The Afghanistan Engineering Support Program assembled this deliverable. It is an approved, official USAID document. Budget information contained herein is for illustrative purposes. All policy, personal, financial, and procurement sensitive information has been removed. Additional information on the report can be obtained from Firouz Rooyani, Tetra Tech Sr. VP International Operations, (703) 387-2151.

Site Visit Report	Project: **Sar-e-Pul Vehicle Bridge Construction (PFA-007)**	
Location: **Sar-e-Pul City, Sar-e-Pul Province**	Coordinates: Latitude:**N 36°12'54.02"**	Longitude: **E 65°56'16.10"**
Inspection Date: **October 30, 2013**	Weather: **Partly Cloudy, Temp @ 18°C, No Precipitation**	
[redacted]	Status: **Incomplete**	

PRESENTED TO

United States Agency for International Development (USAID)
Office of Economic Growth and Infrastructure (OEGI)

Ramp UP North

Great Massoud Road
Kabul, Afghanistan

PRESENTED BY

Tetra Tech, Inc.
Afghanistan Engineering Support Program
Contract No. EDH-I-00-08-00027-00
Task Order No. 1

Work Order WO-LT-0009 AMD #5

Shash Darak
Kabul, Afghanistan

[redacted] **03/15/14**
Title: **Deputy Chief of Party**

EXECUTIVE SUMMARY

The Sar-e-Pul Vehicle Bridge construction project is located in Sar-e-Pul City, in Sar-e-Pul Province. The goal of the project was reconstruction of a 16 meter reinforced concrete vehicle bridge located near the existing Khishti Bridge in Sar-e-Pul City. The project was initiated to improve access to Sar-e-Pul City Center and reduce the risk of damage caused by flood.

On October 30, 2013, two (2) civil engineers from Tetra Tech (Tt) Afghanistan Engineering Support Program (AESP) traveled to Sar-e-Pul to evaluate the visible completed works. Tt determined the construction work of the Sar-e-Pul vehicle bridge was well underway but still incomplete. The contactor's remaining work consisted of cleaning the expansion joint, proper filling of construction joints, painting the guideposts, grading under and around the bridge, and general site cleaning. During the site visit, Tt observed that the wing walls on both sides of the southwest abutment, located toward the existing arch bridge, were modified in the field and did not conform to design drawings. On November 30, 2013, Tt performed a second site visit to the Sar-e-Pul Bridge Project to further inspect the bridge foundations. Several test pits were dug adjacent to the foundations and Tt reviewed construction photos and no abnormalities were found. Tt was tasked by USAID to evaluate the bridge based on the as-built drawings provided and calculate whether the modified wing walls had sufficient dimensions, gravity, and other characteristics to withstand sliding, overturning, and other potentials hazards involved in bridge design bases. Tt developed required technical memorandums for USAID. (Appendix A).

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APPENDICES

This report was prepared for the United States Agency for International Development, Contract No. EDH-I-00-08-00027-00, Task Order 01, Afghanistan Engineering Support Program.

1.0 INTRODUCTION

The Sar-e-Pul Bridge is a vehicle bridge located near the existing Khishti Bridge at Sharwaly in Khan Aqa Community in Sar-e-Pul City. The bridge was constructed by Development Alternative Inc. (DAI) under contract with USAID RC North intending to improve accessibility to Sar-e-Pul City Center.

The bridge is a 16 meter long reinforced concrete bridge with a carriageway width of 8 meters over the Sar-e-Pul River connecting Shar-e-kona and Khan Aqa villages, providing easy access to Sar-e-Pul City. The vehicle bridge deck slab, girders, handrail, and diaphragms are cast in place reinforced concrete that consists of one-span deck slab and three girders. The abutments and wing walls are stone masonry.

The south east wing wall closest to the existing arch bridge and the south west wing wall on the upper stream side were modified, on site, during the construction phase of these walls. Received drawings did not reflect the modifications. The wing wall modifications were carried out with no design approved drawings. The District Rural Rehabilitation & Development (DRRD), the record bridge designer, did not approve the change due to insufficient dimensions considered in its construction. Instead, RAMP UP North was given another set of drawings labeled “Fix” by DRRD. DRRD recommends that if RAMP UP North requires approval of the design, it will need to be a DRRD design. For this purpose, RAMP UP North should continue with the proposed “Fix” by DRRD and demolish the modified wing walls, and rebuild the walls per DRRD’s recommended “Fix” for the modified wing walls.

Tt performed a second site visit to Sar-e-Pul Bridge to collect additional data and further analyze the existing abutment and wing walls. Tt provided technical memorandums to USAID showing concerns regarding insufficient sliding and bearing capacity resistances of the structure.

2.0 SITE VISIT

Two civil engineers from Tetra Tech (Tt) Afghanistan Engineering Support Program (AESP) reviewed the project documentation for the Sar-e-Pul Vehicle Bridge Construction (PFA-007). Tt traveled to Sar-e-Pul Province on October 30, 2013 to evaluate the visible completed works. The provided project documentation included plans, details cross sections in (Appendix B), Technical SOW (Appendix C), and Bill of Quantity (Appendix D). The Tt engineers were accompanied by two DAI project site managers. The findings of this site observation are documented in this report, including photos provided in the Figures section on pages 4 to 18.

On November 30, 2013, Tt performed a second site visit to Sar-e-Pul Bridge Project to inspect the bridge foundations more in-depth. Several test pits were dug adjacent to the foundations, Tt reviewed construction photos, and no abnormalities were found (See Figures Pages 17 and 18). Tt updated the list of items completed, which included relocation of the water line hanging under the bridge, as seen in Figure 2

3.0 SITE VISIT DETAILS: USAID RESPONSIBILITY

Regarding the USAID funded portion of works, the following was observed:

1. The river water has not been redirected under the bridge and still flowing under the old brick bridge (Pul-e-Khishti). (Figures 1, 2 and 3)
    a. **Remaining work:** The contractor is required to divert the river water and perform general cleaning of the site.
2. The girders, deck slab, approach slabs, diaphragms, and handrail are complete according to the plans and specifications. (Figures 2, 5, 10, 11, 12 and 16)
    a. **Remaining work:** The bridge deck expansion joints are required to be cleaned. Presently, the expansion joints are filled with mud and have not been filled with proper joint filling material. (Figures 8 and 9)
3. The abutments stone masonry work and placement of the weep holes are complete per the plan. (See Figures 10, 11 and 15).
4. Installation of 12 concrete guide posts at both bridge approaches is complete. (Figures 4 and 6). However, the painting of the guideposts has not yet started.
    a. **Remaining work:** The contractor is required to paint the guide posts.

