折れ角　0.0000 / 0- 0- 0.00

NO	要素種別	測　点	X　座　標	Y　座　標	接　線　角	始点半径	パラメータ	終点半径	要　素　長
8	クロソイド		1,775.1648	826.7120	157-26-21.52	300.0000	-125.0000	0.0000	52.0833
			1,726.0084	843.8733	162 24 46.45				

離れ / 折れ角　0.0000 / 0- 0- 0.00

NO	要素種別	測　点	X　座　標	Y　座　標	接　線　角	要　素　長
9	直線		1,726.0084	843.8733	162-24-46.45	84.1612
			1,645.7810	869.3030		

円曲線の半径、クロソイドのパラメータに関する符号は、－：上に凸（右回り）
＋：下に凸（左回り）

② 左岸取付け道路

曲線要素　一覧表

曲線名称[AUM Access Road]

NO	要素種別	測　点	X　座　標	Y　座　標	接　線　角	要　素　長
1	直線		1,920.1221	729.5169	32 9 24.73	11.2720
			1,929.6649	735.5163		

離れ / 折れ角　0.0000 / 0 0 0.00

NO	要素種別	測　点	X　座　標	Y　座　標	接　線　角	半　径	要　素　長	円中心X座標	円中心Y座標
2	円曲線		1,929.6649	735.5163	32- 9-24.73	35.0000	30.3781	1,911.0365	765.1471
			1,945.6862	760.2075	81-53-11.66				

離れ / 折れ角　0.0000 / 0- 0- 0.00

NO	要素種別	測　点	X　座　標	Y　座　標	接　線　角	要　素　長
3	直線		1,945.6862	760.2075	81 53 11.66	78.3499
			1,956.7439	837.7731		

円曲線の半径、クロソイドのパラメータに関する符号は、－：上に凸（右回り）
＋：下に凸（左回り）

4)　中間点計算書

① 本線道路

中間点座標一覧表

曲線名称[AUM Planning Road]

主要点名称	測　点	単距離	X 座 標	Y 座 標	接 線 角	区間弦長	弦接線角
BP	0 + 0.0000	0.0000	1,810.4010	476.1900	49-13-15.83	0.0000	0- 0- 0.00
	1 + 0.0000	20.0000	1,823.4638	491.3347	49-13-15.83	20.0000	49-13-15.83
	2 + 0.0000	20.0000	1,836.5267	506.4794	49 13 15.83	20.0000	49 13 15.83
	3 + 0.0000	20.0000	1,849.5895	521.6241	49-13-15.83	20.0000	49-13-15.83
	4 + 0.0000	20.0000	1,862.6524	536.7688	49 13 15.83	20.0000	49 13 15.83
	5 + 0.0000	20.0000	1,875.7152	551.9135	49-13-15.83	20.0000	49-13-15.83
	6 + 0.0000	20.0000	1,888.7781	567.0582	49-13-15.83	20.0000	49-13-15.83
KA1-1	6 + 5.7824	5.7824	1,892.5548	571.4368	49-13-15.83	5.7824	49-13-15.83
	7 + 0.0000	14.2176	1,901.7840	582.2515	50- 7-33.22	14.2175	49-31-21.63
	8 + 0.0000	20.0000	1,914.0955	598.0070	54-27-43.36	19.9952	51-59-43.89
	9 + 0.0000	20.0000	1,924.6193	614.9770	62-22-45.06	19.9840	58- 7-19.57
KE1-1	9 + 1.4345	1.4345	1,925.3066	616.2520	63 5 4.90	1.4345	62 43 49.45
	10 + 0.0000	18.5655	1,932.3408	633.4115	72 20 4.03	18.5453	67 42 34.46
	11 + 0.0000	20.0000	1,936.7265	652.8989	82-17-56.17	19.9748	77-19- 0.10
	12 + 0.0000	20.0000	1,937.6740	672.8512	92 15 48.31	19.9748	87 16 52.24
	13 + 0.0000	20.0000	1,935.1547	692.6665	102-13-40.45	19.9748	97-14-44.38
	14 + 0.0000	20.0000	1,929.2446	711.7470	112-11-32.59	19.9748	107-12-36.52
	15 + 0.0000	20.0000	1,920.1221	729.5169	122- 9-24.73	19.9748	117-10-28.66
A1	15 + 16.0000	16.0000	1,910.6929	742.4273	130- 7-42.45	15.9871	126- 8-33.59
	16 + 0.0000	4.0000	1,908.0622	745.4403	132- 7-16.87	3.9998	131- 7-29.66
KE1-2	16 + 7.8280	7.8280	1,902.6185	751.0634	136- 1-17.23	7.8265	134- 4-17.05
	17 + 0.0000	12.1720	1,893.4589	759.0728	141 25 21.54	12.1675	138 49 57.36
	18 + 0.0000	20.0000	1,877.1399	770.6194	147-25- 2.11	19.9908	144-43- 6.31
	19 + 0.0000	20.0000	1,860.0119	780.9426	149 49 51.12	19.9985	148 55 20.94
KA1-2	19 + 3.4802	3.4802	1,857.0020	782.6896	149-53- 6.29	3.4802	149-52- 1.24
A2	19 + 12.0000	8.5198	1,849.6322	786.9643	149-53- 6.29	8.5198	149-53- 6.29
	20 + 0.0000	8.0000	1,842.7120	790.9782	149 53 6.29	8.0000	149 53 6.29
KA2-1	20 + 10.8842	10.8842	1,833.2969	796.4392	149-53- 6.29	10.8842	149-53- 6.29
	21 + 0.0000	9.1158	1,825.4075	801.0060	150- 2-14.78	9.1158	149-56- 9.12

中間点座標一覧表

曲線名称[AUM Planning Road]

主要点名称	測　点	単距離	X 座 標	Y 座 標	接 線 角	区間弦長	弦接線角
	22 + 0.0000	20.0000	1,807.9809	810.8189	151-26-21.71	19.9995	150-36-58.21
	23 + 0.0000	20.0000	1,790.2022	819.9749	154-18-29.02	19.9979	152-45- 5.32
KE2-1	23 + 2.9675	2.9675	1,787.5220	821.2487	154 51 31.23	2.9675	154 34 50.44
KE2-2	23 + 16.4797	13.5122	1,775.1648	826.7120	157-26-21.52	13.5110	156- 8-56.37
	24 + 0.0000	3.5203	1,771.9062	828.0440	158 5 20.09	3.5203	157 46 4.43
	25 + 0.0000	20.0000	1,753.1594	835.0064	160-55- 1.46	19.9980	159-37-30.83
	26 + 0.0000	20.0000	1,734.1692	841.2795	162-16-42.46	19.9995	161-43-12.00
KA2-2	26 + 8.5631	8.5631	1,726.0084	843.8733	162-24-46.45	8.5631	162-22- 5.12
	27 + 0.0000	11.4369	1,715.1060	847.3290	162-24-46.45	11.4369	162-24-46.45
	28 + 0.0000	20.0000	1,696.0409	853.3721	162-24-46.45	20.0000	162-24-46.45
	29 + 0.0000	20.0000	1,676.9757	859.4152	162-24-46.45	20.0000	162-24-46.45
	30 + 0.0000	20.0000	1,657.9105	865.4583	162 24 46.45	20.0000	162 24 46.45
EP	30 + 12.7242	12.7242	1,645.7810	869.3030	162 24 46.45	12.7242	162 24 46.45

② 左岸取付け道路

中間点座標 一覧表

曲線名称[AUM Access Road]

主要点名称	測　点	単距離	X 座 標	Y 座 標	接 線 角	区間弦長	弦接線角
BP	0 + 0.0000	0.0000	1,920.1221	729.5169	32- 9-24.73	0.0000	0- 0- 0.00
BC1	0 + 11.2720	11.2720	1,929.6649	735.5163	32- 9-24.73	11.2720	32- 9-24.73
	1 + 0.0000	8.7280	1,936.4014	741.0303	46-26-41.40	8.7054	39-18- 3.07
	2 + 0.0000	20.0000	1,945.4148	758.5799	79-11- 7.00	19.7290	62-48-54.20
EC1	2 + 1.6501	1.6501	1,945.6862	760.2075	81 53 11.66	1.6500	80 32 9.33
	3 + 0.0000	18.3499	1,948.2759	778.3737	81-53-11.66	18.3499	81-53-11.66
	4 + 0.0000	20.0000	1,951.0986	798.1735	81 53 11.66	20.0000	81 53 11.66
	5 + 0.0000	20.0000	1,953.9213	817.9733	81 53 11.66	20.0000	81 53 11.66
EP	6 + 0.0000	20.0000	1,956.7439	837.7731	81 53 11.66	20.0000	81 53 11.66

(2)　カピウラ橋

1)　主要点計算書

主要点座標一覧表

曲線名称[kapiura Planning Road]

主要点名称	測　点	追加距離	X 座 標	Y 座 標	始点半径	パラメータ	終点半径	要素長	接 線 角
BP	-1 - 0.0000	-20.0000	216,885.4172	9,370,408.5623	0.0000	0.0000	0.0000	57.4261	56-41-24.27
KA1-1	1 + 17.4261	37.4261	216,916.9538	9,370,456.5541	0.0000	90.0000	140.0000	57.8571	56-41-24.27
KE1-1	4 + 15.2833	95.2833	216,951.9119	9,370,502.5181	140.0000	0.0000	140.0000	75.9841	44 51 3.22
KE1-2	8 + 11.2674	171.2674	217,017.3634	9,370,539.2515	140.0000	90.0000	0.0000	57.8571	13-45-14.29
KA1-2	11 + 9.1246	229.1246	217,074.8091	9,370,545.1471	0.0000	0.0000	0.0000	284.3962	1 54 53.25
KA2-1	25 + 13.5208	513.5208	217,359.0465	9,370,554.6497	0.0000	80.0000	125.0000	51.2000	1-54-53.25
KE2-1	28 + 4.7208	564.7208	217,410.1201	9,370,552.8705	125.0000	0.0000	125.0000	166.6578	350-10-50.22
KE2-2	36 + 11.3786	731.3786	217,513.5289	9,370,437.9648	125.0000	80.0000	0.0000	51.2000	273 47 25.06
KA2-2	39 + 2.5786	782.5786	217,509.9338	9,370,386.9868	0.0000	0.0000	0.0000	56.8199	262- 3-22.03
EP	41 + 19.3985	839.3985	217,502.0812	9,370,330.7122	—	—	—	—	262- 3 22.03

円曲線の半径、クロソイドのパラメータに関する符号は、－：上に凸（右回り）
＋：下に凸（左回り）

主要点要素一覧表

曲線名称[kapiura Planning Road]

要素番号	要素種別
4	クロソイド

主要点名称	測　点	X 座 標	Y 座 標	接 線 角	要 素 長	始点半径	パラメータ	終点半径
KE1-2	8 + 11.2674	217,017.3634	9,370,539.2515	13-45-14.29	57.8571	140.0000	90.0000	0.0000
KA1-2	11 + 9.1246	217,074.8091	9,370,545.1471	1-54-53.25				
X	Y	τ	∠R	XM	YM	σ	TK	TL
57.6106	3.9729	11-50-21.04	0.9947	28.8874	140.9947	3-56-41.87	19.3645	38.6580
So	N	U	V	T				
57.7474	4.0593	18.9525	0.8328	58.4434				

要素番号	要素種別
5	直線

主要点名称	測　点	X 座 標	Y 座 標	接 線 角	要 素 長
KA1-2	11 + 9.1246	217,074.8091	9,370,545.1471	1-54-53.25	284.3962
KA2-1	25 + 13.5208	217,359.0465	9,370,554.6497		

要素番号	要素種別
6	クロソイド

主要点名称	測　点	X 座 標	Y 座 標	接 線 角	要 素 長	始点半径	パラメータ	終点半径
KA2-1	25 + 13.5208	217,359.0465	9,370,554.6497	1-54-53.25	51.2000	0.0000	80.0000	125.0000
KE2-1	28 + 4.7208	217,410.1201	9,370,552.8705	350-10-50.22				
X	Y	τ	∠R	XM	YM	σ	TK	TL
50.9857	3.1848	11-44- 3.03	0.8725	25.5643	125.8725	3-54-36.01	17.1351	34.2086
So	N	U	V	T				
51.1046	3.5592	16.7770	0.7238	51.7095				

円曲線の半径、クロソイドのパラメータに関する符号は、－：上に凸（右回り）
＋：下に凸（左回り）

主要点要素一覧表

曲線名称[kapiura Planning Road]

要素番号	要素種別
1	直線

主要点名称	測　点	X 座 標	Y 座 標	接 線 角	要 素 長
BP	1 0.0000	216,885.4172	9,370,408.5623	56 41 24.27	57.4261
KA1-1	1 + 17.4261	216,916.9538	9,370,456.5541		

要素番号	要素種別
2	クロソイド

主要点名称	測　点	X 座 標	Y 座 標	接 線 角	要 素 長	始点半径	パラメータ	終点半径
KA1-1	1 + 17.4261	216,916.9538	9,370,456.5541	56-41-24.27	57.8571	0.0000	90.0000	140.0000
KE1-1	4 + 15.2833	216,951.9119	9,370,502.5181	44 51- 3.22				
X	Y	τ	／R	XM	YM	σ	TK	TL
57.6106	3.9729	11-50-21.04	0.9947	28.8874	140.9947	3-56-41.87	19.3645	38.6580
So	N	U	V	T				
57.7474	4.0593	18.9525	0.8328	58.4434				

要素番号	要素種別
3	円曲線

主要点名称	測　点	X 座 標	Y 座 標	接線角／中心角	要 素 長	半　径	TL	SL
KE1-1	4 + 15.2833	216,951.9119	9,370,502.5181	44-51- 3.22	75.9841	140.0000	38.9530	5.3180
KE1-2	8 + 11.2674	217,017.3634	9,370,539.2515	13-45-14.29				
中心点	－	217,050.6489	9,370,403.2659	31- 5-48.93				

円曲線の半径、クロソイドのパラメータに関する符号は、－：上に凸（右回り）
＋：下に凸（左回り）

主要点要素一覧表

曲線名称[kapiura Planning Road]

要素番号	要素種別							
7	円曲線							
主要点名称	測　点	X　座　標	Y　座　標	接線角／中心角	要　素　長	半　径	TL	SL
KE2-1	28 + 4.7208	217,410.1201	9,370,552.8705	350 10 50.22				
KE2-2	36 + 11.3786	217,513.5289	9,370,437.9648	273-47-25.06	166.6578	125.0000	98.3482	34.0515
中心点		217,388.8023	9,370,429.7017	76 23 25.16				

要素番号	要素種別							
8	クロソイド							
主要点名称	測　点	X　座　標	Y　座　標	接　線　角	要　素　長	始点半径	パラメータ	終点半径
KE2-2	36 + 11.3786	217,513.5289	9,370,437.9648	273-47-25.06	51.2000	125.0000	80.0000	0.0000
KA2-2	39 + 2.5786	217,509.9338	9,370,386.9868	262- 3-22.03				
X	Y	τ	⊿R	XM	YM	σ	TK	TL
50.9857	3.4848	11 44 3.03	0.8725	25.5643	125.8725	3 54 36.01	17.1351	34.2086
So	N	U	V	T				
51.1046	3.5592	16.7770	0.7238	51.7095				

要素番号	要素種別				
9	直線				
主要点名称	測　点	X　座　標	Y　座　標	接　線　角	要　素　長
KA2-2	39 + 2.5786	217,509.9338	9,370,386.9868	262- 3-22.03	56.8199
EP	41 + 19.3985	217,502.0812	9,370,330.7122		

円曲線の半径、クロソイドのパラメータに関する符号は、－：上に凸（右回り）
＋：下に凸（左回り）

2)　IP 点計算書

IP座標一覧表

曲線名称[kapiura Planning Road]

IP点名称	X　座　標	Y　座　標	接　線　長	接　線　角	交　角
BP	216,885.4172	9,370,408.5623	159.3598	56-41-24.27	
IP-1	216,972.9324	9,370,541.7412	561.5279	1-54-53.25	54-46-31.02
IP 2	217,534.1468	9,370,560.5037	232.0180	262 3 22.03	99 51 31.22
EP	217,502.0812	9,370,330.7122			

曲線名称[kapiura Planning Road]

IP点名称［ IP-1 ］基本型

X =	216,972.9324	Y =	9,370,541.7412	CL =	191.6984	IA =	54 46 31.02
A1 =	90.0000	R =	140.0000	A2 =	90.0000		
L1 =	57.8571	Lc =	75.9841	L2 =	57.8571		
⊿R1 =	0.9947	Xo =	217,050.6489	⊿R2 =	0.9947		
τ1 =	11-50-21.04	Yo =	9,370,403.2659	τ2 =	11-50-21.04		
IP-1-1		X =	216,938.1835	Y =	9,370,488.8611		
IP-1-C		X =	216,979.5274	Y =	9,370,529.9903		
IP 1 2		X =	217,036.1726	Y =	9,370,543.8555		

主要点名称	測点	X座標	Y座標	始点半径	パラメータ	終点半径	要素長	接線角
KA1 1	1 + 17.4261	216,916.9538	9,370,456.5541	0.0000	90.0000	140.0000	57.8571	56 41 24.27
KE1-1	4 + 15.2833	216,951.9119	9,370,502.5181	140.0000	0.0000	140.0000	75.9841	44-51- 3.22
KE1-2	8 + 11.2674	217,017.3634	9,370,539.2515	140.0000	90.0000	0.0000	57.8571	13-45-14.29
KA1-2	11 + 9.1246	217,074.8091	9,370,545.1471					1-54-53.25

円曲線の半径、クロソイドのパラメータに関する符号は、－：上に凸（右回り）
＋：下に凸（左回り）

曲線名称[kapiura Planning Road]

IP点名称［ IP-2 ］基本型

X =	217,534.1468	Y =	9,370,560.5037	CL =	269.0578	IA =	99 51 31.22
A1 =	80.0000	R =	125.0000	A2 =	80.0000		
L1 =	51.2000	Lc =	166.6578	L2 =	51.2000		
⊿R1 =	0.8725	Xo =	217,388.8023	⊿R2 =	0.8725		
τ1 =	11-44- 3.03	Yo =	9,370,429.7017	τ2 =	11-44- 3.03		
IP-2-1		X =	217,393.2360	Y =	9,370,555.7928		
IP-2-C		X =	217,507.0276	Y =	9,370,536.0979		
IP 2 2		X =	217,514.6616	Y =	9,370,420.8671		

主要点名称	測点	X座標	Y座標	始点半径	パラメータ	終点半径	要素長	接線角
KA2 1	25 + 13.5208	217,359.0465	9,370,554.6497	0.0000	80.0000	125.0000	51.2000	1 54 53.25
KE2-1	28 + 4.7208	217,410.1201	9,370,552.8705	125.0000	0.0000	125.0000	166.6578	350-10-50.22
KE2-2	36 + 11.3786	217,513.5289	9,370,437.9648	125.0000	80.0000	0.0000	51.2000	273-47-25.06
KA2-2	39 + 2.5786	217,509.9338	9,370,386.9868					262- 3-22.03

円曲線の半径、クロソイドのパラメータに関する符号は、－：上に凸（右回り）
＋：下に凸（左回り）

3)　曲線要素計算書

曲線要素　一覧表

曲線名称[kapiura Planning Road]

NO	要素種別	測　点	X　座　標	Y　座　標	接　線　角	要　素　長
1	直線		216,885.4172	9,370,408.5623	56 41 24.27	57.4261
			216,916.9538	9,370,456.5541		

離れ / 折れ角　0.0000 / 0 0 0.00

NO	要素種別	測　点	X　座　標	Y　座　標	接　線　角	始点半径	パラメータ	終点半径	要　素　長
2	クロソイド		216,916.9538	9,370,456.5541	56-41-24.27	0.0000	90.0000	140.0000	57.8571
			216,951.9119	9,370,502.5181	44-51- 3.22				

離れ / 折れ角　0.0000 / 0- 0- 0.00

NO	要素種別	測　点	X　座　標	Y　座　標	接　線　角	半　径	要　素　長	円中心X座標	円中心Y座標
3	円曲線		216,951.9119	9,370,502.5181	44 51 3.22	140.0000	75.9841	217,050.6489	9,370,403.2659
			217,017.3634	9,370,539.2515	13-45-14.29				

離れ / 折れ角　0.0000 / 0 0 0.00

NO	要素種別	測　点	X　座　標	Y　座　標	接　線　角	始点半径	パラメータ	終点半径	要　素　長
4	クロソイド		217,017.3634	9,370,539.2515	13-45-14.29	140.0000	90.0000	0.0000	57.8571
			217,074.8091	9,370,545.1471	1 54 53.25				

離れ / 折れ角　0.0000 / 0- 0- 0.00

NO	要素種別	測　点	X　座　標	Y　座　標	接　線　角	要　素　長
5	直線		217,074.8091	9,370,545.1471	1-54-53.25	284.3962
			217,359.0465	9,370,554.6497		

円曲線の半径、クロソイドのパラメータに関する符号は、－：上に凸（右回り）
＋：下に凸（左回り）

曲線要素　一覧表

曲線名称[kapiura Planning Road]

離れ / 折れ角　0.0000 / 0 0 0.00

NO	要素種別	測　点	X　座　標	Y　座　標	接　線　角	始点半径	パラメータ	終点半径	要　素　長
6	クロソイド		217,359.0465	9,370,554.6497	1-54-53.25	0.0000	80.0000	125.0000	51.2000
			217,410.1201	9,370,552.8705	350 10 50.22				

離れ / 折れ角　0.0000 / 0- 0- 0.00

NO	要素種別	測　点	X　座　標	Y　座　標	接　線　角	半　径	要　素　長	円中心X座標	円中心Y座標
7	円曲線		217,410.1201	9,370,552.8705	350 10 50.22	125.0000	166.6578	217,388.8023	9,370,429.7017
			217,513.5289	9,370,437.9648	273-47-25.06				

