No.

Japan International Cooperation Agency (JICA)

National Highway Agency (NHA)

Ministry of Communication (MOC)

Earthquake Reconstruction and Rehabilitation Authority (ERRA)

Pakistan Transport Plan Study

In the Islamic Republic of Pakistan (Implementation)

Technical Assistance For Reconstruction of Bridges Damaged by the 8 October 2005 Earthquake on the Jhelum Valley Road

Final Report

February 2008

NIPPON KOEI CO., LTD.

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PREFACE

In response to a request from the Government of Pakistan, the Government of Japan decided to conduct the Technical Assistance for Reconstruction of Bridges Damaged by the 8 October 2005 Earthquake and entrusted the Implementation to the Japan International Cooperation Agency (JICA).

Consequently, JICA commenced the Pakistan Transport Plan Study in the Islamic Republic of Pakistan (Implementation) aiming at implementing the programme consists of two components; 1) Reconstruction of five bridges damaged by the earthquake on the Jhelum Valley Road and 2) Technology transfer of the landslide disaster management technology under use in Japan.

JICA selected and dispatched a team headed by Mr. Yoshihisa YAMASHITA of Nippon Koei Co., Ltd. from April 2006 to February 2008.

The team conducted the reconstruction works and technology transfer programme in close coordination with the officials concerned of the Government of Pakistan.

I hope that the implementation of the programme will contribute to the development of Pakistan and to the enhancement of friendly relationship between the two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Pakistan for their close cooperation and friendship extended to the study.

February, 2008

Eiji Hashimoto
Vice President
Japan International Cooperation Agency

February, 2008

Letter of Transmittal

We are pleased to submit herewith the Final Report of the Pakistan Transport Plan Study in the Islamic Republic of Pakistan (Implementation). This study was entrusted to Nippon Koei Co., Ltd. under a contract with Japan International Cooperation Agency (JICA), during the period from April 2006 to February 2008.

The report contains the advices and suggestions of the concerned authorities of the Government of Japan and your agency as well as the comments made by the concerned authorities of the Government of Pakistan.

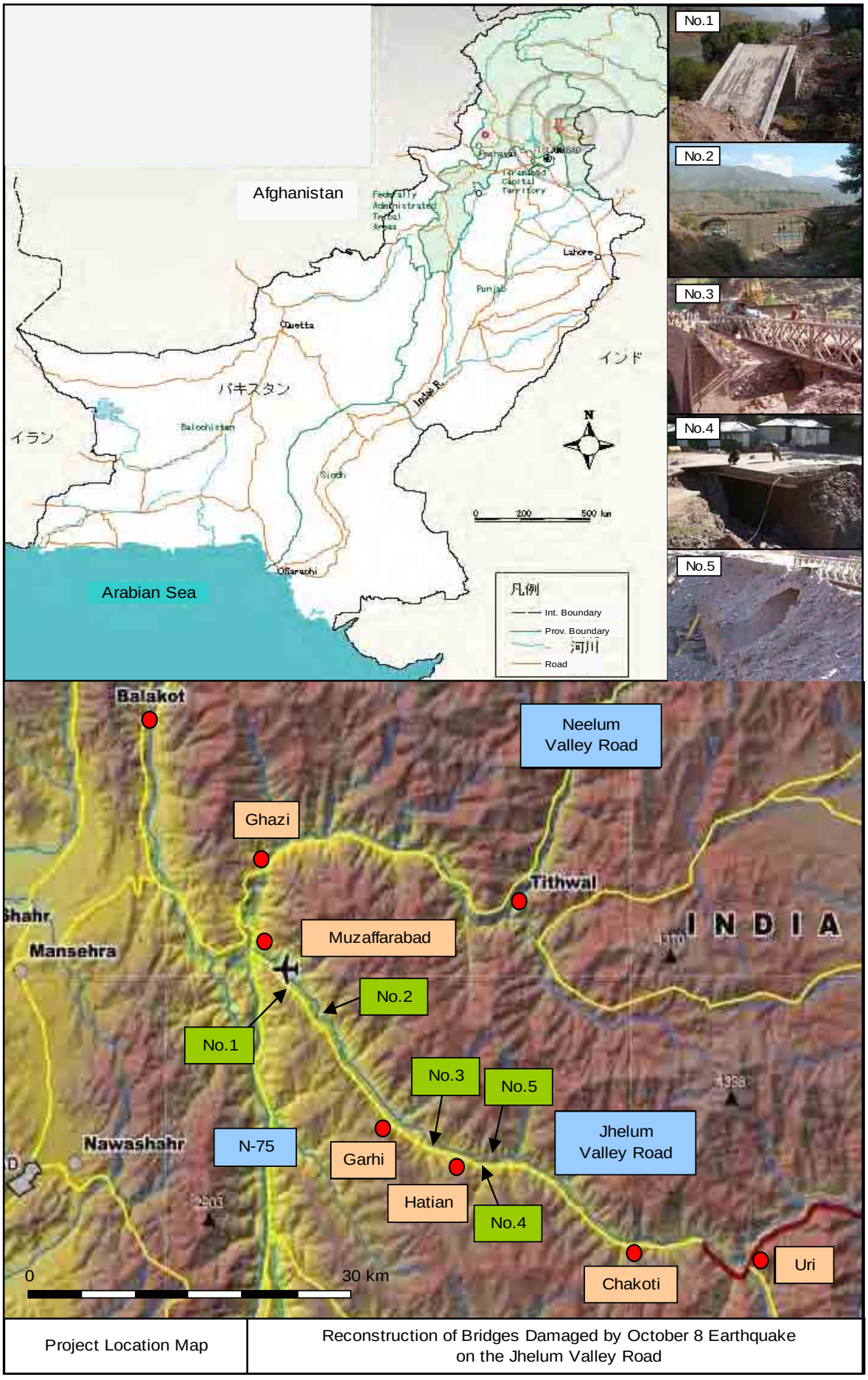
We would like to take this occasion to express our sincere gratitude to JICA and the Ministry of Communications for providing an opportunity to conduct this Study. We are also the most grateful for the cooperation, guidance and assistance of the Earthquake Reconstruction and Rehabilitation Authority, the National Highway Authority, the Japan Landslide Society, the Embassy of Japan in Pakistan and the JICA Pakistan office.

We hope that this report will contribute to the development of Pakistan.

Yours Faithfully,

Yoshihisa YAMAHSITA
Team Leader, JICA Study Team for
the Pakistan Transport Plan Study
in the Islamic Republic of Pakistan (Implementation)

LOCATION MAP OF THE STUDY



Project Location Map	Reconstruction of Bridges Damaged by October 8 Earthquake on the Jhelum Valley Road

Pakistan Transport Plan Study in the Islamic Republic of Pakistan (Implementation)

Technical Assistance for Reconstruction of Five Bridges Damaged by the 8 October 2005 Earthquake

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CHAPTER 1

INTRODUCTION

1. Introduction

1.1 History of the Study

On October 8, 2005, a powerful earthquake with a magnitude of 7.6 on the Richter scale struck the northern part of Pakistan. More than 70,000 people lost their lives and most of the civil society infrastructures as well as roads and bridges were found damaged and destroyed. The disaster affected areas including Azad Jammu and Kashmir (hereinafter referred to as AJK), besides requiring mass scale rehabilitation works, direly needed reconstruction assistance for the damaged roads and bridges.

The Jhelum valley road in AJK, playing an important role on the road network not only in AJK but also in the northern part of Pakistan, also severely damaged, and the access to the people in need in the area was seriously curtailed by the destruction of and damage to this road and its bridges.

Immediately after the earthquake, the Government of Japan (hereinafter referred to as GOJ) dispatched a mission composed of the officials of the Japan International Cooperation Agency (hereinafter referred to as JICA) and consultants to investigate the area severely affected and to prepare a reconstruction programme. The re-construction programme of the five bridges on the Jhelum valley road was selected as a high priority project among the other identified projects by the mission.

Based on the recommendations proposed by the mission and a request made by the Government of Pakistan (hereinafter referred to as GOP) on December 2005, GOJ decided to carry out a technical assistance to reconstruct the five bridges on the Jhelum valley road damaged by the earthquake. In compliance with the decision, JICA included the technical assistance programme for detailed design and preparation of tender documents in the scope of the Pakistan Transport Plan Study in the Islamic Republic of Pakistan implemented by JICA.

A report, Technical Assistance Report for Reconstruction of Bridges Damaged by the October 8 Earthquake on the Jhelum Valley Road including the detailed design and tender documents for the five bridges and recommending the transference of the Landslide Disaster Management Techniques under use in Japan, was prepared in May 2006.

