

## Chapter 3 Project Evaluation

### 3.1 Preconditions

The preconditions necessary for the Project implementation will be as follows. Furthermore, the compensation on land acquisition and the documents approved from the relevant organizations necessary in principle to be completed by time of the announcement of prequalification for contractors after the E/N.

- ✧ In order to secure the project land by DoR, land acquisition of approximately 243m<sup>2</sup> is required at Chuzomsa bridge. The detail of land acquisition is described in Chapter 1.4.2 Land acquisition and resettlement. Land acquisition and payment of compensation shall be completed by the time of the announcement of prequalification for contractors.
- ✧ DoR should conduct IEE and obtain environmental clearance from NEC for implementation of this project.
- ✧ Cooperation and support to custom clearance and tax exemption for procurement materials and equipment for the project needs to be executed rapidly. Those tasks to be done by DoR are described in Chapter 2.3 in detail.
- ✧ After completion of the project, maintenance work by Bhutan is required in order to ensure smooth traffic and the life of road and structures for the project. Implementation of maintenance work including, routine maintenance, cleaning and removal of obstacles is required. At the same time, periodic inspection needs to be surely executed and repair work needs to be properly done if any damage is observed. Therefore, DoR should place personnel and secure budget necessary for aforementioned maintenance and repair work and conduct continuous maintenance work. Those tasks to be done by DoR are mentioned in Chapter 2.4 in detail.

It is supposed that DoR is able to suitably use and maintain the expense and facility. DoR is also able to maintain an adequate budget for operation and maintenance of this bridge after completion of the Project. Therefore it is supposed that the Bhutan side will secure these preconditions for the implementation of the Project.

### 3.2 Necessary Inputs by Recipient Country

Necessary inputs for the realization and sustainability of the Project effects are as follows;

- ✧ Bhutan needs to secure the budget described in Chapter 2.3 in order to execute the project smoothly.
- ✧ To ensure the permanent function of the bridges for project, Bhutan needs to place personnel continuously perform maintenance work and secure budget mentioned in Chapter 2.4 after the completion of the project.
- ✧ DoR needs to place personnel for environmental and social considerations in order to subsequently implement the requirements for the matter such as obtaining environmental clearance and

implementation of land acquisition.

### 3.3 Important Assumptions

Important assumptions for the realization and sustainability of the Project effects are as follows;

- ✧ The further increase in traffic volume is expected after completion of this project. Therefore, routine and periodic maintenance needs to be done continuously in order to ensure the safety of facility expected in the design.
- ✧ In order to ensure smooth traffic on PNH No.1, not only 3 bridges for this project but also widening of road and replacement and reinforcement of bridges in other sections of PNH No.1 needs to be completed.

If the above important assumptions are conducted properly, the intended Project effects shall be realized.

### 3.4 Project Evaluation

#### 3.4.1 Relevance

The principal road network of Bhutan includes only PNH No.1 running east to west and four PNH (No. 2 to 5) running south to the border to India (with the total length of national highways being about 1,860 km (2013)). Specifically, PNH No.1 is the sole trunk road connecting east and west in Bhutan and is of extremely high importance for traffic and transport. The Thimphu - Trongsa section of this highway is facing bridge issues of deterioration, inadequate design criteria, etc. This study examined the relevance of reconstructing three requested bridges in terms of aspects shown below.

#### (1) Alignment with the higher plans of Bhutan

MoWHS developed “Road Sector Master Plan (2007-2027)”. Over the 20-year period up to 2027, it is intended to expand the prefectural and national road network, improve feeder roads, and implement bridge maintenance, repair, and reconstruction. In addition, “11th Five Year Plan (2013~ 2018)” shows the maintenance and repair of existing roads (3,522 km) and reconstruction of bridges (24 bridges) under control of DoR. It also includes a plan of widening of PNH No.1. Reconstruction of the bridges on PNH No.1 in this project is well aligned with above higher plans of Bhutan and is considered highly relevant in terms of project implementation.

#### (2) Importance of PNH No.1 in the road network

As described above, PNH No.1 is the most important national highway in Bhutan, functioning as the one and only trunk road connecting east and west. The Southern East-West Corridor is being constructed as an alternative to PNH No.1, whose progress is sluggish practically due to such issues as fund shortage, environmental application, etc. PNH No.1 will retain its position as the most vital route in Bhutan. On other hand, widening of highway is pushed forward at a rapid rate sequentially from the

Thimphu side under financial assistance from India. The vital issue in this event is how to eliminate, within the scope of the limited budget of the DoR, bottlenecks for large and heavy vehicles whose traveling is expected to increase in the future. Implementation of this project will contribute to elimination of bottlenecks of PNH No.1 and the project is considered highly relevant.

### **(3) Improvement of the width and load carrying capacity**

According to the existing design standard of Bhutan, PNH No.1 is classified into the “Primary National Highway.” The bridges are demanded to secure the effective width of 7.0 m and to meet the loading condition of IRC 70R (100t, single lane) or IRC Class A (double lane) of IRC standard (Indian Design Standard). Most of existing bridges on PNH No.1, including those of the projects, are actually not complying with above requirements on the width and loading conditions. Implementation of this project is considered highly relevant because the project will contribute to improvement of the safety of PNH No.1 by improving the deficiency in the width and load carrying capacity of three target bridges.

### **(4) Breakthrough of technological difficulties**

Bridges on PNH No.1 includes 10 deteriorated bridges constructed before 1980s, which do not comply with the existing design standard in terms of both the width and the load carrying capacity. Three target bridges of the project are among them, which present extreme technological difficulties specifically in terms of the bridge length, clearance under girder, proximity to houses, etc. As reinforcement and reconstruction of the target bridges solely by means of local technological resources is difficult and utilization of Japanese technologies is meaningful, implementation of the project is considered highly relevant.

### **(5) Reconstruction of damaged bridges**

As described above, three target bridges are highly deteriorated and their integrity was evaluated in this study according to the damage evaluation criteria of MLIT, Japan. As a result, all of them were confirmed to be damaged due to deterioration and are in the state “requiring repair and other measures.” Major damages confirmed include exposed reinforcements in the substructure for Chuzomsa Bridge, cracks in the substructure for Nikachu Bridge, and scoured foundation for Zalamchu Bridge. None of these bridges are likely to collapse immediately, and partial reinforcement may be done instead of reconstruction. However, the load carrying capacity of existing bridges was only 40R (55t) even at a time of construction and is difficult to increase to the allowable load of 70R (100 t) by reinforcement only, which means that reconstruction, not reinforcement, should be done. Therefore, reconstruction of new bridges is considered relevant in this project.

### **(6) Relationship with the national projects**

Construction of the hydropower plant is the most critical factor for economic development of Bhutan. Ten hydropower plant construction projects are in the 11th Five-year plan. At present, the Mangdechu

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Hydropower plant is being constructed in Trongsa, in which PNH No.1 is playing a vital role for transport of dam construction materials. Specifically, development of the bridge with the load carrying capacity of 100t is essential for smooth transport of the transformer, the heaviest component of the plant. Reconstruction of the bridge with the load carrying capacity of 100t according to the design standard, as above described, will enable transporting the hydropower plant transformer. Reconstruction of the bridge will therefore contribute to promotion of important national projects and is considered highly relevant.

### 3.4.2 Effectiveness

#### (1) Quantitative effects

Quantitative effects expected from the grant-aid project are summarized in Table 3.4.1.

**Table 3.4.1 Quantitative effects from the grant-aid project**

Index		Standard value (Performance of 2014)	Target value (2020) [In three years after completion of the project]
Bridge load-carrying capacity (total axle load) (t)	Chuzomsa Bridge	55	100
	Nikachu Bridge	55	100
	Zalamchu Bridge	55	100
Average traveling speed* (km/h) * Calculated on the basis of road alignment	Chuzomsa Bridge	16	30
	Nikachu Bridge	16	20
	Zalamchu Bridge	13	20
Annual average daily traffic (vehicles/day)	Wangdue - Pelela Pass	434	541
	Pelela Pass - Trongsa	314	390

Source: JICA Study Team

#### (2) Qualitative effects

Qualitative effects expected from the grant-aid project are listed below;

- ◇ Improvement of the bridge safety

Reconstruction of the bridge, with consequential solution of such issues as deterioration, insufficient width, insufficient loading capacity of existing bridges, will enhance the bridge safety for vehicles.

- ◇ Promotion and smoothing of physical flow

PNH No.1 is the most important trunk which supports Bhutanese economy. The project will contribute to promotion and smoothing of physical flow by eliminating the bottlenecks for large vehicles and by securing the stable cargo transport.

- ◇ Securing the safety of pedestrians

For two bridges (Chuzomsa Bridge and Nikachu Bridge) with houses in the neighborhood and frequent traffic of pedestrians, construction of a new sidewalk will secure the safety of pedestrians (specifically, vulnerable road users, such as women and children).

In consequence, the Project is expected to be relevant.

## 【Appendices】

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## 1. Member List of the Study Team

Name	Position	Organization
Nobuyuki Tsuneoka	Team Leader	Senior Advisor, JICA
Yasunori Tonegawa	Project Management	Transportation and ICT Group, Infrastructure and Peacebuilding Department, JICA
Keigo Konno	Chief Consultant/Bridge Planning	Oriental Consultants Global Co., Ltd.
Yasuhisa Suganuma	Deputy Chief Consultant/Bridge Planning/Road Design	Oriental Consultants Global Co., Ltd.
Shinichi Nii	Bridge Design	INGÉROSEC Corporation
Tetsuya Sano	Natural Condition Survey (Topography and Geology)	Oriental Consultants Global Co., Ltd.
Yoshiyuki Akagawa	Hydrology/River Planning	INGÉROSEC Corporation
Mitsuhide Saito	Construction Planning /Cost Estimates	INGÉROSEC Corporation
Mizuki Takahashi	Environmental and Social Considerations	Oriental Consultants Global Co., Ltd.
Shinya Yamanami	Assistance of Bridge Design	INGÉROSEC Corporation

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ON PRIMARY NATIONAL HIGHWAY NO.1 IN THE KINGDOM OF BHUTAN  
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**2. Study Schedule**

**(1) The first field survey**

Date	JICA			Consultants						
	Team Leader Mr. Nobuyuki Tsuneoka	Planning Coordinator Mr. Yasunori Tonegawa	Chief Consultant/ Bridge Planner Mr. Keigo Konno	Deputy Chief/Bridge Planner/Road Designer Mr. Yasuhisa Suganuma	Bridge Designer Mr. Shinichi Nii	Natural Condition Surveyer (Topography & Geology) Mr. Tetsuya Sano	Hydrology Specialist Mr. Yoshiyuki Akagawa	Construction Programmer/ Cost Estimator Mr. Mitsuhide Saito	Environment & Social Impact Specialist Ms. Mizuki Takahashi	Bridge Design Assistant Mr. Shinya Yamanami
1 7/27 Sun							Move:Tokyo⇒Bangkok			
2 7/28 Mon							Move:Bangkok⇒Paro			
3 7/29 Tue		Tokyo(00:10)T6661⇒ Bangkok(04:50) Bangkok(06:50)KB127⇒ Paro(09:50)	Meeting with related agencies. Data/Information collection in Thimphu							
4 7/30 Wed		10:30 Steering Committee Project for Master Plan Study on Road Slope Management								
5 7/31 Thu		Tokyo(00:20)T6661⇒ Bangkok(04:50) Bangkok(06:50)KB141 ⇒Paro(10:15)								
6 8/1 Fri		13:30 Meeting with JICA HQ in Thimphu								
7 8/2 Sat		Meeting with JICA Bhutan Office								
8 8/3 Sun		Explanation of Inception Report to DoR and GNHC in Thimphu								
9 8/4 Mon		Discussion with DoR								
10 8/5 Tue		Documentation and Data/Information collection in Thimphu								
11 8/6 Wed		Site investigation : Thimphu→Trongsa(NH1)								
12 8/7 Thu		Site investigation : Trongsa→Thimphu(NH1)								
13 8/8 Fri		Discussion with Field Offices of DoR								
14 8/9 Sat		W/D Discussion with DoR in Thimphu								
15 8/10 Sun		Signing on the M/D Report to JICA Bhutan Office								
16 8/11 Mon		Paro(08:10)KB206⇒Mumbai Bombay(10:50) Mumbai Bombay(16:10)9K35⇒Delhi(18:25)								
17 8/12 Tue		10:00 Report to EOJ								
18 8/13 Wed		Delhi(23:30)TG316⇒ Bangkok(05:25)	Data/Information collection in Thimphu							
19 8/14 Thu		Delhi(03:10)⇒ Tokyo(15:45)								
20 8/15 Fri			Site investigation : Thimphu→Wangdue(NH1)							
21 8/16 Sat			Site investigation : Wangdue→Trongsa(NH1)							
22 8/17 Sun			Site investigation : Trongsa→Wangdue(NH1)							
23 8/18 Mon			Site investigation : Wangdue→Thimphu(NH1)							
24 8/19 Tue										
25 8/20 Wed										
26 8/21 Thu										
27 8/22 Fri										
28 8/23 Sat										
29 8/24 Sun										
30 8/25 Mon										
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57 9/21 Sun										
58 9/22 Mon										
59 9/23 Tue										
60 9/24 Wed										
61 9/25 Thu										
62 9/26 Fri										



## Appendices

### (2) The second field survey (Explanation of Draft Outline Design Report)

			JICA		Consultants			
			Team Leader	Planning Coordinator	Chief Consultant/ Bridge Planner	Deputy Chief/Bridge Planner/Road Designer	Bridge Designer	
			Mr. Nobuyuki Tsuneoka	Mr. Yasunori Tonegawa	Mr. Keigo Konno	Mr. Yasuhisa Suganuma	Mr. Shinichi Nii	
1	1/13	Tue	Tokyo(00:20)TG661⇒Bangkok(05:20) Bangkok(07:20)KB121⇒Paro(09:20)					
			12:30 Meeting with JICA Bhutan Office 14:30 Explanation of Draft final Report to DoR and GNHC M/D Discussion with DoR and GNHC					
2	1/14	Wed	M/D Discussion with DoR and GNHC					
3	1/15	Thu	10:30 Signing on the M/D 15:30 Report to JICA Bhutan Office					
4	1/16	Fri	Paro(08:40)KB204⇒Delhi(11:40)		Site investigation : Thimphu→Trongsa(NH1) Discussion with Lobesa Field Office of DoR			
			PM Report to EOJ					
			Delhi(20:20)JL740⇒					
5	1/17	Sat	Tokyo(07:10)		Site investigation : Trongsa→Thimphu(NH1) Discussion with Trongsa Field Office of DoR			
6	1/18	Sun			Move:Paro⇒Bangkok	Project for a Master Plan Study of Road Slope Management in Bhutan	Move:Paro⇒Bangkok	
7	1/19	Mon			Move:Bangkok⇒Tokyo		Move:Bangkok⇒Tokyo	

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**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. Kunzang Wangdi	Specialist, Planning Division
	Mr. M.N. Lamichaney	Specialist, Construction Division
	Mr. Jangchuk Yeshe	Chief Engineer, Design Division
	Mr. Karma Wangdi	Chief Engineer, Design Division
	Mr. Tshering Wangdi(A)	Chief Engineer, Construction Division
	Mr. Tshering Paljare	Chief Engineer, Planning Division
	Mr. Tshering Wangdi(B)	Chief Engineer, Maintenance Division
	Mr. Tougay Choedup	Chief Engineer, Head of Trongsa Regional Division
	Mr. G.M. Rai	Chief Engineer, Head of Lobeyasa Regional Division
	Mr. Karma Tenzin	Executive Engineer, Design Division (Road)
	Mr. Delip Thapa	Executive Engineer, Geotechnical Section
	Ms. Choden	Assistant Engineer, Environmental Unit
Mr. Masumi Ando	JICA Senior Volunteer	
Department of Hydro-met Service, Ministry of Economic Affairs (DHMS, MoEA)	Mr. PP Sharma	Executive Engineer, Hydrology Division
Department of Geology and Mining, Ministry of Economic Affairs (DGM, MoEA)	Mr. Dowchu Drukpa	Seismologist
Wangdue Phodrang Dzongkhag	Mr. Dorji Wangdi	Environmental Officer, Dzongkhag
	Mr. Kunzang	Chief Land Record Officer, Dzongkhag
Trongsa Dzongkhag	Mr. Tshewang Rinzin	Dzongda
	Mr. Dorji Pelzang	Land Record Officer, Dzongkhag
JICA Bhutan Office	Ms. Yumiko Asakuma	Chief Representative
	Mr. Sho Takano	Deputy representative
	Mr. Masanori Sunada	Project Formulation Advisor
	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,

DGM: Department of Geology and Mining, MoEA: Ministry of Economic Affairs

#### 4. Minutes of Discussions (M/D)

##### (1) The first field survey

MINUTES OF DISCUSSIONS  
ON  
THE PREPARATORY SURVEY  
ON  
THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON  
PRIMARY NATIONAL HIGHWAY No. 1  
IN  
KINGDOM OF BHUTAN

In response to a request from the Royal government of the Kingdom of Bhutan (hereinafter referred to as "Bhutan"), Japan International Cooperation Agency (hereinafter referred to as "JICA") in consultation with the Government of Japan decided to conduct a Preparatory Survey (hereinafter referred to as "the Survey") on the Project for Reconstruction of Bridges on Primary National Highway No. 1 (hereinafter referred to as "the Project").

JICA dispatched the Preparatory Survey Team (hereinafter referred to as "the Team") to Bhutan, headed by Mr. Nobuyuki Tsuneoka, Senior Advisor of JICA, from July 31 to September 23, 2014.

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

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

Thimphu August 6, 2014



Nobuyuki Tsuneoka  
Leader  
Preparatory Survey Team  
Japan International Cooperation Agency  
Japan



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



Thinley Namgyel  
Director  
Gross National Happiness Commission  
Kingdom of Bhutan

**ATTACHMENT**

1. Title of the Project  
Both sides confirmed that the title of the project shall be “the Project for Reconstruction of Bridges on Primary National Highway No. 1”.
2. Objective of the Project  
Both sides confirmed that the objective of the Project is to reconstruct Chuzomsa zam, Nika chuzam and Zalanchu zam (previously named “Nagnichu zam”) to ensure smooth and safe traffic on the bridges.
3. Project Site  
The sites of the Project are shown in Annex-1.
4. Objective of the Survey
  - 4-1. To understand the back ground and objective of the Project and examine its impacts and appropriateness.
  - 4-2. To identify the components, outline design and cost estimation of the Project based on the data and information collected from and the results of meetings with Bhutanese side.
  - 4-3. To study the issues of environmental and social considerations through the site survey.
5. Responsible and Implementing Organizations
  - 5-1. The responsible organization is the Department of Roads, Ministry of Works & Human Settlement (DoR).
  - 5-2. The organization chart of DoR is as shown in Annex-2.
  - 5-3. After completion, DoR will be responsible for maintenance and management of the bridges and the roads constructed by the Project.
6. Components of the Project
  - 6-1. The project includes the following components
    - 6-1-1. Construction of the new three bridges with two vehicle lanes,
    - 6-1-2. Construction of approach roads,
    - 6-1-3. Construction and removal of the temporary bridges if deemed necessary,
    - 6-1-4. Construction of scouring and erosion protection for the new bridges
  - 6-2. Technical matters
    - 6-2-1. The new bridges should be carefully planned with a consideration of earthquake resistance, high water level, load resistant capacity, slope disaster and approach roads linearity.
    - 6-2-2. DoR will demolish the existing bridges upon completion of the new three bridges if deemed necessary.
7. Japan's Grant Aid Scheme
  - 7-1. Bhutanese side understands the Japan's Grant Aid scheme explained by the Team, as described in Annex-3 and Annex-4.
  - 7-2. Bhutanese side will take the necessary measures, as described in Annex-5, to facilitate the smooth



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

8. Environmental and Social Considerations

- 8-1. The Team explained the Project is categorized as "Category B" according to the JICA Guideline, since the Project is reconstructing the three bridges and approach roads, and its impact on the environmental may be expected.
- 8-2. Bhutanese side understands the Project needs to follow the JICA guideline. Therefore the initial environmental examination (IEE) shall be done through the survey.
- 8-3. In case of the Project Affected Persons (PAPs) within the Project sites, 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 Bhutanese side will take necessary measures to PAPs according to an Abbreviated RAP in close communication with JICA.

9. Schedule of the Study

- 9-1. The Team will continue further studies in Bhutan until September 23, 2014.
- 9-2. JICA will prepare the draft Preparatory Survey Report and dispatch a mission team to explain its contents to Bhutanese side around January 2015. JICA will explain details of the Project including the final components and cost estimation to Bhutanese side.
- 9-3. When the contents of the draft Preparatory Survey Report are accepted in principle by the Royal Government of Bhutan, JICA will complete the final report and send it to the Royal Government of Bhutan around April 2015.
- 9-4. The above schedule is tentative and subject to change.

10. Proper Use

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

11. Other Relevant Issues

- 11-1. Bhutanese side shall, at its own expense, provide the Team with the following items in cooperation with other organizations concerned
  - (1) security-related information as well as measures to ensure the safety of the survey team;
  - (2) information as well as support in obtaining medical service;
  - (3) data and information necessary for the Survey;
  - (4) counterpart personnel;
  - (5) credentials or identification cards if necessary;
  - (6) entry permits necessary for the survey team members to conduct field surveys;
  - (7) permission for the implementation of traffic survey;



- (8) necessary arrangement for exemption of the taxes, duties, and any charges on equipment, machinery and other materials brought into Bhutan for the implementation of the Survey; and
- (9) support in obtaining other privileges and benefits if necessary.

11-2. Bhutanese side agreed that the following undertakings should be taken by 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.