離れ / 折れ角　0.0000 / 0- 0- 0.00

NO	要素種別	測　点	X　座　標	Y　座　標	接　線　角	始点半径	パラメータ	終点半径	要　素　長
8	クロソイド		217,513.5289	9,370,437.9648	273-47-25.06	125.0000	80.0000	0.0000	51.2000
			217,509.9338	9,370,386.9868	262 3 22.03				

離れ / 折れ角　0.0000 / 0- 0- 0.00

NO	要素種別	測　点	X　座　標	Y　座　標	接　線　角	要　素　長
9	直線		217,509.9338	9,370,386.9868	262- 3-22.03	56.8199
			217,502.0812	9,370,330.7122		

円曲線の半径、クロソイドのパラメータに関する符号は、－：上に凸（右回り）
＋：下に凸（左回り）

4)　中間点計算書

中間点座標一覧表

曲線名称[kapiura Planning Road]

主要点名称	測　点	単距離	X　座　標	Y　座　標	接　線　角	区間弦長	弦接線角
BP	-1 - 0.0000	0.0000	216,885.4172	9,370,408.5623	56-41-24.27	0.0000	0- 0- 0.00
	0 + 0.0000	20.0000	216,896.4005	9,370,425.2766	56-41-24.27	20.0000	56-41-24.27
	1 + 0.0000	20.0000	216,907.3839	9,370,441.9908	56-41-24.27	20.0000	56-41-24.27
KA1-1	1 + 17.4261	17.4261	216,916.9538	9,370,456.5541	56-41-24.27	17.4261	56-41-24.27
	2 + 0.0000	2.5739	216,918.3675	9,370,458.7049	56-39-59.92	2.5739	56-40-56.15
	3 + 0.0000	20.0000	216,929.5472	9,370,475.2875	54-53-16.11	19.9992	56- 0-46.85
	4 + 0.0000	20.0000	216,941.6304	9,370,491.2179	50 16 46.38	19.9946	52 49 10.16
KE1-1	4 + 15.2833	15.2833	216,951.9119	9,370,502.5181	44-51- 3.22	15.2776	47-42-10.55
	5 + 0.0000	4.7167	216,955.3111	9,370,505.7877	42-55-14.00	4.7165	43-53- 8.61
	6 + 0.0000	20.0000	216,970.8785	9,370,518.3167	34-44- 7.60	19.9830	38-49-40.80
	7 + 0.0000	20.0000	216,988.0711	9,370,528.5018	26-33- 1.20	19.9830	30-38-34.40
	8 + 0.0000	20.0000	217,006.5386	9,370,536.1353	18-21-54.80	19.9830	22-27-28.00
KE1-2	8 + 11.2674	11.2674	217,017.3634	9,370,539.2515	13-45-14.29	11.2644	16- 3-34.55
	9 + 0.0000	8.7326	217,025.9022	9,370,541.0753	10-26-59.35	8.7314	12- 3-24.99
	10 + 0.0000	20.0000	217,045.7258	9,370,543.6663	4-54-53.37	19.9922	7-26-47.40
	11 + 0.0000	20.0000	217,065.6902	9,370,544.8266	2-12-33.32	19.9981	3-19-34.49
KA1-2	11 + 9.1246	9.1246	217,074.8091	9,370,545.1471	1 54 53.25	9.1245	2 0 46.61
	12 + 0.0000	10.8754	217,085.6785	9,370,545.5105	1-54-53.25	10.8754	1-54-53.25
	13 + 0.0000	20.0000	217,105.6673	9,370,546.1788	1-54-53.25	20.0000	1-54-53.25
	14 + 0.0000	20.0000	217,125.6561	9,370,546.8471	1-54-53.25	20.0000	1-54-53.25
	15 + 0.0000	20.0000	217,145.6450	9,370,547.5153	1-54-53.25	20.0000	1-54-53.25
	16 + 0.0000	20.0000	217,165.6338	9,370,548.1836	1-54-53.25	20.0000	1-54-53.25
	17 + 0.0000	20.0000	217,185.6226	9,370,548.8519	1-54-53.25	20.0000	1-54-53.25
	18 + 0.0000	20.0000	217,205.6115	9,370,549.5201	1-54-53.25	20.0000	1-54-53.25
	19 + 0.0000	20.0000	217,225.6003	9,370,550.1884	1-54-53.25	20.0000	1-54-53.25
	20 + 0.0000	20.0000	217,245.5891	9,370,550.8566	1-54-53.25	20.0000	1-54-53.25
	21 + 0.0000	20.0000	217,265.5779	9,370,551.5249	1-54-53.25	20.0000	1-54-53.25
	22 + 0.0000	20.0000	217,285.5668	9,370,552.1932	1-54-53.25	20.0000	1-54-53.25
	23 + 0.0000	20.0000	217,305.5556	9,370,552.8614	1 54 53.25	20.0000	1 54 53.25

中間点座標一覧表

曲線名称[kapiura Planning Road]

主要点名称	測　点	単距離	X　座　標	Y　座　標	接　線　角	区間弦長	弦接線角
	24 + 0.0000	20.0000	217,325.5444	9,370,553.5297	1-54-53.25	20.0000	1-54-53.25
	25 + 0.0000	20.0000	217,345.5333	9,370,554.1980	1-54-53.25	20.0000	1-54-53.25
KA2-1	25 + 13.5208	13.5208	217,359.0465	9,370,554.6497	1-54-53.25	13.5208	1-54-53.25
	26 + 0.0000	6.4792	217,365.5223	9,370,554.8591	1-43-36.76	6.4792	1-51- 7.75
	27 + 0.0000	20.0000	217,385.5192	9,370,555.0511	358-46-34.63	19.9977	0-33- 0.04
	28 + 0.0000	20.0000	217,405.4548	9,370,553.5903	352-14-40.94	19.9891	355-48-32.31
KE2-1	28 + 4.7208	4.7208	217,410.1201	9,370,552.8705	350-10-50.22	4.7205	351-13-45.44
	29 + 0.0000	15.2792	217,424.9790	9,370,549.3522	343-10-37.70	15.2697	346-40-43.96
	30 + 0.0000	20.0000	217,443.5794	9,370,542.0603	334- 0-35.33	19.9787	338-35-36.51
	31 + 0.0000	20.0000	217,460.7806	9,370,531.8982	324-50-32.96	19.9787	329-25-34.14
	32 + 0.0000	20.0000	217,476.1430	9,370,519.1254	315-40-30.59	19.9787	320-15-31.77
	33 + 0.0000	20.0000	217,489.2742	9,370,504.0683	306 30 28.22	19.9787	311 5 29.40
	34 + 0.0000	20.0000	217,499.8389	9,370,487.1114	297-20-25.85	19.9787	301-55-27.04
	35 + 0.0000	20.0000	217,507.5670	9,370,468.6880	288-10-23.48	19.9787	292-45-24.67
	36 + 0.0000	20.0000	217,512.2613	9,370,449.2686	279- 0-21.11	19.9787	283-35-22.30
KE2-2	36 + 11.3786	11.3786	217,513.5289	9,370,437.9648	273-47-25.06	11.3747	276-23-53.09
	37 + 0.0000	8.6214	217,513.8185	9,370,429.3497	270-10-16.50	8.6200	271-55-31.14
	38 + 0.0000	20.0000	217,512.7569	9,370,409.3866	264-20-17.06	19.9913	266-57-22.30
	39 + 0.0000	20.0000	217,510.2898	9,370,389.5407	262- 5- 9.17	19.9987	262-54-48.80
KA2-2	39 + 2.5786	2.5786	217,509.9338	9,370,386.9868	262- 3-22.03	2.5786	262- 3-57.74
	40 + 0.0000	17.4214	217,507.5262	9,370,369.7326	262 3 22.03	17.4214	262- 3 22.03
	41 + 0.0000	20.0000	217,504.7621	9,370,349.9245	262- 3-22.03	20.0000	262- 3-22.03
EP	41 + 19.3985	19.3985	217,502.0812	9,370,330.7122	262- 3-22.03	19.3985	262- 3-22.03

6.3.5 数量計算

道路概略設計により作成した概略設計図に基づく道路の工事数量の集計結果を以降に記載する。なお、算出根拠となる概略設計図は「3.2.3 概略設計図」に添付する。

(1) アウム橋

表 6.3.14　数量集計表（アウム橋）

AUM BRIDGE						
工種	種別	細別	規格	単位	数量	摘要
土工						
	除根伐採			m2	7,536	
	掘削工	掘削　オープン	土砂	m3	2,381	
	盛土工	盛土	路床	m3	19,690	
	法面整形工	切土法面		m2	579	
		盛土法面		m2	8,796	
法面工	植生工	植生シート	1:1	m2	579	
		植生シート	1:2	m2	8,796	
擁壁工	かご工	ふとんかご	1000×1500×500	m	23	
舗装工	車道舗装	表層	密粒度 As=5cm	m2	3,915	
		基層	粗粒度 As=5cm	m2	4,439	
		上層路盤	粒度砕石 t=15cm	m2	5,114	本線
		下層路盤	クラッシャラン　t=25cm	m2	5,245	本線
	取り付け道路	砂利道	t=100mm	m2	1,281	
付属施設工	排水構造物工	現場打ち水路-T4	W900XWB450×H450	m	467	
		現場打ち水路-T7	W1800XWB900×H900	m	300	
		石積み型水路				
		コンクリート管	φ600	m	48	
		コルゲートパイプ	φ1200	m		
		集水枡	W900　×B900×H1000	箇所	4	
			W1200　×B1200×H1200	箇所	2	
	路側工	境界ブロック(C)	W200×H100	m	858	切り下げ部
		舗装止め(D)	W100×H150	m	262	
	防護柵工	ガードレール(A)	土中用　W-Beam	m	444	一般部
	区画線工	中央線	W＝80mmx2　実線	m	525	
		車道外側線	W＝100mm　実線	m	1,050	
	道路付属物工	視線誘導標	土中建込型	本	37	
		警戒標識		箇所	1	

(2)　カピウラ橋

表 6.3.15　数量集計表（カピウラ橋）

KAPIURA　BRIDGE						
工種	種別	細別	規格	単位	数量	摘要
土工						
	除根伐採			m2	9,004	
	掘削工	掘削　オープン	土砂	m3	376	
	盛土工	盛土	路床	m3	26,386	
	法面整形工	切土法面		m2	142	
		盛土法面		m2	9,168	
法面工	植生工	植生シート	1:1	m2	142	
		植生シート	1:2	m2	9,168	
擁壁工	かご工	ふとんかご	1000×1500×500	m	27	
舗装工	車道舗装	表層	密粒度 As=5cm	m2	3,942	
		基層	粗粒度 As=5cm	m2	5,816	
		上層路盤	粒度砕石 t=15cm	m2	6,212	本線
		下層路盤	クラッシャラン　t=25cm	m2	6,382	本線
	取り付け道路	砂利道	t=100mm	m2	738	
付属施設工	排水構造物工	現場打ち水路-T4	W900XWB450×H450	m	909	
	路側工	境界ブロック(C)	W200×H100	m	731	切り下げ部
		舗装止め(D)	W100×H150	m	370	
	防護柵工	ガードレール(A)	土中用　W-Beam	m	462	一般部
	区画線工	中央線	W＝80mmx2　実線	m	555	
		車道外側線	W＝100mm　実線	m	1,110	
	道路付属物工	視線誘導標	土中建込型	本	43	

6.4 水理・水文解析結果

6.4.1 カピウラ橋

(1) 現況流下能力

現況河道の流下能力を把握するために、測量断面を用いて不等流計算を実施した。水位縦断図を図 6.4.1 に示す。現況流下能力の評価高は、架橋地点の上下流区間における左右岸の最も低い河岸高とした。カピウラ橋地点における河道の流下能力は概ね 1,100m³/s であり、2 年確率流量を下回る。カピウラ橋の交通規制を行っている守衛へ増水頻度について聞き取り調査をした結果、毎年のように河岸付近まで増水していることからも、計算結果を裏付けている。

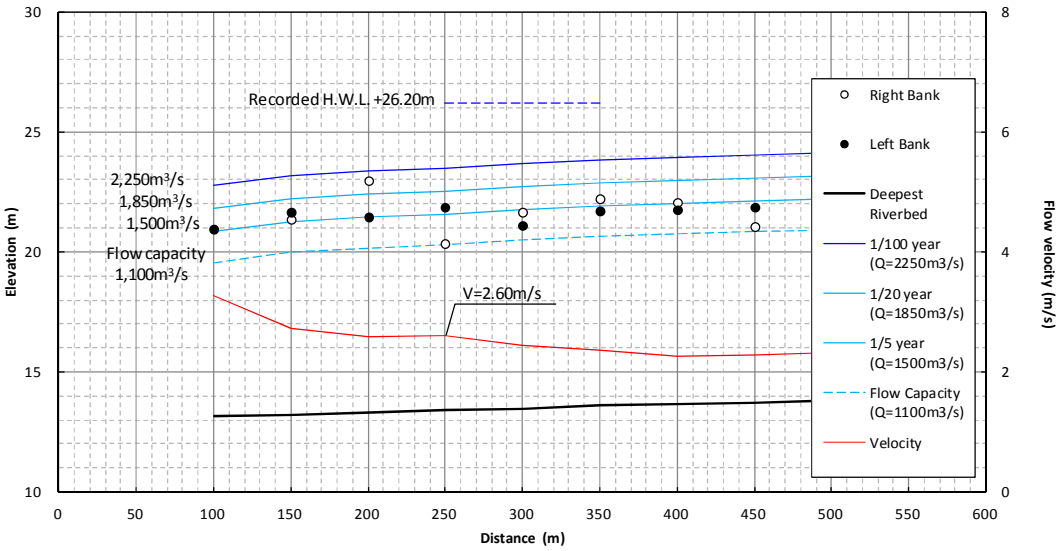


図 6.4.1　現況河道の水位縦断図（カピウラ橋）

(2) 計画規模

橋梁の計画規模は、道路ネットワーク全体の治水安全度と整合を図る必要がある。ニューブリテン国道における他橋梁の計画規模は 100 年確率であるため、カピウラ橋についても 100 年確率を確保した計画とする。

(3) 計画高水位（H.W.L.）

計画流量時の水位縦断図を図 6.4.1 に示す。架橋地点における 100 年確率の計算水位は 23.70m である。一方、聞き取り調査の結果、既往最大水位は 26.20m であり、実際に過去の洪水では流木が既設橋（橋面高 26.00m）に衝突して高欄が壊れたこともある。したがって、安全側を考慮して計画高水位は既往最大水位 26.20m とする。

(4) 設計流速

設計流速は、架橋地点上下流における計算流速の最大値を採用して 2.60m/s とする。

(5)　計画河床高

架橋地点では経年的な河川測量は実施されていない。砂利採取等の河床低下を引き起こす要因は確認されていないため、河床は安定傾向にあると考えられる。そこで、計画河床高は現況河道の最深河床高とする。ただし、最深河床高は洪水時の洗掘や埋戻しによって変動するだけでなくその位置も変化するため、測量結果における架橋地点の最深河床高をそのまま用いるのは適当ではない。現地での目視調査の結果では、架橋地点周辺における洗掘や河岸浸食の痕跡は確認されなかったが、関係者への聞き取り調査によると、上流側の数ヶ所で洗掘や河岸浸食を受けた痕跡が残されていることが確認された。そこで、最深河床高縦断より計画河床勾配を設定し、上流側の最深河床高を包絡する線を計画河床高とする。この結果、架橋地点における計画河床高を+13.00m とする（図 6.4.2）。

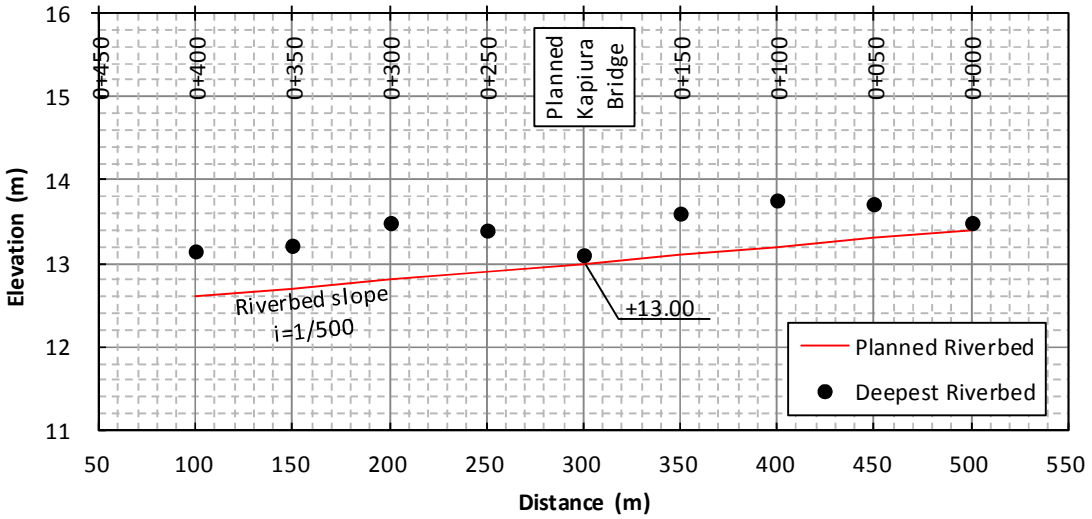


図 6.4.2　計画河床高縦断図（カピウラ橋）

(6)　橋脚による水位堰上げ量

橋脚による水位堰上げ量をドビュッソン公式から推定する。同式では、橋脚設置方向と橋脚形状の影響を見かけの橋脚幅と形状係数で表現することで、堰上げ量を算定する。

$$\Delta h=\frac{Q^2}{2g}\left\{\frac{1}{C^2 b_2^2 (H_1-\Delta h)^2}-\frac{1}{b_1^2 H_1^2}\right\}$$

計算条件

計画高水位	H.W.L.	：	26.20m	
計画河床高	h	：	13.00m	
設計流量	Q	：	2,250m3/s	
橋脚の平面形状によって定まる定数	C	：	0.92	(図 6.4.3 参照)
橋脚上流側の水路幅	b1	：	98m	(河床幅と水面幅の平均値)
河川幅からピア幅の総計を控除した幅	b2	：	94m	
橋脚 1 基の幅	t	：	2.0m	
橋脚の数	n	：	2 本	
橋脚上流側の水深	H1	：	13.20m	

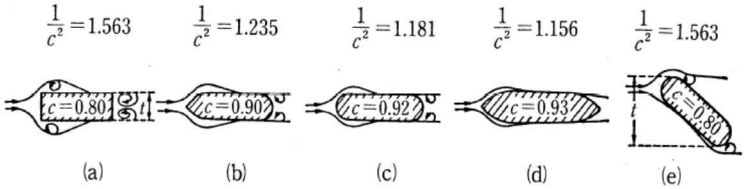


図 6.4.3　橋脚の形状と定数 C の値

以上より、橋脚設置による河川上流側における水位の堰上げ量は 46mm であり、許容値である 100mm 未満（「パ」国基準）を満足する。

(7)　橋脚による局所洗掘量

1)　洗掘深

橋脚周辺の局所洗掘深は、「河川を横過する橋梁に関する計画の手引き(案)，平成 21 年 7 月」に準拠して、以下の旧建設省の土研式を用いて推定する。

$$\frac{Z}{D}=f\left(\frac{h_0}{D},\frac{h_0}{d_m},Fr\right)$$

計算条件				
計画高水位	H.W.L.	：	26.20m	
計画河床高	h	：	13.00m	
平均水深	h0	：	13.20m	(H.W.L. － 計画河床高)
橋脚 1 基の幅	D	：	2.0m	
河床材料の平均粒径	dm	：	1.5mm	(目視推定)
設計流速	V	：	2.60m/s	
フルード数	Fr	：	0.23	(V/√gh0)
	h0/D	：	6.60	
	h0/dm	：	8800	
無次元洗掘深	Z/D	：	1.25	(図 6.4.4 参照)

橋脚軸線に対する流水方向は直角であり、近接橋梁も存在しないため、修正係数 K_α、K_d は 1.0 を採用する。以上より、橋脚設置に伴う最大洗掘深は以下のように推定される。

$$Z = Z/D \times D \times K_\alpha \times K_D$$
$$= 1.25 \times 2.0 \times 1.0 \times 1.0$$
$$= 2.5\text{m}$$