5. Installation of concrete pads (seats) for each girder were installed as per the plan.(Figure 7)
6. The stone masonry work of the wing walls and the construction joint is complete. (Figures 8 and 9) However, the constructed wing walls were not built as per original drawings and have been modified during bridge construction.
7. The embankment work on the northern and western sides of the bridge is in progress per the plan to connect the main road with the side road. (Figures 13 and 14)

Based on the above summary, Tt has determined the construction work for the Sar-e-Pul Vehicle Bridge Construction is well underway and structurally complete, but still requires some cleanup and grading. The contactor remaining work consists of cleaning the expansion joint and filling the joint with proper joint filling material, painting guideposts, diversion of the river to go under the bridge, and general site cleaning.

FIGURES

Figure 1. View of the new constructed bridge and the existing brick bridge

Figure 2. View of the new constructed bridge from downstream

FIGURES (CONTINUED)

Figure 3. View of the downstream side of the existing brick bridge

Figure 4. Left side concrete handrail of the proposed bridge facing Khan Aqa Village

FIGURES (CONTINUED)

Figure 5. The view of the bridge carriageway

Figure 6. View of the right side concrete handrail and the post guides

FIGURES (CONTINUED)

Figure 7. View of the concrete pads and bearing

Figure 8. View of the north and western expansion joint of the vehicle bridge

FIGURES (CONTINUED)

Figure 9. View of the eastern and southern expansion joint of the vehicle bridge

Figure 10. Stone masonry abutment of the bridge facing toward Shar-e-Kona

FIGURES (CONTINUED)

Figure 11. View of the western side stone wing wall of the vehicle bridge

Figure 12. View of the girders and diaphragms

FIGURES (CONTINUED)

Figure 13. Northern side of the bridge toward Khan Aga village; embankment work still remaining

Figure 14. View of the upstream western side road, connected to main road, with embankment placement incomplete

FIGURES (CONTINUED)

Figure 15. View of the water drain PVC weep hole pipe on the bridge

Figure 16. The side view of the bridge deck slab and the handrail

FIGURES (CONTINUED)

Figure 17. Investigation of Foundations

Figure 18. North side of Bridge - Note Removal of Water Line

APPENDIX A – TECHNICAL MEMORANDUMS

TETRA TECH

MEMORANDUM

To: [redacted]

From: [redacted]

Date: December 2, 2013

Re: **WO-LT-0009_AMD5 RC North – Sar-e-Pul Vehicle Bridge**

Per direction from USAID on November 25, 2013, Tetra Tech (Tt) performed a limited design and construction evaluation of the Sar-e-Pul Bridge. USAID identified concerns with the quality of construction and the ability of the bridge to resist failure due to scour. Tt's review included a second site visit to collect additional as-built information and a review of available design and construction documents.

USAID had identified concerns with construction changes that were apparently made in the field including depth of foundation, and configuration of the wing walls. There are also concerns of potential for structural movement and scouring.

Inspection Findings

Tt examined the bridge on October 30, 2013 and November 30, 2013 for compliance with the plans provided by USAID. The examination was limited in scope to a visual inspection of the structure along with review of construction drawings entitled "16M Khan AQA RCC Bridge, Khan AQA, Center, Sari Pul, dated January 2011",(the Plans) and photos provided by the DAI construction manager. Tt found the structures to be in general compliance with the Plans with some exceptions and/or defects as listed below, including an opinion as to the engineering significance of these observations, shown in italics. Reference figures can be found at the end of this memo.

- The eastern wing walls were modified from the original design to provide a more flared transition to the existing retaining wall supporting the roadway.
  (Refer to Figure 1)
  - *From a design standpoint this does not raise any issues.*
  - *The design Plans called for wing walls to be folded back parallel with the existing road. The original design of wing walls conflicted with the geometry of the existing retaining wall on Sheet 7 of 16 of the plans and shows the abutment built between the existing retaining walls on Sheets 8 and 9 of 16 of the Plans. It appears that the abutment was built in front of the existing roadway and these modified wing walls were installed to transition from the roadway to the bridge abutment.*
- The southwest wing wall was modified to provide a flared transition from the abutment and extended to connect with the retaining wall running south along the river. (Refer to Figure 2) The design showed the wing wall running back at 90^0 from the abutment.

- *From a design standpoint this does not raise any issues.*

- Construction joints between the abutment and wing walls appear to be unfinished. (Refer to Figure 3). The design plans do not call out any tolerances or treatment for the finishing of these joints.
    - *The joints are approximately 5cm wide and will be exposed to flowing water. This condition will allow water to wash in and out of the wall, causing a loss of soil material from behind the wall. If left as is, failure of the wing wall, abutment or the roadway above will occur prematurely due to loss of supporting soil material from behind the abutment and wing walls.*
- Expansion Joints on the bridge deck appear to be filled with soil and do not match the detail on page 16 of 16 of the Plans. (Refer to Figure 4)
    - *Filling the expansion joint with soil will create a ridged structure and may result in cracking of the deck slab.*
- Deck beams appear to have a concrete and timber blocking between the abutment cap and bottom of the beams, in front of the elastomeric bearing pads. (Refer to Figure 5)
    - *Bearing pads offer some flexibility to the structure that may be negated by the blocking.*
- Site grading is not complete.

Depth of Foundations

In response to concerns raised by USAID regarding the depth of foundations, Tt discussed these concerns with [redacted] the DAI Project Manager. [redacted] believes the contractor met the requirements for foundation depth, and he provided photos of the foundation installation taken during construction. While photo documentation of the footings is limited to the east abutment and northeast wing wall, the photos provided by Mr. Nikmal do show construction of footings similar to the Plans (Refer to Figure 6). In addition, Tt ordered 1.5 meter to 2 meter deep test holes dug adjacent to some of the structures. While these test holes were unable to expose the bottom of the footings we found no evidence to suggest that the structures were not built to the depths indicated on the Plans. Tt has requested additional photographs from DAI to verify the depth of other component structures (abutments and wing walls).