12. Disclosure of Information

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

Annex-1: Project Sites

Annex-2: Organization Chart of DoR

Annex-3: Japan's Grant Aid Scheme

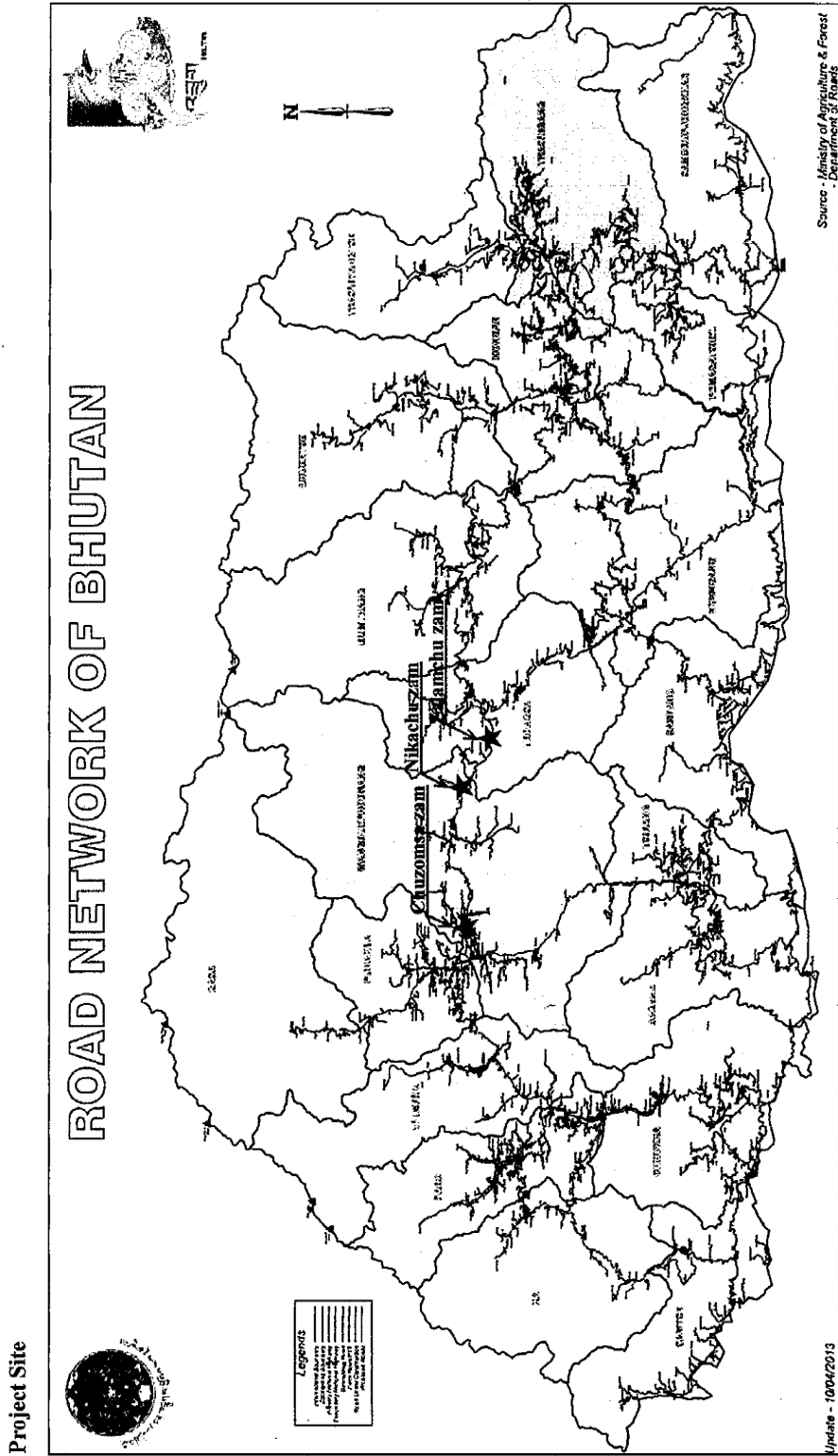
Annex-4: Flowchart of Japan's Grant Aid Procedure

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



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Annex-1

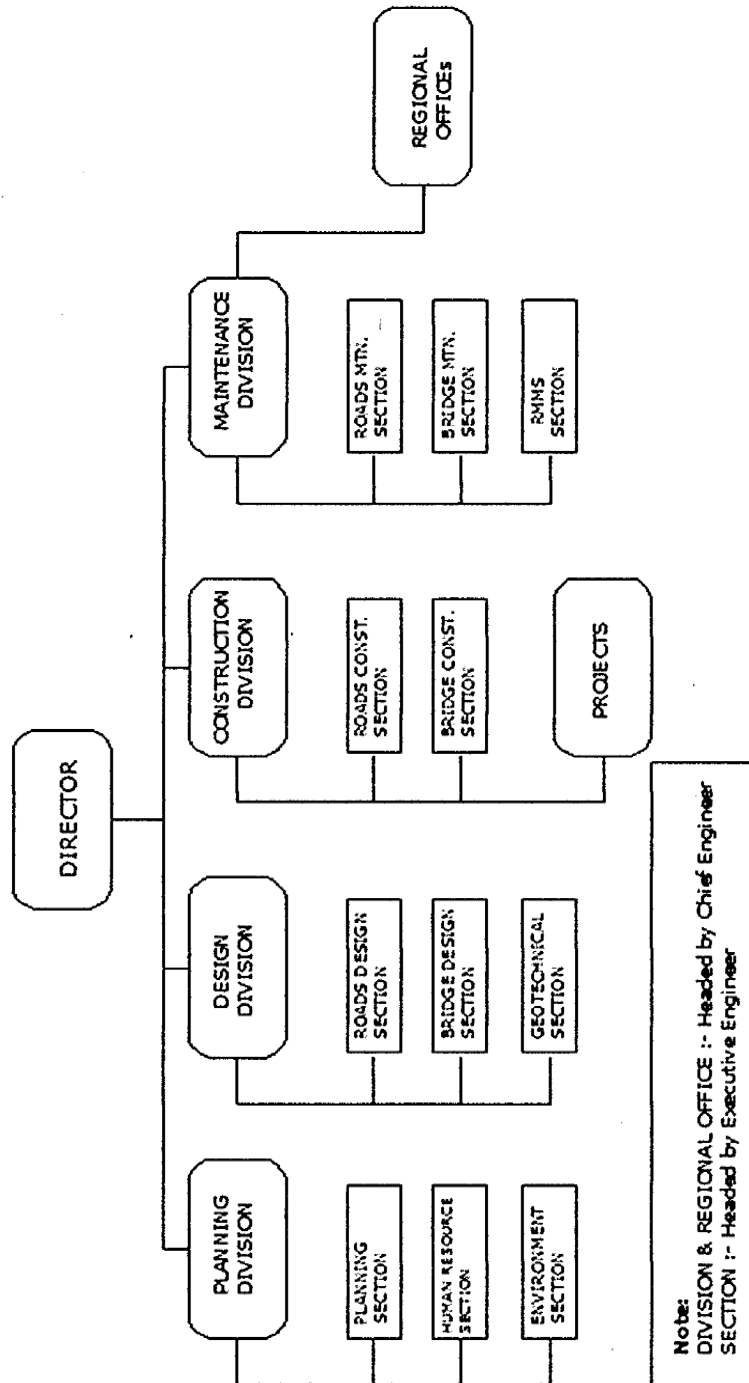


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Handwritten initials/signature

Organization Chart of DOR

DEPARTMENT OF ROADS



Notes:  
DIVISION & REGIONAL OFFICE :- Headed by Chief Engineer  
SECTION :- Headed by Executive Engineer

CS

CS MB



## **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.



(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

- 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 signed 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.



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.

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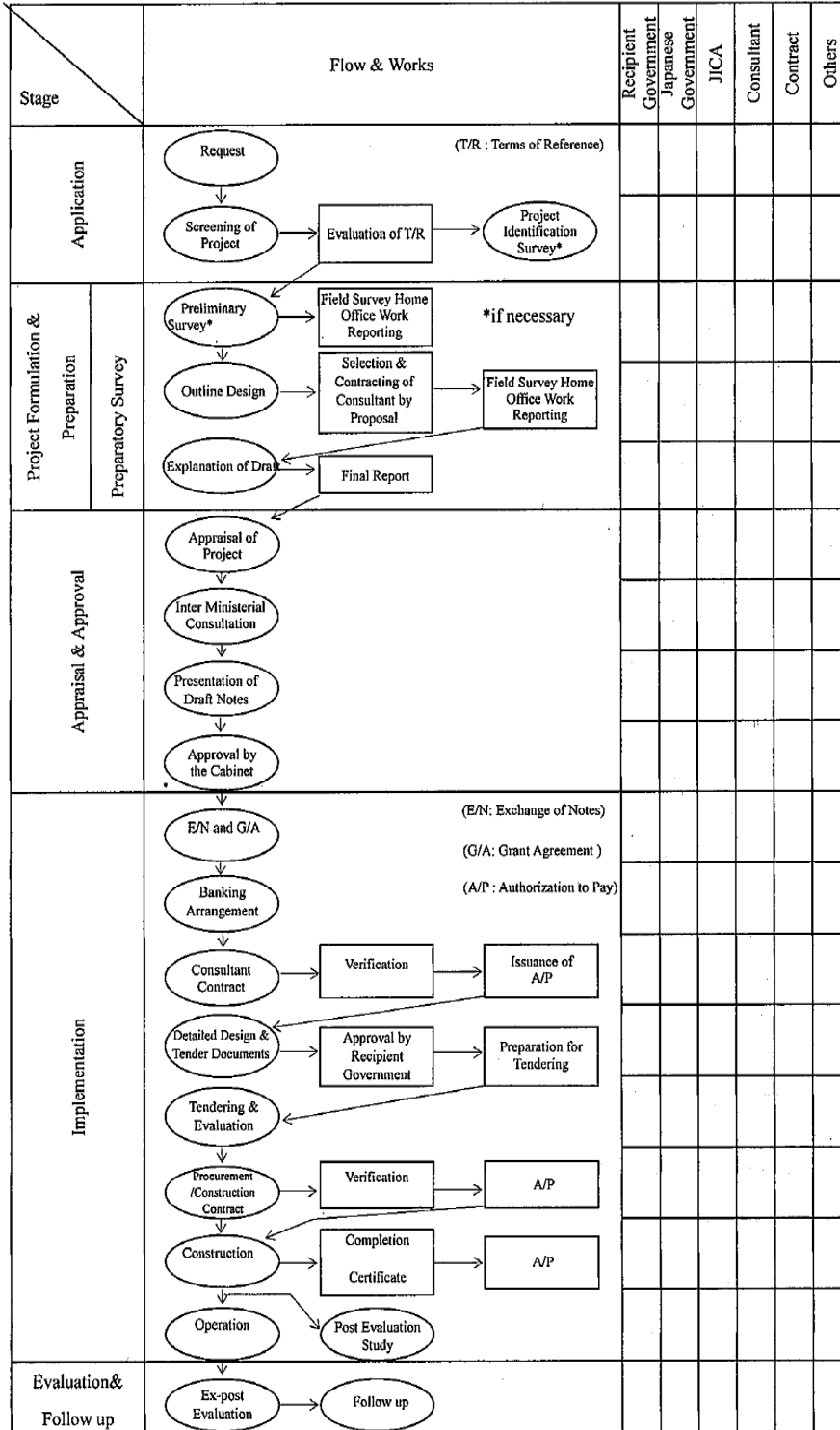
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**PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES  
ON PRIMARY NATIONAL HIGHWAY NO.1 IN THE KINGDOM OF BHUTAN  
FINAL REPORT**

Annex-4

**Flowchart of Japan's Grant Aid Procedure**



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**Major Undertakings to be taken by Each Government**

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

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

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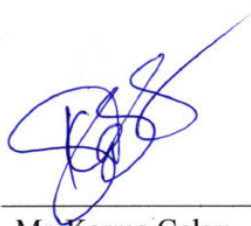
(2) Technical Note (The first field survey)

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. 1 (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 estimate 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 January, 2015.

Thimphu, 22 September 2014



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Mr. Karma Galay

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



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Mr. Keigo Konno

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

**1. Application of Design Guideline**

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

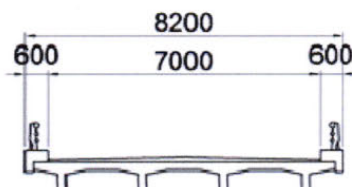
**1.1 Bridge Design**

- 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	3.50	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 5.5m 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 7.50m 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



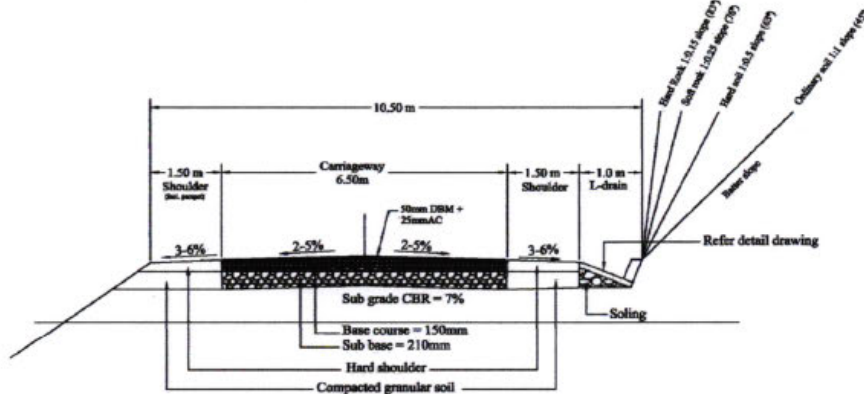
The curb width and the handrail are applied to Japanese Standard.



**1.2 Highway Design**

**(1) Geometric Design**

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



- Guideline on Road Classification System and Delineation of Construction and Maintenance Responsibilities: DoR
- Road Structure Ordinance: Japan Road Association

**(2) Pavement Design**

- Pavement Design Manual: DoR

**2. 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<sup>2</sup>
- Superstructure (Slab) : 24N/mm<sup>2</sup>
- (Girder, beam) : 30N/mm<sup>2</sup>
- Reinforcing bar : Fe 500

**3. Pavement Design Life**

- Pavement Design Manual: DoR

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**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 1. Bhutan is mainly located in zone V.

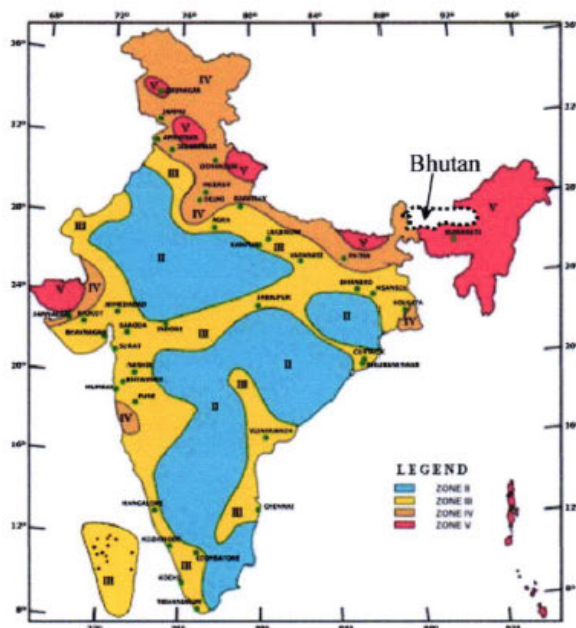


Figure 1 Seismic Zone of India

**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.

**PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES  
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FINAL REPORT**

TECHNICAL NOTES FOR RECONSTRUCTION OF BRIDGES ON PNH NO. 1

**7. Design Condition**

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

**Table 1 Design Condition**

Parameter	Unit	Design	Remarks
<b>1. Bridge Design</b>			
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
<b>2. Road Design</b>			
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 $\leq$ radius of curve < 160 $\rightarrow$ 0.25 60 $\leq$ radius of curve < 90 $\rightarrow$ 0.50 45 $\leq$ radius of curve < 60 $\rightarrow$ 0.75 32 $\leq$ radius of curve < 45 $\rightarrow$ 1.00 26 $\leq$ radius of curve < 32 $\rightarrow$ 1.25 21 $\leq$ radius of curve < 26 $\rightarrow$ 1.50 19 $\leq$ radius of curve < 21 $\rightarrow$ 1.75	As per Japanese Standard
Transition Length	m	20km/hr: 20 60km/hr: 50	As per Japanese Standard

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**8. Environmental Considerations**

**8.1 EIA Study Schedule**

The Bhutanese side has confirmed the EIA study schedule as shown in Table 2.

**Table 2 Tentative Schedule of EIA**

Year/Month	2014						2015			
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Consensus Meeting with DOR and NEC		■								
Reconnaissance			■							
Stakeholder Meeting on Scoping Stage (PAP Level)			■							
Scoping			■							
EIA Study (simple survey and literature survey on IEE)			■	■	■					
preparation of EIA report					■	■				
EIA approval Process						■	■	■	■	
Approval of Environmental Permission									■	■

**8.2 Policy Framework and Authorization for ARAP**

The Bhutanese side has confirmed the abbreviated resettlement action plan (ARAP) schedule as shown in Table 3.

**Table 3 Tentative Schedule of ARAP**

Year/Month	2014						2015			
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Consensus Meeting with Relevant Parties		■								
Preparation of ARAP Framework and Authorization			■							
Socialization for ARAP, Census, Inventory of Loss Assets, Socio-economic survey, Replacement cost survey			■	■	■					
Preparation of ARAP report and authorization by implementation agency					■	■	■	■	■	

**9. Traffic Survey Results and Analysis**

Traffic surveys (traffic volume survey, OD survey and axle load survey) were carried out at the point of Wangdue and Trongsa. The result of traffic surveys and their analysis shall be reflected to design of the objective bridges.

**10. Requests from DoR to the Team**

DoR requested the Team to plan footpaths (width 1.0 m x 2) on Chuzomsa Bridge and Nikachu Bridge because of too much old of the existing both bridges. The Team answered that JICA would asset 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.

**(3) The second field survey (Explanation of Draft Outline Design Report)**

**MINUTES OF DISCUSSIONS  
ON  
THE PREPARATORY SURVEY  
FOR  
THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON  
PRIMARY NATIONAL HIGHWAY No. 1  
IN  
BHUTAN**

**(Explanation of Draft Outline Design Report)**

On the basis of the preparatory survey in Bhutan from July to September, 2014 and following technical examination in Japan, Japan International Cooperation Agency (hereinafter referred to as "JICA") prepared a Draft Outline Design Report (hereinafter referred to as "the Report") on the Project for Reconstruction of Bridges on Primary National Highway No. 1 (hereinafter referred to as "the Project").


The Preparatory Survey Team, headed by Mr. Nobuyuki Tsuneoka, Senior Advisor of JICA, explained to and consulted with the Department of Roads, Ministry of Works & Human Settlement (hereinafter referred to as "DoR") and the concerned officials of the Royal Government of Bhutan (hereinafter referred to as "RGOB") on the contents of the Report.

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

Thimphu, January 15, 2015



Nobuyuki Tsuneoka  
Leader  
Preparatory Survey Team  
Japan International Cooperation Agency  
Japan



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



Rinchen Wangdi  
Chief Programme Coordinator  
Gross National Happiness Commission  
Bhutan

**ATTACHMENT**

1. Components of the Draft Outline Design Report

- 1.1. Bhutanese side agreed and accepted in principle the contents of the Report explained by the Team. As a result of the Survey the Team examined and found out the best solutions therefore the main components of the Project consist of following three construction works.
- a) Reconstruction of Chuzomsa zam, Nikachu zam and Zalamchu zam (hereinafter referred to as “the Bridges”)
  - b) Construction of the access roads for the Bridges
  - c) Construction of revetment works for Chuzomsa zam and Nikachu zam

2. Cost Estimation for the Project

- 2.1. Japanese side explained to Bhutanese side the estimate of the Project Cost described in Annex-1; while, the final Project Cost described in the Exchange of Note (hereinafter referred to as “E/N”) would be appraised by the Government of Japan (hereinafter referred to as “GOJ”).
- 2.2. Both sides further confirmed that the Project Cost in Annex-1, and details of the construction works in the Report should never be duplicated and/or disclosed to any third parties until all the contracts for the Project are concluded.
- 2.3. The Team explained and Bhutanese side agreed that the cost for land acquisition is also subject to change but in principle it will be compensated at full replacement cost according to the JICA Guidelines for Environmental and Social Considerations (hereinafter referred to as “JICA Guidelines”).

3. Undertaking by Bhutanese Side

- 3.1. Bhutanese side promised to undertake the Major Undertakings to be taken by DoR for the Project listed in Annex-2 at full responsibility and its own expenses based on the contents of the Report.
- 3.2. 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 regulations of E/N between both governments.  
For the sake of this smooth tax exemption procedures, the Team recommended DoR / Gross National Happiness Commission (hereinafter referred to as “GNHC”) that DoR / 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.



- 3.3. Bhutanese side agreed to execute the undertakings listed in Annex-2 in time, duly understanding the possibilities of the suspension / termination of this Grant Aid assistance if there will be violations on the undertakings.
- 3.4. 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.
- 3.5. Bhutanese side agreed that DoR will report to JICA office the progress of their undertakings by Bhutanese side until all the works to be done. Reports to JICA office shall be submitted monthly with actual progress bar chart in Annex-2. Other than the monthly report, DoR shall reply if requested by JICA. Bhutanese side also agreed to provide JICA with the progress of National Cadastral Re-survey Program which may affect the land acquisition of the Project.
- 3.6. Bhutanese side agreed to demolish the existing Zalamchu zam as soon as possible after the completion of the Project. And also demolish the existing Chuzomsa zam and Nikachu zam at an appropriate time. Before the demolition, Chuzomsa zam and Nikachu zam can be used for local pedestrian and light traffic for a certain period with proper maintenance.

4. Operation and Maintenance of the Facilities

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

Term	Object	Location subject to inspection, Frequency	Maintenance Description	Unit	Unit cost (Nu)	Workload	Maintenance Cost (Nu)
Inspection	Bridge	Once/week	Routine Inspection	Lump sum	-	-	20,000
		Once/2 years	Periodic inspection	Lump sum	-	-	10,000
		In case of emergency	Special Inspection	Lump sum	-	-	10,000
	Road	Once/week	Routine Inspection	Lump sum	-	-	10,000
		Once/2 years	Periodic inspection	Lump sum	-	-	5,000
		In case of emergency	Special Inspection	Lump sum	-	-	5,000
①Subtotal							60,000
Annual	Bridge	Drainage	Cleaning of catch basin and drainage pipe	No.	100	15	1,500
		Expansion joint	Cleaning, repair of rubber portion	No.	500	6	3,000
		Bridge surface	Small-scale repair	m <sup>2</sup>	220	130	28,600
		Bearing	Cleaning	No.	100	6	600
	Road	Road surface	Repair of pavement	No.	620	30	18,600
		Ditch	Removal of soil	m	50	855	42,750
②Subtotal							95,050
5 years	Bridge	Handrail	Repair	m	1,000	9	9,000
		River bank	Inspection and repair of gabion	m	1,800	200	360,000



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	Road	Marking	Repainting	m	30	600	18,000
	③Subtotal						387,000
	④Average amount of each year (③/5year)						77,400
10 years	Road	Road surface	Repaving	m <sup>2</sup>	1,000	4,033,000	4,033,000
	⑤Subtotal						4,033,000
	⑥Average amount of each year (⑤/10year)						403,300
20 years	Bridge	Bridge surface	Repaving	m <sup>2</sup>	1,000	1,300,000	1,300,000
		Deck slab	Installation of waterproof sheet at deck slab	m <sup>2</sup>	1,300	1,690,000	1,690,000
		Expansion joint	Replacement	m	35,000	60	2,100,000
	⑦Subtotal						5,090,000
	⑧Average amount of each year (⑦/20year)						254,500
Total amount for each year (①+②+④+⑥+⑧)							890,250

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

- (1) Although the project includes some facilities to ensure traffic safety such as sign posts and guardrail, frequency of accidents might not be reduced due mainly to increased traffic volume. Therefore continuous traffic safety awareness activities by relevant organizations are required.
- (2) Passing the bridges by overloaded vehicles would cause significant damage to the bridge structure which may lead to shorter lifespan.
- (3) Proper asset management mainly for bridges will impact greatly to maintenance cost and lifespan.

#### 5. Environment and Social Considerations

- 5.1. Both sides confirmed that information on environmental and social considerations including major impacts and relevant mitigation measures is summarized in the Environmental Checklist attached as Annex-3. DoR confirmed that they will inform JICA of any major changes, which may affect environmental and social considerations, by revising the Checklist in a timely manner.
- 5.2. Both sides confirmed continuous environmental monitoring will be conducted by DoR in accordance with the Environmental Checklist and Monitoring Form attached as Annex-3 and Annex-4.
- 5.3. DoR confirmed that the results of environmental monitoring will be provided to JICA by filling in Environmental Monitoring Form attached as Annex-4 on a quarterly basis until the completion of the Project, provided that there is no outstanding issue regarding the environmental and social considerations during implementation of the Project.  
In case JICA finds that there is necessity for improvement in a situation with respect to environmental and social considerations after the agreed monitoring period, JICA can request to extend the period of monitoring and reporting until JICA confirms the issues have been properly addressed.

- 4 -

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

6. Implementation Schedule

Both sides confirmed Implementation Schedule of the Project attached as Annex-5. The schedule is assuming that construction will be started in January, 2016 with rainy seasons and winter seasons considered. Both sides understood that the delay of starting may cause further delay of completion.

7. 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 August 6, 2014 continue to be valid unless information is updated by the draft Preparatory Survey Report.

8. Japan's Grant Aid Scheme

8.1. Bhutanese side fully understood and reconfirmed the scheme of the Japan's Grant Aid and the necessary measures to be undertaken by Bhutanese side, which was explained by the Japanese side and agreed as the Minutes of Discussion signed on August 6, 2014.

9. Schedule of the Study

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

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

10. Disclosure of Information

10.1. Bhutanese side agreed to JICA's disclosure of the study results excluding the Project cost after completion of the Preparatory Survey, and all the study results including the Project cost after all the contracts for the Project are concluded.

11. Misconduct

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

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



- Annex-1: Project Cost Estimation
- Annex-2: Undertakings to be taken by the Royal Government Bhutan
- Annex-3: Environmental Checklist
- Annex-4: Environmental Monitoring Form
- Annex-5: Implementation Schedule

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Annex-1: Project Cost Estimation

CONFIDENTIAL

(1) Cost Borne by the Government of Japan

Components		Cost Estimation (Million Yen)
Building Construction	Construction of Chuzomsa zam (including approach road and revetment)	760
	Construction of Nikachu zam (including approach road and revetment)	522
	Construction of Zalamchu zam (including approach road and revetment)	429
Detailed Design and Procurement Supervision		190
Total		1,901

(2) Cost Borne by the Royal Government of Bhutan

Items	Cost Estimation (Ngultrum)
Payment of bank commission	1,613,000
Land acquisition / land rent for temporary yards	73,000
Removal of the existing bridge (Zalamchu zam)*	1,000,000
Total	2,686,000

\*The demolition of Chuzomsa zam and Nikachu zam by DoR is not included

(3) Conditions of Cost Estimation

- Estimated timing: July 2014
- Exchange rates: USD1.00 = 103.25 JPY  
BTN 1.00 = 1.86 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.

