Appendices

Appendix 1　Member List of the Study Team

1. Member List of the Study Team

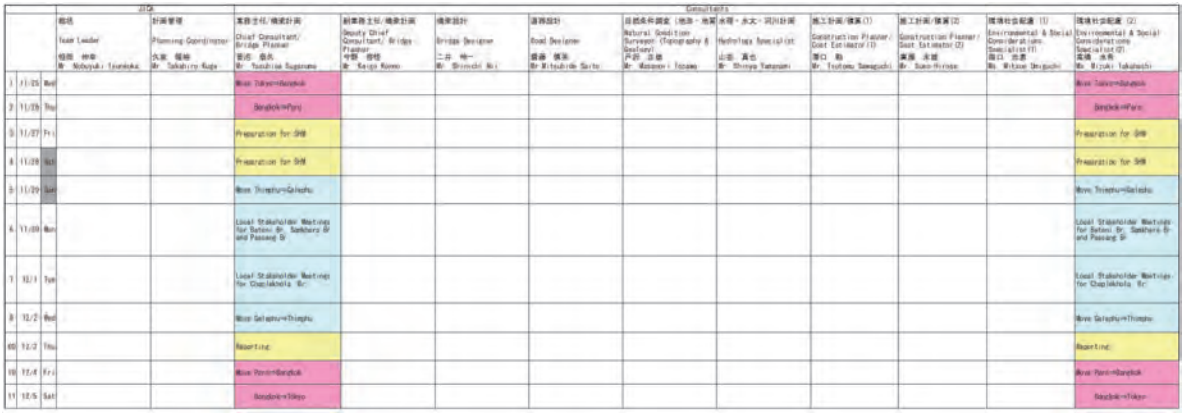
Name	Position	Organization
Nobuyuki Tsuneoka	Team Leader	Senior Advisor, JICA
Takahiro Kuge	Project Management	Transportation and ICT Group, Infrastructure and Peacebuilding Department, JICA
Yasuhisa Suganuma	Chief Consultant/Bridge Planning	Oriental Consultants Global Co., Ltd.
Hiroaki Kobayashi	Chief Consultant/Bridge Planning	Oriental Consultants Global Co., Ltd.
Keigo Konno	Deputy Chief Consultant/Bridge Planning	Oriental Consultants Global Co., Ltd.
Shinichi Nii	Bridge Design	INGÉROSEC Corporation
Mitsuhide Saito	Road Design	INGÉROSEC Corporation
Masanori Tozawa	Natural Condition Survey (Topography and Geology)	Oriental Consultants Global Co., Ltd.
Shinya Yamanami	Hydrology/River Planning	INGÉROSEC Corporation
Tsutomu Sawaguchi	Construction Planning /Cost Estimates 1	Oriental Consultants Global Co., Ltd.
Sueo Hirose	Construction Planning /Cost Estimates 2	INGÉROSEC Corporation
Mitsue Umiguchi	Environmental and Social Considerations 1	Oriental Consultants Global Co., Ltd.
Mizuki Takahashi	Environmental and Social Considerations 2	Oriental Consultants Global Co., Ltd.

Appendix 2　Study Schedule

2. Study Schedule

(1) The first field survey

(2) The first field survey (Stakeholder meeting)



(3) The second field survey

			JICA		Consultants		
			Team Leader Mr. Nobuyuki Tsuneoka	Planning Coordinator Mr. Takahiro Kuge	Chief Consultant/ Bridge Planner Mr. Hiroaki Kobayashi	Deputy Chief/Bridge Planner Mr. Keigo Konno	Bridge Designer Mr. Shinichi Nii
1	9/8	Thu			Tokyo(00:20)⇒Bangkok(04:50): TG661 Bangkok(09:50)⇒Paro(12:35): KB141		
					15:00 The courtesy call with DOR 16:30 JICA Bhutan Office 17:30 Meeting with Local consultant about the survey of coodinates		
2	9/9	Fri			Move:Thimphu→Trongsa		
3	9/10	Sat	Tokyo(00:20)TG661⇒Bangkok(04:50) Bangkok(09:05)KB121⇒Paro(12:20)		AM: Confirming coordinates of Teleganchu bridge for D/D on site PM: Move:Trongsa→Bajo		
4	9/11	Sun	document preparation		Move:Bajo→Thimphu		
5	9/12	Mon	XX:XX Meeting with JICA Bhutan Office XX:XX Explanation of Draft final Report to DoR and GNHC				
6	9/13	Tue	XX:XX M/D Discussion with DoR and GNHC				
7	9/14	Wed	AM Signing on the M/D PM Report to JICA Bhutan Office				
8	9/15	Thu	Paro(07:30)KB204⇒Delhi(09:20)		Move:Thimphu→Geleph		
9	9/16	Fri	AM Report to EOJ Delhi(23:30)TG316		Confirming coordinates of 3 bridges for D/D on site		
10	9/17	Sat	⇒Bangkok(05:25) Bangkok(07:35)TG676⇒Tokyo(15:45)		Move:Geleph→Thimphu		
11	9/18	Sun			Preparation work		
12	9/19	Mon			Preparation work	Move:Paro⇒Bangkok	Preparation work
13	9/20	Tue			Paro(13:35)⇒Bangkok(19:00)	Move:Bangkok⇒Tokyo	Paro(13:35)⇒Bangkok(19:00)
14	9/21	Wed			Bangkok(22:45)⇒Tokyo(06:55)		Bangkok(22:45)⇒Tokyo(06:55)

Appendix 3　List of Parties Concerned in the Recipient Country

3. List of Parties Concerned in the Recipient Country

Organization	Name	Position
Department of Roads, Ministry of Works and Human Settlement (DOR,MoWHS)	Mr. Karma Galay	Director
	Mr. Karma Tenzin	Executive Engineer, Design Division (Road)
	Mr.Tshering Wangdi (A)	Chief Engineer, Construction Division
	Mr. M.N. Lamichaney	Specialist, Construction Division
	Mr.Ngawang Thinley	Engineer, Design Division (Bridge)
	Ms. Choden	Assistant Engineer, Environmental Unit
	Mr. Tougay Choedup	Chief Engineer, Head of Trongsa Regional Division
	Mr. Karma Dorji	Chief Engineer, Head of Zhemgang Regional Division
	Mr. Sharap Phuntso	Chief Engineer, Head of Sarpang Regional Division
	Mr. Tsewang Dorji	Chief Engineer, Bridge Division
	Ms. Sonam Yangzom	Assistant Engineer, Construction Division/ Environmental Unit
	Mr. Masumi Ando	JICA Senior Volunteer
Department of Hydro-met Service, Ministry of Economic Affairs (DHMS, MoEA)	Mr. Phuntsho Namgyal	Chief Engineer
	Mr. Karma Dupchu	Chief/Project Manager
	Mr.Tayba Buddha Tamang	Meteorologist
Ministry of Agriculture and Forests (MoAF)	Mr. Tshering Dorji	Forest Officer
	Ms. Tshering Zam	Forest Officer, Wildlife Conservation Division
	Mr. Phub Dhendup	Chief Forestry Officer, Sarpang Forest Division
National Environment Commission (NEC)	Mr. Tenzin Khorlo	Chief, Environmenal Service Division
National Land Commission (NLC)	Mr.Tenzin Namgay	Chiedf Land Registrar, Rural Land Division
Trongsa Dzongkhag	Mr. Sonam Rinchen	Dzongda
	Mr. Ugyen Tenzin	Dzongkhag Environmental Officer
Sarpang Dzongkhag	Mr. Dasho Dawala	Dzongdag
	Mr. Tenzin Choda	Dzongkhag Environmental Officer
	Mr. Thinley Dorji	Dzongkhag Land Record Officer
Royal Manas National Park	Mr. Tenzin Wangchuk	Chief Forest Officer
	Mr. Sangay Dorji	Forester
	Mr. Shhup Lhendup	Forester
	Ms. Singye Wangmo	Sr. Forestry Officer
JICA Bhutan Office	Ms. Yumiko Asakuma	Chief Representative
	Mr. Koji Yamada	Chief Representative
	Mr. Sho Takano	Deputy representative
	Ms. Tomoko Miyata	Project Formulation Advisor

DOR: Department of Roads, MoWHS: Ministry of Works and Human Settlement,

DHMS Department of Hydro-met Service, MoEA: Ministry of Economic Affairs,

MoAF: Ministry of Agriculture and Forests

NEC: National Environment Commission

NLC: National Land Commission

Appendix 4　Minutes of Discussions (M/D)

4. Minutes of Discussions (M/D)

(1) The first field survey

MINUTES OF DISCUSSIONS
ON
THE PREPARATORY SURVEY
FOR
THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON
PRIMARY NATIONAL HIGHWAY No. 4
IN
BHUTAN

In response to a request from the Royal Government of Bhutan (hereinafter referred to as "RGoB"), the Government of Japan decided to conduct a Preparatory Survey for the Project for Reconstruction of Bridges on Primary National Highway No. 4 (hereinafter referred to as "the Project"), and entrusted the Preparatory Survey to Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent the Preparatory Survey Team for the Outline Design (hereinafter referred to as "the Team") to Bhutan, headed by Dr. Nobuyuki Tsuneoka, Leader of the Team, and scheduled to stay in the country from July 26 to September 20, 2015.

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

Thimphu July 31, 2015

Nobuyuki Tsuneoka
Leader
Preparatory Survey Team
Japan International Cooperation Agency
Japan

Karma Galay
Director
Department of Roads
Ministry of Works & Human Settlement
Bhutan

Kuenzang L. Sangey
Officiating CPO
Development Cooperation Division
Gross National Happiness Commission
Bhutan

ATTACHMENT

1. Objective of the Project

The objective of the Project is to increase load carrying capacity and extend vehicle lanes by reconstruction of Telegangchu zam, Chaplekhola zam, Beteni zam, Samkhara zam and Passang zam, thereby contributing to ensure smooth and safe traffic on the bridges.

2. Title of the Preparatory Survey

Both sides confirmed the title of the Preparatory Survey as "the Preparatory Survey for the Project for Reconstruction of Bridges on Primary National Highway No. 4"

3. Project Site

Both sides confirmed that the sites of the Project are shown in Annex 1.

4. Line Agency and Executing Agency

Both sides confirmed the line agency and the executing agency as follows:

4-1. The line agency is Ministry of Works & Human Settlement (hereinafter referred to as "MoWHS"), which would be the agency to supervise the executing agency.

4-2. The executing agency is the Department of Roads, MoWHS (hereinafter referred to as "DoR"). The executing agency shall coordinate with all the relevant agencies to ensure smooth implementation of the Project and ensure that the Undertakings are taken by relevant agencies properly and on time. The organization charts are shown in Annex 2

5. Items requested by RGoB

5-1. As a result of discussions, both sides confirmed that the items requested by RGoB are as follows:

- Reconstruction of the five existing bridges (Telegangchu zam, Chaplekhola zam, Beteni zam, Samkhara zam and Passang zam) on Primary National Highway No. 4

5-2. JICA will assess the appropriateness of the above requested items through the survey and will report findings to the Government of Japan. The final components of the Project would be decided by the Government of Japan.

6. Japanese Grant Scheme

6-1. The Bhutanese side understood the Japanese Grant Scheme and its procedures as described in Annex 3, Annex 4 and Annex 5, and necessary measures to be taken by RGoB.

6-2. The Bhutanese side agreed to take the necessary measures, as described in Annex 6, for smooth implementation of the Project, as a condition for the Japanese Grant to be implemented. The detailed contents of the Annex 6 will be worked out during the survey and shall be agreed no later than by the Explanation of the Draft Preparatory Survey Report.

The contents of Annex 6 will be used to determine the following:

(1) The scope of the Project.
(2) The timing of the Project implementation.
(3) Timing and possibility of budget allocation.

Contents of Annex 6 will be updated as the Preparatory Survey progresses, and will finally be the Attachment to the Grant Agreement(G/A).

7. Schedule of the Survey

7-1. The Team will proceed with further survey in Bhutan until September 20, 2015.

7-2. JICA will prepare a draft Preparatory Survey Report in English and dispatch a mission to Bhutan in order to explain its contents around February 2016.

7-3. If the contents of the draft Preparatory Survey Report is accepted in principle and the Undertakings are fully agreed by the Bhutanese side, JICA will complete the final report in English and send it to Bhutan around April 2016.

7-4. The above schedule is tentative and subject to change.

8. Environmental and Social Considerations

8-1. The Bhutanese side confirmed to give due environmental and social considerations during implementation of the Project, and after completion of the Project, in accordance with the JICA Guidelines for Environmental and Social Considerations (April, 2010). (hereinafter referred to as "The JICA guidelines")

8-2. The Team explained the Project is categorized as "Category B" according to the JICA Guidelines, since the Project is reconstructing the five bridges and approach roads, and its impact on the environment may be limited. Referring to the approval letter from Department of Forests and Park Services, Ministry of Agriculture and Forests to DoR dated on August 4, 2014, the Team also explained the survey should confirm that part of the Project (Chaplekhola zam) is located in the multiple use zone of the Royal Manas national park, and that it does not have significant potential adverse impacts on the environment.

8-3. The Bhutanese side confirmed to conduct the necessary procedures concerning the environmental assessment (including stakeholder meetings, Initial Environmental Examination (IEE) etc.) and make IEE report of the Project. The IEE approval shall be received from the responsible authorities and submitted to JICA Bhutanese Office preferably before the Cabinet approval of the Project by the Government of Japan.

8-4. In case of the Project Affected Persons (PAPs) within the Project sites, the Bhutanese 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 the Bhutanese side will take necessary measures to PAPs according to an Abbreviated RAP in close communication with JICA.

9. Operation and Maintenance

9-1. The Bhutanese side will take every necessary action including securing enough budget and personnel

for the operation and maintenance of the facilities implemented by the Project.

9-2. The Team explained and the Bhutanese side agreed that taking necessary actions to let the road users respect traffic regulations are fundamental regarding the following three issues to maintain the facilities and to ensure road safety.

(1) Although the Project includes some facilities to ensure traffic safety such as guardrails increasing traffic will inevitably raise the risks of accidents.

(2) Overloading trucks which would exceed designed live load would cause earlier rehabilitation and shorter life.

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

10. Safety Measures

10-1. To avoid accidents on site during the implementation of the Project, the Bhutanese side agreed to make the consultant and the contractor take safety measures such as setting safety assurance to the site, providing information for security control to the public, and deploying adequate security personnel, based on "The Guidance for the Management of Safety for Construction Works in Japanese ODA Projects" which has been published on JICA's URL below.

http://www.jica.go.jp/activities/schemes/oda_safety/ku57pq00001nz4eu-att/guidance_en.pdf

10-2. The Team recommended DoR to explain to the site citizens about the Project (necessity and significance, construction period, sites, impact etc.), so that wide support of them can be obtained for the smooth implementation of the Project.

11. Misconduct

If JICA receives information concerning suspected corrupt or fraudulent practices, DoR 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 Bhutan;

(2) not to treat unfairly or unfavorably the physical persons and juridical persons, that provide the information.

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.

13. Other Relevant Issues

13-1. The Bhutanese side shall, at its own expenses, 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 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 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 Bhutan for the implementation of the Survey; and
(9) support in obtaining other privileges and benefits if necessary.

13-2. The Bhutanese side agreed that the following undertakings should be taken by the Bhutanese side at the Bhutanese expenses under the Project if implementation of the Project is approved by the Government of Japan;

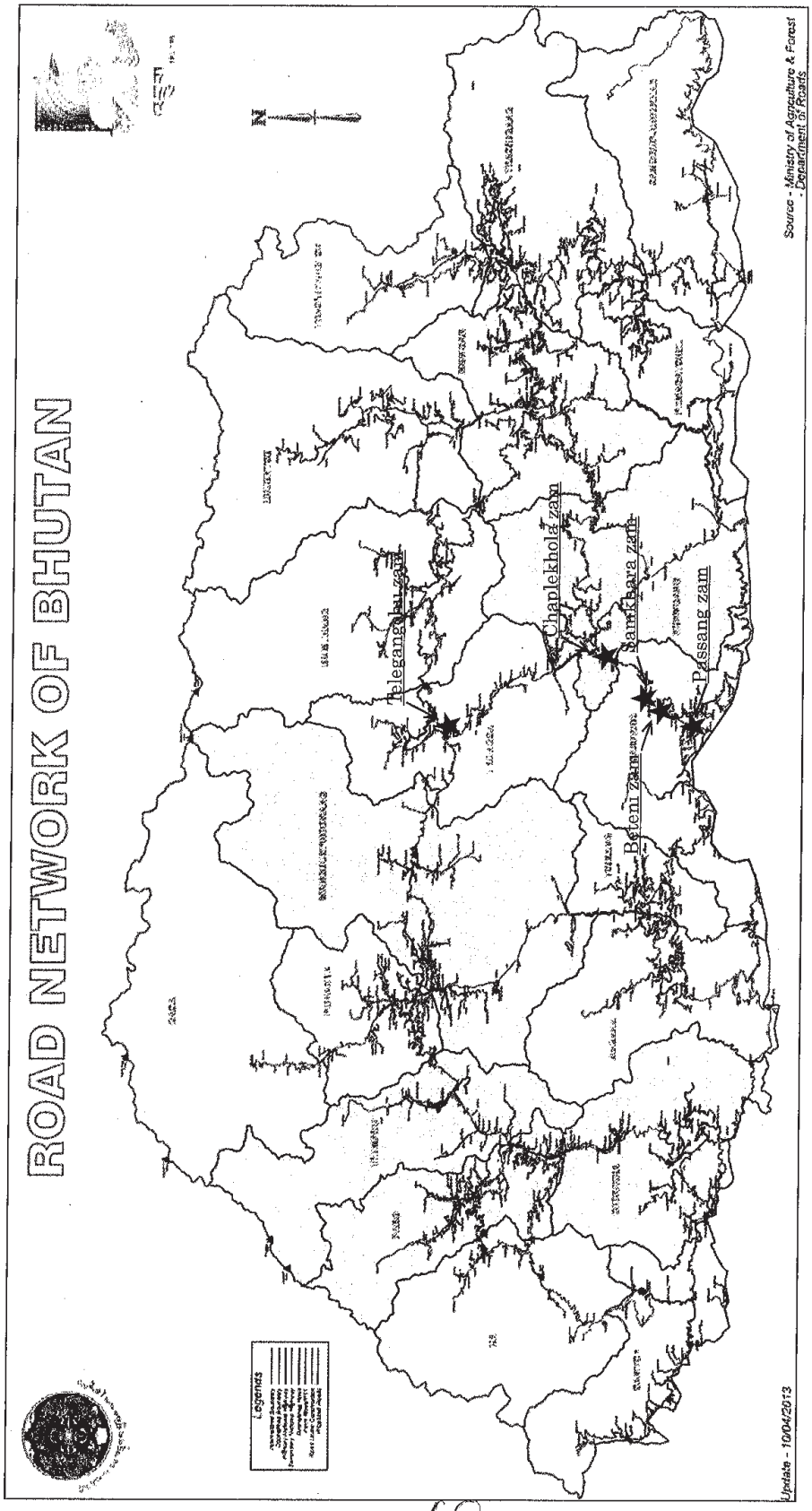
(1) to provide tax exemption for construction materials and equipment for the Project.
1) The Bhutanese side agreed that customs duties, internal taxes and other fiscal levies which may be imposed in Bhutan are exempted under mutual agreement of Exchange of Note (E/N).
2) If any expenses stated above are caused by some reasons such as the delay of execution of tax exemption, the Bhutanese side shall pay for it.
(2) 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;
(3) to relocate existing utilities within the Project site;
(4) to relocate existing buildings and facilities if necessary;
(5) to arrange issuance of license, permission and other necessary procedures for the Project;
(6) to obtain the royalties/permission for taking raw materials such as stone/rock/filling materials from the quarry/river-bed/borrow pit; and
(7) to provide security measures for all concerned working for the Project.

13-3. Both sides agreed that the five bridges should be reconstructed at the positions in reference to the results of this preparatory survey. The Team will inform the best candidate position of each bridge in the middle of August, 2015 in the Technical Notes. After agreement by the Bhutanese side, the Team will commence the outline design of the bridges along the lines of the Technical Notes. The Bhutanese side recognized a possibility that the Bhutanese side should be responsible for the removal of the current bridges after the completion of the Project, if the new bridges are constructed on the different locations from the existing bridges. The responsibility of the removal should be determined by each bridge in the Technical Notes.

Annex-1: Project Sites
Annex-2: Organization Chart of DoR
Annex-3: Japan's Grant Aid
Annex-4: Flow Chart of Japan's Grant Aid Procedure
Annex-5: Financial Flow of Japan's Grant Aid
Annex-6: Major Undertakings to be taken by Each Government

Annex-1

Project Site



Annex-2

Organization Chart of DOR

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.

(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

Annex-3

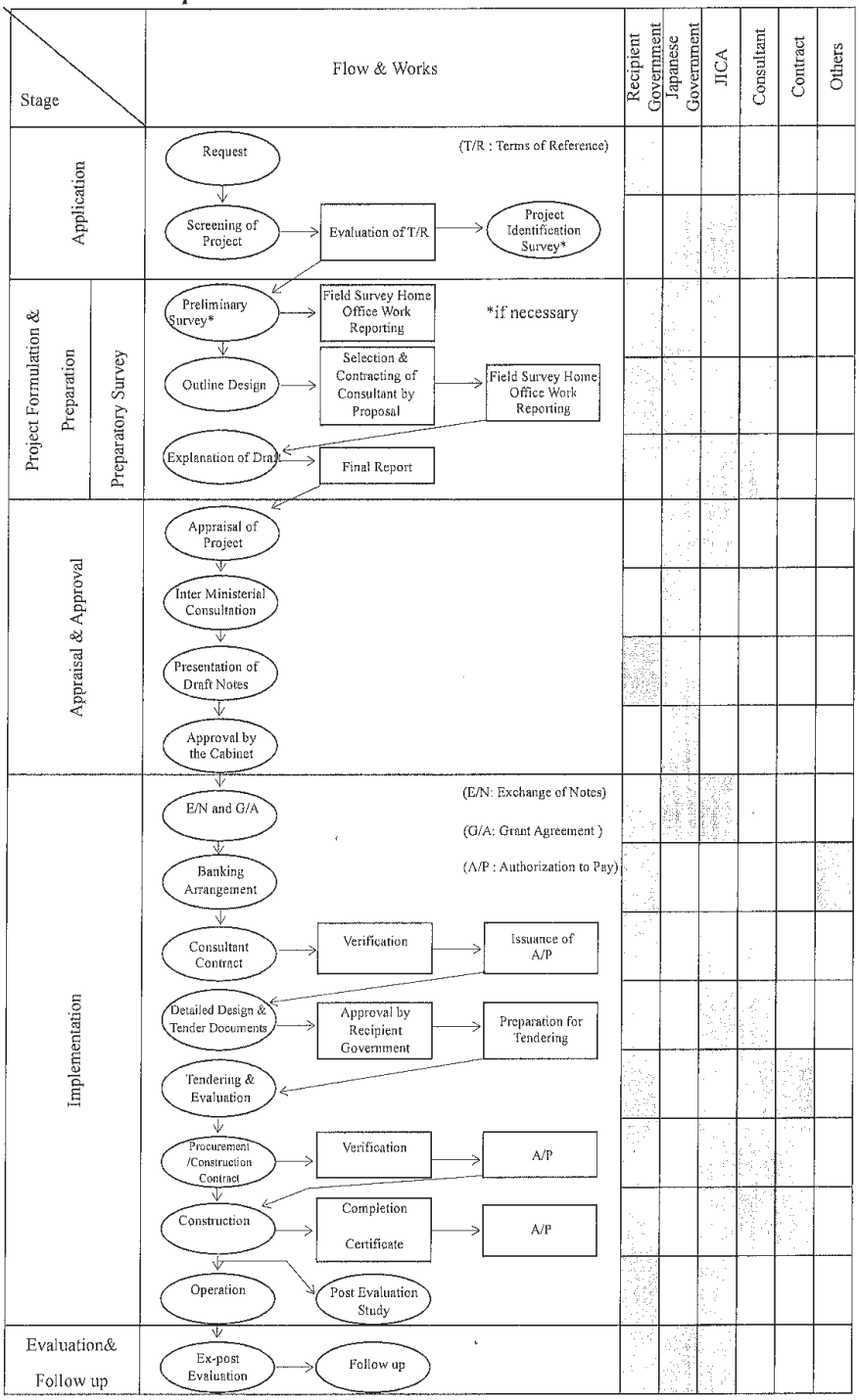
commissions paid to the Bank.

(10) Social and Environmental Considerations

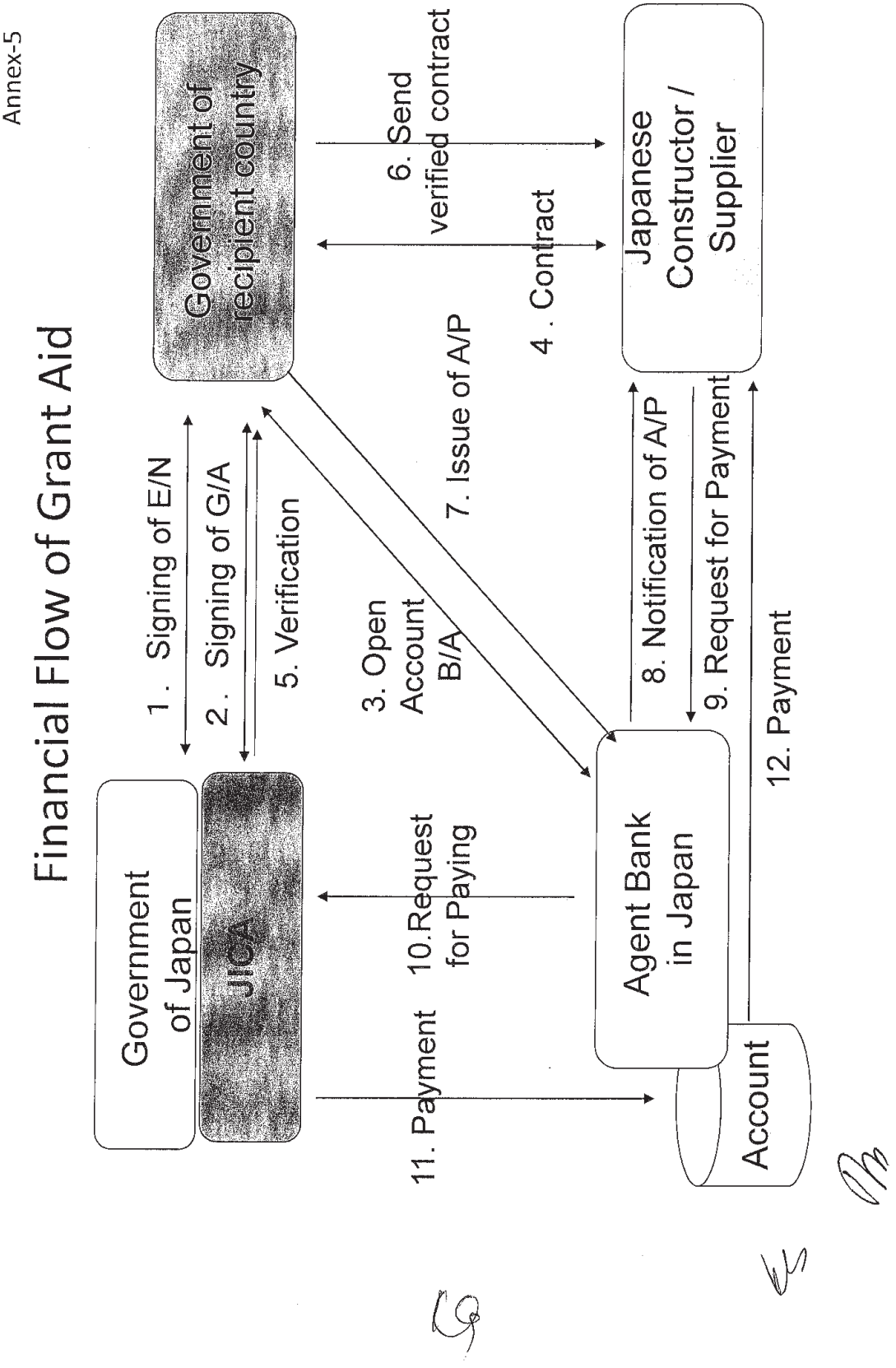
A recipient country must carefully consider social and environmental impacts by the Project and must comply with the environmental regulations of the recipient country and JICA socio-environmental guidelines.

Annex-4

Flowchart of Japan's Grant Aid Procedure



Annex-5


Financial Flow of Grant Aid
Government of recipient country
Japanese Constructor / Supplier
Government of Japan
JICA
Agent Bank in Japan
Account
1. Signing of E/N
2. Signing of G/A
5. Verification
6. Send verified contract
4. Contract
7. Issue of A/P
3. Open Account B/A
8. Notification of A/P
9. Request for Payment
12. Payment
10.Request for Paying
11. Payment

Annex-6

Annex-6: Major Undertakings to be taken by Each Government

Major Undertakings to be taken by Recipient Government

1. Before the Tender

NO	Items	Deadline	In charge	Cost	Ref.
1	To approve IEE/EIA	within 1 month after G/A	NEC		
2	To implement EIA	before start of the construction	DoR,MoWHS		
3	To open Bank Account (Banking Arrangement (B/A))	within 1 month after G/A	GNHC		
4	To secure lands 1) right of way for Sta. **+***-Sta.**+*** 2) temporary construction yard and stock yard near the Project area 3) borrow pit and disposal site near the Project area	before notice of the tender document	DoR		
5	To obtain the planning, zoning, building permit	before notice of the tender document	DoR		
6	To clear, level and reclaim the following sites when needed the site to be confiremed in the DRAFT FINAL REPORT	before notice of the tender document	DoR		

2. During the Project Implementation

NO	Items	Deadline	In charge	Cost	Ref.
1	To bear the following commissions to a bank of Japan for the banking services based upon the B/A				
	1) Advising commission of A/P	within 1 month after the singing of the contract	GNHC		
	2) Payment commission for A/P	every payment	GNHC		
2	To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country				
	1) Tax exemption and customs clearance of the products at the port of disembarkation	during the Project	DoR		
	2) Internal transportation from the port of disembarkation to the project site	during the Project	-		
3	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work	during the Project	DoR		
4	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the Products and/or the Services be exempted; Such customs duties, internal taxes and other fiscal levies mentioned above include VAT, commercial tax, income tax and corporate tax of Japanese nationals, resident tax, fuel tax, but not limited, which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract	during the Project	DoR,MoF		
5	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for construction of the facilities as well as for the transportation and installation of the equipment	during the Project	DoR		
6	To submit environmental monitoring report to JICA Bhutan Office	during the Project	DoR		

Annex-6

3. After the Project

NO	Items	Deadline	In charge	Cost	Ref.
1	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid 1) Allocation of maintenance cost 2) Operation and maintenance structure 3) Routine/Periodic inspection	After completion of the construction	DoR		

Major Undertakings to be covered by the Grant Aid

No	Items	Deadline	Cost Estimated (Million Japanese Yen)*	
1	To construct roads/bridges (or To procure equipment)		XX.XX	
	- Reconstruction of the road			
	- Reconstruction of the bridge			
	1) To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country			
	a) Marine(Air) transportation of the products from Japan to the recipient country			
	b) Internal transportation from the port of disembarkation to the project site			
	2) To construct access roads			
	a) Within the site			
2	To implement detailed design, tender support and construction supervision (Consultant)		YY.YY	
3	Contingencies		ww.ww	
	Total		ZZ.ZZ	

(2) Technical Note (The first field survey)

TECHNICAL NOTES

JICA Preparatory Survey Team (hereinafter referred to as "the Team") on the Preparatory Survey (hereinafter referred to as "the Survey") on The Project for Reconstruction of Bridges on Primary National Highway No.4 (hereinafter referred to as "the Project") and the Department of Roads in Ministry of Works and Human Settlement (hereinafter referred to as "DoR") which is the responsible and implementing organization for the Project has agreed upon the items described in the attached Technical Notes. Based on these Technical Notes, the Team will carry out the outline design for the Project including the project cost estimates through analysis of the field survey findings and discussions with concerned authorities in Japan.

The results of the analysis and the outline design will be presented and explained in February, 2016.

Thimphu, 10 August 2015

Mr. Karma Galay

Director,
Department of Roads,
Ministry of Works and Human Settlement,
Bhutan

Mr. Yasuhisa Suganuma

Chief Consultant,
Preparatory Survey Team,
Japan International Cooperation Agency,
Japan

1. New Bridge Location

Based on the recommendation from the Team, DoR agreed to the new bridge location for each bridge as follows;

- Telegangchu Bridge: Shift the bridge toward downstream side of the existing location
- Chaplekhola Bridge: Shift the bridge toward downstream side of the existing location
- Beteni Bridge: Reconstruct at the existing location
- Samkhara Bridge: Shift the bridge toward upstream side of the existing location
- Passang Bridge: Reconstruct at the existing location

2. Application of Design Guideline

Reference shall be made to the following manuals and specification for the outline design requirements of the bridges and approach roads.

2.1 Bridge Design

- Guidelines on use of Standard Work Items for Common Road Works: DoR

Sl. No	Road Classification	Carriage Width (m)	Loading Capacity	Footpath
1	Asian Highway (AH-48)	7.50	Single lane IRC 70R (wheeled) or Double lane IRC class A (whichever is critical)	Optional
2	Primary National Highway (PNH)	7.00	Single lane IRC 70R (wheeled) or Double lane IRC class A (whichever is critical)	Optional
3	Secondary National Highway (SNH)	5.50	IRC Class A (double lane)	Optional
4	Dzongkhag Road	3.30	IRC Class A (single lane)	Optional
5	Farm road	3.50	IRC Class A (single lane)	
6	Thromde road	Varies from 7.50 to 15.00	Single lane IRC 70R (wheeled) or Double lane IRC class A (whichever is critical)	Both side 1.50m wide

Note: Bridges shall be designed for IRC class 70R (wheeled) loading and at least 5.3m carriage width irrespective of the load classification, if the road has potential of catering traffic to planned or Hydro Power Plants or Projects.
However, the width of the temporary bridges (bailey bridges) for single lane is 3.27m wide with 24R loading commonly used in farm roads and double lane bailey bridge of 7.30m wide can be used in the PNH and SNH for temporary measures.

- Standard Specification and Code of Practice for Road Bridge: The Indian Road Congress (IRC)
- Specifications for Highway Bridges (Part I – V): Japan Road Association

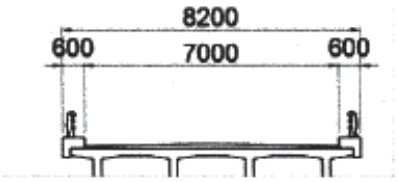


Figure 1 Typical cross section of bridge

The curb width and the handrail are applied to Japanese Standard.

- Sidewalk

  DoR requested the Team to plan the sidewalk (width 1.5m, both sides) on Passang Bridge. Because this bridge is located inside city area and many pedestrians are passing the bridge. As for other 4 bridges, DoR didn't request any sidewalk because they were located at remote area. The Team answered that JICA would assess the appropriateness of the request through the Survey and would report the findings to the Government of Japan. Implementation and components of the Project will be decided by the Government of Japan.

2.2 Highway Design

(1) Geometric Design

- Guidelines on use of Standard Work Items for Common Road Works: DoR

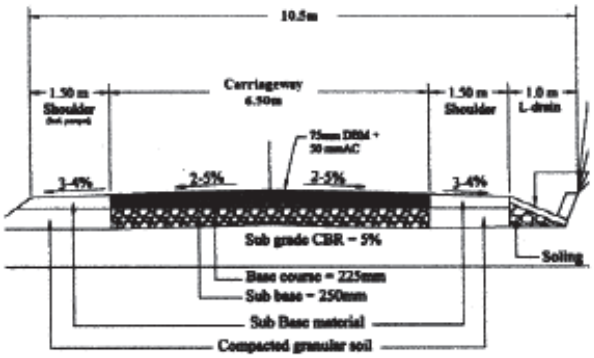


Figure 2 Typical cross section of approach road

- Guideline on Road Classification System and Delineation of Construction and Maintenance Responsibilities: DoR
- INITIAL PROJECT DOCUMENT (IPD): DoR
- Road Structure Ordinance: Japan Road Association

(2) Pavement Design

- Pavement Design Manual: DoR
- INITIAL PROJECT DOCUMENT (IPD): DoR

3. Bridge Structure Material

Followed to analysis a consideration of easy maintenance, concrete is preferred as the bridge material. However the bridge material shall be compared with concrete and steel.

- **Concrete**
  - Substructure : 21N/mm^2
  - Superstructure (Slab) : 24N/mm^2
    (Girder, beam) : 30N/mm^2
  - Steel :SMA400W, SMA490W, SMA570W
  - Reinforcing bar : Fe 500

4. Seismic Condition

Condition for earthquake resistance design of the objective bridges is applied to the Indian Standard of the Indian Road Congress (IRC). Seismic zone of India is shown in Figure 3. Bhutan is mainly located in zone V.

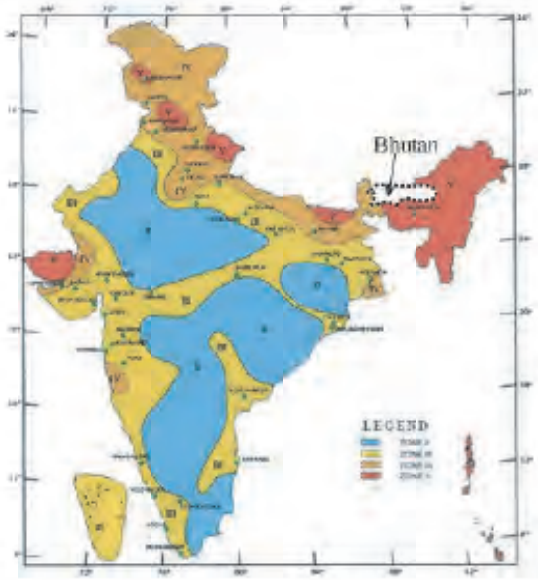


Figure 3 Seismic Zone of India

5. Ground Condition

Ground condition of the bearing stratum for the foundation and the substructure shall be planned and decided based on the result of laboratory test and boring.

6. River Condition

Based on the result of catchment area of each river for the objective bridges, discharge volume shall be calculated including the past records, rainfall density, riverbed gradient and so on. The high water level to plan the bridge length and elevation is directly related by the discharge volume.

Aforesaid river condition will be planned by using Japanese Standard.

7. Design of River Protection

7.1 Necessary river protection length for bridge construction

- Applied standard: Government Ordinance for Structural Standards for River Administration Facilities (Japanese standard)
- River protection must cover the range of 10m or more upstream and downstream from both ends of abutment (Figure-4).

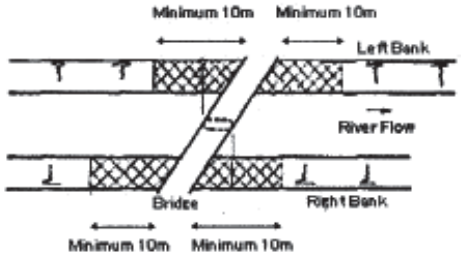


Figure-4 Necessary river protection length for bridge construction

8. Design Condition

The design condition including aforesaid conditions to be applied is shown in Table 1.