※右図は h_0/D が範囲外であるが、上限のグラフであるため採用した。

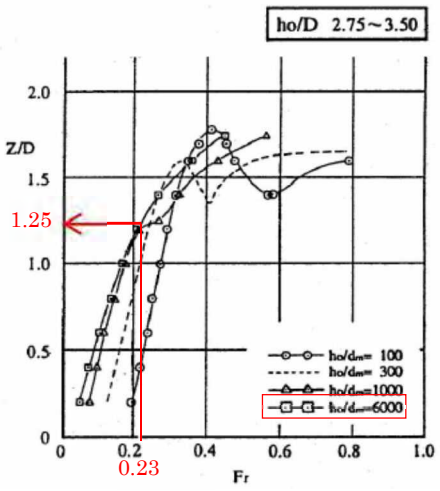


図 6.4.4　Fr～Z/D と h_0/d_m の関係図

2)　洗掘範囲

橋脚周辺での洗掘範囲 R は、上記で求めた最大洗掘深 Z と図 6.4.5 に示される水中安息角 θ の平均値を用いて算出する。

$$R = Z / \tan\theta$$
$$= 2.5 / 0.62$$
$$= 4.0\text{m}$$

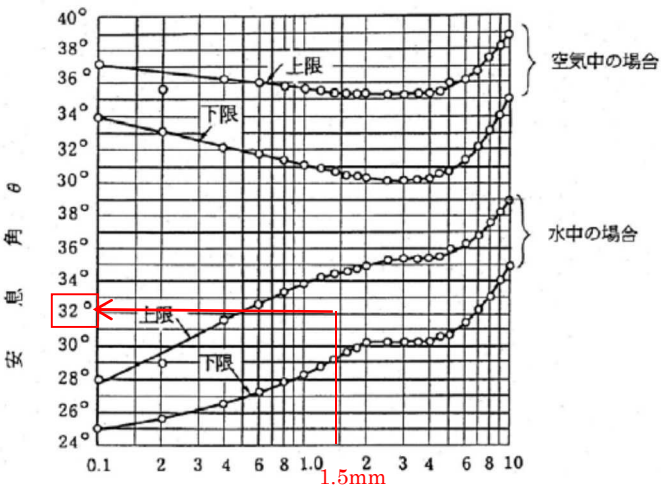


図 6.4.5　安息角 θ と平均粒径の関係

3)　橋脚防護工の敷設範囲

橋脚防護工の敷設範囲は、最小敷設範囲 5m（河川管理施設等構造令，p.319）と上記で算出した洗掘範囲のうち大きいほうの値を採用する。

以上より、橋脚防護工の必要敷設範囲は 5.0m とする。

(8)　施工時の検討

1)　流出量

「仮締切堤設置基準(案)，国交省」によると、仮締切工の設計対象水位は過去 5 年間の最大水位、もしくは、当該水位が過去 5 年間で異常出水と判断される場合は、過去 10 年間の第 2 位の水位を採用することができると規定されている。そこで、本検討では過去 10 年間を対象として、河川内での仮締切工が必要となる橋脚工事の予定期間における流出量を算出した。ただし、架橋地点近傍で水位及び流量が観測されていないことから、ダミ観測所の観測日雨量を用いて流出量を算定し水位に換算する。

ダミ観測所における過去 10 年間の月別最大日雨量を表 6.4.1 に示す。過去 5 年の最大日雨量 154.0mm/day（2010 年 1 月）を異常出水と判断し、過去 10 年間の第 2 位日雨量 127.8mm/day(2008 年 1 月)を採用する。このときの流出量は 1,200m³/s であり、これは 2 年確率流量をやや下回る規模である（表 6.4.2）。

表 6.4.1　過去 10 年間の月別最大日雨量（ダミ観測所）

(mm/day)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max.
2004	102.2	127.4	120.2	36.6	56.0	62.0	32.8	17.6	62.4	80.4	57.0	107.2	127.4
2005	69.6	90.2	78.8	188.4	46.0	49.6	33.2	24.2	61.6	56.8	74.8	92.4	188.4
2006	104.4	104.4	76.2	57.8	32.4	69.4	45.2	57.0	48.4	10.4	61.4	50.8	104.4
2007	107.4	72.0	144.4	24.8	50.2	67.4	41.0	39.6	33.4	66.6	89.2	117.6	144.4
2008	127.8	93.6	48.4	92.6	27.2	43.0	73.2	54.4	22.4	47.2	27.4	21.0	127.8
2009	50.6	62.4	86.2	46.2	82.2	60.0	15.0	47.0	50.4	30.4	58.4	52.0	86.2
2010	154.0	139.8	91.6	110.4	23.0	27.6	73.0	61.4	77.4	31.8	76.2	44.0	154.0
2011	80.0	89.8	41.0	72.8	31.6	31.6	83.4	44.0	37.2	53.8	97.0	100.0	100.0
2012	90.4	186.0	105.4	51.0	81.0	60.6	28.2	82.4	45.2	61.6	73.8	62.6	186.0
2013	94.0	96.0	208.2	108.2	55.8	---	28.2	150.4	44.8	---	21.4	58.8	208.2

: 雨期

カピウラ橋橋脚施工 (Oct - Jan)

表 6.4.2　対象年及び施工期間別の流出量

対象年	施工期間	ダミ観測所 日雨量 (mm/day)	確率規模	カピウラ橋		
				補正 係数	流域日雨量 (mm/day)	流域流出量 (m^3/s)
過去 5 年の最大	Oct - Jan	154.0	2～3 年	1.23	189.4	1,300
過去 10 年の第 2 位	Oct - Jan	127.8	2 年以下	1.23	157.2	**1,200**

2)　水位と流速

施工時流量を対象とした水位縦断図を図 6.4.6 に示す。仮締切工の設計対象水位は 20.82m とし、流速は架橋地点上下流における計算流速の最大値を採用して 2.17m/s とする。

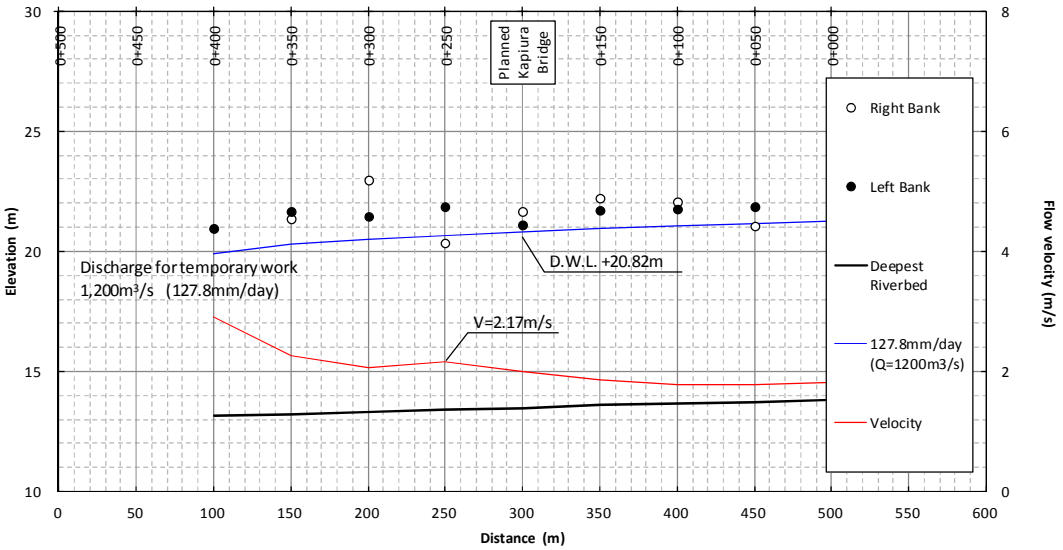


図 6.4.6　施工時流量を対象とした水位縦断図（カピウラ橋）

(9)　極限荷重時の検討

1)　流出量

「パ」国では、洪水時における流木や残骸の衝突荷重を考慮するため、2,000 年確率の水位と流速を極限荷重として橋梁設計に取り入れており、2,000 年確率流量は 100 年確率流量に 1.65 を乗じた値として算出する。カピウラ橋については 3,750m^3/s となる。

2)　水位と流速

2,000 年確率流量を対象とした水位縦断図を図 6.4.7 に示す。設計対象水位は 26.86m、流速は架橋地点上下流における計算流速の最大値を採用して 3.09m/s とする。

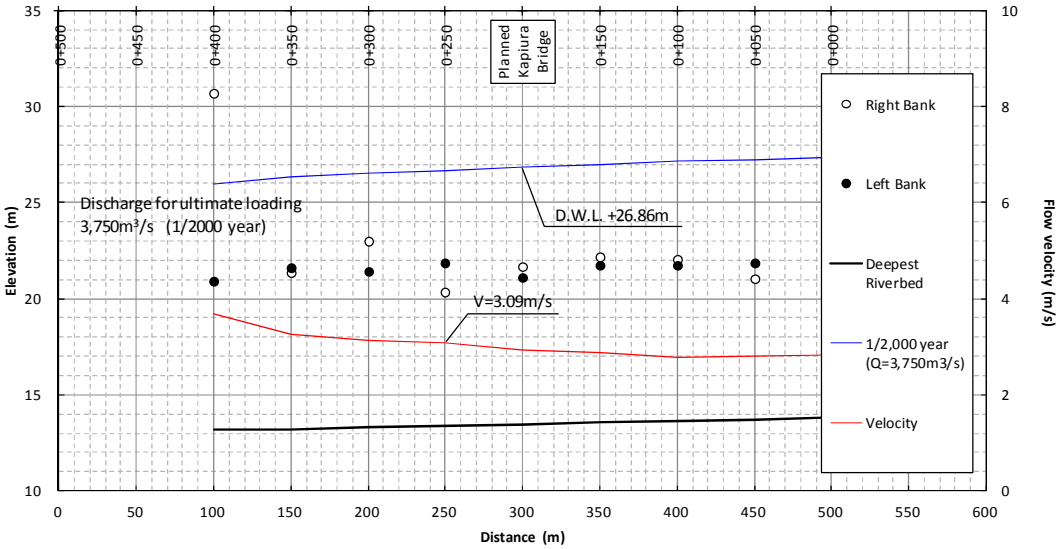


図 6.4.7　極限荷重時（2000 年確率流量）を対象とした水位縦断図（カピウラ橋）

6.4.2 アウム橋

(1) 現況流下能力

アウム橋における不等流計算による水位縦断図を図 6.4.8 に示す。アウム橋付近における河道の流下能力は概ね 500m³/s で、これは 20 年確率と 100 年確率の中間程度である。

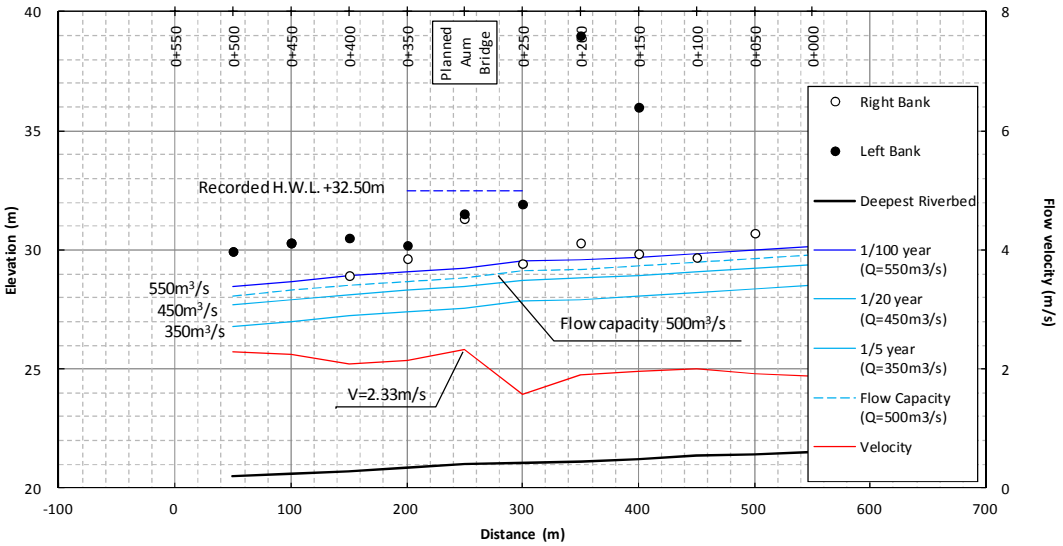


図 6.4.8　現況河道の水位縦断図（アウム橋）

(2) 計画規模

橋梁の計画規模は、道路ネットワーク全体の治水安全度と整合を図る必要がある。ニューブリテン国道における他橋梁の計画規模は 100 年確率であるため、アウム橋についても 100 年確率を確保した計画とする。

(3) 計画高水位（H.W.L.）

計画流量時の水位縦断図を図 6.4.8 に示す。架橋地点における 100 年確率の計算水位は 29.23m となる。一方、聞き取り調査の結果、既往最大水位は 32.50m であり、安全側を考慮して計画高水位は既往最大水位 32.50m とする。

(4) 設計流速

設計流速は、架橋地点上下流における計算流速の最大値を採用して 2.33m/s とする。

(5) 計画河床高

架橋地点では経年的な河川測量は実施されていない。砂利採取等の河床低下を引き起こす要因は確認されていないため、河床は安定傾向にあると考えられる。したがって、計画河床高はカピウラ橋と同様に現況河道の最深河床高を包絡する線とし、架橋地点における計画河床高を+20.80m とする（図 6.4.9）。

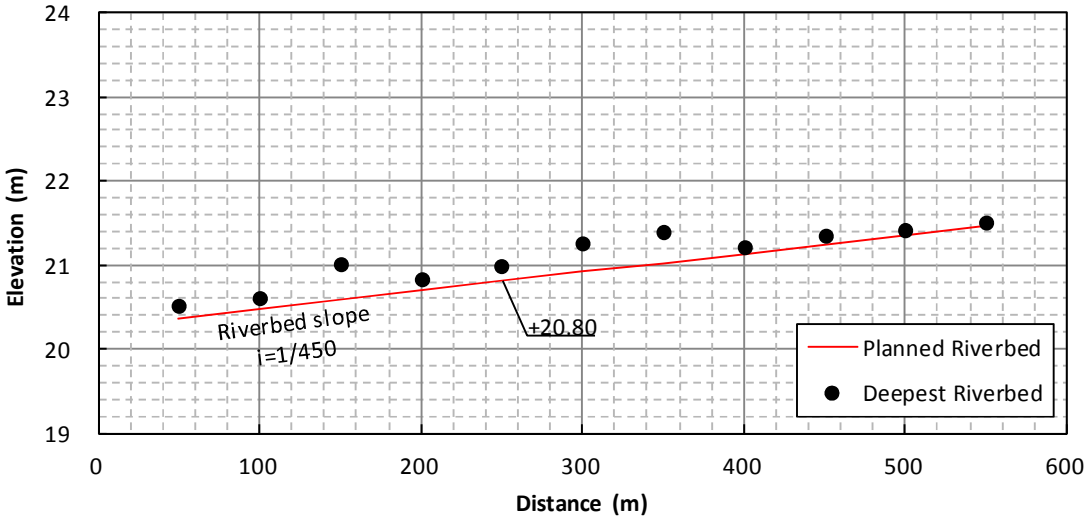


図 6.4.9　計画河床高縦断図（アウム橋）

(6)　橋脚による水位堰上げ量

橋脚による水位堰上げ量を、ドビュッソン公式を用いて推定する。ドビュッソン公式では、橋脚設置方向と橋脚形状の影響を見かけの橋脚幅と形状係数で表現することで、堰上げ量を算定する。

$$\Delta h=\frac{Q^2}{2g}\left\{\frac{1}{C^2 b_2^2 (H_1-\Delta h)^2}-\frac{1}{b_1^2 H_1^2}\right\}$$

計算条件

計画高水位	H.W.L.	：	32.50m	
計画河床高	h	：	20.80m	
設計流量	Q	：	550m³/s	
橋脚の平面形状によって定まる定数	C	：	0.92	(図 6.4.10 参照)
橋脚上流側の水路幅	b_1	：	41m	(河床幅と水面幅の平均値)
河川幅からピア幅の総計を控除した幅	b_2	：	39m	
橋脚 1 基の幅	t	：	2.0m	
橋脚の数	n	：	1 本	
橋脚上流側の水深	H_1	：	11.70m	

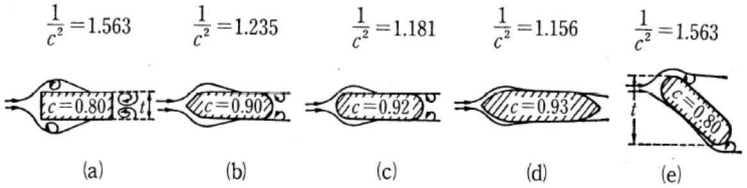


図 6.4.10　橋脚の形状と定数 C の値

以上より、橋脚設置による河川上流側における水位の堰上げ量は 21mm であり、許容値である 100mm 未満（「パ」国基準）を満足する。

(7)　橋脚による局所洗掘量

1)　洗掘深

橋脚周辺の局所洗掘深は、「河川を横過する橋梁に関する計画の手引き(案)，平成 21 年 7 月」に準拠して、以下の旧建設省の土研式を用いて推定する。

$$\frac{Z}{D}=f\left(\frac{h_0}{D},\frac{h_0}{d_m},Fr\right)$$

計算条件

計画高水位	H.W.L.	：	32.50m	
計画河床高	h	：	20.80m	
平均水深	h_0	：	11.70m	(H.W.L. － 計画河床高)
橋脚 1 基の幅	D	：	2.0m	
河床材料の平均粒径	d_m	：	2.0mm	(目視推定)
設計流速	V	：	2.40m/s	
フルード数	Fr	：	0.22	($V/\sqrt{gh_0}$)
	h_0/D	：	5.85	
	h_0/d_m	：	5850	
無次元洗掘深	Z/D	：	1.25	(図 6.4.11 参照)

橋脚軸線に対する流水方向は直角であり、近接橋梁も存在しないため、修正係数 K_α、K_d は 1.0 を採用する。以上より、橋脚設置に伴う最大洗掘深は以下のように推定される。

$$Z = Z/D \times D \times K_\alpha \times K_D$$
$$= 1.25 \times 2.0 \times 1.0 \times 1.0$$
$$= 2.5\text{m}$$

※右図は h_0/D が範囲外であるが、上限のグラフであるため採用した。

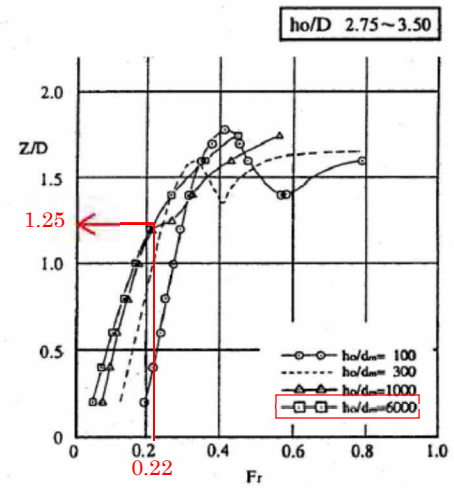


図 6.4.11　Fr～Z/D と h_0/d_m の関係図

2)　洗掘範囲

橋脚周辺での洗掘範囲 R は、上記で求めた最大洗掘深 Z と図 6.4.12 に示される水中安息角 θ の平均値を用いて算出する。

$$R = Z / \tan\theta$$
$$= 2.5 / 0.64$$
$$= 3.9\text{m}$$

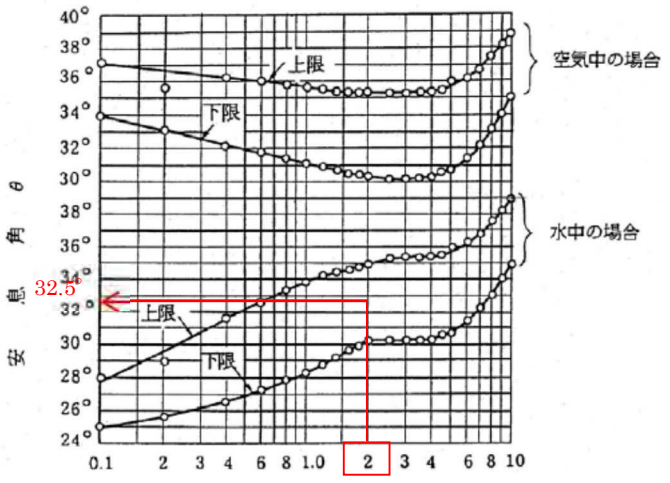


図 6.4.12　安息角 θ と平均粒径の関係

3)　橋脚防護工の敷設範囲

橋脚防護工の敷設範囲は、最小敷設範囲 5m（河川管理施設等構造令，p.319）と上記で算出した洗掘範囲のうち大きいほうの値を採用する。

以上より、橋脚防護工の必要敷設範囲は 5.0m とする。

(8)　施工時の検討

1)　流出量

カピウラ橋と同様に、過去 10 年間の第 2 位日雨量 127.8mm/day(2008 年 1 月)を採用する（表 6.4.3）。このときの流出量は 290m³/s であり、これは 2 年確率流量をやや下回る規模である（表 6.4.4）。

表 6.4.3　過去 10 年間の月別最大日雨量（ダミ観測所）

(mm/day)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max.
2004	102.2	127.4	120.2	36.6	56.0	62.0	32.8	17.6	62.4	80.4	57.0	107.2	127.4
2005	69.6	90.2	78.8	188.4	46.0	49.6	33.2	24.2	61.6	56.8	74.8	92.4	188.4
2006	104.4	104.4	76.2	57.8	32.4	69.4	45.2	57.0	48.4	10.4	61.4	50.8	104.4
2007	107.4	72.0	144.4	24.8	50.2	67.4	41.0	39.6	33.4	66.6	89.2	117.6	144.4
2008	127.8	93.6	48.4	92.6	27.2	43.0	73.2	54.4	22.4	47.2	27.4	21.0	127.8
2009	50.6	62.4	86.2	46.2	82.2	60.0	15.0	47.0	50.4	30.4	58.4	52.0	86.2
2010	154.0	139.8	91.6	110.4	23.0	27.6	73.0	61.4	77.4	31.8	76.2	44.0	154.0
2011	80.0	89.8	41.0	72.8	31.6	31.6	83.4	44.0	37.2	53.8	97.0	100.0	100.0
2012	90.4	186.0	105.4	51.0	81.0	60.6	28.2	82.4	45.2	61.6	73.8	62.6	186.0
2013	94.0	96.0	208.2	108.2	55.8	---	28.2	150.4	44.8	---	21.4	58.8	208.2

: 雨期

アウム橋橋脚施工（Oct - Jan）

表 6.4.4　対象年及び施工期間別の流出量

対象年	施工期間	ダミ観測所 日雨量 (mm/day)	確率規模	アウム橋		
				補正 係数	流域日雨量 (mm/day)	流域流出量 (m³/s)
過去 5 年の最大	Oct - Jan	154.0	2～3 年	1.00	154.0	310
過去 10 年の第 2 位	Oct - Jan	127.8	2 年以下	1.00	127.8	**290**