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Annex-2: Undertakings to be taken by the Royal Government of Bhutan

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

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

*Note : (P) means provisional*

Undertaking	Month	2015												2016		Remarks	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2		
Project Implementation	Exchange of Notes and Grant Agreement (P)				▼												
	Detailed design																
	Tender notice																
	Construction Works																
Securing Budget <i>(See Annex-1 for items and estimated cost to be secured.)</i>	Request of budget for FY 2015-2016	Plan			▼												
	Approval of budget for FY 2015-2016	Plan				▼											
	Available timing for payment	Plan						▼									
Tax Exemption <i>(See 3. in the Attachment for exception)</i>	Discussion of tax exemption to DRC by DoR/GNHIC	Plan															Begin preparation of application and consultation with DRC relating to the existing E/NS for the other projects
	Submission of application for each tax payments	Plan															Application must be submitted each shipment time when the exemption will be required.
Land Acquisition and Compensation for Structures	Submission of Application from DoR to DLAAAC	Plan															(Completed in September 2014)
	Preparation of ARAP	Plan															
	Stakeholder meeting for ARAP	Plan															(Completed in September 2014)
	Submission of Application from DLAAAC to NLC	Plan			▼												
	Preliminary approval issued from NLC	Plan				▼											
	Update of ARAP	Plan															
	Agreements with land owners	Plan							▼								
	Submission of detailed report (ARAP) from DLAAAC to NLC	Plan								▼							
	Approval issued from NLC	Plan									▼						
	Completion of Land acquisition	Plan										▼					
Environmental & Social Considerations	Preparation of IEE report	Plan		▼													(Requested to be done in January 2014)
	Submission of Project Application and IEE report for Environmental Clearance from DoR to NEC	Plan		▼													
	Environment Clearance issued from NEC	Plan				▼											
	Review and approval of Environmental Management Plan (EMP)	Plan															EMP shall be submitted by the Contractor during the preparation of construction
	Commencement of environmental monitoring	Plan															Monitoring report shall be submitted to JICA during construction
Provision of Temporary Work Yards include contractor's site office and plant yard	Negotiation with land owners	Plan															Temporary work yards shall be near the Project sites
	Contracts for land rent	Plan															
Provision of Borrow Pits and Quarry (ies)	Contract with borrow pits and quarry(ies) owners	Plan															Borrow pits and Quarries shall be near the Project sites.
Provision of waste disposal area	Acquisition of approval of soil and construction waste disposal from the dump site owner	Plan															Following dump site shall be applied; (Chuzanes zang) State-owned land located at km toward Thongsa from the bridge site (Otsachu zang) State-owned land located at 3km toward Thongsa from the bridge site (Zolanchu zang) State-owned land around the bridge site
	Opening of bank account and arrange Authorization to Pay	Plan															
Payment of bank commission	Payment commission	Plan															

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

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



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**Annex-3: Environmental Checklist**

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have 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) Y	(a) Under preparation of draft IEE and will be submitted to NEC in Feb, 2015 and approved in May, 2015 (b) ditto (c) The conditions are not expected as of January, 2015 (d) Forest Clearance has been obtained from DFFS, MoAF and Dzongkhag Administrative approval has been issued from concerned Dzongkhag as of December, 2014
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) Y	(a) 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 because the expected traffic volume is around 300-400 a day. (b) The predicted air quality does not expected to exceed Bhutan's standard level.
	(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 is caused and discharged from the construction area, general and appropriate mitigation measures minimize the adverse impacts. 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 because the expected traffic volume is around 300-400 a day. (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) N	(a) There are not any protected areas designated by Bhutan's laws or international treaties and conventions.
	(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) N (e) N	(a) The project site does not encompass primeval forests, tropical rain forests, ecologically valuable habitats. (b) The project site does not encompass the protected habitats of endangered species designated by the Bhutan's laws or international treaties and conventions. (c) The project activities does not give significant impacts on the ecosystem. (d) Since the project area is developed, thus any negative impacts are not expected and any protection measures are not taken. (General measures will be prepared appropriately) (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 effect 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, land protection measures are prepared. (b) ditto (c) The mitigation measures for soil erosion and run off such as silt fence are planned in earth work section.

Appendices

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 socio-economic studies on resettlement? (d) Is the compensation 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) Y (b) Y (c) Y (d) Y (e) Y (f) Y (g) Y (h) Y (i) Y (j) Y	(a) Involuntary resettlement is not caused, but land acquisition of a small area is expected. (b) The adequate explanation on compensation are given to affected persons of land acquisition (The explanation has been made in Sep. 2014). (c) Resettlement plan (ARAP) is made based on ARAP survey. (d) Compensation will be paid prior to land acquisition. (e) Compensation policies are prepared in ARAP. (f) The adverse impact is not expected but ARAP pay particular attention to vulnerable groups or persons, including women, children, the elderly, people below the poverty line if necessary. (g) The applicable laws, regulations and guidelines have been explained to PAPs and formulated basic consensus. The final affected area and affected persons will be identified in detailed design stage and agreed with affected persons prior to implementation of construction. (h) The organizational framework established to properly implement resettlement will be set up, and its capacity and budget will be secured on the ARAP in the detailed design stage. (i) A monitoring plan about the impacts of resettlement before and during construction. (j) If necessary, the grievance redress mechanism in Bhutan will be used.
	(2) Living and Livelihood	(a) Where bridges and access roads are newly installed, is there a possibility that the project will affect the existing means of transportation and the associated workers? Is there a possibility that the project will cause significant impacts, such as extensive alteration of existing land uses, changes in sources of livelihood, or unemployment? Are adequate measures considered for preventing these impacts? (b) Is there any possibility that the project will adversely affect the living conditions of the inhabitants other than the target population? Are adequate measures considered to reduce the impacts, if necessary? (c) Is there any possibility that diseases, including infectious diseases, such as HIV will be brought due to immigration of workers associated with the project? Are adequate considerations given to public health, if necessary? (d) Is there any possibility that the project will adversely affect road traffic in the surrounding areas (e.g., increase of traffic congestion and traffic accidents)? (e) Is there any possibility that project will impede the movement of inhabitants? (f) Is there any possibility that bridges will cause a sun shading and radio interference?	(a) N (b) N (c) N (d) Y (e) Y (f) N	(a) This project does not affect the existing means of transportation and the associated workers. Appropriate mitigation measures will be proposed and carried out on ARAP for the affected persons by land acquisition. (b) There are no 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 impacts such as sun shading and radio interference.
4 Social Environment	(3) Heritage	(a) Is there a possibility that the project will damage the local archaeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(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 all of 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) 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) Land acquisition is caused, thus adequate mitigation measures are prepared on ARAP.
	(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 EIA 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) except  
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 -4: 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)

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	µg/m <sup>3</sup>			200 (24 Hour Average)	SPM (0.1mg/m <sup>3</sup> )	- On the boundary of approach road and residence (1 point ×3 bridges) - 2 times a year during construction - Air sampler High volume sampler
NO <sub>2</sub>	µg/m <sup>3</sup>			80 (24 Hour Average)	0.04-0.06(ppm)	
SO <sub>2</sub>	µg/m <sup>3</sup>			80 (24 Hour Average)	0.04(ppm)	
CO	µg/m <sup>3</sup>			2000 (8 Hour Average)	10(ppm)	
PM <sub>10</sub>	µg/m <sup>3</sup>			100 (24 Hour Average)	SPM(0.1mg/m <sup>3</sup> )	

- Water Quality (Water Quality in the river)

	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	-	

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Appendices

-Noise / Vibration

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

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

2. Social Environment and others

-Resettlement (Land acquisition)

Monitoring Item	Monitoring Results during Report Period
Proper compensation, consultation, agreement with the affected people and confirmation of payment in compensation.	

- Existing social infrastructures and services

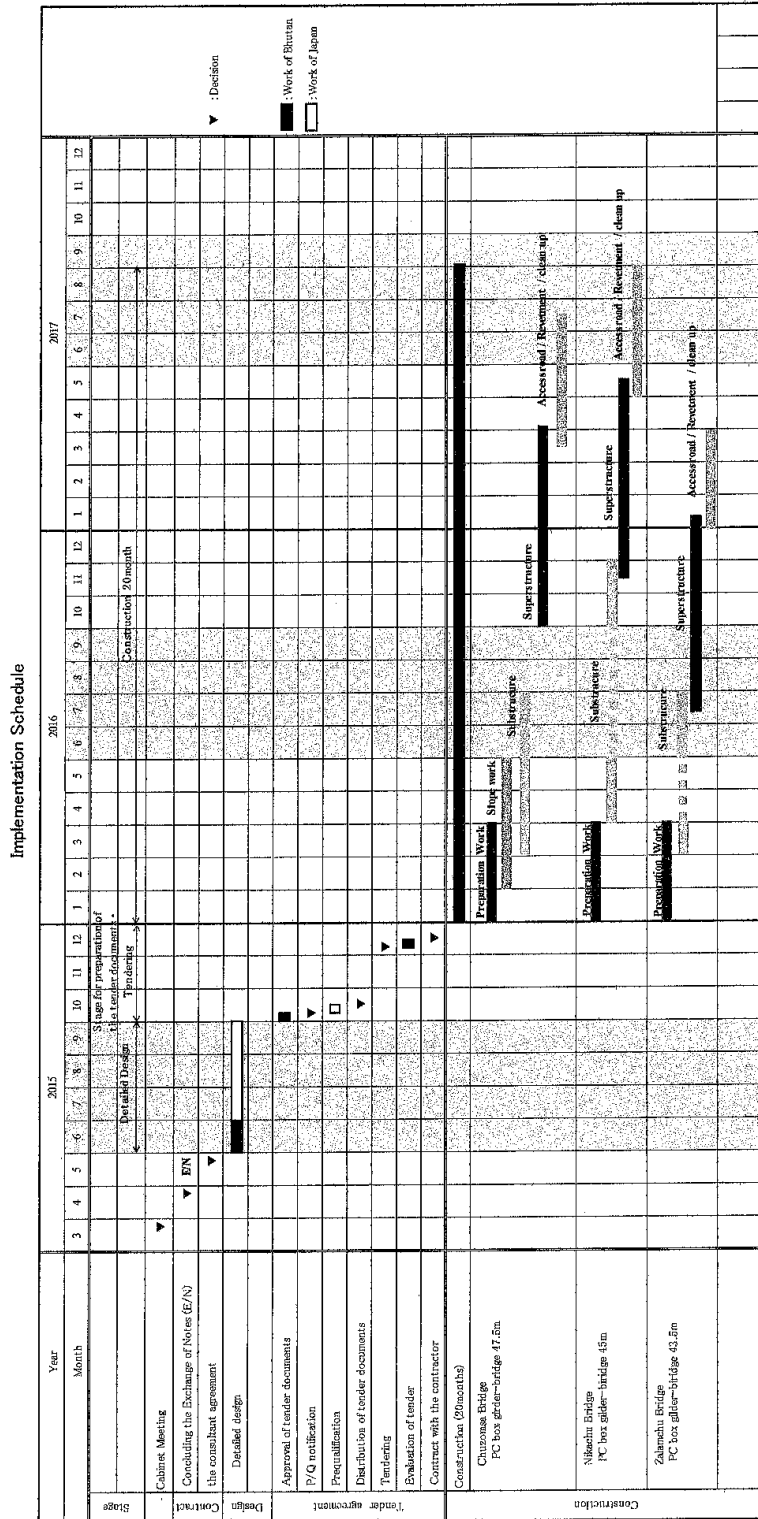
Monitoring Item	Monitoring Results during Report Period
Securing pass road and transit time of pass road at construction site	

- Accident

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

**PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES  
ON PRIMARY NATIONAL HIGHWAY NO.1 IN THE KINGDOM OF BHUTAN  
FINAL REPORT**

Annex -5: Implementation Schedule



■ : Decision  
 ■ : Work of Bhutan  
 □ : Work of Japan  
 ■ : Preparation Work  
 ■ : Slope work  
 ■ : Substructure  
 ■ : Superstructure  
 ■ : Accessroad / Revetment / clean up  
 ■ : Rainy season

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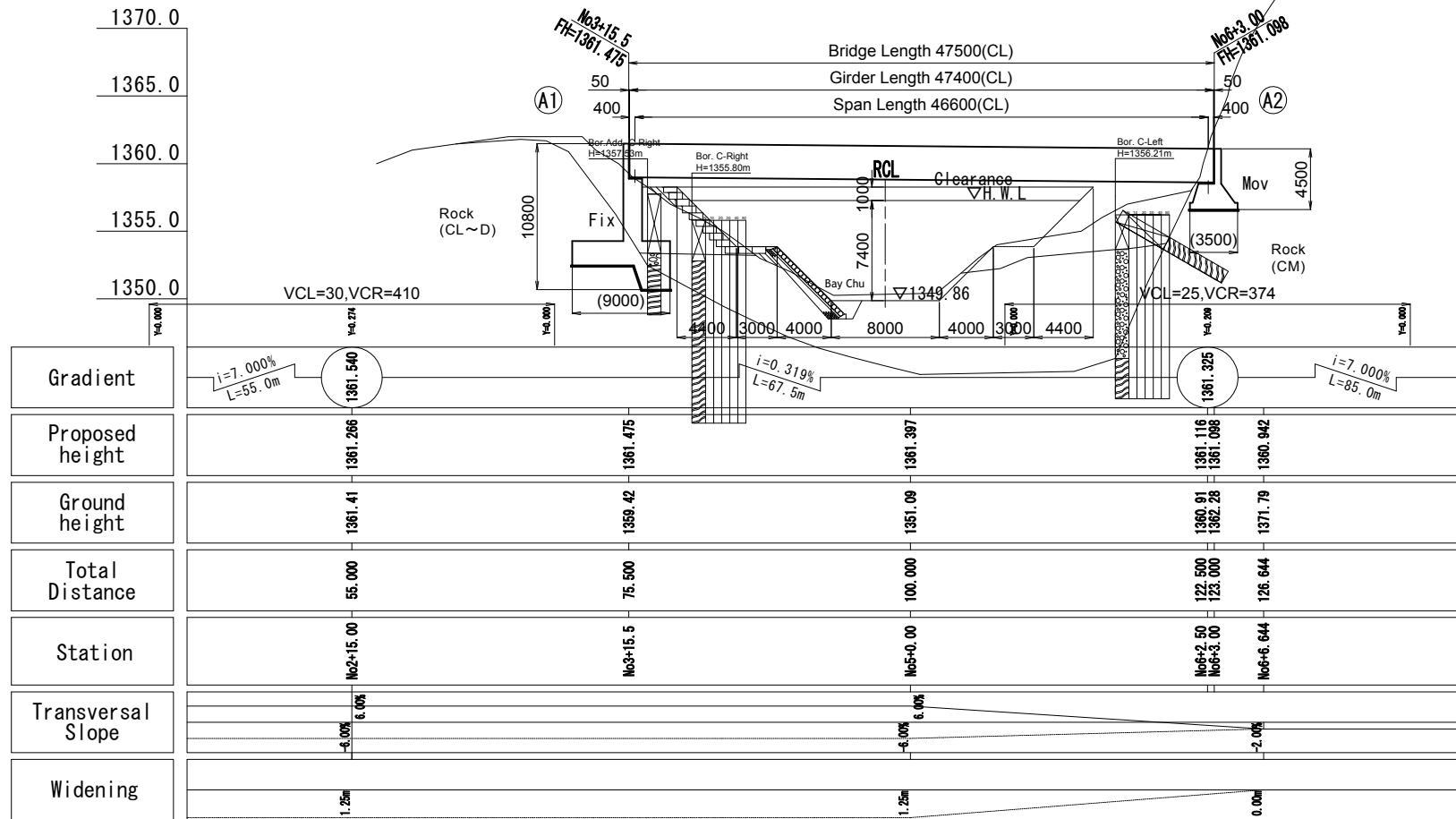
## 5. Outline Design Drawings

No.	Drawing Title
1. General Drawings	
1	GENERAL DRAWING (Chuzomsa Bridge)
2	GENERAL DRAWING (Nikachu Bridge)
3	GENERAL DRAWING (Zalamchu Bridge)
2. Road Drawings	
(1) Chuzomsa Bridge	
C-1	PLAN
C-2	PROFILE
C-3	TYPICAL CROSS SECTION
C-4	CROSS SECTION(1)
C-5	CROSS SECTION(2)
C-6	CROSS SECTION(3)
C-7	CROSS SECTION(4)
C-8	CROSS SECTION(5)
C-9	CROSS SECTION(6)
C-10	ROAD STRUCTURE
(2) Nikachu Bridge	
N-1	PLAN
N-2	PROFILE AND TYPICAL CROSS SECTION
N-3	CROSS SECTION(1)
N-4	CROSS SECTION(2)
N-5	CROSS SECTION(3)
N-6	CROSS SECTION(4)
N-7	ROAD STRUCTURE
(3) Zalamchu Bridge	
Z-1	PLAN
Z-2	PROFILE AND TYPICAL CROSS SECTION
Z-3	CROSS SECTION(1)
Z-4	CROSS SECTION(2)
Z-5	CROSS SECTION(3)
Z-6	CROSS SECTION(4)
Z-7	CROSS SECTION(5)
Z-8	ROAD STRUCTURE

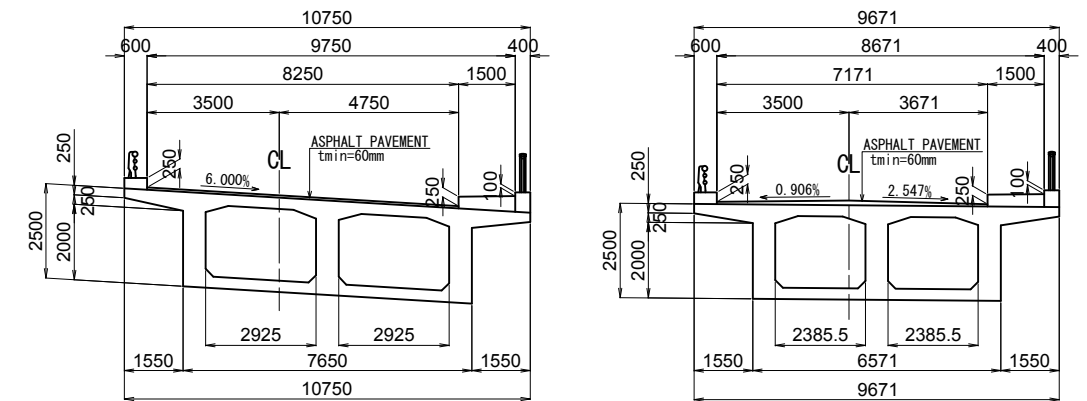
# 1. General Drawings

# GENERAL DRAWING (Chuzomsa Bridge)

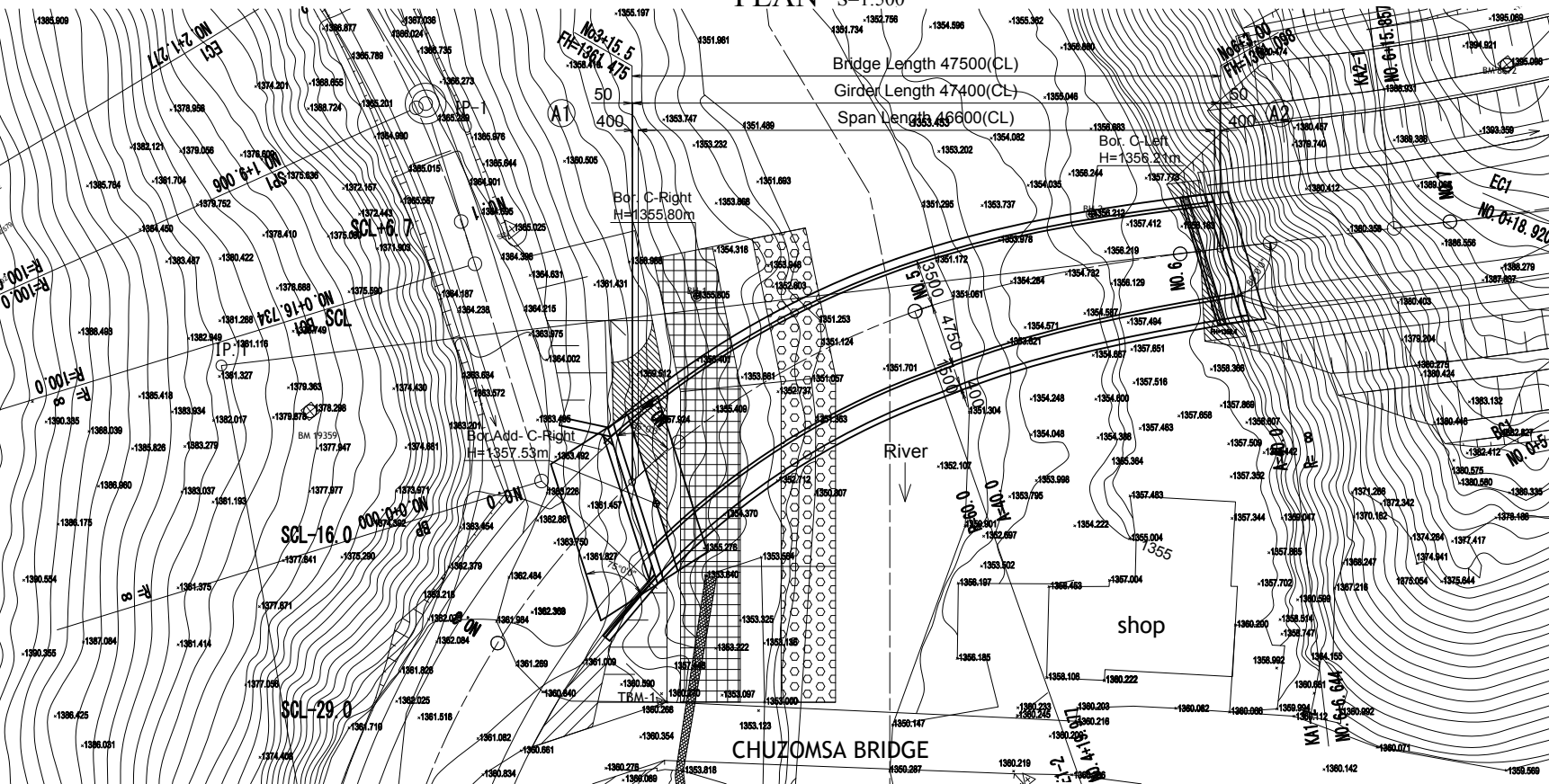
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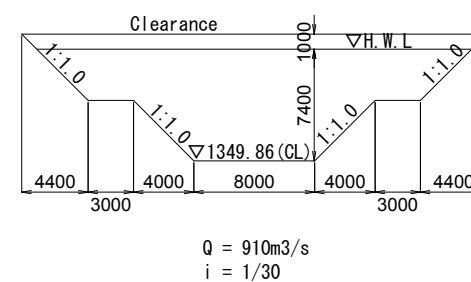
CROSS SECTION S=1:200



PLAN S=1:500



RIVER CROSS SECTION S=1:500



## Design condition

Bridge Length	47.500m	
Span Length	46.600m	
Road Width	8.666m~9.750m	
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 $\sigma_{ck}=30 N/mm^2$ ReinforcigBar SD345 Equivalent Tendon 12S12.7mm
Sub structure	Form	Structure Inverted T-Type Abutment Foundation Spread Foundation
	Material strength	Concrete $\sigma_{ck}=21 N/mm^2$ ReinforcigBar SD345 Equivalent

Royal Government of Bhutan  
MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR)  
JAPAN INTERNATIONAL COOPERATION AGENCY

CONSULTANTS:  
THE CONSORTIUM OF  
Oriental Consultants Co., Ltd.  
AND INGEROSEC CORPORATION

PROJECT NAME:  
PREPARATORY SURVEY ON  
THE PROJECT FOR RECONSTRUCTION OF  
BRIDGE ON PRIMARY NATIONAL HIGHWAY No.1

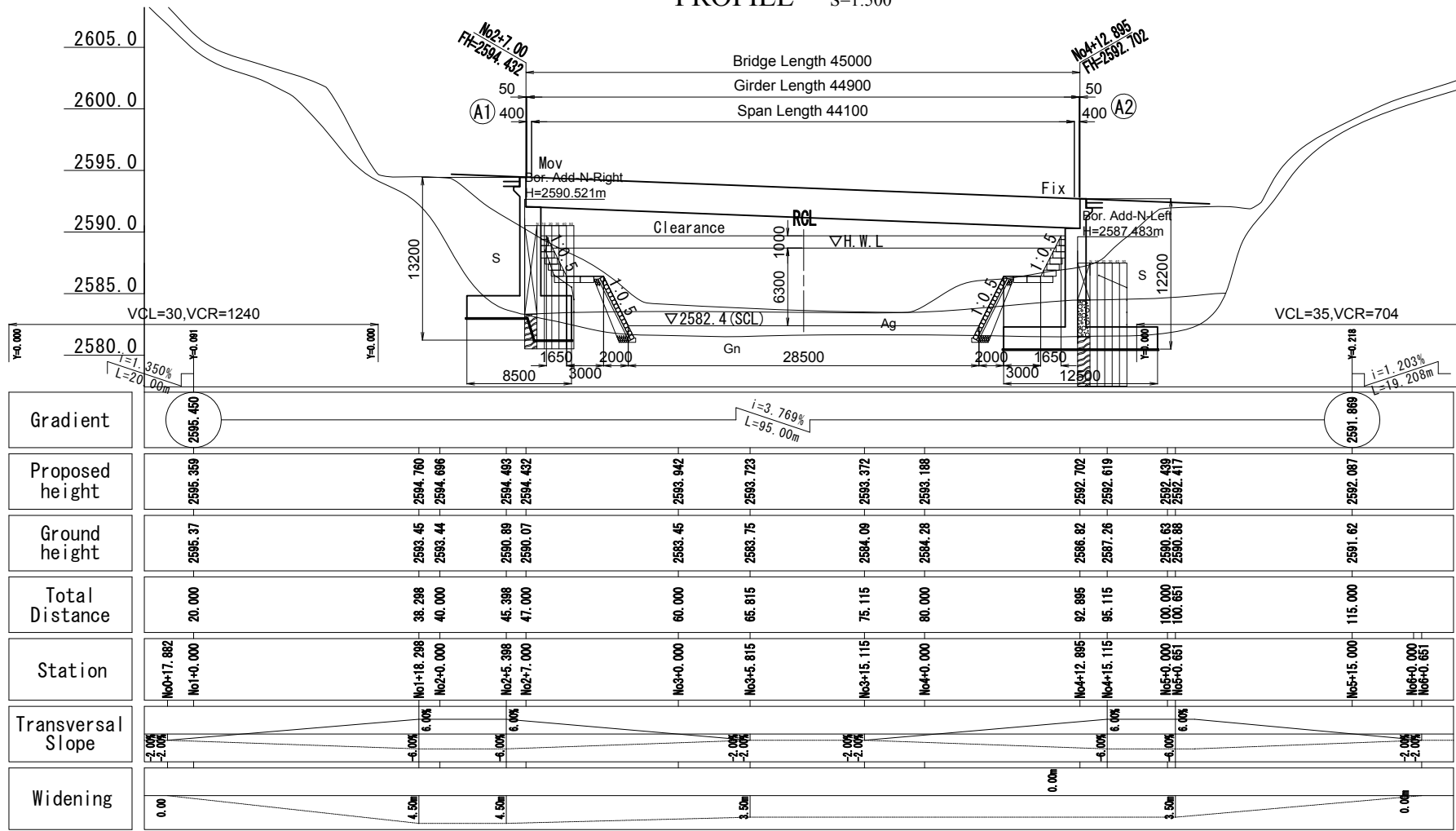
DRAWING TITLE:  
GENERAL DRAWING  
(Chuzomsa Bridge)