Table 1 Design Condition

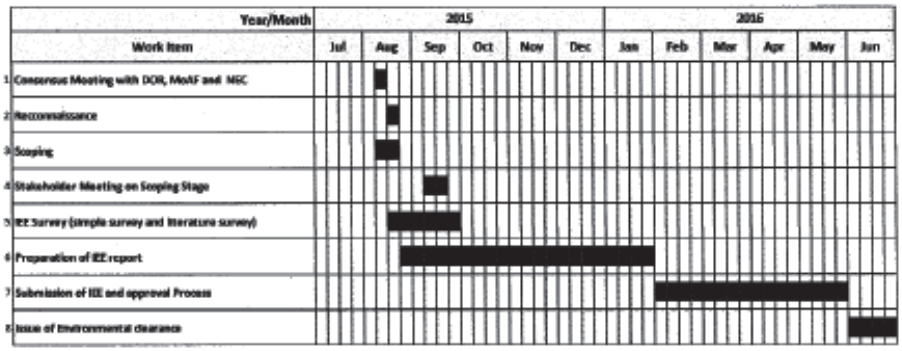
Parameter	Unit	Design	Remarks
1. Bridge Design			
Live Load		IRC 70R or IRC class A	As per DoR Standard
Horizontal Seismic Coefficient		To be calculated	Based on IRC Standard
Design Speed	km/hr	20	As per Japanese Standard
Carriageway Width	m	7.0	As per DoR Standard
Standard Crossfall	%	2.0	As per DoR Standard
Maximum Superelevation	%	6.0	At curved section
Maximum Gradient	%	7.0	As per Bhutanese Standard
Affixed Articles		Add on the Bridge	As per DoR Standard
2. Road Design			
Design Speed	km/hr	20 (Approach road) 60 (Main road)	As per Japanese Standard As per DoR Standard
Carriageway Width	m	6.5	As per DoR Standard
Shoulder Width	m	1.5	As per DoR Standard
Standard Crossfall	%	2.0	As per DoR Standard
Maximum Superelevation	%	6.0	At curved section
Maximum Gradient	%	7.0	As per DoR Standard
Minimum Radius	m	15.0 (Approach road) 115.0 (Main road)	As per Japanese Standard As per DoR Standard
Widening Space	m	90≦radius of curve<160→0.25 60≦radius of curve<90→0.50 45≦radius of curve<60→0.75 32≦radius of curve<45→1.00 26≦radius of curve<32→1.25 21≦radius of curve<26→1.50 19≦radius of curve<21→1.75	As per Japanese Standard
Transition Length	m	20km/hr: 20 60km/hr: 50	As per Japanese Standard

9. Environmental Considerations

9.1 IEE Study Schedule

The Bhutanese side will conduct the IEE study and obtain the environmental clearance and has confirmed the schedule for procedure of obtaining Environmental clearance as shown in Table 2.

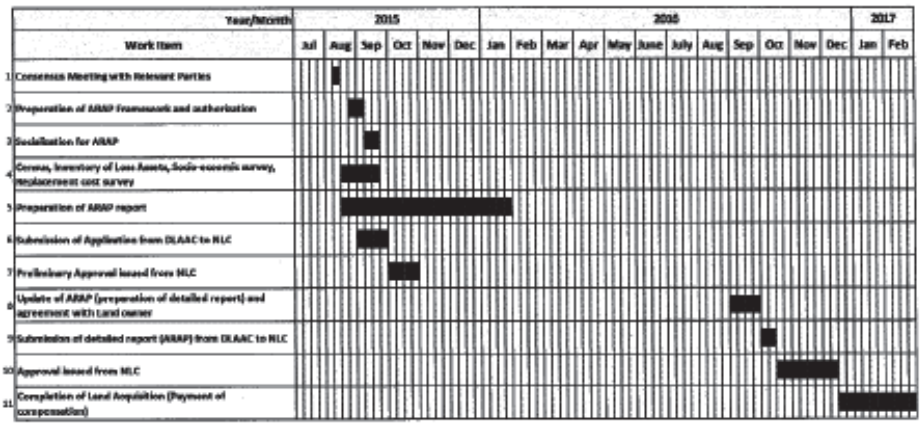
Table 2 Tentative Schedule of IEE



9.2 Policy Framework and Authorization for ARAP

The Bhutan side will prepare the abbreviated resettlement action plan (ARAP) compliant with JICA guideline based on the ARAP prepared by JICA study team in the case the necessity of land acquisition or/and resettlements arises. The tentative schedule is shown in Table 3 is confirmed by the Bhutanese side.

Table 3 Tentative Schedule of ARAP



10. Others

10.1 Type of Chaplekhola Bridge

According to the site investigation, the catchment areas upstream of the Chaplekhola Bridge is small, so large river cross sections may not be required. Depending on the river cross sections and conditions, the Team proposed to adopt "box culvert" instead of bridge. The adoption of box culvert would include advantages, such as cost reduction, shortening of the construction period, reduction of terrain modified during construction, and technology transfer of a highly versatile new technology to Bhutan.

DoR agreed to the proposal with the condition that the Team would conduct a further detailed study and confirm the possibility of adoption and size of box culvert.

10.2 Removal of existing bridges

DoR agreed to the policy on the removal of existing bridges which were proposed by the Team based on the bridge planning as shown below;

- Telegangchu Bridge: New bridge will be constructed at downstream of the existing bridge. DoR will remove the existing bridge on their own responsibility as soon as the completion of new bridge.
- Chaplekhola Bridge: New bridge will be constructed at downstream of the existing bridge. DoR will remove the existing bridge on their own responsibility as soon as the completion of new bridge.
- Beteni Bridge: Japan side will remove the existing bridge because the new bridge will be constructed at the same location as the existing bridge.
- Samkhara Bridge: Japan side will remove the existing bridge because high-technology will be required to remove the bridge. It is better from the viewpoint of economic and technical to use same equipment for both construction of the new bridge and removal of the existing bridge.
- Passang Bridge: Japan side will remove the existing bridge because the new bridge will be constructed at the same location as the existing bridge.

10.3 Relocation of existing facilities/utilities

The Team found the following facilities/utilities at the site during site investigation;

- Beteni Bridge: Bridge security guard hut (vacant)
- Samkhara Bridge: Bridge security guard hut (vacant), electric line/pole
- Passang Bridge: 2 water pipes (on the existing bridge)

DoR agreed to discuss with related agencies and relocate or remove them before tender process on their own responsibility.

10.4 Maintenance and reconstruction of temporary detour

[At Beteni Bridge]

There is a temporary detour for heavy vehicle at upstream of Beteni Bridge. It is under repair by DoR regional office now (see Figure-5) because it has been damaged by overflowing water after heavy rain during the monsoon. The Team explained that this detour could be used as a detour during construction instead of installing temporary bridge, so that construction cost could be reduced. Therefore, the Team requested DoR to repair and maintain the detour properly. DoR agreed to do that on their own responsibility.

Figure-5 Temporary detour at upstream of Beteni Bridge (during monsoon)

[At Passang Bridge]

There is a temporary detour for heavy vehicle at upstream of Passang Bridge. However, it has been cut and it is not in use now (see Figure-6). The Team explained that this detour could be used as a detour during construction instead of installing temporary bridge, so that construction cost could be reduced. Therefore, the Team requested DoR to reconstruct the detour before tender process. DoR agreed to do that on their own responsibility.

Figure-6 Temporary detour at upstream of Passang Bridge

10.5 Tentative Schedule of the Project

Tentative Schedule of the Project will be as follows;

- E/N: June 2016
- G/A: June 2016
- Detailed Design: from August 2016 to May 2017
- Tender: from May 2017 to August 2017
- Construction: starting from September 2017

(3) M/D (The second field survey)

Minutes of Discussions
on the Preparatory Survey for
The Project for Reconstruction of Bridges on
Primary National Highway No. 4
in Bhutan
(Explanation on Draft Preparatory Survey Report)

On the basis of the discussions and field survey in Bhutan in July 2015, and the subsequent technical examination of the results in Japan, the Japan International Cooperation Agency (hereinafter referred to as "JICA") prepared a draft Preparatory Survey Report (hereinafter referred to as "the Draft Report") on the Project for Reconstruction of Bridges on Primary National Highway No. 4 (hereinafter referred to as "the Project").

In order to explain the Draft Report and to consult with the concerned officials of the Government of Bhutan on its contents, JICA sent to Bhutan the Preparatory Survey Team for the explanation of the Draft Report (hereinafter referred to as "the Team"), headed by Mr. Nobuyuki Tsuneoka, Leader of the Team.

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

Thimphu, September 14, 2016

Nobuyuki Tsuneoka
Leader
Preparatory Survey Team
Japan International Cooperation Agency
Japan

Karma Galay
Director
Department of Roads
Ministry of Works & Human Settlement
Bhutan

Passang Dorji
Officiating CPO
Development Cooperation Division
Gross National Happiness Commission
Bhutan

ATTACHMENT

1. Objective of the Project

The objective of the Project is to increase load carrying capacity and extend vehicle lanes by reconstruction of Telegangchu bridge, Beteni bridge, Samkhara bridge and Passang bridge, thereby contributing to ensure smooth and safe traffic on the bridges.

2. Project Site

Both sides confirmed that the sites of the Project are shown in Annex 1.

3. Contents of the Draft Report

After the explanation of the contents of the Draft Report by the Team, the Bhutanese side agreed in principle to its contents.

4. Cost Estimation

Both sides confirmed that the Project cost estimation described in Annex 2 was provisional and would be examined further by the Government of Japan (hereinafter referred to as "GoJ") for its final approval.

5. Confidentiality of the Cost Estimation and Specifications

Both sides confirmed that the Project cost estimation and technical specifications in the Draft Report should never be duplicated or disclosed to any third parties until all the contracts of the Project are concluded.

6. Project Implementation Schedule

The Team explained to the Bhutanese side that the expected implementation schedule is as attached in Annex 3.

7. Expected outcomes and Indicators

Both sides agreed that key indicators for expected outcomes are as follows.

[Quantitative Effect]

Effect		Base Value (2015)	Target Value (2023)
The average speed	Telegangchu Bridge	13	20

(km/h)	Beteni Bridge	12	20
	Samkhara Bridge	14	20
	Passang Bridge	19	60
Increase in bridge load bearing capacity(t)	All 4 Bridges	55	100
Average daily traffic volume(units/day)	Trongsa~ Zhemgang	190	245
	Zhemgang~ Gelephu	233	301
Average daily passenger (number /day)	Trongsa~ Zhemgang	640	826
	Zhemgang~ Gelephu	785	1,014
Average cargo weight(ton/day)	Trongsa~ Zhemgang	382	493
	Zhemgang~ Gelephu	469	606

[Qualitative Effect]

(1) Improvement in bridge performance and safety
(2) Improvement of road traffic safety
(3) Improvement of river environment
(4) Increased and smoother physical distribution
(5) Ensuring safety of pedestrians

The Bhutanese side has responsibility to monitor the indicators and is requested to report to JICA their achievement in the target year 2023.

8. Undertakings Taken by Both Sides

Both sides confirmed undertakings described in Annex 4. The Bhutanese side assured to take the necessary measures and coordination including allocation of the necessary budget which are preconditions of implementation of the Project. It is further agreed that the costs are indicative, i.e. at Outline Design level. More accurate costs will be calculated at the Detailed Design stage. Contents of Annex 4 will be updated as the Detailed Design progresses, and will finally be used in the contract document.

8.1. The Bhutanese side confirmed that the customs duties, internal taxes and other fiscal levies, imposed in Bhutan with respect to the purchase of the products and the services shall be exempted in accordance with the Exchange of Notes (hereinafter referred to as "E/N") between both governments.

For the sake of this smooth tax exemption procedures, the Team recommended DoR and Gross National Happiness Commission (hereinafter referred to as "GNHC") that DoR and GNHC would begin necessary preparations of the

application of tax exemption mentioned above and consultation with Department of Revenue and Customs (hereinafter referred to as "DRC") and relevant organizations, if any, based on the past E/N contents as soon as possible.

8.2. The Bhutanese side agreed to make their best efforts to secure necessary budget for their scope of work in time and to report its progress to JICA Bhutan office (hereinafter referred to as "JICA office") in order to ensure the budgeting. If the budget cannot be secured in time and/or appropriately, there is a possibility that the Project might be suspended / terminated.

8.3. The Bhutanese side agreed to repair the detour road of Passang bridge which was damaged and cut by flood before the construction starts.

8.4. The Bhutanese side agreed to maintain the detour roads of Beteni bridge and Passang bridge properly while constructing new bridges.

8.5. The Bhutanese side agreed to remove the existing Telegangchu bridge and the detour roads as soon as possible after the completion of the Project , because it's dangerous that those road will prevent safe traffic and smooth river flow.

9. Monitoring during the Implementation
The Project will be monitored and reported every month by the executing agency and using the Project Monitoring Report (PMR) in Annex 5.

10. Ex-Post Evaluation
JICA will conduct ex-post evaluation three (3) years after the project completion with respect to five evaluation criteria (Relevance, Effectiveness, Efficiency, Impact, Sustainability) of the Project. Result of the evaluation will be publicized. The Bhutanese side is required to provide necessary support for JICA.

11. Issues to be Considered for the Smooth Implementation of the Project
Both sides confirmed the issues to be considered and taken necessary measures for the smooth implementation of the Project described in Annex 4.

12. Schedule of the Study
JICA will complete the Final Report of the Preparatory Survey in accordance with the confirmed items and send it to the Bhutanese side around November 2016.

13. Environmental and Social Considerations

13-1 General Issues

13-1-1 Environmental Guidelines and Environmental Category

The Team explained that 'JICA Guidelines for Environmental and Social Considerations (April 2010)' (hereinafter referred to as 'the Guidelines') is applicable for the Project. The Project is categorized as B because the Project is not located in a sensitive area, nor has it sensitive characteristics, nor falls it into sensitive sectors under the Guidelines, and its potential adverse impacts on the environment are not likely to be significant.

13-1-2 Environmental Checklist

The environmental and social considerations including major impacts and mitigation measures for the Project are summarized in the Environmental Checklist attached as Annex 6. Both sides confirmed that in case of major modification of the content of the Environmental Checklist, the Bhutanese side shall submit the modified version to JICA in a timely manner.

13-2 Environmental Issues

13-2-1 Initial Environmental Examination (IEE)

Both sides confirmed the IEE report will be approved by National Environmental Commission (hereinafter referred to as 'NEC') in November 2016.

The Bhutanese side agreed JICA's disclosure of provided IEE report on its website.

13-2-2 Environmental Management Plan and Environmental Monitoring Plan

Both sides confirmed Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP) of the Project is as Annex 7 and 8, respectively. Both side agreed that environmental mitigation measures and monitoring shall be conducted based on the EMP and EMoP, which may be updated during the detailed design stage.

13-3 Environmental Monitoring

13-3-1 Environmental Monitoring

Both sides agreed that the Bhutanese side will submit results of environmental monitoring to JICA by using the monitoring form attached as Annex 9.

13-3-2 Information Disclosure of Monitoring Results

Both sides confirmed that the Bhutanese side will disclose results of environmental monitoring to local stakeholders through their website.

The Bhutanese side agreed JICA will disclose results of environmental monitoring

submitted by the Bhutanese side as the monitoring forms attached as Annex 9 on its website.

14. Other Relevant Issues

14-1. Operation and Maintenance of the Facilities(Equipment)

The team explained the importance of operation and maintenance of the facilities constructed by the Project considering that proper asset management impacts greatly on life-span of the facilities and its maintenance cost. The Bhutanese side shall secure enough staff and budgets necessary for appropriate operation and maintenance of the facilities. The annual operation and maintenance costs are estimated and shown in the Report.

14-2. Project Component

Both sides confirmed that the target bridges of the project are 4 bridges which are shown in annex 1.

The Team explained to the Bhutanese side that Chaplekhola Bridge would be reluctantly excluded from the project component.

14-3. Validity of the Previous Minutes of Discussions

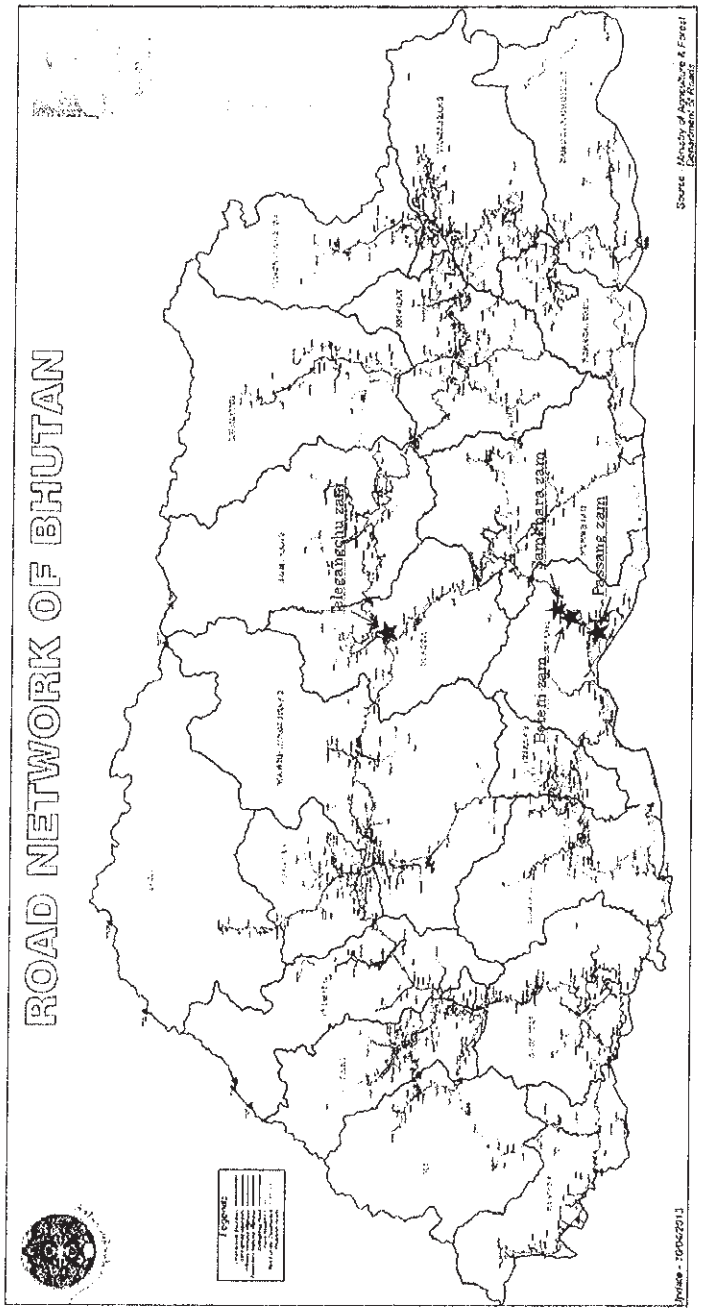
Both sides confirmed that all the agreements in the Minutes of Discussions of the preceding Preparatory Survey signed on July 31, 2015 continue to be valid unless information is updated by the draft Preparatory Survey Report

14-4. Disclosure of Information

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

Annex 1 Project Sites
Annex 2 Project Cost Estimation
Annex 3 Project Implementation Schedule
Annex 4 Major Undertakings to be taken by Each Government
Annex 5 Project Monitoring Report (template)
Annex 6 Environmental Check List
Annex 7 Environmental Management Plan
Annex 8 Environmental Monitoring Plan
Annex 9 Environmental Monitoring Form

Annex 1 Project Sites



Annex 2

CONFIDENTIAL

(1) Cost Borne by the Government of Japan

This part is closed due to the confidenciality

(2) Cost Borne by the Royal Government of Bhutan

Items	Cost Estimation (Ngultrum)
Payment of bank commission	1,613,000
To refund customs duties, internal taxes and other fiscal levies	19,000,000
To remove and relocate obstacles at sites	1,500,000
Removal of the existing bridge (Teleganchu bridge)	1,000,000
Removal of the detour road (Beteni bridge)	1,000,000
To repair the detour road (Passang bridge)	1,000,000
Total	25,113,000

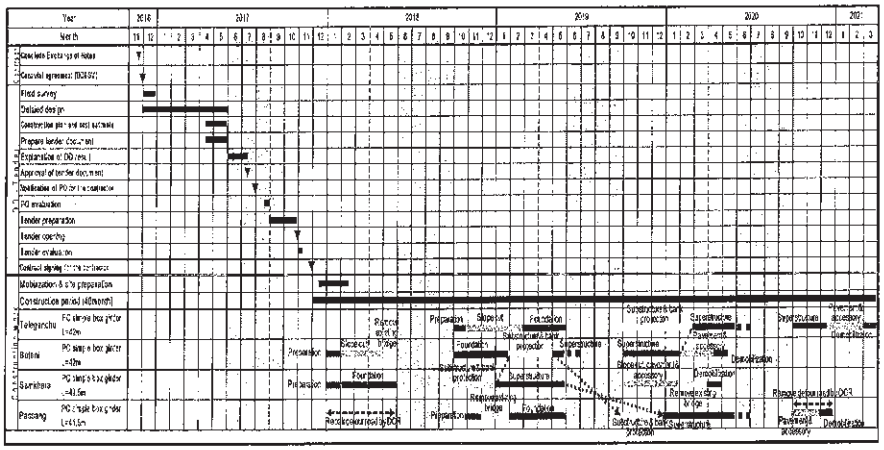
(3) Conditions of Cost Estimation

- Estimated timing: September 2015
- Exchange rates: USD1.00 = 124.39 JPY
  BTN 1.00 = 2.08 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 3

Tentative Project Implementation Schedule



Annex 4

Major Undertakings to be taken by Recipient Government

1. Before the Tender

NO	Items	Deadline	In charge	Cost (Million Ngultrum)	Ref.
1	To open Bank Account (Banking Arrangement (B/A))	within 1 month after G/A	GNHC		
2	To approve IEE	November 2016	Dzongkhags/ DoR		
3	To implement IEE	before start of the construction	DoR,MoWHS		
4	To clear, level and reclaim the following sites 1) To remove the DoR road office at side of road.(Beteni Bridge) 2) To remove the DoR road office and electricity facility on new road. (Samkhara Bridge) 3) To relocate the current water pipe(Passang Bridge)	before notice of the tender document	DoR	1.5	
5	To repair the detour road for Passang Bridge which was damaged and cut by flood.		DoR	1	
	1) To secure the budget for repairing	before notice of the tender document	DoR		
	2) To repair the detour road	before start of the Passang Bridge construction	DoR		
6	To obtain the planning, zoning, building permit 1) the permission for taking raw materials such as soil materials from the plant	before notice of the tender document	DoR		
7	To approve the result of DD (estimated cost and revised contents etc.)	end of DD	DoR		

2. During the Project Implementation

NO	Items	Deadline	In charge	Cost (Million Ngultrum)	Ref.
1	To bear the following commissions to a bank of Japan for the banking services based upon the B/A				
	1) Advising commission of A/P	within 1 month after the singing of the contract	GNHC		
	2) Payment commission for A/P	every payment	GNHC	1.6	0.1% of payment amount
2	To ensure prompt unloading and customs clearance in recipient country				
	1) Tax exemption and customs clearance of the products	during the Project	DoR		

3	To accord Japanese nationals and/or physical persons of third countries whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work	during the Project	DoR		
4	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the Products and/or the Services be borne Such customs duties, internal taxes and other fiscal levies mentioned above include VAT, commercial tax, income tax and corporate tax of Japanese nationals, resident tax, fuel tax, but not limited, which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract	during the Project	DoR,	19	
5	To bear all the expenses, other than those to be borne by the Grant Aid.	during the Project	DoR		
6	To submit Project Monitoring Report to JICA Bhutan office.	every month	DoR		MD
7	To maintain the detour roads of Beteni Bridge and Passang Bridge properly while constructing new Bridges.	during the construction	DoR		
8	To implement Environmental Management Plan (EMP) and Environmental Monitoring of Plan (EMoP)	during the construction	DoR		MD
9	To submit results of environmental monitoring to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	during the construction	DoR		

3. After the Project

NO	Items	Deadline	In charge	Cost (Million Ngultrum)	Ref.
1	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid 1) Allocation of maintenance cost(each year) 2) Operation and maintenance structure 3) Routine check/Periodic inspection	After completion of the construction	DoR	1.3	
2	To implement EMP and EMoP	for a period based on EMP and EMoP	DoR		
3	To demolish the existing Bridge	within three years	DoR		
	1) The existing Telegangchu Bridge,	within three years	DoR	1	
	2) The detour road of Beteni Bridge	within three years	DoR	1	
4	To submit results of environmental monitoring to JICA, by using the monitoring form, semiannually - The period of environmental monitoring may be extended if any significant negative impacts on the environment are found. The extension of environmental monitoring will be decided based on the agreement between DoR and JICA.	for three years after the Project	DoR		
5	to submit results of quantitative effect indicator to JICA according to quantitative effect described in MD.	three years after the Project	DoR		

(B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable)

Major Undertakings to be Covered by the Japanese Grant

This part is closed due to the confidenciality

Annex 5
G/A NO. XXXXXXX
PMR prepared on DD/MM/YY

Project Monitoring Report
on
The Project for Reconstruction of Bridges on Primary National Highway No.4 in the Kingdom of Bhutan
Grant Agreement No. XXXXXXX
20XX, Month

Organization Information

Authority (Signer of the G/A)	Person in Charge	_____
		(Division) _____
	Contacts	Address: _____
		Phone/FAX: _____
		Email: _____
Executing Agency	Person in Charge	_____
		(Division) _____
	Contacts	Address: _____
		Phone/FAX: _____
		Email: _____
Line Agency	Person in Charge	_____
		(Division) _____
	Contacts	Address: _____
		Phone/FAX: _____
		Email: _____

Outline of Grant Agreement:

Source of Finance	Government of Japan: Not exceeding JPY _____ mil. Government of (_____): _____
Project Title	The Project for Reconstruction of Bridges on Primary National Highway No.4 in the Kingdom of Bhutan
E/N	Signed date: Duration:
G/A	Signed date: Duration:

G/A NO. XXXXXXX
PMR prepared on DD/MM/YY

1: Project Description

1-1 Project Objective

Reconstruction of 4 bridges (Telegangchu, Beteni, Samkhara and Passang) on PNH No.4 (hereinafter referred to as "the Project") aims to improve dual traffic, travelling time, loading capacity and traffic safety on the Project bridges and to ensure smooth and stable traffic.

1-2 Necessity and Priority of the Project

- Consistency with development policy, sector plan, national/regional development plans and demand of target group and the recipient country.

To be described.

1-3 Effectiveness and the indicators

- Effectiveness by the project

Quantitative Effect (Operation and Effect indicators)		
Indicators	Original (Yr 2015)	Target (Yr 2023)
1. Bridge bearing load of all bridges (ton)	35	100
2. Average vehicle speed (km/hr)		
(1) Teleganchu	13	20
(2) Beteni	12	20
(3) Samkhara	14	20
(4) Passang	19	60
3. Annual average daily traffic volume (No. of cars)		
(1) Trongsa – Zhemgang	190	245
(2) Zhemgang – Gelephu	233	301
4. Number of passengers (No. per day)		
(1) Trongsa – Zhemgang	640	826
(2) Zhemgang – Gelephu	785	1,014
5. Cargo weight (ton per day)		
(1) Trongsa – Zhemgang	640	826
(2) Zhemgang – Gelephu	785	1,014
Qualitative Effect		
- Improve safety level of bridge and road *- Improve function of bridge and road* *- Improve river circumstance* *- Ensure safety of pedestrians* *- Facilitate smooth and mass logistics*		

2: Project Implementation

2-1 Project Scope

Table 2-1-1a: Comparison of Original and Actual Location

Location	**Original:** *(M/D)*	**Actual:** *(PMR)*

G/A NO. XXXXXXX
PMR prepared on DD/MM/YY

	Attachment(s):Map	**Attachment(s):Map**

Table 2-1-1b: Comparison of Original and Actual Scope

Items	Original	Actual
1. Reconstruction of Teleganchu Bridge	* PC simple box girder * L=42m (1span), W=11.4 - 13.7m * Approach road (53.5m + 95.9m)	To be described during construction stage, if necessary.
2. Reconstruction of Beteni Bridge	* PC simple box girder * L=42m (1span), W=8.8 – 10.1m * Approach road (81.0m + 99.0m)	To be described during construction stage, if necessary.
3. Reconstruction of Samkhara Bridge	* PC simple box girder * L=49.5m (1span), W=9.1 – 10.6m * Approach road (59.0m + 84.0m)	To be described during construction stage, if necessary.
4. Reconstruction of Passang Bridge	* PC simple box girder * L=41.5m (1span), W=10.0m * Approach road (49.5m + 50.0m)	To be described during construction stage, if necessary.

2-1-2 Reason(s) for the modification if there have been any.

(PMR)
To be described during construction stage, if necessary.

2-2 Implementation Schedule
2-2-1 Implementation Schedule

Table 2-2-1: Comparison of Original and Actual Schedule

Items	Original		Actual
	DOD	G/A	
[M/D]	*(M/D)*		*(PMR)* As of (Date of Revision)
'Soft component' shall be stated in the column of 'Items'.			Please state not only the most updated schedule but also other past revisions chronologically.
Project Completion Date*			

*Project Completion was defined as _____ at the time of G/A.

(Sample)Table 2-2-1: Comparison of Original and Actual Schedule

Items	Original		Actual
	DOD	G/A	
Cabinet Approval	Nov/2016		-
E/N	Nov/2016		
G/A	Nov/2016		
Detailed Design	Dec/2016 – Jul/2017		
Tender Notice	Aug/2017		
Tender	Oct/2017		
Construction Period	Dec/2017-Mar/2021		

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Project Completion Date	Mar/2021		
Defect Liability Period	Mar/2022		

*Project Completion was defined as Check-out of Construction work at the time of G/A.

2-2-2 Reasons for any changes of the schedule, and their effects on the project.

2-3 Undertakings by each Government

2-3-1 Major Undertakings

See Attachment 2.

2-3-2 Activities

See Attachment 3.

2-3-3 Report on RD

See Attachment 4.

2-4 Project Cost

2-4-1 Project Cost

Table 2-4-1a Comparison of Original and Actual Cost by the Government of Japan

This part is closed due to the confidenciality

(Sample)Table 2-4-1b Comparison of Original and Actual Cost by the Government of Bhutan

Items		Cost (1,000 BTN)	
Original	Actual	Original[1),2)]	Actual

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Bank commission		1,613	
Removal of existing Teleganchu Bridge		1,000	
Maintenance and removal of detour road on Beteni Bridge		1,000	
Maintenance and removal of detour road on Passang Bridge		1,000	
Total		4,613	

Note: 1) Date of estimation: Sep/2015
2) Exchange rate: 1 US Dollar = 59.80 BTN (local currency)

2-4-2 Reason(s) for the wide gap between the original and actual, if there have been any, the remedies you have taken, and their results.

(PMR)

2-5 Organizations for Implementation

2-5-1 Executing Agency:

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

Original: *(M/D)*

Actual, if changed: *(PMR)*

2-6 Environmental and Social Impacts

- The results of environmental monitoring as attached in Attachment 5 in accordance with Schedule 4 of the Grant Agreement.
- The results of social monitoring as attached in Attachment 5 in accordance with Schedule 4 of the Grant Agreement.
- Information on the disclosed results of environmental and social monitoring to local stakeholders, whenever applicable.

3: Operation and Maintenance (O&M)

3-1 O&M and Management

- Organization chart of O&M
- Operational and maintenance system (structure and the number ,qualification and skill of staff or other conditions necessary to maintain the outputs and benefits of the project soundly, such as manuals, facilities and equipment for maintenance, and spare part stocks etc)

G/A NO. XXXXXXX
PMR prepared on DD/MM/YY

Original: *(M/D)*
Actual: *(PMR)*

3-2 **O&M Cost and Budget**
- The actual annual O&M cost for the duration of the project up to today, as well as the annual O&M budget.

Original: *(M/D)*

4: Precautions (Risk Management)

- Risks and issues, if any, which may affect the project implementation, outcome, sustainability and planned countermeasures to be adapted are below.

Original Issues and Countermeasure(s): *(M/D)*	
Potential Project Risks	Assessment
1.	Probability: H/M/L
(Description of Risk)	Impact: H/M/L
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action during the Implementation:
	Contingency Plan (if applicable):
2.	Probability: H/M/L
(Description of Risk)	Impact: H/M/L
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action during the Implementation:
	Contingency Plan (if applicable):
3.	Probability: H/M/L
(Description of Risk)	Impact: H/M/L

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	Analysis of Probability and Impact:
	Mitigation Measures:
	Action during the Implementation:
	Contingency Plan (if applicable):
Actual issues and Countermeasure(s)	
(PMR)	

5: Evaluation at Project Completion and Monitoring Plan

5-1 Overall evaluation

Please describe your overall evaluation on the project.

5-2 Lessons Learnt and Recommendations

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

5-3 Monitoring Plan for the Indicators for Post-Evaluation

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.

G/A NO. XXXXXXX
PMR prepared on DD/MM/YY

Attachment

1. Project Location Map
2. Undertakings to be taken by each Government
3. Monthly Report
4. Report on RD
5. Environmental Monitoring Form / Social Monitoring Form
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (Final Report Only)

Attachment 6

Monitoring sheet on price of specified materials

1. Initial Conditions (Confirmed)

	Items of Specified Materials	Initial Volume A	Initial Unit Price (¥) B	Initial total Price C=A×B	1% of Contract Price D	Condition of payment	
						Price (Decreased) E=C−D	Price (Increased) F=C+D
1	Item 1	●●t	●	●	●	●	●
2	Item 2	●●t	●	●	●		
3	Item 3						
4	Item 4						
5	Item 5						

2. Monitoring of the Unit Price of Specified Materials

(1) Method of Monitoring : ●●

(2) Result of the Monitoring Survey on Unit Price for each specified materials

	Items of Specified Materials	1st ●month, 2015	2nd ●month, 2015	3rd ●month, 2015	4th	5th	6th
1	Item 1						
2	Item 2						
3	Item 3						
4	Item 4						
5	Item 5						

(3) Summary of Discussion with Contractor (if necessary)

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Attachment 7

Report on Proportion of Procurement (Recipient Country, Japan and Third Countries)
(Actual Expenditure by Construction and Equipment each)

	Domestic Procurement (Recipient Country) A		Foreign Procurement (Japan) B		Foreign Procurement (Third Countries) C		Total D
Construction Cost		(A/D%)		(B/D%)		(C/D%)	
Direct Construction Cost		(A/D%)		(B/D%)		(C/D%)	
others		(A/D%)		(B/D%)		(C/D%)	
Equipment Cost		(A/D%)		(B/D%)		(C/D%)	
Design and Supervision Cost		(A/D%)		(B/D%)		(C/D%)	
Total		(A/D%)		(B/D%)		(C/D%)	

Annex 6 Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) N (b) N (c) N (d) N	(a) Applical on (which is same as IEE report) is under preparation and Environmental Clearance is expected to be obtained in June, 2016 (b) ditto 1 (c) The conditions are not expected as of January, 2016 (d) Forest Clearance(FC) and Clearance (EC) need to be obtained and they are under procedure.
	(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? Understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) Y	(a) Local stakeholder meetings was held based on JICA Guidelines and Bhutan's EIA Procedure. The project outline, tentative schedule was disclosed and exchange opinions with participants has been done. (The first stakeholder meeting has been held in September 2014) (b) The opinions and comments will be reflected to the engineering design and environmental management plan
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) Several alternative plans were examined in this project including from the environmental and social considerations point of view.
2 Pollution Control	(1) Air Quality	(a) Is there a possibility that air pollutants emitted from the project related sources, such as vehicles traffic will affect ambient air quality? Does ambient air quality comply with the country's air quality standards? Are any mitigating measures taken? (b) If air quality already exceed country's standards near the route, is there a possibility that the project will make air pollution worse?	(a) N (b) N	(a) The predicted air quality does not expected to exceed Bhutan's standard level considering traffic volume (b) The predicted air quality does not expected to exceed Bhutan's standard level considering traffic volume
	(2) Water Quality	(a) Is there a possibility that soil runoff from the bare lands resulting from earthmoving activities, such as cutting and filling will cause water quality degradation in downstream water areas? (b) Is there a possibility that the project will contaminate water sources, such as well water?	(a) N (b) N	(a) Although turbid water may be causec and discharged from the construction area, general and appropriate mitigation measures to minimize the adverse impacts shall be taken. These mitigation measures are planned on the environmental management plan. (b) There are no water sources affected by project.
	(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 sound from the vehicle and train traffic comply with the country's standards?	(a) Y (b) Y	(a) The predicted noise does not expected to exceed Bhutan's standard level considering the expected traffic volume. (b) There are no structure which cause low frequency sound.
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 affect the protected areas?	(a) Y/N	(a) Chaphikhola Bridge is located in the Multiple-Use zone of the edge of Royal Manas National Park. The impact to the protected area is not expected since the project is replacement of the bridge on the existing route and the scope is not large.
	(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) N (b) N (c) N (d) Y (e) N	(a) The project site is in the Multiple Use Zone, therefore it is not considered to encompass ecologically valuable habitats. (b) The project site does not encompass the protected habitats of endangered species because the site is in the Multiple-Use zone (c) The project activities does not give significant impacts on the ecosystem. (d) Adequate measures are taken under the management of Royal Manas National Park. (e) Adverse impacts to the ecosystems are not expected since this project is replacement of existing bridges.
	(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) There are not any construction activity that cause hydrologic change
	(4) Topography and Geology	(a) Is there any soft ground on the route that may cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides, where needed? (b) Is there a possibility that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides? (c) Is there a possibility that soil runoff will result from cut and fill areas, waste soil disposal sites, and borrow sites? Are adequate measures taken to prevent soil runoff?	(a) N (b) N (c) Y	(a) There are no soft ground area in the cutting land section on the route slope protection measures are prepared. (b) ditto 1 (c) The mitigation measures for soil erosion and run off such as silt fence are planned in earth work section.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4 Social Environment	(1) Resettlement / Land acquisition	(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 the compensations going to be paid prior to the resettlement? (e) Is the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	(a) N (b) N (c) N (d) N (e) N (f) N (g) N (h) N (i) N (j) N	(a) Involuntary resettlement and land acquisition is not expected. (b) ditto (c) ditto (d) ditto (e) ditto (f) ditto (g) ditto (h) ditto (i) ditto (j) ditto
	(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? (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 shading and radio interference?	(a) N (b) N (c) N (d) Y (e) Y (f) N	(a) The project does not affect the existing means of transportation and the associated workers. (b) There are not possibility that the project will adversely affect the living conditions of inhabitants other than the affected inhabitants. (c) There are no impacts expected in occurrence of diseases, including communicable diseases, such as HIV will be introduced due to immigration of workers associated with the project. However, adequate mitigation measures such as health check and education will be conducted based on environmental management plan, if necessary. (d) The project may give adverse impact to existing connected road since traffic restriction is required, thus adequate mitigation measures will be prepared. Additionally traffic safety will be secured by the mitigation measures during construction. The driving speed after construction of the bypass will be controlled by local police and setting up sign boards along the road. (e) ditto ! (f) There are not any planned bridges cause adverse impact such as sun shading and radio interference.
4 Social Environment	(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 not any possibilities that the project will adversely affect the heritage.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) There are not any possibilities that the project will adversely affect the local landscape.
	(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 the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a) N (b) N	(a) There are not any designated ethnic minorities and indigenous peoples in the rights-of-way. (b) ditto !
	(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 to violate safety of other individuals involved, or local residents?	(a) N (b) Y (c) Y (d) Y	(a) Construction will be carried out in compliance with labor law in Bhutan (b) Adequate safety consideration will be taken (c),(d) Based on Bhutan's labor law, safety education and education for consideration to residence will be given to workers
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) Y	(a) Adequate measures considered to reduce impacts during construction will be prepared based on environmental management plan (b) Adverse impacts on ecosystem are not predicted (c) For Passan Bridge, the impact to social environment particularly during construction is expected but adequate measures will be prepared.
	(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) The proponent will prepare monitoring program for the environmental items based on approved IEE and it will be implemented. (b) The monitoring items, methods and frequencies included in the monitoring program will be prepared based on JICA Guidelines and Bhutan's EIA procedures (c) The proponent will establish an adequate monitoring framework based on JICA Guidelines and Bhutan's EA procedures (d) Regulatory requirements pertaining to the monitoring report system will be identified, such as the format and frequency of reports from the proponent to the regulatory authorities based on JICA Guidelines and Bhutan's EIA procedures.
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) Large scale deforestation is not expected. (b) There are not any construction plan for the Power Transmission and Distribution lines.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N	(a) It is not likely to give impacts to transboundary or global issues

1) Regarding the term "Country's Standards" mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are required to be made.
In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).
2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which the project is located.