2)　水位と流速

施工時流量を対象とした水位縦断図を図 6.4.13 に示す。仮締切工の設計対象水位は 26.99m とし、流速は架橋地点上下流における計算流速の最大値を採用して 1.95m/s とする。

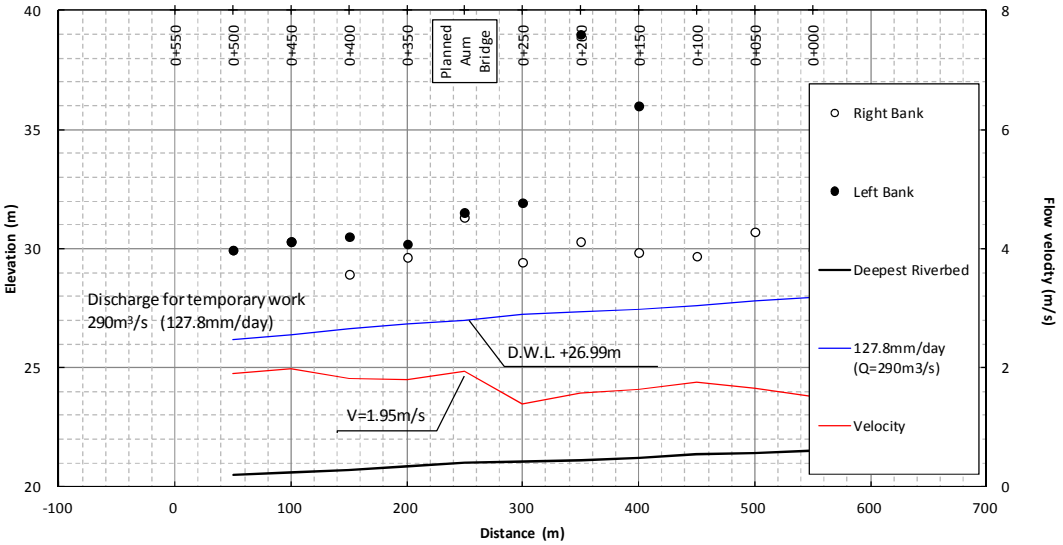


図 6.4.13　施工時流量を対象とした水位縦断図（アウム橋）

(9)　極限荷重時の検討

1)　流出量

「パ」国では、洪水時における流木や残骸の衝突荷重を考慮するため、2,000 年確率の水位と流速を極限荷重として橋梁設計に取り入れており、2,000 年確率流量は 100 年確率流量に 1.65 を乗じた値とする。アウム橋については 950m³/s となる。

2)　水位と流速

2,000 年確率流量を対象とした水位縦断図を図 6.4.14 に示す。設計対象水位は 31.68m、流速は架橋地点上下流における計算流速の最大値を採用して 2.71m/s とする。

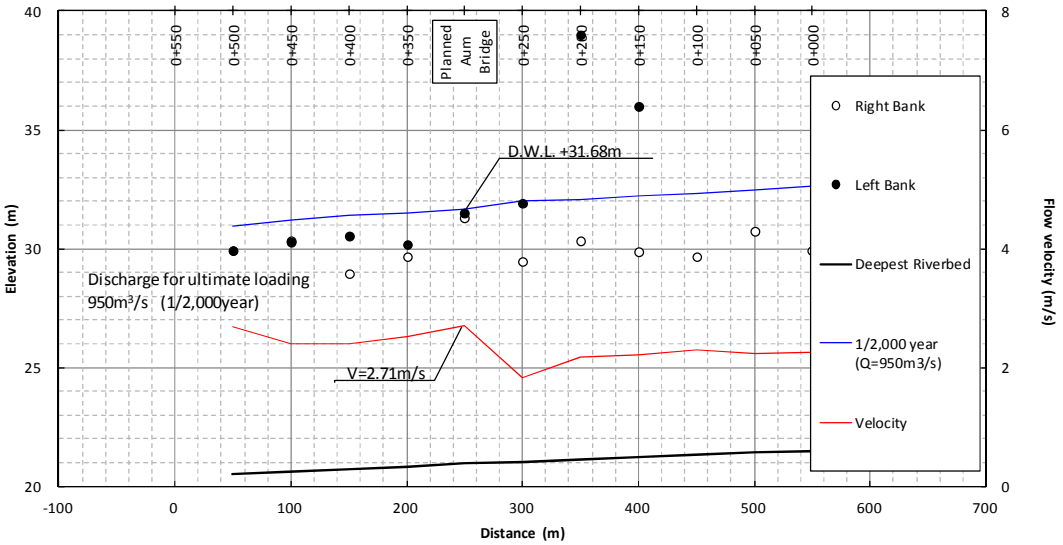


図 6.4.14　極限荷重時（2000 年確率流量）を対象とした水位縦断図（アウム橋）

6.5 地形測量結果

6.5.1 地形測量図

図 6.5.1　アウム橋地形図

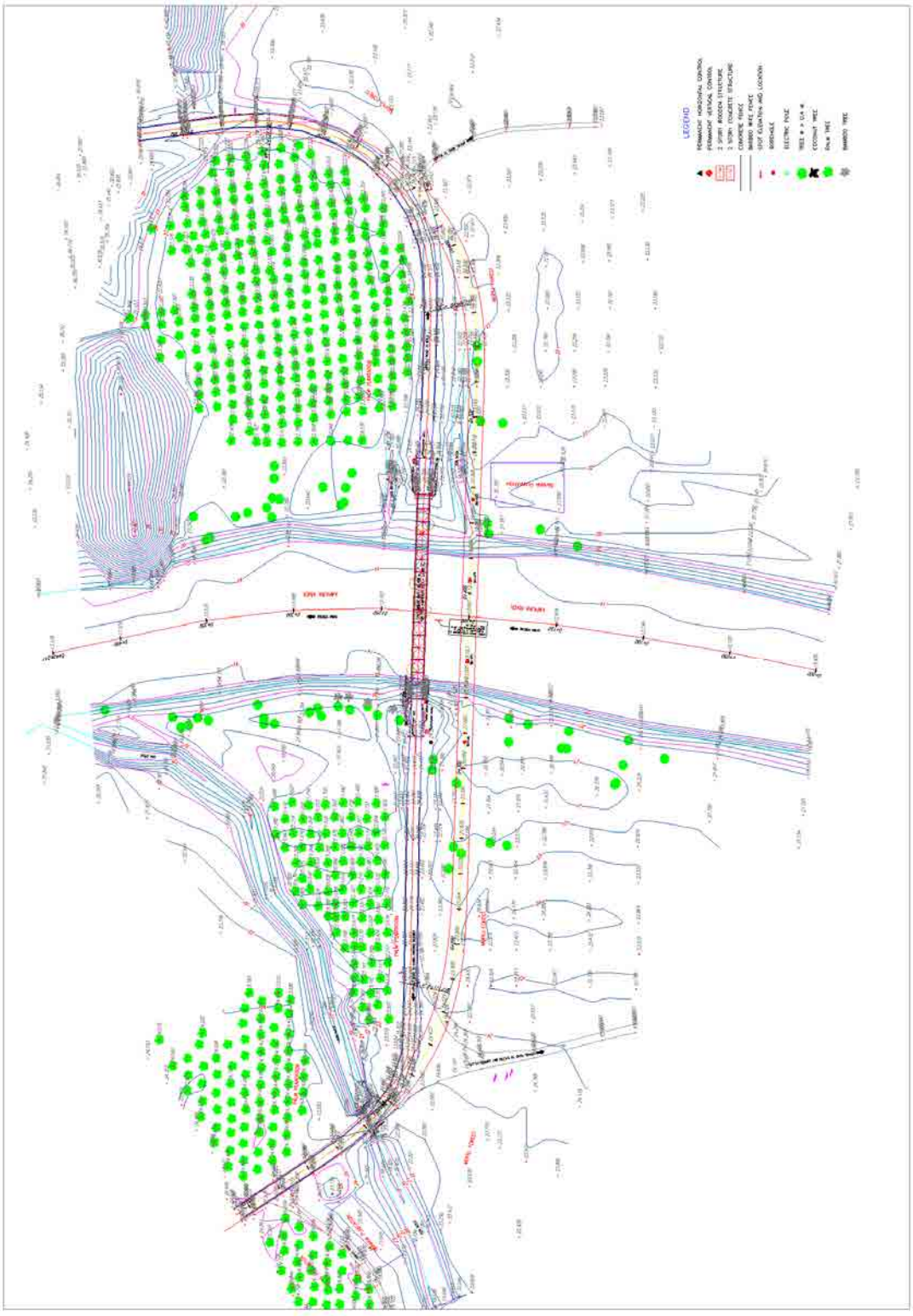


図 6.5.2　カピウラ橋地形図

6.5.2 ベンチマーク

SURVEYED BY :	CLIENT :	STATION :
SIAM TONE CO., LTD.	CHODAI CO.,LTD.	BM-AM1
		DATE : 14/06/2014

STATION RECORD SHEET : DESCRIPTION FOR CONTROL POINT

PROJECT : BRIDGE RECONSTRUCTION ON NEW BRITAIN HIGHWAY

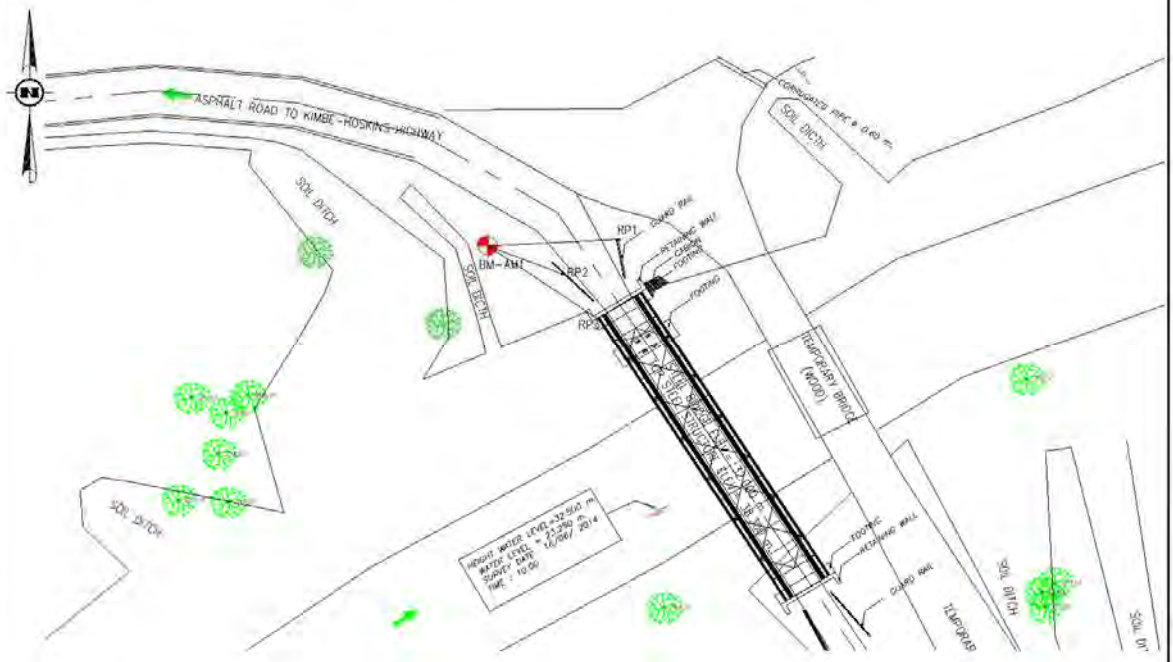
LOCATION : AUM BRIDGE

WGS1984 Geodatic Co-ordinates			WGS1984UTM Co-ordinates		Indian1975UTM Co-ordinates		Elevation
Latitude (N)	Longitude (E)	Ellip.ht	Northing	Easting	Northing	Easting	*(MSL)*
-	-	-	9372393.458	216702.679	-	-	32.249

SCALE FACTORS : 0.0000

DESCRIPTION OF MARK
PERMANENT MONUMENT

LOCATION



GENERAL INFORMATION

RP-1	COLUMN OF GUARDRAIL	Azi.	87 °	Dist.	18.53	meter
RP-2	COLUMN OF GUARDRAIL	Azi.	112 °	Dist.	11.16	meter
RP-3	COLUMN OF BRIDGE	Azi.	125 °	Dist.	18.95	meter

SURVEYED BY :	CLIENT :	STATION :
SIAM TONE CO., LTD.	CHODAI CO.,LTD.	BM-AM2
		DATE : 14/06/2014

STATION RECORD SHEET : DESCRIPTION FOR CONTROL POINT

PROJECT : BRIDGE RECONSTRUCTION ON NEW BRITAIN HIGHWAY

LOCATION : AUM BRIDGE

WGS1984 Geodatic Co-ordinates			WGS1984UTM Co-ordinates		Indian1975UTM Co-ordinates		Elevation
Latitude (N)	Longitude (E)	Ellip.ht	Northing	Easting	Northing	Easting	*(MSL)*
-	-	-	9372180.371	216833.590	-	-	30.136

SCALE FACTORS : 0.0000

DESCRIPTION OF MARK
PERMANENT MONUMENT

LOCATION

GENERAL INFORMATION

RP-1	COLUMN OF SIGN	Azi.	9 °	Dist.	99.59	meter
RP-2	PALM TREE	Azi.	92 °	Dist.	17.93	meter
RP-3	PALM TREE	Azi.	334 °	Dist.	11.52	meter

SURVEYED BY :	CLIENT :	STATION :
SIAM TONE CO., LTD.	CHODAI CO.,LTD.	BM-KP1
		DATE : 19/06/2014

STATION RECORD SHEET : DESCRIPTION FOR CONTROL POINT

PROJECT : BRIDGE RECONSTRUCTION ON NEW BRITAIN HIGHWAY

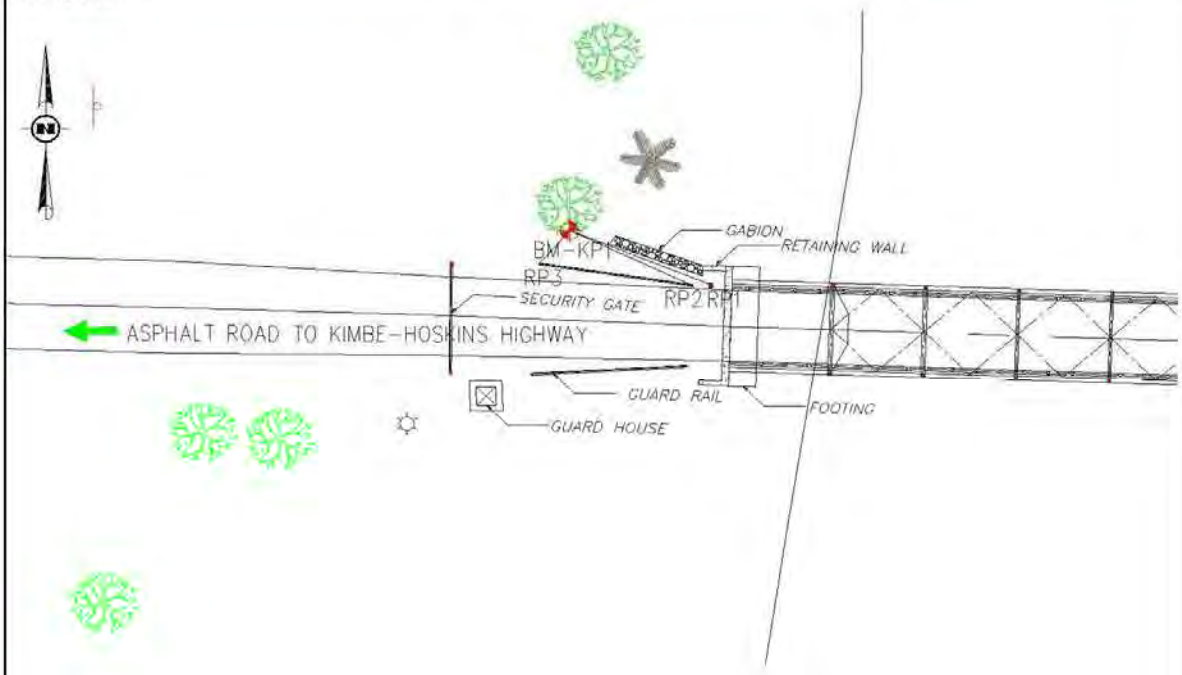
LOCATION : KAPIURA BRIDGE

WGS1984 Geodatic Co-ordinates			WGS1984UTM Co-ordinates		Indian1975UTM Co-ordinates		Elevation
Latitude (N)	Longitude (E)	Ellip.ht	Northing	Easting	Northing	Easting	*(MSL)*
-	-	-	9370513.000	217173.000	-	-	25.062

SCALE FACTORS : 0.0000

DESCRIPTION OF MARK
PERMANENT MONUMENT

LOCATION



GENERAL INFORMATION

RP-1	STEEL COLUMN	Azi.	112 °	Dist.	11.53	meter
RP-2	COLUMN OF GUARDRAIL	Azi.	115 °	Dist.	10.48	meter
RP-3	COLUMN OF GUARDRAIL	Azi.	221 °	Dist.	3.60	meter

SURVEYED BY :	CLIENT :	STATION :
SIAM TONE CO., LTD.	CHODAI CO.,LTD.	BM-KP2
		DATE : 19/06/2014

STATION RECORD SHEET : DESCRIPTION FOR CONTROL POINT

PROJECT : BRIDGE RECONSTRUCTION ON NEW BRITAIN HIGHWAY

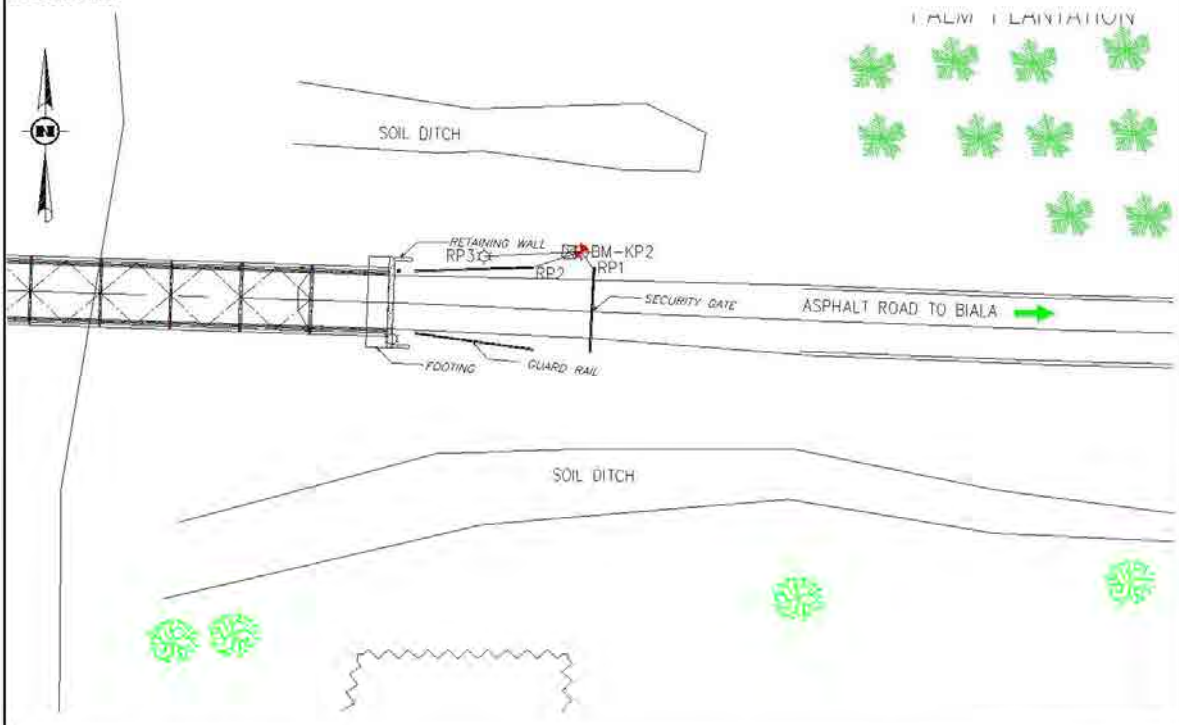
LOCATION : KAPIURA BRIDGE

WGS1984 Geodatic Co-ordinates			WGS1984UTM Co-ordinates		Indian1975UTM Co-ordinates		Elevation
Latitude (N)	Longitude (E)	Ellip.ht	Northing	Easting	Northing	Easting	*(MSL)*
-	-	-	9370506.788	217321.055	-	-	25.000

SCALE FACTORS : 0.0000

DESCRIPTION OF MARK
PERMANENT MONUMENT

LOCATION

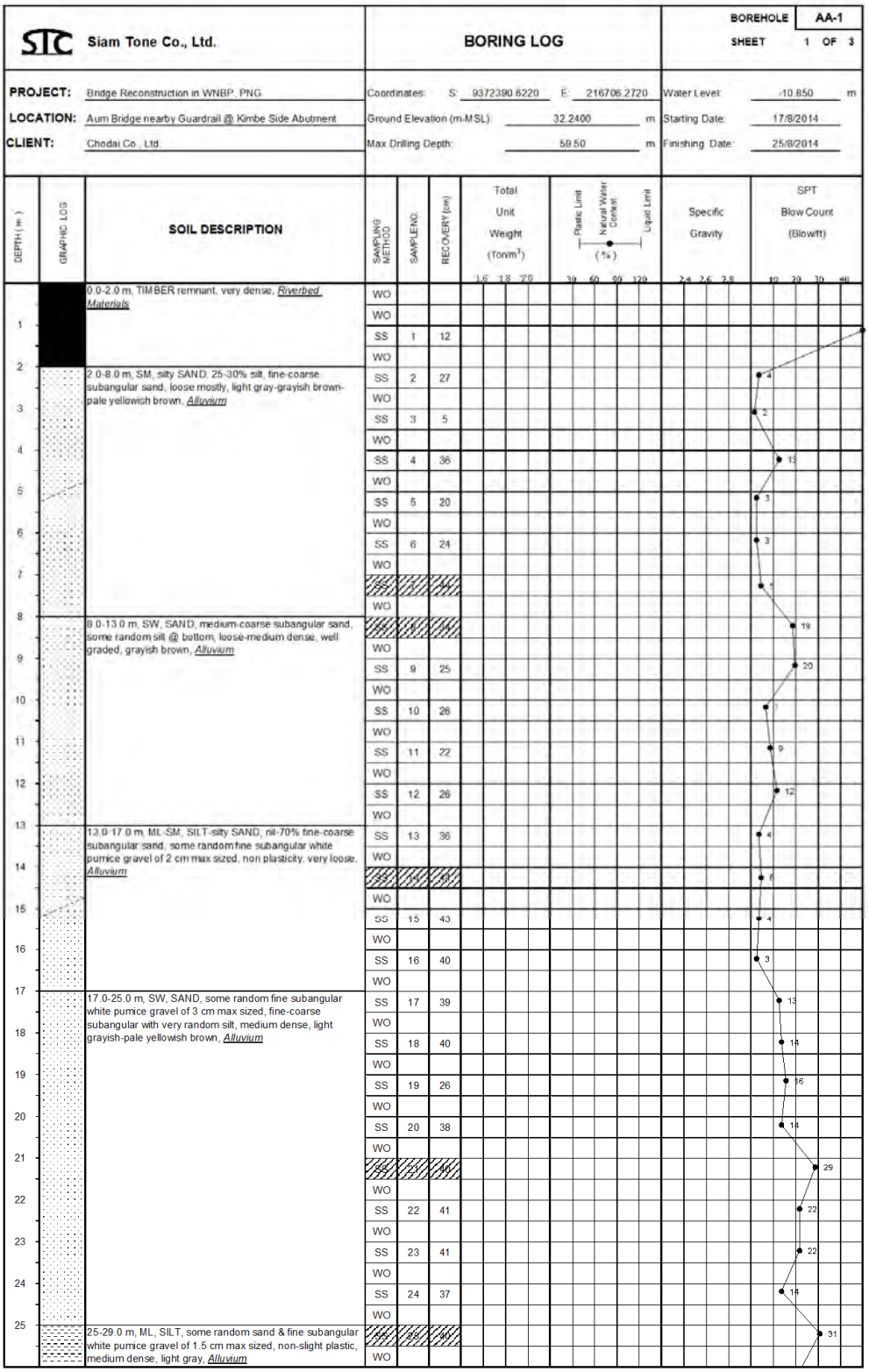


GENERAL INFORMATION

RP-1	STEEL COLUMN	Azi.	147 °	Dist.	2.22	meter
RP-2	COLUMN OF GUARDRAIL	Azi.	251 °	Dist.	5.22	meter
RP-3	LIGHTING POLE	Azi.	267 °	Dist.	9.96	meter

6.6 地質調査結果　ボーリング柱状図

6.6.1 アウム橋



STC Siam Tone Co., Ltd.