DATE:  
PREPARED BY:  
CHECKED BY:

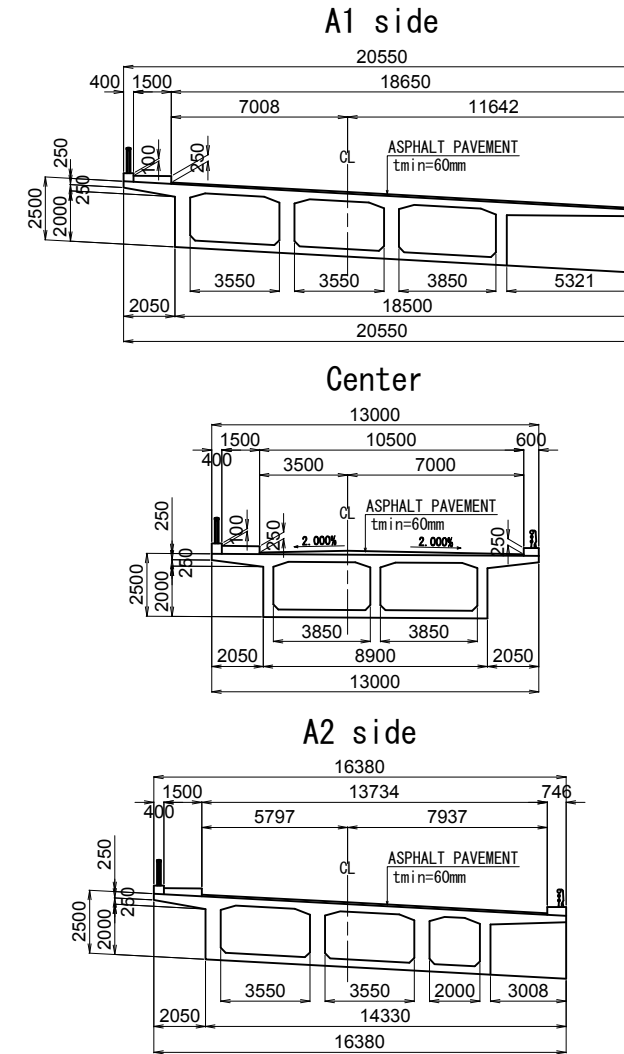
DRAWING No. :  
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# GENERAL DRAWING (Nikachu Bridge)

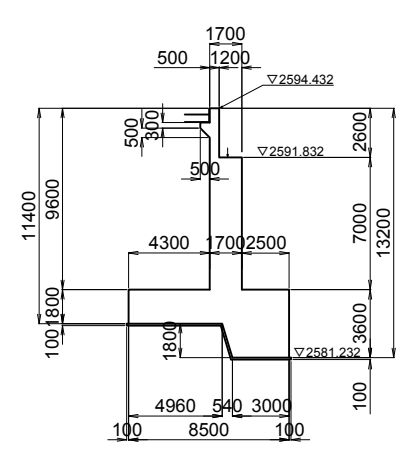
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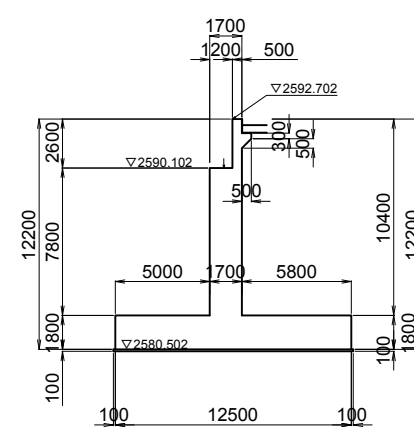
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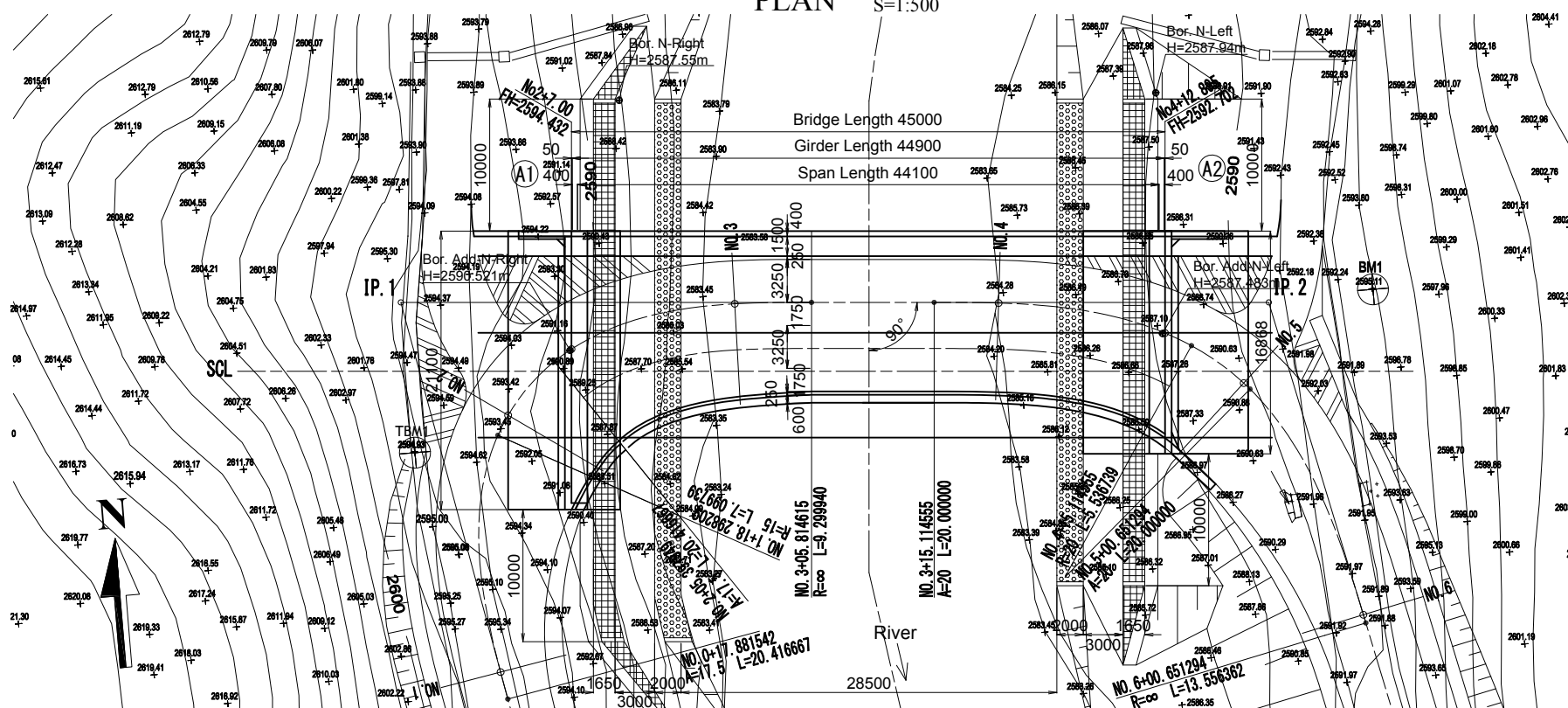
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A2 ABUTMENT S=1:400



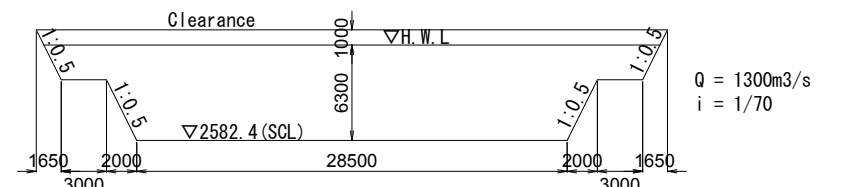
PLAN S=1:500



Design condition

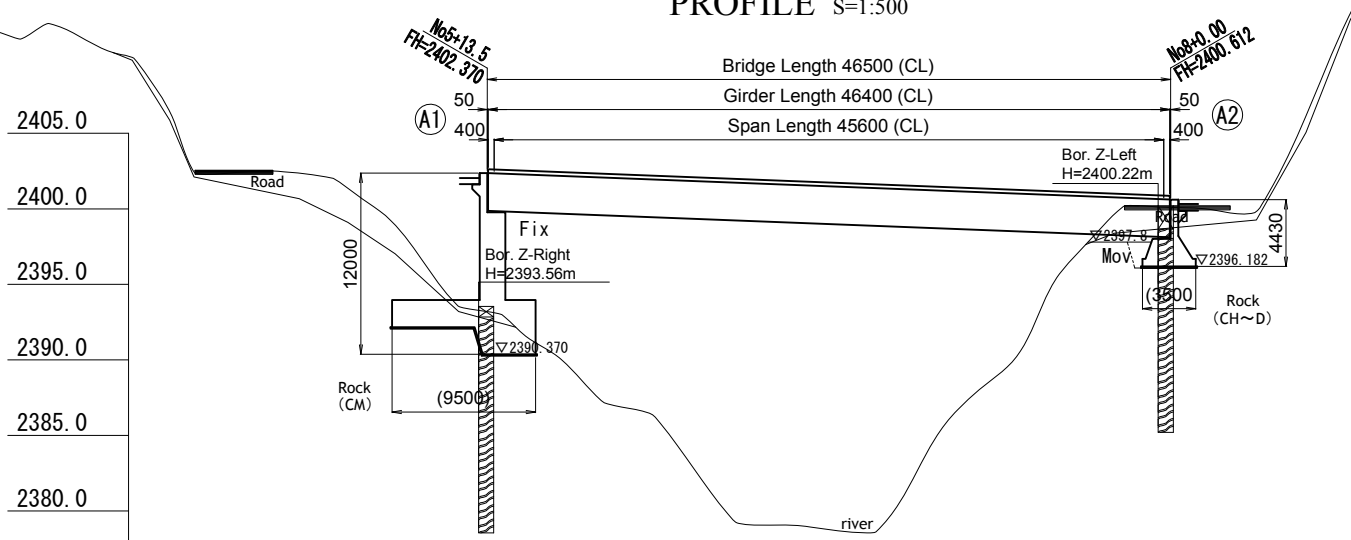
Bridge Length	45.000m		
Span Length	44.100m		
Road Width	20.550m~16.380m		
Live Load	Single lane IRC 70R(wheeled) or Double lane IRC Class A		
Design Seismic Scale	KH=0.22 KV=0.00		
Super structure	Form	PC Box-Shape Girder	
	Material strength	Concrete	$\sigma_{ck}=30 \text{ N/mm}^2$
		ReinforcigBar	SD345 Equivalent
Sub structure	Tendon	12S12.7mm	
	Form	Structure	Inverted T-Type Abutment
		Foundation	Spread Foundation
Material strength	Concrete	$\sigma_{ck}=21 \text{ N/mm}^2$	
	ReinforcigBar	SD345 Equivalent	

RIVER CROSS SECTION S=1:500



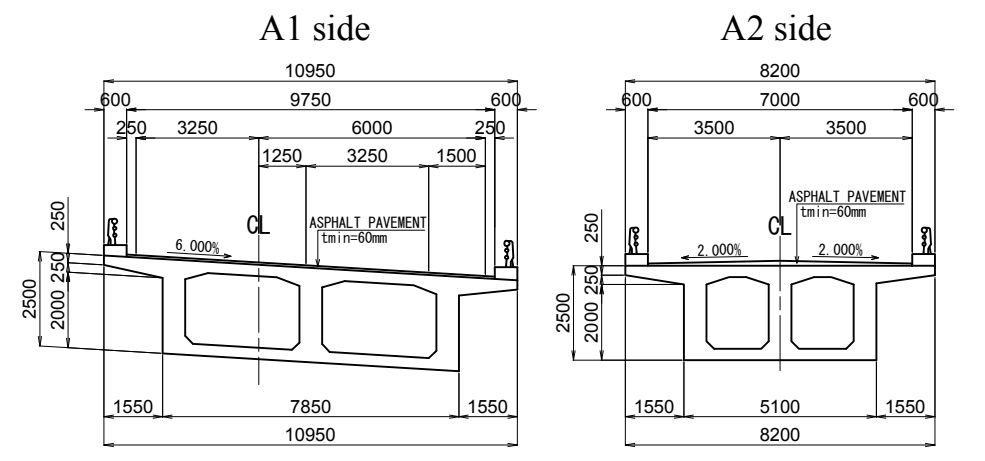
# GENERAL DRAWING (Zalamchu Bridge)

PROFILE S=1:500

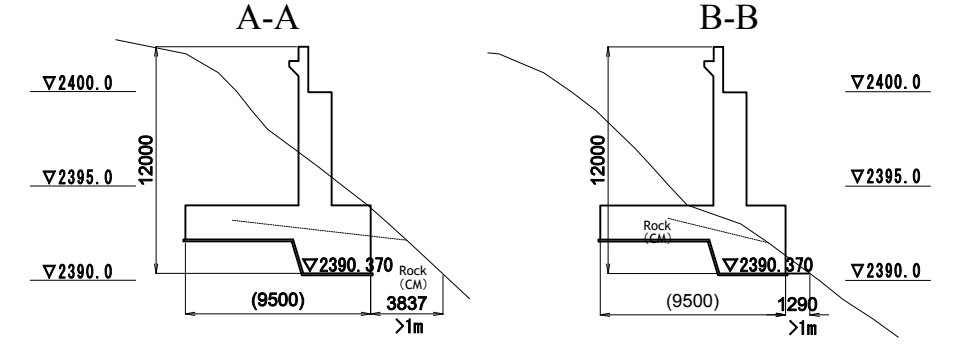


Gradient	i=3.78%		i=3.78%		i=3.78%	
Proposed height	2402.880	2402.370	2402.124	2401.979	2401.104	2400.546
Ground height	2402.35	2390.50	2386.11	2382.15	2388.51	2399.48
Total Distance	100.000	113.500	120.000	123.847	140.000	161.737
Station	No6+0.00	No6+13.5	No6+0.00	KE3	No7+0.00	KA3
Transversal Slope			-6.00%	-2.00%	-2.00%	-2.00%
Widening			2.75m	0.63m	0.06m	0.06m

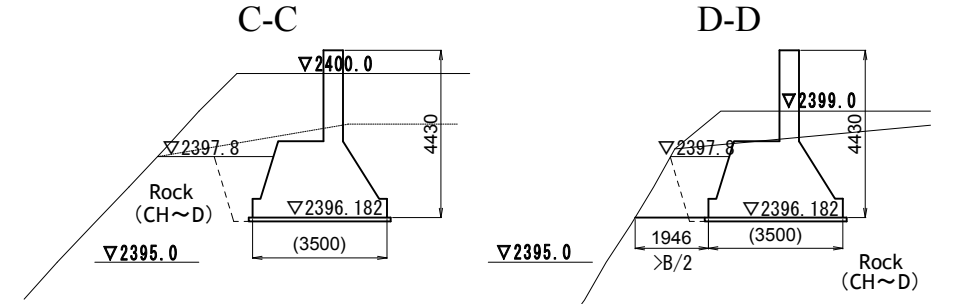
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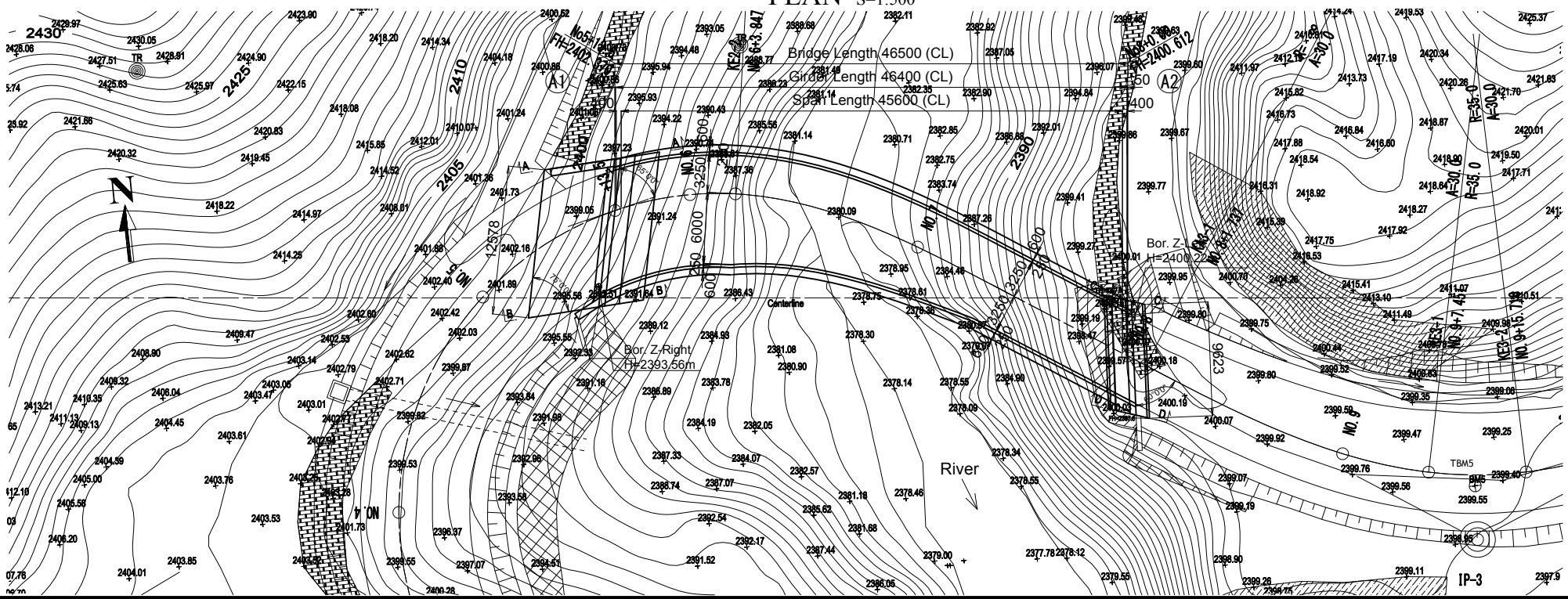
A1 ABUTMENT S=1:400



A2 ABUTMENT S=1:200



PLAN S=1:500



## Design condition

Bridge Length	46.500m		
Span Length	45.600m		
Road Width	7.000m~9.750m		
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	$\sigma_{ck}=30 \text{ N/mm}^2$
		ReinforcBar	SD345 Equivalent
Sub structure	Tendon	12S12.7mm	
	Form	Structure	Inverted T-Type Abutment
	Foundation	Material strength	Spread Foundation
	Concrete	$\sigma_{ck}=21 \text{ N/mm}^2$	
	ReinforcBar	SD345 Equivalent	



## 2. Road Drawings

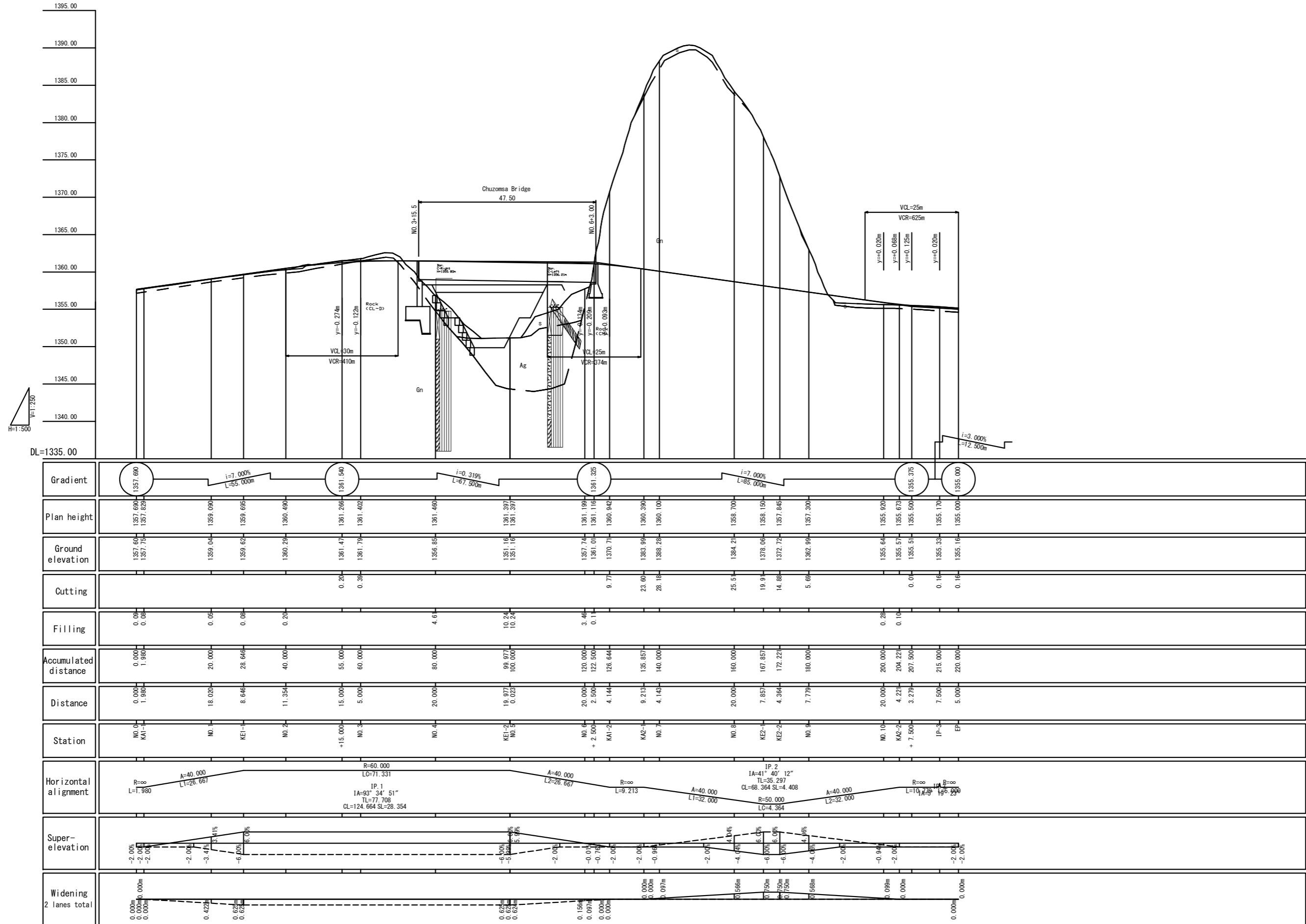
## (1) Chuzomsa Bridge

PLAN (CHUZOMSA BRIDGE)