Consequently, JICA commenced the Pakistan Transport Plan Study in the Islamic Republic of Pakistan (Implementation) (hereinafter referred to as the Study) aiming at implementing the programme. Accordingly, JICA entrusted to Nippon Koei Co., Ltd (hereinafter referred to as the Study Team) on April 2006 to conduct the Study to implement the programme.

The Study Team thereafter awarded the components of the programme, "Reconstruction of the Five Bridges Damaged by the Earthquake" and "Technology Transfer of the Landslide Disaster Management" to SAMBU Construction Co. Ltd (hereinafter referred to as the Contractor) through competitive biddings on July 2006 and to the team organized by the Japan Landslide Society (JLS) respectively.

The reconstruction work was carried out in coordination with the National Highway Authority (hereinafter referred to as NHA). NHA sponsored for reconstruction of No.3 (Seri) Bridge approach road and slope protection works.

Out of five bridges, No.1, No.2, No.4 and No.5 were substantially completed by the end of October 2007. The Study was completed with completion of No.3 Bridge and the bridges have since been handed over to NHA on February 13, 2008.

1.2 Scope of the Study

The scope of the Study is to carry out implementation of the following two components.

- Reconstruction of five bridges damaged by the earthquake on the Jhelum valley road
- Technology transfer of the landslide disaster management technology under use in Japan

(1) Reconstruction of five bridges damaged by the earthquake

This component, implementation of reconstruction of the five bridges damaged by the earthquake, aims not only to conduct immediate and direct of the reconstruction works but also to transfer and introduce a slope protection technique through the implementation of works. The bridge name, location and length of the five bridges are as shown in Table 1.2.1 below.

Table 1.2.1 Bridge name, location and length of the five bridges

Bridge Name	Length	Location	Financed by
No.1 Subri Bridge	30.75m	Km: 06+560	JICA
No.2 Tundali Bridge	30.75m	Km: 10+060	JICA
No.3 Seri Bridge	9.50m	Km: 31+200	JICA
No.3 Approach Road (A)	50.00m	_	JICA
No.3 Approach Road (B)	125.00m	_	NHA
No.4 Sawan Bridge	3.00m	Km: 42+990	JICA
No.5 Kucha Bridge	9.20m	Km: 43+990	JICA

(2) Technology Transfer of the Landslide Disaster Management

This component aims to transfer the technology of the Landslide Disaster Management under use in Japan so as to provide appropriate basic materials for planning of practical measures for rehabilitation of the slopes along the national roads. Contents of this component are as follow.

- Acquisition of topographical and geological information
- Topographical field inspections and recommendation of countermeasures
- Geological field inspection
- Hazard mapping on landslides
- Examination of the method for hazard assessment on landslides
- Organization of training courses and seminars on hazard mapping and assessment
- Digitalization of the result of the topographical interpretation on landslides by GIS
- Preparation of a guideline of slope inspection for maintenance of roadside slope

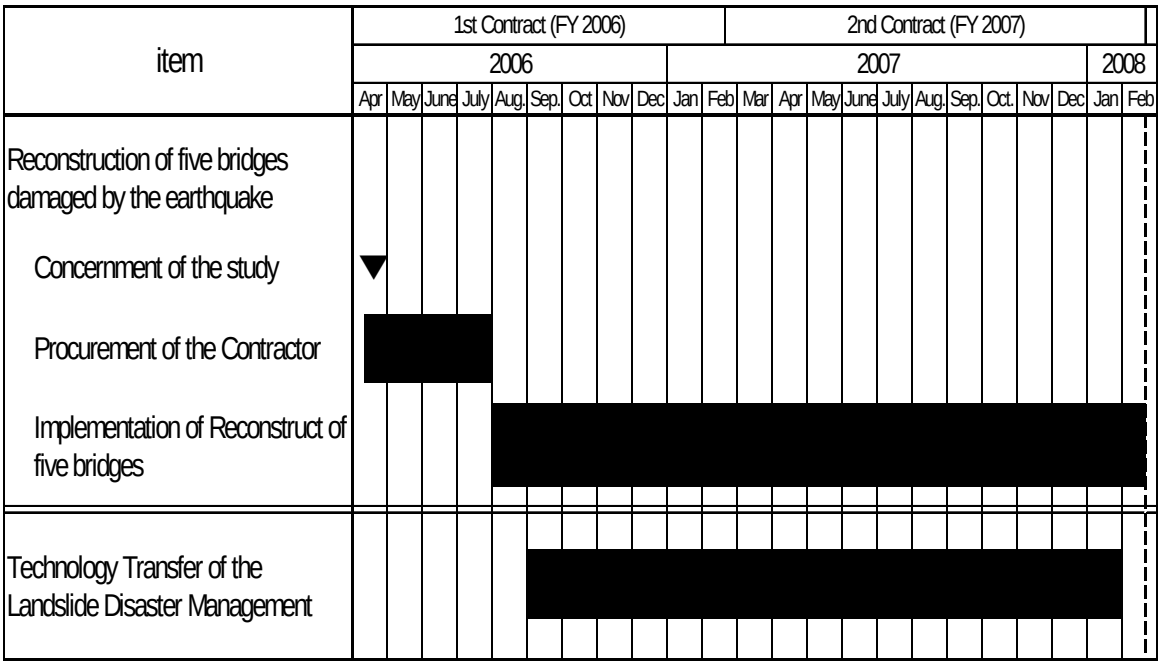
Following seminars and workshops have been conducted by the Study Team.

- 1st Seminar : Slope inspection and countermeasure, September 3 and 4, 2007
- 1st Workshop : Identification and assessment of landslide, December 21, 22 and 23, 2007
- 2nd Seminar : Landslide disaster management, December 26, 2007
- 2nd Workshop : Monitoring, prediction and mitigation of landslide hazards, January 28 and 29, 2008

1.3 Schedule of the Study

The study was proceeded as shown in Table 1.3.1.

Table 1.3.1 Time Table of the Study



1.4 Organization and Assignment of the Study Team

(1) Reconstruction of five bridges damaged by the earthquake

Name	Position	Nationality	Assignment Period
Mr. Tetu Nakagawa	Project Coordinator	Japanese	April 2006 - February 2008
Mr. Yoshihisa Yamashita	Project Manager-1	Japanese	July 2007 - February 2008
Mr. Masaru Homma	Project Manager-2	Japanese	April 2006 - July 2007
Mr. G.N.Malik	Deputy Project Manager	Pakistani	May 2006 - February 2008
Mr. Yasushi Momose	Geotechnical Engineer	Japanese	June 2006 - January 2008
Mr. Takeshi Yoshida	Bridge Engineer-1	Japanese	May 2006 - April 2007
Mr. Yukinori Uchimura	Bridge Engineer-2	Japanese	December 2006 - February 2007
Mr. Makoto Kubota	Resident Engineer	Japanese	August 2007 - February 2008
Mr. Said Bacha	Bridge Engineer	Pakistani	June 2006 - July 2007
Mr. Shahid Nawaz	Site Engineer	Pakistani	June 2006 - July 2007
Mr. Z.U.Niazi	Material Engneer	Pakistani	September 2006 - January 2008

(2) Technology Transfer of the Landslide Disaster Management

Experts of the Japan Landslide Society who were engaged in this component are shown in Tablebelow..