BORING LOG

BOREHOLE AA-1
SHEET 1 OF 3

PROJECT: Bridge Reconstruction in WNBP, PNG
LOCATION: Aum Bridge nearby Guardrail @ Kimbe Side Abutment
CLIENT: Chodai Co., Ltd.

Coordinates: S: 9372390.6220 E: 216706.2720
Ground Elevation (m-MSL): 32.2400 m
Max Drilling Depth: 59.50 m

Water Level: -10.850 m
Starting Date: 17/8/2014
Finishing Date: 25/8/2014

DEPTH (m.)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO.	RECOVERY (cm)	Total Unit Weight (Ton/m³) 1.6 1.8 2.0	Plastic Limit / Natural Water Content (%) / Liquid Limit 30 60 90 120	Specific Gravity 2.4 2.6 2.8	SPT Blow Count (Blow/ft) 10 20 30 40
1		0.0-2.0 m, TIMBER remnant, very dense, *Riverbed Materials*	WO						
			SS	1	12				50
2			WO						
		2.0-8.0 m, SM, silty SAND, 25-30% silt, fine-coarse subangular sand, loose mostly, light gray-grayish brown-pale yellowish brown, *Alluvium*	SS	2	27				4
3			WO						
			SS	3	5				2
4			WO						
			SS	4	36				13
5			WO						
			SS	5	20				3
6			WO						
			SS	6	24				3
7			WO						
			SS	7	24				5
8			WO						
		8.0-13.0 m, SW, SAND, medium-coarse subangular sand, some random silt @ bottom, loose-medium dense, well graded, grayish brown, *Alluvium*	SS	8	24				19
9			WO						
			SS	9	25				20
10			WO						
			SS	10	26				7
11			WO						
			SS	11	22				9
12			WO						
			SS	12	26				12
13			WO						
		13.0-17.0 m, ML-SM, SILT-silty SAND, nil-70% fine-coarse subangular sand, some random fine subangular white pumice gravel of 2 cm max sized, non plasticity, very loose, *Alluvium*	SS	13	36				4
14			WO						
			SS	14	40				5
15			WO						
			SS	15	43				4
16			WO						
			SS	16	40				3
17			WO						
		17.0-25.0 m, SW, SAND, some random fine subangular white pumice gravel of 3 cm max sized, fine-coarse subangular with very random silt, medium dense, light grayish-pale yellowish brown, *Alluvium*	SS	17	39				13
18			WO						
			SS	18	40				14
19			WO						
			SS	19	26				16
20			WO						
			SS	20	38				14
21			WO						
			SS	21	40				29
22			WO						
			SS	22	41				22
23			WO						
			SS	23	41				22
24			WO						
			SS	24	37				14
25			WO						
		25-29.0 m, ML, SILT, some random sand & fine subangular white pumice gravel of 1.5 cm max sized, non-slight plastic, medium dense, light gray, *Alluvium*	SS	25	40				31
			WO						

SIAM TONE CO., LTD.

BORING LOG

BORING NO. AA-1
SHEET 2 OF 3

PROJECT:	Bridge Reconstruction in WNBP, PNG	Coordinates:	N: 9372390.8220 E: 216706.2720	Water Level:	-10.85 m
LOCATION:	Aum Bridge nearby Guardrail @ Kimbe Side Abutment	Ground Elevation (m-MSL):	32.2400 m	Starting Date:	17/8/2014
CLIENT:	Chodai Co., Ltd	Max Drilling Depth:	59.50 m	Finishing Date:	25/8/2014

DEPTH (m.)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO.	RECOVERY (cm)	Organic Content (%)	Plastic Limit / Natural Water Content (%) / Liquid Limit	Specific Gravity	SPT Blow Count (Blow/ft)
26		25-29.0 m, ML, SILT, some random sand & fine subangular white pumice gravel of 1.5 cm max sized, non-slight plastic, medium dense, light gray, *Alluvium*	WO						
			SS	26	42				21
27			WO						
			SS	27	35				14
28			WO						
			SS	28	38				17
29			WO						
		29.0-32.0 m, SW, SAND with silt & gravel, nil-15% silt, 5-10% fine subangular gray river & white pumice gravel of 2.5 cm max sized, fine-coarse subangular sand, well graded, medium dense-dense, *Alluvium*	SS	29	32				20
30			WO						
			SS	30	32				13
31			WO						
			SS	31	45				41
32			WO						
		32.0-36.0 m, ML-SM, SILT with sand-silty SAND with gravel, 20-70% fine-coarse subangular sand, 1 m thin pure silt on top, 10-20% fine subangular white pumice gravel of 3 cm max sized, medium dense mostly, *Alluvium*	SS	32	45				4
			WO						
33			SS	33	42				26
			WO						
34			SS	34	37				21
			WO						
35			SS	35	33				26
			WO						
36		36-43.0 m, ML, SILT, random fine subangular white pumice gravel of 1.5 cm max sized, non-slight plasticity, very loose, light gray-light grayish brown, *Alluvium*	SS	36	42				2
			WO						
37			SS	37	44				8
			WO						
38			SS	38	45				5
			WO						
39			SS	39	45				4
			WO						
40			SS	40	45				3
			WO						
41			SS	41	35				5
			WO						
42			SS	42	25				4
			WO						
43		43.0-46.0 m, SW, SAND, fine-coarse subangular sand, well graded, medium dense, light gray-light grayish brown, *Alluvium*	SS	43	Loss				11
			WO						
44			SS	44	35				19
			WO						
45			SS	45	25				24
			WO						
46		46.0-59.5 m, SM, silty SAND, 30% silt, fine-coarse subangular sand, random fine subangular white pumice gravel of 3 cm max sized with 2 m thick @ 50 & 58 m, medium dense @ 46-50, very loose @ 50-54 & dense-very dense @ 54 m - end hole, gray mostly with light grayish brown on top, *Alluvium*	SS	46	Loss				12
			WO						
47			SS	47	15				11
			WO						
48			SS	48	45				5
			WO						
49			SS	49	45				18
			WO						
50			SS	50	45				4
			WO						

SIAM TONE CO., LTD.

BORING LOG

BORING NO. AA-1
SHEET 3 OF 3

PROJECT: Bridge Reconstruction in WNBP, PNG
LOCATION: Aum Bridge nearby Guardrail @ Kimbe Side Abutment
CLIENT: Chodai Co., Ltd.

Coordinates: N: 9372390.6220 E: 216706.2720
Ground Elevation (m-MSL): 32.2400 m
Max.Drilling Depth: 59.50 m

Water Level: -10.85 m
Starting Date: 17/8/2014
Finishing Date: 25/8/2014

DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO.	RECOVERY (cm)	Total Unit Weight (Ton/m³) 1.6 1.8 2.0	Plastic Limit / Natural Water Content / Liquid Limit (%) 30 60 90 120	Specific Gravity 2.4 2.6 2.8	SPT Blow Count (Blow/ft) 10 20 30 40
51		46.0-59.5 m,SM, silty SAND, 30% silt, fine-coarse subangular sand, random fine subangular white purhice gravel of 3 cm max sized with 2 m thck @ 50 & 58 m, medium dense @ 46-50, very loose @ 50-54 & dense-very dense @ 54 m - end hole, gray mostly with light grayish brown on top, *Alluvium*	SS	50	45				4
			WO						
			Lab						
52			WO						2
			SS	52	Loss				
53			WO						
			SS	53	45				3
54			WO						
			SS	54	44				21
55			WO						
			Lab						50/27
56			WO						
			SS	56	45				41
57			WO						
			SS	57	34				50/22
58			WO						
			SS	58	45				43
59			WO						
			Lab						50/26
		End of hole @ 59.5 m							

Loss
Lab, WO - Wash out, SS-Split Spoon Sampling

Siam Tone Co., Ltd.

BORING LOG

BOREHOLE AP-1
SHEET 1 OF 2

PROJECT: Bridge Reconstruction in WNBP, PNG
LOCATION: Aum Bridge @ Middle Pier (drill from middle Aum Bdg)
CLIENT: Chodai Co., Ltd.

Coordinates: S. 9372362.8400 E. 216734.5160
Ground Elevation (m-MSL): 20.9500 m
Max.Drilling Depth: 44.50 m

Water Level: In River m
Starting Date: 28/8/2014
Finishing Date: 2/9/2014

DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO.	RECOVERY (cm)	Total Unit Weight (Ton/m³) 1.6 1.8 2.0	Plastic Limit / Natural Water Content / Liquid Limit (%) 30 60 90 120	Specific Gravity 2.4 2.6 2.8	SPT Blow Count (Blow/ft) 10 20 30 40
0		0.0-4.0 m, GRAVEL with sand, loose, *Alluvium*	WO						
1			WO						
			SS	1	18				8
2			WO						
			SS	2	12				8
3			WO						
			SS	3	15				11
4			WO						
		4.0-28.0 m, silty SAND, SAND, gravelly SAND mixtures, medium dense, *Alluvium*	SS	4	27				9
5			WO						
			SS	5	29				11
6			WO						
			SS	6	45				7
7			WO						
			SS	7	16				17
8			WO						
			SS	8	23				17
9			WO						
			SS	9	19				27
10			WO						
			SS	10	21				20
11			WO						
			SS	11	39				34
12			WO						
			SS	12	34				16
13			WO						
			SS	13	36				18
14			WO						
			SS	14	37				17
15			WO						
			SS	15	41				25
16			WO						
			SS	16	41				33
17			WO						
			SS	17	45				23
18			WO						
			SS	18	45				22
19			WO						
			SS	19	38				31
20			WO						
			SS	20	37				22
21			WO						
			SS	21	45				23
22			WO						
			SS	22	45				20
23			WO						
			SS	23	43				16
24			WO						
			SS	24	38				22
25			WO						
			SS	25	40				18
			WO						

SIAM TONE CO., LTD.

BORING LOG

BORING NO. AP-1
SHEET 2 OF 2

PROJECT: Bridge Reconstruction in WNBP, PNG
LOCATION: Aum Bridge @ Middle Pier (drill from middle Aum Bdg)
CLIENT: Chodai Co., Ltd.

Coordinates: N: 9372362.8400 E: 216734.5160
Ground Elevation (m-MSL): 20.9500 m
Max Drilling Depth: 44.50 m

Water Level: In River m
Starting Date: 28/8/2014
Finishing Date: 2/9/2014

DEPTH (m.)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO.	RECOVERY (cm)	Organic Content (%) 1.0 2.0 3.0	Plastic Limit / Natural Water Content (%) / Liquid Limit 30 60 90 120	Specific Gravity 2.4 2.6 2.8	SPT Blow Count (Blow/ft) 10 20 30 40
26		4.0-26.0 m, silty SAND-SAND-gravelly SAND mixtures, medium dense, *Alluvium*	SS	26	40				
			WO						
		26.0-32.0 m, SILT, loose, *Alluvium*	SS	26	45				6
27			WO						
			SS	27	40				9
28			WO						
			SS	28	38				7
29			WO						
			SS	29	38				2
30			WO						
			SS	30	45				12
31			WO						
			SS	31	44				2
32			WO						
		32.0-33.0 m, GRAVEL with sand, medium dense, *Alluvium*	SS	32	20				16
33			WO						
		33.0-40.0 m, silty SAND, medium dense with dense @ the last metre, *Alluvium*	SS	33	20				22
			WO						
34			SS	34	32				13
			WO						
35			SS	35	35				23
			WO						
36			SS	36	27				25
			WO						
37			SS	37	32				17
			WO						
38			SS	38	42				12
			WO						
39			SS	39	32				31
			WO						
40		32.0-40.0 m, silty SAND-SAND with gravel, dense-very dense, *Alluvium*	SS	40	32				32
			WO						
41			SS	41	31				50/19
			WO						
42			SS	42	20				43
			WO						
43			SS	43	36				31
			WO						
44			SS	43	20				31
		End of hole @ 44.5 m							

Loss

Lab, WO - Wash out, SS-Split Spoon Sampling

Siam Tone Co., Ltd.

BORING LOG

BOREHOLE AA-2
SHEET 1 OF 3

PROJECT:	Bridge Reconstruction in WNBP, PNG	Coordinates:	S. 9372328.3430	E. 216754.7280	Water Level: -10.100 m
LOCATION:	Aum Bridge Access Road @ Ubaie Side Abutment	Ground Elevation (m-MSL):	31.8000 m		Starting Date: 7/9/2014
CLIENT:	Chodai Co., Ltd.	Max. Drilling Depth:	71.50 m		Finishing Date: 14/9/2014

DEPTH (m.)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO.	RECOVERY (cm)	Total Unit Weight (Tonm^3) 1.6 1.8 2.0	Plastic Limit / Natural Water Content / Liquid Limit (%) 20 60 90 120	Specific Gravity 2.4 2.6 2.8	SPT Blow Count (Blow/ft) 10 20 30 40
0		0.0-3.0 m, SAND, loose-medium dense, *Alluvium*	WO						
1			WO						
			SS	1	40				11
2			WO						
			SS	2	12				10
3			WO						
		3.0-5.5 m, gravelly SAND, medium dense, *Alluvium*	SS	3	20				11
4			WO						
			SS	4	24				22
5			WO						
			SS	5	20				25
6		5.5-8.5 m, ML, SILT, very loose, *Alluvium*	WO						
			SS	6	36				4
7			WO						
			SS	7	25				4
8			WO						
			SS	8	26				5
9		8.5-13.0 m, gravelly SAND, loose-medium dense, *Alluvium*	WO						
			SS	9	Loss				50/22
10			WO						
			SS	10	35				15
11			WO						
			SS	11	35				9
12			WO						
			SS	12	34				8
13			WO						
		13.0-15.0 m, SM, silty SAND, medium dense-dense, *Alluvium*	SS	13	45				33
14			WO						
			SS	14	39				23
15			WO						
		15.0-21.0 m, SAND, loose-medium dense, *Alluvium*	SS	15	39				12
16			WO						
			SS	16	40				12
17			WO						
			SS	17	42				8
18			WO						
			SS	18	36				11
19			WO						
			SS	19	25				4
20			WO						
			SS	20	38				13
21			WO						
		21.0-37.0 m, gravelly SAND, very random silt, medium dense mostly, *Alluvium*	SS	21	40				21
22			WO						
			SS	22	38				23
23			WO						
			SS	23	38				32
24			WO						
			SS	24	37				17
25			WO						
			SS	25	36				21
			WO						

SIAM TONE CO., LTD.

BORING LOG

BORING NO. AA-2
SHEET 2 OF 3

PROJECT:	Bridge Reconstruction in WNBP, PNG	Coordinates:	N. 9372328.3430	E. 216754.7280	Water Level	-10.10	m
LOCATION:	Aum Bridge Access Road @ Ubaie Side Abutment	Ground Elevation (m-MSL):	31.8000	m	Starting Date	7/9/2014	
CLIENT:	Chodai Co., Ltd	Max.Drilling Depth:	71.50	m	Finishing Date	14/9/2014	

DEPTH (m.)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO.	RECOVERY (cm)	Organic Content (%) 1.0 2.0 3.0	Plastic Limit — Natural Water Content (%) — Liquid Limit 30 60 90 120	Specific Gravity 2.4 2.6 2.8	SPT Blow Count (Blow/ft) 10 20 30 40
26		21.0-37.0 m, gravelly SAND, very random silt, medium dense mostly, *Alluvium*	SS	25	36				
			WO						
			SS	26	27				19
27			WO						
			SS	27	37				25
28			WO						
			SS	28	42				23
29			WO						
			SS	29	36				17
30			WO						
			SS	30	35				17
31			WO						
			SS	31	40				35
32			WO						
			SS	32	37				31
33			WO						
			SS	33	42				22
34			WO						
			SS	34	38				21
35			WO						
			SS	35	42				31
36			WO						
			SS	36	40				26
37			WO						
		37.0-42.0 m, ML, SILT, loose mostly, *Alluvium*	SS	37	45				4
38			WO						
			SS	38	42				37
39			WO						
			SS	39	45				4
40			WO						
			SS	40	45				8
41			WO						
			SS	41	45				10
42			WO						
		42.0-60.0 m, silty SAND-SAND, very random gravel, medium dense, *Alluvium*	SS	42	45				28
43			WO						
			SS	43	36				20
44			WO						
			SS	44	36				19
45			WO						
			SS	45	33				19
46			WO						
			SS	46	34				25
47			WO						
			SS	47	40				15
48			WO						
			SS	48	45				11
49			WO						
			SS	49	38				22
50			WO						
			SS	50	27				19
			WO						

SIAM TONE CO., LTD.

BORING LOG

BORING NO. AA-2
SHEET 3 OF 3

PROJECT: Bridge Reconstruction in WNBP, PNG
LOCATION: Aum Bridge Access Road @ Ubaie Side Abutment
CLIENT: Chodai Co., Ltd.

Coordinates: N. 9372328.3430 E. 216754.7280
Ground Elevation (m MSL): 31.8000 m
Max Drilling Depth: 71.50 m

Water Level: -10.10 m
Starting Date: 7/9/2014
Finishing Date: 14/9/2014

DEPTH (m.)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO.	RECOVERY (cm)	Total Unit Weight (Ton/m³) 1.6 1.8 2.0	Plastic Limit — Natural Water Content (%) — Liquid Limit 30 60 90 120	Specific Gravity 2.4 2.6 2.8	SPT Blow Count (Blow/ft) 10 20 30 40
51		46.0-59.5 m, silty SAND, with 2 m thick pure silt @ 47 m, medium dense @ 46-50, very loose @ 50-54 & dense-very dense @ 54 m - end hole, *Alluvium*	SS	50	27				
			WO						
			SS	51	37				18
52			WO						
			SS	52	42				21
53			WO						
			SS	53	37				18
54			WO						
			SS	54	38				23
55			WO						
			SS	55	38				18
56			WO						
			SS	56	39				15
57			WO						
			SS	57	40				23
58			WO						
			SS	58	43				21
59			WO						
			SS	59	30				19
60			WO						
		60.0-67.0 m, SM, silty SAND, medium dense mostly, *Alluvium*	SS	60	38				9
61			WO						
			SS	61	45				13
62			WO						
			SS	62	40				24
63			WO						
			SS	63	45				9
64			WO						
			SS	64	26				15
65			WO						
			SS	65	32				19
66			WO						
			SS	66	27				37
67			WO						
		67.0-70.0 m, gravelly SAND, dense, *Alluvium*	SS	67	33				43
68			WO						
			SS	68	32				33
69			WO						
			SS	69	30				31
70			WO						
		70.0-71.5 m, SM, silty SAND, dense, *Alluvium*	SS	70	39				32
71			WO						
			SS	71	45				31
		End of hole @ 71.5 m							

Loss
Lab. WO - Wash out, SS-Split Spoon Sampling

6.6.2 カピウラ橋

Siam Tone Co., Ltd. — **BORING LOG** — BOREHOLE KA-1, SHEET 1 OF 3

PROJECT: Bridge Reconstruction in WNBP, PNG
LOCATION: Kapiura Bridge @ Kimbe Side Abutment (Sta 0+315)
CLIENT: Chodai Co., Ltd.