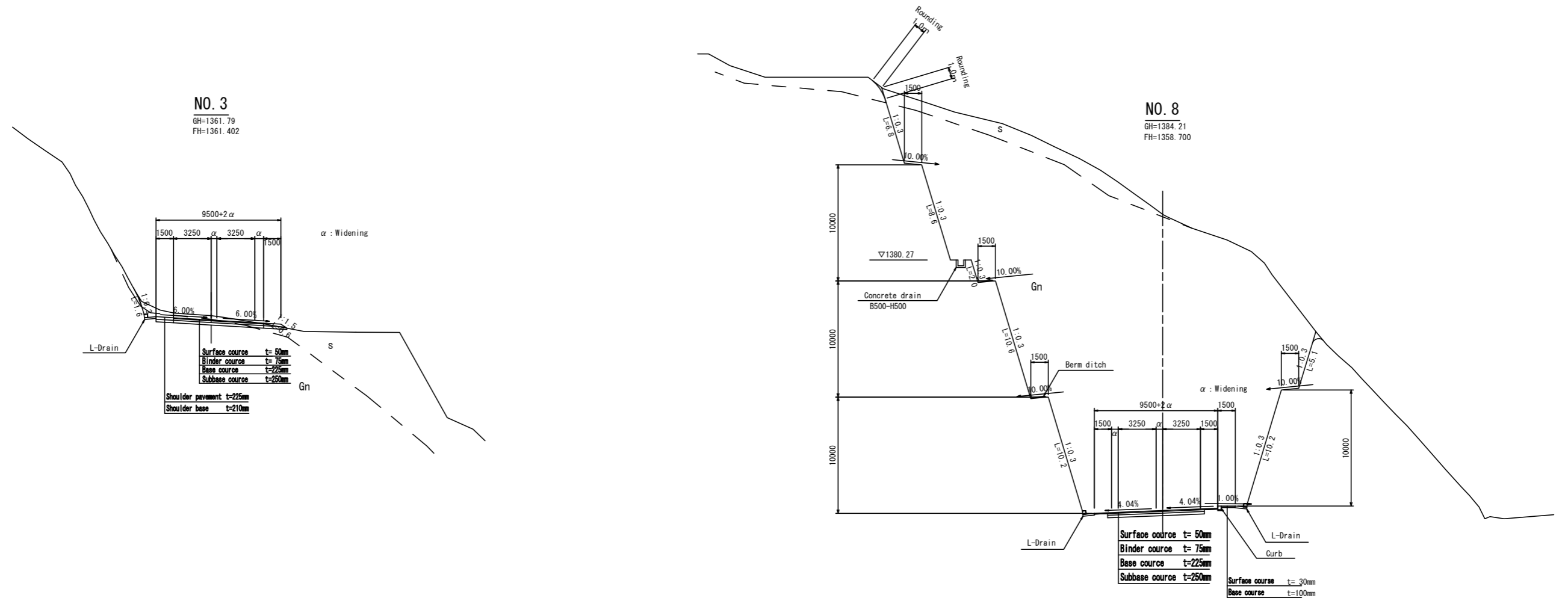
<p>Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>CONSULTANTS: THE CONSORTIUM OF ORIENTAL CONSULTANTS GLOBAL CO.,LTD AND INGEROSEC CORPORATION</p>	<p>PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.1 IN BHUTAN</p>	<p>DRAWING TITLE: PLAN(CHUZOMSA BRIDGE)</p>	<p>DATE: PREPARED BY: CHECKED BY:</p>	<p>DRAWING No. : C-1</p>
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PROFILE



Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANTS:	PROJECT NAME:	DRAWING TITLE:	DATE:	DRAWING No. :
	THE CONSORTIUM OF ORIENTAL CONSULTANTS GLOBAL CO.,LTD AND INGEROSEC CORPORATION	PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.1 IN BHUTAN	PROFILE (CHUZOMSA BRIDGE)	PREPARED BY: CHECKED BY:	C-2

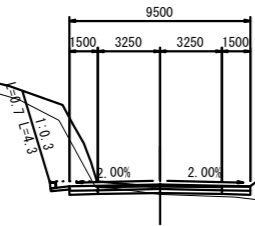
TYPICAL CROSS SECTION S=1:200



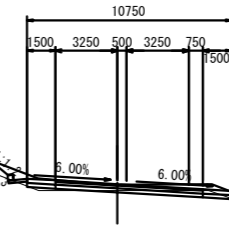
<p>Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>CONSULTANTS: THE CONSORTIUM OF ORIENTAL CONSULTANTS GLOBAL CO.,LTD AND INGEROSEC CORPORATION</p>	<p>PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.1 IN BHUTAN</p>	<p>DRAWING TITLE: TYPICAL CROSS SECTION (CHUZOMSA BRIDGE)</p>	<p>DATE: PREPARED BY: CHECKED BY:</p>	<p>DRAWING No. : C-3</p>
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CROSS SECTION(1)

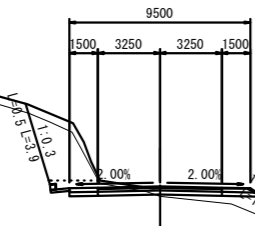
**KA1-1 (NO. 0+1.98)**  
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 FH=1357.829



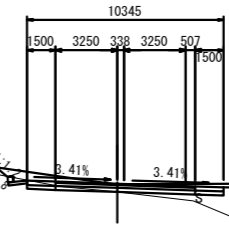
**KE1-1 (NO. 1+8.646)**  
 GH=1359.62  
 FH=1359.695



**BP (NO. 0)**  
 GH=1357.60  
 FH=1357.690



**NO. 1**  
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 FH=1359.090



DL=1345.00

DL=1345.00

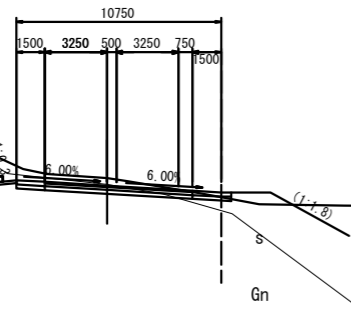
DL=1345.00

DL=1345.00

Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANTS:	PROJECT NAME:	DRAWING TITLE:	DATE:	DRAWING No. :
	THE CONSORTIUM OF ORIENTAL CONSULTANTS GLOBAL CO.,LTD AND INGEROSEC CORPORATION	PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.1 IN BHUTAN	CROSS SECTION(1) (CHUZOMSA BRIDGE)	PREPARED BY:	C-4
				CHECKED BY:	

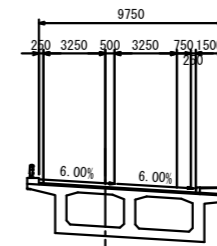
CROSS SECTION(2)

**NO. 3**  
GH=1361.79  
FH=1361.402



**KE1-2 (NO. 4+19.977)**

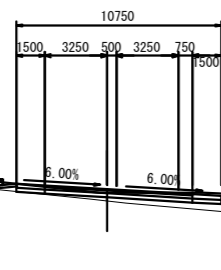
GH=1351.16  
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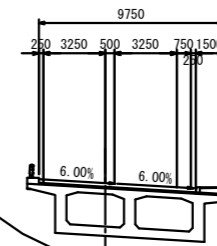
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**NO. 2**  
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FH=1360.490



**NO. 4**

GH=1356.85  
FH=1361.460

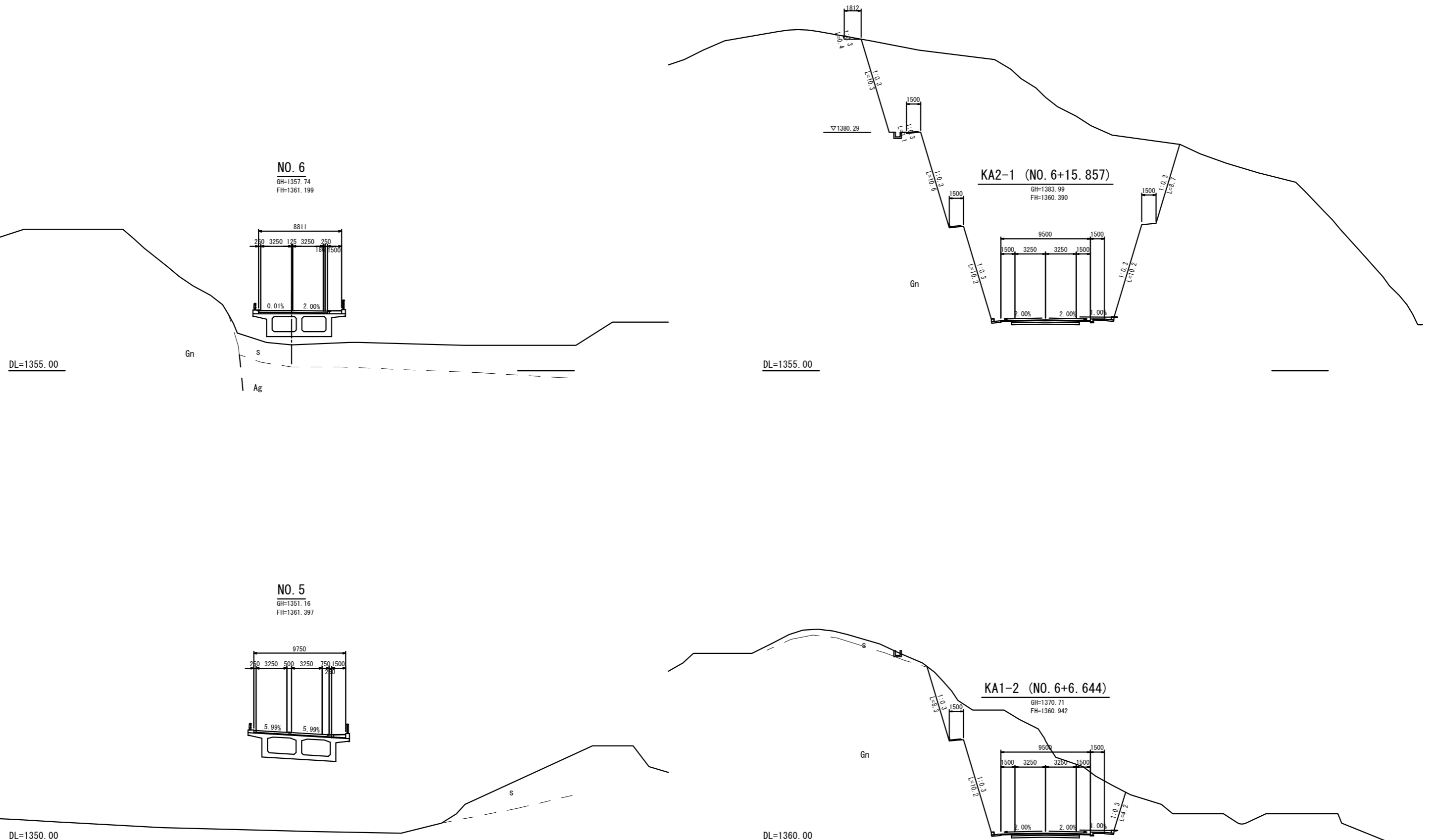


DL=1345.00

DL=1350.00

<p>Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>CONSULTANTS: THE CONSORTIUM OF ORIENTAL CONSULTANTS GLOBAL CO.,LTD AND INGEROSEC CORPORATION</p>	<p>PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.1 IN BHUTAN</p>	<p>DRAWING TITLE: CROSS SECTION(2) (CHUZOMSA BRIDGE)</p>	<p>DATE: PREPARED BY: CHECKED BY:</p>	<p>DRAWING No. : C-5</p>
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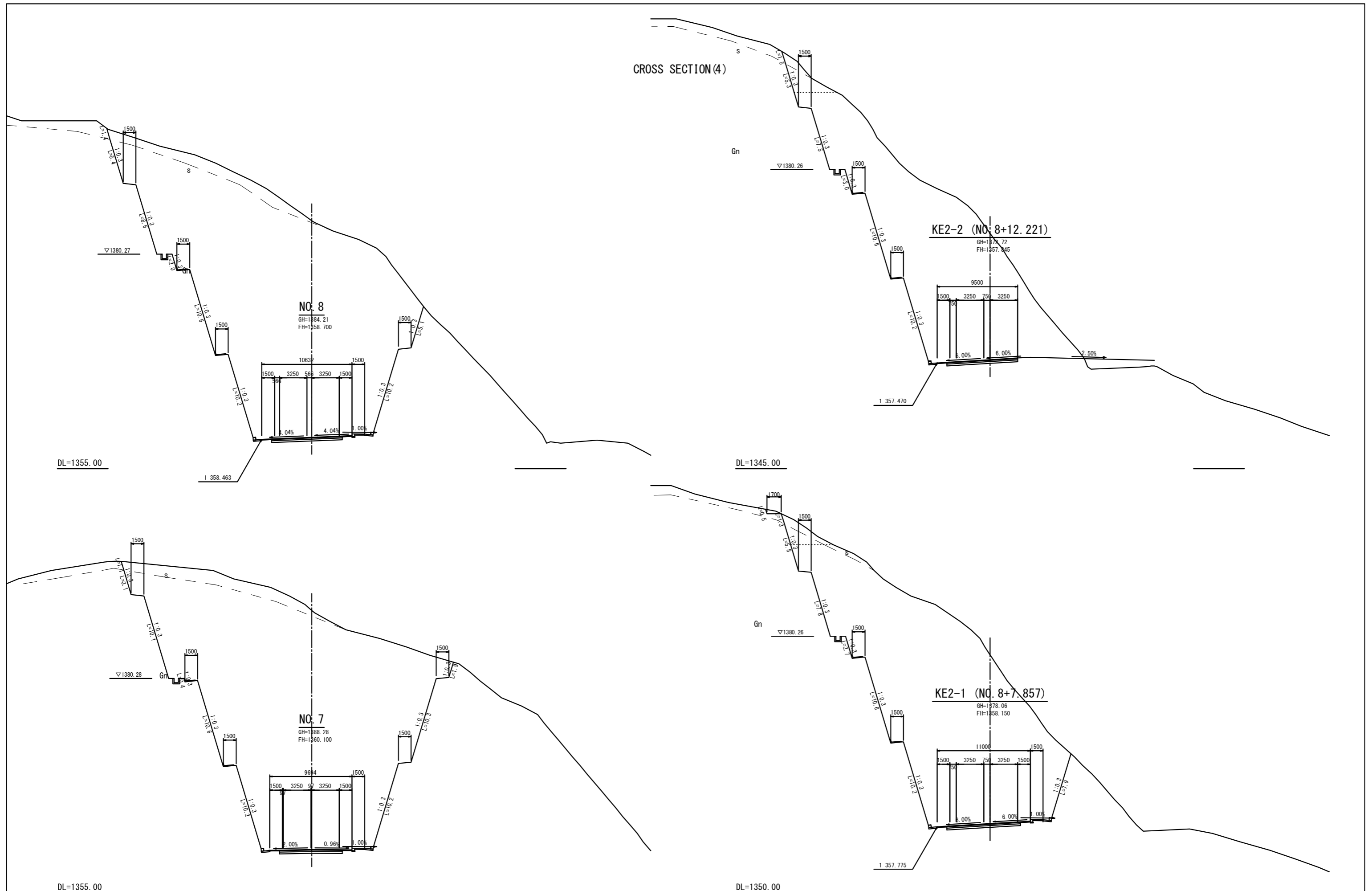
CROSS SECTION (3)



<p>Royal Government of Bhutan          MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR)          JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>CONSULTANTS:          THE CONSORTIUM OF          ORIENTAL CONSULTANTS GLOBAL CO.,LTD          AND INGEROSEC CORPORATION</p>	<p>PROJECT NAME:          PREPARATORY SURVEY ON          THE PROJECT FOR RECONSTRUCTION OF BRIDGES          ON PRIMARY NATIONAL HIGHWAY No.1 IN BHUTAN</p>	<p>DRAWING TITLE:          CROSS SECTION(3)          (CHUZOMSA BRIDGE)</p>	<p>DATE:          PREPARED BY:          CHECKED BY:</p>	<p>DRAWING No. :          C-6</p>
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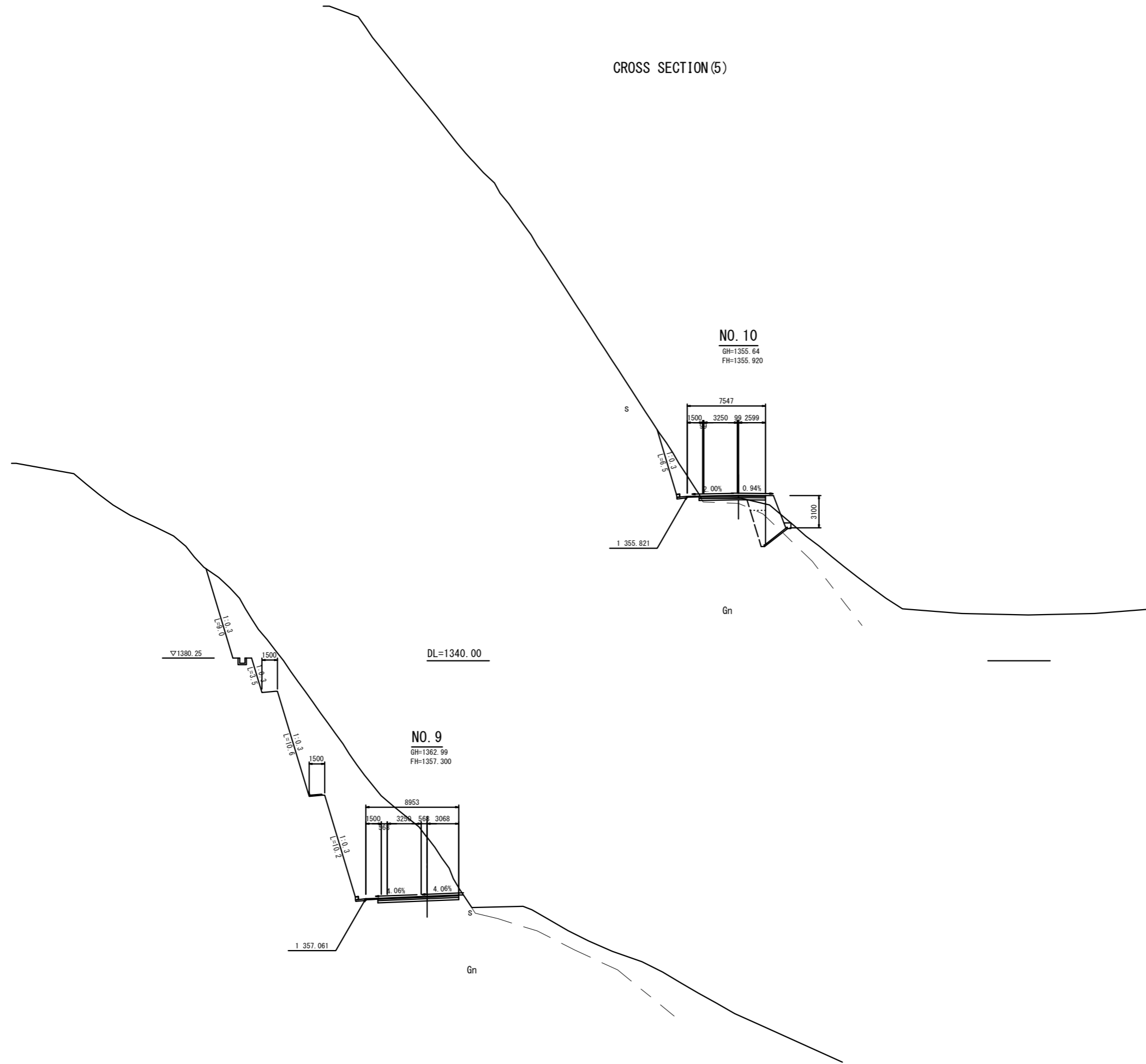


CROSS SECTION (4)



<p>Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>CONSULTANTS: THE CONSORTIUM OF ORIENTAL CONSULTANTS GLOBAL CO.,LTD AND INGEROSEC CORPORATION</p>	<p>PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.1 IN BHUTAN</p>	<p>DRAWING TITLE: CROSS SECTION(4) (CHUZOMSA BRIDGE)</p>	<p>DATE: PREPARED BY: CHECKED BY:</p>	<p>DRAWING No. : C-7</p>
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CROSS SECTION (5)



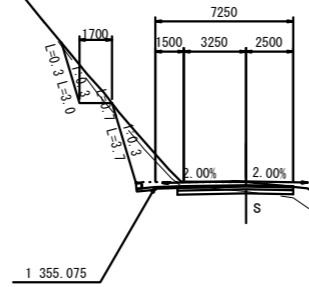
DL=1340.00

Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANTS:	PROJECT NAME:	DRAWING TITLE:	DATE:	DRAWING No. :
	THE CONSORTIUM OF ORIENTAL CONSULTANTS GLOBAL CO.,LTD AND INGEROSEC CORPORATION	PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.1 IN BHUTAN	CROSS SECTION(5) (CHUZOMSA BRIDGE)	PREPARED BY:	C-8
				CHECKED BY:	

CROSS SECTION(6)

IP-3 (NO. 10+15)

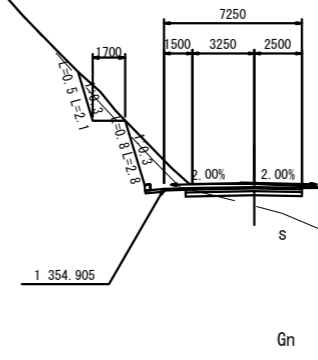
GH=1355.33  
FH=1355.170



DL=1340.00

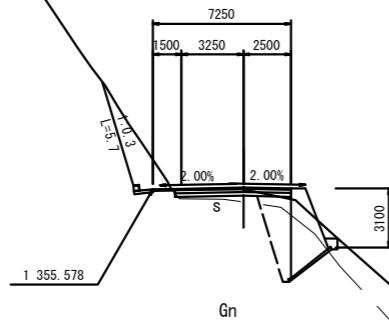
EP (NO. 11)

GH=1355.16  
FH=1355.000



KA2-2 (NO. 10+4.221)

GH=1355.57  
FH=1355.673



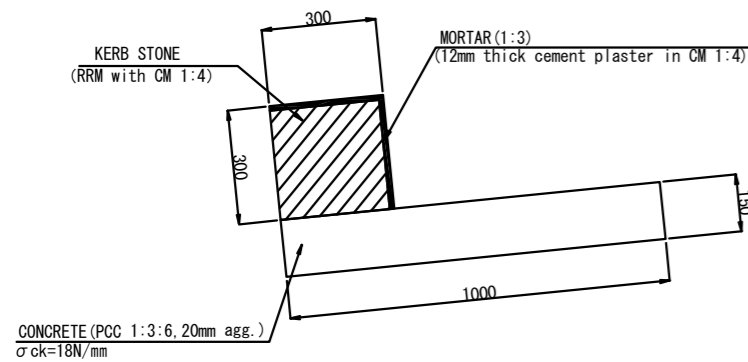
DL=1340.00

DL=1325.00

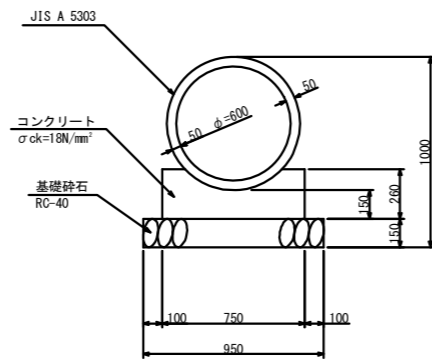
<p>Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>CONSULTANTS: THE CONSORTIUM OF ORIENTAL CONSULTANTS GLOBAL CO.,LTD AND INGEROSEC CORPORATION</p>	<p>PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.1 IN BHUTAN</p>	<p>DRAWING TITLE: CROSS SECTION(6) (CHUZOMSA BRIDGE)</p>	<p>DATE: PREPARED BY: CHECKED BY:</p>	<p>DRAWING No. : C-9</p>
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ROAD STRUCTURE

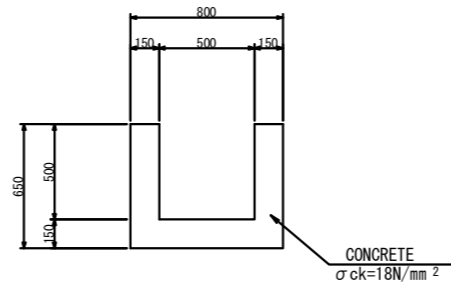
L-DRAIN S=1:20



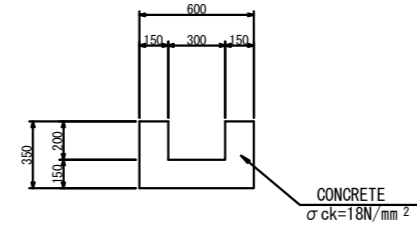
Pipe culvert (P1-RC-2-D600) S=1:20



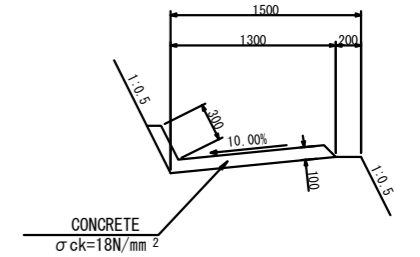
Concrete drain (500x500) S=1:20



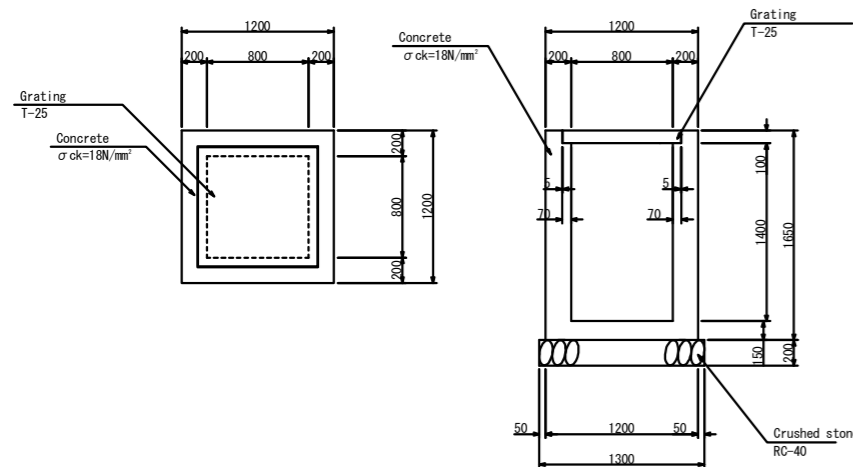
Vertical drain (300x200) S=1:20



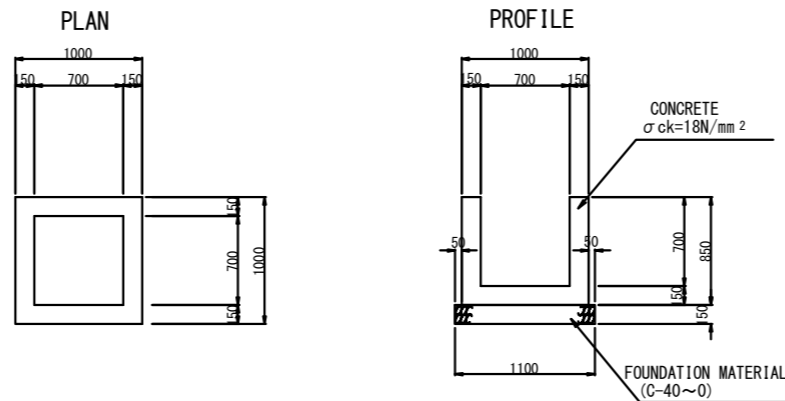
Verm ditch S=1:30



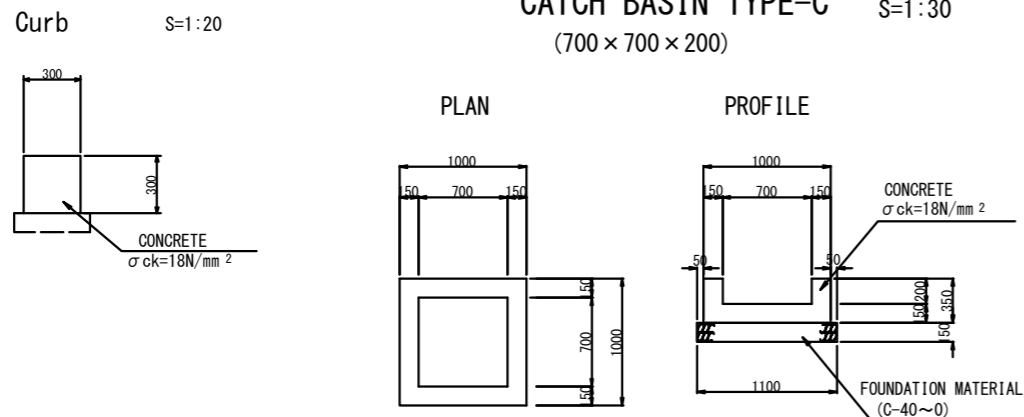
CATCH BASIN TYPE-A (800x800x1400) S=1:30