Name	Speciality	Department	Age	Degree	Special instruction 1	Special instruction 2
H. MARUI	erosion control engineering , landslide, geotecnical engineering	Professor, Niigata Univ.	58	Dr.	Doctor of Engineering, Doctor of Aguriculture	The Japan Landslide Society, President
T. MIYAGI	geography, geomorphology, enviroment,GIS	Professor, Tohoku-gakuin Univ	55	Dr.	Doctor of Science	The Japan Landslide Society, Trustee
M. CHIGIRA	engineering geology, geotecnical engineering, structural geology	Professor, Kyoto Univ.	51	Dr.	Doctor of Science	The Japan Landslide Society, Trustee
D. HIGAKI	geography, geomorphorogy, mitigation of landslide hazards	Professor, Hirosaki Univ.	53	Dr.	Doctor of Science	The Japan Landslide Society, Trustee
H.YAGI	geography, geomorphology, GIS	Professor, Yamagata Univ.	49	Dr.	Doctor of Science	The Japan Landslide Society, Research and planning W.G.
K. KONAGAI	erosion control engeneering, numerical mathematics, earthquake hazards	Professor, Univ. of Tokyo	54	Dr	Doctor of Engineering	Japan Society of Civil Engineers, The Japanese Geotechinical Society
H.YOSHIMATSU	mitigation of landslide hazards, erosion control, engineering numerical analysis	SABO Technical Center	59	Dr	Professional Engineer (construction), Ph.D	The Japan Landslide Society,Trustee
T. YAMASAKI	mitigation of landslide hazards, geology, geotecnical engineering	Lecturer, Shizuoka Univ.	56	Dr.	Professional Engineer (science), Doctor of Science	The Japan Landslide Society, Trustee
S. ABE	mitigation of landslide hazards, geology, erosion control engineering	Okuyama Boring Co.,Ltd	58	Dr.	Professional Engineer (science, construction), Doctor of Engineering	The Japan Landslide Society, Trustee
T.UEDA	mitigation of landslide hazards, enviroment, forest engineering	Techno Forest Co., Ltd.	51	Ms.	Professional Engineer (forest engineering), Master	JICA short term expert (landslide)
T. MAYUMI	mitigation of landslide hazards, geography, geotecnical engineering	Kokudobousai Co.,Ltd.	41	Dr.	Professional Engineer (construction), Ph.D	JICA short term expert (landslide)
M.ENOKIDA	mitigation of landslide hazards, slope stability analysis, hydrological engineering	Kokudobousai Co.,Ltd.	45	Dr.	Professional Engineer (construction, forest engineering), Doctor of Engineering	The Japan Landslide Society Research and planning W.G.,
F. HASHIMOTO	geography, enviroment, GIS	Kokudobousai Co.,Ltd.	27	Ba.		The Japan Landslide Society International communication W.G.,

CHAPTER 2

IMPLEMENTATION OF RECONSTRUCTION OF FIVE BRIDGES

2. Implementation of Reconstruction of Five Bridges

2.1 Contents of the Bridges to be Reconstructed

The outline of the five bridges is as described in Table 2.1.1.

Table 2.1.1 Outline of the five bridges

Bridge Name	Outline of the structure
No.1 Subri Bridge	Location: Km 6+600 Bridge Length: 30.0 m Width: 9.7 m Structural type: PC T Girder Bridge Construction cost: 27,961,288PKR
No.2 Tundali Bridge	Location: Km 10+100 Bridge Length: 30.0 m Width: 9.7 m Structural type: PC T Girder Bridge Construction cost: 26,745,802PKR
No.3 Seri Bridge	Location: Km 31+200 Bridge Length: 9.5 m Width: 30.0 m Structural type: Box culvert Construction cost: 37,560,570PKR Others: The slope protection works and the approach road originally adopted were partially canceled and the log-chute and the embankment using gabions were added in the construction stage.
No.4 Sawan Box-culvert	Location: Km 41+300 Length: 3.0 m Width: 16.8 m Structural type: Box culvert Construction cost: 6,853,124PKR
No.5 Kucha Bridge	Location: Km 42+600 Bridge Length: 9.2 m Width: 19.0 m Structural type: Box culvert Construction cost: 11,654,525PKR

Note: Project costs are the final amount of each structure excluding the mobilization and demobilization costs.

The detailed drawings of bridges are attached in Appendix B-1.

2.2 Modification of the Approach Road Design of No.3 Bridge (Slope Protection Work)

(1) General

In the detailed design stage, the No.3 Bridge site located at the foot of the extremely steep slope was designed taking into account the minimum radius of 30 metre (design speed of 40km/hr) by shifting the alignment toward mountainside. Massive cutting towards the mountainside therefore was unavoidable to construct the approach road. The slope protection works under the free frame method with anchor, which is an advanced technology in use in Japan, was adopted taking technology transfer aspect into consideration. However, this design concept was revised due to financial and technical reasons as described below.

(2) Change of the Slope Protection Works from Concrete Cribwork with Anchor to Mortar Spray

In the first tendering stage, it was experienced that all bidding prices were more than eight times above the engineering estimate due to the application of the advanced slope protection method. To enhance the competition to cut the price, the cut slope of 1:1.0 with mortar spray, which is locally available method, was adopted instead of the free frame method with anchor based on the additional investigation done by the Study Team. The justification of this revision is attached in Appendix B-2.

(3) Change in the Design Concept of the Approach Road

During the construction stage, however, excavation of the slopes revealed that it consisted of loose stiff clayey soil with sub-angular boulders having diameter between 0.3 to 2.0m at the top step of the cut slope instead of the hardened and well-cemented gravely soil. For such loose stiff clayey soil with sub-angular boulders, Mortar Spray Work is not applicable and the Crib Works should be selected as the countermeasure for slope stabilization in consideration of the frequent rock falling due to erosion of the soil surface.

Taking into account the budgetary constraint and cost-efficiency, it is recommendable to modify the concept of improvement of the site (the slope protection section) as below.

- To stabilize the existing slope by removal of the top soil loosened by the earthquake,
- To apply the suitable slope protection works for the cutting slope established by the above top soil removal work,
- To minimize cutting works along the existing road and carry out widening as much as possible within the existing road using common and locally available methods.

Based on the above modified concept, Nippon Koei would propose to change the improvement plan as shown in the figures (Appendix B-2). Main points in the proposed modified plan are as follow:

- To shift the alignment at the corner using 25m radius curvature to avoid the massive cutting in the JICA Section,
- To extend the box-culvert about 5m in length and construct U shaped channel (Log Chute) about 66m in length,
- To widen the narrow section of the existing road towards valley side by filling work protected by gabion and founded on the U shaped channel,
- To widen the existing road as much as possible within the existing road using wet-masonry wall at mountain and valley side.

The justification of this revision is also attached in Appendix B-2.

2.3 Contractual Administration

(1) Review of the tender documents

The tender documents prepared under the Pakistan Transport Plan Study in the Islamic Republic of Pakistan implemented by JICA were reviewed and revised by the Study Team in April and May 2006. The design conditions of the bridge and approach road also were adjusted and coordinated with the Highway Rehabilitation Project Pakistan financed by the World Bank and implemented by the National Highway Improvement Programme (hereinafter referred to as NHIP) at the same time with the Study.

(2) Co-financing by NHA

Since the revised construction cost estimated for the whole works exceeded the budget of JICA, it was decided that NHA will co-finance for a part of the slope protection works of the No.3 Bridge approach road (hereinafter referred to as “NHA portion”). The area covered by NHA budget was shown in the Drawings and the tender documents were prepared considering and including the NHA portion as well.

It is noted that the afore-mentioned Slope Protection component of the project constitutes two parts financed each by JICA and NHA respectively. Change in the design concept described in (3) of Chapter 2.2 therefore was discussed in detail at all appropriate levels of NHA. The overall design concept although was agreed in principle by NHA, yet the budgetary constraints of NHA necessitated curtailment of the scope of work proposed under this design concept. As a result of the comprehensive discussions made with NHA, it has been agreed mutually that the partial scope of work reduced under constraints shall be taken up for implementation by NHA under the now on-going World Bank financed project of the Jhelum Valley Road (Muzaffarabad-Chokothi Road).

(3) Procurement of the Contractor

The procurement of the contractor by competitive bidding was carried out based on the procurement guidelines of JICA and through twice biddings as described below.

[First bidding]

Tender notice:	April 12, 2006
Distribution of the tender documents:	April 19, 2006
Bid opening:	May 13, 2006

In the first bidding, four tenderers submitted pre-qualification documents were qualified. However single tender was submitted and the bid price was about eight times higher than the engineering estimate. Then the first bid ended in failure.

The reason of the extremely high bids was examined and judged that the application of the slope protection works (free frame method) applied at the No.3 Bridge approach road, for which only Japanese material and equipment are applicable, could make the bidding uncompetitive. Consequently, to enhance the competition, the design concept for the slope protection works was modified to apply the locally available method (mortar spray work) as described in section 2.2 of Chapter 2.

[Second bidding]

Based on the revised tender drawings due to the change, changed the slope protection method at No.3 Bridge approach road from the free frame method to the mortar spray work, the second tender was proceeded as under.

Tender notice:	June 03, 2006
Distribution of the tender documents:	June 05, 2006
Bid opening:	June 20, 2006

For the second tender, three (3) tenderers submitted the bids. SAMBU Construction Co. Ltd submitted the bid which was found lowest and within the engineering estimate. Through the tender evaluation, SAMBU Construction Co. Ltd. was selected as the successful tenderer and the contract between the Study Team and SAMBU Construction Co. Ltd. (hereinafter referred to as the Contractor) was signed on July 25, 2006.