Annex 7 Environmental Management Plan

Category	No	Impacted Item on JICA Guidelines	Outline (Mitigation measures)	Implementation agency	Responsible agency	Cost
During Operation						
Pollution	1	Air Pollution	✓ Measure air quality regularly ✓ Use and maintain regularly low contamination construction equipment ✓ Avoid unnecessary idling ✓ Sprinkle water during the construction phase	Contractor	Project proponent (DoR)	Included in the construction cost
	2	Water Pollution	✓ Inspect water quality regularly ✓ Prevent oil leak of construction equipment ✓ Installation of sediment discharge prevention sheet ✓ Construction of drainage facilities and sedimentation pond	Contractor	Project proponent (DoR)	Included in the construction cost
	3	Waste	✓ Examine possibility of reuse ✓ Waste separation and collection/ disposal ✓ Transportation/ disposal of soil and specify the soil dumping area ✓ Appropriate treatment of waste oil ✓ Installation of wastewater treatment facility(septic tank) in base camp	Contractor	Project proponent (DoR)	Included in the construction cost
	4	Noise and Vibration	✓ Restriction of construction time (No construction during the night time) ✓ Use low-noise/ less-vibration type of construction equipment and maintain it regularly	Contractor	Project proponent (DoR)	Included in the construction cost
Natural Environment	5	Protected Area	✓ Reduce the number of logging as possible ✓ Plant trees at roadside ✓ Share the information and cooperate (ex. hold meeting regularly) with Royal Manas National Park.	Contractor	Project proponent (DoR)	Included in the construction cost
	6	Ecosystem	✓ Plant trees at roadside ✓ Avoid logging of fruit trees and useful trees as possible	Contractor	Project proponent (DoR)	Included in the construction cost
Social Environment	7	Existing social infrastructures and services	✓ Advance announcement about construction schedule and plan to road-user and local resident ✓ Secure the road traffic	Contractor	Project proponent (DoR)	Included in the construction cost
Others	8	Accidents	✓ Install sign to show construction schedule and night lighting ✓ Install fence to prevent resident from entering inside the construction area ✓ Secure the parking space for construction vehicle ✓ Post the traffic control staff	Contractor	Project proponent (DoR)	Included in the construction cost

Category	No	Impacted Item on JICA Guidelines	Outline (Mitigation measures)	Implementation agency	Responsible agency	Cost
During Operation						
PL	1	Air Pollution	✓ Measure air quality regularly	DoR	Project proponent (DoR)	Included in the construction cost
Ö	2	Accidents	✓ Installment of Indicator	DoR	Project proponent (DoR)	Included in the construction cost

Annex 8 Environmental Monitoring Plan

Category	Items	Location	Frequency	Implementation agency	Responsible agency
【Construction phase】 (4 bridges)					
Air Pollution	TSP, PM_{10}, CO, NOx, SOx etc. of which measured in baseline data	Near construction site	4times/year	Contractor	Project proponent (DoR)
Noise	Noise generated by construction	Near construction site	4times/year	Contractor	Project proponent (DoR)
Water pollution	pH, SS,BOD, EC, T-Coli, etc. of which measured in baseline data	River at construction	Once/month	Contractor	Project proponent (DoR)
Waste	Type, Quantity and disposal sites of construction waste.	Construction site and waste disposal site	4times/year	Contractor	Project proponent (DoR)
Accidents	Number and details of accident	Construction site	4times/year	Contractor	Project proponent (DoR)
【Operation phase】 (4bridges)					
Air Pollution	TSP, PM_{10}, CO, NOx, SOx etc. of which measured in baseline data	Near construction site	twice/year	DoR	Project proponent (DoR)
Accidents	Number and details of accident	Construction site	twice/year	DoR	Project proponent (DoR)
【Construction phase】(Passang Bridge)					
Existing social infrastructures and services	Number of complaint and opinion	Near construction site	Suitably	Contractor	Project proponent (DoR)

Annex 9 Environmental Monitoring Form

Environmental Monitoring Form

·If environmental reviews indicate the need of monitoring by JICA, JICA undertakes monitoring for necessary items that are decided by environmental reviews. JICA undertakes monitoring based on regular reports including measured data submitted by the project proponent. When necessary, the project proponent should refer to the following monitoring form for submitting reports.

·When monitoring plans including monitoring items, frequencies and methods are decided, project phase or project life cycle (such as construction phase and operation phase) should be considered.

1. Pollution Countermeasures

Air Quality (Traffic /Ambient Air Quality) [4 Bridges]

Item	Unit	Measured Value (Mean) Along road/Residential area	Measured Value (Max.)	Country's Standards	Referred International Standards (Japanese standard)	Remarks (Measurement Point, Frequency, Method, etc.)
TSP	$\mu g/m^3$			200 (24 Hour Average)	SPM (0.1mg/m3)	– On the boundary of approach road and residence (1 point ×3 bridges) – 2 times a year during construction – Air sampler High volume sampler
NO2	$\mu g/m^3$			80 (24 Hour Average)	0.04-0.06(ppm)	
SO2	$\mu g/m^3$			80 (24 Hour Average)	0.04(ppm)	
CO	$\mu g/m^3$			2000 (8 Hour Average)	10(ppm)	
PM10	$\mu g/m^3$			100 (24 Hour Average)	SPM (0.1mg/m3)	

- Water Quality (Water Quality in the river) [4 Bridges]

	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standards	Referred International Standards (Japanese Standards/ D category river)	Remarks (Measurement Point, Frequency, Method, etc.)
pH	-			6-9	6.5-8.5	– Downstream portions of affected water bodies (1 point ×3 bridges) – Once a month during construction – Grab sampling
DO	mg/l			-	2	
TSS	mg/l			-	SS 100	
BOD	mg/l			50	8	
Total Coliform	1,000 MPN/ 100ml			10,000	-	
EC	µS/cm			2000	-	

- Noise / Vibration[4 Bridges]

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standards	Referred International Standards (Japanese Standard)	Remarks (Measurement Point, Frequency, Method, etc.)
Noise level	dB(A)			For Industrial areas Day(0600-2200): 75 dB(A) Night(2200-0600) : 65 dB(A) * Value for industrial area is applied since the monitoring is planned only for temporary period of construction	Specified Construction noise 85 dB(A) (Maximum value of 90% range)	– On the boundary of construction yard and residence (1 point ×3 bridges) – 2 times a year during construction – Digital sound level meter

- Waste[4 Bridges]

Monitoring Item	Monitoring Results during Report Period
Type, quantity and disposal sites of construction waste	

2. Social Environment and others

- Existing social infrastructures and services[Passang Bridge]

Monitoring Item	Monitoring Results during Report Period
Number of opinions and complains	

- Accident[4 Bridges]

Monitoring Item	Monitoring Results during Report Period
Number and details of accident	

Appendix 5 Outline Design Drawings

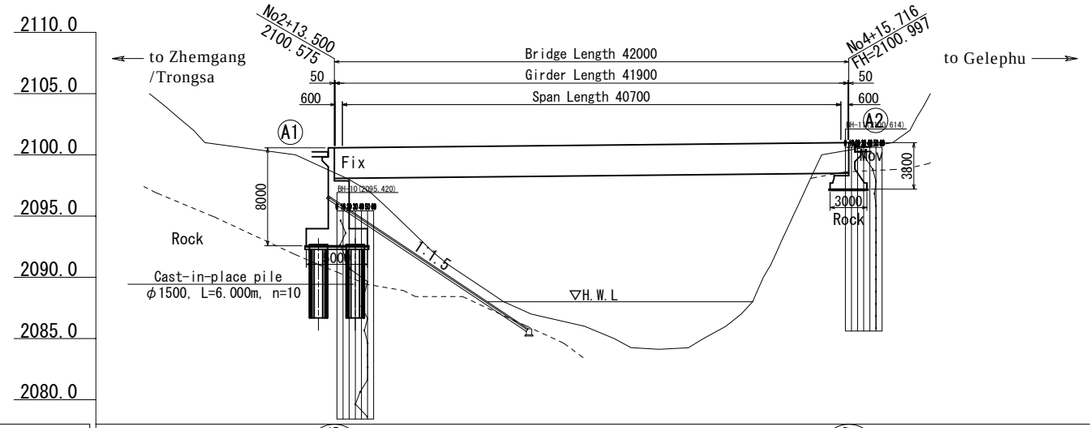
5. Outline Design Drawings

No.	Drawing Title
(1) Telegangchu Bridge	
1	GENERAL DRAWING
2	PLAN
3	PROFILE
4	CROSS SECTION (1)
5	CROSS SECTION (2)
6	CROSS SECTION (3)
7	CROSS SECTION (4)
8	RETAINING WALL GENERAL DRAWING
(2) Beteni Bridge	
1	GENERAL DRAWING
2	PLAN
3	PROFILE
4	CROSS SECTION (1)
5	CROSS SECTION (2)
6	CROSS SECTION (3)
7	RETAINING WALL GENERAL DRAWING
(3) Samkhara Bridge	
1	GENERAL DRAWING
2	PLAN
3	PROFILE
4	CROSS SECTION (1)
5	CROSS SECTION (2)
6	CROSS SECTION (3)
7	RETAINING WALL GENERAL DRAWING(1)
8	RETAINING WALL GENERAL DRAWING(2)
(4) Passang Bridge	
1	GENERAL DRAWING
2	PLAN
3	PROFILE
4	CROSS SECTION (1)
5	CROSS SECTION (2)
6	CROSS SECTION (3)
7	RETAINING WALL GENERAL DRAWING

(1) Telegangchu Bridge

GENERAL DRAWING(Telegangchu Bridge)

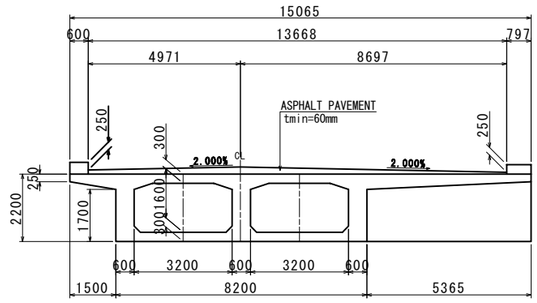
PROFILE A1:S=1:250 A3:S=1:500



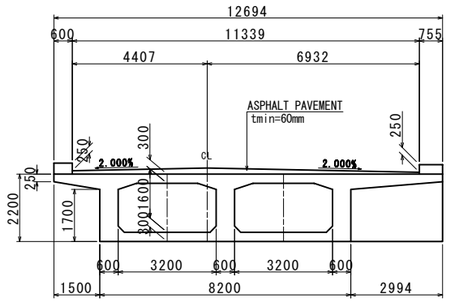
Gradient	i=1.000% L=42.0m
Proposed height	2100.536 2100.575 2100.640 2100.707 2100.840 2100.876 2100.997 2101.040 2101.056
Ground height	2100.00 2093.00 2093.83 2088.50 2083.40 2084.90 2101.41 2100.90 2101.90
Total Distance	47.576 53.500 60.000 66.710 80.000 83.569 95.644 100.000 101.569
Station	KE2-2 No2+13.500 No3 KA2-2 No4 KA3-1 No4+15.716 No5 KE3-1
Transversal Slope	-6.0% -2.0% -2.0% -2.0% -2.0% -6.0%
Widening	4.25 0.00 0.00 4.00

CROSS SECTION A1:S=1:100 A3:S=1:200

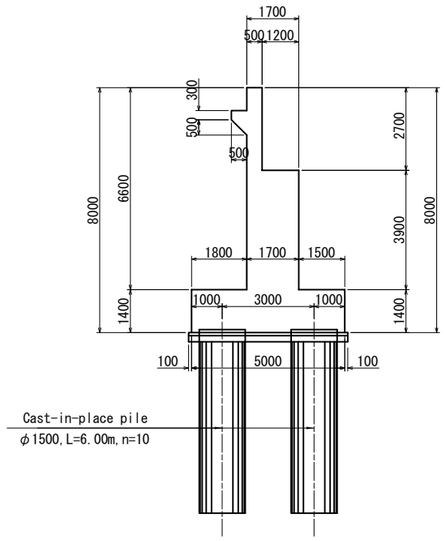
A1 SIDE



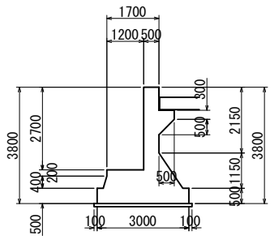
A2 SIDE



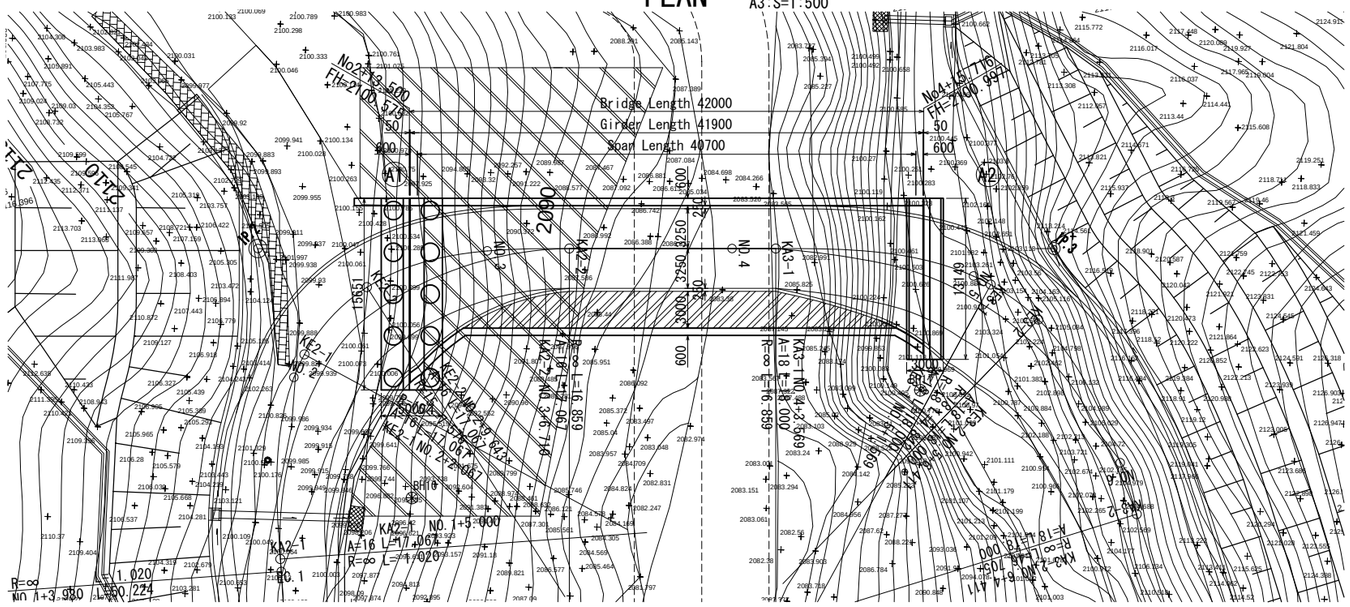
A1 ABUTMENT A1:S=1:100 A3:S=1:200



A2 ABUTMENT A1:S=1:100 A3:S=1:200



PLAN A1:S=1:250 A3:S=1:500



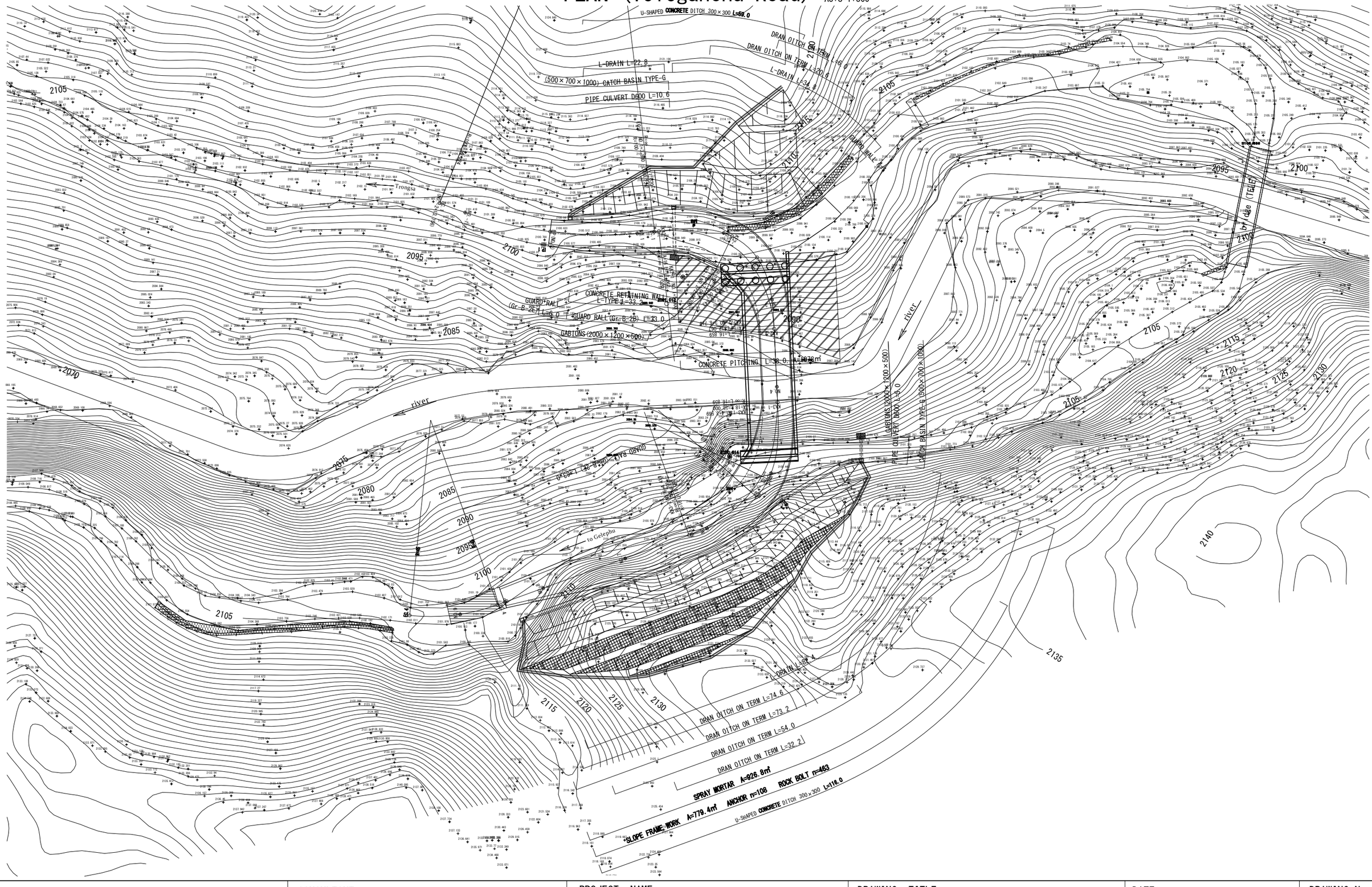
Design condition

Bridge Length			42.000m
Span Length			41.900m
Road Width			15.065m～12.694m
Live Load			Single lane IRC 70R(wheeled) or Double lane IRC Class A
Design Seismic Scale			KH=0.22 KV=0.00
Super structure	Form		PC Box-Shape Girder
	Material strength	Concrete	σck=30 N/mm^2
		ReinforcigBar	SD345 Equivalent
		Tendon	12S12.7mm
Sub structure	Form	Structure	A1:Inverted T-Type Abutment A2:Gravity-Type Abutment
		Foundation	A1:Cast in place Pile A2:Spread Foundation
	Material strength	Concrete	σck=21 N/mm^2
		ReinforcigBar	SD345 Equivalent

Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANTS: THE CONSORTIUM OF Oriental Consultants Global Co., Ltd. AND INGEROSEC CORPORATION	PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.4	DRAWING TITLE: GENERAL DRAWING (Telegangchu Bridge)	DATE: PREPARED BY: CHECKED BY:	DRAWING No. :

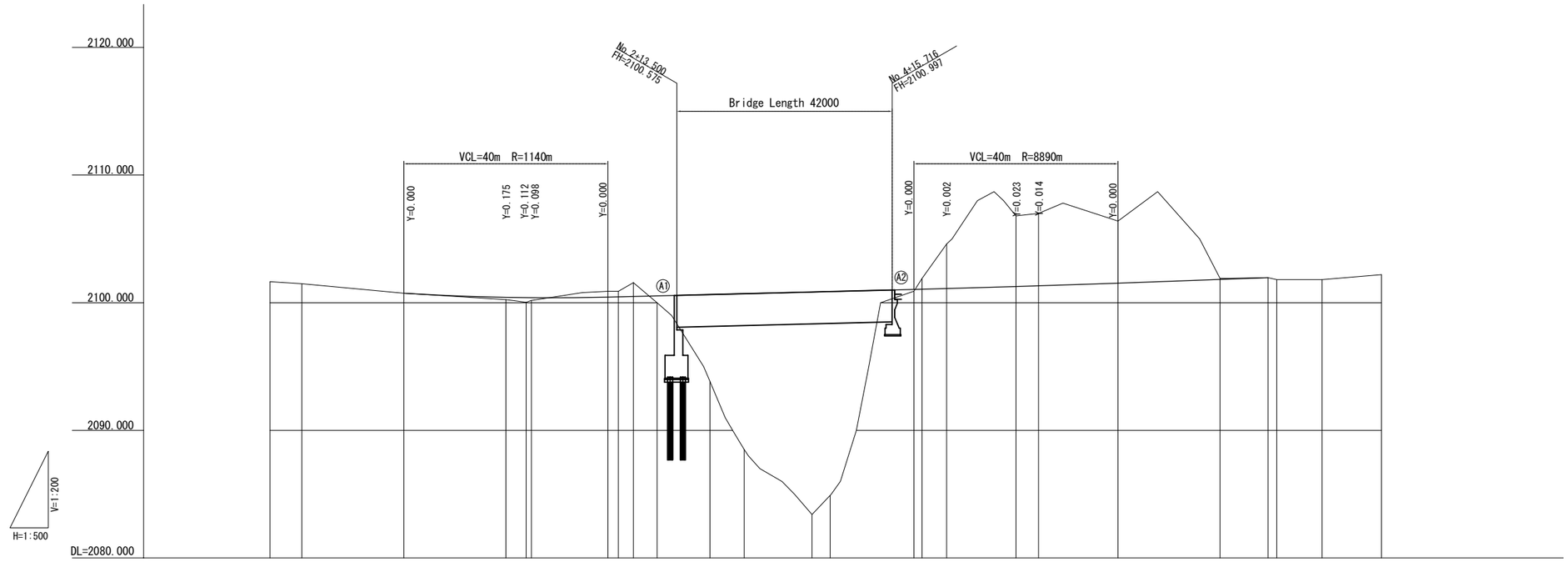
PLAN (Teleganchu Road)

A1:S=1:400
A3:S=1:800



Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANT: THE CONSORTIUM OF Oriental Consultants Global Co., Ltd. AND INGEROSEC CORPORATION	PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.4	DRAWING TITLE: PLAN (Teleganchu Road)	DATE: PREPARED BY: CHECKED BY:	DRAWING No. :

PROFILE (Teleganchu Road)



Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANT: THE CONSORTIUM OF Oriental Consultants Global Co., Ltd. AND INGEROSEC CORPORATION	PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.4	DRAWING TITLE: PROFILE (Teleganchu Road)	DATE: PREPARED BY: CHECKED BY:	DRAWING No. :

CROSS SECTION (1) (Teleganchu Road)

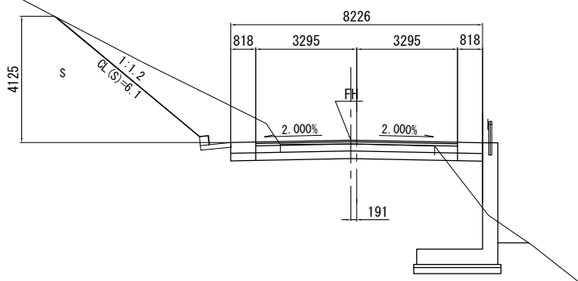
A1:S=1:100
A3:S=1:200

NO.0+15.900

GH=2100.33
FH=2100.453

NO.0+15.900				
地盤高	2100.33m		計画高	2100.453m
切土面積			盛土面積	
掘削（片）	S	6.3	路床盛土	0.9
掘削（オ）		16.7	路体盛土	0.0
掘削（片）	SGn	0.0	埋め戻し	10.8
掘削（オ）		0.0		
掘削（片）	HGn	0.0		
掘削（オ）		0.0		

法面工					
左			右		
切土法面整形	S	6.1	切土法面整形	S	0.0
切土法面整形	SGn	0.0	切土法面整形	SGn	0.0
切土法面整形	HGn	0.0	切土法面整形	HGn	0.0
盛土法面整形		0.0	盛土法面整形		0.0
切土植生工	S	6.1	切土植生工	S	0.0
モルタル吹付		0.0	モルタル吹付		0.0
吹付法枠		0.0	吹付法枠		0.0
盛土植生工		0.0	盛土植生工		0.0



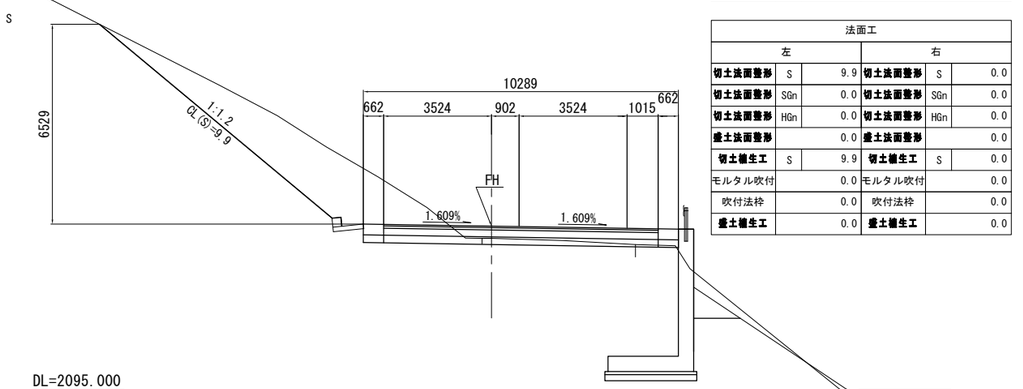
DL=2090.000

NO.1+12.700

GH=2099.99
FH=2100.390

NO.1+12.700				
地盤高	2099.99m		計画高	2100.390m
切土面積			盛土面積	
掘削（片）	S	14.1	路床盛土	0.0
掘削（オ）		23.3	路体盛土	0.0
掘削（片）	SGn	0.0	埋め戻し	16.5
掘削（オ）		0.0		
掘削（片）	HGn	0.0		
掘削（オ）		0.0		

法面工					
左			右		
切土法面整形	S	9.9	切土法面整形	S	0.0
切土法面整形	SGn	0.0	切土法面整形	SGn	0.0
切土法面整形	HGn	0.0	切土法面整形	HGn	0.0
盛土法面整形		0.0	盛土法面整形		0.0
切土植生工	S	9.9	切土植生工	S	0.0
モルタル吹付		0.0	モルタル吹付		0.0
吹付法枠		0.0	吹付法枠		0.0
盛土植生工		0.0	盛土植生工		0.0



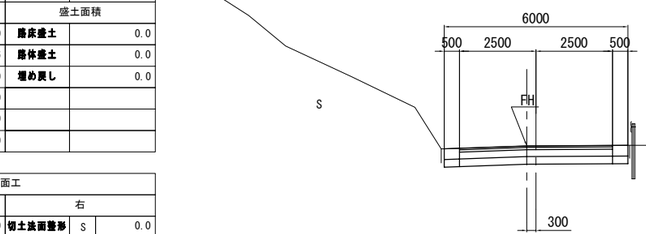
DL=2095.000

NO.0

GH=2100.74
FH=2100.740

NO.0+0.000				
地盤高	2100.74m		計画高	2100.740m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	0.0
掘削（オ）		3.6	路体盛土	0.0
掘削（片）	SGn	0.0	埋め戻し	0.0
掘削（オ）		0.0		
掘削（片）	HGn	0.0		
掘削（オ）		0.0		

法面工					
左			右		
切土法面整形	S	0.0	切土法面整形	S	0.0
切土法面整形	SGn	0.0	切土法面整形	SGn	0.0
切土法面整形	HGn	0.0	切土法面整形	HGn	0.0
盛土法面整形		0.0	盛土法面整形		0.0
切土植生工	S	0.0	切土植生工	S	0.0
モルタル吹付		0.0	モルタル吹付		0.0
吹付法枠		0.0	吹付法枠		0.0
盛土植生工		0.0	盛土植生工		0.0



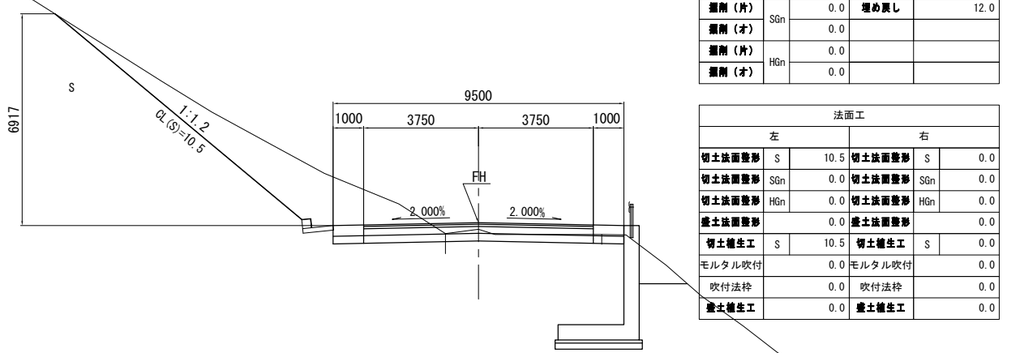
DL=2090.000

KA2-1 (NO.1+5.000)

GH=2100.17
FH=2100.388

KA2-1(NO.1+5.000)				
地盤高	2100.17m		計画高	2100.388m
切土面積			盛土面積	
掘削（片）	S	11.9	路床盛土	0.0
掘削（オ）		19.7	路体盛土	0.0
掘削（片）	SGn	0.0	埋め戻し	12.0
掘削（オ）		0.0		
掘削（片）	HGn	0.0		
掘削（オ）		0.0		

法面工					
左			右		
切土法面整形	S	10.5	切土法面整形	S	0.0
切土法面整形	SGn	0.0	切土法面整形	SGn	0.0
切土法面整形	HGn	0.0	切土法面整形	HGn	0.0
盛土法面整形		0.0	盛土法面整形		0.0
切土植生工	S	10.5	切土植生工	S	0.0
モルタル吹付		0.0	モルタル吹付		0.0
吹付法枠		0.0	吹付法枠		0.0
盛土植生工		0.0	盛土植生工		0.0

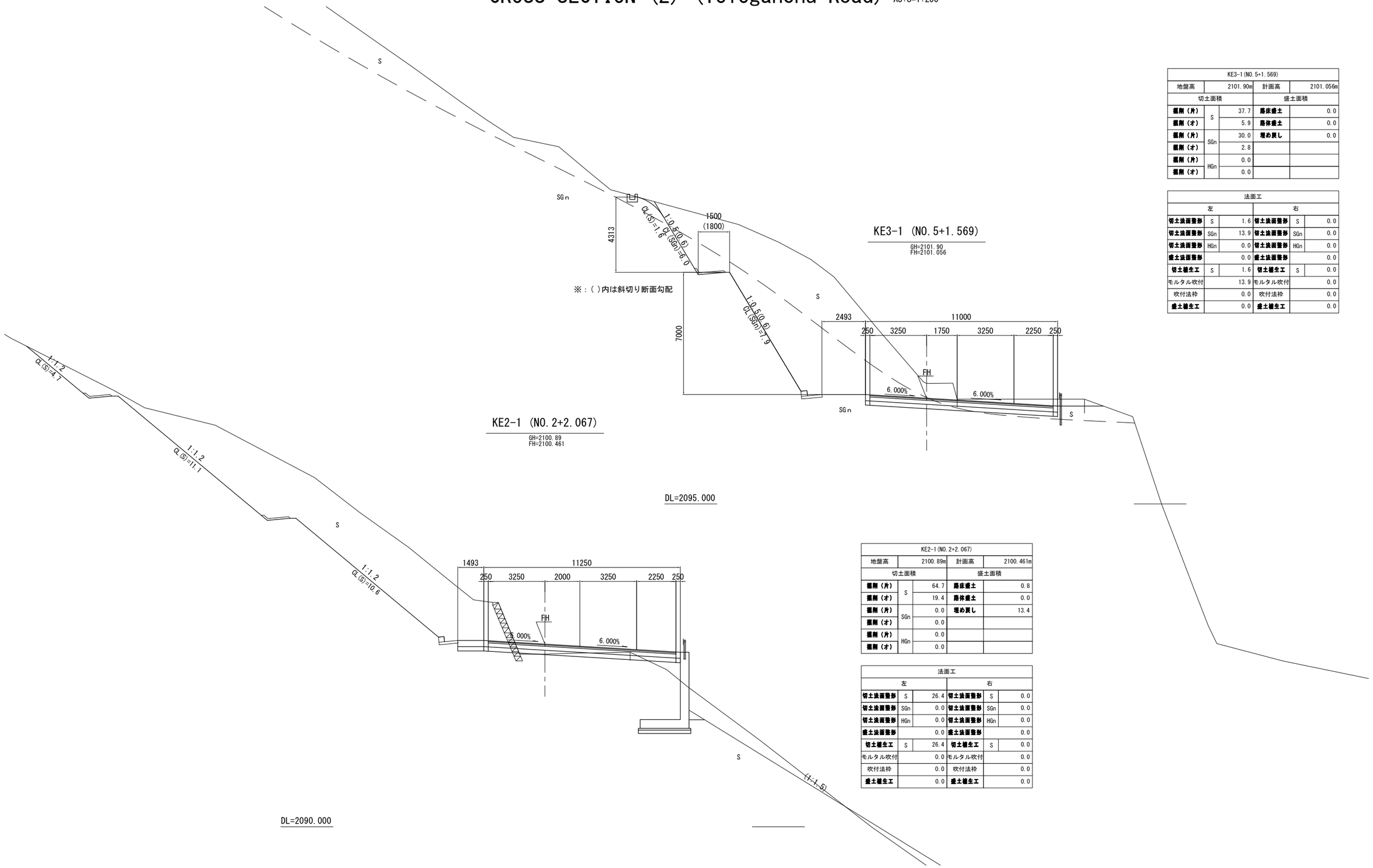


DL=2090.000

Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANT: THE CONSORTIUM OF Oriental Consultants Global Co., Ltd. AND INGEROSEC CORPORATION	PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.4	DRAWING TITLE: CROSS SECTION (1) (Teleganchu Road)	DATE: PREPARED BY: CHECKED BY:	DRAWING No. :

CROSS SECTION (2) (Teleganchu Road)

A1:S=1:100
A3:S=1:200



KE3-1(NO.5+1.569)				
地盤高		2101.90m	計画高	2101.056m
切土面積			盛土面積	
掘削（片）	S	37.7	路床盛土	0.0
掘削（オ）		5.9	路体盛土	0.0
掘削（片）	SGn	30.0	埋め戻し	0.0
掘削（オ）		2.8		
掘削（片）	HGn	0.0		
掘削（オ）		0.0		

法面工					
左			右		
切土法面整形	S	1.6	切土法面整形	S	0.0
切土法面整形	SGn	13.9	切土法面整形	SGn	0.0
切土法面整形	HGn	0.0	切土法面整形	HGn	0.0
盛土法面整形		0.0	盛土法面整形		0.0
切土植生工	S	1.6	切土植生工	S	0.0
モルタル吹付		13.9	モルタル吹付		0.0
吹付法枠		0.0	吹付法枠		0.0
盛土植生工		0.0	盛土植生工		0.0

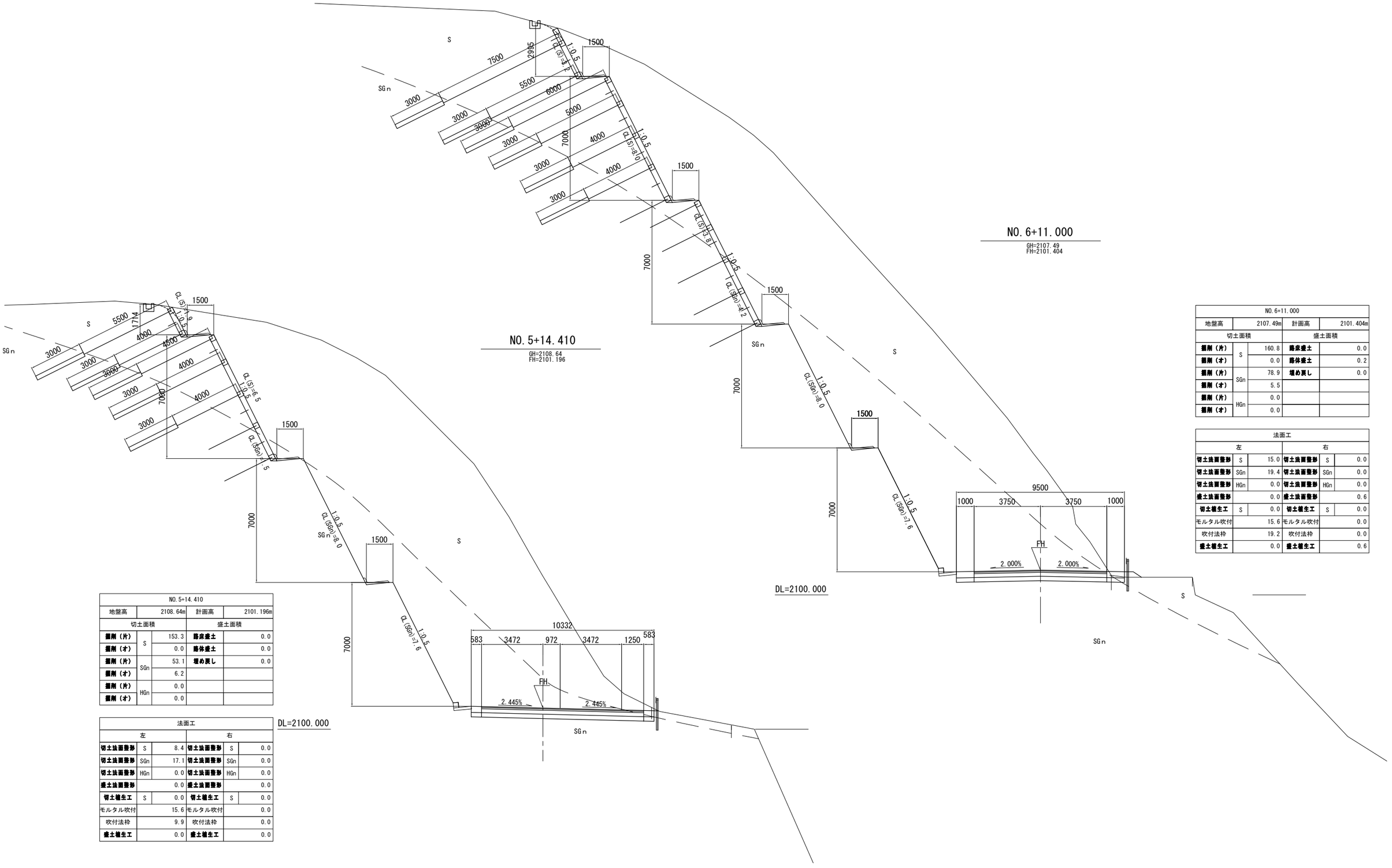
KE2-1(NO.2+2.067)				
地盤高		2100.89m	計画高	2100.461m
切土面積			盛土面積	
掘削（片）	S	64.7	路床盛土	0.8
掘削（オ）		19.4	路体盛土	0.0
掘削（片）	SGn	0.0	埋め戻し	13.4
掘削（オ）		0.0		
掘削（片）	HGn	0.0		
掘削（オ）		0.0		

法面工					
左			右		
切土法面整形	S	26.4	切土法面整形	S	0.0
切土法面整形	SGn	0.0	切土法面整形	SGn	0.0
切土法面整形	HGn	0.0	切土法面整形	HGn	0.0
盛土法面整形		0.0	盛土法面整形		0.0
切土植生工	S	26.4	切土植生工	S	0.0
モルタル吹付		0.0	モルタル吹付		0.0
吹付法枠		0.0	吹付法枠		0.0
盛土植生工		0.0	盛土植生工		0.0

Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANT: THE CONSORTIUM OF Oriental Consultants Global Co., Ltd. AND INGEROSEC CORPORATION	PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.4	DRAWING TITLE: CROSS SECTION (2) (Teleganchu Road)	DATE: PREPARED BY: CHECKED BY:	DRAWING No. :

CROSS SECTION (3) (Teleganchu Road)

A1:S=1:100
A3:S=1:200



NO.6+11.000				
地盤高		2107.49m	計画高	2101.404m
切土面積			盛土面積	
掘削（片）	S	160.8	路床盛土	0.0
掘削（オ）		0.0	路体盛土	0.2
掘削（片）	SGn	78.9	埋め戻し	0.0
掘削（オ）		5.5		
掘削（片）	HGn	0.0		
掘削（オ）		0.0		

法面工				
左			右	
切土法面整形	S	15.0	切土法面整形	S 0.0
切土法面整形	SGn	19.4	切土法面整形	SGn 0.0
切土法面整形	HGn	0.0	切土法面整形	HGn 0.0
盛土法面整形		0.0	盛土法面整形	0.6
切土植生工	S	0.0	切土植生工	S 0.0
モルタル吹付		15.6	モルタル吹付	0.0
吹付法枠		19.2	吹付法枠	0.0
盛土植生工		0.0	盛土植生工	0.6