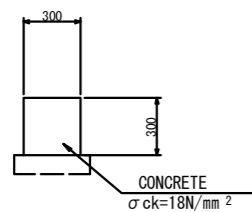
CATCH BASIN TYPE-B (700x700x700) S=1:20



CATCH BASIN TYPE-C (700x700x200) S=1:30

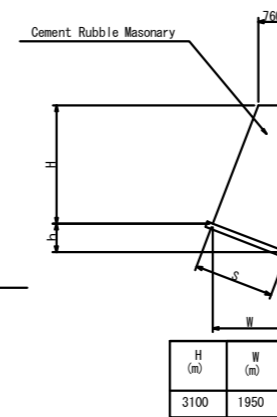


Curb S=1:20

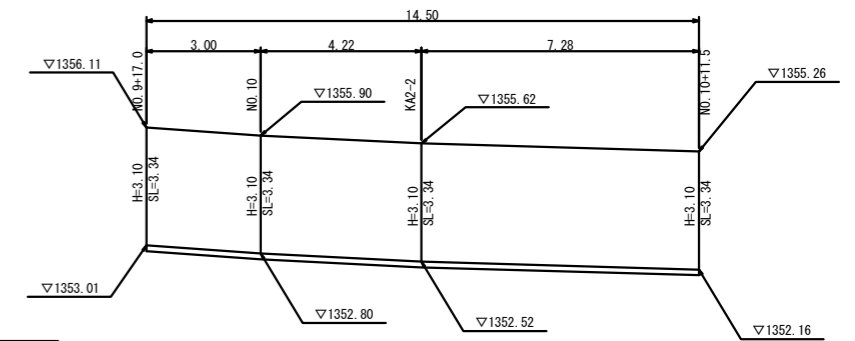


RETAINING WALL S=1:100

SECTION



DEPLOYMENT



CONCRETE RETAINING WALL S=1:100

DEPLOYMENT

(NO. 6+2.7 LEFT) (NO. 6+4.4 RIGHT)

SECTION

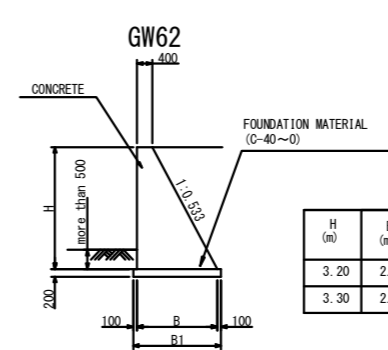
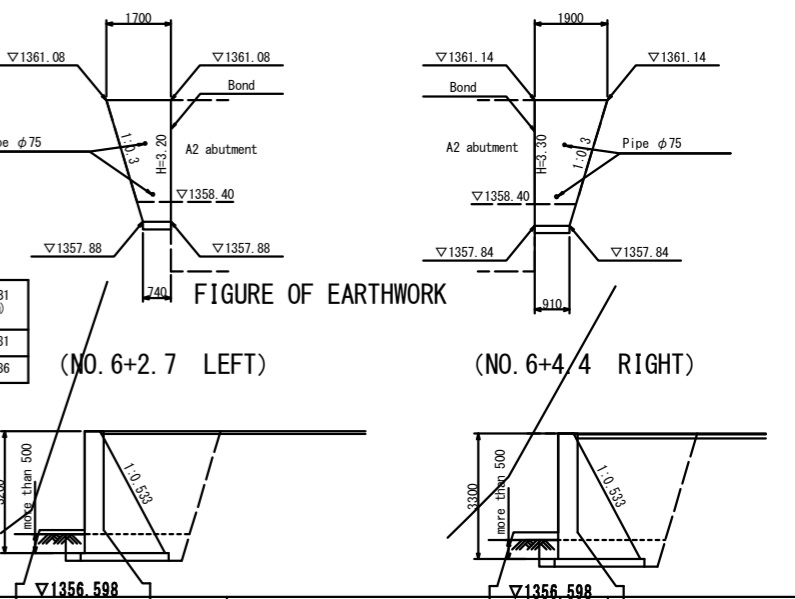
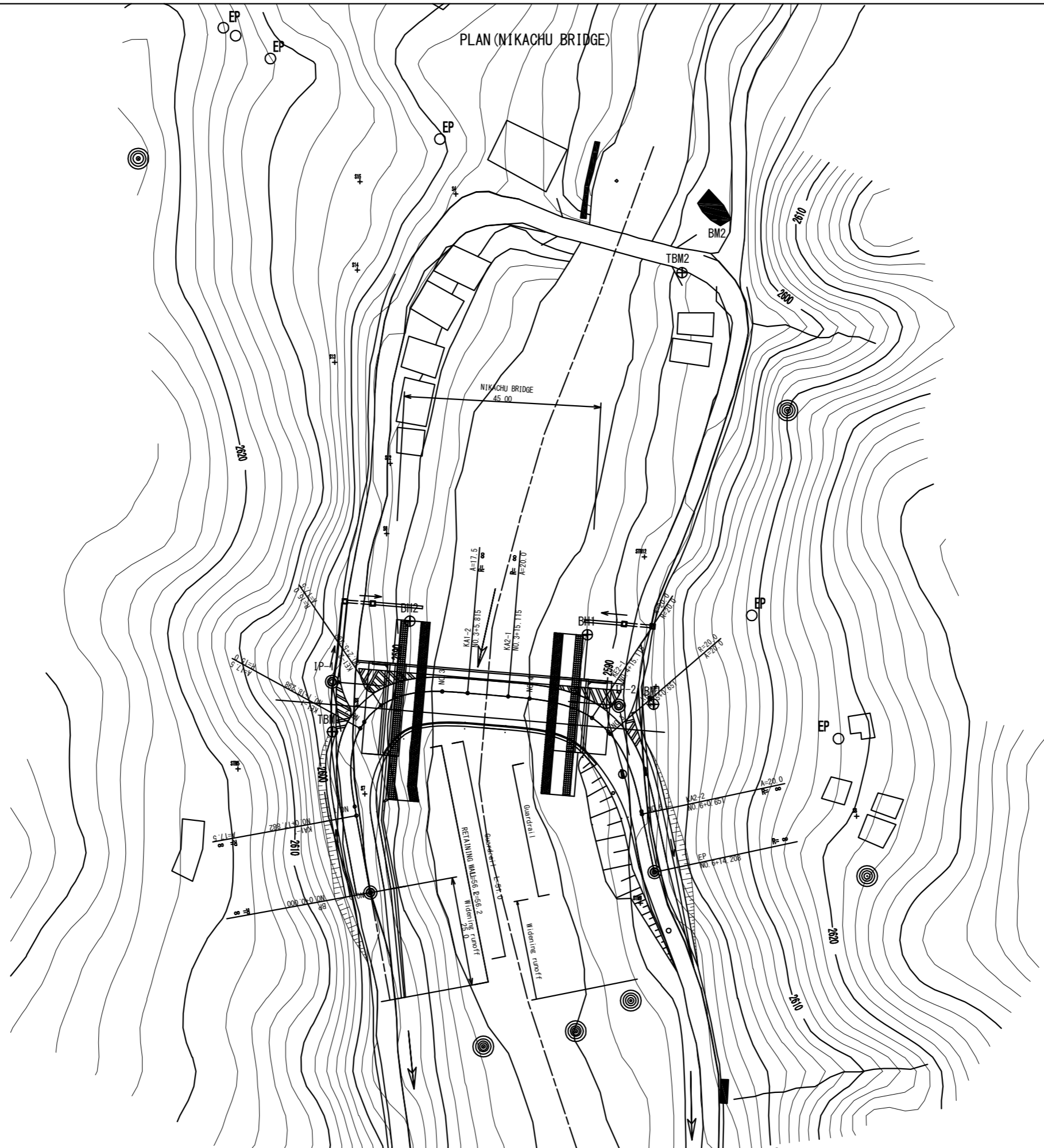


FIGURE OF EARTHWORK



## (2) Nikachu Bridge



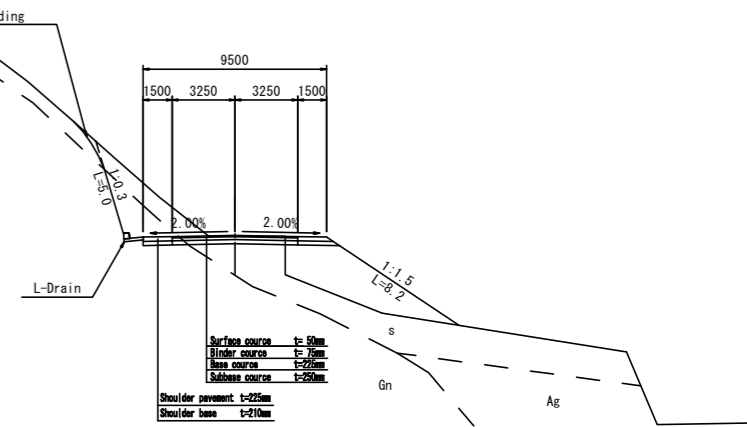
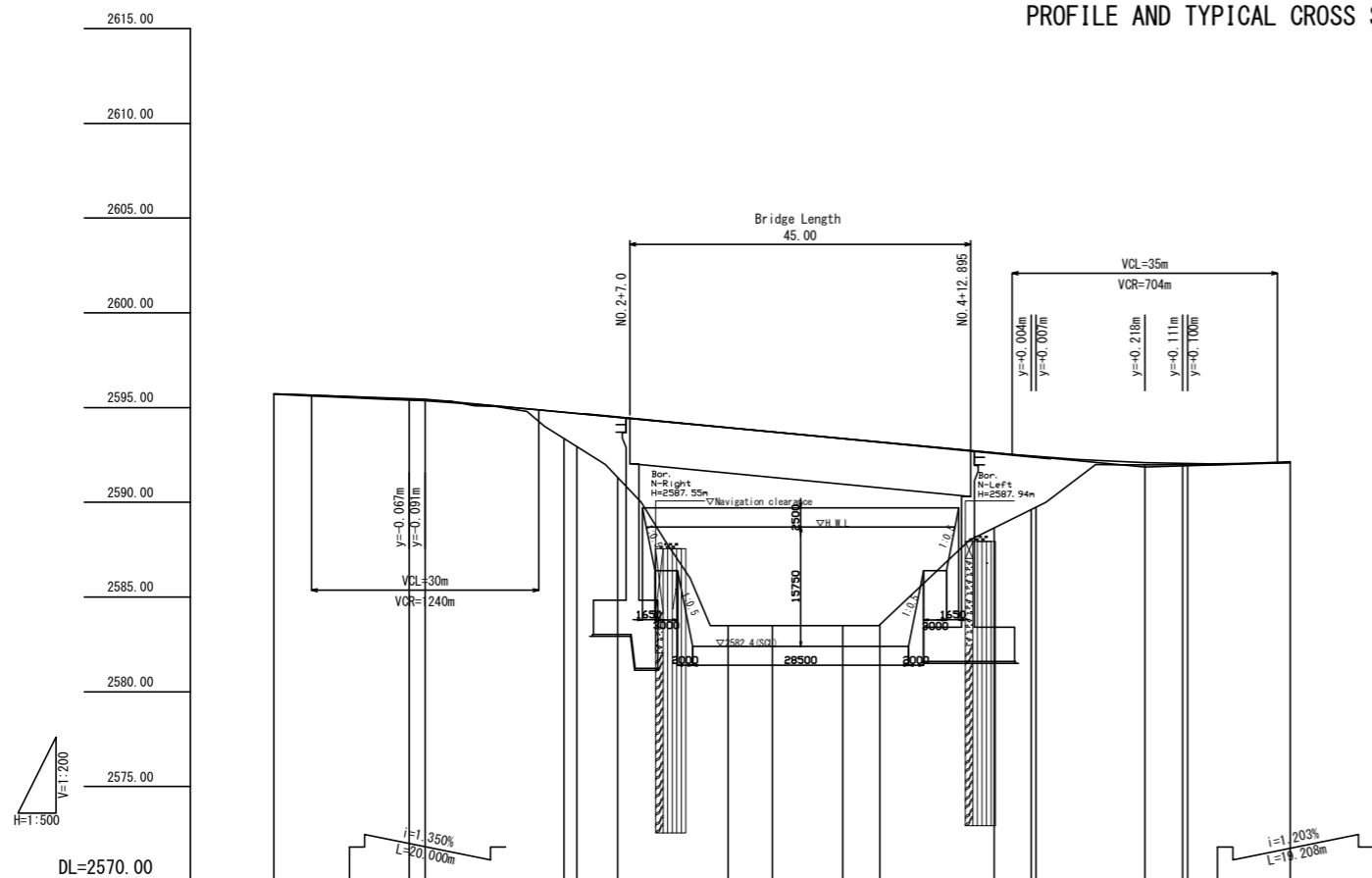
<p>Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>CONSULTANTS: THE CONSORTIUM OF ORIENTAL CONSULTANTS GLOBAL CO.,LTD AND INGEROSEC CORPORATION</p>	<p>PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.1 IN BHUTAN</p>	<p>DRAWING TITLE: PLAN (NIKACHU BRIDGE)</p>	<p>DATE: PREPARED BY: CHECKED BY:</p>	<p>DRAWING No. : N-1</p>
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PROFILE AND TYPICAL CROSS SECTION

TYPICAL CROSS SECTION S=1:200

KA2-2 (NO. 6+0.651)

GH=2591.99  
FH=2592.037

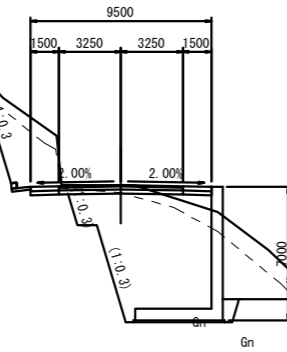


Gradient	2595.720		2595.450		2591.869		2592.100	
Plan height	2595.720	2595.412	2595.359	2594.760	2593.372	2593.372	2592.087	2592.100
Ground elevation	2595.71	2595.40	2595.38	2593.37	2593.50	2593.50	2591.97	2592.14
Cutting		0.02						0.04
Filling	0.01	0.01	1.39	1.76	3.18	10.44	10.22	9.87
Accumulated distance	0.000	17.882	20.000	38.288	40.000	45.388	60.000	65.815
Distance	0.000	17.882	2.118	18.288	1.702	5.388	14.802	5.815
Station	NO. 0	KA1-1	NO. 1	KE1-1	NO. 2	KE1-2	NO. 3	KA1-2
Horizontal alignment	<p>R=∞ L=17.882    A=17.500 L1=20.417    R=15.000 LC=7.100    A=17.500 L2=20.417    R=∞ L=9.300    A=20.000 L1=20.000    R=20.000 LC=5.537    A=20.000 L2=20.000    R=∞ L=13.556</p> <p>IP. 1 IA=105° 6' 18" TL=31.125 CL=47.933 SL=11.543</p> <p>IP. 2 IA=73° 9' 27" TL=25.372 CL=45.537 SL=5.934</p>							
Super-elevation	<p>-2.00%    -2.00%    -2.00%    -6.00%    -6.00%    -2.00%    -2.00%    -6.00%    -6.00%    -2.00%    -2.00%    -2.00%    -2.00%</p>							
Widening 2 lanes total	<p>0.000m    0.000m    0.000m    0.40m    1.500m    1.500m    3.755m    3.500m    3.500m    3.500m    3.500m    0.98m    0.114m    0.000m    0.000m    0.000m</p>							

CROSS SECTION(1)

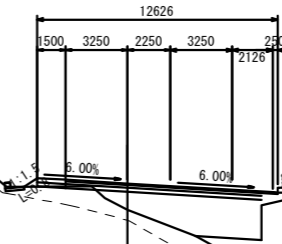
KA1-1 (NO. 0+17.882)

GH=2595.40  
FH=2595.412



KE1-1 (NO. 1+18.298)

GH=2593.37  
FH=2594.760

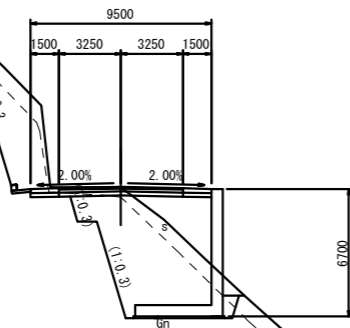


DL=2580.00

DL=2580.00

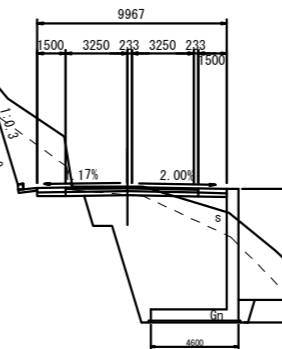
BP (NO. 0)

GH=2595.71  
FH=2595.720



NO. 1

GH=2595.38  
FH=2595.359



DL=2580.00

DL=2580.00

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.1 IN BHUTAN

DRAWING TITLE:  
CROSS SECTION(1)  
(NIKACHU BRIDGE)

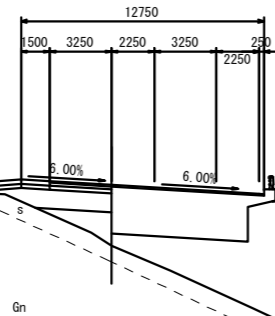
DATE:  
PREPARED BY:  
CHECKED BY:

DRAWING No. :  
N-3

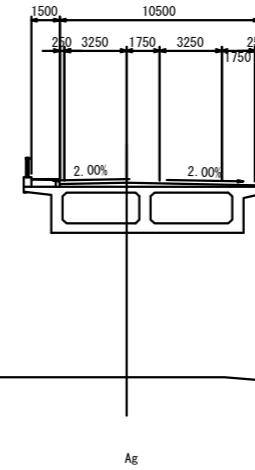


CROSS SECTION (2)

KE1-2 (NO. 2+5.398)  
 GH=2591.31  
 FH=2594.493



KA1-2 (NO. 3+5.815)  
 GH=2583.50  
 FH=2593.723

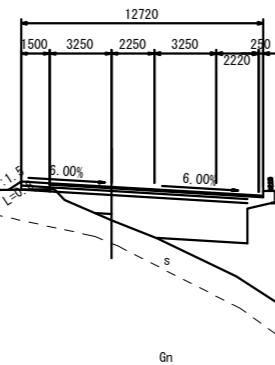


DL=2580.00

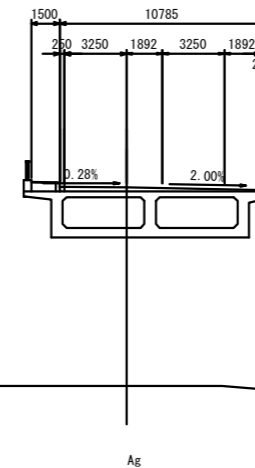
DL=2580.00

Ag

NO. 2  
 GH=2592.94  
 FH=2594.696



NO. 3  
 GH=2583.50  
 FH=2593.942



DL=2580.00

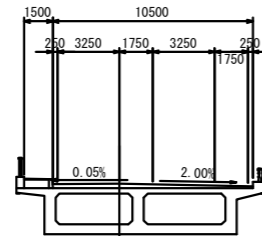
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Ag

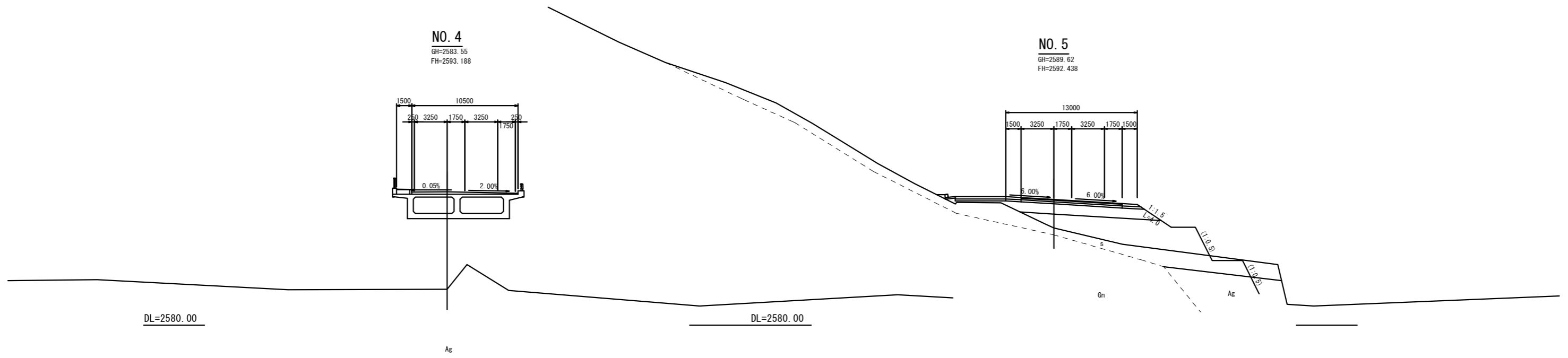
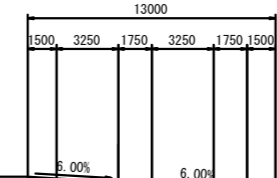
Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANTS:	PROJECT NAME:	DRAWING TITLE:	DATE:	DRAWING No. :
	THE CONSORTIUM OF ORIENTAL CONSULTANTS GLOBAL CO.,LTD AND INGEROSEC CORPORATION	PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.1 IN BHUTAN	CROSS SECTION(2) (NIKACHU BRIDGE)	PREPARED BY:	N-4
				CHECKED BY:	

CROSS SECTION(3)

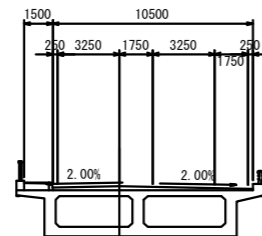
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GH=2583.55  
FH=2593.188



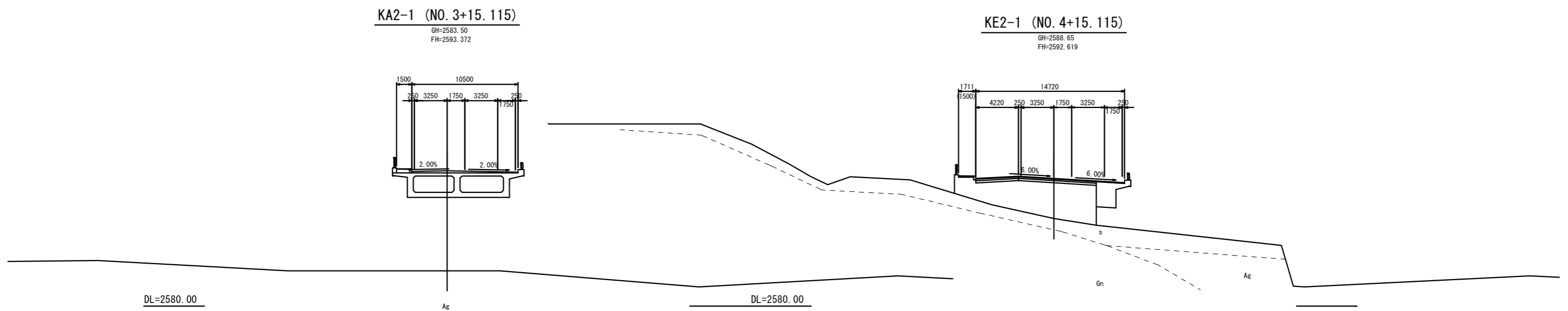
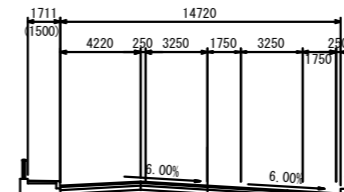
**NO. 5**  
GH=2589.62  
FH=2592.438