Structural Stability and Scour

The plans and testing information received from USAID were sent to Tt reachback for a brief structural and geotechnical evaluation of stability and scour. The Tt structural review found that the abutments do not meet the minimum standards for bridge foundations based on bearing pressure and resistance to lateral movement. Information provided was limited to design information shown on the Plans and did not include a geotechnical report or design calculations. (See attached Memo entitled "WO-LT-0007-5 RC North - Sar-e-Pul Vehicle Bridge Documents" prepared by Alison Lima P.E.)

Insufficient information is available to make any assumptions regarding potential scour. Necessary information for hydraulic modeling would include soil gradation, geotechnical information at the structures, design flows, and survey information upstream and downstream of the bridge. A topographic survey is provided on Sheet 2 of 16 in the Plans, however there appears to be a benchmark error in the field. Benchmark (BM) 1 and BM 2 differ on the plans by 0.25meters, while in the field these benchmarks appear to be approximately 1.5 to 2 meters different in elevation.

The river peak flow for a 50 year return frequency is stated as 378 m^3/second according to [redacted] However, the details as to how this flow rate was developed is unknown. Tt would need to review the runoff study as part of a hydraulic evaluation.

ATTACHMENTS

FIGURES

Figure 1 - East Side Wingwall

Figure 2 - Southeast Wingwall

Figure 3 - Southeast Wingwall Construction Joint

Figure 4 - Bridge Deck Expansion Joint

Figure 5 - Bridge Beam Connection

Figure 6 - West Abutment and Conc. Pad for Northwest Wingwall

MEMORANDUM

TETRA TECH

To: [redacted]

Fr: [redacted].

Re: Analysis of Existing Walls
WO-LT-0009_AMD5 RC North – Sar-e-Pul Vehicle Bridge

Preliminary Stability Calculations

Dt: December 2, 2013

Tetra Tech reviewed the bridge design drawings and the wall as-built drawings. Based on the information available, it appears that the newly constructed retaining walls were built in a similar fashion to the sections shown on the design drawings, but without a design performed for the walls themselves.

Based on the geometry noted in the as-built drawings, the wall stability was analyzed considering the weight of the wall, lateral earth pressure and lateral surcharge on the retained side of the wall due to vehicular traffic in the roadway. The restraining effect of soil in front of the wall was neglected – it has been assumed that the soil in front of the wall may become eroded/scoured away. The effects of buoyancy should have been included, however since the design water elevation is unknown, buoyancy was not included in the preliminary stability calculations.

The wall was first analyzed assuming that the stone footing and stone wall act together as a unit. Based on the information contained on the design drawings, an allowable bearing pressure of 6 ksf has been assumed. The results of the preliminary stability calculations for this condition are summarized in the table below:

Wall and Footing	**Computed**	**Allowable/Limit**	**Conclusion**
Bearing Pressure	4.16 ksf	6.0 ksf	OK
Factor of Safety (Overturning)	3.12	2.0 min	OK
Factor of Safety (Sliding)	1.4	1.5 min	No Good

Subsequently, the wall was analyzed assuming that the wall and footing do not act together, and the wall must withstand the overturning forces without the benefit of the footing. The results of the preliminary stability calculations for this condition are summarized in the table below:

Wall Alone	**Computed**	**Allowable/Limit**	**Conclusion**
Bearing Pressure	14.21 ksf	6.0 ksf	No Good
Factor of Safety (Overturning)	4.85	2.0 min	OK
Factor of Safety (Sliding)	1.43	1.5 min	No Good

It should be noted that it is NOT conservative to ignore buoyancy – including buoyancy would have a negative impact on the overall stability of the wall. A hydraulic analysis should be performed in order to determine the design water elevation plus identify if scour is a concern.

The preliminary wall stability analysis also did not include seismic loads. Although it is customary to include both lateral earth pressures as well as the wall inertia due to a seismic event, field stone walls have little resistance to withstand seismic loads. We do not recommend including seismic loads in the wall analysis since it is likely that the wall would fail in a seismic event.

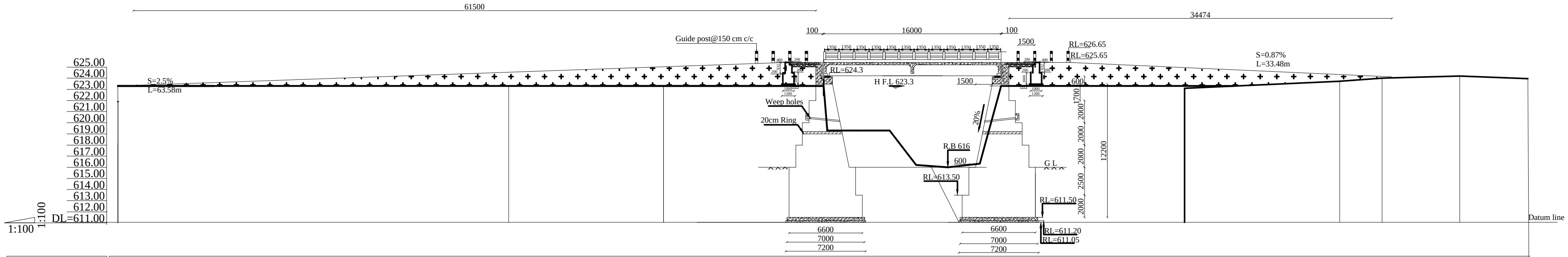
Before final stability calculations can be performed, a hydraulic analysis should be performed to determine the design water elevation and the susceptibility of the walls to scour. In order to assemble the hydraulic model, Tetra Tech needs the soil gradations and testing information at the retaining walls, the design flows, and some survey information upstream and downstream of the bridge.