The Contractor commenced the Work on August 01, 2006 in accordance with the contract.

Along with the contract signing between the Study Team and the Contractor, the contract for NHA portion was also signed between Nippon Koei Co., Ltd. (as a representative of NHA) and SAMBU Construction Co. Ltd. on November 13, 2006 and the Contractor commenced the works of the NHA portion.

(4) Revision in the Contract

The contract was revised based on the budgetary administration of JICA, modification in the works and time extensions as follow.

- Original agreement for Fiscal Year (FY) 2006: Singed on July 25, 2006
- Original agreement for FY 2007: Singed on February 21, 2007
- 1st Revised agreement for FY 2007: Singed on August 1, 2007
- 2nd Revised agreement for FY 2007: Singed on January 23, 2008
- 3rd Revised (final) agreement for FY 2007: Singed on February 13, 2008

Copies of the agreements and the final bill of quantities are attached in Appendix B-4.

(5) Taking Over of the Facilities

Following the substantial completion of No.1, No.2, No.4 and No.5 bridges, an opening ceremony was held out at the No.1 Bridge site on November 11, 2007.

Photo: Opening ceremony held on November 11, 2007

The overall work was completed on February 7, 2008 and the all facilities were handed over to NHA on February 13, 2008 based on the joint inspection by JICA, NHA and the Study Team. The copy of the taking over certificate is attached in Appendix C.

2.4 Progress of the Works

The construction progress and photos showing the bridge progress in the chronological order are given in section 2.4.1 and 2.4.2 below.

2.4.1 Construction progress

(1) Overall Progress chart

Progress Chart (Overall)

Portion	No.	Description	Contract Amount 1st Contract (Rs.)	(%)	2nd Contract (Rs.)	(%)	Whole Contract (Rs.)	(%)
JICA	1	Mobilization	54,884,400.30	56.6%	5,792,250.00	7.4%	60,676,650.30	34.6%
	2	Demobilization	0.00	0.0%	3,963,475.00	5.1%	3,963,475.00	2.3%
	3	Bridge No. 1	14,897,177.53	15.4%	13,064,110.24	16.7%	27,961,287.77	15.9%
	4	Bridge No. 2	13,105,151.64	13.5%	13,640,650.56	17.4%	26,745,802.20	15.2%
	5	Bridge No. 3	5,088,232.88	5.2%	28,489,794.60	36.3%	33,578,027.48	19.1%
	6	Slope Protection (Bridge No. 3)	3,750,000.00	3.9%	232,542.50	0.3%	3,982,542.50	2.3%
	7	Culvert No. 4	1,067,511.38	1.1%	5,785,612.54	7.4%	6,853,123.92	3.9%
	8	Bridge No. 5	4,213,944.25	4.3%	7,440,581.21	9.5%	11,654,525.46	6.6%
Total Amount			**97,008,418**	**100.0%**	**78,409,017**	**100.0%**	**176,415,435**	**100.0%**

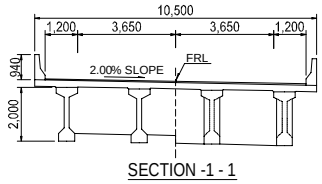
					2006 Aug.	Sep.	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	2007 Aug.	Sep.	Oct.	Nov	Dec	Jan	2008 Feb
Plan	(%)		1st Contract	Monthly Progress (%)	19.3%	22.1%	5.6%	12.6%	14.1%	16.0%	10.3%												
				Accumulative Progress (%)	19.3%	41.4%	47.0%	59.6%	73.7%	89.7%	100.0%												
			2nd Contract	Monthly Progress (%)							2.9%	2.2%	9.1%	14.8%	13.9%	14.3%	14.3%	7.0%	6.7%	3.5%	3.5%	3.9%	3.9%
				Accumulative Progress (%)							2.9%	5.1%	14.2%	29.0%	42.9%	57.2%	71.5%	78.5%	85.2%	88.7%	92.2%	96.1%	100.0%
			Whole Contract	Monthly Progress (%)	10.3%	11.8%	3.0%	6.7%	7.5%	8.5%	5.5%	2.3%	4.3%	6.9%	6.5%	6.7%	6.7%	3.2%	3.2%	1.7%	1.7%	1.7%	1.8%
				Accumulative Progress (%)	10.3%	22.1%	25.1%	31.8%	39.3%	47.8%	53.3%	55.6%	59.9%	66.8%	73.3%	80.0%	86.7%	89.9%	93.1%	94.8%	96.5%	98.2%	100.0%
Actual	(%)		1st Contract	Monthly Progress (%)	18.7%	23.3%	5.6%	18.6%	13.4%	10.1%	10.3%												
				Accumulative Progress (%)	18.7%	42.0%	47.6%	66.2%	79.6%	89.7%	100.0%												
			2nd Contract	Monthly Progress (%)							2.9%	23.3%	11.6%	13.5%	10.0%	7.1%	9.3%	5.9%	1.3%	2.9%	1.2%	11.0%	
				Accumulative Progress (%)							2.9%	26.2%	37.8%	51.3%	61.3%	68.4%	77.7%	83.6%	84.9%	87.8%	89.0%	100.0%	
			Whole Contract	Monthly Progress (%)	12.3%	10.4%	3.0%	10.1%	7.0%	5.7%	7.0%	3.7%	6.4%	7.5%	5.5%	3.9%	5.2%	3.3%	0.6%	1.6%	0.7%	6.1%	
				Accumulative Progress (%)	12.3%	22.7%	25.7%	35.8%	42.8%	48.5%	55.5%	59.2%	65.6%	73.1%	78.6%	82.5%	87.7%	91.0%	91.6%	93.2%	93.9%	100.0%	

(2) Progress chart of No.1 Bridge

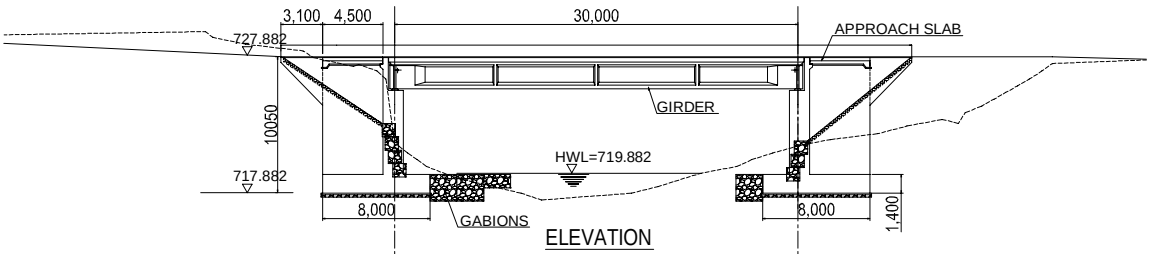
Progress Chart (Bridge No. 1)

Portion	No.	Description	Contract Amount 1st Contract (Rs.)	(%)	2nd Contract (Rs.)	(%)	Whole Contract (Rs.)	(%)
JICA	3.1	Demolition (Existing Structure)	82,938	0.6%	0	0.0%	82,938	0.3%
	3.2	Earth Works	1,581,599	10.6%	2,545,062	19.5%	4,126,661	14.8%
	3.3	Sub-Structure & Foundation	9,623,099	64.6%	6,413,375	49.1%	16,036,474	57.4%
	3.4	Super-Structure	3,526,168	23.7%	2,209,711	16.9%	5,735,878	20.5%
	3.5	Pavement	0	0.0%	1,480,016	11.3%	1,480,016	5.3%
	3.6	Incidental Works	83,375	0.6%	415,946	3.2%	499,321	1.8%
Total Amount			**14,897,178**	**100.0%**	**13,064,110**	**100.0%**	**27,961,288**	**100.0%**