Coordinates: S: 9370477.9920 E: 217160.6360
Ground Elevation (m-MSL): 21.3000 m
Max.Drilling Depth: 65.50 m

Water Level: -5.500 m
Starting Date: 30/7/2014
Finishing Date: 8/8/2014

DEPTH (m.)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO.	RECOVERY (cm)	Total Unit Weight (Ton/m³)	Plastic Limit / Natural Water Content (%) / Liquid Limit	Specific Gravity	SPT Blow Count (Blow/ft)
1		0.0-6.0 m, SP, SAND, fine-medium subangular sand, poorly graded, very loose, yellowish brown, *Recent Alluvium of Gully Deposit*	WO						
			WO						
			SS	1	25				2
2			WO						
			SS	2	25				0
3			WO						
			SS	3	24				1
4			WO						
			SS	4	15				0
5			WO						
			SS	5	15				0
6			WO						
		6.0-10.5 m, SP, SAND with gravel-gravelly SAND, 10-35% fine subangular-subround gray river with little white pumice gravel of 2 cm max sized, fine-coarse subangular sand, poorly graded, medium dense, light gray-gray, *Alluvium*	SS	6	25				12
7			WO						
			SS	7	20				18
8			WO						
			SS	8	25				31
9			WO						
			SS	9	20				12
10			WO						
			SS	10	21				5
11		10.5-14.0 m, SM-SW, silty SAND-SAND, nil-30% silt, fine-medium subangular sand, well graded, very loose-loose, gray, *Alluvium*	WO						
			SS	11	15				1
12			WO						
			SS	12	45				4
13			WO						
			SS	13	40				4
14			WO						
		14.0-19.0 m, SW, gravelly SAND, 35% fine subround gray river gravel of 3 cm max sized, medium subangular sand, well graded, dense mostly, gray, *Alluvium*	SS	14	30				31
15			WO						
			SS	15	18				33
16			WO						
			SS	16	25				30
17			WO						
			SS	17	21				18
18			WO						
			SS	18	14				49
19			WO						
		19.0-22.0 m, SM, silty SAND, 30% silt, fine subangular sand, loose-medium dense, light gray-light grayish brown, *Alluvium*	SS	19	30				23
20			WO						
			SS	20	33				20
21			WO						
			SS	21	41				7
22			WO						
		22.0-40.0 m, SW, SAND, very random @ 1-2 m thick silty sand and sand with gravel @ few specific depths as detailed, fine-coarse subangular sand, well graded, medium dense, light gray mostly with some random pale yellowish brown-light grayish brown, *Alluvium*	SS	22	32				10
23			WO						
			SS	23	45				9
24			WO						
			SS	24	40				14
25			WO						
		25.0-26.0 m, SM, silty SAND, 30% silt, fine subangular sand, loose, light gray (same @ 23-24 m)	SS	25	30				9
			WO						

SIAM TONE CO., LTD.

BORING LOG

BORING NO. KA-1
SHEET 2 OF 3

PROJECT: Bridge Reconstruction in WNBP, PNG
LOCATION: Kapiura Bridge @ Kimbe Side Abutment (Sta 0+315)
CLIENT: Chodai Co., Ltd.

Coordinates: N: 9370477.9920 E: 217160.6360
Ground Elevation (m-MSL): 21.3000 m
Max.Drilling Depth: 65.50 m

Water Level: -5.50 m
Starting Date: 30/7/2014
Finishing Date: 8/8/2014

DEPTH (m.)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO.	RECOVERY (cm)	Organic Content (%)	Plastic Limit / Natural Water Content (%) / Liquid Limit	Specific Gravity	SPT Blow Count (Blow/ft)
26		22.0-40.0 m, SW, SAND, very random @ 1-2 m thick silty sand and sand with gravel @ a few specific depths as detailed, fine-coarse subangular sand, well graded, medium dense, light gray mostly with some random pale yellowish brown-light grayish brown, *Alluvium*	WO						
			SS	26	40				23
27			WO						
			SS	27	42				15
28			WO						
		28.0-29.0 m, SW, gravelly SAND, 20% fine pumice gravel of 1.5 cm max sized, medium-coarse subangular sand, well graded, medium dense, light gray	SS	28	32				16
29			WO						
			SS	29	45				25
30			WO						
			SS	30	35				16
31			WO						
			SS	31	41				20
32			WO						
			SS	32	45				20
33			WO						
			SS	33	35				17
34			WO						
		34.0-35.0 m, ML, SILT, random fine subround white pumice gravel of 1 cm max sized, non plasticity, medium dense, light gray	SS	34	43				23
35			WO						
		35.0-37.0 m, SW, SAND with gravel, 10% fine subround white pumice gravel of 1.5 cm max sized, fine-medium subangular sand, well graded, medium dense, light grayish brown	SS	35	43				23
36			WO						
			SS	36	45				27
37			WO						
			SS	37	43				20
38			WO						
		38.0-40.0 m, SM, silty SAND, 30% silt, fine subangular sand,medium dense, light gray	SS	38	40				18
39			WO						
			SS	39	38				15
40			WO						
		40.0-43.0 m, ML, SILT SILT with sand, nil 15% medium coarse subangular sand, non plasticity, light gray, *Alluvium*	SS	40	10				40
41			WO						
			SS	41	10				12
42			WO						
			SS	42	30				39
43			WO						
		43.0-56.0 m, SW, SAND, fine-coarse subangular sand, well graded, medium dense, light grayish brown, *Alluvium*	SS	43	23				26
44			WO						
			SS	44	28				37
45			WO						
			SS	45	33				20
46			WO						
			SS	46	45				17
47			WO						
			SS	47	36				16
48			WO						
			SS	48	39				22
49			WO						
			SS	49	38				19
50			WO						
			SS	50	35				13
			WO						

SIAM TONE CO., LTD.

BORING LOG

BORING NO. KA-1
SHEET 3 OF 3

PROJECT:	Bridge Reconstruction in WNBP, PNG	Coordinates: N 9370477.9920	E 217160.6360	Water Level	-5.50 m
LOCATION:	Kapiura Bridge @ Kimbe Side Abutment (Sta 0+315)	Ground Elevation (m-MSL)	21.3000 m	Starting Date	30/7/2014
CLIENT:	Chodai Co., Ltd.	Max Drilling Depth	65.50 m	Finishing Date	8/8/2014

DEPTH (m.)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO.	RECOVERY (cm)	Total Unit Weight (Ton/m³)	Plastic Limit / Natural Water Content (%) / Liquid Limit	Specific Gravity	SPT Blow Count (Blow/ft)
						1.5 1.8 2.0	30 60 90 120	2.4 2.6 2.8	10 20 30 40
51		43.0-56.0 m, SW, SAND, fine-coarse subangular sand, well graded, medium dense, light grayish brown, *Alluvium*	SS	50	35				
			WO						
			SS	51	35				24
52			WO						
			SS	52	30				16
53			WO						
			SS	53	35				20
			WO						
54		54.0-58.0 m, SW, SAND, fine-coarse subangular sand, well graded, dense, dark gray	SS	54	32				41
			WO						
55			SS	55	Loss				31
			WO						
56		58.0-60.0 m, SW, SAND with gravel, 10% fine subround white pumice gravel of 2 cm max sized, medium-coarse subangular sand, well graded, medium dense, light grayish brown, *Alluvium*	SS	56	37				22
			WO						
57									30
			WO						
58			SS	58	35				21
			WO						
59			SS	59	36				17
			WO						
60		60.0-64.0 m, SM, silty SAND with gravel, 15% fine-coarse subangular gray river gravel of 5 cm max sized, medium subangular sand, well graded, light grayish brown, *Alluvium*	SS	60	35				39
			WO						
61			SS	61	24				40
			WO						
62			SS	62	11				42
			WO						
63			SS	63	16				38
			WO						
64		64.0-65.5 m, SW, SAND, fine-coarse subangular sand, well graded, dense, light gray-gray, *Alluvium*	SS	64	30				31
			WO						
65									30
		End of hole @ 65.5 m							

Loss
Lab, WO - Wash out, SS-Split Spoon Sampling

Siam Tone Co., Ltd.

BORING LOG

BOREHOLE KA-2
SHEET 1 OF 2

PROJECT: Bridge Reconstruction in WNBP, PNG
LOCATION: Kapaura Bridge @ Ubai Side Abutment
CLIENT: Chodai Co., Ltd.

Coordinates: S 9370473.3110 E 217298.5550
Ground Elevation (m-MSL): 21.0000 m
Max Drilling Depth: 40.50 m

Water Level: -5.800 m
Starting Date: 11/8/2014
Finishing Date: 14/8/2014

DEPTH (m.)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO.	RECOVERY (cm)	Total Unit Weight (Ton/m³)	Plastic Limit / Natural Water Content (%) / Liquid Limit	Specific Gravity	SPT Blow Count (Blow/ft)
1		0.0-2.0 m, SM, silty SAND, 30% silt, fine subangular sand, very loose, yellowish brown, *Alluvium*	SS	1	45				2
2		2.0-10.0 m, SW, SAND with gravel, 10-15% fine-coarse subangular white pumice gravel of 2 cm max sized, medium-coarse subangular sand, well graded, loose	SS	2	26				12
3			SS	3	29				11
4			SS	4	45				9
5			SS	5	Loss				6
6			SS	6	35				10
7			SS	7	36				9
8			SS	8	45				8
9			SS	9	33				9
10		10.0-13.0 m, ML, SILT, low plasticity, very loose-loose, yellowish brown with some gray, *Volcanic Ash*	SS	10	45				8
11			SS	11	45				8
12			SS	12	45				8
13		13.0-16.0 m, SW, SAND with gravel-SAND, nil-10% fine subround white pumice & gray river gravel of 2 cm max sized, medium subangular-subround sand, well graded, loose-medium dense, light grayish brown-dark gray, *Alluvium*	SS	13	45				10
14			SS	14	45				15
15			SS	15	33				48
16		16.0-18.0 m, GP, GRAVEL-sand mixtures, 20% medium-coarse subangular sand, fine subround gray river gravel of 3 cm max sized, poorly graded, dense, dark gray, *Alluvium*	SS	16	24				38
17			SS	17	45				38
18		18.0-22.0 m, SM, silty SAND, 30% silt, fine subangular-sybround sand, medium dense, light gray, a random pale yellowish brown silt layer of 1 m thick @ 20-21 m, *Alluvium*	SS	18	Loss				19
19			SS	19	45				11
20			SS	20	35				6
21			SS	21	27				19
22		22.0-25.0 m, SW, SAND, fine-coarse subangular sand, well graded, medium dense, light gray-gray, *Alluvium*	SS	22	45				19
23			SS	23	37				19
24			SS	24	37				12
25		25.0-27.0 m, SM, silty SAND wt gravel, 30% silt, nil-15% fine subang whitegravel of 1.5 cm max sized, fine subang sand, med dense, light gray, *Alluvium*	SS	25	38				17

SIAM TONE CO., LTD.

BORING LOG

BORING NO. KA-2
SHEET 2 OF 2

PROJECT: Bridge Reconstruction in WNBP, PNG
LOCATION: Kapiura Bridge @ Ubai Side Abutment
CLIENT: Chodai Co., Ltd.

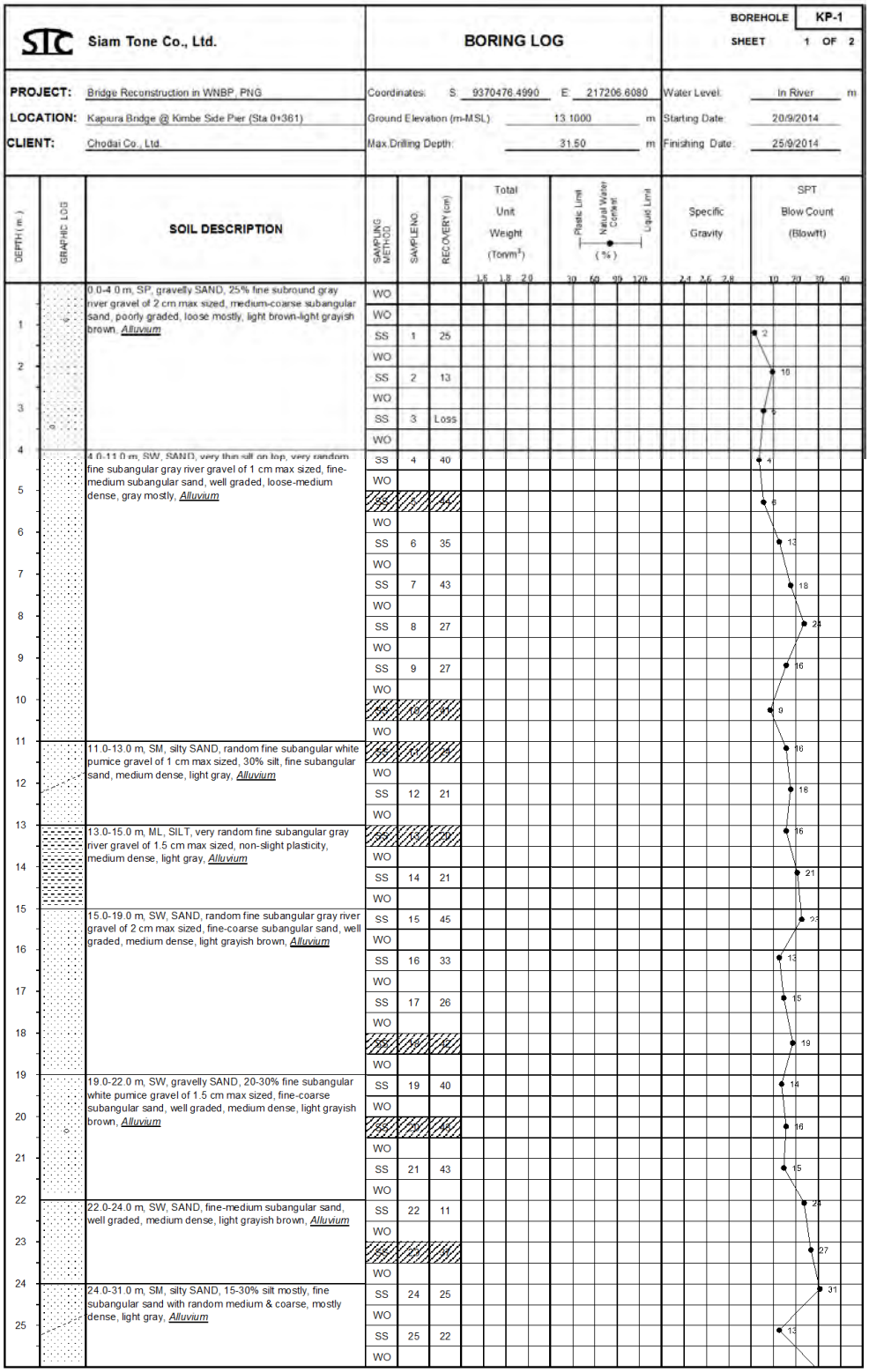
Coordinates: N: 9370473.3110 E: 217298.5550
Ground Elevation (m-MSL): 21.0000 m
Max Drilling Depth: 40.50 m

Water Level: -5.80 m
Starting Date: 11/8/2014
Finishing Date: 14/8/2014

DEPTH (m.)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO.	RECOVERY (cm)	Organic Content (%)	Plastic Limit / Natural Water Content (%) / Liquid Limit	Specific Gravity	SPT Blow Count (Blow/ft)
25		25.0-27.0 m, SM, silty SAND with gravel, 30% silt, nil-15% fine subangular white pumice gravel of 1.5 cm max sized, fine subangular sand, medium dense, light gray, *Alluvium*	SS	25	38				
			WO						
26			SS	26	39				17
			WO						
27		27.0-33.0 m, SW, SAND, fine-coarse subangular sand, with very random fine subround white pumice gravel of 1.5 cm max sized, well graded, medium dense, light gray brown, *Alluvium*	SS	27	35				18
			WO						
28			SS	28	38				21
			WO						
29			SS	29	40				18
			WO						
30			SS	30	35				17
			WO						
31			SS	31	25				16
			WO						
32			SS	32	35				17
			WO						
33		33.0-35.0 m, ML, SILT, low plasticity, medium dense, gray, *Alluvium*	SS	33	39				23
			WO						
34			SS	34	40				22
			WO						
35		35.0-38.0 m, SM-SW, silty SAND-SAND, nil-30% silt, fine-coarse subangular sand, well graded, medium dense-dense, light gray-light grayish brown, *Alluvium*	SS	35	32				39
			WO						
36			SS	36	35				31
			WO						
37			SS	37	39				19
			WO						
38		38.0-40.0 m, ML, SILT with sand,20% fine subangular sand, non plasticity, dense, gray, *Alluvium*	SS	38	40				31
			WO						
39			SS	39	38				35
			WO						
40		40.0-40.5 m, SM, silty SAND 30% silt, med dense, gray	SS	40	38				31

■ Loss

▨ Lab, WO - Wash out, SS-Split Spoon Sampling



Siam Tone Co., Ltd.

BORING LOG

BOREHOLE KP-1
SHEET 1 OF 2

PROJECT: Bridge Reconstruction in WNBP, PNG
LOCATION: Kapiura Bridge @ Kimbe Side Pier (Sta 0+361)
CLIENT: Chodai Co., Ltd.

Coordinates: S: 9370476.4990 E: 217206.6080
Ground Elevation (m-MSL): 13.1000 m
Max.Drilling Depth: 31.50 m

Water Level: In River m
Starting Date: 20/9/2014
Finishing Date: 25/9/2014

DEPTH (m.)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO.	RECOVERY (cm)	SPT Blow Count (Blow/ft)
1		0.0-4.0 m, SP, gravelly SAND, 25% fine subround gray river gravel of 2 cm max sized, medium-coarse subangular sand, poorly graded, loose mostly, light brown-light grayish brown, *Alluvium*	WO			
			WO			
			SS	1	25	2
2			WO			
			SS	2	13	10
3			WO			
			SS	3	Loss	5
4			WO			
		4.0-11.0 m, SW, SAND, very thin silt on top, very random fine subangular gray river gravel of 1 cm max sized, fine-medium subangular sand, well graded, loose-medium dense, gray mostly, *Alluvium*	SS	4	40	4
5			WO			
			SS	5	45	6
			WO			
6			SS	6	35	13
			WO			
7			SS	7	43	18
			WO			
8			SS	8	27	24
			WO			
9			SS	9	27	16
			WO			
10			SS	10	40	9
			WO			
11		11.0-13.0 m, SM, silty SAND, random fine subangular white pumice gravel of 1 cm max sized, 30% silt, fine subangular sand, medium dense, light gray, *Alluvium*	SS	11	40	10
12			WO			
			SS	12	21	18
			WO			
13		13.0-15.0 m, ML, SILT, very random fine subangular gray river gravel of 1.5 cm max sized, non-slight plasticity, medium dense, light gray, *Alluvium*	SS	13	40	16
14			WO			
			SS	14	21	21
			WO			
15		15.0-19.0 m, SW, SAND, random fine subangular gray river gravel of 2 cm max sized, fine-coarse subangular sand, well graded, medium dense, light grayish brown, *Alluvium*	SS	15	45	23
16			WO			
			SS	16	33	13
17			WO			
			SS	17	26	15
18			WO			
			SS	18	40	19
			WO			
19		19.0-22.0 m, SW, gravelly SAND, 20-30% fine subangular white pumice gravel of 1.5 cm max sized, fine-coarse subangular sand, well graded, medium dense, light grayish brown, *Alluvium*	SS	19	40	14
20			WO			
			SS	20	40	16
21			WO			
			SS	21	43	15
22			WO			
		22.0-24.0 m, SW, SAND, fine-medium subangular sand, well graded, medium dense, light grayish brown, *Alluvium*	SS	22	11	24
23			WO			
			SS	23	40	27
24			WO			
		24.0-31.0 m, SM, silty SAND, 15-30% silt mostly, fine subangular sand with random medium & coarse, mostly dense, light gray, *Alluvium*	SS	24	25	31
25			WO			
			SS	25	22	13
			WO			

SIAM TONE CO., LTD.

BORING LOG

BORING NO. KP-1
SHEET 2 OF 2

PROJECT: Bridge Reconstruction in WNBP, PNG
LOCATION: Kapiura Bridge @ Kimbe Side Pier (Sta 0+361)
CLIENT: Chodai Co., Ltd.

Coordinates: N 9370476.4990 E: 217206.6080
Ground Elevation (m-MSL): 13.1000 m
Max Drilling Depth: 31.50 m

Water Level: In River m
Starting Date: 20/9/2014
Finishing Date: 25/9/2014

DEPTH (m.)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO.	RECOVERY (cm)	Organic Content (%)	Plastic Limit / Natural Water Content (%) / Liquid Limit	Specific Gravity	SPT Blow Count (Blow/ft)
26		24.0-31.0 m, SM; silty SAND, 15-30% silt mostly, fine subangular sand with random medium & coarse, mostly dense, light gray, *Alluvium*	SS	25	22				
			WO						
			WO						31
27			WO						
			SS	27	11				
28			WO						
			SS	28	27				33
29			WO						
			SS	29	26				4
30			WO						
			WO						32
31			WO						
			SS	31	20				33
		End of hole @ 31.5 m							

Siam Tone Co., Ltd.