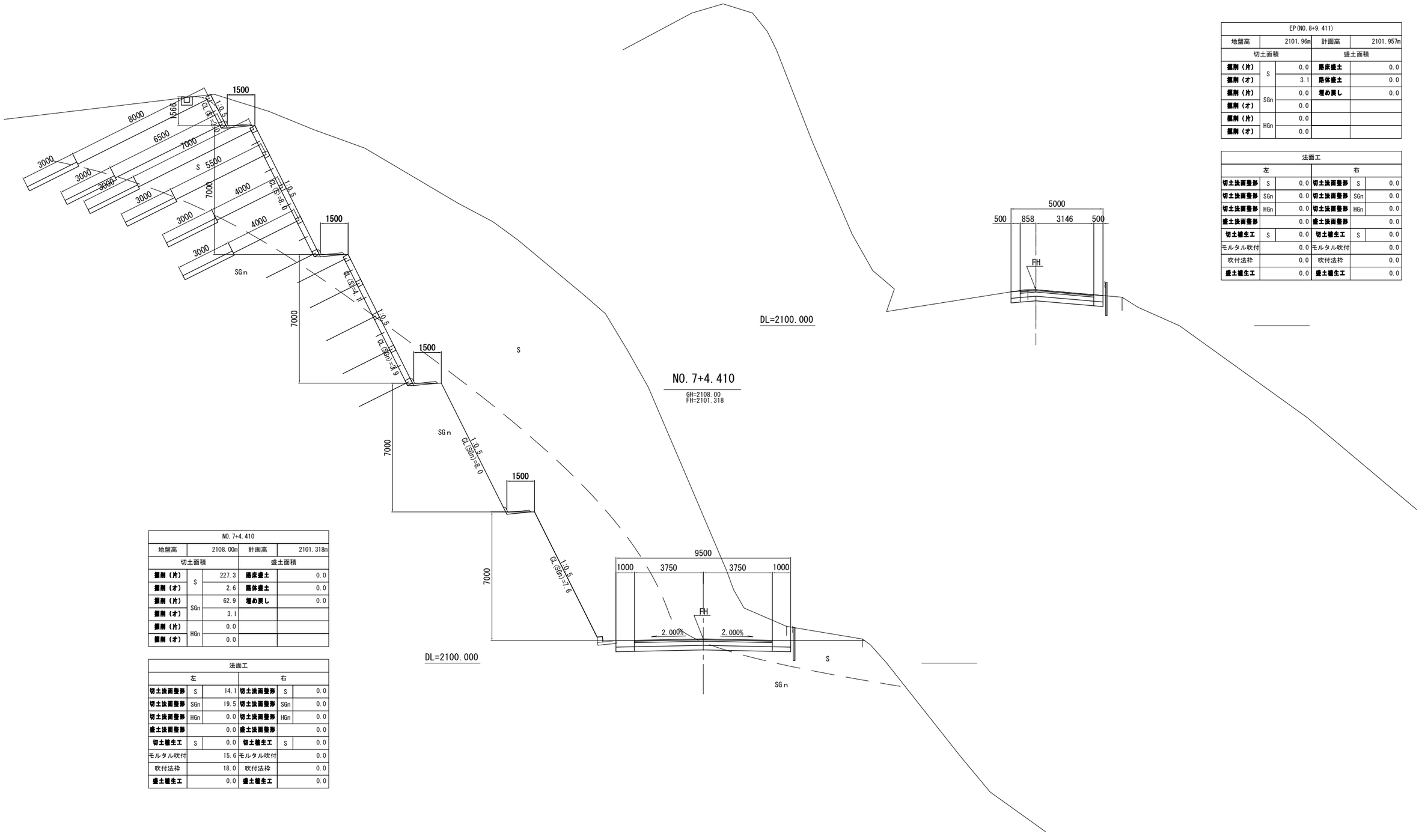
NO.5+14.410				
地盤高		2108.64m	計画高	2101.196m
切土面積			盛土面積	
掘削（片）	S	153.3	路床盛土	0.0
掘削（オ）		0.0	路体盛土	0.0
掘削（片）	SGn	53.1	埋め戻し	0.0
掘削（オ）		6.2		
掘削（片）	HGn	0.0		
掘削（オ）		0.0		

法面工				
左			右	
切土法面整形	S	8.4	切土法面整形	S 0.0
切土法面整形	SGn	17.1	切土法面整形	SGn 0.0
切土法面整形	HGn	0.0	切土法面整形	HGn 0.0
盛土法面整形		0.0	盛土法面整形	0.0
切土植生工	S	0.0	切土植生工	S 0.0
モルタル吹付		15.6	モルタル吹付	0.0
吹付法枠		9.9	吹付法枠	0.0
盛土植生工		0.0	盛土植生工	0.0

Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANT: THE CONSORTIUM OF Oriental Consultants Global Co., Ltd. AND INGEROSEC CORPORATION	PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.4	DRAWING TITLE: CROSS SECTION (3) (Teleganchu Road)	DATE: PREPARED BY: CHECKED BY:	DRAWING No. :

CROSS SECTION (4) (Teleganchu Road)

A1:S=1:100
A3:S=1:200



EP(NO.8+9.411)				
地盤高		2101.96m	計画高	2101.957m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	0.0
掘削（オ）		3.1	路体盛土	0.0
掘削（片）	SGn	0.0	埋め戻し	0.0
掘削（オ）		0.0		
掘削（片）	HGn	0.0		
掘削（オ）		0.0		

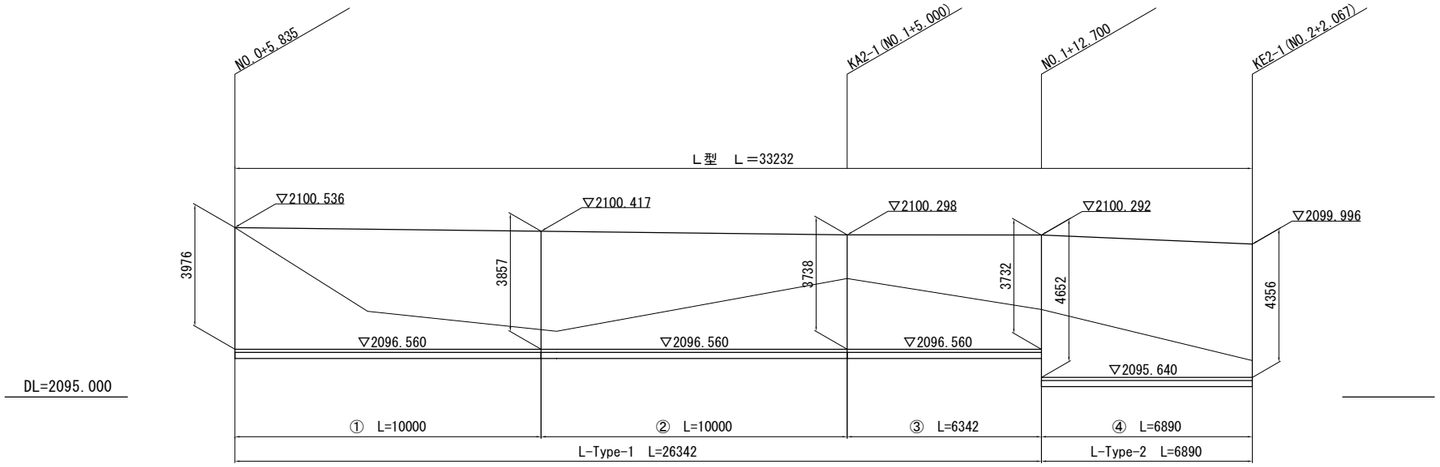
法面工					
左			右		
切土法面整形	S	0.0	切土法面整形	S	0.0
切土法面整形	SGn	0.0	切土法面整形	SGn	0.0
切土法面整形	HGn	0.0	切土法面整形	HGn	0.0
盛土法面整形		0.0	盛土法面整形		0.0
切土植生工	S	0.0	切土植生工	S	0.0
モルタル吹付		0.0	モルタル吹付		0.0
吹付法枠		0.0	吹付法枠		0.0
盛土植生工		0.0	盛土植生工		0.0

NO.7+4.410				
地盤高		2108.00m	計画高	2101.318m
切土面積			盛土面積	
掘削（片）	S	227.3	路床盛土	0.0
掘削（オ）		2.6	路体盛土	0.0
掘削（片）	SGn	62.9	埋め戻し	0.0
掘削（オ）		3.1		
掘削（片）	HGn	0.0		
掘削（オ）		0.0		

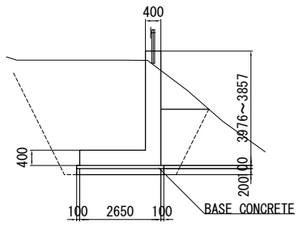
法面工					
左			右		
切土法面整形	S	14.1	切土法面整形	S	0.0
切土法面整形	SGn	19.5	切土法面整形	SGn	0.0
切土法面整形	HGn	0.0	切土法面整形	HGn	0.0
盛土法面整形		0.0	盛土法面整形		0.0
切土植生工	S	0.0	切土植生工	S	0.0
モルタル吹付		15.6	モルタル吹付		0.0
吹付法枠		18.0	吹付法枠		0.0
盛土植生工		0.0	盛土植生工		0.0

Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANT: THE CONSORTIUM OF Oriental Consultants Global Co., Ltd. AND INGEROSEC CORPORATION	PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.4	DRAWING TITLE: CROSS SECTION (4) (Teleganchu Road)	DATE: PREPARED BY: CHECKED BY:	DRAWING No. :

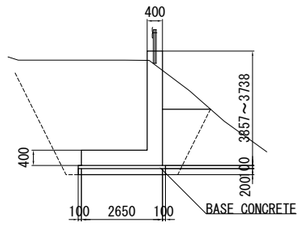
RETAINING WALL GENERAL DRAWING　S＝1／100



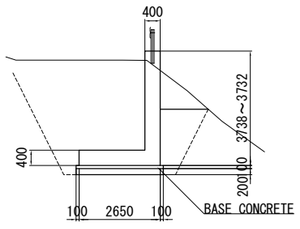
Type-1 ①



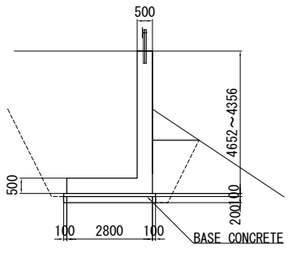
Type-1 ②



Type-1 ③



Type-2

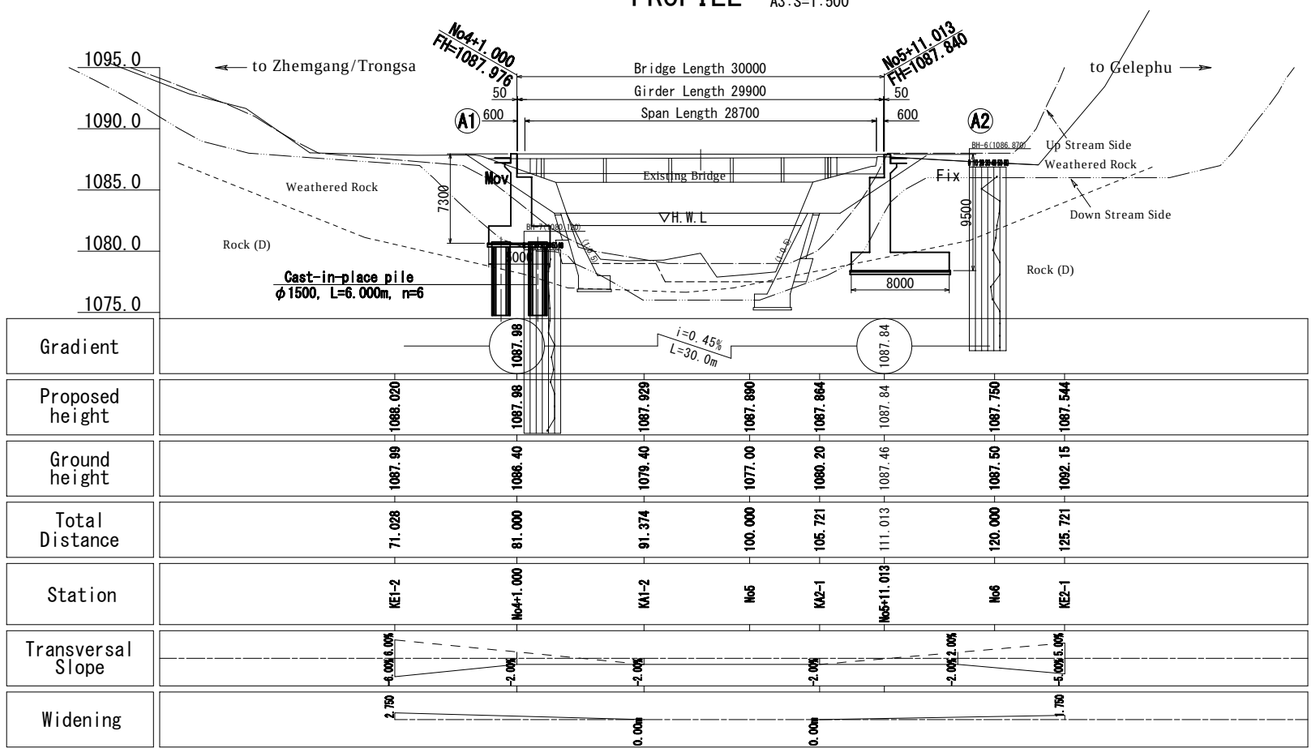


Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANTS: THE CONSORTIUM OF Oriental Consultants Global Co., Ltd. AND INGEROSEC CORPORATION	PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.4	DRAWING TITLE: RETAINING WALL GENERAL DRAWING (TELEGANCHU ROAD)	DATE: PREPARED BY: CHECKED BY:

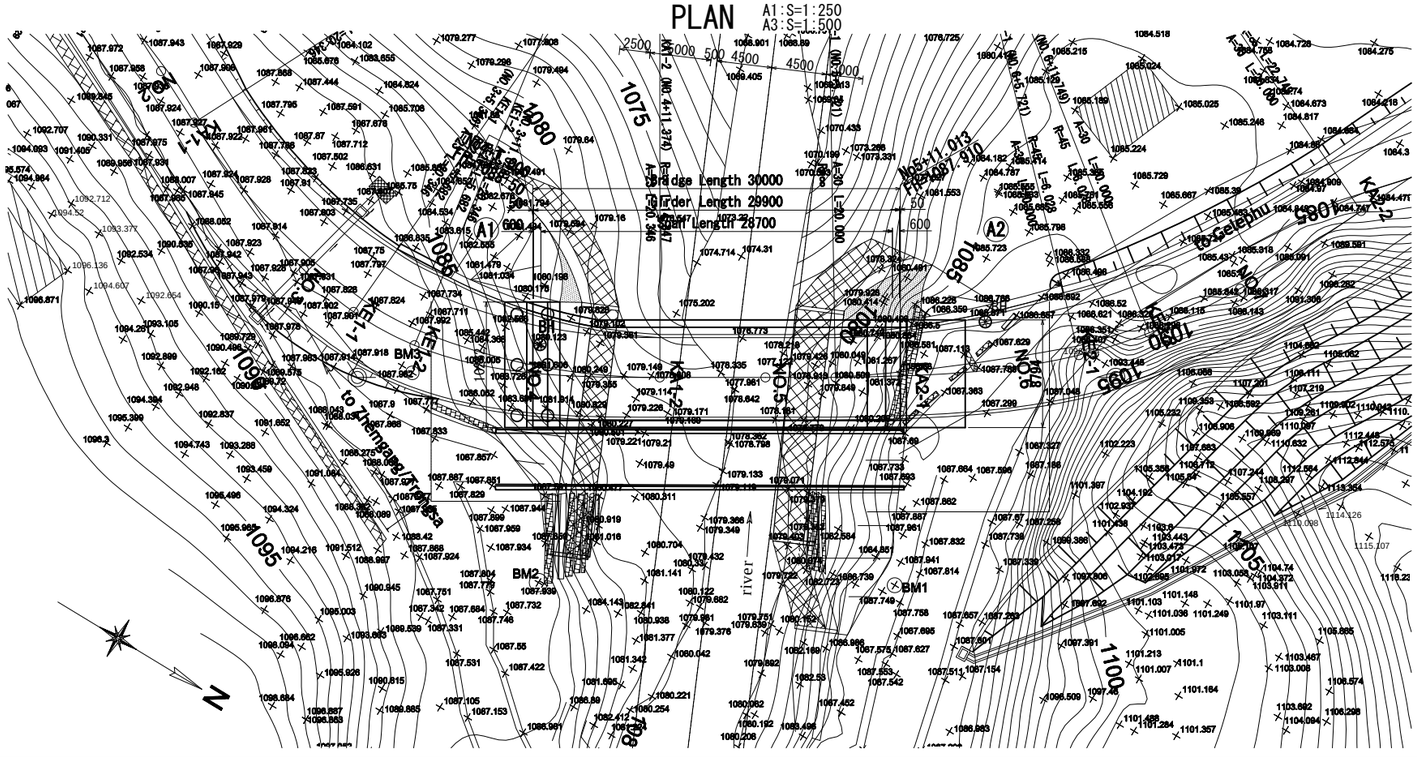
(2) Beteni Bridge

GENERAL DRAWING(Beteni Bridge)

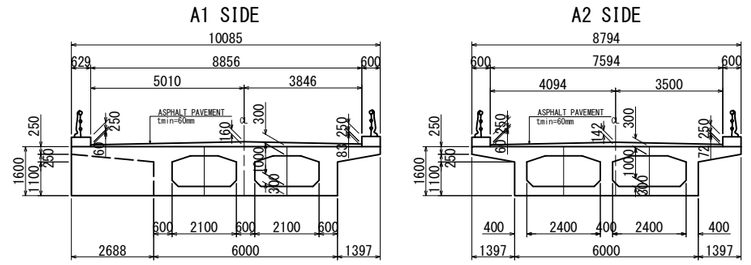
PROFILE A1:S=1:250 A3:S=1:500



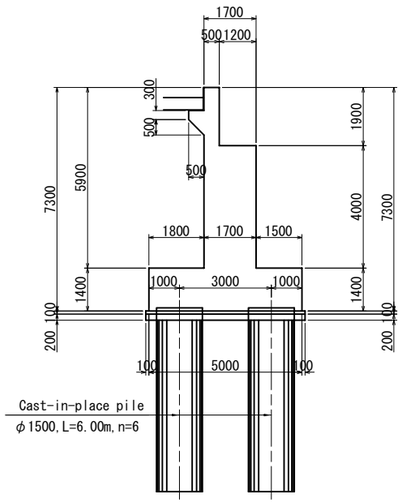
PLAN A1:S=1:250 A3:S=1:500



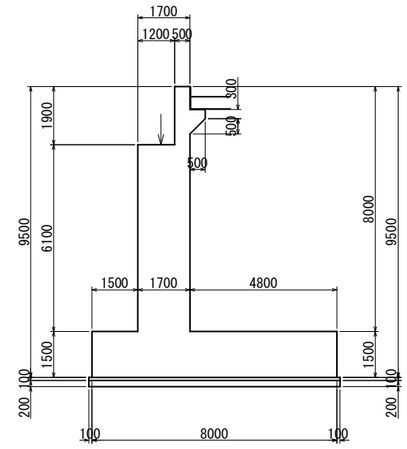
CROSS SECTION A1:S=1:100 A3:S=1:200



A1 ABUTMENT A1:S=1:100 A3:S=1:200



A2 ABUTMENT A1:S=1:100 A3:S=1:200



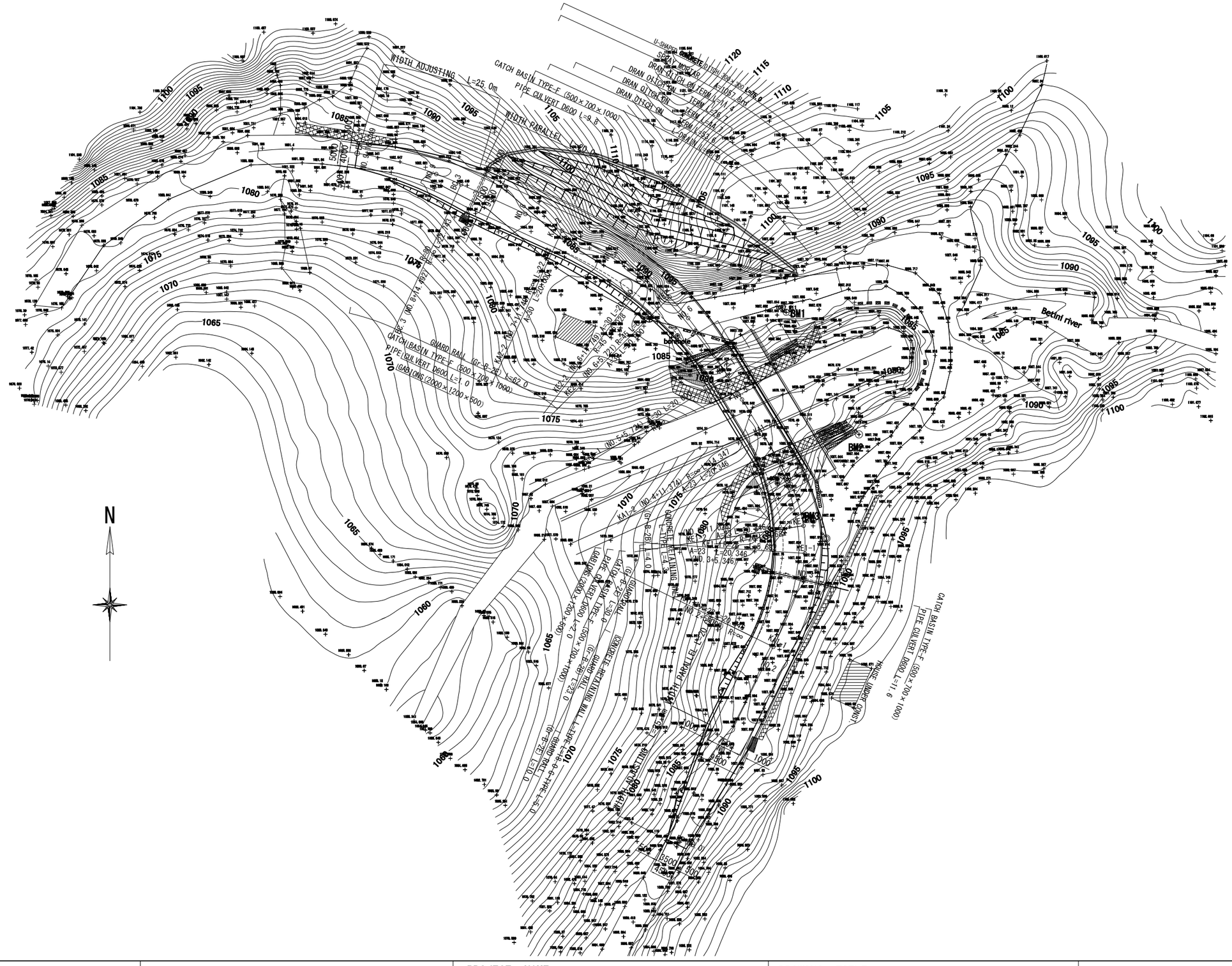
Design condition

Bridge Length			30.000m
Span Length			28.700m
Road Width			10.085m～8.794m
Live Load			Single lane IRC 70R(wheeled) or Double lane IRC Class A
Design Seismic Scale			KH=0.22 KV=0.00
Super structure	Form		PC Box-Shape Girder
	Material strength	Concrete	σck=30 N/mm^2
		ReinforcigBar	SD345 Equivalent
		Tendon	12S12.7mm
Sub structure	Form	Structure	A1:Inverted T-Type Abutment A2:Inverted T-Type Abutment
		Foundation	A1:Cast in place Pile A2:Spread Foundation
	Material strength	Concrete	σck=21 N/mm^2
		ReinforcigBar	SD345 Equivalent

Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANTS: THE CONSORTIUM OF Oriental Consultants Global Co., Ltd. AND INGEROSEC CORPORATION	PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.4	DRAWING TITLE: GENERAL DRAWING (Beteni Bridge)	DATE: PREPARED BY: CHECKED BY:	DRAWING No. :

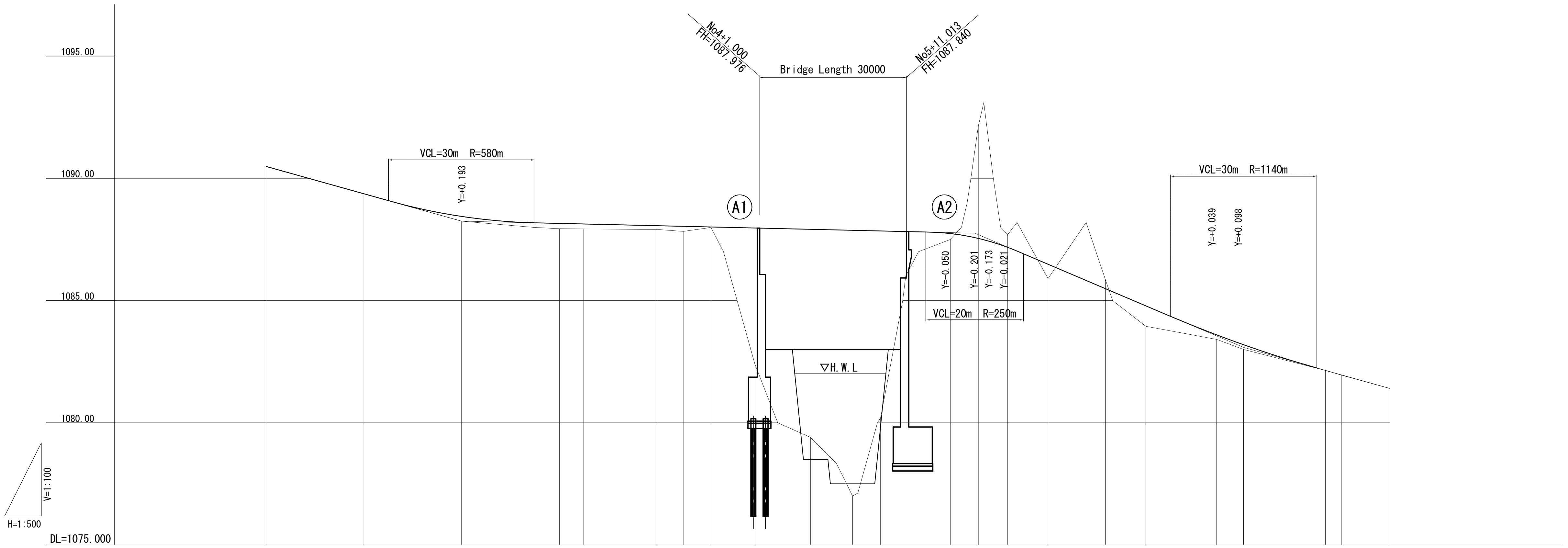
PLAN (Beteni Road)

A1:S=1:400
A3:S=1:800



Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANT: THE CONSORTIUM OF Oriental Consultants Global Co., Ltd. AND INGEROSEC CORPORATION	PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.4	DRAWING TITLE: PLAN (Beteni Road)	DATE: PREPARED BY: CHECKED BY:	DRAWING No. :

PROFILE (Beteni Bridge)



STATION	-20.000	BP (NO.0)	NO.1	NO.2	KA1-1	NO.3	KE1-1	KE1-2	NO.4	+1.000 (A1)	KA1-2	NO.5	KA2-1	+11.013 (A2)	NO.6	+5.000	KE2-1	KE2-2	NO.7	KA2-2	NO.8	BC.3	NO.9	EP (+16.749)	NO.10	+10.000
PROPOSED HEIGHT	1090.490		1088.443	1088.160	1088.138	1088.070	1088.046	1088.020	1087.980	1087.976	1087.929	1087.890	1087.864	1087.840	1087.750	1087.577	1087.544	1087.185	1086.507	1085.512	1084.813	1083.625	1083.217	1082.140	1081.950	
GROUND HEIGHT	1090.49	1089.37	1088.25	1087.94	1087.93	1087.91	1087.83	1087.99	1082.40		1079.40	1077.00	1080.20		1087.50		1092.15	1087.70	1085.90	1085.85	1083.95	1083.41	1083.00	1082.14	1081.95	1081.40
CUTTING																	4.606	0.515		0.068						
FILLING			0.193	0.220	0.208	0.160	0.216	0.030	5.580		8.529	10.890	7.664		0.250				0.607		0.863	0.215	0.217	0.000	0.000	
TOTAL DISTANCE	-20.000	0.000	20.000	40.000	45.000	60.000	65.346	71.028	80.000		91.374	100.000	105.721		120.000	125.000	125.721	131.749	140.000	151.749	160.000	174.492	180.000	196.749	200.000	210.000
SINGLE DISTANCE	0.000	20.000	5.000	20.000	5.000	15.000	0.346	5.682	8.972		11.374	8.626	5.721		14.279	5.000	0.721	6.028	8.251	11.749	8.251	14.492	5.508	16.749	3.251	10.000

GRAVDIENT: 1090.490 — i=5.600% L=20.000m — 1088.250 — i=0.450% L=105.000m — 1087.778 — i=8.470% L=55.000m — 1083.119 — i=5.845% L=20.000m — 1081.950

CURVE BAND: R=∞ L=45.000 — A=23.000 L=20.346 — R=26.000 L=5.682 — A=23.000 L=20.346 — R=∞ L=14.347 — A=30.000 L=20.000 — R=45.000 L=6.028 — A=30.000 L=20.000 — R=∞ L=22.743 — R=80.000

SUPER-ELEVATION: -2.000% — -2.000% — 2.000% / -2.000% — 6.000% / -6.000% — 6.000% / -6.000% — 2.000% / -2.000% — -2.000% — -2.000% — 2.000% / -2.000% — 5.000% / -5.000% — 5.000% / -5.000% — 2.000% / -2.000% — -2.000% — -2.000% — 2.000% / -2.000% — 3.000% / -3.000%

WIDENING: 0.000 — 0.000 / 0.000 — 2.750 / 0.000 — 2.750 / 0.000 — 0.000 — 0.000 — 1.750 / 0.000 — 1.750 / 0.000 — 0.000 — 0.000

Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANTS: THE CONSORTIUM OF Oriental Consultants Global Co., Ltd. AND INGEROSEC CORPORATION	PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGE ON PRIMARY NATIONAL HIGHWAY No.4	DRAWING TITLE: PROFILE DRAWING (Beteni Bridge)	DATE: PREPARED BY: CHECKED BY:	DRAWING No. :

CROSS SECTION (1) (Beteni Road)

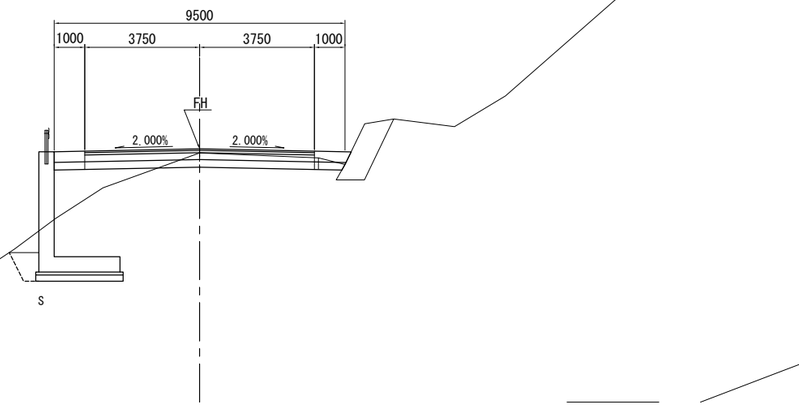
A1:S=1:100
A3:S=1:200

NO.1+7.000

GH=1088.14
FH=1088.273

NO.1+7.000				
地盤高	1088.14m		計画高	1088.273m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	2.3
掘削（オ）		13.7	路体盛土	0.0
掘削（片）	SGn	0.0	埋め戻し	9.1
掘削（オ）		0.0		
掘削（片）	HGn	0.0		
掘削（オ）		0.0		

法面工				
左			右	
切土法面整形	S	0.0	切土法面整形	S 0.0
切土法面整形	SGn	0.0	切土法面整形	SGn 0.0
切土法面整形	HGn	0.0	切土法面整形	HGn 0.0
盛土法面整形		0.0	盛土法面整形	0.0
切土植生工	S	0.0	切土植生工	S 0.0
モルタル吹付		0.0	モルタル吹付	0.0
吹付法枠		0.0	吹付法枠	0.0
盛土植生工		0.0	盛土植生工	0.0

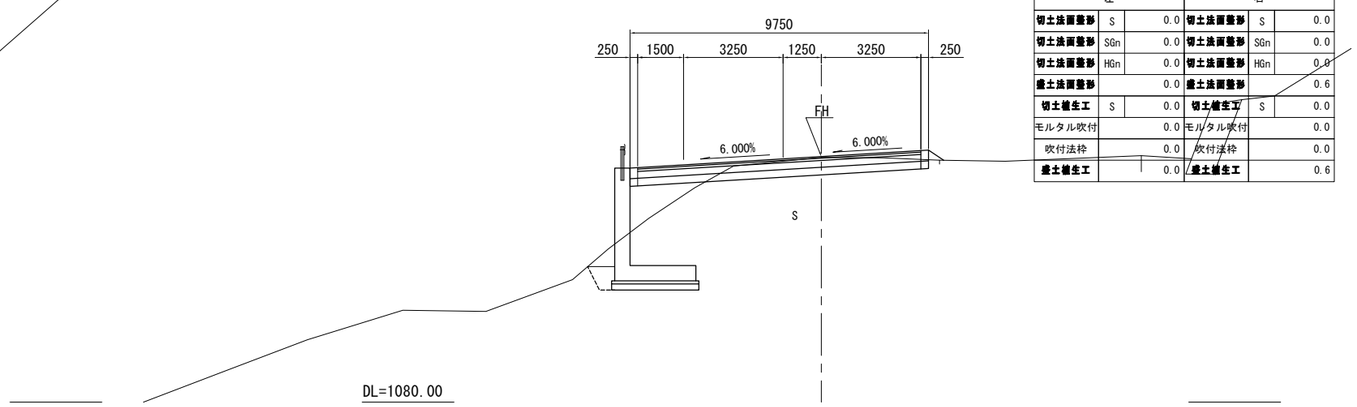


KE1-2(NO.3+11.028)

GH=1087.93
FH=1088.020

KE1-2(NO.3+11.028)				
地盤高	1087.93m		計画高	1088.020m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	1.8
掘削（オ）		14.4	路体盛土	0.1
掘削（片）	SGn	0.0	埋め戻し	8.9
掘削（オ）		0.0		
掘削（片）	HGn	0.0		
掘削（オ）		0.0		

法面工				
左			右	
切土法面整形	S	0.0	切土法面整形	S 0.0
切土法面整形	SGn	0.0	切土法面整形	SGn 0.0
切土法面整形	HGn	0.0	切土法面整形	HGn 0.0
盛土法面整形		0.0	盛土法面整形	0.6
切土植生工	S	0.0	切土植生工	S 0.0
モルタル吹付		0.0	モルタル吹付	0.0
吹付法枠		0.0	吹付法枠	0.0
盛土植生工		0.0	盛土植生工	0.6

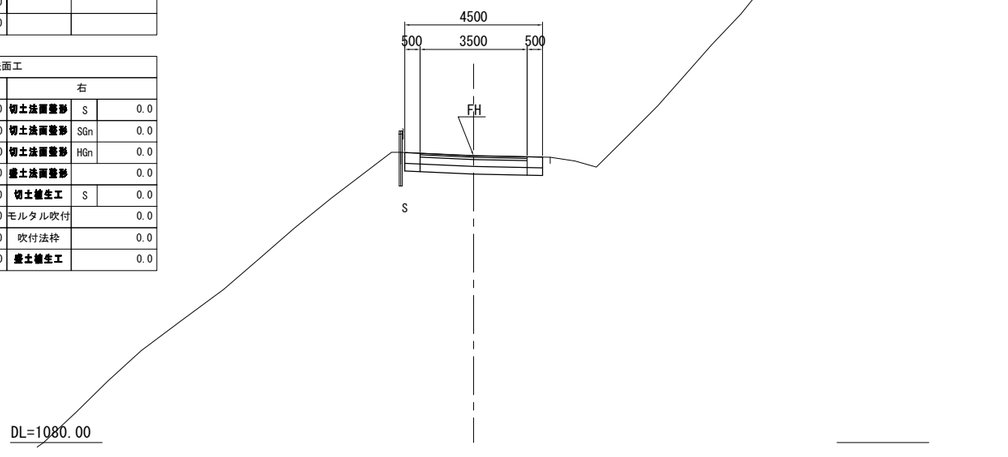


NO.0

GH=1089.37
FH=1089.370

NO.0+0.000				
地盤高	1089.37m		計画高	1089.370m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	0.0
掘削（オ）		2.7	路体盛土	0.0
掘削（片）	SGn	0.0	埋め戻し	0.0
掘削（オ）		0.0		
掘削（片）	HGn	0.0		
掘削（オ）		0.0		

法面工				
左			右	
切土法面整形	S	0.0	切土法面整形	S 0.0
切土法面整形	SGn	0.0	切土法面整形	SGn 0.0
切土法面整形	HGn	0.0	切土法面整形	HGn 0.0
盛土法面整形		0.0	盛土法面整形	0.0
切土植生工	S	0.0	切土植生工	S 0.0
モルタル吹付		0.0	モルタル吹付	0.0
吹付法枠		0.0	吹付法枠	0.0
盛土植生工		0.0	盛土植生工	0.0

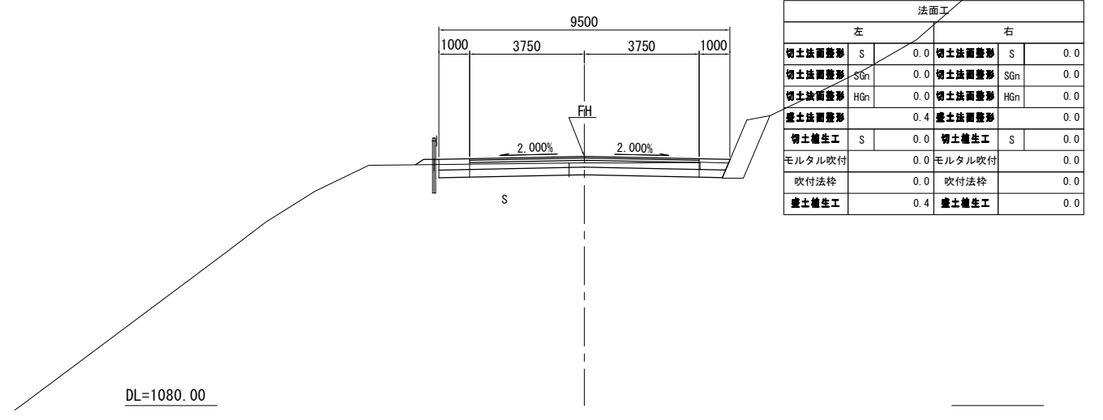


KA1-1 (NO.2+5.000)

GH=1087.93
FH=1088.138

NO.2+5.000				
地盤高	1087.93m		計画高	1088.138m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	0.0
掘削（オ）		4.0	路体盛土	0.1
掘削（片）	SGn	0.0	埋め戻し	0.0
掘削（オ）		0.0		
掘削（片）	HGn	0.0		
掘削（オ）		0.0		

法面工				
左			右	
切土法面整形	S	0.0	切土法面整形	S 0.0
切土法面整形	SGn	0.0	切土法面整形	SGn 0.0
切土法面整形	HGn	0.0	切土法面整形	HGn 0.0
盛土法面整形		0.4	盛土法面整形	0.0
切土植生工	S	0.0	切土植生工	S 0.0
モルタル吹付		0.0	モルタル吹付	0.0
吹付法枠		0.0	吹付法枠	0.0
盛土植生工		0.4	盛土植生工	0.0



Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANT: THE CONSORTIUM OF Oriental Consultants Global Co., Ltd. AND INGEROSEC CORPORATION	PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.4	DRAWING TITLE: CROSS SECTION (1) (Beteni Road)	DATE: PREPARED BY: CHECKED BY:	DRAWING No. :

CROSS SECTION (2) (Beteni Road)