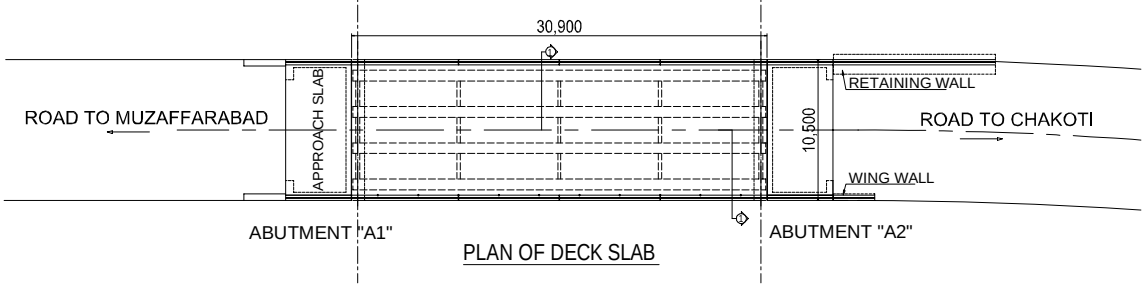
			Aug.	Sep.	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.
			2006							2007										2008	
			1st Contract							2nd Contract											
Plan	(%)	1st Contract Monthly Progress (%)	0.2%	3.0%	4.3%	27.3%	34.3%	27.6%	3.3%												
		1st Contract Accumulative Progress (%)	0.2%	3.2%	7.5%	34.8%	69.1%	96.7%	100.0%												
		2nd Contract Monthly Progress (%)							0.20%	12.9%	18.4%	28.1%	21.7%	8.5%	2.9%	7.0%	0.3%				
		2nd Contract Accumulative Progress (%)							0.20%	13.1%	31.5%	59.6%	81.3%	89.8%	92.7%	99.7%	100.0%				
		Whole Contract Monthly Progress (%)	0.1%	1.7%	2.4%	15.1%	19.1%	15.3%	1.8%	5.8%	8.2%	12.5%	9.7%	3.8%	1.2%	3.2%	0.1%				
		Whole Contract Accumulative Progress (%)	0.1%	1.8%	4.2%	19.3%	38.4%	53.7%	55.5%	61.3%	69.5%	82.0%	91.7%	95.5%	96.7%	99.9%	100.0%				
Actual	(%)	1st Contract Monthly Progress (%)	0.0%	11.6%	15.8%	24.3%	19.8%	16.3%	12.2%												
		1st Contract Accumulative Progress (%)	0.0%	11.6%	27.4%	51.7%	71.5%	87.8%	100.0%												
		2nd Contract Monthly Progress (%)							0.20%	26.1%	29.3%	25.4%	1.1%	0.0%	5.6%	6.1%	3.1%	1.3%	1.3%	0.5%	
		2nd Contract Accumulative Progress (%)							0.20%	26.3%	55.6%	81.0%	82.1%	82.1%	87.7%	93.8%	96.9%	98.2%	99.5%	100.0%	
		Whole Contract Monthly Progress (%)	0.0%	6.1%	8.5%	13.0%	10.5%	8.7%	6.5%	12.3%	13.7%	11.8%	0.6%	0.0%	2.6%	2.8%	1.5%	0.5%	0.6%	0.3%	
		Whole Contract Accumulative Progress (%)	0.0%	6.1%	14.6%	27.6%	38.1%	46.8%	53.3%	65.6%	79.3%	91.1%	91.7%	91.7%	94.3%	97.1%	98.6%	99.1%	99.7%	100.0%	



SECTION -1 - 1



ELEVATION



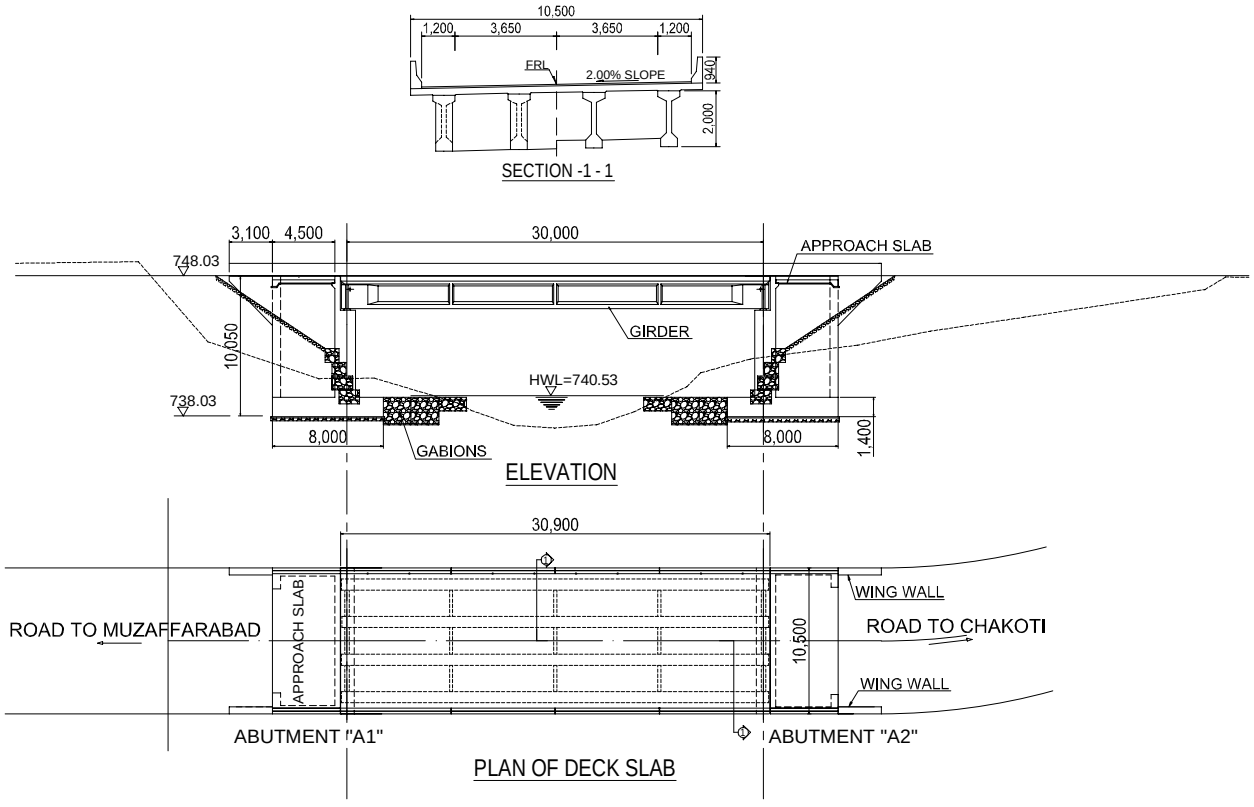
PLAN OF DECK SLAB

(3) Progress chart of No.2 Bridge

Progress Chart (Bridge No. 2)

Portion	No.	Description	Contract Amount 1st Contract (Rs.)	(%)	2nd Contract (Rs.)	(%)	Whole Contract (Rs.)	(%)
JICA	4.1	Demolition (Existing Structure)	0	0.0%	0	0.0%	0	0.0%
	4.2	Earth Works	1,116,408	8.5%	2,023,018	14.8%	3,139,426	11.7%
	4.3	Sub-Structure & Foundation	9,670,243	73.8%	4,611,343	33.8%	14,281,586	53.4%
	4.4	Super-Structure	2,235,126	17.1%	4,229,106	31.0%	6,464,232	24.2%
	4.5	Pavement	0	0.0%	1,853,397	13.6%	1,853,397	6.9%
	4.6	Incidental Works	83,375	0.6%	923,786	6.8%	1,007,161	3.8%
Total Amount			**13,105,152**	**100.0%**	**13,640,650**	**100.0%**	**26,745,802**	**100.0%**