**KA2-1 (NO. 3+15.115)**  
GH=2583.50  
FH=2593.372



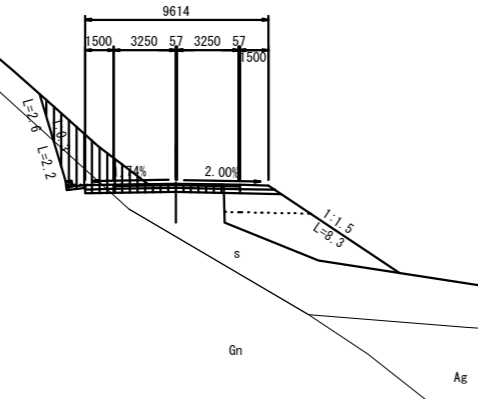
**KE2-1 (NO. 4+15.115)**  
GH=2588.65  
FH=2592.619



Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANTS:	PROJECT NAME:	DRAWING TITLE:	DATE:	DRAWING No. :
	THE CONSORTIUM OF ORIENTAL CONSULTANTS GLOBAL CO.,LTD AND INGEROSEC CORPORATION	PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.1 IN BHUTAN	CROSS SECTION(3) (NIKACHU BRIDGE)	PREPARED BY:	N-5
				CHECKED BY:	

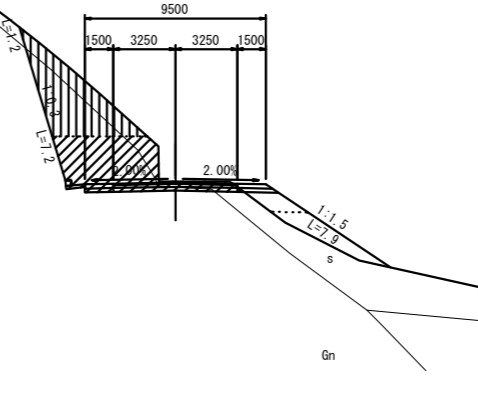
CROSS SECTION(4)

**NO. 6**  
GH=2591.98  
FH=2592.040



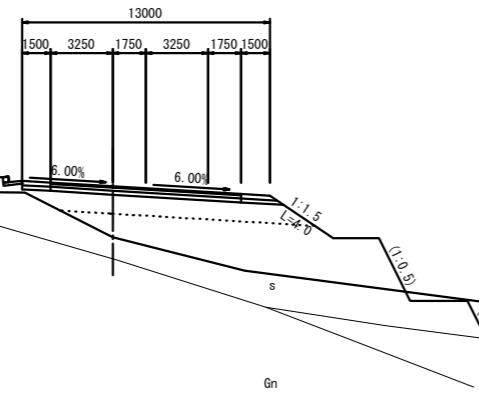
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**EP (NO. 6+14.208)**  
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FH=2592.100



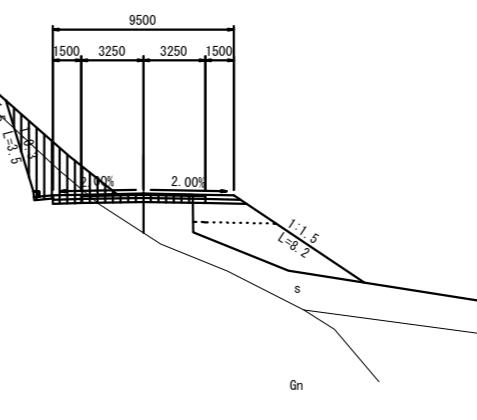
DL=2580.00

**KE2-2 (NO. 5+0.651)**  
GH=2589.74  
FH=2592.417



DL=2580.00

**KA2-2 (NO. 6+0.651)**  
GH=2591.99  
FH=2592.037

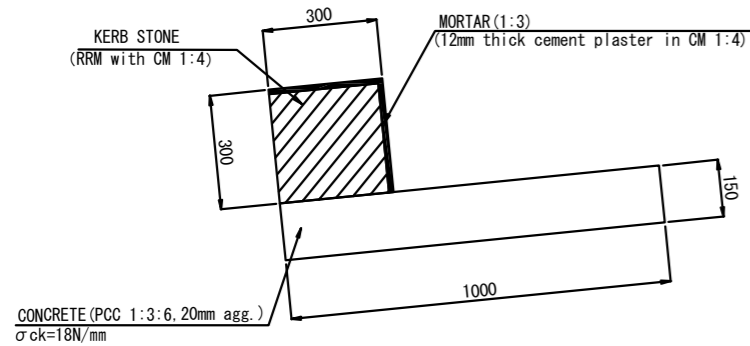


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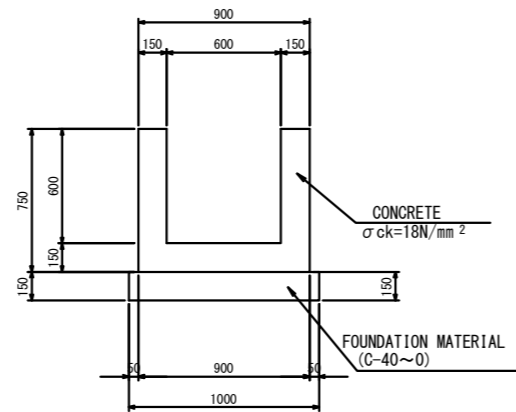
<p>Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>CONSULTANTS: THE CONSORTIUM OF ORIENTAL CONSULTANTS GLOBAL CO.,LTD AND INGEROSEC CORPORATION</p>	<p>PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.1 IN BHUTAN</p>	<p>DRAWING TITLE: CROSS SECTION(4) (NIKACHU BRIDGE)</p>	<p>DATE: PREPARED BY: CHECKED BY:</p>	<p>DRAWING No. : N-6</p>
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ROAD STRUCTURE

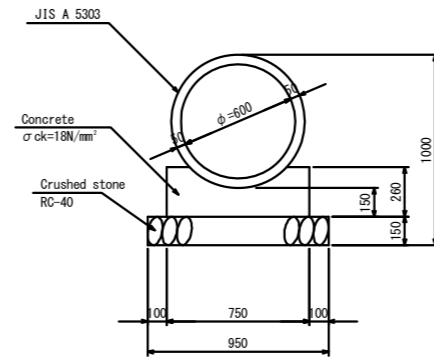
L-DRAIN S=1:20



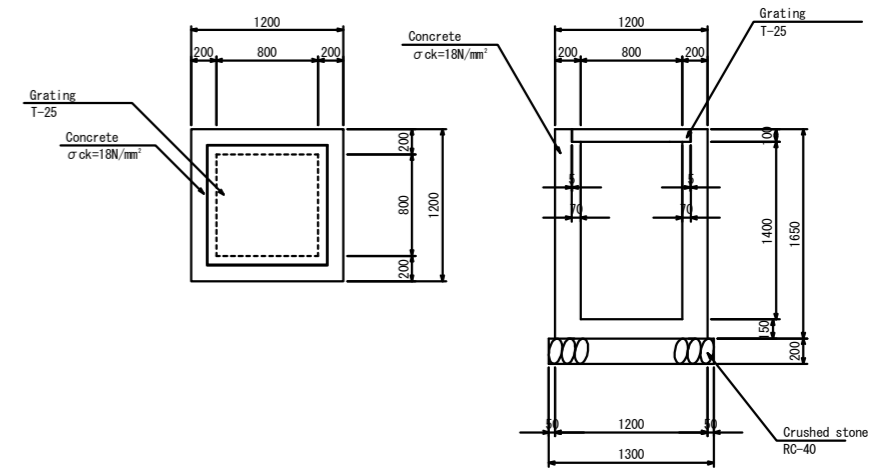
Concrete Drainage (600 x 600) S=1:20



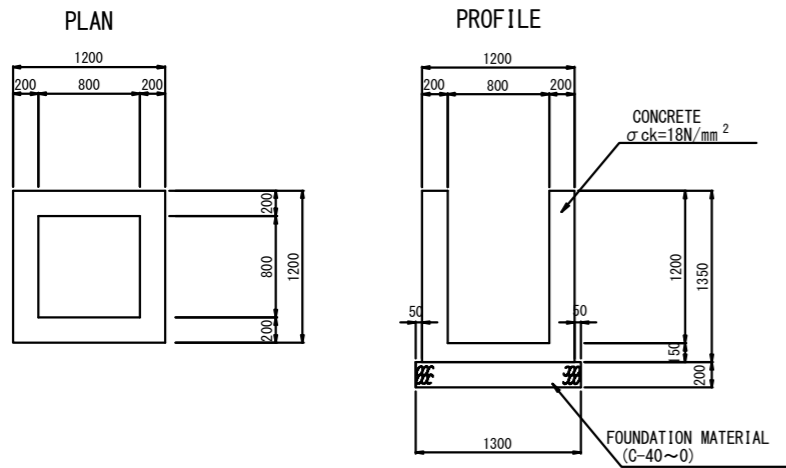
Pipe Culvert (P1-RC-2-D600) S=1:20



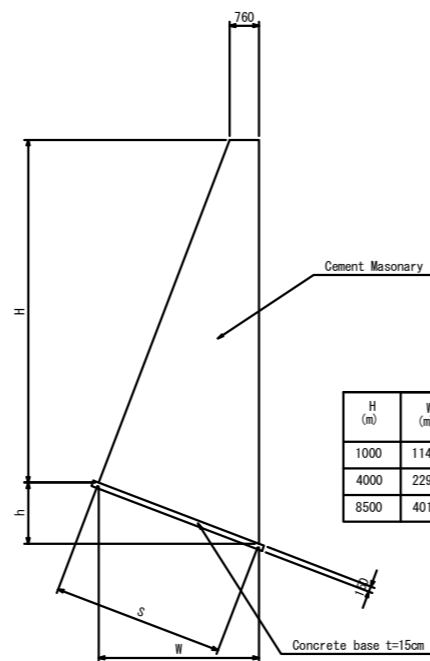
CATCH BASIN TYPE-A (800 x 800 x 1400) S=1:30



CATCH BASIN TYPE-B (800 x 800 x 1200) S=1:30

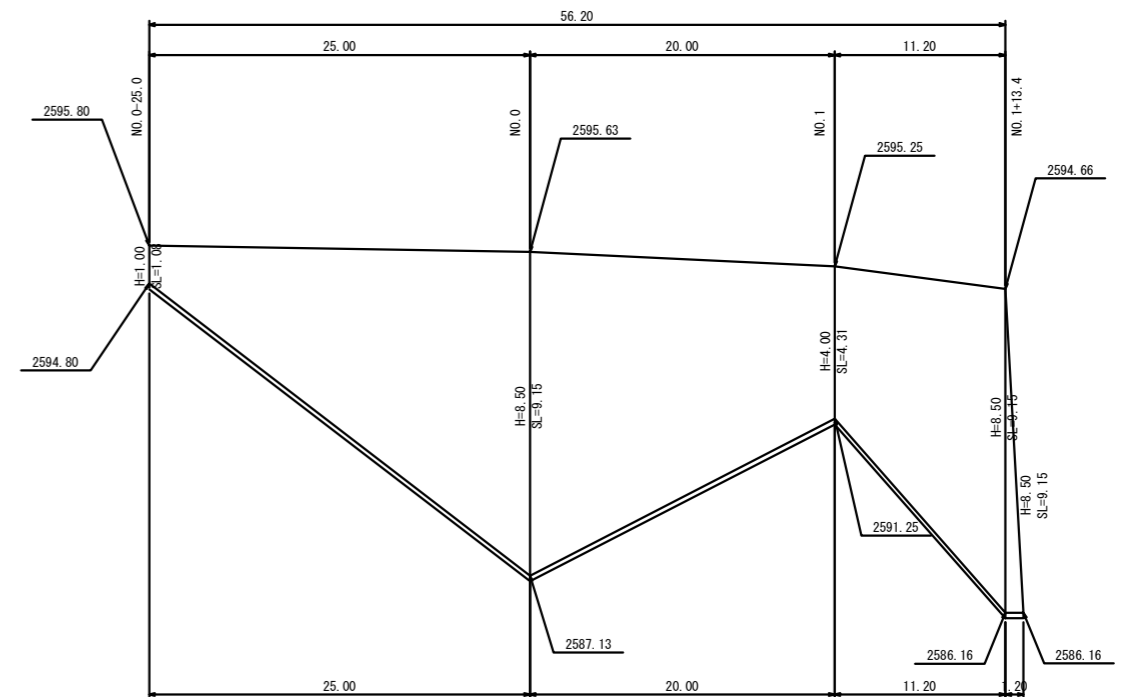


SECTION S=1:100

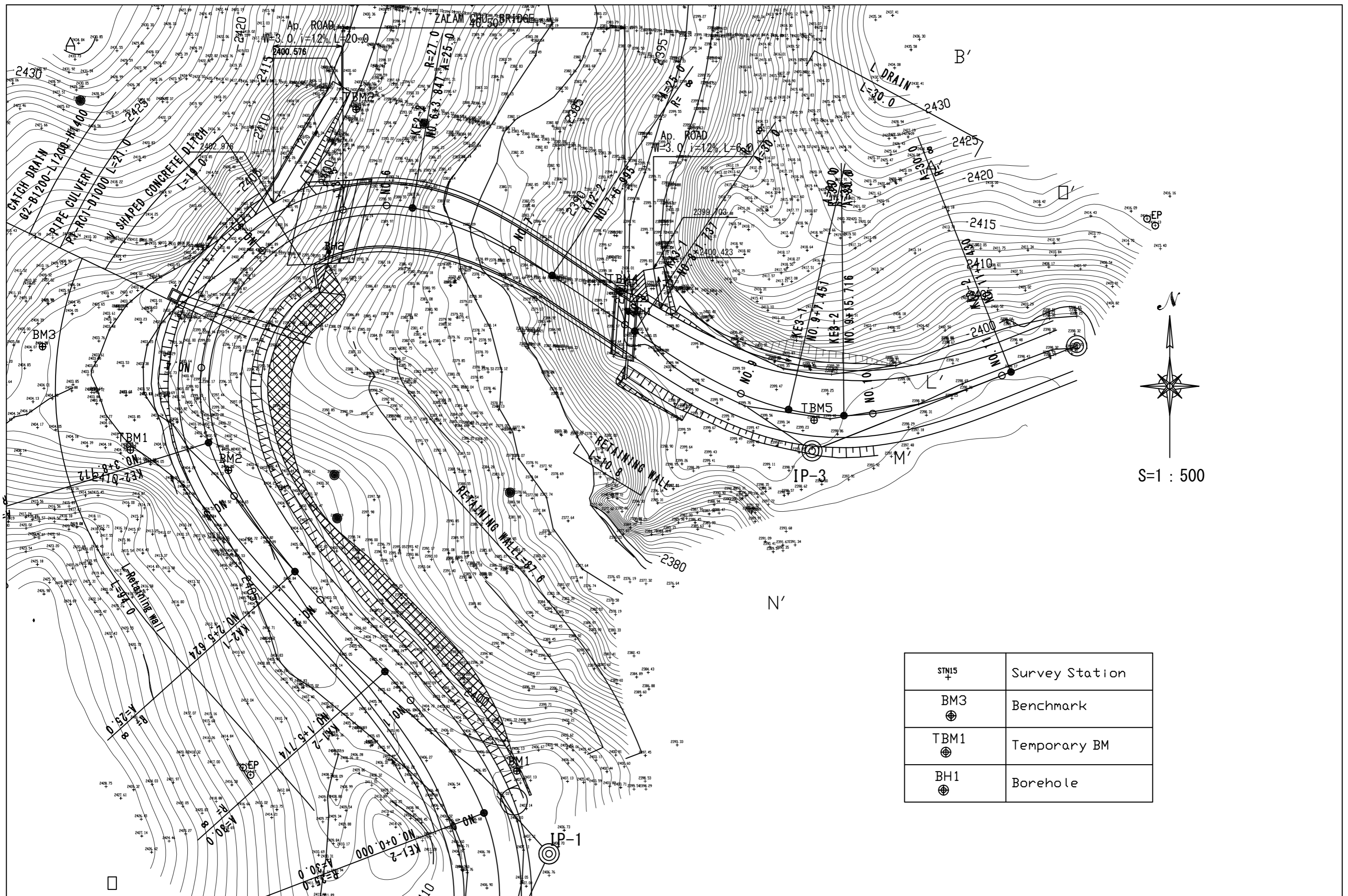


RETAINING WALL

DEPLOYMENT SH=1:250 SV=1:100



### (3) Zalamchu Bridge

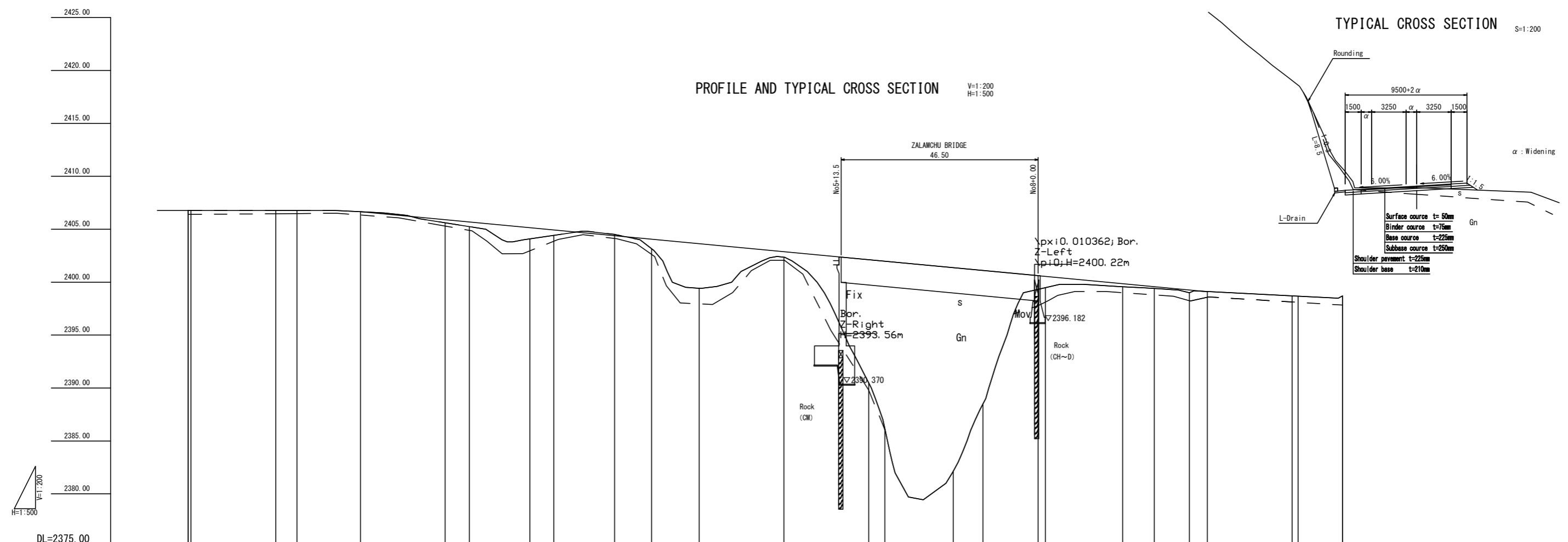


STN15 +	Survey Station
BM3 ⊕	Benchmark
TBM1 ⊕	Temporary BM
BH1 ⊕	Borehole

PROFILE AND TYPICAL CROSS SECTION

V=1:200  
H=1:500

TYPICAL CROSS SECTION S=1:200

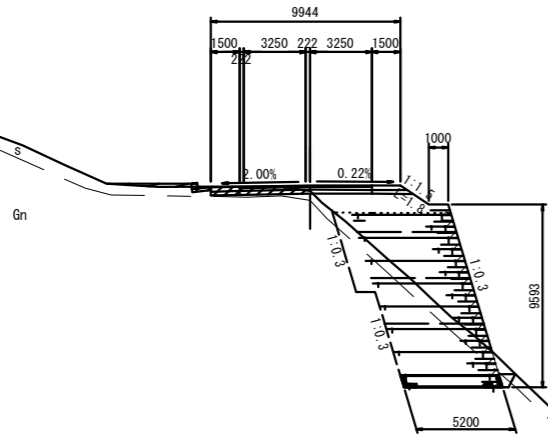


H=1:500  
V=1:200  
DL=2375.00

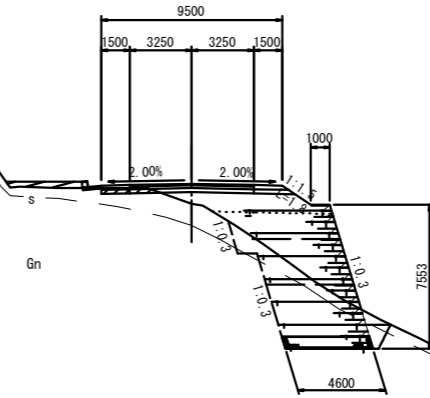
Gradient	2406.660		i=3.780% L=200.000m		2399.100																							
Plan height																												
Ground elevation	2406.78	2406.78	2406.78	2406.66	2405.61	2405.25	2404.09	2404.42	2404.51	2403.16	2399.42	2402.35	2390.50	2386.11	2382.15	2388.51	2399.32	2399.48	2399.56	2399.41	2399.00	2399.11	2388.70	2398.61	2398.69			
Cutting									0.12																			
Filling				0.10	0.29	0.44	1.06	0.51		0.90	4.22	0.53	11.62	15.87	19.22	12.59	1.29	1.07	0.30	0.16	0.26							
Accumulated distance	-47.987	-40.888	-40.000	-20.000	-14.973	0.000	20.000	25.714	40.000	45.624	60.000	68.772	80.000	100.000	120.000	132.847	146.995	160.000	161.731	180.000	187.45	195.716	200.000	220.000	221.430	231.904		
Distance	0.000	7.289	0.688	20.000	5.027	14.973	20.000	5.714	14.286	5.624	14.376	8.772	11.228	20.000	20.000	3.847	16.153	6.995	13.005	1.731	18.263	7.451	8.285	4.284	20.000	1.430	10.474	
Station	BP	KA1-1	NO. 1	KE1-1	KE1-2	NO. 2	KA1-2	NO. 3	KA2-1	NO. 4	KE2-1	NO. 5	KE2-2	NO. 6	KA2-2	NO. 7	KA3-1	KA3-2	NO. 8	KE3-1	KE3-2	NO. 9	KA3-2	NO. 10	KA3-2	EP		
Horizontal alignment	<p>IP. 1 IA=66° 36' 24" TL=36.308 CL=66.402 SL=7.815 R=35.000 LC=14.973</p> <p>IP. 2 IA=165° 59' 40" TL=238.000 CL=101.371 SL=201.199</p> <p>IP. 3 IA=55° 37' 27" TL=31.676 CL=59.693 SL=5.457 R=35.000 LC=8.265</p>																											
Super-elevation	<p>-2.00% -2.00%</p>																											
Widening 2 lanes total	<p>0.000m 0.000m</p>																											

CROSS SECTION(1)

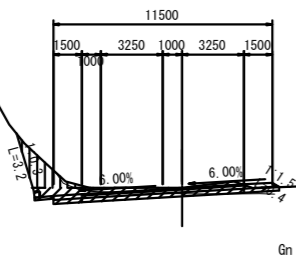
**NO. 1**  
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FH=2405.904