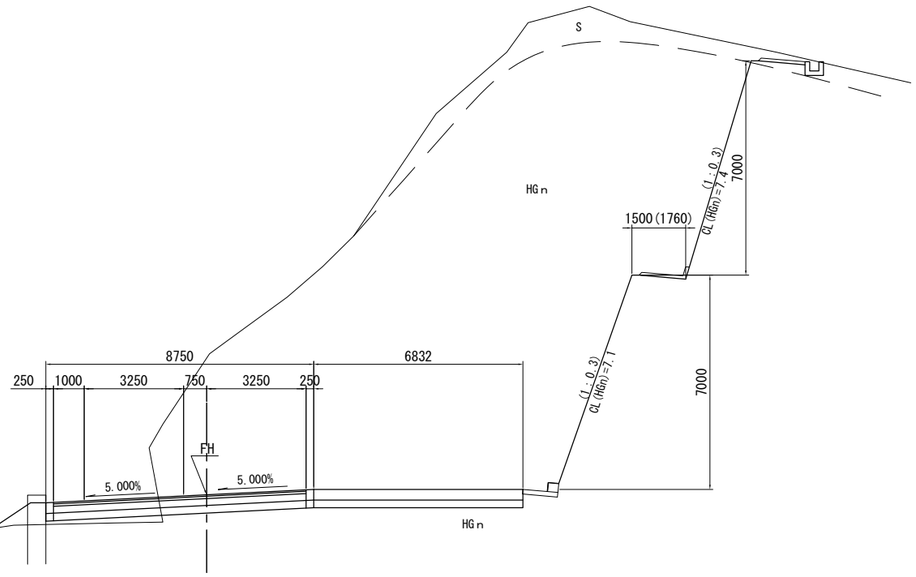
A1:S=1:100
A3:S=1:200

KE2-1(NO.6+5.721)

GH=1092.15
FH=1087.544

KE2-1(NO.6+5.721)				
地盤高		1092.15m	計画高	1087.544m
切土面積			盛土面積	
掘削（片）	S	9.9	路床盛土	0.6
掘削（オ）		0.0	路体盛土	0.8
掘削（片）	SGn	0.0	埋め戻し	0.0
掘削（オ）		0.0		
掘削（片）	HGn	162.9		
掘削（オ）		7.1		

法面工					
左			右		
切土法面整形	S	0.0	切土法面整形	S	0.0
切土法面整形	SGn	0.0	切土法面整形	SGn	0.0
切土法面整形	HGn	0.0	切土法面整形	HGn	14.5
盛土法面整形		1.5	盛土法面整形		0.0
切土植生工	S	0.0	切土植生工	S	0.0
モルタル吹付		0.0	モルタル吹付		14.5
吹付法枠		0.0	吹付法枠		0.0
盛土植生工		1.5	盛土植生工		0.0

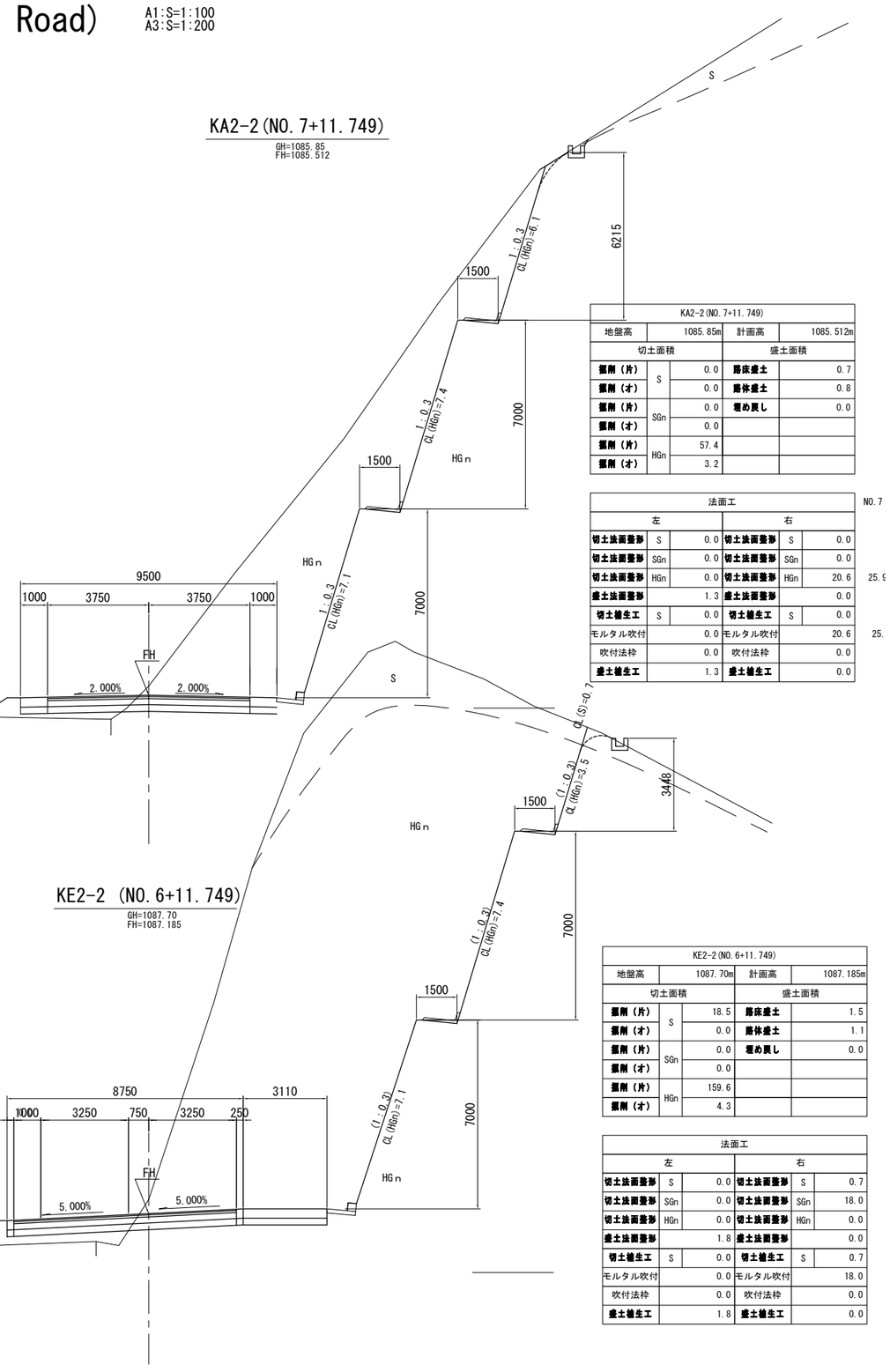


KA2-2(NO.7+11.749)

GH=1085.85
FH=1085.512

KA2-2(NO.7+11.749)				
地盤高		1085.85m	計画高	1085.512m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	0.7
掘削（オ）		0.0	路体盛土	0.8
掘削（片）	SGn	0.0	埋め戻し	0.0
掘削（オ）		0.0		
掘削（片）	HGn	57.4		
掘削（オ）		3.2		

法面工					NO.7
左			右		
切土法面整形	S	0.0	切土法面整形	S	0.0
切土法面整形	SGn	0.0	切土法面整形	SGn	0.0
切土法面整形	HGn	0.0	切土法面整形	HGn	20.6
盛土法面整形		1.3	盛土法面整形		0.0
切土植生工	S	0.0	切土植生工	S	0.0
モルタル吹付		0.0	モルタル吹付		20.6
吹付法枠		0.0	吹付法枠		0.0
盛土植生工		1.3	盛土植生工		0.0



DL=1085.00

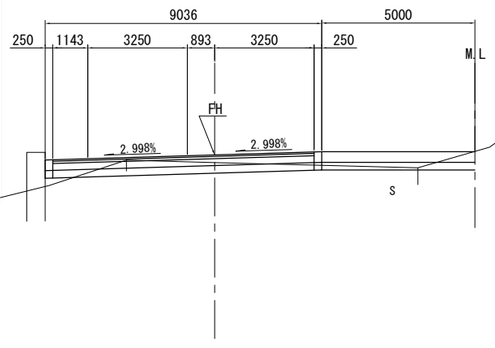
DL=1080.00

NO.6

GH=1087.50
FH=1087.750

NO.6+0.000				
地盤高		1087.50m	計画高	1087.750m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	0.1
掘削（オ）		3.6	路体盛土	0.0
掘削（片）	SGn	0.0	埋め戻し	0.0
掘削（オ）		0.0		
掘削（片）	HGn	0.0		
掘削（オ）		0.0		

法面工					
左			右		
切土法面整形	S	0.0	切土法面整形	S	0.0
切土法面整形	SGn	0.0	切土法面整形	SGn	0.0
切土法面整形	HGn	0.0	切土法面整形	HGn	0.0
盛土法面整形		0.0	盛土法面整形		0.0
切土植生工	S	0.0	切土植生工	S	0.0
モルタル吹付		0.0	モルタル吹付		0.0
吹付法枠		0.0	吹付法枠		0.0
盛土植生工		0.0	盛土植生工		0.0



DL=1085.00

KE2-2 (NO.6+11.749)

GH=1087.70
FH=1087.185

KE2-2(NO.6+11.749)				
地盤高		1087.70m	計画高	1087.185m
切土面積			盛土面積	
掘削（片）	S	18.5	路床盛土	1.5
掘削（オ）		0.0	路体盛土	1.1
掘削（片）	SGn	0.0	埋め戻し	0.0
掘削（オ）		0.0		
掘削（片）	HGn	159.6		
掘削（オ）		4.3		

法面工				
左			右	
切土法面整形	S	0.0	切土法面整形	S 0.7
切土法面整形	SGn	0.0	切土法面整形	SGn 18.0
切土法面整形	HGn	0.0	切土法面整形	HGn 0.0
盛土法面整形		1.8	盛土法面整形	0.0
切土植生工	S	0.0	切土植生工	S 0.7
モルタル吹付		0.0	モルタル吹付	18.0
吹付法枠		0.0	吹付法枠	0.0
盛土植生工		1.8	盛土植生工	0.0

Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANT: THE CONSORTIUM OF Oriental Consultants Global Co., Ltd. AND INGEROSEC CORPORATION	PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.4	DRAWING TITLE: CROSS SECTION (2) (Beteni Road)	DATE: PREPARED BY: CHECKED BY:	DRAWING No. :

CROSS SECTION (3) (Beteni Road)

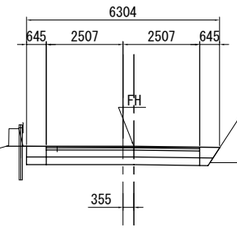
A1:S=1:100
A3:S=1:200

NO.9+9.500

GH=1082.54
FH=1082.577

NO.9+9.500				
地盤高		1082.54m	計画高	1082.577m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	0.0
掘削（オ）		3.6	路体盛土	0.0
掘削（片）	SGn	0.0	埋め戻し	0.0
掘削（オ）		0.0		
掘削（片）	HGn	0.0		
掘削（オ）		0.0		

法面工					
左			右		
切土法面整形	S	0.0	切土法面整形	S	0.0
切土法面整形	SGn	0.0	切土法面整形	SGn	0.0
切土法面整形	HGn	0.0	切土法面整形	HGn	0.0
盛土法面整形		0.0	盛土法面整形		0.0
切土植生工	S	0.0	切土植生工	S	0.0
モルタル吹付		0.0	モルタル吹付		0.0
吹付法枠		0.0	吹付法枠		0.0
盛土植生工		0.0	盛土植生工		0.0



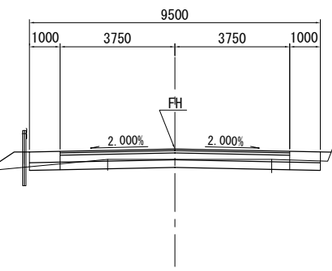
DL=1080.00

NO.8+11.749

GH=1083.50
FH=1083.838

NO.8+11.749				
地盤高		1083.50m	計画高	1083.838m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	0.0
掘削（オ）		2.6	路体盛土	0.5
掘削（片）	SGn	0.0	埋め戻し	0.0
掘削（オ）		0.0		
掘削（片）	HGn	0.0		
掘削（オ）		0.0		

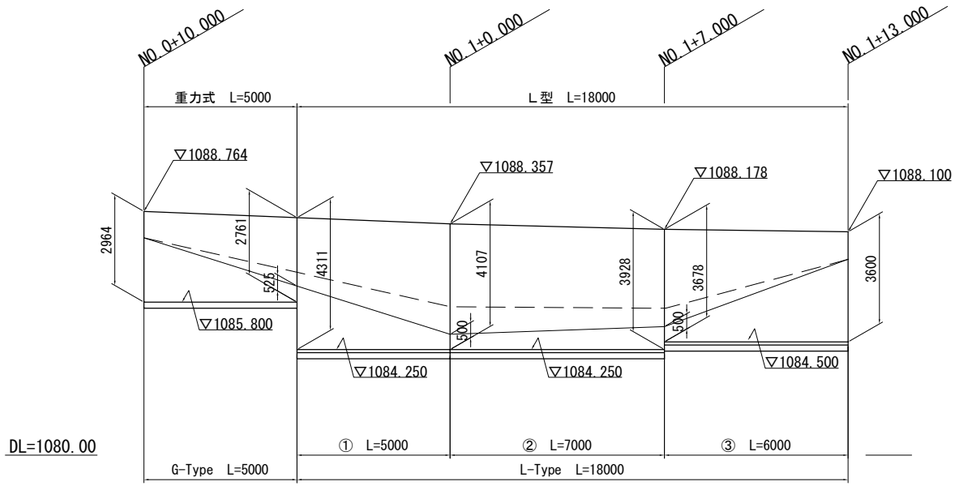
法面工					
左			右		
切土法面整形	S	0.0	切土法面整形	S	0.0
切土法面整形	SGn	0.0	切土法面整形	SGn	0.0
切土法面整形	HGn	0.0	切土法面整形	HGn	0.0
盛土法面整形		1.1	盛土法面整形		0.0
切土植生工	S	0.0	切土植生工	S	0.0
モルタル吹付		0.0	モルタル吹付		0.0
吹付法枠		0.0	吹付法枠		0.0
盛土植生工		1.1	盛土植生工		0.0

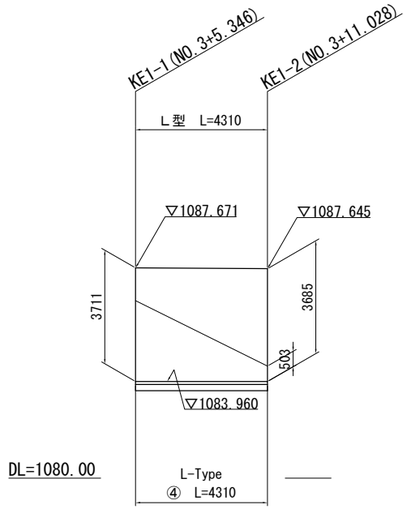


DL=1080.00

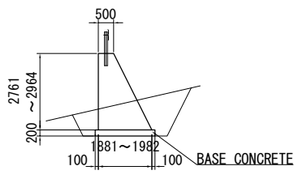
Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANT: THE CONSORTIUM OF Oriental Consultants Global Co., Ltd. AND INGEROSEC CORPORATION	PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.4	DRAWING TITLE: CROSS SECTION (3) (Beteni Road)	DATE: PREPARED BY: CHECKED BY:	DRAWING No. :

RETAINING WALL GENERAL DRAWING S=1:100

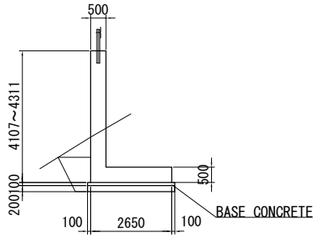




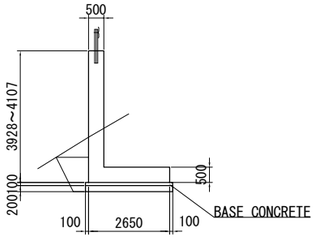
G-Type



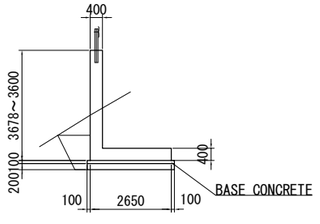
L-Type ①



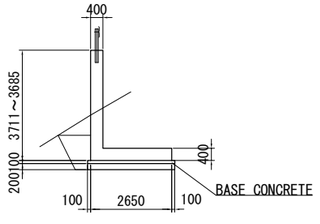
L-Type ②



L-Type ③



L-Type ④



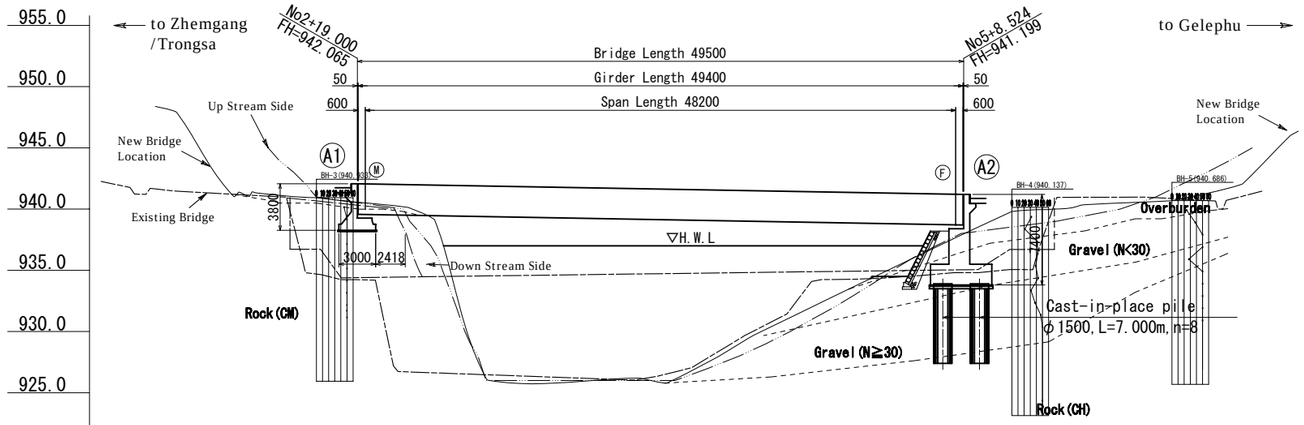
Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	THE CONSORTIUM OF Oriental Consultants Global Co., Ltd. AND INGEROSEC CORPORATION	PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.4	DRAWING TITLE: RETAINING WALL GENERAL DRAWING (BETENI ROAD)	DATE: PREPARED BY: CHECKED BY:

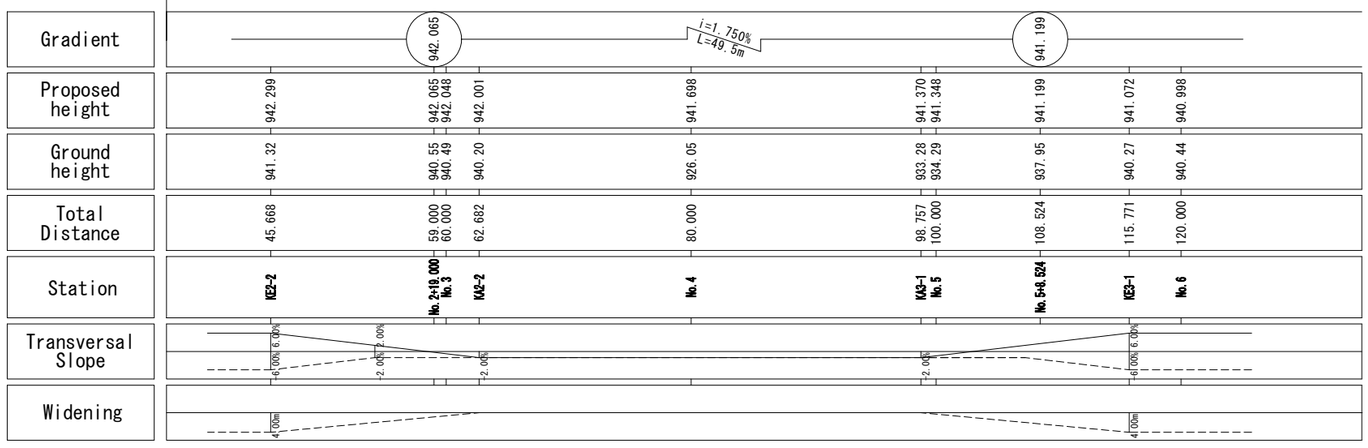
DRAWING No. :

(3) Samkhara Bridge

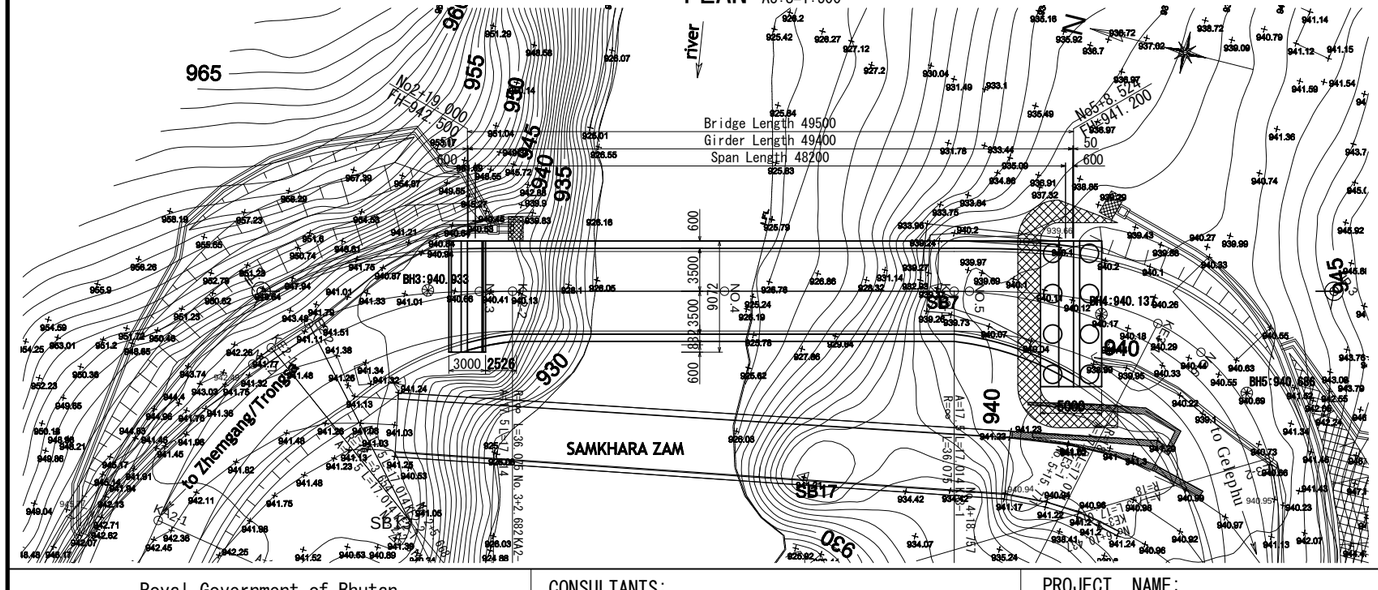
GENERAL DRAWING(Samkhara Bridge)

PROFILE A1:S=1:250 A3:S=1:500



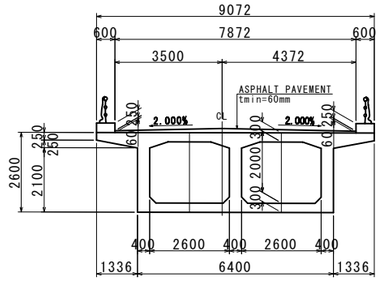


PLAN A1:S=1:250 A3:S=1:500

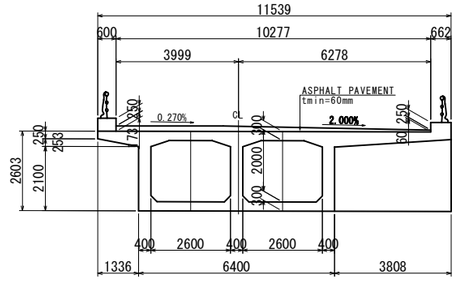


CROSS SECTION A1:S=1:100 A3:S=1:200

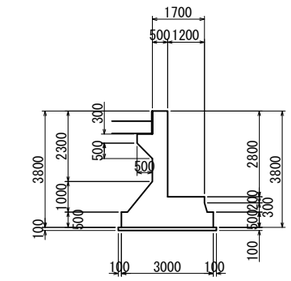
A1 SIDE



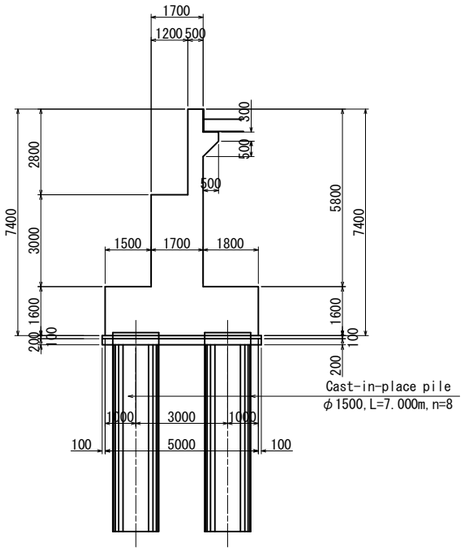
A2 SIDE



A1 ABUTMENT A1:S=1:100 A3:S=1:200



A2 ABUTMENT A1:S=1:100 A3:S=1:200



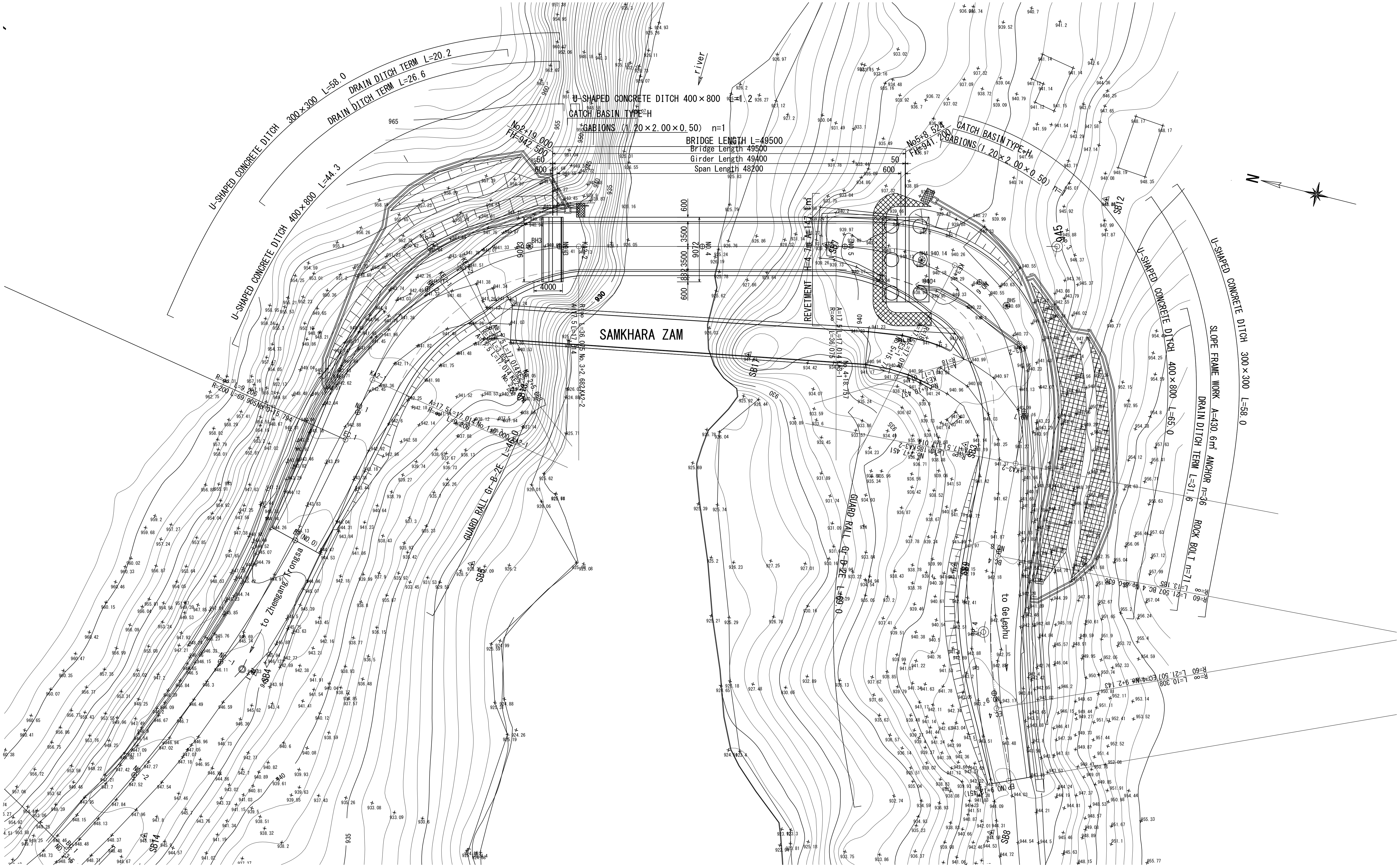
Design condition

Bridge Length			49.500m
Span Length			48.200m
Road Width			9.072m～11.539m
Live Load			Single lane IRC 70R(wheeled) or Double lane IRC Class A
Design Seismic Scale			KH=0.22 KV=0.00
Super structure	Form		PC Box-Shape Girder
	Material strength	Concrete	σck=30 N/mm^2
		ReinforcigBar	SD345 Equivalent
		Tendon	12S12.7mm
Sub structure	Form	Structure	A1:Gravity-Type Abutment A2:Inverted T-Type Abutment
		Foundation	A1:Spread Foundation A2:Cast in place Pile
	Material strength	Concrete	σck=21 N/mm^2
		ReinforcigBar	SD345 Equivalent

Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANTS: THE CONSORTIUM OF Oriental Consultants Global Co., Ltd. AND INGEROSEC CORPORATION	PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.4	DRAWING TITLE: GENERAL DRAWING (Samkhara Bridge)	DATE: PREPARED BY: CHECKED BY:	DRAWING No. :

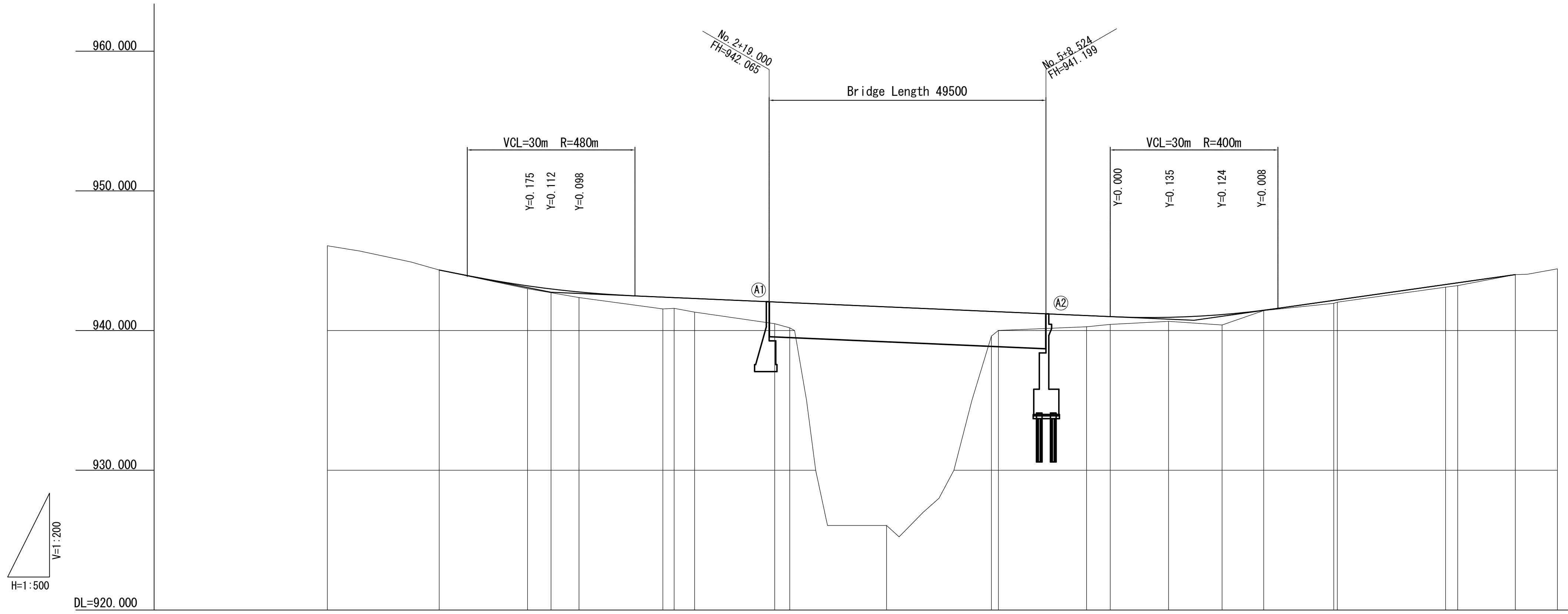
PLAN (Samkhara Road)

A1:S=1:250
A3:S=1:500



Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANT: THE CONSORTIUM OF Oriental Consultants Global Co., Ltd. AND INGEROSEC CORPORATION	PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.4	DRAWING TITLE: PLAN (Samkhara Road)	DATE: PREPARED BY: CHECKED BY:	DRAWING No. :

PROFILE (Samkhara Road)



STATION	GRAVDIENT	PROPOSED HEIGHT	GROUND HEIGHT	CUTTING	FILLING	TOTAL DISTANCE	SINGLE DISTANCE
NO.-1			946.07			-20.000	-20.000
BP (NO.0)	944.340	944.340	944.34		0.000	0.000	0.000
	i=7.961% L=20.000m						
EC.1		943.203	943.00		0.203	15.794	15.794
NO.1	942.748	942.981	942.71		0.271	20.000	4.206
KA2-1		942.764	942.36		0.404	25.000	5.000
NO.2		942.398	941.55		0.848	40.000	20.000
KE2-1		942.363	941.59		0.773	42.014	2.014
KE2-2		942.299	941.32		0.979	45.668	3.654
+19.0 NO.3		942.065 942.048	940.49		1.558	60.000	14.332
KA2-2		942.001	940.20		1.801	62.682	2.682
NO.4	i=1.750% L=115.000m	941.698	926.05		15.648	80.000	13.290
KA3-1		941.370	939.60		1.770	98.757	18.757
NO.5		941.348	940.01		1.338	100.000	1.243
+8.524		941.199					
KE3-1		941.072	940.27		0.802	115.771	15.771
NO.6		940.998	940.44		0.558	120.000	4.229
KE3-2		940.950	940.66		0.290	130.437	10.437
+15.000	2101.240	941.015					
NO.7		941.145	940.40		0.745	140.000	9.563
KA3-2		941.453	941.43		0.023	147.451	7.451
NO.8	i=5.700% L=57.451m	942.160	941.95		0.210	160.000	12.549
BC.4		942.197	942.03		0.167	160.636	0.636
NO.9		943.300	943.11		0.190	180.000	19.364
EC.4		943.422	943.22		0.202	182.143	2.143
(+12.451) EP	944.010	944.010	944.01		0.000	192.451	10.308
NO.10			944.42			200.000	7.549

CURVE BAND
R=200.000 L=69.905 / R=∞ L=9.206 / A=17.500 L=17.014 / R=18.000 L=3.654 / A=17.500 L=17.014 / R=∞ L=36.075 / A=17.500 L=17.014 / R=18.000 L=14.666 / A=17.500 L=17.014 / R=∞ L=13.185 / R=60.000 L=21.508 / R=∞

SUPER-ELEVATION
-2.000% / -2.000% / 2.000% -2.000% / 6.000% -6.000% / 6.000% -6.000% / 2.000% -2.000% / -2.000% / -2.000% / 2.000% -2.000% / 6.000% -6.000% / 6.000% -6.000% / 2.000% -2.000% / -2.000% / -2.000%

WIDENING
0.000 / 0.000 0.000 / 0.000 4.000 / 0.000 4.000 / 0.000 0.000 / 0.000 0.000 / 0.000 4.000 / 0.000 4.000 / 0.000 0.000 / 0.000

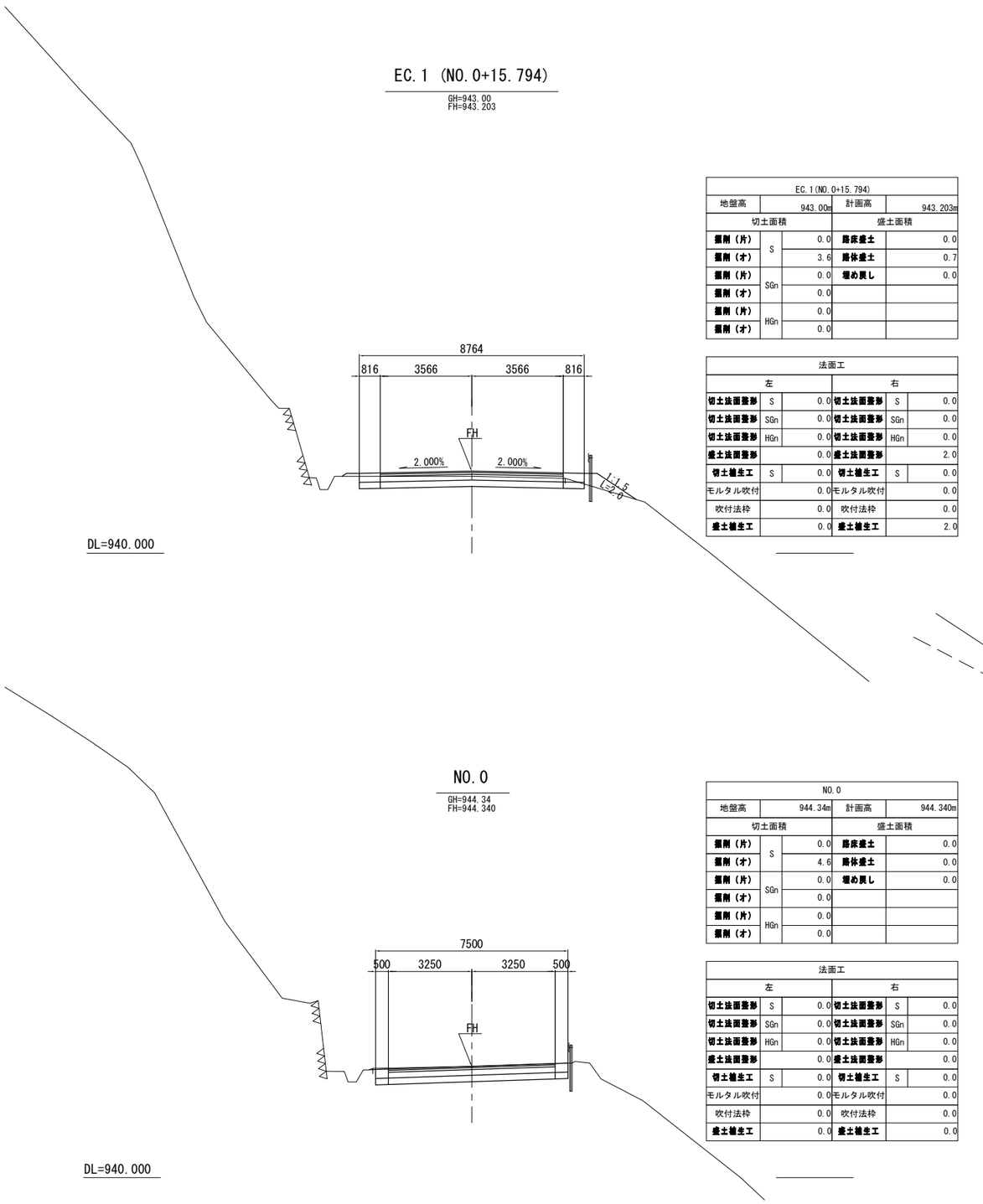
Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANT: THE CONSORTIUM OF Oriental Consultants Global Co., Ltd. AND INGEROSEC CORPORATION	PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.4	DRAWING TITLE: PROFILE (Samkhara Road)	DATE: PREPARED BY: CHECKED BY:	DRAWING No. :

CROSS SECTION (1) (Samkhara Road)

A1:S=1:100
A3:S=1:200

EC.1 (NO.0+15.794)