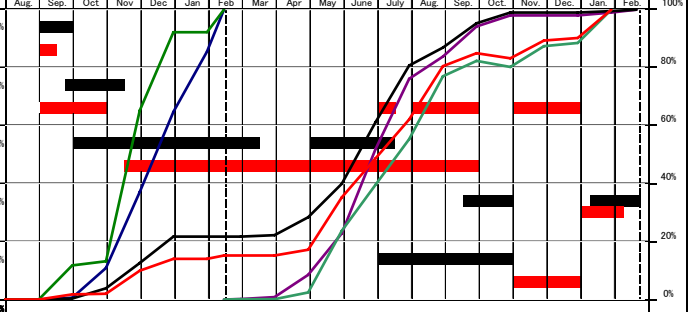
				Aug.	Sep.	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.
				1st Contract 2006						2nd Contract 2007											2008	
Plan	(%)	1st Contract	Monthly Progress (%)	0.0%	0.03%	4.0%	6.2%	28.5%	51.6%	9.7%												
			Accumulative Progress (%)	0.0%	0.03%	4.0%	10.2%	38.7%	90.3%	100.0%												
		2nd Contract	Monthly Progress (%)							9.7%	11.5%	12.5%	18.6%	4.9%	28.8%	4.3%	9.5%	0.2%				
			Accumulative Progress (%)							9.7%	21.2%	33.7%	52.3%	57.2%	86.0%	90.3%	99.8%	100.0%				
		Whole Contract	Monthly Progress (%)	0.0%	0.04%	4.3%	4.8%	18.0%	19.3%	4.7%	5.6%	6.1%	9.1%	2.4%	19.0%	2.1%	4.6%	0.1%				
			Accumulative Progress (%)	0.0%	0.04%	4.3%	9.1%	27.1%	46.4%	51.2%	56.8%	62.8%	71.9%	74.3%	93.2%	95.3%	99.9%	100.0%				
Actual	(%)	1st Contract	Monthly Progress (%)	0.0%	0.0%	9.8%	41.8%	11.3%	14.3%	22.7%												
			Accumulative Progress (%)	0.0%	0.0%	9.8%	51.6%	63.0%	77.3%	100.0%												
		2nd Contract	Monthly Progress (%)							8.0%	7.6%	20.9%	18.9%	18.1%	4.4%	2.9%	9.8%	9.0%	0.1%	0.0%	0.3%	
			Accumulative Progress (%)							8.0%	15.6%	36.5%	55.4%	73.5%	77.9%	80.8%	90.6%	99.6%	99.7%	99.7%	100.0%	
		Whole Contract	Monthly Progress (%)	0.0%	0.0%	4.4%	18.7%	5.2%	6.3%	14.4%	8.0%	10.6%	9.7%	9.2%	2.2%	1.5%	5.0%	4.6%	0.0%	0.1%	0.1%	
			Accumulative Progress (%)	0.0%	0.0%	4.4%	23.1%	28.3%	34.6%	49.0%	57.0%	67.6%	77.3%	86.5%	88.7%	90.2%	95.2%	99.8%	99.8%	99.9%	100.0%	



(4) Progress chart of No.3 Bridge

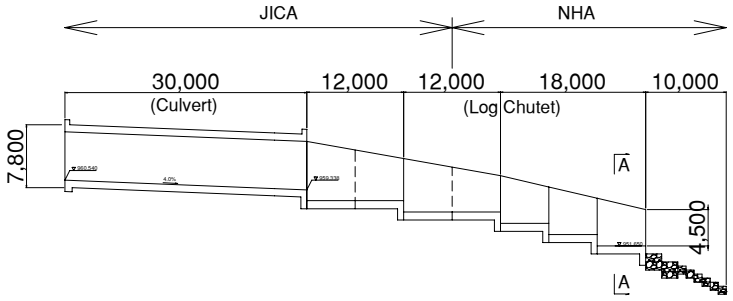
Progress Chart (Bridge No. 3)

Portion	No.	Description	Contract Amount 1st Contract (Rs.)	(%)	2nd Contract (Rs.)	(%)	Whole Contract (Rs.)	(%)
JICA	5.1	Demolition (Existing Structure)	0	0.0%	15,000	0.1%	15,000	0.0%
	5.2	Earth Works	608,125	12.0%	4,110,283	14.4%	4,718,408	14.1%
	5.3	Culvert	4,480,108	88.0%	21,348,146	74.9%	25,828,254	76.9%
	5.4	Pavement	0	0.0%	1,675,624	5.9%	1,675,624	5.0%
	5.5	Incidental Works	0	0.0%	1,340,741	4.7%	1,340,741	4.0%
Total Amount			**5,088,233**	**100.0%**	**28,489,794**	**100.0%**	**33,578,027**	**100.0%**

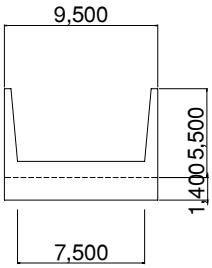


					Aug.	Sep.	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.
Plan	(%)	1st Contract	Monthly Progress	(%)	0.0%	0.6%	10.3%	26.2%	27.6%	20.8%	14.5%												
			Accumulative Progress	(%)	0.0%	0.6%	10.9%	37.1%	64.7%	85.5%	100.0%												
		2nd Contract	Monthly Progress	(%)							0.2%	0.6%	7.7%	14.2%	29.2%	24.2%	7.7%	10.4%	3.8%	0.0%	0.0%	1.0%	1.0%
			Accumulative Progress	(%)							0.2%	0.8%	8.5%	22.7%	51.9%	76.1%	83.8%	94.2%	98.0%	98.0%	98.0%	99.0%	100.0%
		Whole Contract	Monthly Progress	(%)	0.0%	0.3%	3.6%	8.7%	9.1%	0.0%	0.0%	0.5%	6.2%	11.5%	21.3%	19.5%	6.2%	8.4%	3.7%	0.0%	0.0%	0.5%	0.5%
			Accumulative Progress	(%)	0.0%	0.3%	3.9%	12.6%	21.7%	21.7%	21.7%	22.2%	28.4%	39.9%	61.2%	80.7%	86.9%	95.3%	99.0%	99.0%	99.0%	99.5%	100.0%
Actual	(%)	1st Contract	Monthly Progress	(%)	0.0%	11.8%	1.4%	52.0%	27.0%	0.0%	7.8%												
			Accumulative Progress	(%)	0.0%	11.8%	13.2%	65.2%	92.2%	92.2%	100.0%												
		2nd Contract	Monthly Progress	(%)							0.2%	0.0%	2.3%	21.3%	15.9%	15.7%	21.7%	5.3%	−2.1%	7.2%	1.1%	11.5%	
			Accumulative Progress	(%)							0.1%	0.1%	2.4%	23.7%	39.6%	55.3%	77.0%	82.3%	80.2%	87.4%	88.5%	100.0%	
		Whole Contract	Monthly Progress	(%)	0.0%	1.8%	0.2%	7.9%	4.1%	0.0%	1.2%	0.0%	2.0%	18.0%	13.5%	13.4%	18.4%	4.5%	−1.8%	6.1%	0.9%	9.8%	
			Accumulative Progress	(%)	0.0%	1.8%	2.0%	9.9%	14.0%	14.0%	15.2%	15.2%	17.2%	35.2%	48.7%	62.1%	80.5%	85.0%	83.2%	89.3%	90.2%	100.0%	

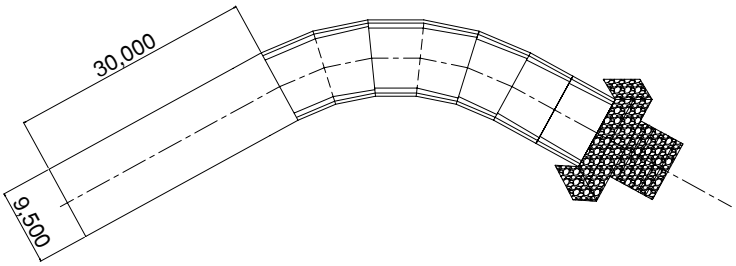
Profile of Log Chute



A-A Section



Plane of Log Chute



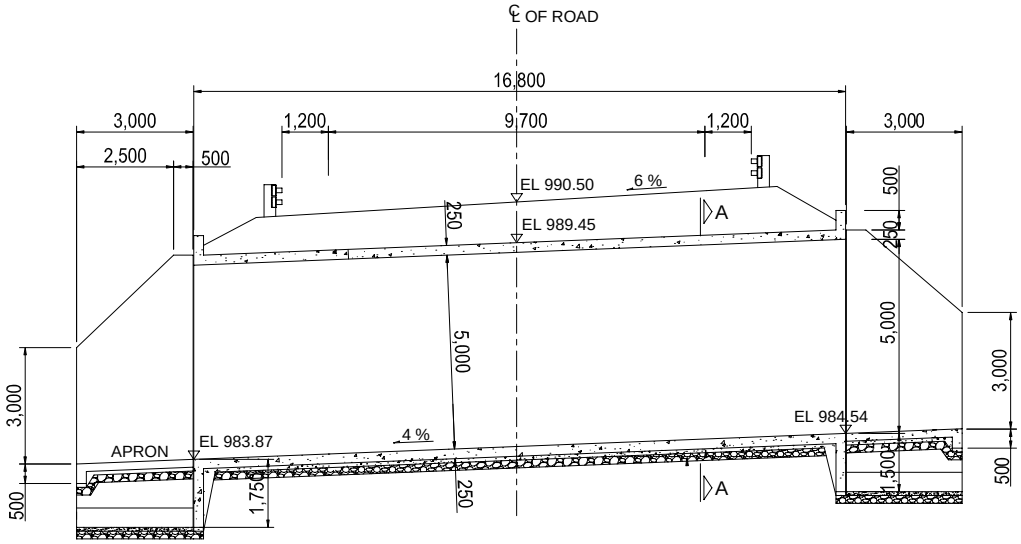
(5) Progress chart of No.4 Bridge

Progress Chart (Bridge No. 4)