APPENDIX B – RUN-P-SAR-PFA-007-VEHICLE BRIDGE DRAWINGS

16 M KHAN AQA RCC BRIDGE
KHAN AQA , CENTER , SARI PUL

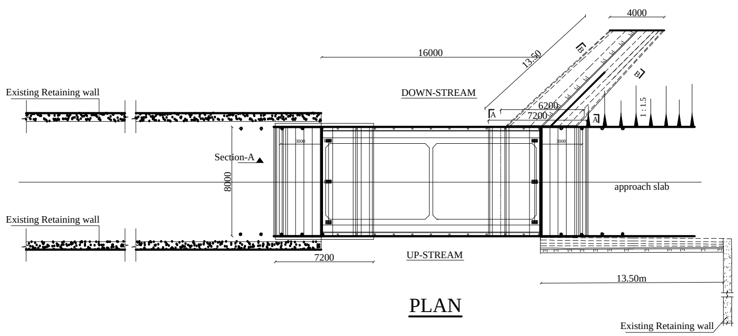
SHEET No.	DRAWING TITLES	REMARKS
1	INDEX SHEET AND GENERAL REQUIREMENT OF MATERIALS	
2	GENERAL SITE PLAN	
3-4	SURVEY SECTIONS	
5	LANG SECTIONS	
6	DEOLITION OF EXISTING ABUTMENTS PLAN AND SECTION	
7	PLAN	
8	PLAN & CROSS SECTION	
9	PLAN & ELEVATION	
10	FRONT ELEVATION OF LEFT ABUTMENT	
11	FRONT ELEVATION OF RIGHT ABUTMENT	
12	DETAILS OF DECK SLAB GIRDER SLAB	
13	DETAILS OF GIRDER AND BIAPHRAGMS	
14	ABUTMENT AND APPROCH SLAB	
15	FENCE DATAILAND GUID POST	
16	DETAILS OF BEARING SEAT & EXPENSION JOINT	

SURVEYED BY			CHECKED BY			PROVINCE	SUR-E-PUL	PROJECT NAME: KHAN AQA BRIDGE BRIDGE	SHEET NO 01
DRAWN BY			REVIEWED BY			DISTRICT	CENTER		
DESIGNED BY			APPROVED BY			VILLAGE	KHAN AQA	DRAWING TITLE: INDEX SHEET	SCALE: AUG 2019



Design Level	623.31	624.47	624.94	624.91	619.31	616.00	616.00	616.00	616.00	616.00	623.34	623.3	624.29	624.77	624.21	624.00	624.19	623.96
Cut(+) Fill(-)	0.00	+1.17	+1.64	+1.61	0.00	-3.30	-3.29	-0.20	0.00	-0.32	+0.63	0.00	+1.61	+1.47	+0.48	0.00	0.00	0.00
Road Level	623.31	623.3	623.3	623.3	619.31	619.30	619.29	616.20	616.0	616.32	622.67	623.3	622.68	623.30	623.73	624.00	624.19	623.96
Accumulated Distance	0.00	35.22	49.17	63.58	63.92	66.70	69.53	71.92	74.78	77.66	78.33	79.58	80.42	96.12	110.08	113.9	120.9	127.04
point Number	8.00	5.00	21.00	25.00	161.00	168.00	164.00	177.00	175.00	171.00	28.00		31.00	33.00	35.00	38.00	40.00	42.00