BORING LOG

BOREHOLE KP-2
SHEET 1 OF 2

PROJECT:	Bridge Reconstruction in WNBP, PNG	Coordinates:	S: 9370474.9250	E: 217252.8100	Water Level: In River m
LOCATION:	Kapiura Bridge @ Ubai Side Pier (Sta 0+407)	Ground Elevation (m-MSL):	13.6000 m		Starting Date: 26/9/2014
CLIENT:	Chodai Co., Ltd.	Max.Drilling Depth:	30.50 m		Finishing Date: 3/10/2014

DEPTH (m.)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO.	RECOVERY (cm)	Total Unit Weight (Ton/m³) 1.6 1.8 2.0	Plastic Limit / Natural Water Content (%) / Liquid Limit 30 60 90 120	Specific Gravity 2.4 2.6 2.8	SPT Blow Count (Blow/ft) 10 20 30 40
1		0.0-2.0 m, SW, gravelly SAND, 30% fine subround gray river gravel of 2.5 cm max sized, medium-coarse subangular sand, well graded, very loose, light brown, *Alluvium*	WO						
			WO						
			SS	1	8				2
2			WO						
		2.0-5.0 m, ML, SILT, low plasticity, very loose mostly, gray, with 1 m thick silty sand @ bottom, *Alluvium*	SS	2	45				2
			WO						
3			SS	3	42				6
			WO						
4			SS	4	40				4
			WO						
5			SS	5	45				4
			WO						
6			SS	6	45				14
		6.0-9.0 m, SW, SAND, some fine subangular gray river gravel of 3 cm max sized, medium-coarse subangular sand, well graded, medium dense, gra-light grayish brown, *Alluvium*	WO						
7			SS	7	17				20
			WO						
8			SS	8	17				22
			WO						
9		9.0-11.0 m, SW, gravelly SAND, 35% fine subround gray river gravel of 3.5 cm max sized, medium-coarse subangular sand, well graded, medium dense, gray, *Alluvium*	SS	9	Loss				11
			WO						
10			SS	10	5				29
			WO						
11		11.0-14.0 m, ML-SM, SILT-silty SAND, nil-80% fine subangular sand, very random fine subangular gray river gravel of 2.5 cm max sized, well graded, loose-medium dense, light gray, *Alluvium*	SS	11	16				32
			WO						
12			SS	12	17				8
			WO						
13			SS	13	78				13
			WO						
14		14.0-25.0 m, SW, SAND, random silt & fine subangular gray river gravel of 1 cm max sized @ a few specific depths, fine-coarse subangular sand, well graded, medium dense, light gray-light graish brown, *Alluvium*	SS	14	20				13
			WO						
15			SS	15	78				33
			WO						
16			SS	16	12				20
			WO						
17			SS	17	21				16
			WO						
18			SS	18	78				24
			WO						
19			SS	19	36				24
			WO						
20			SS	20	35				13
			WO						
21			SS	21	40				21
			WO						
22			SS	22	78				20
			WO						
23			SS	23	41				20
			WO						
24			SS	24	40				21
			WO						
25		25.0-30.5 m, SM, silty SAND, 5-30% silt, fine-coarse subangular sand, well graded, light gray-light grayish brown, *Alluvium*	SS	25	78				50/26
			WO						

SIAM TONE CO., LTD.

BORING LOG

BORING NO. KP-2
SHEET 2 OF 2

PROJECT: Bridge Reconstruction in WNBP, PNG
LOCATION: Kapiura Bridge @ Ubai Side Pier (Sta 0+407)
CLIENT: Chodai Co., Ltd.

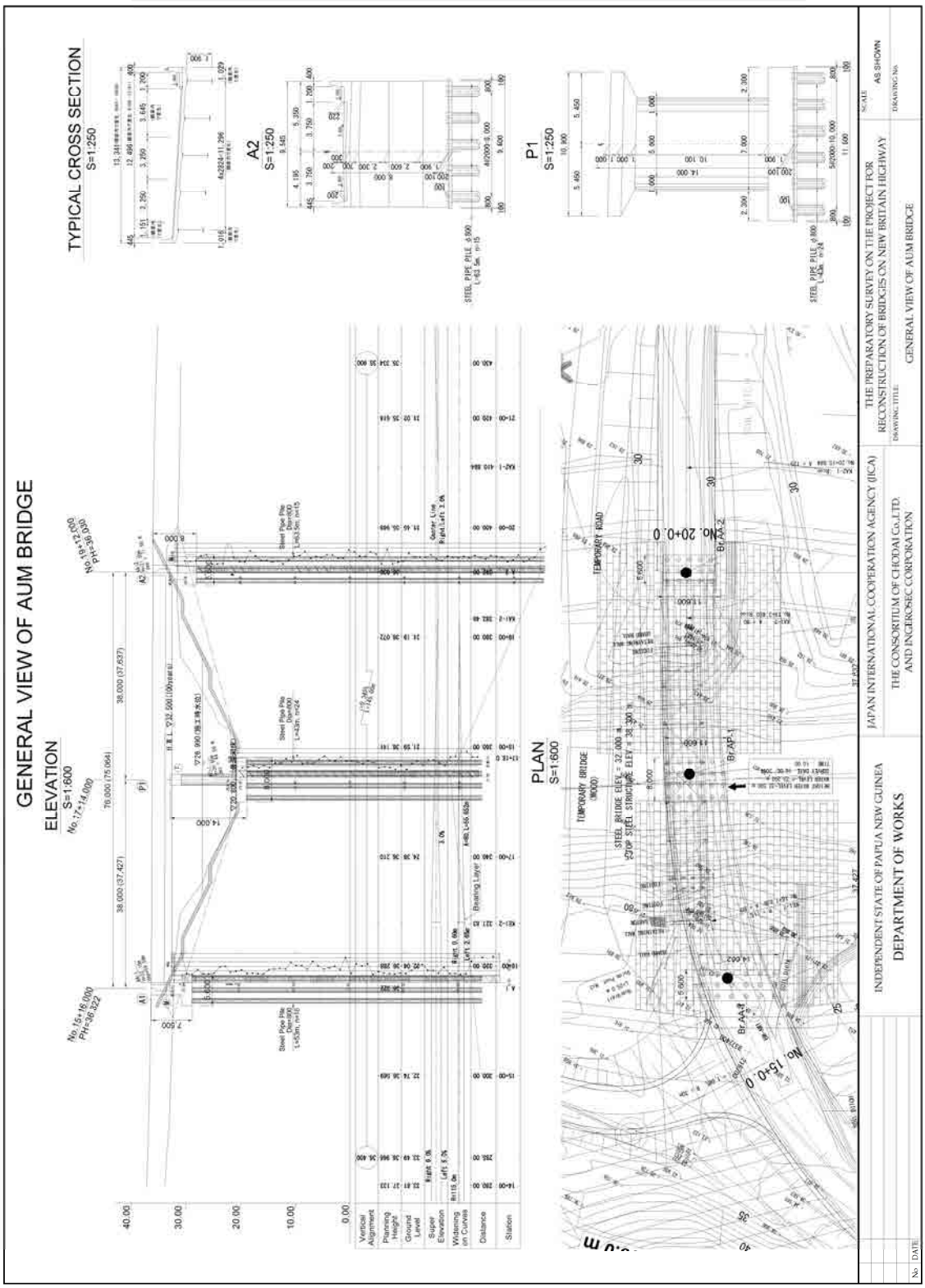
Coordinates: N 9370474.9250 E 217252.8100
Ground Elevation (m-MSL): 13.6000 m
Max.Drilling Depth: 30.50 m

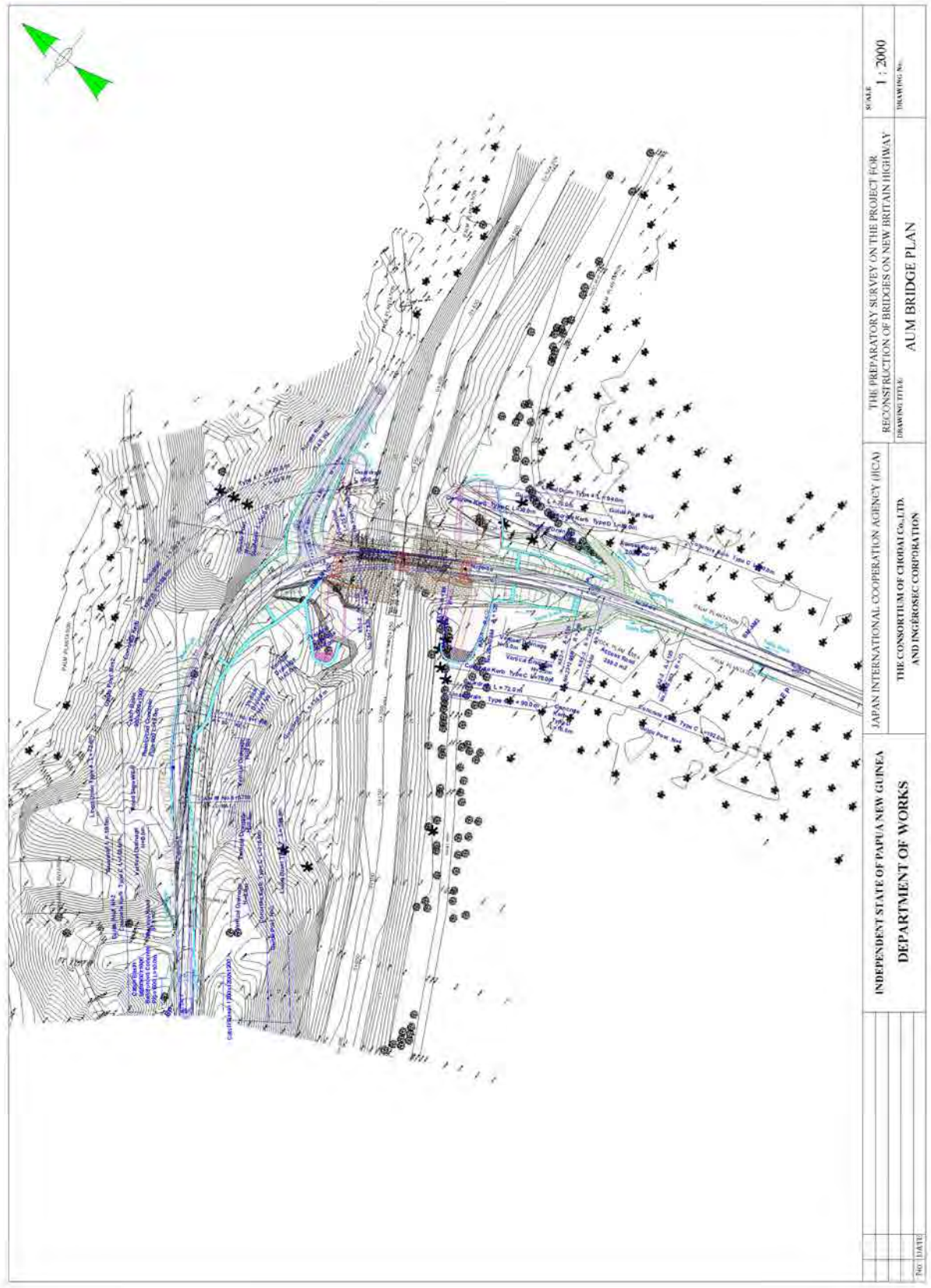
Water Level: In River m
Starting Date: 26/9/2014
Finishing Date: 3/10/2014

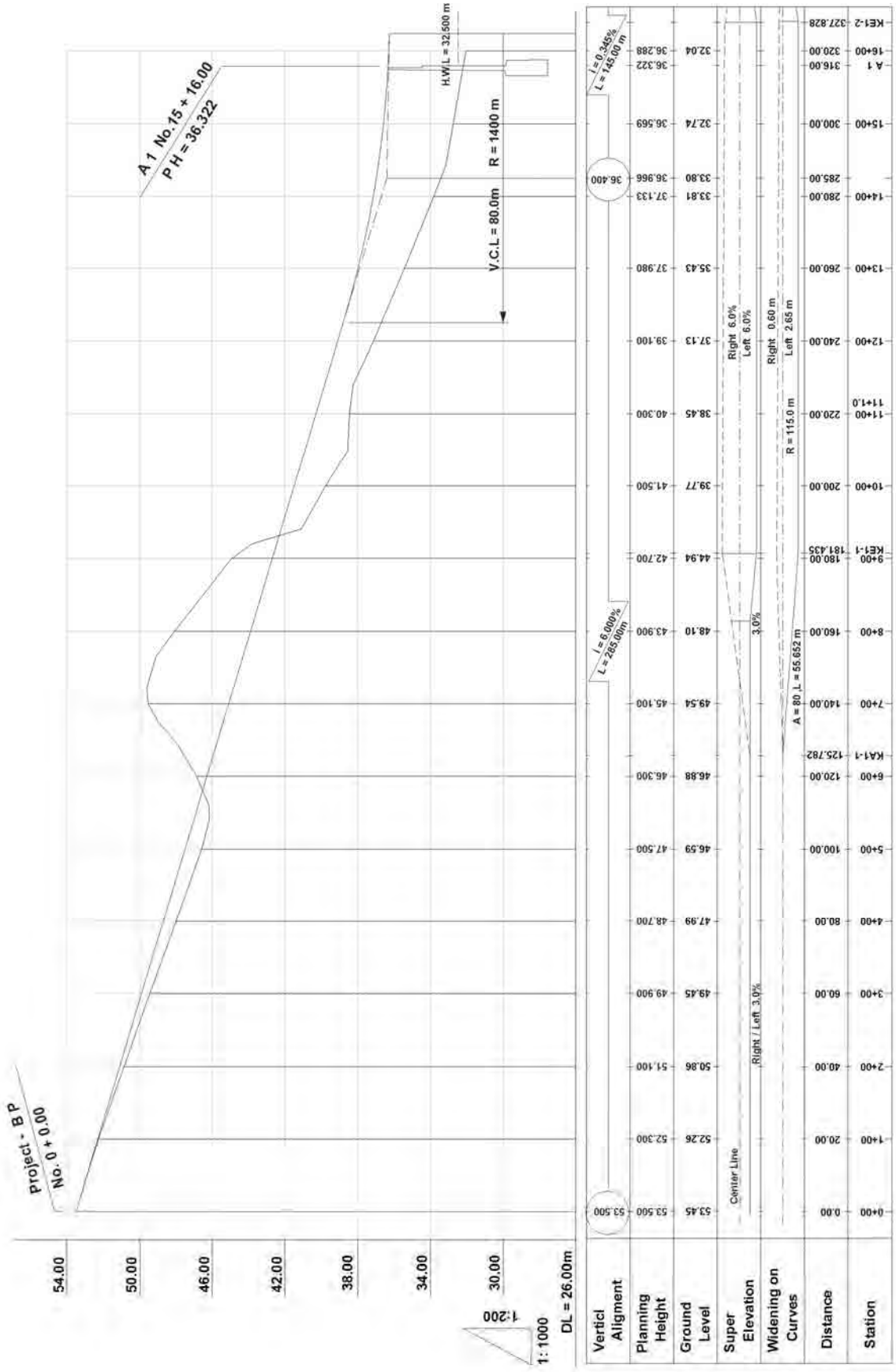
DEPTH (m.)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO.	RECOVERY (cm)	Organic Content (%)	Plastic Limit / Natural Water Content (%) / Liquid Limit	Specific Gravity	SPT Blow Count (Blow/ft)
26		25.0-30.5 m, SM, silty SAND, 5-30% silt, some random fine subangular gray river & white pumice gravel of 1 cm max sized, fine-coarse subangular sand, well graded, light gray-light grayish brown, *Alluvium*	WO						
			SS	26	44				50/29
27			WO						
			SS	27	45				40
28			WO						
			SS	28	40				31
29			WO						
			SS	29	40				31
30			WO						
			SS	30	40				41
		End of hole @ 30.5 m							