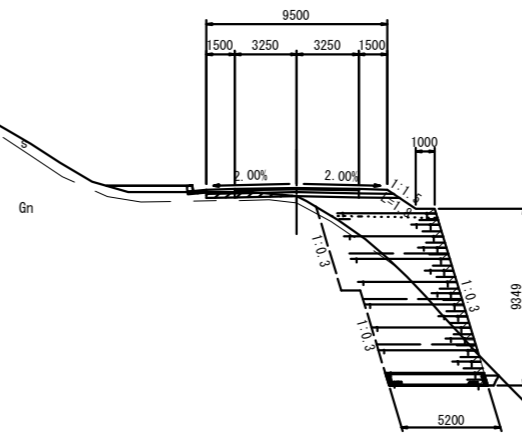
**NO. 2**  
GH=2404.09  
FH=2405.148



**NO. 0**  
GH=2406.66  
FH=2406.660



**KA1-2 (NO. 1+5.714)**  
GH=2405.25  
FH=2405.688



DL=2375.00

DL=2375.00

DL=2370.00

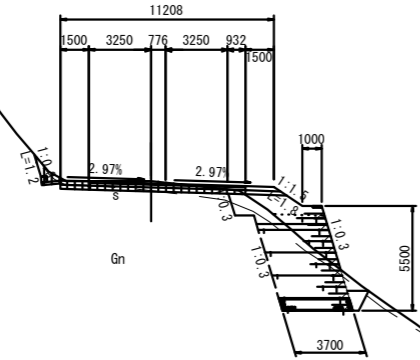
DL=2375.00

<p>Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>CONSULTANTS: THE CONSORTIUM OF ORIENTAL CONSULTANTS GLOBAL CO.,LTD AND INGEROSEC CORPORATION</p>	<p>PROJECT NAME: PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.1 IN BHUTAN</p>	<p>DRAWING TITLE: CROSS SECTION(1) (ZALAMCHU BRIDGE)</p>	<p>DATE: PREPARED BY: CHECKED BY:</p>	<p>DRAWING No. : Z-3</p>
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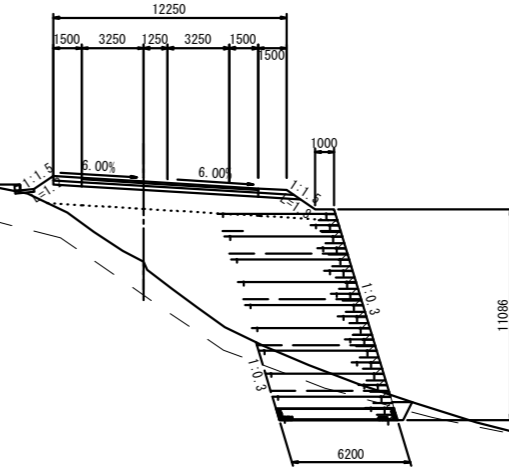


CROSS SECTION(2)

**NO. 3**  
GH=2404.51  
FH=2404.392



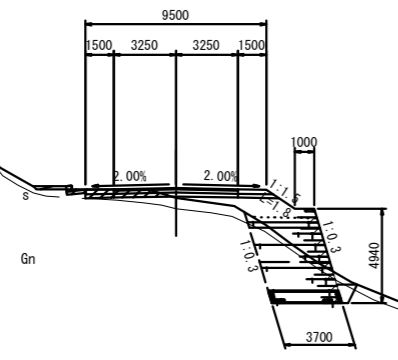
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FH=2403.636



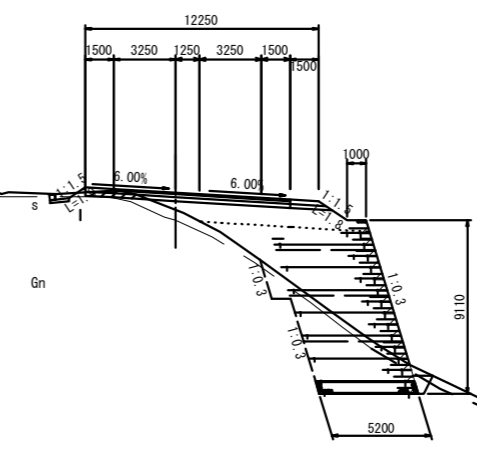
DL=2375.00

DL=2375.00

**KA2-1 (NO. 2+5.624)**  
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FH=2404.935



**KE2-1 (NO. 3+8.772)**  
GH=2403.16  
FH=2404.060

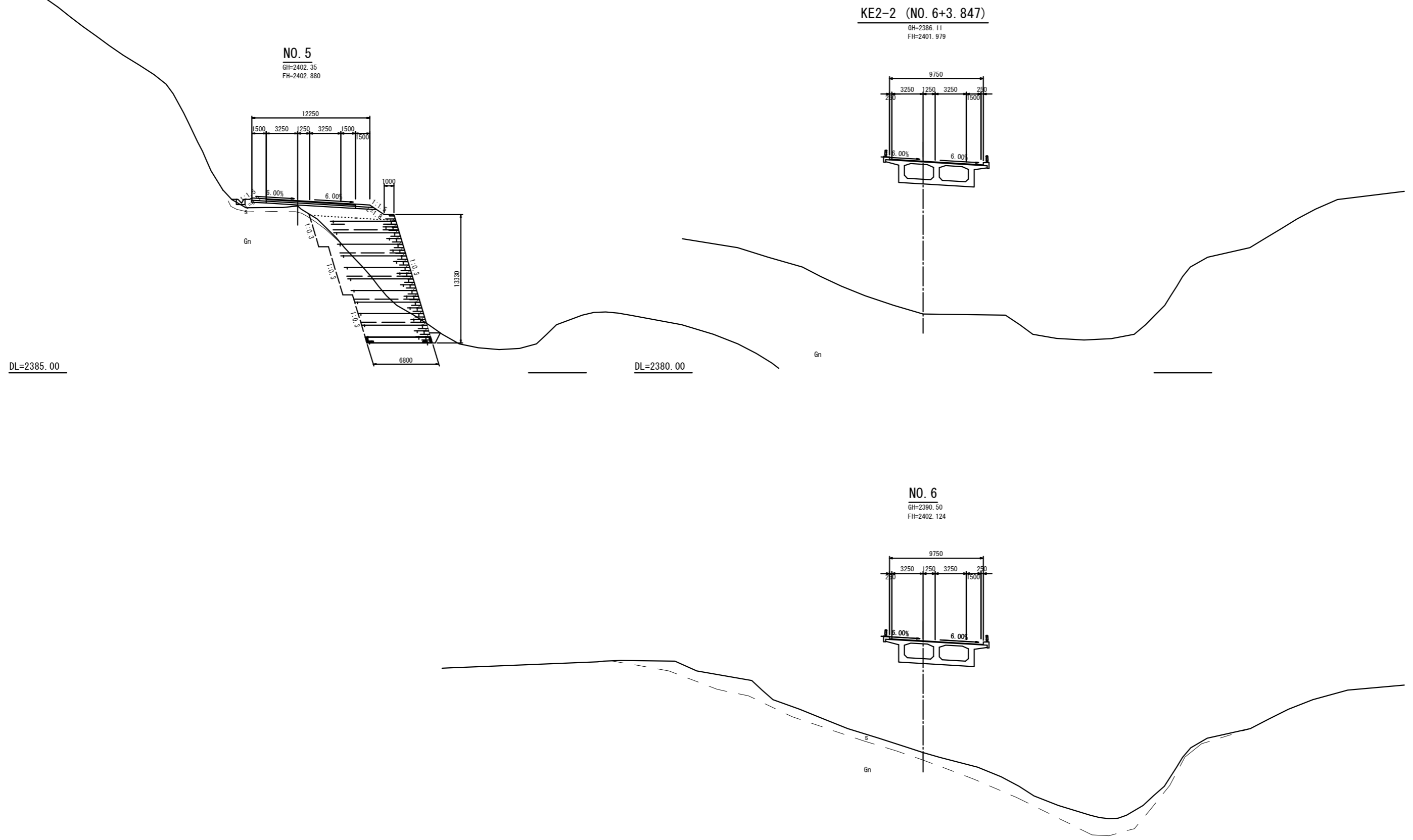


DL=2375.00

DL=2375.00

Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANTS:	PROJECT NAME:	DRAWING TITLE:	DATE:	DRAWING No. :
	THE CONSORTIUM OF ORIENTAL CONSULTANTS GLOBAL CO.,LTD AND INGEROSEC CORPORATION	PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.1 IN BHUTAN	CROSS SECTION(2) (ZALAMCHU BRIDGE)	PREPARED BY:	Z-4
				CHECKED BY:	

CROSS SECTION(3)

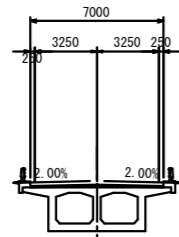


Royal Government of Bhutan MINISTRY OF WORKS and HUMAN SETTLEMENT (DoR) JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANTS:	PROJECT NAME:	DRAWING TITLE:	DATE:	DRAWING No. :
	THE CONSORTIUM OF ORIENTAL CONSULTANTS GLOBAL CO.,LTD AND INGEROSEC CORPORATION	PREPARATORY SURVEY ON THE PROJECT FOR RECONSTRUCTION OF BRIDGES ON PRIMARY NATIONAL HIGHWAY No.1 IN BHUTAN	CROSS SECTION(3) (ZALAMCHU BRIDGE)	PREPARED BY:	Z-5
				CHECKED BY:	

CROSS SECTION(4)

KA2-2 (NO. 7+6.995)

GH=2388.51  
FH=2401.104

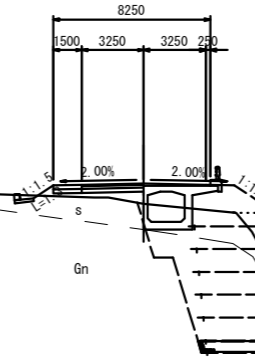


Gn

DL=2375.00

KA3-1 (NO. 8+1.737)

GH=2399.48  
FH=2400.546

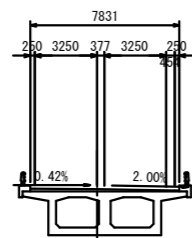


Gn

DL=2375.00

NO. 7

GH=2382.15  
FH=2401.368

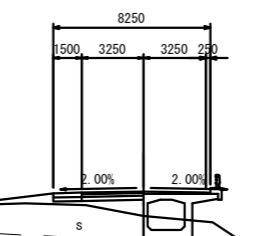


Gn

DL=2375.00

NO. 8

GH=2399.32  
FH=2400.612



Gn

DL=2375.00

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.1 IN BHUTAN

DRAWING TITLE:  
CROSS SECTION(4)  
(ZALAM CHU BRIDGE)

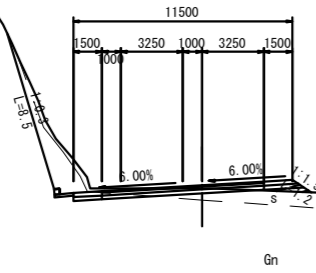
DATE:  
PREPARED BY:  
CHECKED BY:

DRAWING No. :  
Z-6

CROSS SECTION (5)

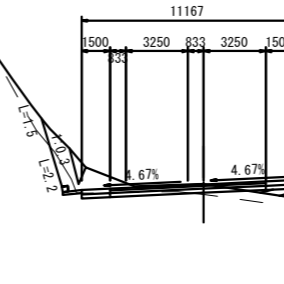
KE3-1 (NO. 9+7.451)

GH=2399.41  
FH=2399.574



NO. 10

GH=2399.11  
FH=2399.100

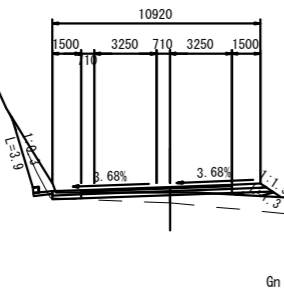


DL=2380.00

DL=2385.00

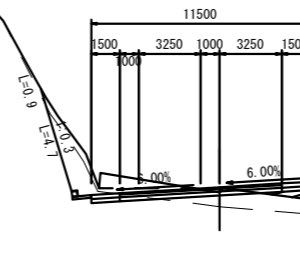
NO. 9

GH=2399.56  
FH=2399.856



KE3-2 (NO. 9+15.716)

GH=2399.00  
FH=2399.262



DL=2380.00

DL=2380.00

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.1 IN BHUTAN

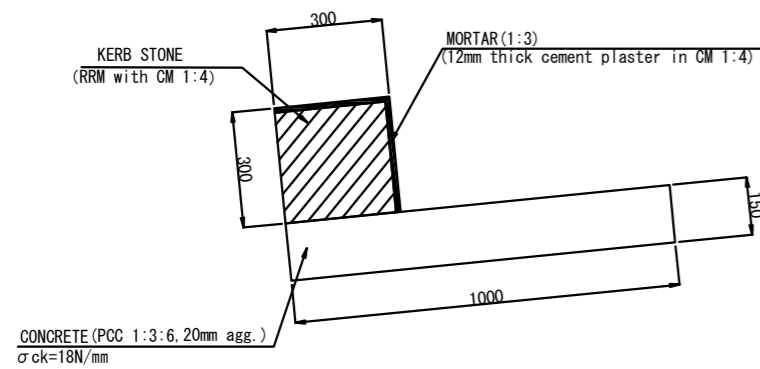
DRAWING TITLE:  
CROSS SECTION(5)  
(ZALAMCHU BRIDGE)

DATE:  
PREPARED BY:  
CHECKED BY:

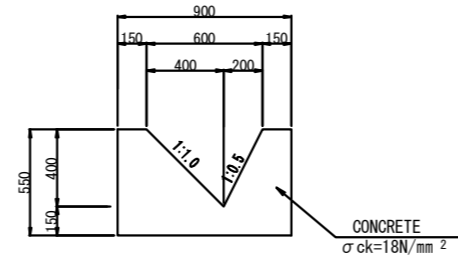
DRAWING No. :  
Z-7

# ROAD STRUCTURE

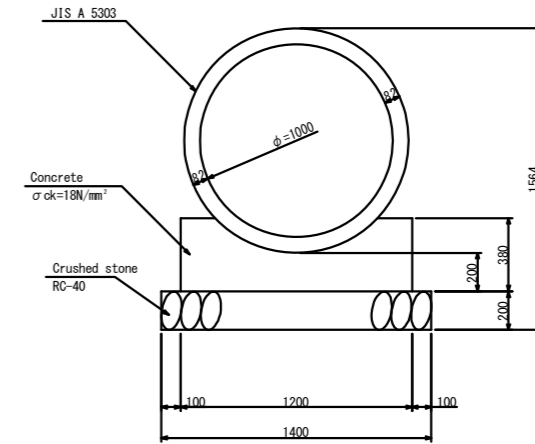
L-DRAIN S=1:10



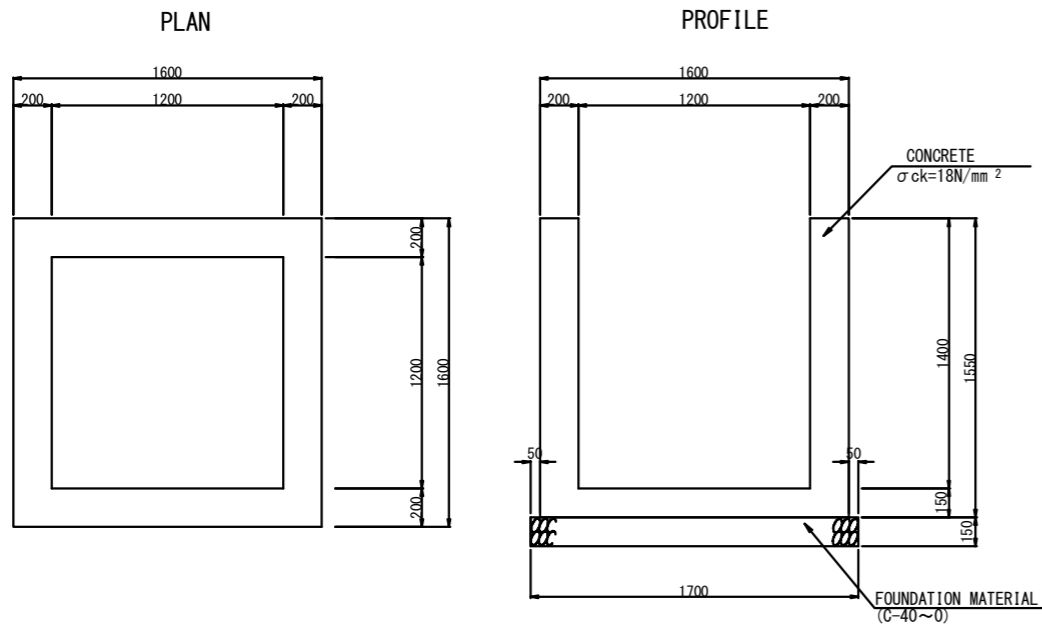
V-SHAPED CONCRETE DITCH S=1:20



Pipe culvert S=1:20  
(P1-RC-1-D1000)

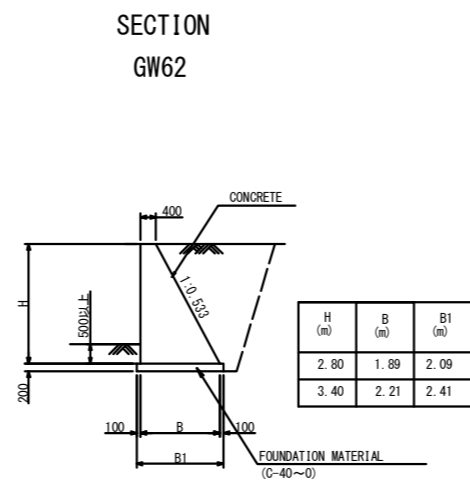


CATCH BASIN TYPE-A S=1:20  
(1000 × 1000 × 1400)



CONCRETE RETAINING WALL S=1:100

(NO. 8 LEFT)



(NO. 8 RIGHT)

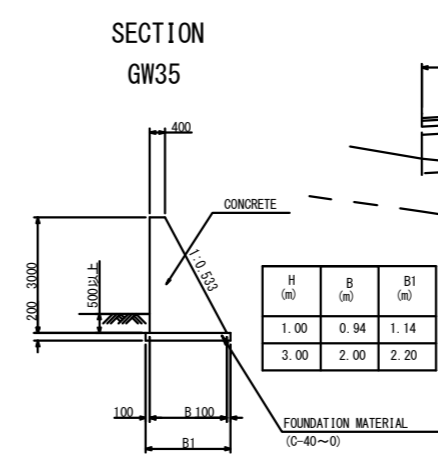
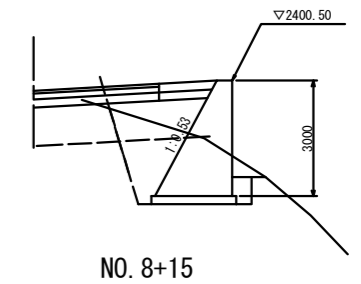


FIGURE OF EARTHWORK  
NO. 8+10



DEPLOYMENT

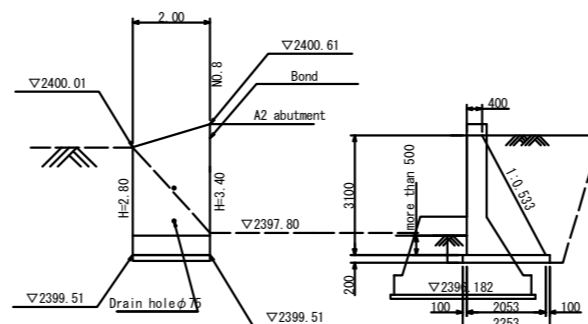
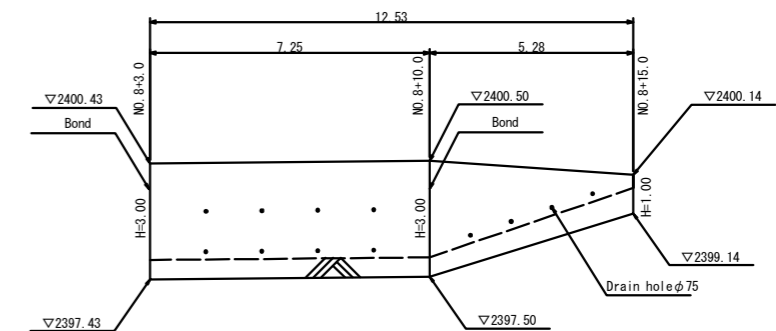
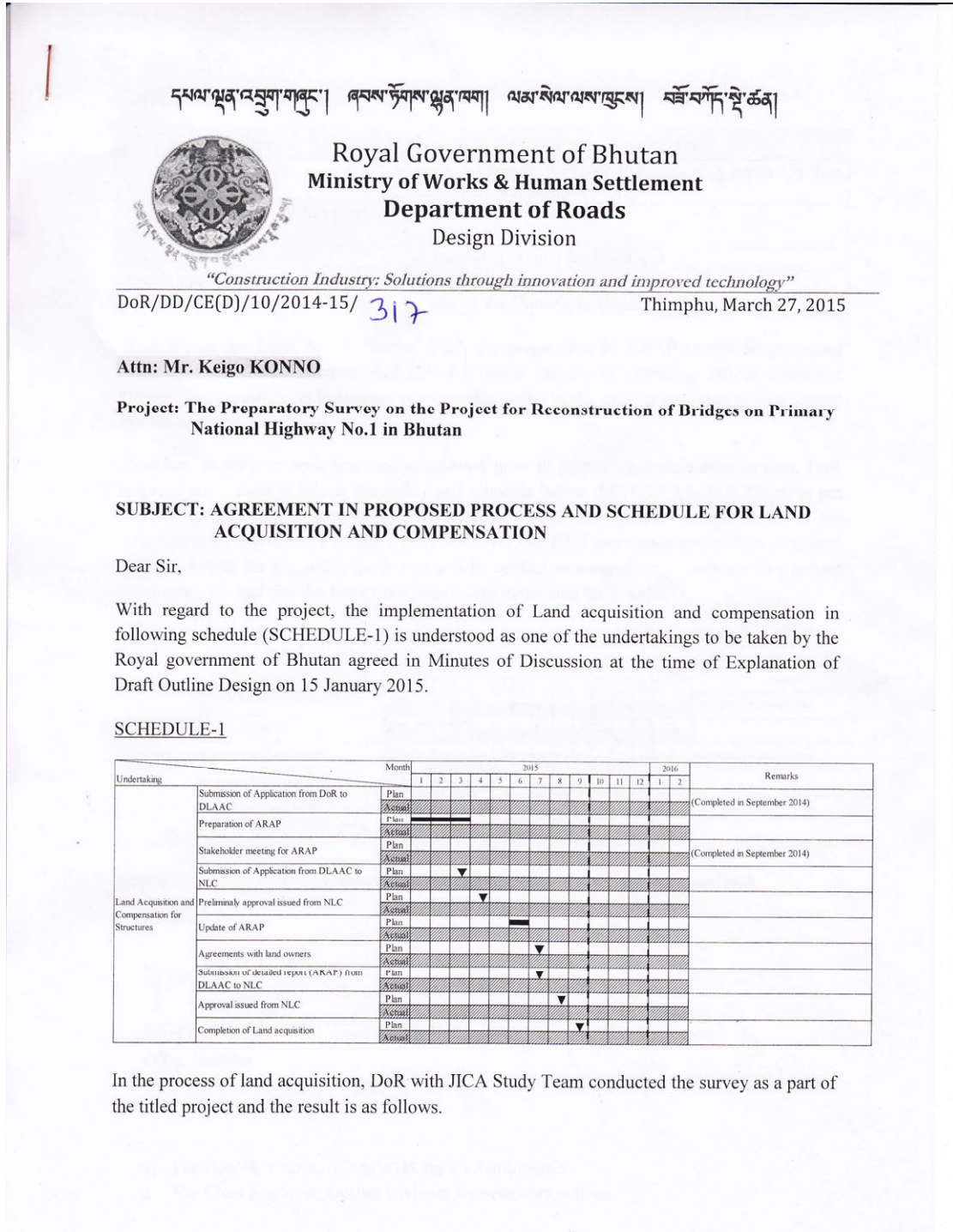


FIGURE OF EARTHWORK



**6. Other Relevant Data**

**(1) Letter from DoR regarding land acquisition**



The result of the ARAP survey

Item	Chuzomsa Bridge
Total PAHs and PAPs	9 PAPs (Project Affected Persons) in 1 PAHs (Project Affected Households)
Residential PAHs (PAPs) to be Relocated	None
Land Acquired (decimal)	6 decimals (243m <sup>2</sup> ) for Dry Land
Crops and Trees	Trees:18
Note	Name of the Household Head: Ms. Aum Kelzang

However, as per Land Act of Bhutan 2007, the preparation of ARAP cannot be processed currently since the PAH mentioned above is under process of obtaining official document (Thram) that establish the legitimacy of ownership to the land. And it is expected to take several months to obtain the Thram.

Therefore, in order to complete land acquisition prior to project implementation in time, DoR proposes and agrees to follow the policy and schedule below (SCHEDULE-2) if Thram is not obtained by June 2015. According to the regulation of Bhutan, person without Thram is not subjected to the payment of compensation. However, the PAH mentioned above shall be treated as a title-holder (in line JICA guideline) and be subject to compensation only for this project considering the fact that the family has been living in the area for a while.

SCHEDULE-2

Undertaking	Month	2015												2016		Remarks		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2			
Submission of Application from DoR to DLAAC	Plan																	(Completed in September 2014)
	Actual																	
Preparation of ARAP	Plan																	(Completed in September 2014)
	Actual																	
Stakeholder meeting for ARAP	Plan																	(Completed in September 2014)
	Actual																	
Update of ARAP	Plan																	
	Actual																	
Agreements with land owners	Plan																	
	Actual																	
Completion of Land acquisition (Payment of compensation)	Plan																	
	Actual																	

Your understanding and kind cooperation on this matter would be highly appreciated.

Yours faithfully,



Jangchuk Yeshi  
 Offtg. Director  
 Department of Road, MOWHS

Copy to:

1. The Hon'ble Secretary, MoWHS for kind information
2. The Chief Engineer, Design Division for necessary actions