ELEVATION



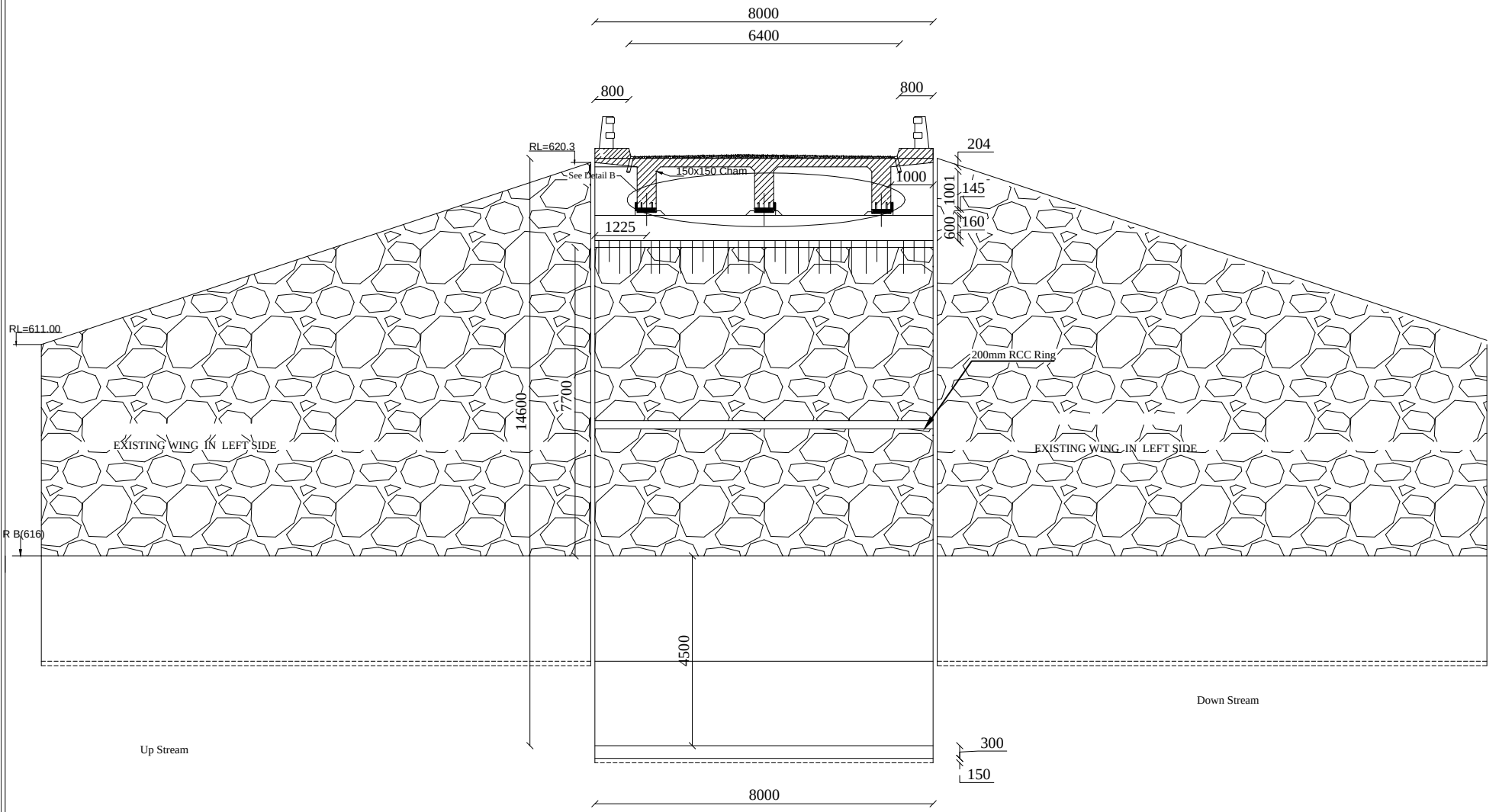
PLAN

SURVEY BY	CHECKED BY	PROVINCE	SUR-E-PUL	PROJECT NAME: KHAN AQA BRIDGE	
DESIGNED BY	REVIEWED BY	DISTRICT	CENTER		
ATTESTED BY	APPROVED BY	VILLAGE	KHAN AQA	DRAWING TITLE: PLAN &CROSS SECTION	

SHEET NO 9 / 16

NOT-SCALE

AUG 2012



FRONT ELEVATION OF LEFT ABUTMENT

All dimentions are in millimetre unless otherwise mentioned.

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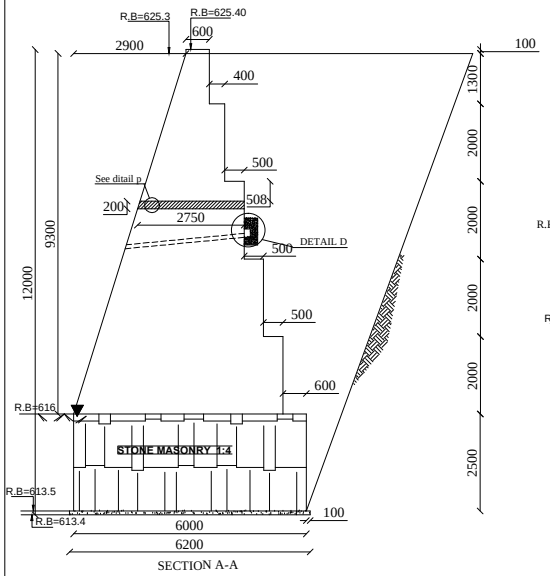
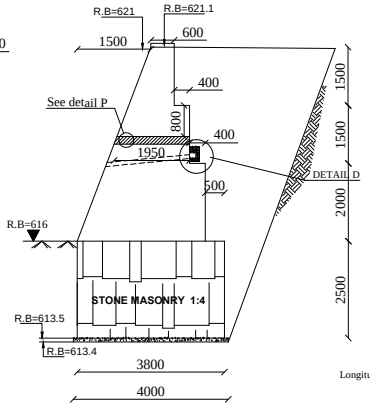
DESIGNED BY			REVIEWED BY			DISTRICT	CENTER	
ATTESTED BY			APPROVED BY			VILLAGE	KHAN AQA	DRAWING TITLE: RIGHT ELEVATION OF BRIDGE

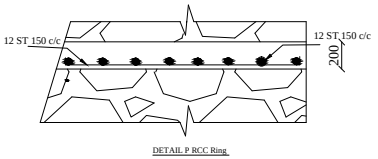
SHEET NO 10 of 16 | Scale | AUG 2012



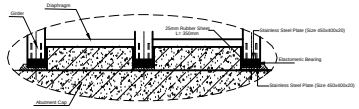
SECTION A-A



Section B-B



DETAIL P RCC Ring



DETAIL -B Roller Support
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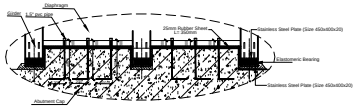

DETAIL -B' Pin Support
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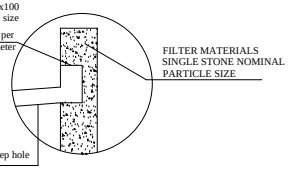
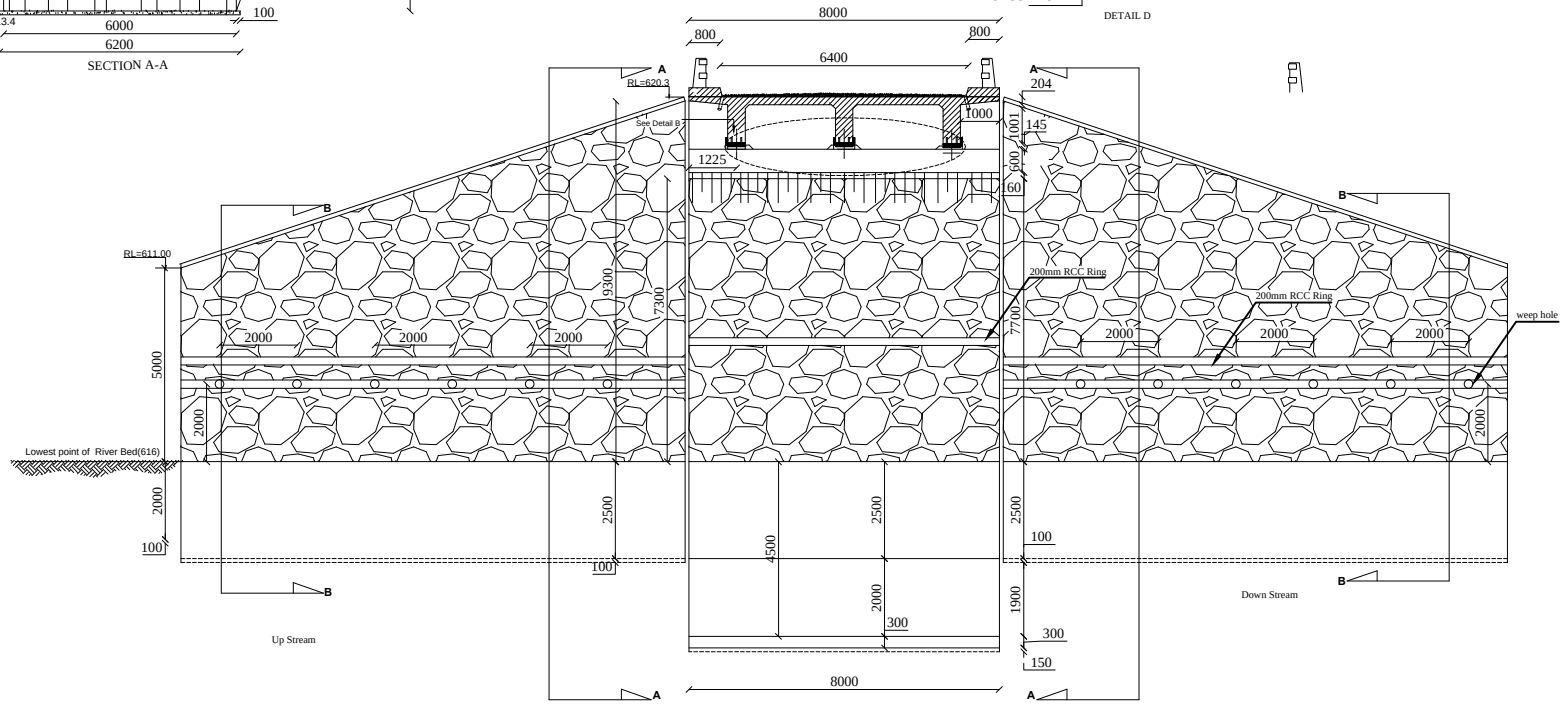