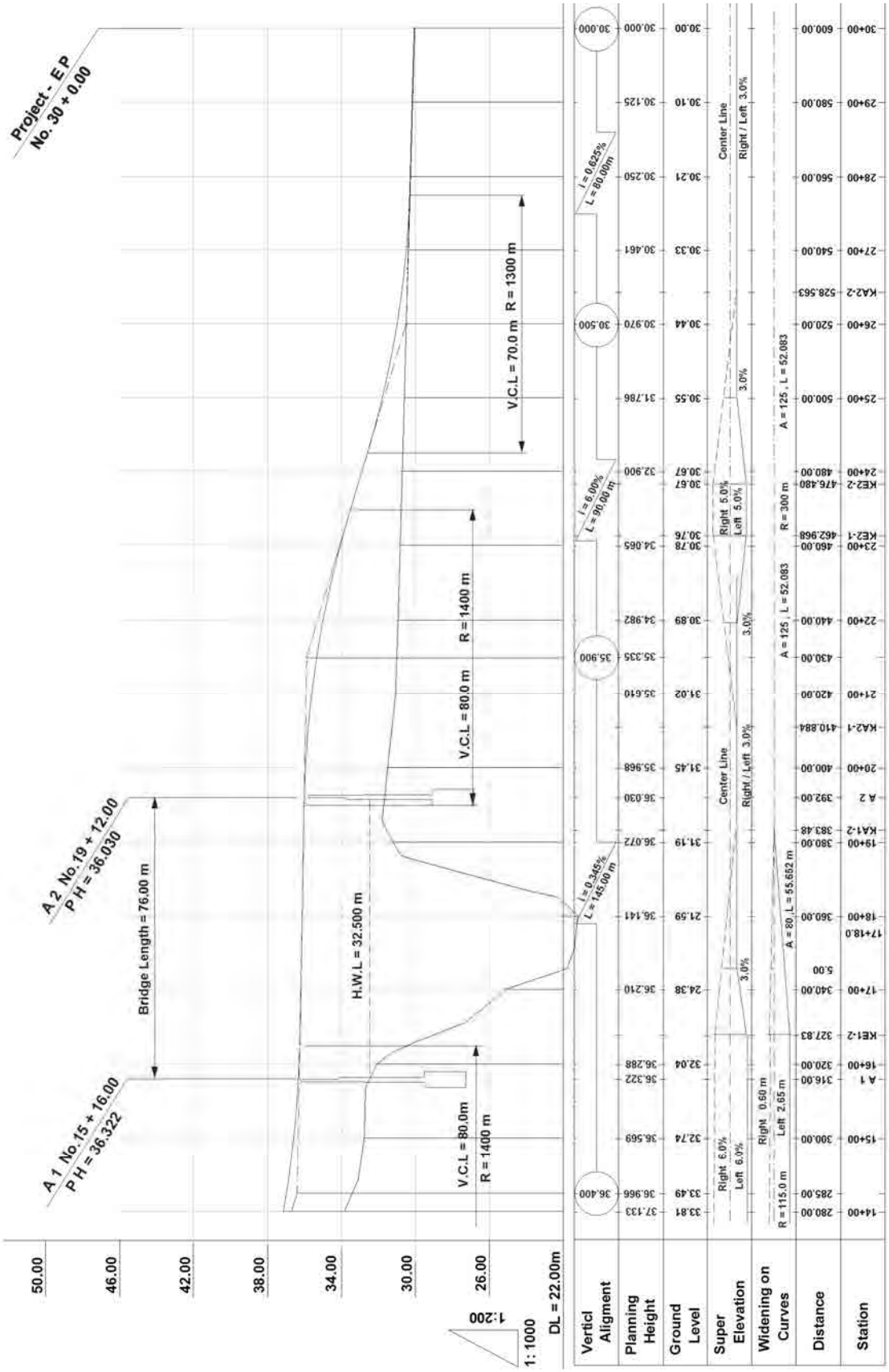
6.7 概略設計図

6.7.1 アウム橋

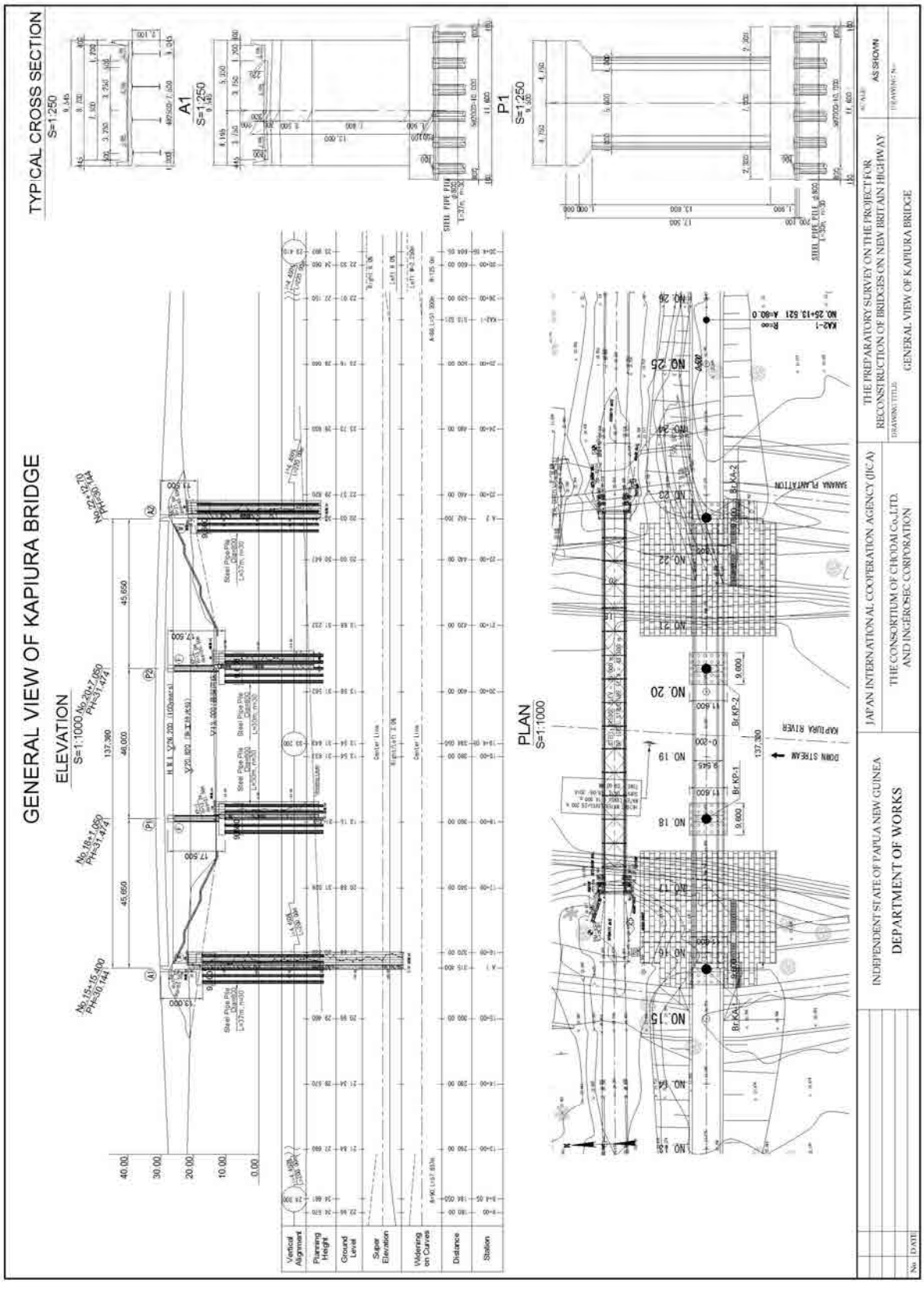


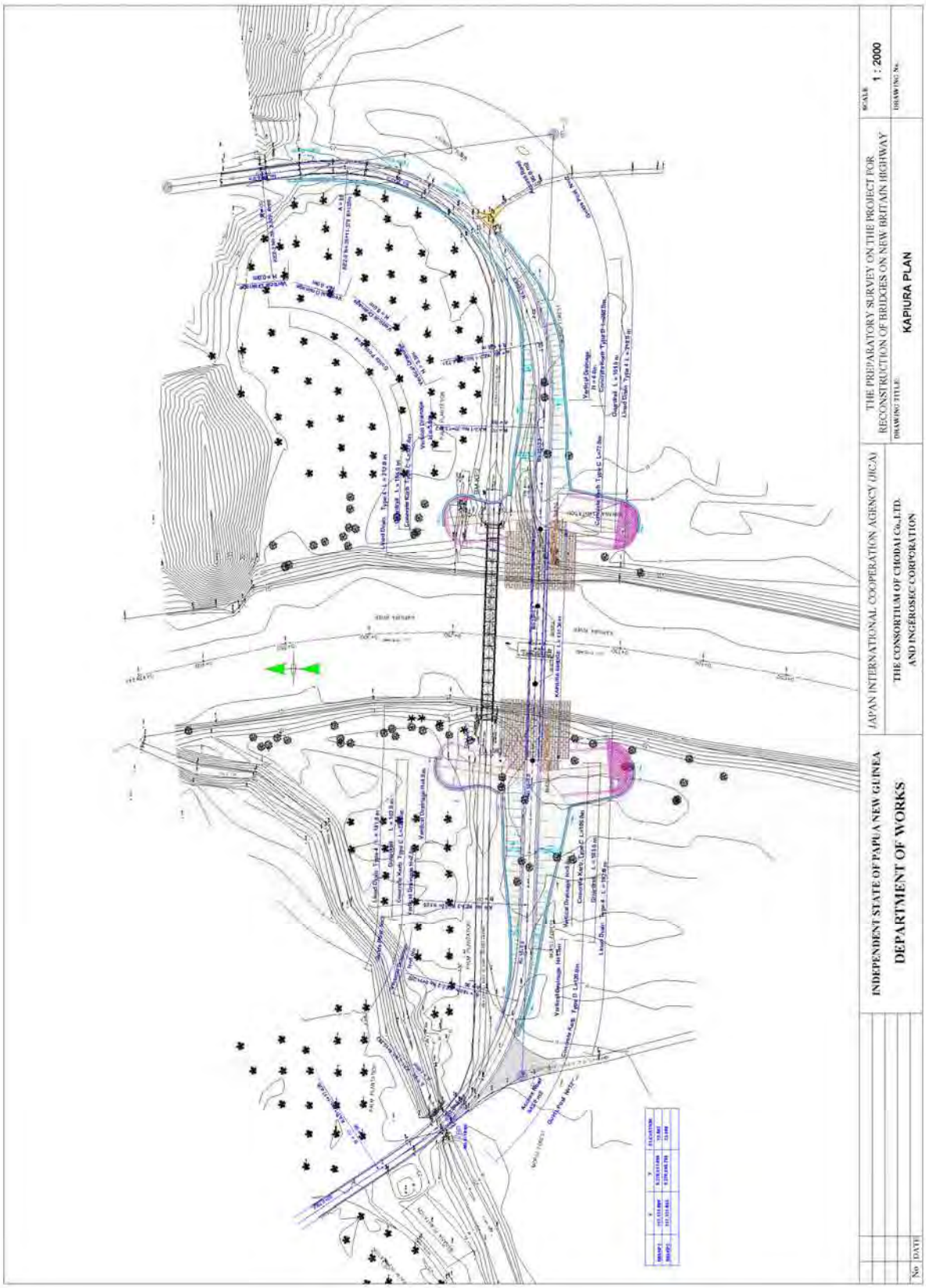

INDEPENDENT STATE OF PAPUA NEW GUINEA
DEPARTMENT OF WORKS
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE CONSORTIUM OF CHODAI Co.,LTD.
AND INGEROSEC CORPORATION
THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON NEW BRITAIN HIGHWAY
DRAWING TITLE
AUM BRIDGE PLAN
SCALE
1 : 2000
DRAWING No.
NO. DATE

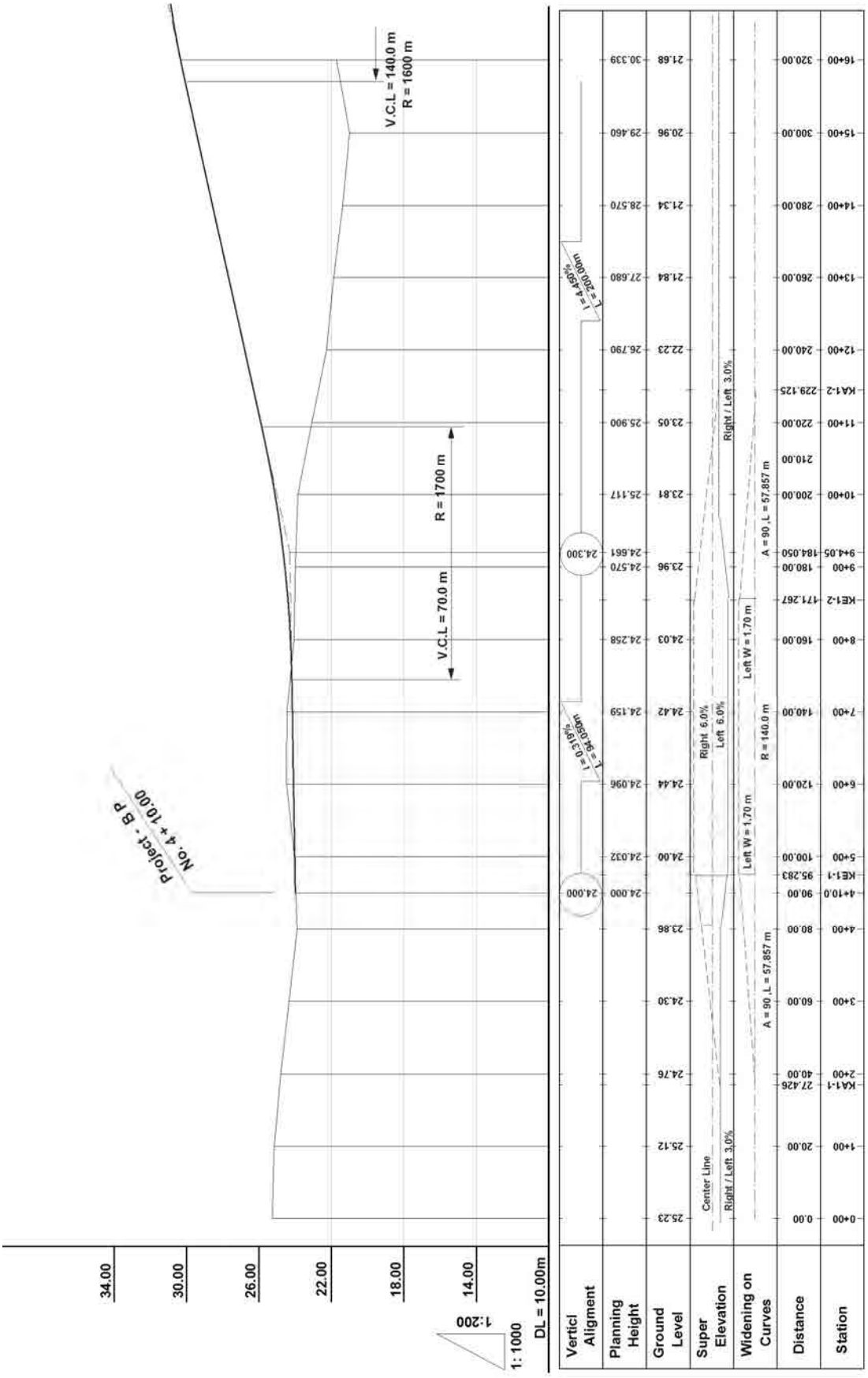

A 1 No.15 + 16.00
P H = 36.322
H.W.L = 32.500 m
R = 1400 m
V.C.L = 80.0m
Project - B P
No. 0 + 0.00
54.00
50.00
46.00
42.00
38.00
34.00
30.00
1:200
1: 1000
DL = 26.00m
Vertcl Aligment
Planning Height
Ground Level
Super Elevation
Widening on Curves
Distance
Station
Center Line
Right / Left 3.0%
3.0%
Right 6.0%
Left 6.0%
Right 0.60 m
Left 2.65 m
R = 115.0 m
A = 80 ⊥ = 55.652 m
I = 0.345%
L = 145.00 m
I = 6.000%
L = 285.00m
KE1-2
A 1
KE1-1
KA1-1

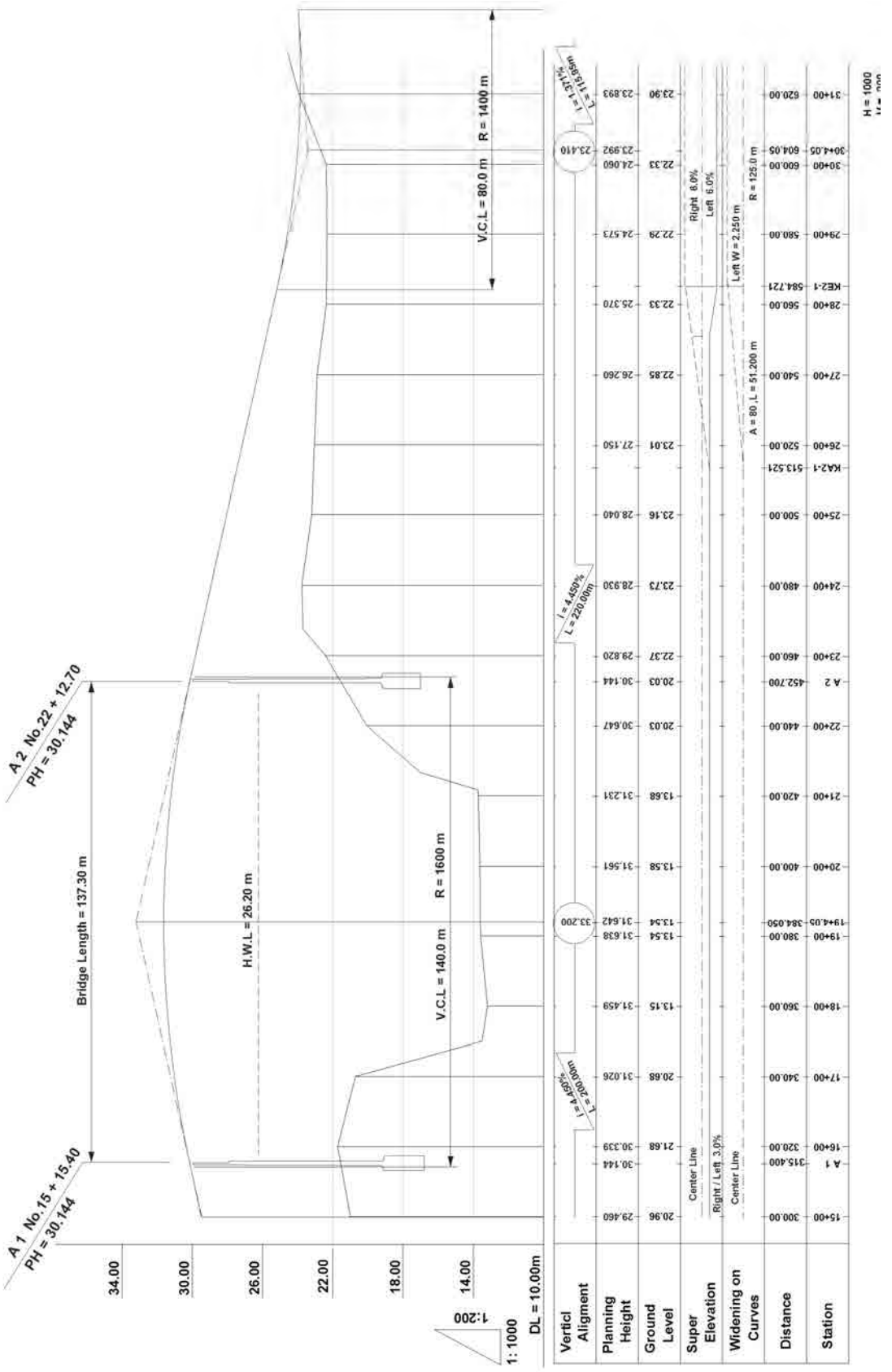

Project - E.P
No. 30 + 0.00
A 2 No.19 + 12.00
P.H = 36.030
A 1 No.15 + 16.00
P.H = 36.322
Bridge Length = 76.00 m
H.W.L = 32.500 m
V.C.L = 80.0m
R = 1400 m
V.C.L = 80.0 m
R = 1400 m
V.C.L = 70.0 m
R = 1300 m
50.00
46.00
42.00
38.00
34.00
30.00
26.00
1:200
1: 1000
DL = 22.00m
Vertcl Aligment
Planning Height
Ground Level
Super Elevation
Widening on Curves
Distance
Station
Center Line
Right / Left 3.0%
Right 6.0%
Left 6.0%
Right 5.0%
Left 5.0%
Right 0.60 m
Left 2.65 m
R = 115.0 m
A = 80 , L = 55.662 m
A = 125 , L = 52.083
R = 300 m
A = 125 , L = 52.083
i = 0.625%
L = 80.00m
i = 6.00%
L = 90.00 m
i = 0.345%
L = 145.00 m

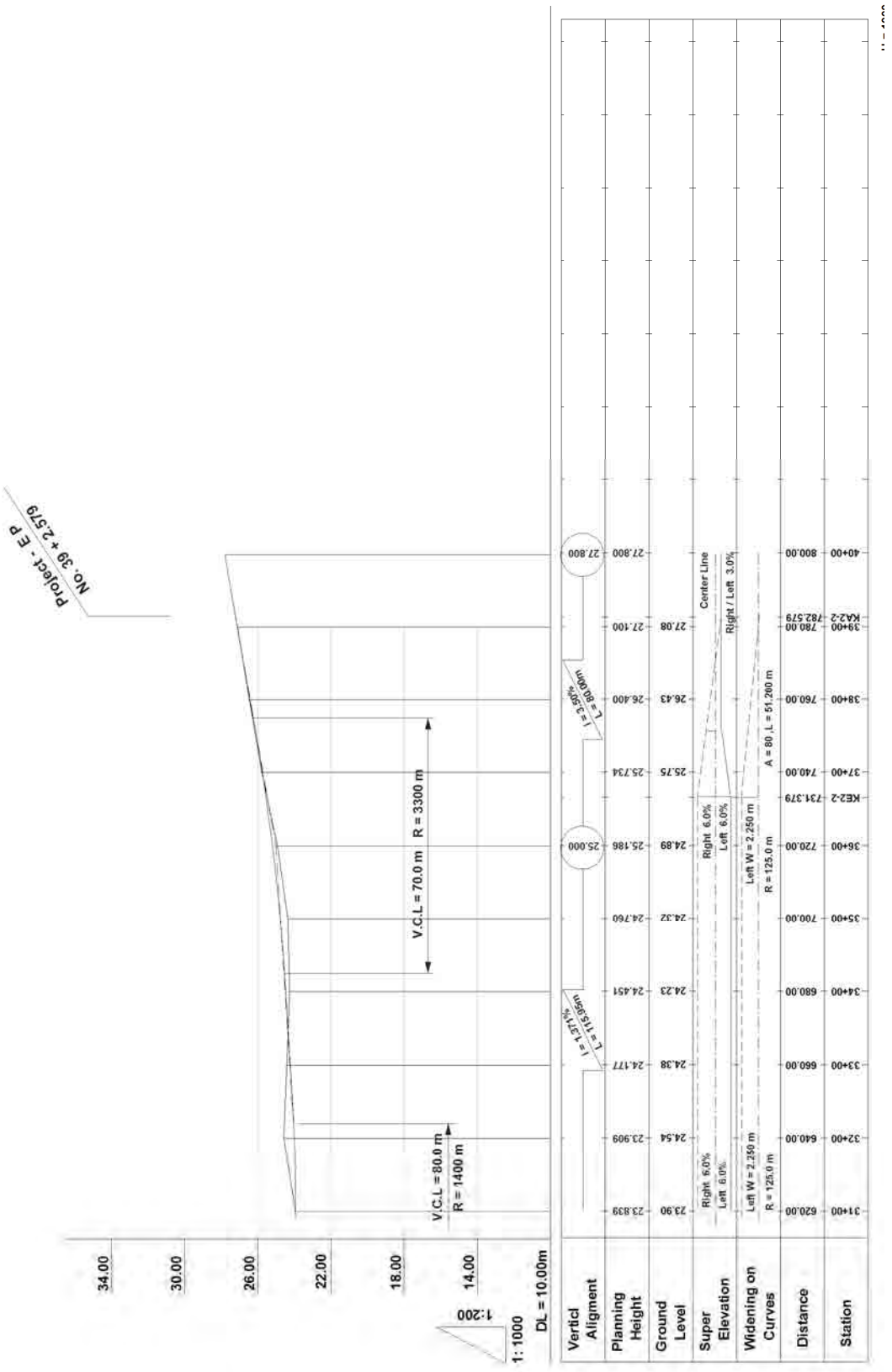
6.7.2 カピウラ橋


GENERAL VIEW OF KAPIURA BRIDGE
TYPICAL CROSS SECTION
S=1:250
A1
S=1:250
P1
S=1:250
ELEVATION
S=1:1000
PLAN
S=1:1000
KAPIURA RIVER
DOWN STREAM
SAVANA PLANTATION
INDEPENDENT STATE OF PAPUA NEW GUINEA
DEPARTMENT OF WORKS
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE CONSORTIUM OF CHODAI Co.,LTD.
AND INGEROSEC CORPORATION
THE PREPARATORY SURVEY ON THE PROJECT FOR
RECONSTRUCTION OF BRIDGES ON NEW BRITAIN HIGHWAY
GENERAL VIEW OF KAPIURA BRIDGE
AS SHOWN


INDEPENDENT STATE OF PAPUA NEW GUINEA
DEPARTMENT OF WORKS
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE CONSORTIUM OF CHODAI Co.,LTD.
AND INGEROSEC CORPORATION
THE PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON NEW BRITAIN HIGHWAY
DRAWING TITLE:
KAPIURA PLAN
SCALE 1 : 2000
DRAWING No.
No DATE


V.C.L = 140.0 m
R = 1600 m
R = 1700 m
V.C.L = 70.0 m
Project - B.P
No. 4+ 10.00
i = 4.450%
L = 200.00m
i = 0.319%
L = 94.050m
Center Line
Right / Left 3.0%
Right 6.0%
Left 6.0%
Left W = 1.70 m
R = 140.0 m
A = 90 ,L = 57.857 m
34.00
30.00
26.00
22.00
18.00
14.00
1:200
1:1000
DL = 10.00m
Vertcl Aligment
Planning Height
Ground Level
Super Elevation
Widening on Curves
Distance
Station


A 2 No.22 + 12.70
PH = 30.144
A 1 No.15 + 15.40
PH = 30.144
Bridge Length = 137.30 m
H.W.L = 26.20 m
V.C.L = 140.0 m
R = 1600 m
V.C.L = 80.0 m
R = 1400 m
34.00
30.00
26.00
22.00
18.00
14.00
1:200
1: 1000
DL = 10.00m
Vertcl Aligment
Planning Height
Ground Level
Super Elevation
Widening on Curves
Distance
Station
Center Line
Right / Left 3.0%
Center Line
A = 80 ,L = 51.200 m
R = 125.0 m
Left W = 2,250 m
Right 6.0%
Left 6.0%
H = 1000


Project - E P
No. 39 + 2.579
V.C.L = 70.0 m R = 3300 m
V.C.L = 80.0 m
R = 1400 m
34.00
30.00
26.00
22.00
18.00
14.00
1:200
1: 1000
DL = 10.00m
Vertical Aligment
Planning Height
Ground Level
Super Elevation
Widening on Curves
Distance
Station
Center Line
Right / Left 3.0%
Right 6.0%
Left 6.0%
Left W = 2.250 m
R = 125.0 m
A = 80 L = 51.200 m
L = 80.00m
i = 3.50%
L = 115.85m
i = 1.71%
27.800
25.000
KA2-2
KE2-2
782.579
731.379