GH=943.00
FH=943.203

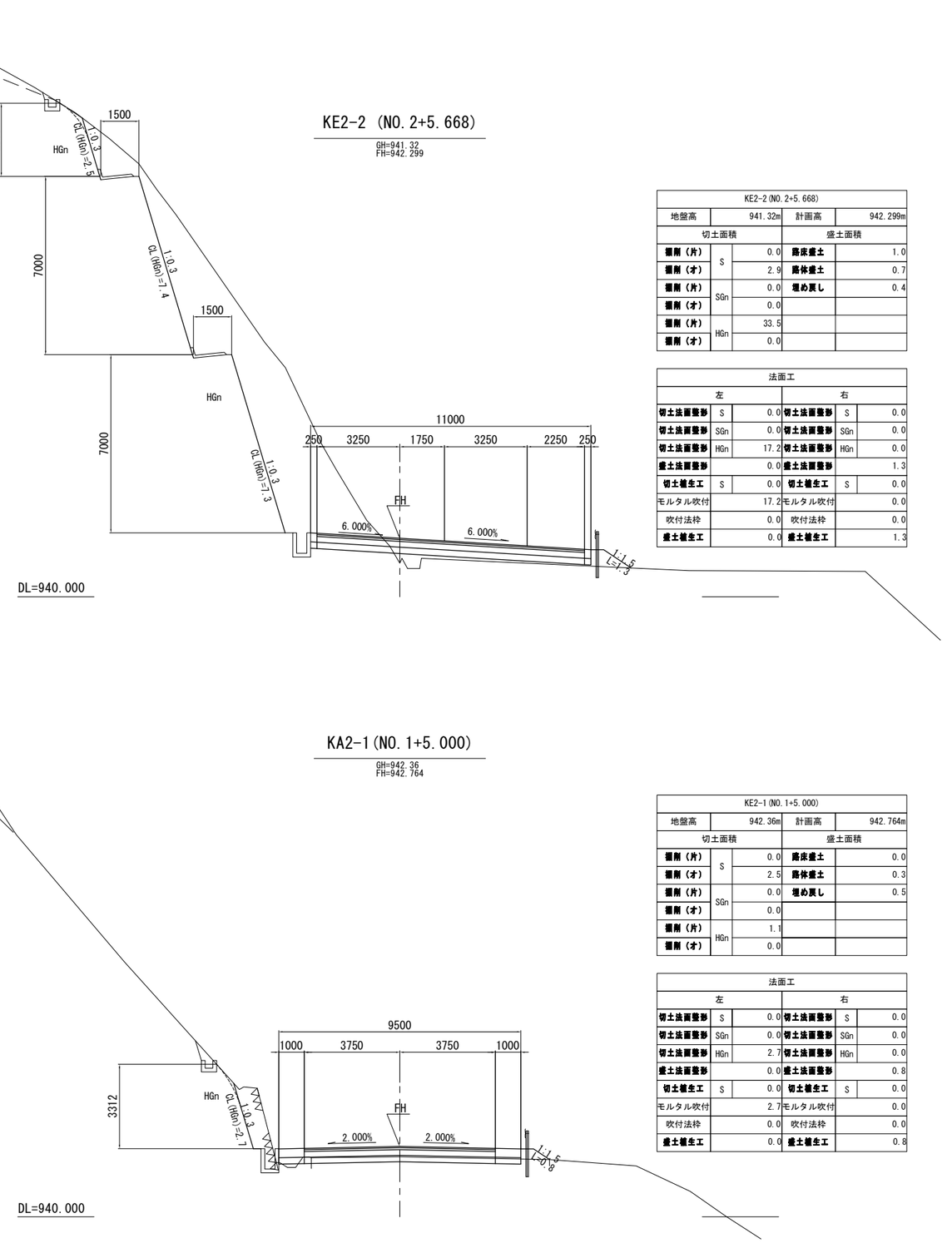


EC.1(NO.0+15.794)				
地盤高		943.00m	計画高	943.203m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	0.0
掘削（オ）		3.6	路体盛土	0.7
掘削（片）	SGn	0.0	埋め戻し	0.0
掘削（オ）		0.0		
掘削（片）	HGn	0.0		
掘削（オ）		0.0		

法面工				
左			右	
切土法面整形	S	0.0	切土法面整形	S 0.0
切土法面整形	SGn	0.0	切土法面整形	SGn 0.0
切土法面整形	HGn	0.0	切土法面整形	HGn 0.0
盛土法面整形		0.0	盛土法面整形	2.0
切土植生工	S	0.0	切土植生工	S 0.0
モルタル吹付		0.0	モルタル吹付	0.0
吹付法枠		0.0	吹付法枠	0.0
盛土植生工		0.0	盛土植生工	2.0

KE2-2 (NO.2+5.668)

GH=941.32
FH=942.299

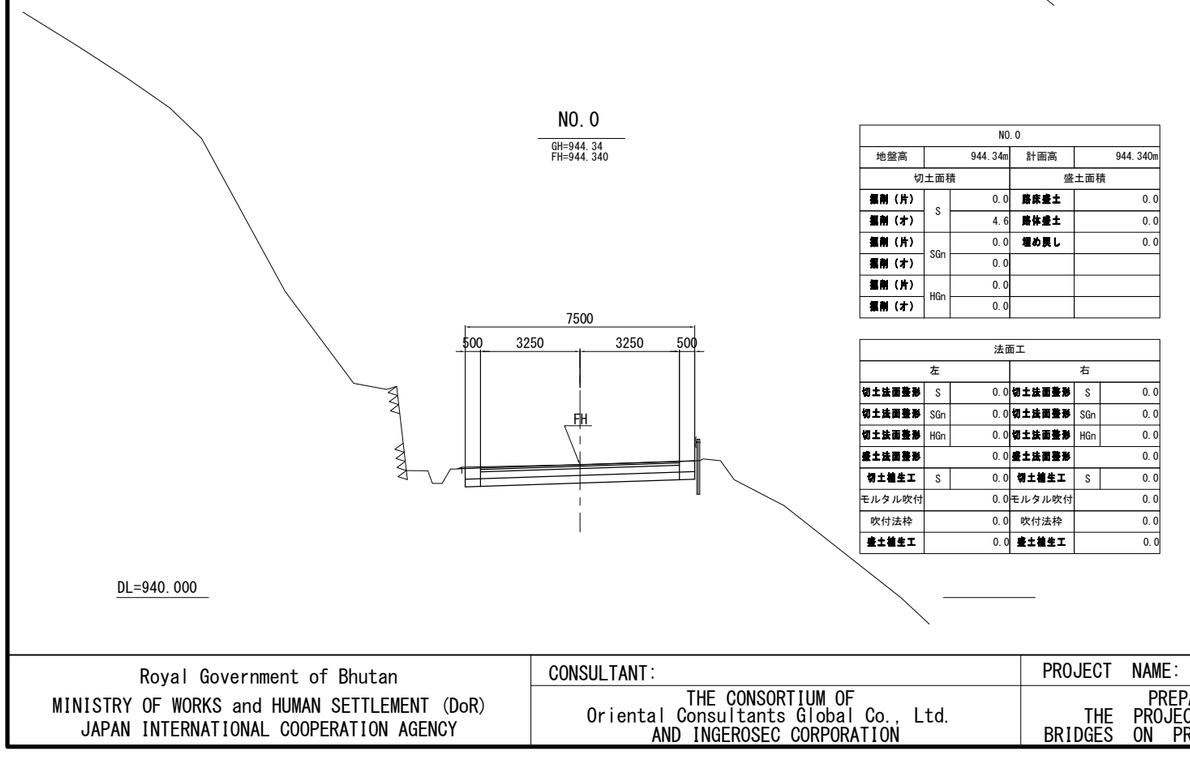


KE2-2(NO.2+5.668)				
地盤高		941.32m	計画高	942.299m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	1.0
掘削（オ）		2.9	路体盛土	0.7
掘削（片）	SGn	0.0	埋め戻し	0.4
掘削（オ）		0.0		
掘削（片）	HGn	33.5		
掘削（オ）		0.0		

法面工				
左			右	
切土法面整形	S	0.0	切土法面整形	S 0.0
切土法面整形	SGn	0.0	切土法面整形	SGn 0.0
切土法面整形	HGn	17.2	切土法面整形	HGn 0.0
盛土法面整形		0.0	盛土法面整形	1.3
切土植生工	S	0.0	切土植生工	S 0.0
モルタル吹付		17.2	モルタル吹付	0.0
吹付法枠		0.0	吹付法枠	0.0
盛土植生工		0.0	盛土植生工	1.3

NO.0

GH=944.34
FH=944.340



NO.0				
地盤高		944.34m	計画高	944.340m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	0.0
掘削（オ）		4.6	路体盛土	0.0
掘削（片）	SGn	0.0	埋め戻し	0.0
掘削（オ）		0.0		
掘削（片）	HGn	0.0		
掘削（オ）		0.0		

法面工				
左			右	
切土法面整形	S	0.0	切土法面整形	S 0.0
切土法面整形	SGn	0.0	切土法面整形	SGn 0.0
切土法面整形	HGn	0.0	切土法面整形	HGn 0.0
盛土法面整形		0.0	盛土法面整形	0.0
切土植生工	S	0.0	切土植生工	S 0.0
モルタル吹付		0.0	モルタル吹付	0.0
吹付法枠		0.0	吹付法枠	0.0
盛土植生工		0.0	盛土植生工	0.0

KA2-1(NO.1+5.000)

GH=942.36
FH=942.764

KE2-1(NO.1+5.000)				
地盤高		942.36m	計画高	942.764m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	0.0
掘削（オ）		2.5	路体盛土	0.3
掘削（片）	SGn	0.0	埋め戻し	0.5
掘削（オ）		0.0		
掘削（片）	HGn	1.1		
掘削（オ）		0.0		

法面工				
左			右	
切土法面整形	S	0.0	切土法面整形	S 0.0
切土法面整形	SGn	0.0	切土法面整形	SGn 0.0
切土法面整形	HGn	2.7	切土法面整形	HGn 0.0
盛土法面整形		0.0	盛土法面整形	0.8
切土植生工	S	0.0	切土植生工	S 0.0
モルタル吹付		2.7	モルタル吹付	0.0
吹付法枠		0.0	吹付法枠	0.0
盛土植生工		0.0	盛土植生工	0.8

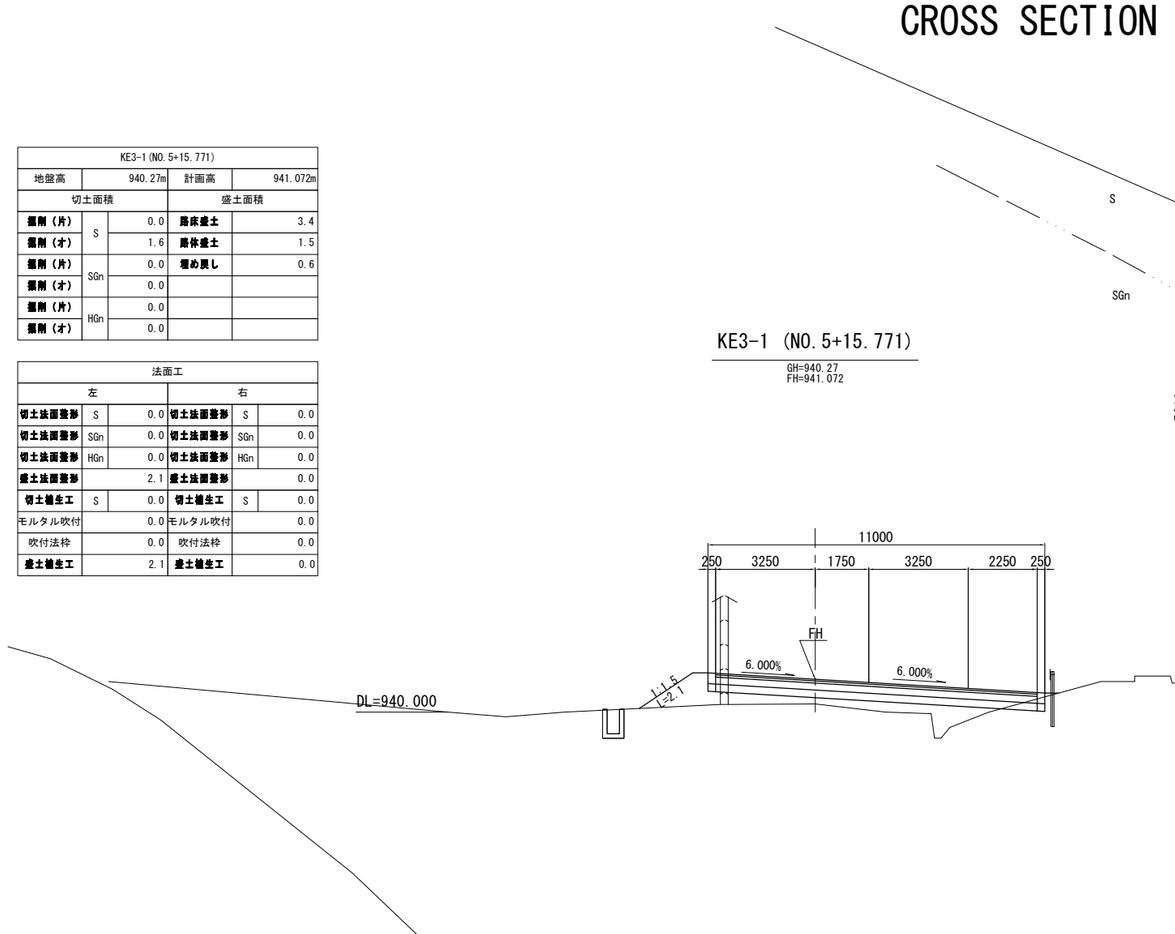
Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANT: THE CONSORTIUM OF Oriental Consultants Global Co., Ltd. AND INGEROSEC CORPORATION	PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.4	DRAWING TITLE: CROSS SECTION (1) (Samkhara Road)	DATE: PREPARED BY: CHECKED BY:	DRAWING No. :

CROSS SECTION (2) (Samkhara Road)

A1:S=1:100
A3:S=1:200

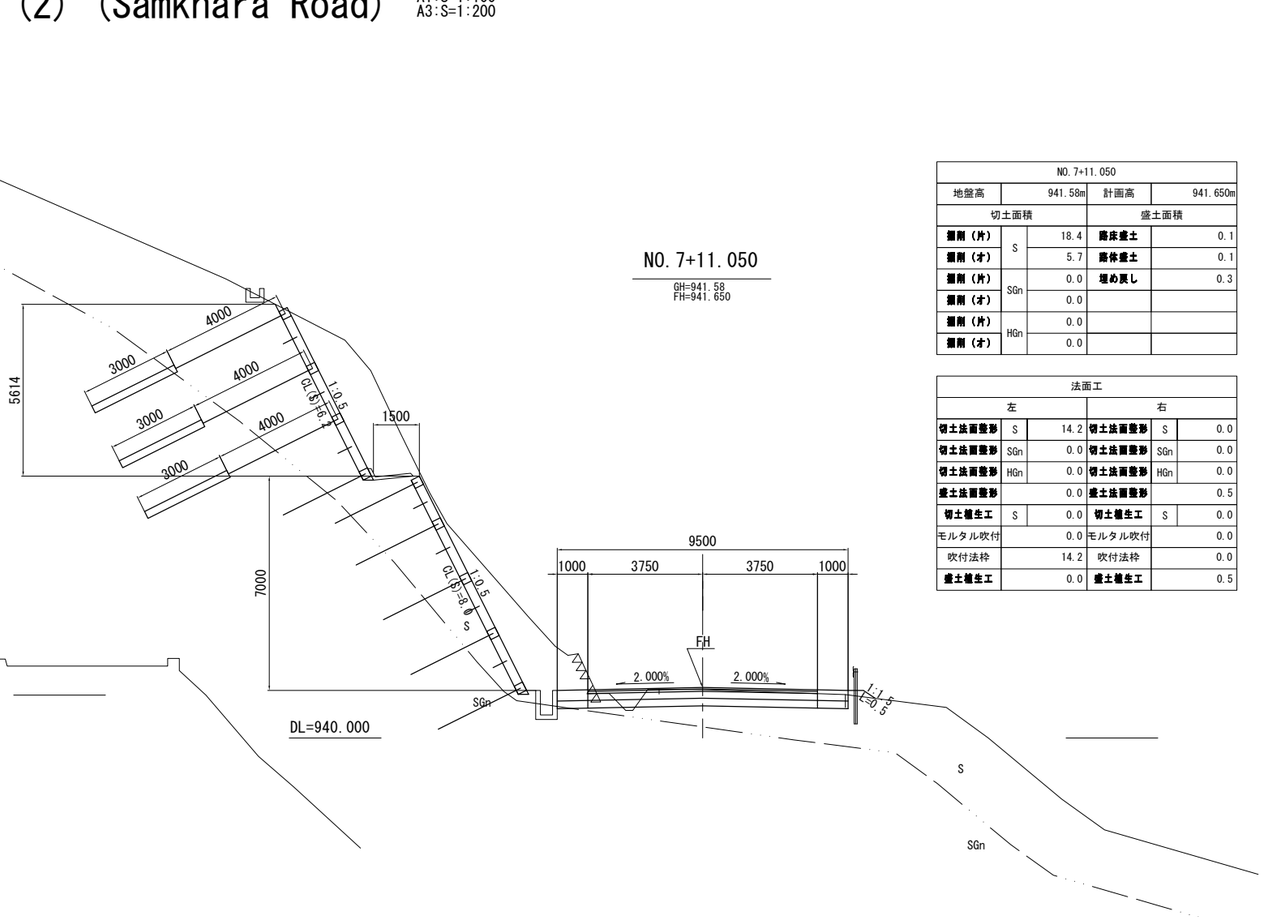
KE3-1(NO.5+15.771)				
地盤高		940.27m	計画高	941.072m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	3.4
掘削（オ）		1.6	路体盛土	1.5
掘削（片）	SGn	0.0	埋め戻し	0.6
掘削（オ）		0.0		
掘削（片）	HGn	0.0		
掘削（オ）		0.0		

法面工					
左			右		
切土法面整形	S	0.0	切土法面整形	S	0.0
切土法面整形	SGn	0.0	切土法面整形	SGn	0.0
切土法面整形	HGn	0.0	切土法面整形	HGn	0.0
盛土法面整形		2.1	盛土法面整形		0.0
切土植生工	S	0.0	切土植生工	S	0.0
モルタル吹付		0.0	モルタル吹付		0.0
吹付法枠		0.0	吹付法枠		0.0
盛土植生工		2.1	盛土植生工		0.0



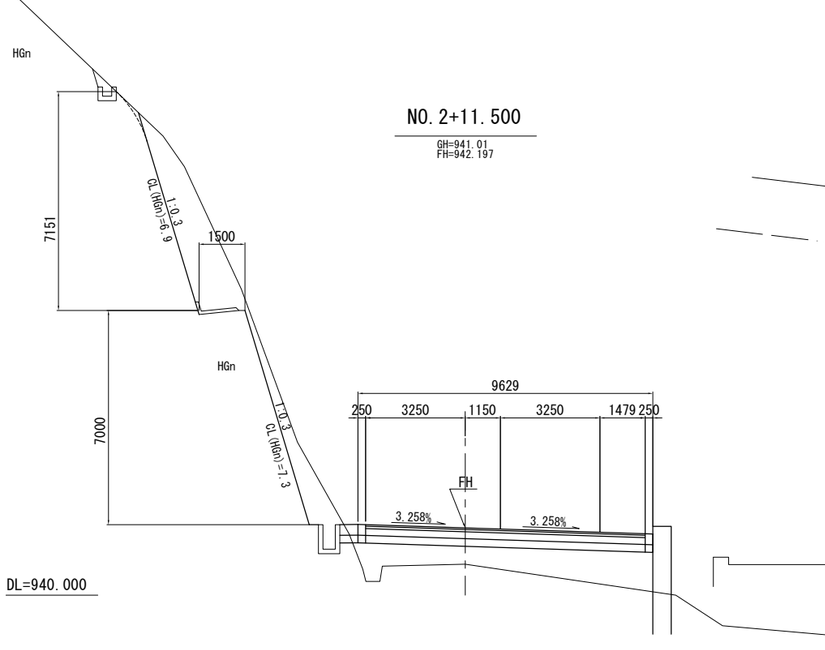
NO.7+11.050				
地盤高		941.58m	計画高	941.650m
切土面積			盛土面積	
掘削（片）	S	18.4	路床盛土	0.1
掘削（オ）		5.7	路体盛土	0.1
掘削（片）	SGn	0.0	埋め戻し	0.3
掘削（オ）		0.0		
掘削（片）	HGn	0.0		
掘削（オ）		0.0		

法面工					
左			右		
切土法面整形	S	14.2	切土法面整形	S	0.0
切土法面整形	SGn	0.0	切土法面整形	SGn	0.0
切土法面整形	HGn	0.0	切土法面整形	HGn	0.0
盛土法面整形		0.0	盛土法面整形		0.5
切土植生工	S	0.0	切土植生工	S	0.0
モルタル吹付		0.0	モルタル吹付		0.0
吹付法枠		14.2	吹付法枠		0.0
盛土植生工		0.0	盛土植生工		0.5



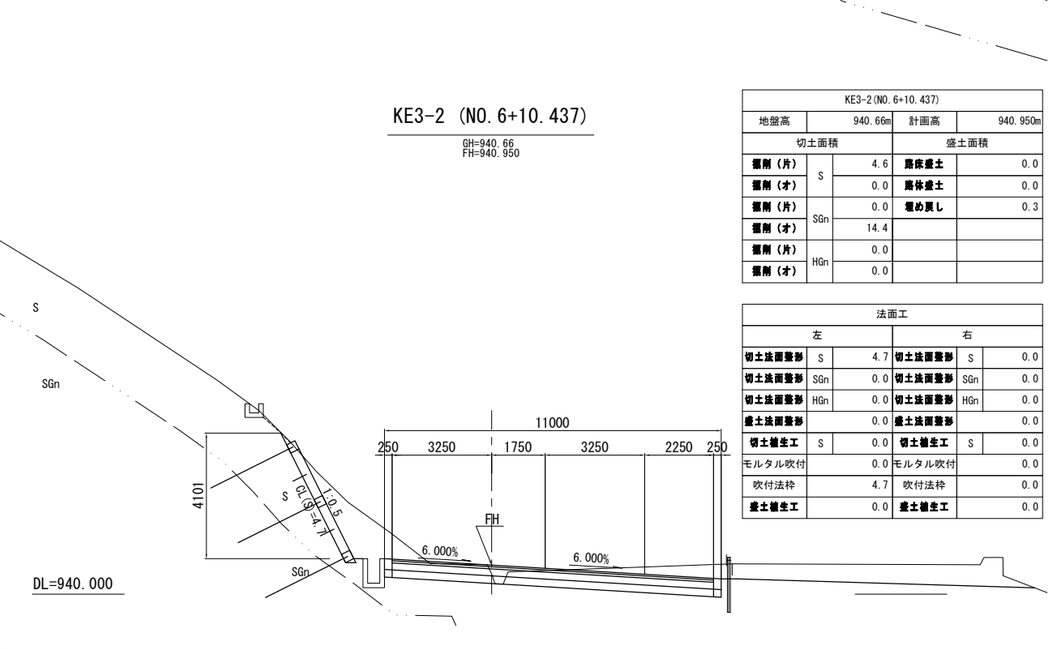
NO.2+11.500				
地盤高		941.01m	計画高	942.197m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	8.5
掘削（オ）		0.0	路体盛土	0.0
掘削（片）	SGn	0.0	埋め戻し	0.4
掘削（オ）		0.0		
掘削（片）	HGn	11.3		
掘削（オ）		1.2		

法面工					
左			右		
切土法面整形	S	0.0	切土法面整形	S	0.0
切土法面整形	SGn	0.0	切土法面整形	SGn	0.0
切土法面整形	HGn	14.2	切土法面整形	HGn	0.0
盛土法面整形		0.0	盛土法面整形		0.0
切土植生工	S	0.0	切土植生工	S	0.0
モルタル吹付		14.2	モルタル吹付		0.0
吹付法枠		0.0	吹付法枠		0.0
盛土植生工		0.0	盛土植生工		0.0



KE3-2(NO.6+10.437)				
地盤高		940.66m	計画高	940.950m
切土面積			盛土面積	
掘削（片）	S	4.6	路床盛土	0.0
掘削（オ）		0.0	路体盛土	0.0
掘削（片）	SGn	0.0	埋め戻し	0.3
掘削（オ）		14.4		
掘削（片）	HGn	0.0		
掘削（オ）		0.0		

法面工					
左			右		
切土法面整形	S	4.7	切土法面整形	S	0.0
切土法面整形	SGn	0.0	切土法面整形	SGn	0.0
切土法面整形	HGn	0.0	切土法面整形	HGn	0.0
盛土法面整形		0.0	盛土法面整形		0.0
切土植生工	S	0.0	切土植生工	S	0.0
モルタル吹付		0.0	モルタル吹付		0.0
吹付法枠		4.7	吹付法枠		0.0
盛土植生工		0.0	盛土植生工		0.0



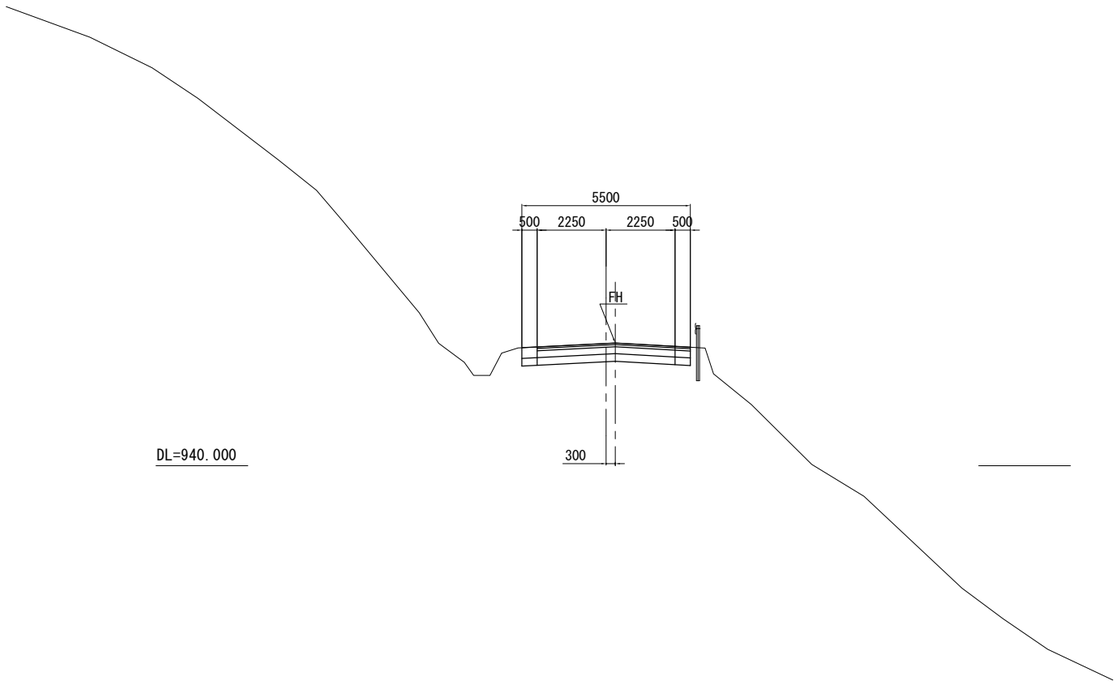
Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANT: THE CONSORTIUM OF Oriental Consultants Global Co., Ltd. AND INGEROSEC CORPORATION	PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.4	DRAWING TITLE: CROSS SECTION (2) (Samkhara Road)	DATE: PREPARED BY: CHECKED BY:	DRAWING No. :

CROSS SECTION (3) (Samkhara Road)

A1:S=1:100
A3:S=1:200

EP (NO.9+12.451)

GH=944.01
FH=944.010

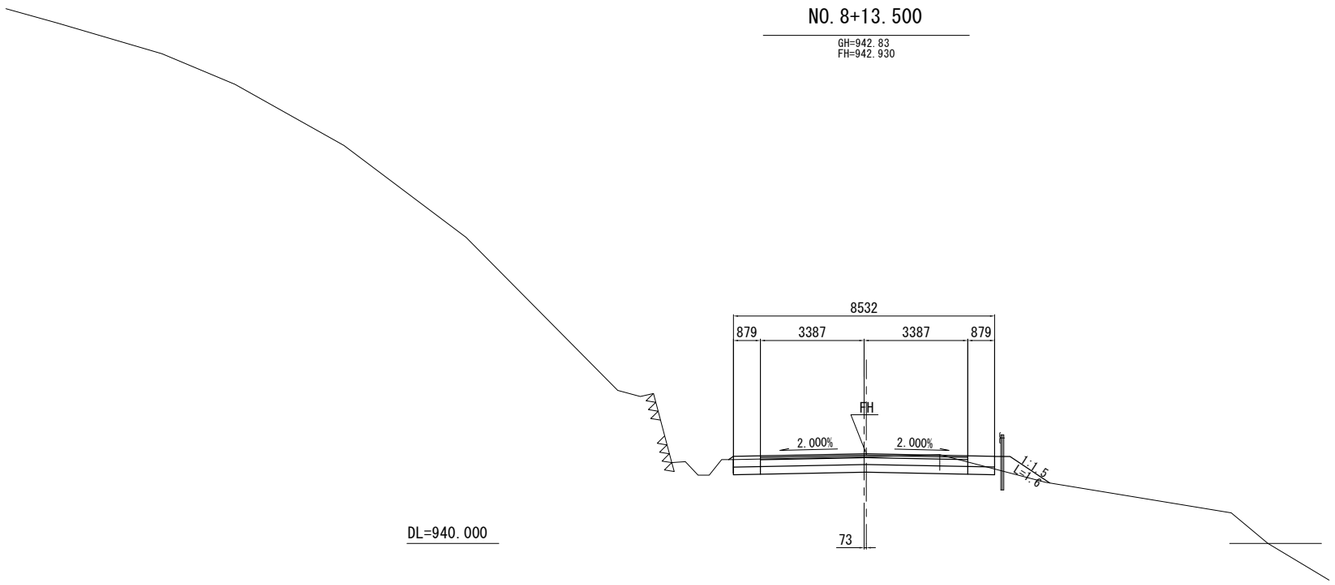


EP(NO.9+12.451)				
地盤高		944.01m	計画高	944.010m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	0.0
掘削（オ）		3.3	路体盛土	0.0
掘削（片）	SGn	0.0	埋め戻し	0.0
掘削（オ）		0.0		
掘削（片）	HGn	0.0		
掘削（オ）		0.0		

法面工					
左			右		
切土法面整形	S	0.0	切土法面整形	S	0.0
切土法面整形	SGn	0.0	切土法面整形	SGn	0.0
切土法面整形	HGn	0.0	切土法面整形	HGn	0.0
盛土法面整形		0.0	盛土法面整形		0.0
切土植生工	S	0.0	切土植生工	S	0.0
モルタル吹付		0.0	モルタル吹付		0.0
吹付法枠		0.0	吹付法枠		0.0
盛土植生工		0.0	盛土植生工		0.0

NO.8+13.500

GH=942.83
FH=942.930



NO.8+13.500				
地盤高		942.83m	計画高	942.930m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	0.0
掘削（オ）		4.2	路体盛土	0.6
掘削（片）	SGn	0.0	埋め戻し	0.0
掘削（オ）		0.0		
掘削（片）	HGn	0.0		
掘削（オ）		0.0		

法面工					
左			右		
切土法面整形	S	0.0	切土法面整形	S	0.0
切土法面整形	SGn	0.0	切土法面整形	SGn	0.0
切土法面整形	HGn	0.0	切土法面整形	HGn	0.0
盛土法面整形		0.0	盛土法面整形		1.6
切土植生工	S	0.0	切土植生工	S	0.0
モルタル吹付		0.0	モルタル吹付		0.0
吹付法枠		0.0	吹付法枠		0.0
盛土植生工		0.0	盛土植生工		1.6

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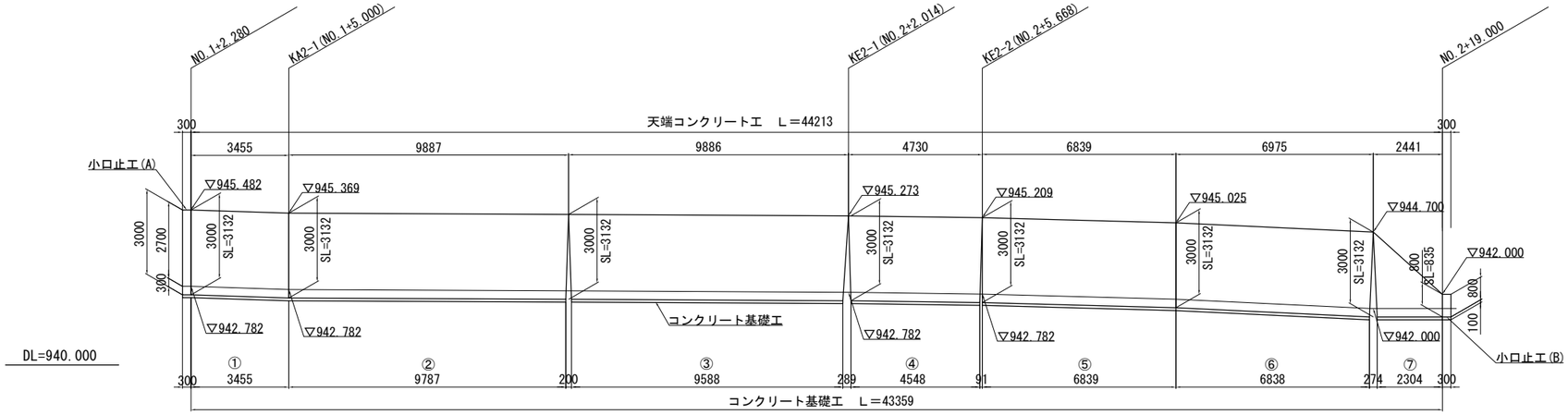
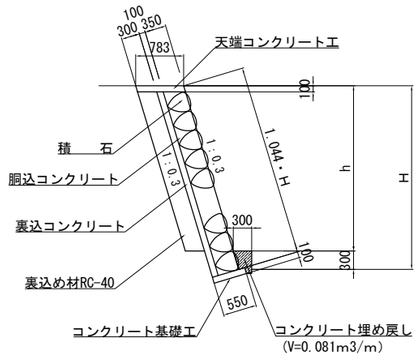
RETAINING WALL GENERAL DRAWING(1) (Samkhara Bridge)

A1:S=1:100
A3:S=1:200

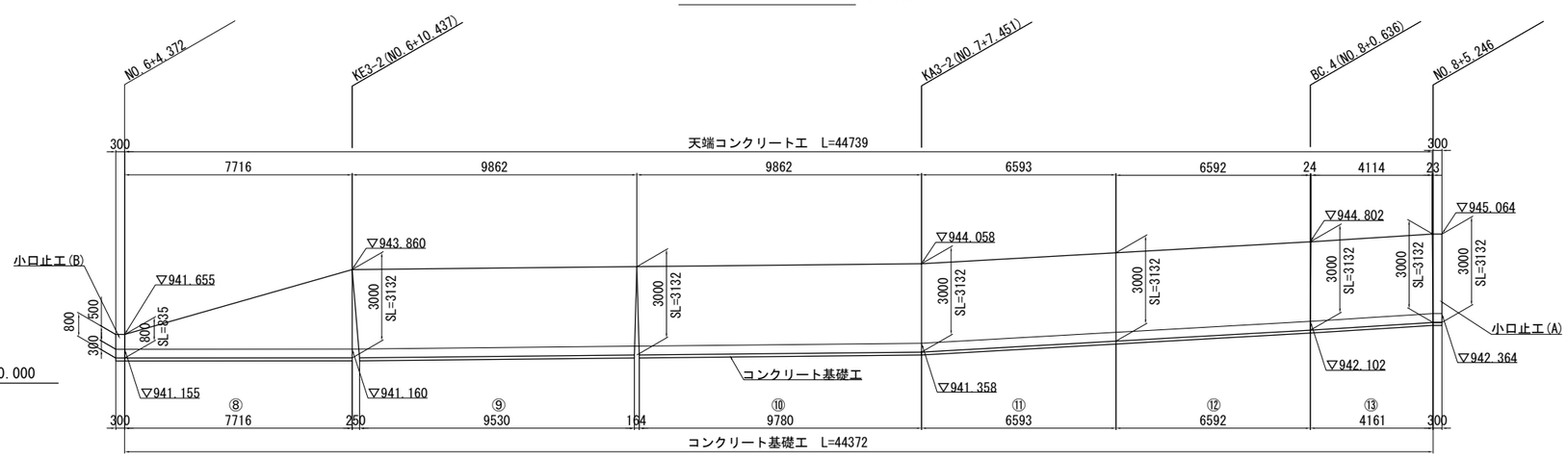
RIGHT BANK SIDE S=1:100



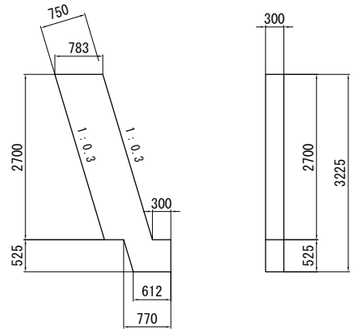
標準断面図 S=1:50



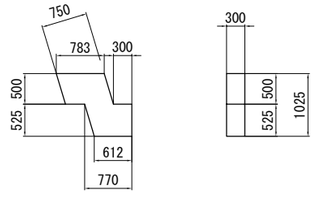
LEFT BANK SIDE S=1:100



小口止工(A) S=1:50



小口止工(B) S=1:50

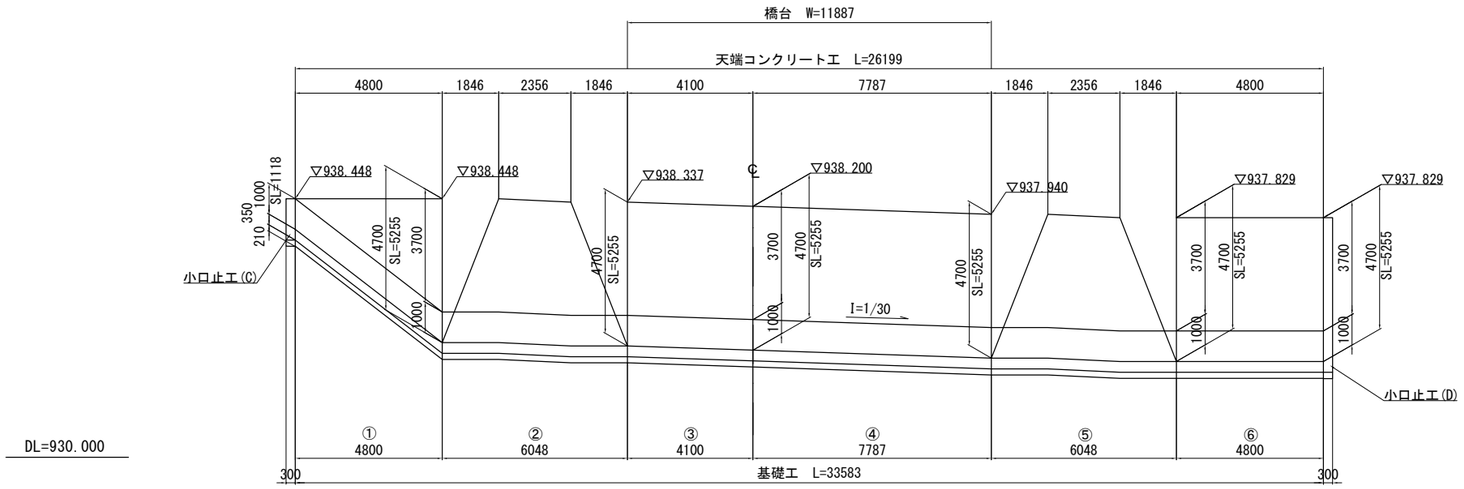


Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANTS: THE CONSORTIUM OF Oriental Consultants Global Co., Ltd. AND INGEROSEC CORPORATION	PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.4	DRAWING TITLE: RETAINING WALL GENERAL DRAWING(1) (Samkhara Bridge)	DATE: PREPARED BY: CHECKED BY:	DRAWING No. :

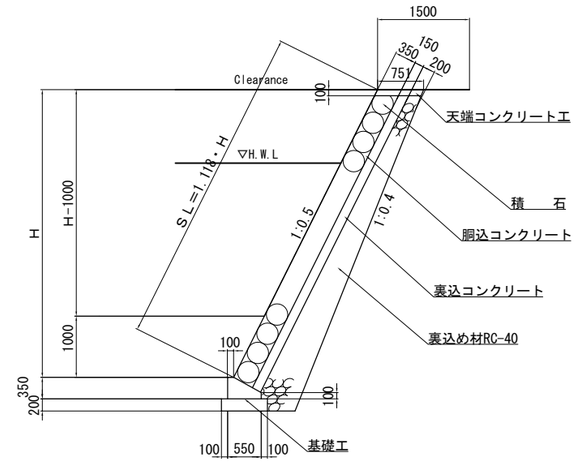
RETAINING WALL GENERAL DRAWING(2) (Samkhara Bridge)