DETAIL D



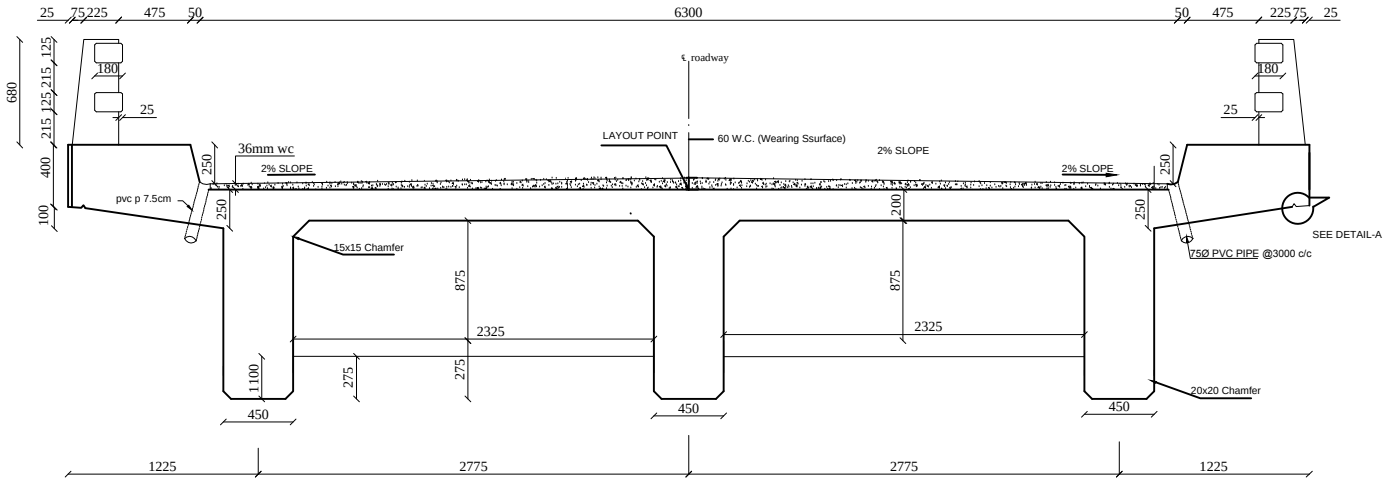
FRONT ELEVATION OF RIGHT ABUTMENT

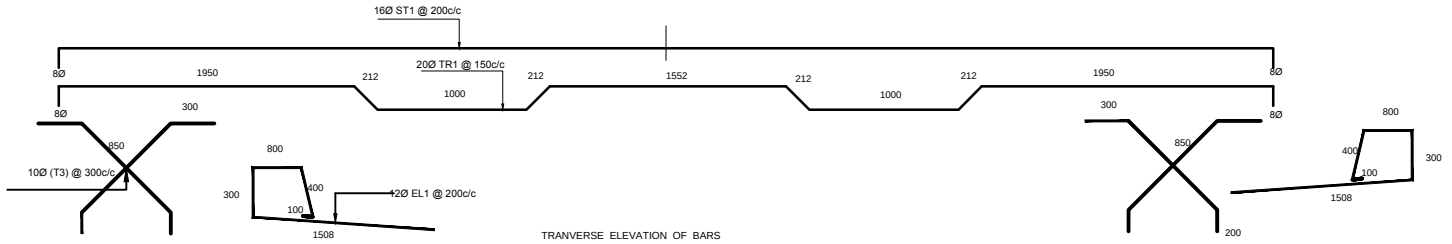
All dimentions are in millimetre unless otherwise mentioned.