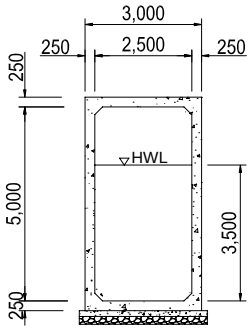
Portion	No.	Description	Contract Amount 1st Contract (Rs.)	(%)	2nd Contract (Rs.)	(%)	Whole Contract (Rs.)	(%)
JICA	7.1	Demolition (Existing Structure)	4,500	0.4%	4,500	0.1%	9,000	0.1%
	7.2	Earth Works	90,803	8.5%	1,125,161	19.4%	1,215,964	17.7%
	7.3	Culvert	972,208	91.1%	3,307,081	57.2%	4,279,289	62.4%
	7.4	Pavement	0	0.0%	1,296,732	22.4%	1,296,732	18.9%
	7.5	Incidental Works	0	0.0%	52,139	0.9%	52,139	0.8%
Total Amount			**1,067,511**	**100.0%**	**5,785,613**	**100.0%**	**6,853,124**	**100.0%**

1st Contract: 2006 Aug. Sep. Oct Nov Dec Jan | 2nd Contract: Feb Mar Apr May June 2007 July Aug. Sep. Oct. Nov. Dec. Jan. 2008 Feb.

				Aug.	Sep.	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.
Plan	(%)	1st Contract	Monthly Progress (%)	0.0%	5.8%	7.0%	52.2%	26.4%	3.4%	5.2%												
			Accumulative Progress (%)	0.0%	5.8%	12.8%	65.0%	91.4%	94.8%	100.0%												
		2nd Contract	Monthly Progress (%)							0.0%	0.0%	10.2%	54.2%	12.2%	8.6%	14.7%	0.0%	0.1%				
			Accumulative Progress (%)							0.0%	0.0%	10.2%	64.4%	76.6%	85.2%	99.9%	99.9%	100.0%				
		Whole Contract	Monthly Progress (%)	0.0%	2.1%	2.7%	1.6%	7.1%	1.4%	0.0%	0.0%	8.7%	45.9%	10.3%	7.3%	12.5%	0.0%	0.4%				
			Accumulative Progress (%)	0.0%	2.1%	4.8%	6.4%	13.5%	14.9%	14.9%	14.9%	23.6%	69.5%	79.8%	87.1%	99.6%	99.6%	100.0%				
Actual	(%)	1st Contract	Monthly Progress (%)	0.0%	0.0%	0.0%	10.7%	68.0%	12.0%	9.3%												
			Accumulative Progress (%)	0.0%	0.0%	0.0%	10.7%	78.7%	90.7%	100.0%												
		2nd Contract	Monthly Progress (%)							0.0%	0.0%	24.7%	6.7%	31.4%	17.5%	1.1%	18.3%	0.0%	-0.2%	0.4%	0.0%	
			Accumulative Progress (%)							0.0%	0.0%	24.7%	31.4%	62.8%	80.3%	81.4%	99.7%	99.7%	99.5%	99.9%	99.9%	
		Whole Contract	Monthly Progress (%)	0.0%	0.0%	0.0%	1.7%	10.5%	1.9%	1.5%	0.0%	20.9%	5.6%	26.5%	14.8%	0.9%	15.5%	0.0%	-0.3%	0.4%	0.1%	
			Accumulative Progress (%)	0.0%	0.0%	0.0%	1.7%	12.2%	14.1%	15.6%	15.6%	36.5%	42.1%	68.6%	83.4%	84.3%	99.8%	99.8%	99.5%	99.9%	100.0%	



CULVERT - CROSS - SEC.



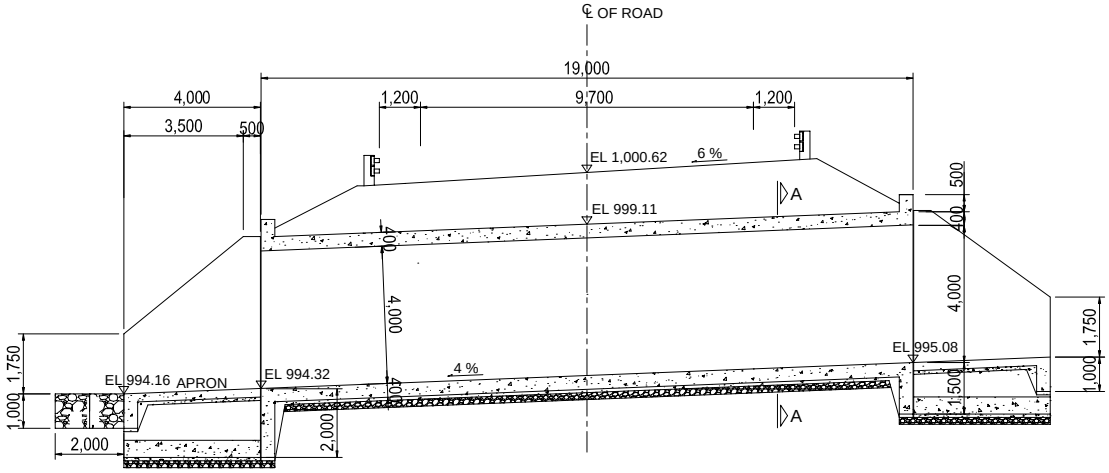
SEC-A-A

(6) Progress chart of No.5 Bridge

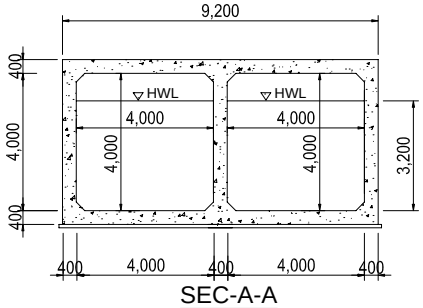
Progress Chart (Bridge No. 5)

Portion	No.	Description	Contract Amount 1st Contract (Rs.)	(%)	2nd Contract (Rs.)	(%)	Whole Contract (Rs.)	(%)
JICA	8.1	Demolition (Existing Structure)	147,250	3.5%	0	0.0%	147,250	1.3%
	8.2	Earth Works	483,219	11.5%	922,023	12.4%	1,405,242	12.1%
	8.3	Culvert	3,583,476	85.0%	3,977,892	53.5%	7,561,367	64.9%
	8.5	Pavement	0	0.0%	2,404,965	32.3%	2,404,965	20.6%
	8.6	Incidental Works	0	0.0%	135,701	1.8%	135,701	1.2%
Total Amount			**4,213,944**	**100.0%**	**7,440,581**	**100.0%**	**11,654,525**	**100.0%**

				1st Contract 2006 Aug.	Sep.	Oct	Nov	Dec	Jan	2nd Contract 2007 Feb	Mar	Apr	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	2008 Jan.	Feb.
Plan	(%)		1st Contract	Monthly Progress (%)	4.3%	9.4%	8.4%	32.9%	17.3%	3.8%	23.9%												
				Accumulative Progress (%)	4.3%	13.7%	22.1%	55.0%	72.3%	76.1%	100.0%												
			2nd Contract	Monthly Progress (%)							17.1%	0.0%	24.3%	7.6%	22.4%	9.0%	19.4%	0.0%	0.2%			
				Accumulative Progress (%)							17.1%	17.1%	41.4%	49.0%	71.4%	80.4%	99.8%	99.8%	100.0%			
			Whole Contract	Monthly Progress (%)	1.6%	3.5%	3.1%	12.1%	6.4%	1.4%	10.8%	0.0%	15.3%	4.8%	14.1%	14.5%	12.2%	0.1%	0.1%			
				Accumulative Progress (%)	1.6%	5.1%	8.2%	20.3%	26.7%	28.1%	38.9%	38.9%	54.2%	59.0%	73.1%	87.6%	99.8%	99.9%	100.0%			
Actual	(%)		1st Contract	Monthly Progress (%)	0.0%	0.0%	1.1%	18.4%	48.4%	18.1%	14.0%												
				Accumulative Progress (%)	0.0%	0.0%	1.1%	19.5%	67.9%	86.0%	100.0%												
			2nd Contract	Monthly Progress (%)							16.6%	0.0%	32.6%	10.6%	10.3%	10.4%	16.1%	1.3%	0.0%	0.0%	2.1%	0.0%
				Accumulative Progress (%)							16.6%	16.6%	49.2%	59.8%	70.1%	80.5%	96.6%	97.9%	97.9%	97.9%	100.0%	100.0%
			Whole Contract	Monthly Progress (%)	0.0%	0.0%	0.4%	6.7%	17.5%	6.6%	5.0%	10.6%	20.8%	6.8%	6.5%	6.6%	10.3%	0.8%	0.0%	0.0%	6.7%	6.7%
				Accumulative Progress (%)	0.0%	0.0%	0.4%	7.1%	24.6%	31.2%	36.2%	46.8%	67.6%	74.4%	80.9%	87.5%	97.8%	98.8%	98.6%	98.6%	100.0%	100.0%



CULVERT - CROSS - SEC.