A1:S=1:100
A3:S=1:200

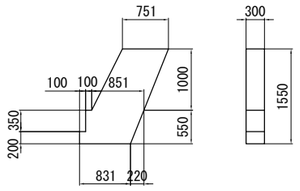
左岸護岸工 S=1:100



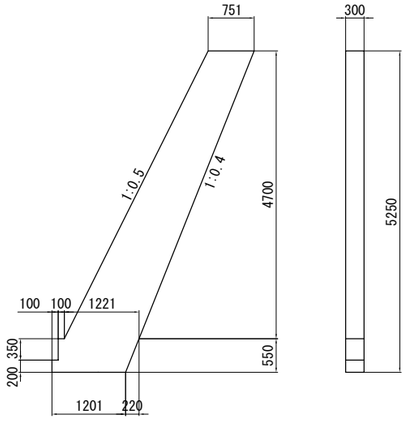
標準断面図 S=1:50



小口止工(C) S=1:50



小口止工(D) S=1:50

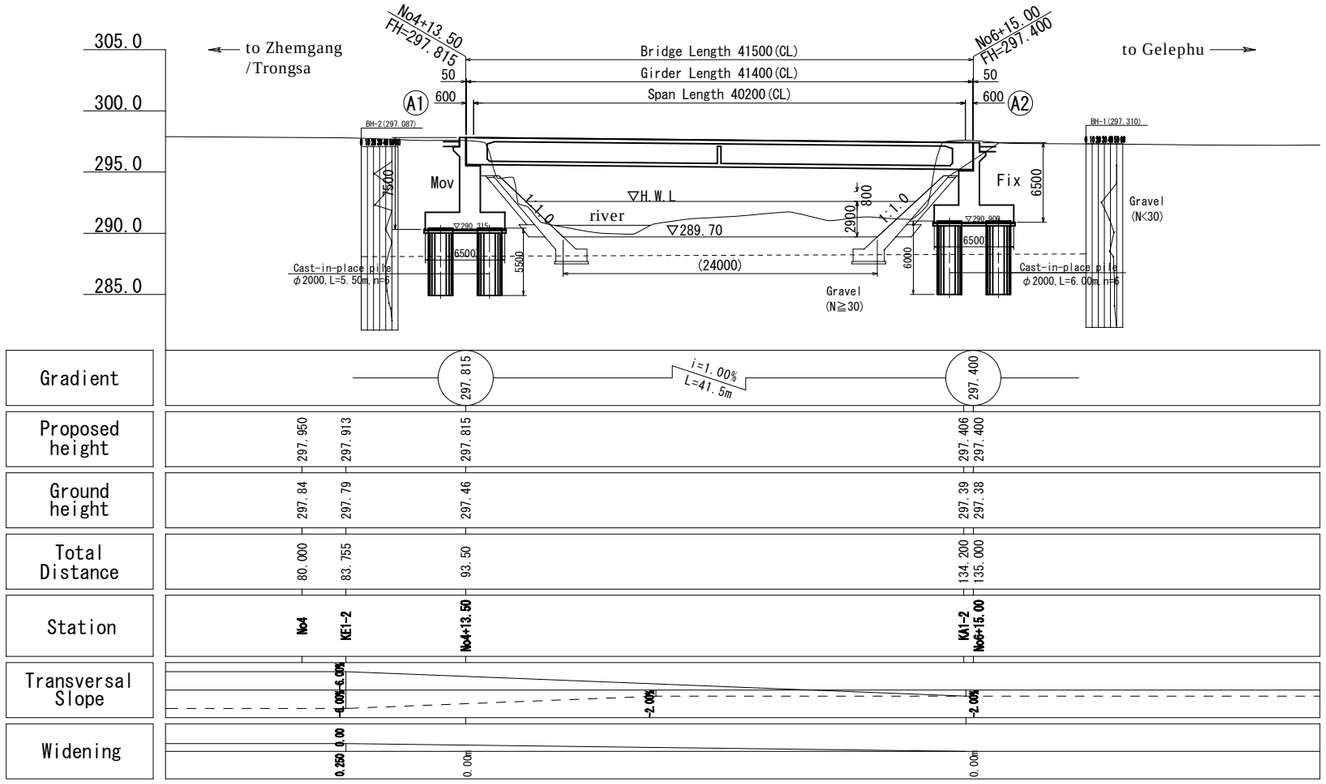


Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANTS: THE CONSORTIUM OF Oriental Consultants Global Co., Ltd. AND INGEROSEC CORPORATION	PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.4	DRAWING TITLE: RETAINING WALL GENERAL DRAWING(2) (Samkhara Bridge)	DATE: PREPARED BY: CHECKED BY:	DRAWING No. :

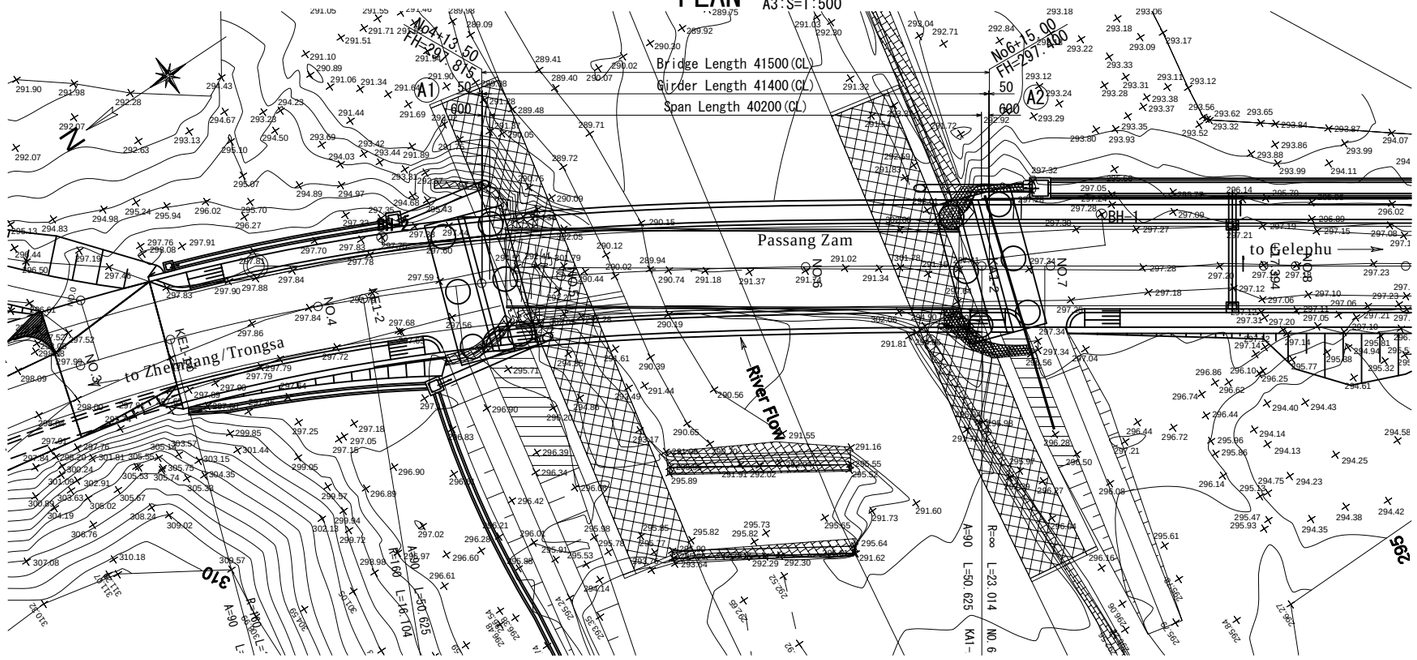
(4) Passang Bridge

GENERAL DRAWING(Passang Bridge)

PROFILE A1:S=1:250 A3:S=1:500

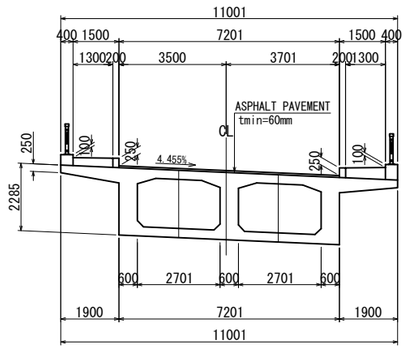


PLAN A1:S=1:250 A3:S=1:500

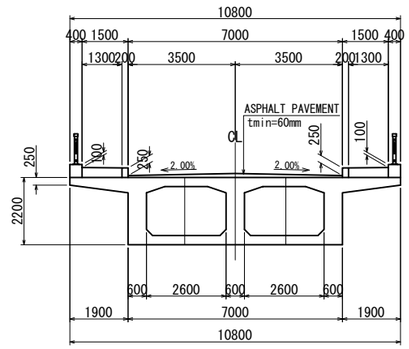


CROSS SECTION A1:S=1:100 A3:S=1:200

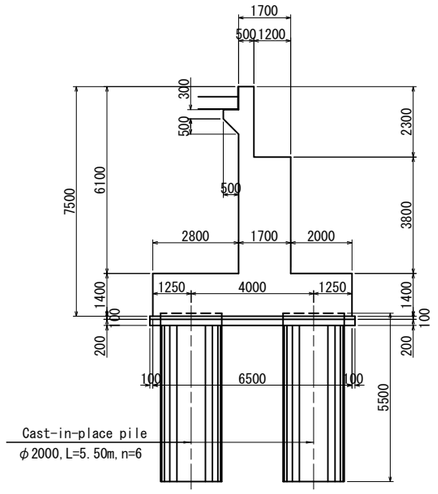
A1 SIDE



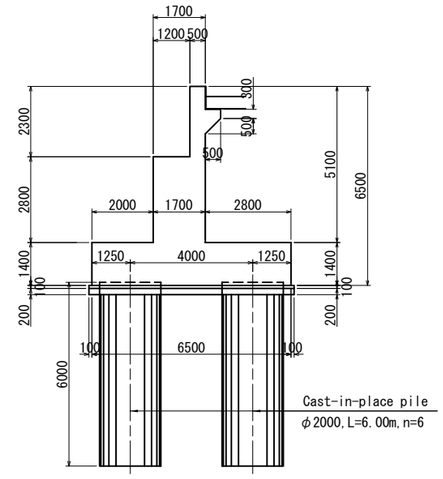
A2 SIDE



A1 ABUTMENT A1:S=1:100 A3:S=1:200



A2 ABUTMENT A1:S=1:100 A3:S=1:200



Design condition

Bridge Length			41.500m
Span Length			41.400m
Road Width			1.500m + 7.000m + 1.500m
Live Load			Single lane IRC 70R(wheeled) or Double lane IRC Class A
Design Seismic Scale			KH=0.22 KV=0.00
Super structure	Form		PC Box-Shape Girder
	Material strength	Concrete	σck=30 N/mm^2
		ReinforcigBar	SD345 Equivalent
		Tendon	12S12.7mm
Sub structure	Form	Structure	Inverted T-Type Abutment
		Foundation	Cast-in-place pile
	Material strength	Concrete	σck=21 N/mm^2
		ReinforcigBar	SD345 Equivalent

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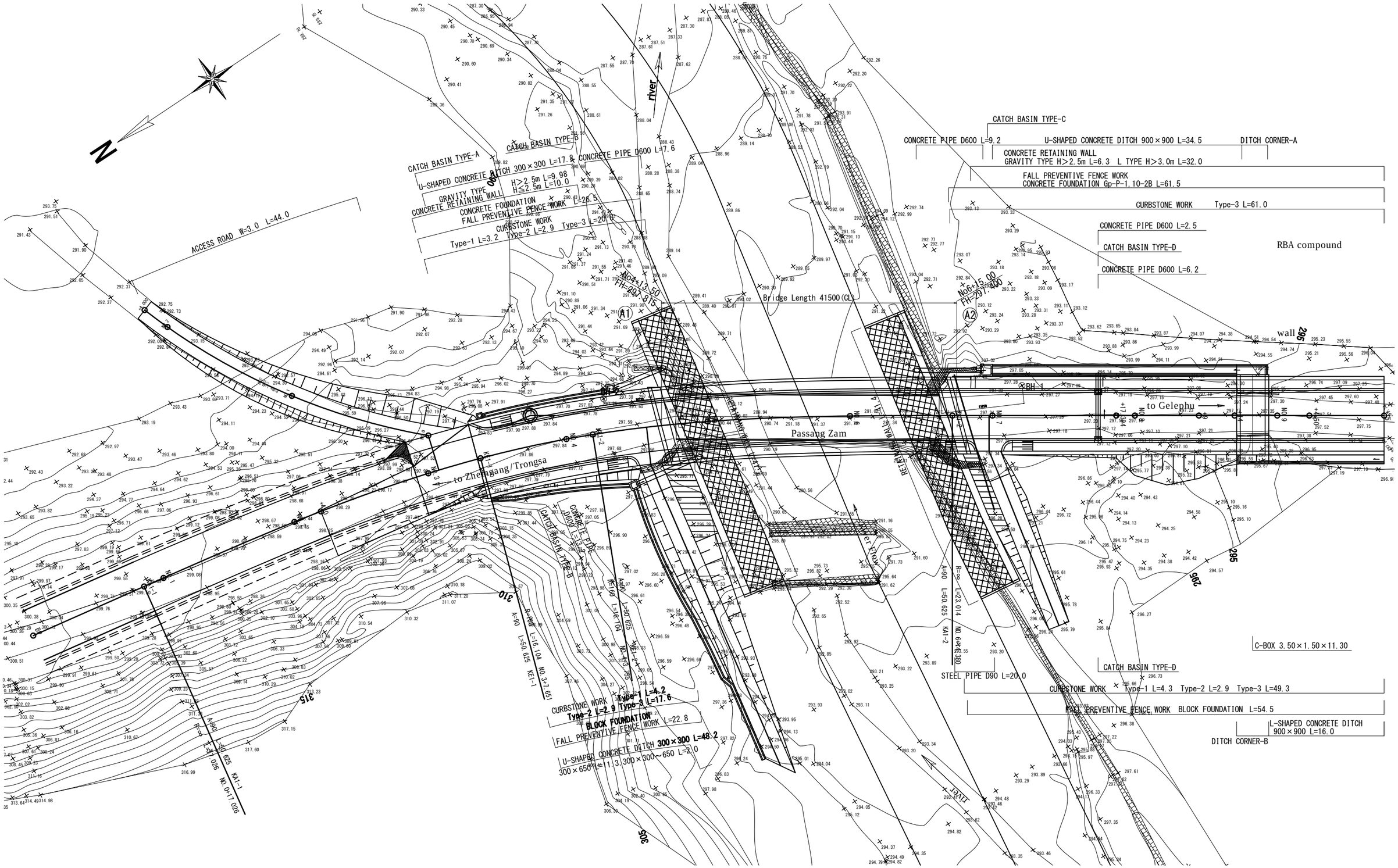
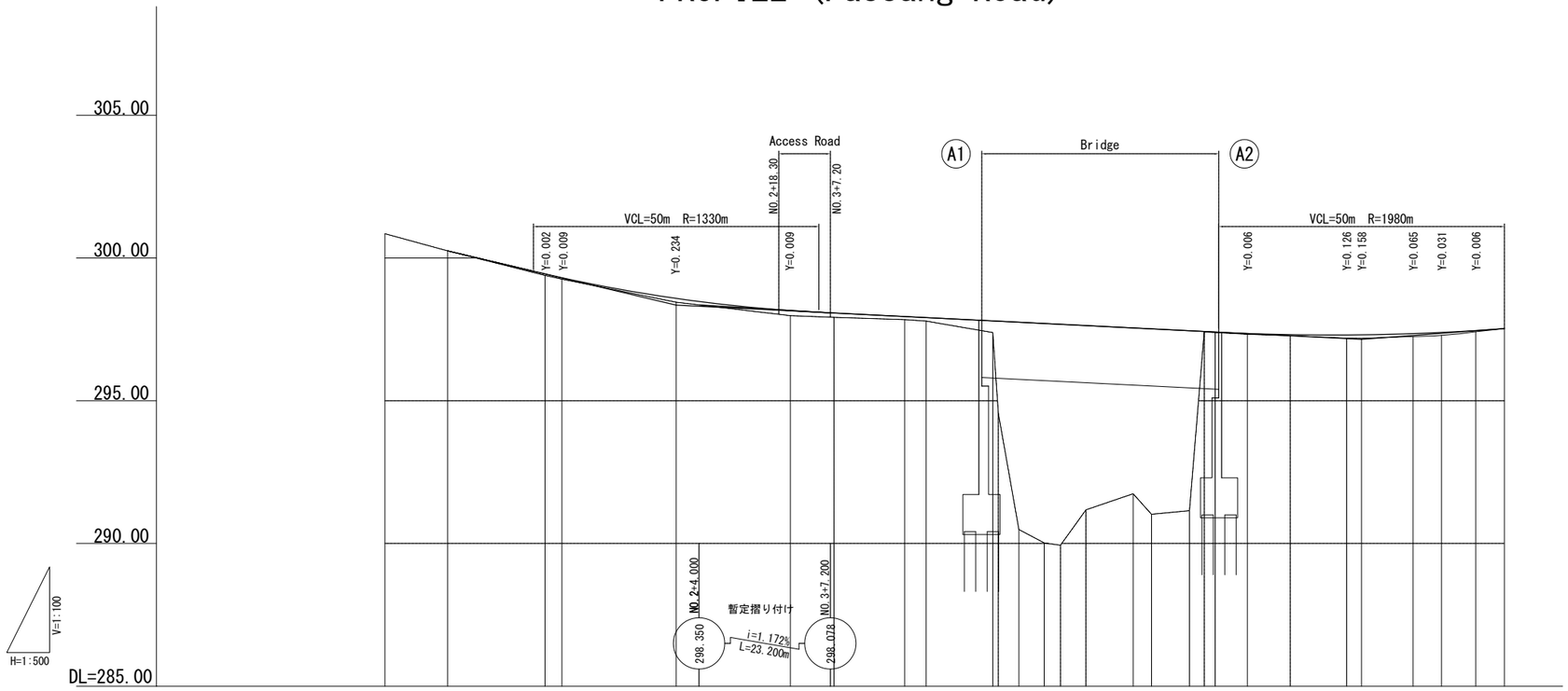
PLAN(Passang Road)

A1:S=1:250
A3:S=1:500



Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANT: THE CONSORTIUM OF Oriental Consultants Global Co., Ltd. AND INGEROSEC CORPORATION	PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.4	DRAWING TITLE: PLAN (Passang Road)	DATE: PREPARED BY: CHECKED BY:	DRAWING No. :

PROFILE (Passang Road)



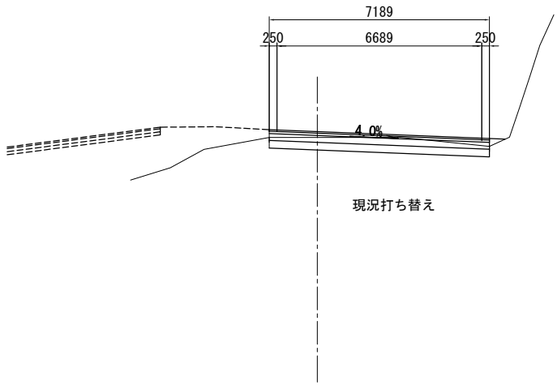
Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANT: THE CONSORTIUM OF Oriental Consultants Global Co., Ltd. AND INGEROSEC CORPORATION	PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.4	DRAWING TITLE: PROFILE (Passang Road)	DATE: PREPARED BY: CHECKED BY:	DRAWING No. :

CROSS SECTION (1) (Passang Road)

A1:S=1:100
A3:S=1:200

NO.2+18.300

GH=297.99
FH=298.401 (暫定FH=298.182)

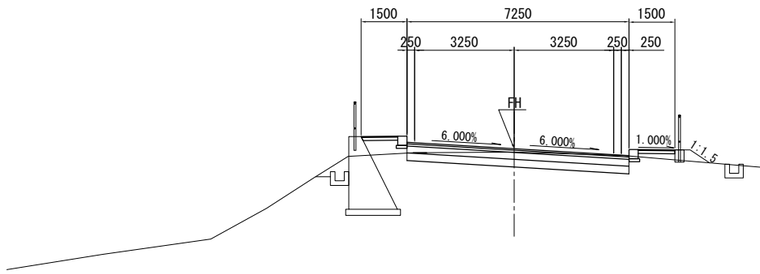


NO.2+18.300				
地盤高		297.99m	計画高	暫定298.182m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	0.0
掘削（オ）		3.1	路体盛土	0.1
掘削（片）	礫	0.0	埋め戻し	0.0
掘削（オ）		0.0		

法面工				
左			右	
切土法面整形	S	0.0	切土法面整形	S 0.0
切土法面整形	礫	0.0	切土法面整形	礫 0.0
盛土法面整形		0.0	盛土法面整形	0.0
切土植生工	S	0.0	切土植生工	S 0.0
モルタル吹付	礫	0.0	モルタル吹付	礫 0.0
盛土植生工		0.0	盛土植生工	0.0

NO.4

GH=297.84
FH=297.950

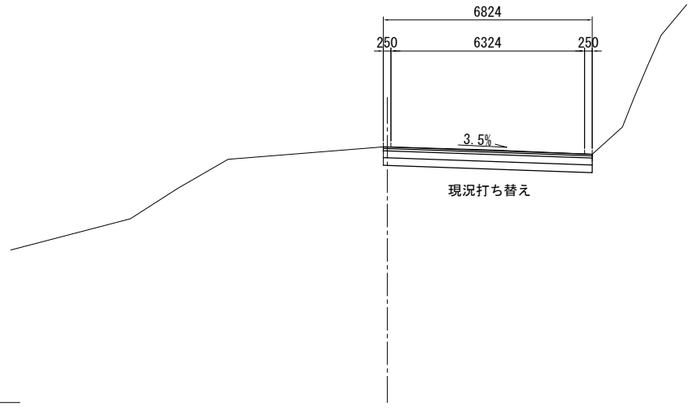


No.4				
地盤高		297.84m	計画高	297.950m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	0.7
掘削（オ）		3.1	路体盛土	0.3
掘削（片）	礫	0.0	埋め戻し	3.5
掘削（オ）		6.3		

法面工				
左			右	
切土法面整形	S	0.0	切土法面整形	S 0.0
切土法面整形	礫	0.0	切土法面整形	礫 0.0
盛土法面整形		0.0	盛土法面整形	0.8
切土植生工	S	0.0	切土植生工	S 0.0
モルタル吹付	礫	0.0	モルタル吹付	礫 0.0
盛土植生工		0.0	盛土植生工	0.8

NO.2+4.000

GH=298.35
FH=298.544 (暫定FH=298.350)

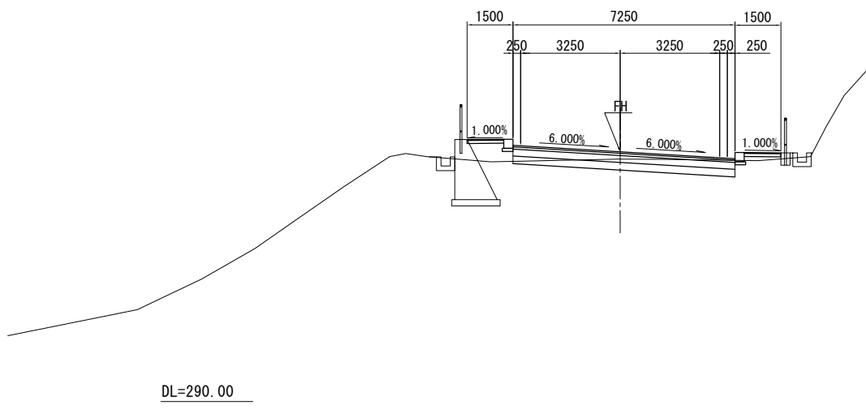


NO.2+4.000				
地盤高		298.35m	計画高	暫定298.350m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	0.0
掘削（オ）		4.2	路体盛土	0.0
掘削（片）	礫	0.0	埋め戻し	0.0
掘削（オ）		0.0		

法面工				
左			右	
切土法面整形	S	0.0	切土法面整形	S 0.0
切土法面整形	礫	0.0	切土法面整形	礫 0.0
盛土法面整形		0.0	盛土法面整形	0.0
切土植生工	S	0.0	切土植生工	S 0.0
モルタル吹付	礫	0.0	モルタル吹付	礫 0.0
盛土植生工		0.0	盛土植生工	0.0

KE1-1(NO.3+7.651)

GH=297.92
FH=298.159



KE1-1 (NO.3+7.651)				
地盤高		297.92m	計画高	298.159m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	0.9
掘削（オ）		3.1	路体盛土	0.0
掘削（片）	礫	0.0	埋め戻し	2.5
掘削（オ）		1.8		

法面工				
左			右	
切土法面整形	S	0.0	切土法面整形	S 0.0
切土法面整形	礫	0.0	切土法面整形	礫 0.0
盛土法面整形		0.0	盛土法面整形	0.0
切土植生工	S	0.0	切土植生工	S 0.0
モルタル吹付	礫	0.0	モルタル吹付	礫 0.0
盛土植生工		0.0	盛土植生工	0.0

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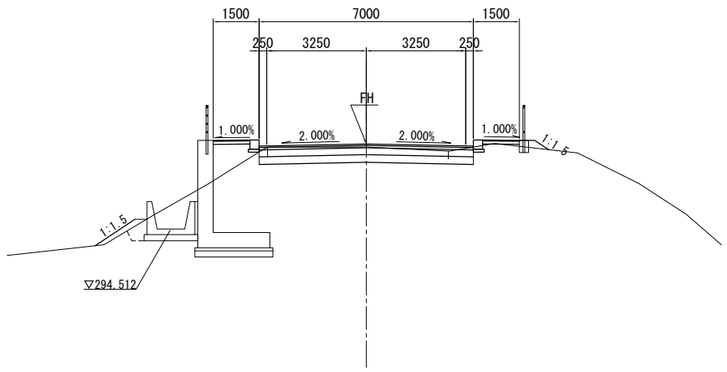
CROSS SECTION (2) (Passang Road)

A1:S=1:100
A3:S=1:200

NO.7+17.397

GH=297.19
FH=297.302



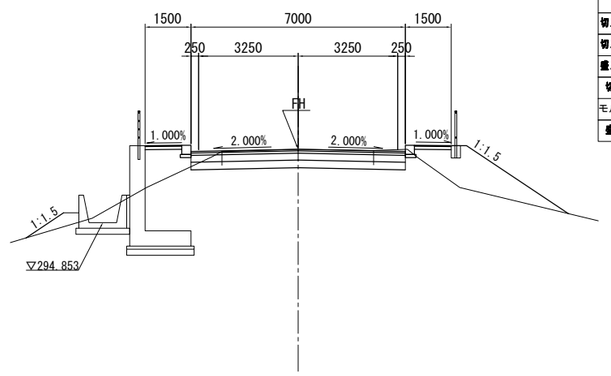
DL=290.00

NO.7+17.397				
地盤高		297.19m	計画高	297.302m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	1.0
掘削（オ）		3.5	路体盛土	0.4
掘削（片）	礫	0.0	埋め戻し	8.0
掘削（オ）		12.2		

法面工				
左			右	
切土法面整形	S	0.0	切土法面整形	S	0.0
切土法面整形	礫	0.0	切土法面整形	礫	0.0
盛土法面整形		1.6	盛土法面整形		0.5
切土植生工	S	0.0	切土植生工	S	0.0
モルタル吹付	礫	0.0	モルタル吹付	礫	0.0
盛土植生工		1.6	盛土植生工		0.5

NO.8+9.000

GH=297.25
FH=297.351



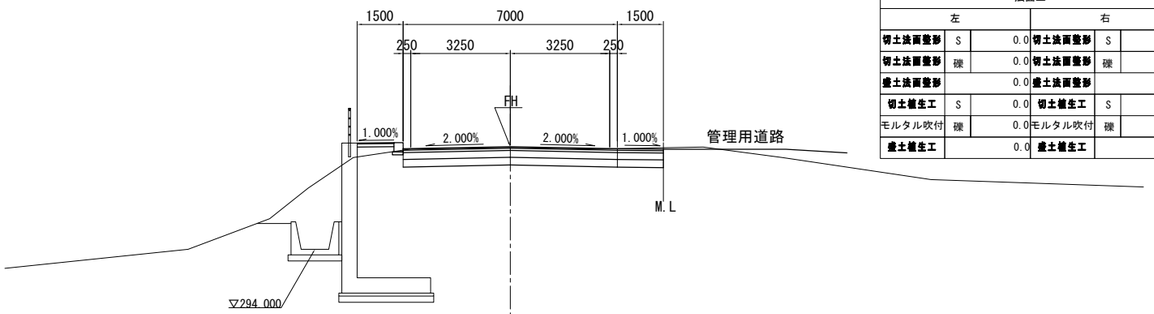
DL=290.00

No.8+9.000				
地盤高		297.25m	計画高	297.351m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	2.0
掘削（オ）		4.0	路体盛土	3.5
掘削（片）	礫	0.0	埋め戻し	6.1
掘削（オ）		9.2		

法面工				
左			右	
切土法面整形	S	0.0	切土法面整形	S	0.0
切土法面整形	礫	0.0	切土法面整形	礫	0.0
盛土法面整形		1.4	盛土法面整形		4.0
切土植生工	S	0.0	切土植生工	S	0.0
モルタル吹付	礫	0.0	モルタル吹付	礫	0.0
盛土植生工		1.4	盛土植生工		4.0

NO.7

GH=297.33
FH=297.356



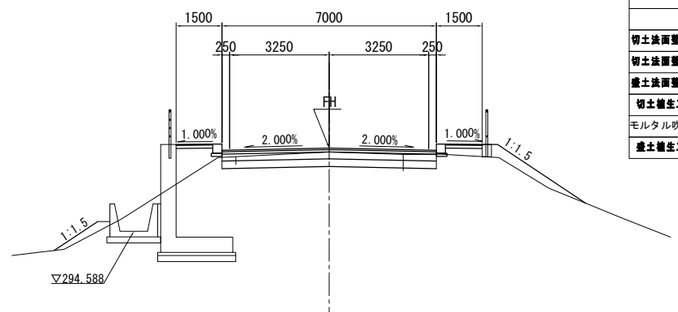
DL=290.000

No.7				
地盤高		297.33m	計画高	297.356m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	0.3
掘削（オ）		5.0	路体盛土	0.0
掘削（片）	礫	0.0	埋め戻し	17.9
掘削（オ）		26.2		

法面工				
左			右	
切土法面整形	S	0.0	切土法面整形	S	0.0
切土法面整形	礫	0.0	切土法面整形	礫	0.0
盛土法面整形		0.0	盛土法面整形		0.0
切土植生工	S	0.0	切土植生工	S	0.0
モルタル吹付	礫	0.0	モルタル吹付	礫	0.0
盛土植生工		0.0	盛土植生工		0.0

NO.8

GH=297.18
FH=297.308



DL=290.00

No.8				
地盤高		297.18m	計画高	298.308m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	1.3
掘削（オ）		3.1	路体盛土	1.3
掘削（片）	礫	0.0	埋め戻し	8.0
掘削（オ）		12.0		

法面工				
左			右	
切土法面整形	S	0.0	切土法面整形	S	0.0
切土法面整形	礫	0.0	切土法面整形	礫	0.0
盛土法面整形		1.7	盛土法面整形		3.5
切土植生工	S	0.0	切土植生工	S	0.0
モルタル吹付	礫	0.0	モルタル吹付	礫	0.0
盛土植生工		1.7	盛土植生工		3.5

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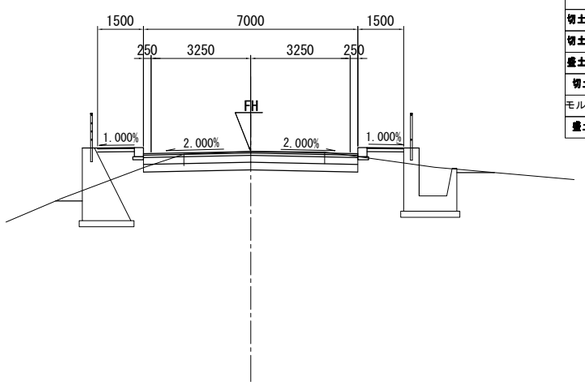
CROSS SECTION (3) (Passang Road)

A1:S=1:100
A3:S=1:200

NO.9+4.500

GH=297.52
FH=297.515

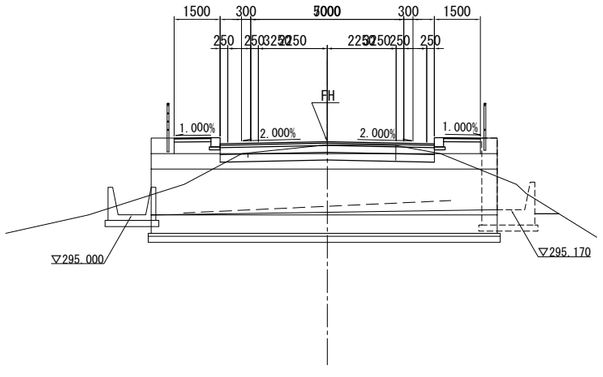


NO.9+4.500				
地盤高		297.52m	計画高	297.515m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	1.2
掘削（オ）		3.9	路体盛土	0.0
掘削（片）	礫	0.0	埋め戻し	5.6
掘削（オ）		10.4		

法面工					
左			右		
切土法面整形	S	0.0	切土法面整形	S	0.0
切土法面整形	礫	0.0	切土法面整形	礫	0.0
盛土法面整形		0.0	盛土法面整形		0.0
切土植生工	S	0.0	切土植生工	S	0.0
モルタル吹付	礫	0.0	モルタル吹付	礫	0.0
盛土植生工		0.0	盛土植生工		0.0

NO.8+14.000

GH=297.29
FH=297.393



NO.8+14.000				
地盤高		297.29m	計画高	297.393m
切土面積			盛土面積	
掘削（片）	S	0.0	路床盛土	1.0
掘削（オ）		35.4	路体盛土	0.0
掘削（片）	礫	0.0	埋め戻し	1.0
掘削（オ）		0.0		

法面工					
左			右		
切土法面整形	S	0.0	切土法面整形	S	0.0
切土法面整形	礫	0.0	切土法面整形	礫	0.0
盛土法面整形		0.0	盛土法面整形		0.0
切土植生工	S	0.0	切土植生工	S	0.0
モルタル吹付	礫	0.0	モルタル吹付	礫	0.0
盛土植生工		0.0	盛土植生工		0.0

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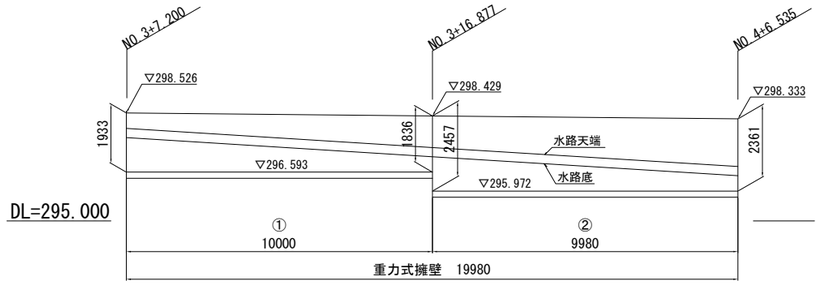
RETAINING WALL GENERAL DRAWING (Passang Road)

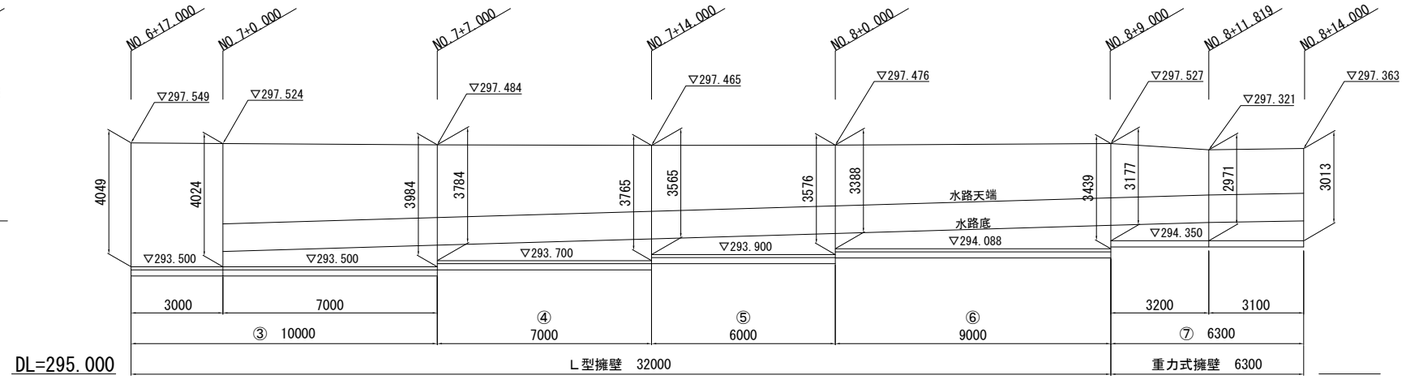
A1:S=1:100
A3:S=1:200

本線部擁壁展開図

起点側

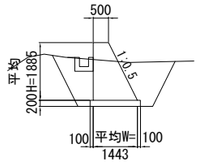


終点側

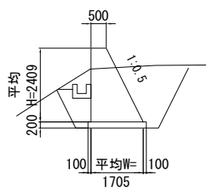


重力式擁壁

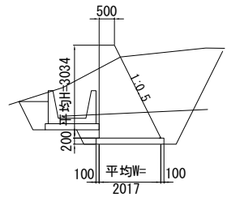
①区間
（平均断面）



②区間
（平均断面）

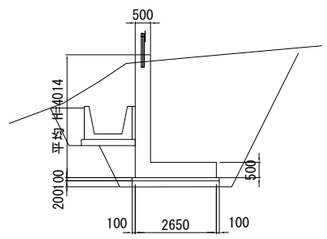


⑦区間
（平均断面）

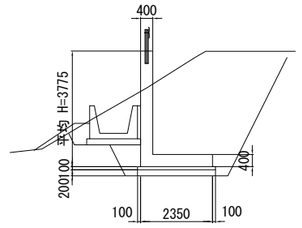


L型擁壁

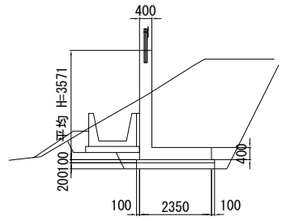
③区間
（平均断面）



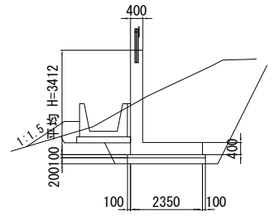
④区間
（平均断面）



⑤区間
（平均断面）



⑥区間
（平均断面）



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Appendix 6 Soundness survey

6. Soundness survey

(1) Characteristics at the bridge site

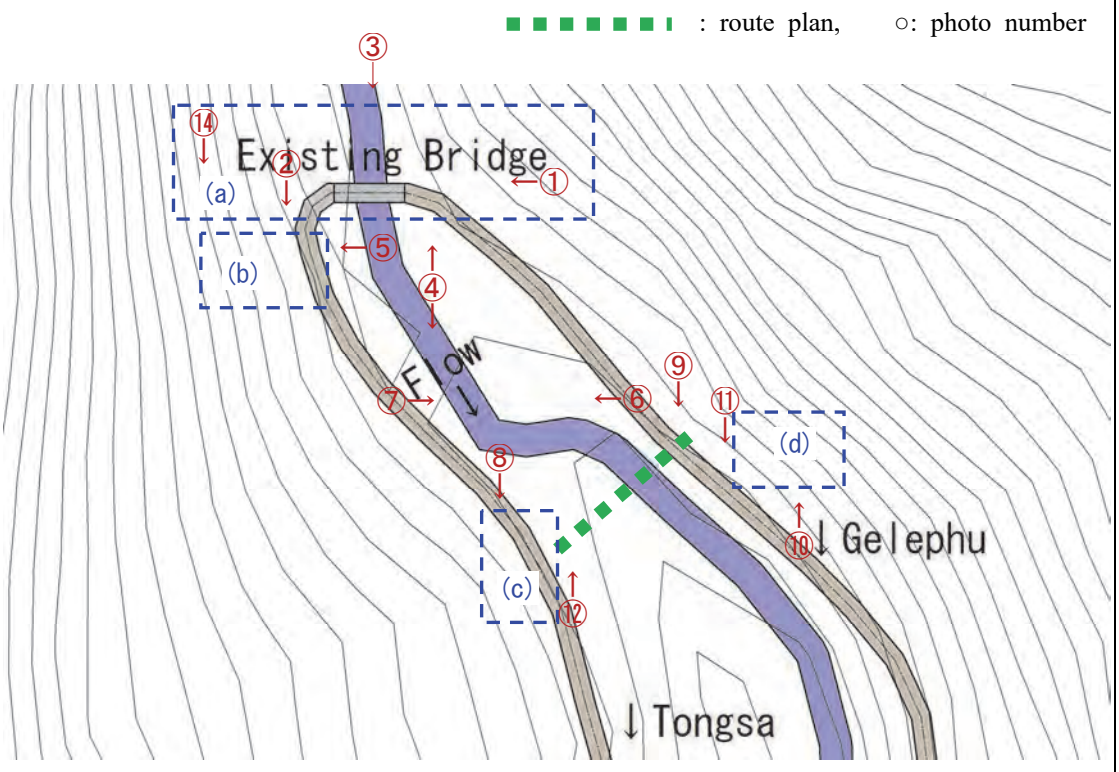
1) Telegangchu Bridge

The characteristics of the bridge site are shown by below figure.