SURVEYED BY			CHECKED BY			PROVINCE	SUR-E-PUL	PROJECT NAME: KHAN AQA BRIDGE
DESIGNED BY			REVIEWED BY			DISTRICT	CENTER	
ATTESTED BY			APPROVED BY			VILLAGE	KHAN AQA	DRAWING TITLE: RIGHT ELEVATION OF BRIDGE

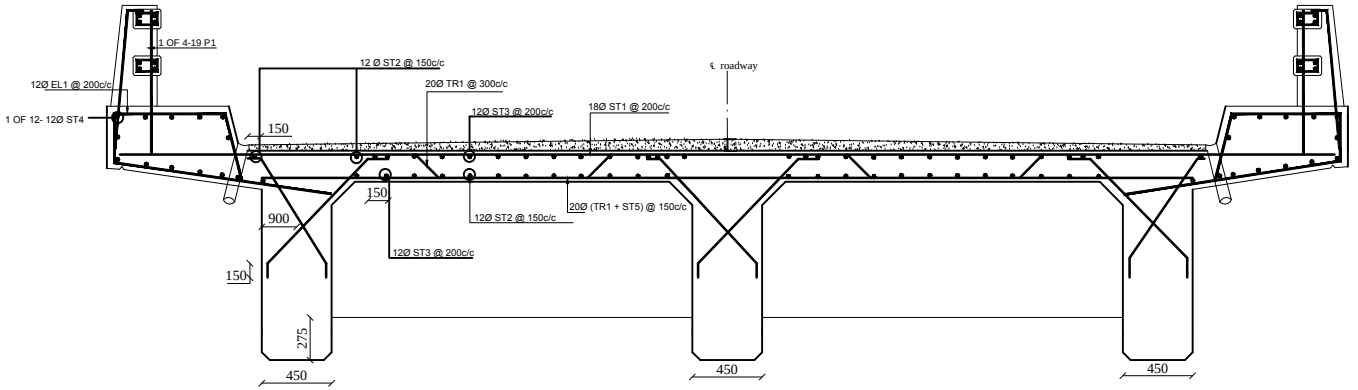
SHEET NO 11 of 16 | Scale | AUG 2012

DETAILS OF DECK SLAB GIRDER SLAB





TRANVERSE ELEVATION OF BARS



REINF.DETAILS OF DECK GIRDER SLAB

DETAIL-A

SCHEDULE AND QUANTITIES OF REINFORCEMENT FOR DECK SLAB

SHAPE CODE	BAR SHAPE	COMPONENT	BAR MARK	BAR DIA (mm)	BAR LENGTH (mm)	NO. OF MEMBER	NO. OF BAR IN EACH MEMBER	TOTAL NO. OF BAR	TOTAL LENGTH (m)	UNIT WEIGHT OF BAR (Kg/m)	TOTAL WEIGHT (Kg)	SHAPE CODE	
													1000
											2103.05	99a	9200
										2.46	1200	20	16000
										1.998	1998	20	16000
										0.89	526.88	20	16000
										0.89	396.72	20	16000
										0.89	346.76	20	16000
										0.89	345.28	20	16000
										2.46	442.69	99b	800
20	a	DECK SLAB	TR1	20	8300	1	103	103	854.9	2.46	2103.05	99a	1000
21	a b		ST1	16	7800	1	77	77	600.6	1.998	1200	20	9200
60	b a		ST2	12	16000	1	37	37	592	0.89	526.88	20	16000
99a	c b a		ST3	12	16000	1	28	28	448	0.89	396.72	20	16000
99b	c b a		ST4	20	16000	2	12	24	384.1	0.89	345.76	20	16000
			ST5	12	3108	1	107	107	332.3	0.89	345.28	20	16000
			EL1	12	3108	2	80	160	497.28	2.46	442.69	99b	800

TOTAL = 6671.28 kg x1.05=7004.85kg

NOTE

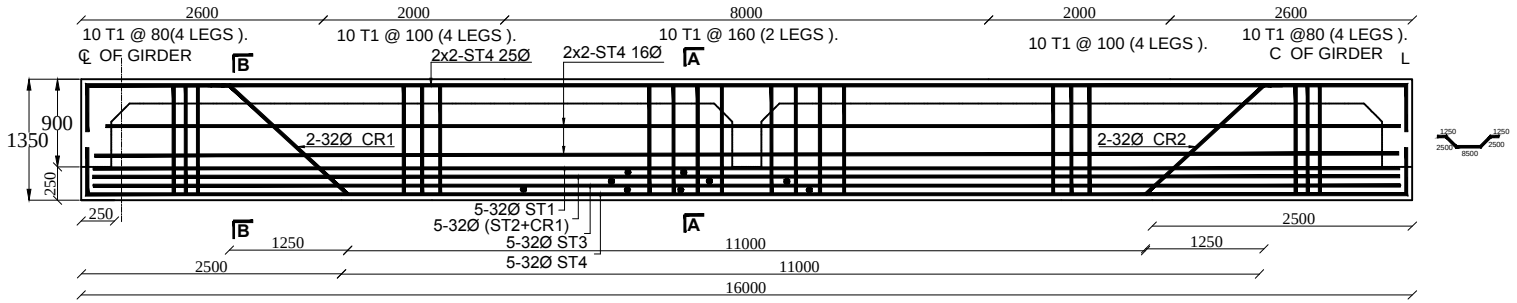
MINIMUN CLEAR COVER FOR SLAB :

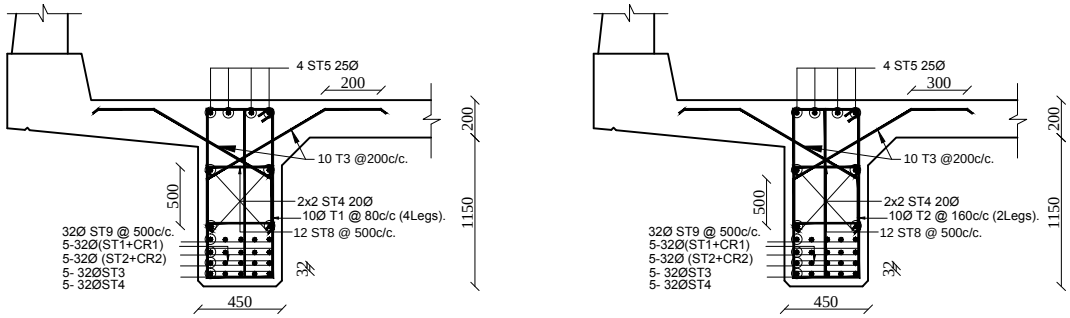
TOP BAR - 50 mm
BOTTOM BAR - 50 mm
EDGE - 50 mm

All dimentions are in millimetre unless otherwise mentioned.