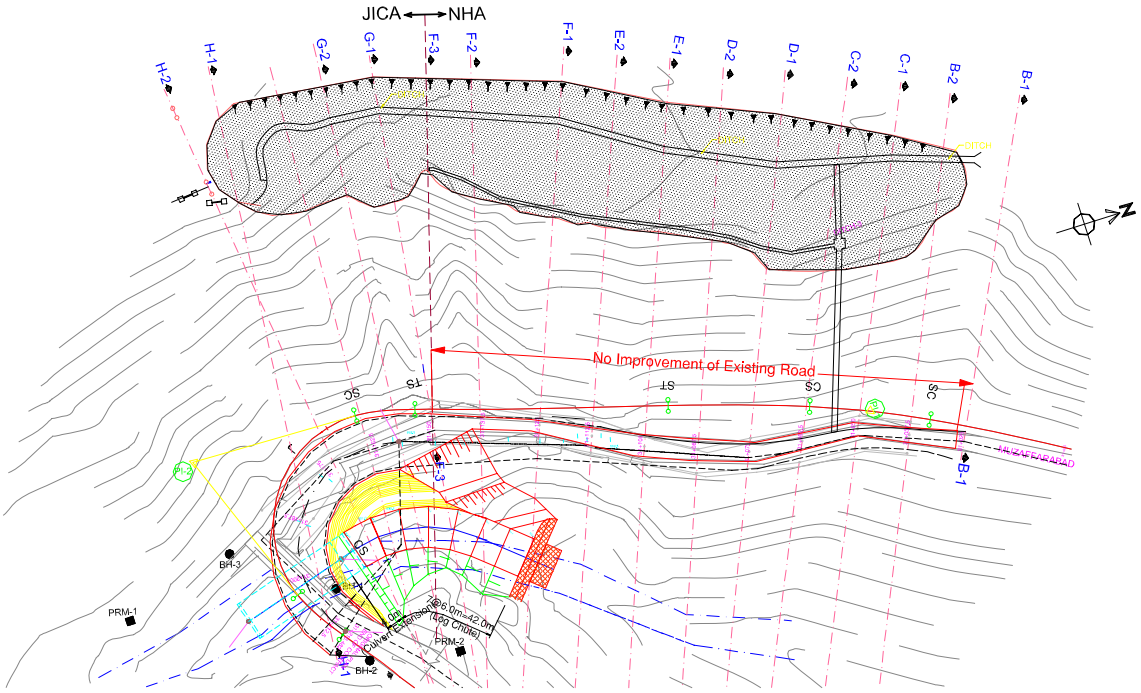
SEC-A-A

(7) Progress chart of No.3 Bridge Slope Protection (JICA Portion)

Table 2-7 Progress Chart (Bridge No. 3 Slope Protection, JICA Portion)

Portion	No.	Description	Contract Amount 1st Contract (Rs.)	(%)	2nd Contract (Rs.)	(%)	Whole Contract (Rs.)	(%)
JICA	6.1	Earth Works	3,750,000	100.0%	(2,063,750)	-887.5%	1,686,250	42.3%
	6.2	Retaining Wall	0	0.0%	0	0.0%	0	0.0%
	6.3	Mortar Spray	0	0.0%	1,978,540	850.8%	1,978,540	49.7%
	6.4	Pavement	0	0.0%	317,753	136.6%	317,753	8.0%
	6.5	Incidental Works	0	0.0%	0	0.0%	0	0.0%
Total Amount			**3,750,000**	**100.0%**	**232,543**	**100.0%**	**3,982,543**	**100.0%**

				Aug.	Sep.	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.
				1st Contract 2006						2nd Contract 2007											2008	
Plan	(%)		1st Contract Monthly Progress (%)	0.0%	10.4%	7.8%	10.4%	10.6%	32.9%	27.9%												
			1st Contract Accumulative Progress (%)	0.0%	10.4%	18.2%	28.6%	39.2%	72.1%	100.0%												
			2nd Contract Monthly Progress (%)							0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	15.0%	17.0%	17.0%	17.0%	15.0%	2.0%	
			2nd Contract Accumulative Progress (%)							0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	15.0%	32.0%	49.0%	66.0%	83.0%	98.0%	100.0%
			Whole Contract Monthly Progress (%)	0.0%	9.7%	7.2%	9.7%	9.8%	31.1%	26.7%	9.7%	9.7%	9.7%	9.7%	9.7%	9.7%	1.0%	1.0%	1.0%	1.0%	0.9%	0.1%
			Whole Contract Accumulative Progress (%)	0.0%	9.7%	16.9%	26.6%	36.4%	67.5%	94.2%	94.2%	94.2%	94.2%	94.2%	94.2%	95.0%	96.0%	97.0%	98.0%	99.0%	99.9%	100.0%
Actual	(%)		1st Contract Monthly Progress (%)	0.0%	0.0%	0.0%	13.3%	29.2%	44.2%	13.3%												
			1st Contract Accumulative Progress (%)	0.0%	0.0%	0.0%	13.3%	42.5%	86.7%	100.0%												
			2nd Contract Monthly Progress (%)							0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-43.0%	0.0%	0.0%	136.0%	7.0%	0.0%	
			2nd Contract Accumulative Progress (%)							0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-43.0%	-43.0%	-43.0%	93.0%	100.0%	100.0%	
			Whole Contract Monthly Progress (%)	0.0%	0.0%	0.0%	12.3%	27.3%	41.6%	13.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-2.5%	0.0%	0.0%	7.9%	0.4%	0.0%	
			Whole Contract Accumulative Progress (%)	0.0%	0.0%	0.0%	12.3%	39.6%	81.2%	94.2%	94.2%	94.2%	94.2%	94.2%	94.2%	91.7%	91.7%	91.7%	99.6%	100.0%	100.0%	



2.4.2 Progress Photos

(1) Photos showing progress of No.1 Bridge

The old bridge damaged by the earthquake

An abutment under construction

PC girders erected

Super structure constructed

Asphalt pavement on the bridge

Bridge completed

(2) Photos showing progress of No.2 Bridge

The old bridge damaged by the earthquake

An abutment under construction

PC girders erected

Super structure constructed

Asphalt pavement on the bridge

Bridge completed

(3) Photos showing progress of No.3 Bridge

Top of the slope before cutting

Slopping work under cutting

Slope protection (Mortar spray), completed

Mortar spray and Concrete cover work

The old bridge damaged by the earthquake

Box-culvert, completed

(4) Photos showing progress of No.3 Bridge, Log chute and road works

Log chute, under construction

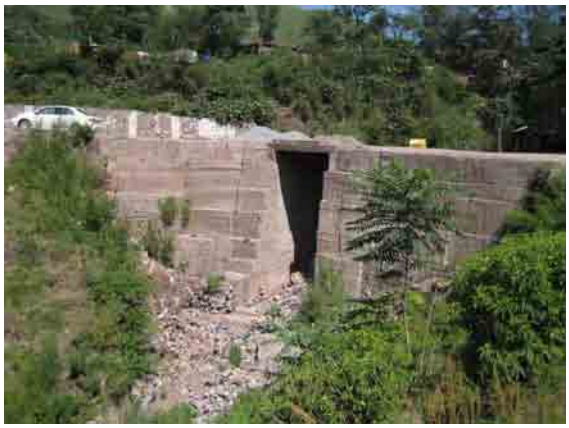
Road works, embankment protected by gabions

Base cause laying

Pavement works

No.3 Bridge site, completed

(5) Photos showing progress of No.4 Bridge



Old bridge damaged by the earthquake

Demolishing work

Box-culvert, completed

Wing wall under construction

Pavement work

No.4 Bridge site, completed

(6) Photos showing progress of No.5 Bridge

Old bridge damaged by the earthquake

Box-culvert, completed

Wing wall under construction

Asphalt pavement work

Asphalt pavement, completed

No.5 Bridge site, completed