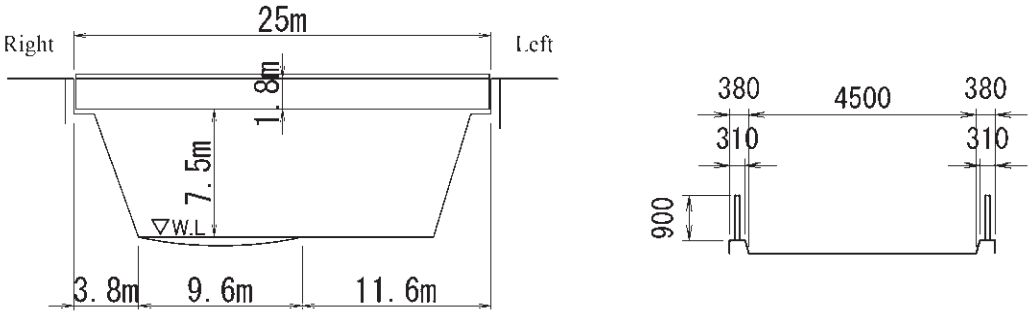
Characteristics

- The location of the bridge site is around 3km to the south from Tongsa city.
- The existing bridge is surrounded by mountains.(a)
- There is the slope failure aera around right side of the existing bridge.(b)
- There is the wall aera in the right bank around 200m away from the existing bridge to the down stream side.(c)
- There is the overhang of rock face in the road of the left bank around 200m away from the existing bridge to the down stream side.(d)
- There is the mountain which has a steep slope in the back side of both abutments of the existing bridge.

Plan

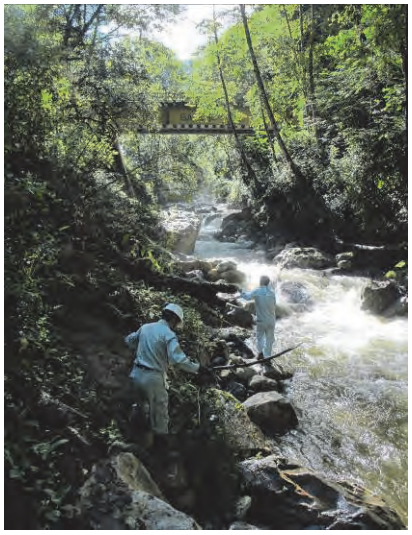


Exsisting bridge



Source: JICA study team

Figure1 Characteristics at Telegangchu bridge

No	Photograph	Memo
①		The existing bridge from the left bank
②		The existing bridge from the right bank
③		The existing bridge from upstream side
④	 	Left photo: The new route from downstream side of the existing bridge Right photo: The existing bridge from downstream side

Source: JICA study team

Figure2　The photograph of Telegangchu bridge (1/3)

No	Photograph	Memo
⑤		The slope failure aera around right side of the existing bridge
⑥		The river flow line is like a S shape around 150m downstream side from the existing bridge
⑦		The river and the road on right bank side
⑧		○ in the photo means the new abutment position on the right bank side.

Source: JICA study team

Figure3　The photograph of Telegangchu bridge (2/3)

No	Photograph	Memo
⑨		○ in the photo means the new abutment position on the left bank side.
⑩		○ in the photo means the new abutment position on the left bank side. And there is the waterfall in the downstream side from ○.
⑪		The overhang of rock face in the road of the left bank
⑫	 	Left photo: The wall aera in the right bank Right photo: The damage of the road near the wall area

Source: JICA study team

Figure4　The photograph of Telegangchu bridge (3/3)

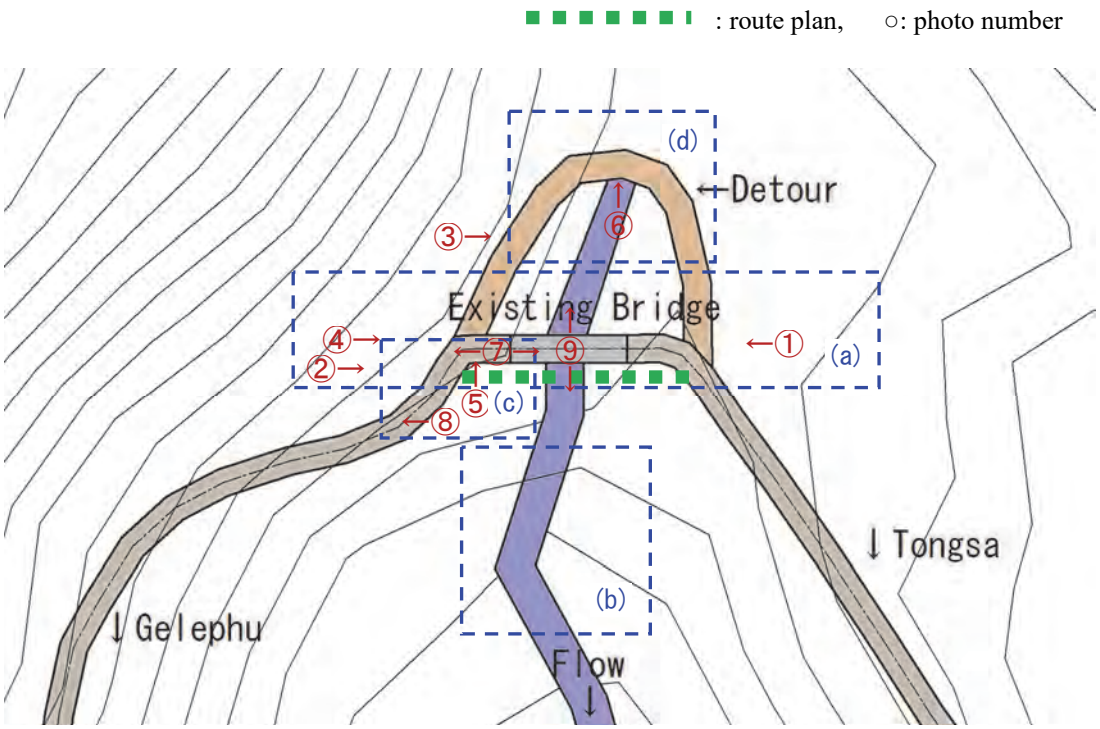
2) Beteni Bridge

The characteristics of the bridge site are shown by below figure.

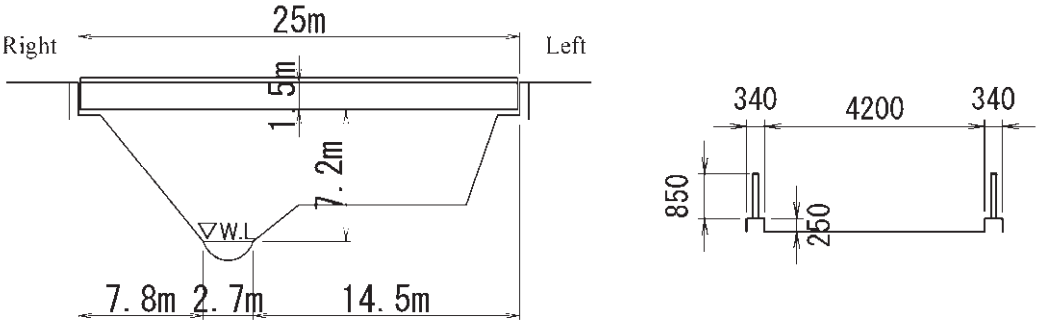
Characteristics

- The location of the bridge site is around 40km to the nouth from Gelephu city.
- The existing bridge is surrounded by mountains.(a)
- The riverbed greatly changes.(b)
- There is DOR office closed now in the right bank side near the existing bridge.(c)
- There is the detour for havey vehicle in the upstream bank side from the existing bridge.(d)
- There is the mountain which has a steep slope in the back side of both abutments of the existing bridge.

Plan



Exsisting bridge



Source: JICA study team

Figure5 Characteristics at Beteni bridge

No	Photograph	Memo
①		The existing bridge from the left bank
②		The existing bridge from the right bank
③		The existing bridge from the right bank on the detour
④		The existing bridge from the right bank
⑤	 	The guide sign

Source: JICA study team

Figure6　The photograph of Beteni bridge (1/2)

No	Photograph	Memo
⑥	 	The detour for havey vehicle in the upstream bank side from the existing bridge Left photo: The damage after the heavy rain Right photo: After reconstruction
⑦	 	Each banks from the existing bridge Left photo: overhang of rock face in the road of the right bank Right photo: there is a house on the hill
⑧		DOR office closed now in the right bank side near the existing bridge
⑨	 	The bottom of the river from the existing bridge Left photo: upstream side Right photo: downstream side

Source: JICA study team

Figure7 The photograph of Beteni bridge (2/2)

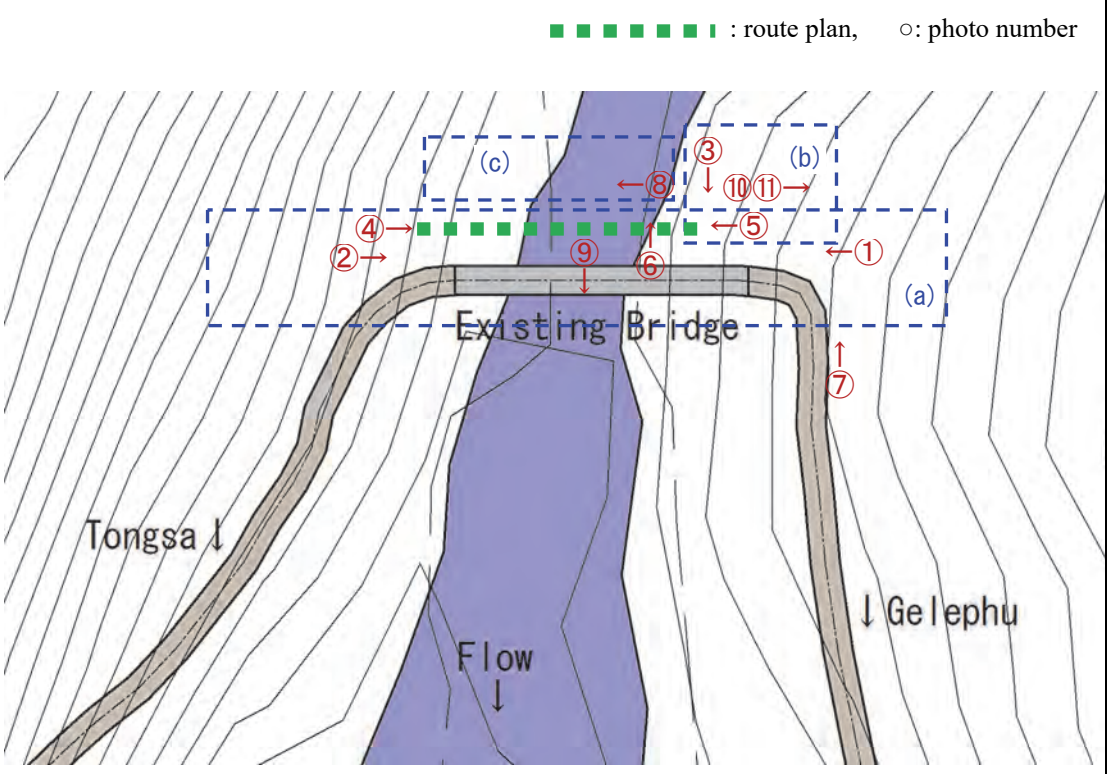
3) Samkhara Bridge

The characteristics of the bridge site are shown by below figure.

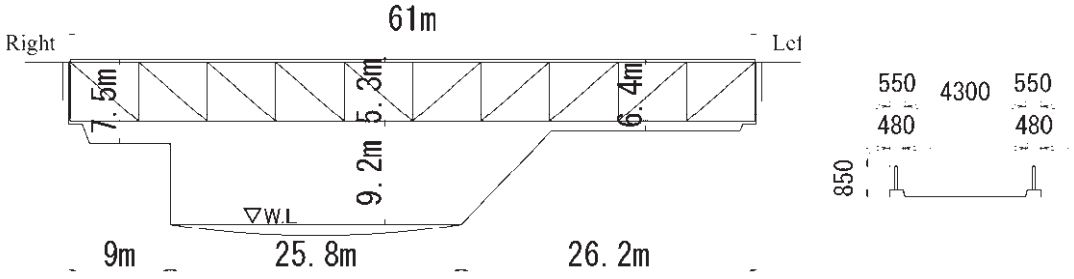
Characteristics

- The location of the bridge site is around 35km to the nouth from Gelephu city.
- The existing bridge is surrounded by mountains.（a）
- There are rocks in the spots of the river.
- There is DOR office closed now in the left bank side near the existing bridge.（b）
- There is the electric cable which is not used now near the existing bridge.（c）
- There is the mountain which has a steep slope in the back side of both abutments of the existing bridge.

Plan



Exsisting bridge



Source: JICA study team

Figure8　Characteristics at Samkhara bridge

No	Photograph	Memo
①		The existing bridge from the left bank
②		The existing bridge from the right bank
③		The existing bridge from the left bank
④		The existing bridge from the right bank
⑤		The upstream side of the existing bridge from the left bank
⑥		The upstream side of the existing bridge from the right bank

Source: JICA study team

Figure9 The photograph of Samkhara bridge (1/2)

No	Photograph	Memo
⑦		The existing bridge from the left bank
⑧		The bottom of the river from the upstream side of the existing bridge
⑨		The bottom of the river from the existing bridge
⑩		DOR office closed now in the left bank side near the existing bridge
⑪		DOR office closed now and the electric cable which is not used now in the left bank side near the existing bridge

Source: JICA study team

Figure10　The photograph of Samkhara bridge (2/2)

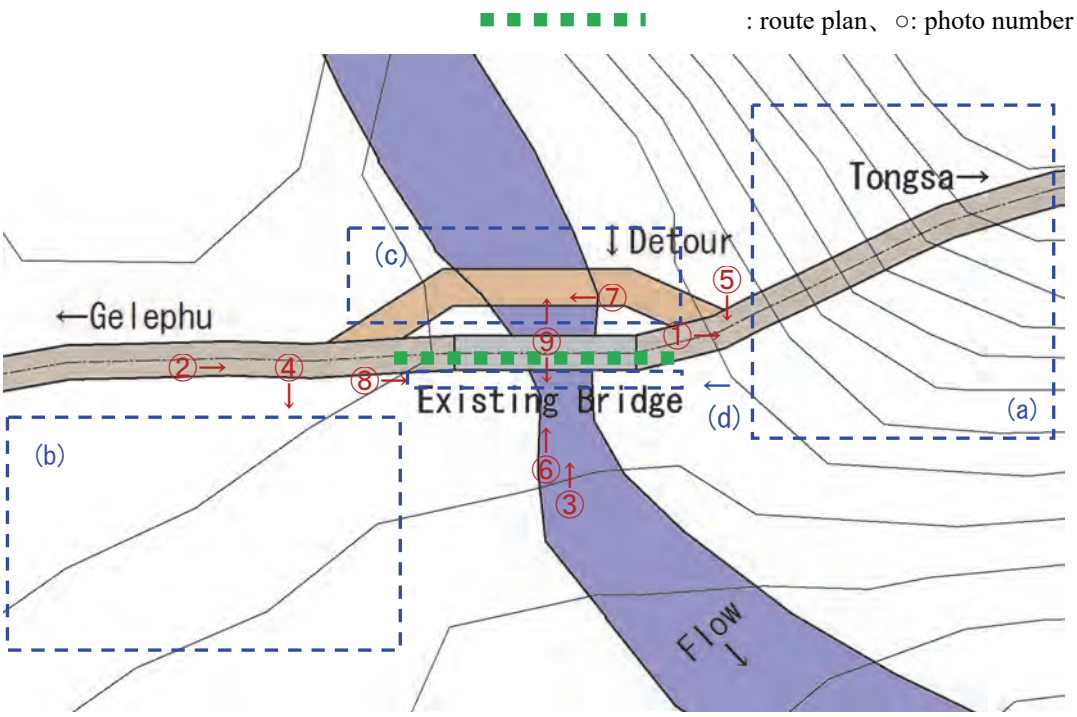
4) Passang Bridge

The characteristics of the bridge site are shown by below figure.

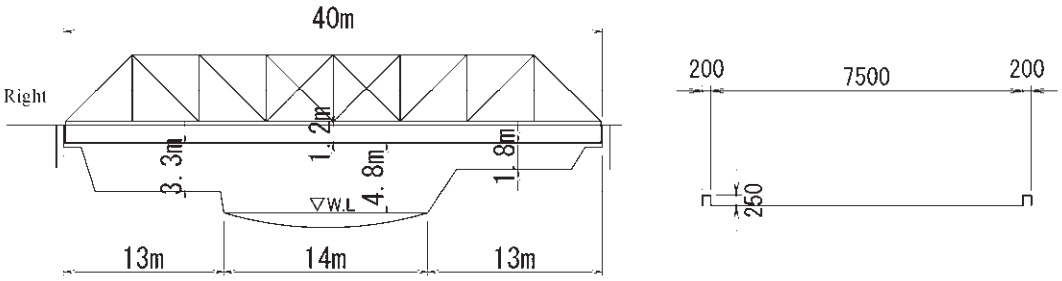
Characteristics

- The location of the bridge site is around 6km to the nouth from Gelephu city.
- There is a mountain in the left bank of upstream side ftom the existing bridge, and the office in the left bank of downstream side ftom the existing bridge.（a）
- There is the army office in the right bank of downstream side ftom the existing bridge.（b）
- There is the detour for havey vehicle in the upstream bank side from the existing bridge.（c）
- The existing bridge has the water pipe.（d）

Plan

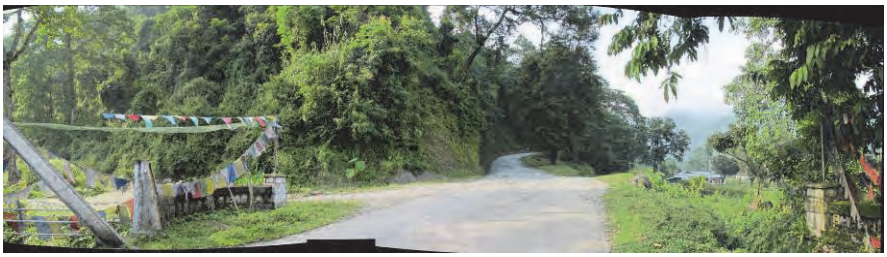


Exsisting bridge



Source: JICA study team

Figure11 Characteristics at Passang bridge

No	Photograph	Memo
①		The existing road of the left bank side from the existing bridge
②		The existing road of the right bank side from the existing bridge
③		The existing bridge from the downstream side
④		The army office in the right bank side from the existing bridge
⑤		The office in the left bank side from the existing bridge

Source: JICA study team

Figure12　The photograph of Passang bridge (1/2)

No	Photograph	Memo
⑥		The detour from the existing bridge (which has a damage)
⑦		The detour from the left bank side (which has a damage)
⑧	 	The water pipe
⑨	 	The bottom of the river from the existing bridge Left photo: upstream side Right photo: downstream side

Source: JICA study team

Figure13 The photograph of Passang bridge (2/2)

(2) Condition of Existing Bridges

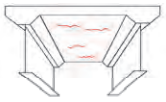
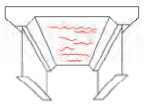
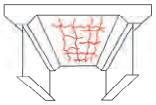
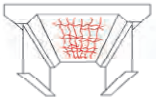
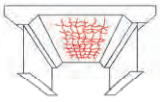
1) Survey methodology

Structural appraisals were conducted for the Study in accordance with the damage evaluation criteria (a. to e.) of the Ministry of Land, Infrastructure, Transport and Tourism, Japan. The details of the evaluation criteria are shown below. The survey consists mainly of visual inspections at a distance and visual inspections in close proximity, if close access is possible.

(a) Damage State to be Determined and Recorded *main bridge structure

Structure	Member	Material	Damage	Possibility of confirmation		Damage evaluation criterion (a ~ e) (Reference : Ministry of Land, Infrastructure, Transport and Tourism, MLIT in Japan))
				Visual inspection (from a distance)	Visual inspection (closer)	
Super-structure	Deck Slab	Concrete	Spalling/ Rebar exposure	○	○	a:Not found, b:-, c:Peeling, d:Rebar exposure(small), e:Rebar exposure(big)
			Water leakage/ Free lime	○	○	a:Not found, b:-, c:Water leakage, d:Free lime, e:Free lime+Rust fluid
			Crack	○	○	Appendix
			peeling off	△	○	a:Not found b:- c:- d:- e:Found
			Loose part	△	○	a:Not found b:- c:- d:- e:Found
	Main Girder	Steel	Corrosion	○	○	Appendix
			Crack	×	○	a:Not found b:- c:Crack of paintingcoating d:- e:Absolute crack
			Loosen / dropping of bolts	△	○	a:Not found, b:-, c:less than 5% of total, d:-, e:more than 5% of total
			Fracture	△	○	a:Not found b:- c:- d:- e:Found
			Deterioration of anti-corrosion function	△	○	a:Not found b:- c:Partial loose part d:Spalling e:Spalling and spot rusting
		Concrete	Crack	○	○	Appendix
			Spalling/ Rebar exposure	○	○	a:Not found b:- c:Peeling d:Rebar exposure(small) e:Rebar exposure(big)
			Water leakage/ Free lime	○	○	a:Not found b:- c:Water leakage d:Free lime e:Free lime+Rust fluid
			Loose part	△	○	a:Not found b:- c:- d:- e:Found
Substructure	Body	Concrete	Crack	○	○	Appendix
			Spalling/ Rebar exposure	○	○	a:Not found b:- c:Peeling d:Rebar exposure(small) e:Rebar exposure(big)
			Water leakage/ Free lime	○	○	a:Not found b:- c:Water leak d:Free lime e:Free lime+Rust fluid
		Concrete block/ masonry	Deformation	○	○	a:Not found b:- c:- d:- e:Found

【Crack on slab】

	Crack phenomenon	
a	【Crack spacing & crack characteristic】 Crack has occurred only on one direction and more than 1.0m as minimum crack spacing. 【Crack width】 Less than 0.05mm of maximum crack width (such as hair-crack)	
b	【Crack spacing & crack characteristic】 Crack has mainly occurred on one direction and crack spacing of between 1.0m ~ 0.5m, but not square-block type. 【crack width】 Mainly less than 0.1mm, but partly over 0.1mm.	
c	【Crack spacing & crack characteristic】 Crack has occurred on about 0.5m before square-block type. 【Crack width】 Mainly less than 0.2mm, but partly over 0.2mm.	
d	【Crack spacing & Crack characteristic】 Crack has occurred on 0.5m ~ 0.2m and also square-block type. 【Crack width】 Over 0.2mm and partly peeling off concrete	
e	【Crack spacing & Crack characteristic】 Crack has occurred on less than 0.2m and mainly square-block type. 【Crack width】 More than 0.2mm and continuously peeling off concrete	

【Corrosion on steel】

	Corrosion phenomenon
a	Nothing
b	Corrosion has ocuurred on steel surface, but impossible to see reduction of its thickness. Furtheremore very minor area of corrosion damage.
c	Corrosion has occurred on steel surface, but impossible to see reduction of its thickness. And crack has occurred entirely on focusing parts or some spred area.
d	Corrosion has occurred on steel surface, also possible to see slightly reduction of its thickness. And crack has occurred entirely on focusing parts or many spred area.
e	Corrosion has apparently expanded on steel surface, also possible to see definitely reduction of its thickness. And crack has occurred entirely with many spred area.

【Crack on concrete structure】

	Crack phenomenon
a	Nothing
b	Small crack width (less than 0.2mm in case of RC structure) , large crack spacing (over o.5m in case of minimum crack spacing)
c	Small crack width (less than 0.2mm in case of RC structure) , small crack spacing (over o.5m in case of minimum crack spacing)
	Or modest crack width (more than 0.2mm less than 0.3mm in case of RC structure) , large crack spacing (more than 0.5m in case of minimum crack spacing)
d	Modest crack width (more than 0.2mm less than 0.3mm in case of RC structure) , small crack spacing (more than 0.5m in case of minimum crack spacing)
	Or large crack with (more than 0.3mm in case of RC struture) , large crack spacing (more than 0.5m in case of minimum crack spacing)
e	Large crack width (more than 0.3mm in case of RC structure), small crack spacing (less than 0.5m in case of minimum crack spacing)

Source: the Ministry of Land, Infrastructure, Transport and Tourism, Japan

Figure14 The evaluation criteria(1/2)

(b) Damage State to be Determined and Recorded *bridge components and accessories

Structure	Member	Kinds of damage	Contents	Damage evaluation criterion (a～e) (Reference : Ministry of Land, Infrastructure, Transport and Tourism, MLIT in Japan))
Bearing shoe	Shoe	Functional deficit	Severe corrosion, damage/hardening/missing of parts	a:Not found b:- c:- d:- e:Functional deficit due to damage
		Extraordinary noises	Extraordinary noises in case of passing of vehicle	a:Not found b:- c:- d:- e:Found
	Mortar	Clogging with soil	Clogging with soil and water	a:Not found b:- c:- d:- e:Found
		Deformation･ Deficit	Crack of mortar, partial deficit	a:Not found b:- c:Partially found d:- e:Severely deficit
Ancillary facilities	Railing, Guardrail	Deformation･ Deficit	Broken due to collision of vehicle	a:Not found b:- c:Partially found d:- e:Severely deficit
			Dangerous location for passangers	
Deck surface	Pavement	Abnormity on pavement	Hole, big pothole, crack	a:Not found b:- c:- d:- e:Crack width is more than 5mm, etc
		Unevenness on road surface	Dangerous parts for passangers	a:Not found b:- c:less than 2cm d:- e:more than 2cm
	Expansion joint	Unevenness on road surface	Big gaps	a:Not found b:- c:less than 2cm d:- e:more than 2cm
		Abnormity at expansion gap	Broken	a:Not found b:- c:Small disconnect d:- e:Disjunction or contact
Drainage facilities		Clogging with soil	Clogging with soil and overlay	a:Not found b:- c:- d:- e:Found
		Water leak, Bearing water	Drainage facilities are broken and girder is directly afftected by drained water, etc.	a:Not found b:- c:- d:- e:Water leakage･ Bearing water
Whole bridge		Extraordinary deflection	Extraordinary deflection is found	a:Not found b:- c:- d:- e:Found
		Settlement, movement, tilting	Settlement, movement, incline at foundation and bearing, etc.	a:Not found b:- c:- d:- e:Found
		Scouring	Scouring at pier, foundation	a:Not found b:- c:Scouring d:- e:Severe scouring
		Others	Illegal occupation, graffiti, damage by birds, damage by fire, etc.	Only record

Source: the Ministry of Land, Infrastructure, Transport and Tourism, Japan

Figure15 The evaluation criteria(2/2)

2) Evaluation results

Summary

Telegangchu: There is the spalling/ rebar exposure at the slab and slope failure aera around right side of the existing bridge.

Beteni: There is a havey crack on the wall of the abutment.

Samkhara: There are many corrosions in the girder and many damages of the slab.

Passang: There are many corrosions in the girder and many damages of the slab and the abutment.

Structure	Member	Damage	Tele	Beteni	Samk	Passa
Super structure	Slab	Spalling Rebar exposure	e	a	a	c
		Water leak Free lime	a	a	d	c
		Crack	a	a	d	b
		Peeling off	a	a	a	a
		Loose part	a	a	a	a
	Girder (Steel)	Corrosion	—	—	b	c
		Crack	—	—	Cannot find	Cannot find
		Loosen/dropping of bolts	—	—	a	a
		Fracture	—	—	a	a
		Deterioration of anti-corrosion function	—	—	e	e
	Girder (concrete)	Crack	a	b	—	—
		Spalling Rebar exposure	d	a	—	—
		Water leak Free lime	a	a	—	—
		Loose part	a	a	—	—
Sub structure	Body	Crack	a	d	a	a
		Spalling Rebar exposure	a	a	c	a
		Water leak Free lime	a	a	a	a
Revetment		Deformation	a	a	-	e

Source: JICA study team

Figure16 The evaluation of each bridge (1/2)

Structure	Member	Damage	Tele	Beteni	Samk	Passa
Bearing shoe	Shoe	Functional deficit	e	e	a	e
		Extraordinary noises	a	a	a	a
	Mortar	Clogging with soil	a	e	e	e
		Deformation	a	Cannot find	a	Cannot find
Ancillary facilities	Railing	Deformation	c	a	a	a
Deck surface	Pavement	Abnormity on pavement	No As	e	a	e
		Unevenness on road surface	c	a	e	a
	Joint	Unevenness on road surface	c	c	a	Cannot find
		Abnormity at expansion gap	c	Too close	a	Cannot find
Drainage facilities		Clogging with soil	Nothing	a	a	a
		Water leak Free lime	Nothing	a	a	e
Whole bridge		Extraordinary deflection	a	a	a	a
		Settlement, movement, tilting	e	a	a	a
		Scouring	c	a	a	a
		Others	Moss			

Source: JICA study team

Figure17 The evaluation of each bridge (2/2)

Site condition Photo	Location	from Tongsa side	Location	from Gelephu side
				
	Location	from down stream of Tongsa	Location	from down stream of Gelephu
				
	Location	from up stream of Tongsa	Location	from up stream of Gelephu
				
	Location	down stream direction	Location	up stream direction
				

Source: JICA study team

Figure18　The bridge ledger of Telegangchu bridge(1/2)

Damage photo

Member	Slab			Member	Girder		
Type	Rabar exposure	Level	e	Type	Spalling/Rabar exposure	Level	d
Condition				Condition	By poor construction		
							
Member	Body			Member	Bearing shoe		
Type		Level	a	Type	Functional defict	Level	e
Condition	Soundness			Condition	Functional defict by water and soil		
							
Member	Railing			Member	Pavement and Joint		
Type	Deformation	Level	c	Type	Unevenness	Level	c
Condition				Condition			
							
Member	Whole bridge			Member	Whole bridge		
Type	Slope failure	Level	e	Type	Scouring	Level	c
Condition	The abutment becomes dangerous by Slope failure.			Condition	There is a possibility to scour because of the condition of abutment and the river flow.		
							

Source: JICA study team

Figure19 The bridge ledger of Telegangchu bridge (2/2)

Site condition Photo				
	Location	from Tongsa side	Location	from Gelephu side
				
	Location	from down stream of Tongsa	Location	from down stream of Gelephu
				
	Location	from up stream of Tongsa	Location	from up stream of Gelephu
				
	Location	down stream direction	Location	up stream direction
				

Source: JICA study team

Figure20 The bridge ledger of Beteni bridge (1/2)

Damage photo

Member	Slab			Member	Main girder		
Type		Level	a	Type	Crack	Level	b
Condition	Soundness			Condition	There are many small cracks.		

Member	Body			Member	body		
Type	Crack	Level	d	Type	Crack	Level	d
Condition	There is a heavy crack line on the wall of the abutment.			Condition	There is a heavy crack line on the wall of the abutment.		

Member	Bearing shoe			Member	Pavement		
Type	Functional defict	Level	e	Type	Unevenness	Level	e
Condition	By clgging with soil			Condition			

Member	Expantion joint			Member			
Type	Abnormity	Level	e	Type		Level	
Condition	No space			Condition			

Source: JICA study team

Figure21 The bridge ledger of Beteni bridge (2/2)

Site condition Photo				
	Location	from Tongsa side	Location	from Gelephu side
				
	Location	from down stream of Tongsa	Location	from down stream of Gelephu
				
	Location	from up stream of Tongsa	Location	from up stream of Gelephu
				
	Location	down stream direction	Location	up stream direction
				

Source: JICA study team

Figure22　The bridge ledger of Samkhara bridge (1/2)

Damage photo

Member	Slab			Member	Slab		
Type	Free lime	Level	d	Type	Crack	Level	d
Condition				Condition			
							
Member	Main girder			Member	Main beam		
Type	Corrosion	Level	b	Type	Deterioration	Level	e
Condition				Condition			
							
Member	Body			Member	Bearing shoe		
Type	Spalling	Level	c	Type	Clogging with soil	Level	e
Condition	By poor construction			Condition			
							
Member	Pavement			Member			
Type	Unevennes	Level	e	Type		Level	
Condition				Condition			
							

Source: JICA study team

Figure23 The bridge ledger of Samkhara bridge (2/2)

Site condition Photo	Location	from Tongsa side	Location	from Gelephu side
				
	Location	from down stream of Tongsa	Location	from down stream of Gelephu
				
	Location	from up stream of Tongsa	Location	from up stream of Gelephu
				
	Location	down stream direction	Location	up stream direction
				

Source: JICA study team

Figure24 The bridge ledger of Passang bridge (1/2)

Damage photo

Member	Slab			Member	Slab		
Type	Spalling/Water leakage	Level	c	Type	Crack	Level	b
Condition	By water from drainage			Condition	The detail investigation is nessary.		
							
Member	Main girder			Member	Main girder		
Type	Corrosion	Level	c	Type	Deterioration	Level	e
Condition				Condition			
							
Member	Body			Member	Bearing shoe		
Type	Deformation	Level	e	Type	Clogging with soil	Level	e
Condition				Condition			
							
Member	Pavement			Member	Drainage facilities		
Type	Abnormity	Level	e	Type	Water leakage	Level	e
Condition				Condition	There are not drainage facilities.		
							

Source: JICA study team

Figure25　The bridge ledger of Passang bridge (2/2)

Appendix 7 Supplemental Explanation of Quantitative Effects from the Grant-Aid Project

7. Supplemental Explanation of Quantitative Effects from the Grant-Aid Project

(1) Introduction

This part is made for supplemental explanation of quantitative effects from the grant-aid project as mentioned in Chapter 3 of the main text. The indices to be discussed are as shown in the following table.

Quantitative effects from the grant-aid project

Index		Standard value (measured in 2015)	Target value (2024) [In three years after completion of the project]
Annual average daily traffic (vehicles/day)	Trongsa – Zhemgang	190	245
	Zhemgang – Gelephu	233	301
Annual average daily passengers (numbers/day)	Trongsa – Zhemgang	640	826
	Zhemgang – Gelephu	785	1,014
Annual average daily cargo weight (ton/day)	Trongsa – Zhemgang	382	493
	Zhemgang – Gelephu	469	606

(2) Outline of the Traffic Survey

In the preparatory survey period, the traffic counting work by vehicle type was implemented in accordance with the methodology and work contents indicated in the following table.

Outline of Traffic Counting Work by Vehicle Type

Item	Contents
Work method	Counting by the surveyor
Survey point	Trongsa (Telegangchu Bridge), Mid. point (Beteni Bridge), Gelephu (Passang Bridge): total 3points
Work period	1day in weekday and 1day in weekend: total 2days, September, 2015
Working hours	12hours (06:00 ~ 18:00)

Subsequently, the daily traffic volume (2-directions) in each section was calculated as shown in the following table on the basis of the survey result.

Daily Traffic Volume (2-directions) by Section

Section	Weekday (03/Sep)	Weekend (05/Sep)
Trongsa – Zhemgang	**190vehicle per day**	164vehiclles per day
Zhemgang – Gelephu	**233vehicles per day**	197vehicles per day

Note there were not big differences of the volumes between “weekday” and “weekend” in the both sections. Therefore, the volume in the weekday having larger volume was defined as “standard value” of the indices.

(3) Supplemental Explanation for the Indices

1) Annual Average Daily Passengers

Composition ratio of vehicle type in the daily traffic volume is as shown in the following table.

Composition Ratio of Vehicle Type in the Daily Traffic Volume

Point	Car	Van	Mini bus	Large bus	Pick up-truck (4 Wheels)	2 Axle truck	3 Axle truck	4 or more axle	Motor cycle	Total
Telegangchu (Week day)	57	19	3	5	81	23	0	1	1	190
Telegangchu (Week end)	56	16	0	0	62	26	2	0	2	164
Beteni (Week day)	17	1	0	0	15	13	2	0	0	48
Beteni (Week end)	13	0	0	1	1	12	20	0	0	47
Passang (Week day)	93	24	5	6	57	43	0	0	5	233
Passang (Week end)	69	20	0	10	49	39	2	0	8	197
Total	305	80	8	22	265	156	26	1	16	879
Ratio	**34.70%**	**9.10%**	**0.91%**	**2.50%**	**30.15%**	**17.75%**	**2.96%**	**0.11%**	**1.82%**	**100%**

JICA survey team additionally implemented counting work of numbers of the passengers after randomly selecting some vehicles (3 to 5) by vehicle type near the project site (Trongsa). As a result, average daily passengers was computed on the basis of "average passengers by vehicle type" and "standard value of average daily traffic volume" as shown in the following tables.

Annual Average Daily Passengers (Standard Value): Trongsa – Zhemngang Setion

Item	Car	Van	Mini bus	Large bus	Pick up-truck (4 Wheels)	2 Axle truck	3 Axle truck	4 or more axle	Motor cycle	Total
Numbers of vehicles	66	17	2	5	57	34	6	0	3	190
Passengers (average)	3	3	10	25	3	2	2	2	1	
Total	198	52	17	119	172	67	11	0	3	**640**

Annual Average Daily Passengers (Standard Value): Zhemngang – Gelephu Setion

Item	Car	Van	Mini bus	Large bus	Pick up-truck (4 Wheels)	2 Axle truck	3 Axle truck	4 or more axle	Motor cycle	Total
Numbers of vehicles	81	21	2	6	70	41	7	0	4	233
Passengers (average)	3	3	10	25	3	2	2	2	1	
Total	243	64	21	146	211	83	14	1	4	**785**

Given the above calculation, increasing ratio of the traffic volume between "standard values" and "target value in three years after completion of the project (2024)", namely

- Trongsa – Zhemngang : 245vehicles
- Zhemngang – Gelephu : 301vehicles

set up the target value of this index as follows;

- Trongsa – Zhemngang : (245vehicles / 190vehicles) × 640passengers = **826passengers per day**
- Zhemngang – Gelephu : (301vehicles / 233vehicles) × 785passengers = **1,014passengers per day**

2) Annual Average Daily Cargo Weight

As same as above section, the team additionally implemented confirmatory work for cargo weight of freight vehicles by interview and visual after randomly selecting some vehicles (3 to 5) by vehicle type near the project site (Trongsa). As a result, average daily cargo weight was computed on the basis of "average weight by vehicle type" and "standard value of average daily traffic volume" as shown in the following tables.

Annual Average Daily Cargo Weight (Standard Value): Trongsa – Zhemngang Setion

Item	Car	Van	Mini bus	Large bus	Pick up-truck (4 Wheels)	2 Axle truck	3 Axle truck	4 or more axle	Motor cycle	Total
Numbers of vehicles	66	17	2	5	57	34	6	0	3	190
Ave. weight (t)		0.1			0.2	8.0	15.0	70.0		
Total	0.0	1.7	0.0	0.0	11.5	269.8	84.3	15.1	0.0	**382**

Annual Average Daily Cargo Weight (Standard Value): Zhemngang – Gelephu Setion

Item	Car	Van	Mini bus	Large bus	Pick up-truck (4 Wheels)	2 Axle truck	3 Axle truck	4 or more axle	Motor cycle	Total
Numbers of vehicles	81	21	2	6	70	41	7	0	4	233.0
Ave. weight (t)		0.1			0.2	8.0	15.0	70.0		
Total	0.0	2.1	0.0	0.0	14.0	330.8	103.4	18.6	0.0	**469**

Given the above calculation and the increasing ratio set up the target value of this index as follows;

- Trongsa – Zhemngang : (245vehicles / 190vehicles) × 382tons = **493tons per day**
- Zhemngang – Gelephu : (301vehicles / 233vehicles) × 785tons = **606tons per day**