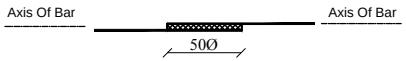
SURVEYED BY			CHECKED BY			PROVINCE	SUR-E-PUL	PROJECT NAME: KHAN AQA BRIDGE
DESIGNED BY			REVIEWED BY			DISTRICT	CENTER	
ATTESTED BY			APPROVED BY			VILLAGE	KHAN AQA	DRAWING TITLE: DETAILS OF DECK SLAB GIRDER SLAB

SHEET NO 12 OF 16 | Scale | AUG 2012





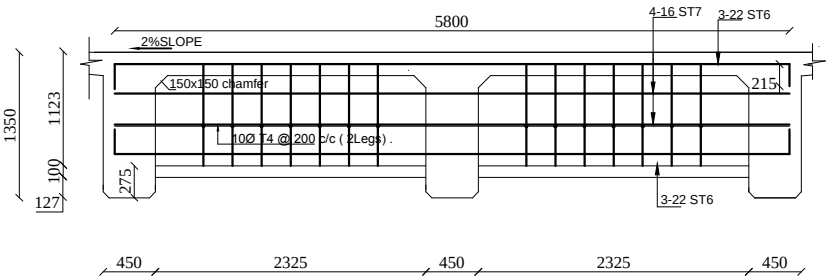
SECTION A-A



DETAIL OF OVERLAP AND WELDING

NOTE:

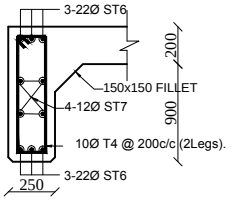
Aftar Welding of Rebars the Axis of All Bars Should be Placed in one Axis .



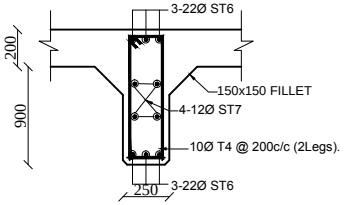
NOTE

MINIMUM CLEAR COVER FOR GIRDER AND DIAPHRAGM :

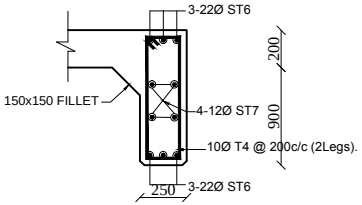
BOTTOM BAR - 50 mm
SIDE - 40 mm



PIN SUPPURT DIAPHRAGM



MID DIAPHRAGM



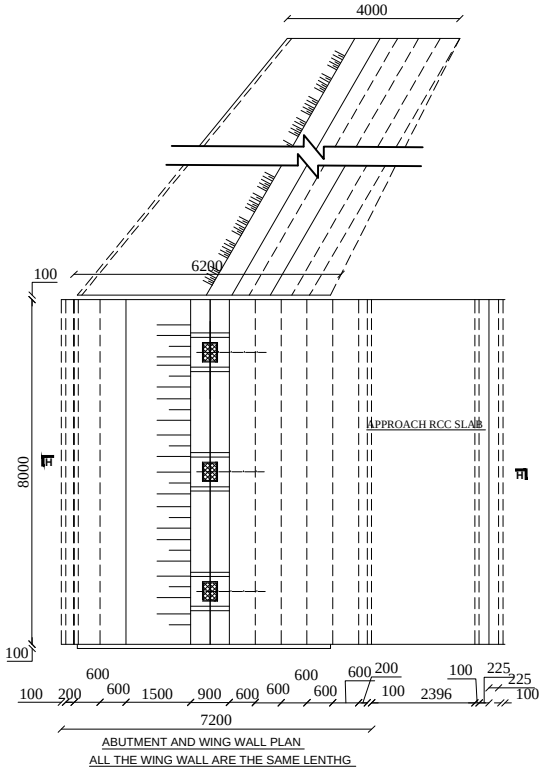
ROLLER SUPPURT DIAPHRAGM

BAR BENDING SCHEDULE AND QUANTITIES FOR EACH GIRDER

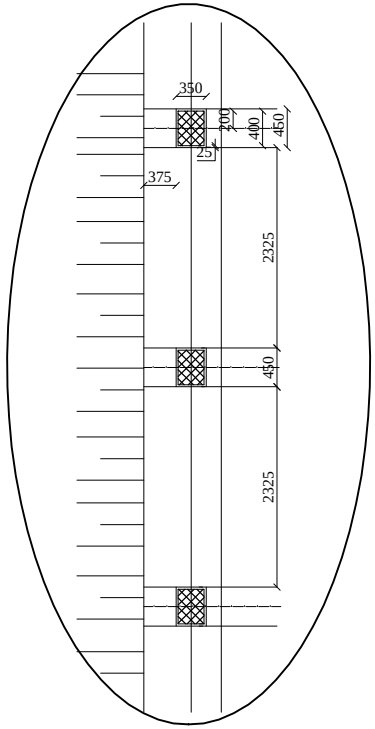
COMPONENT	BAR SHAPE	SHAPE CODE	BAR MARK	BAR DIA (mm)	BAR LENGTH (mm)	NO. OF MEMBER	NO. OF BAR IN EACH MEMBER	TOTAL NO. OF BAR	TOTAL LENGTH (m)	UNIT WEIGHT OF BAR (Kg/m)	TOTAL WEIGHT (Kg)	SHAPE CODE	DIMENSIONS (mm) a	b	c	c
BEAM & DIAPHRAGM		99a	CR1	32	13500	1	2	2	27	6.31	170.37	99a	11000	1250		150
		20	CR2	32	13500	1	2	2	27	6.31	170.37	99a	11000	1250		150
		38	ST1	32	15800	1	5	5	79	6.31	498.49	20	15800			
		60a	ST2	32	15800	1	5	5	79	6.31	498.49	38	15800			
		60	ST3	32	15800	1	5	5	79	6.31	498.49	38	15800			
		99L	ST4	32	16500	1	5	5	82.5	6.31	520.575	20	15900	300		
			ST5	25	16500	1	4	4	66	3.85	254.1	38	15900	300		
			ST6	22	6100	3	3	9	54.9	2.98	163.6	38	5800	150		
			ST7	12	5800	3	4	12	69.6	0.888	61.8	20	5800			
			T1	10	3295	1	50	50	164.75	0.62	102.14	60a	3080	215		100
			T2	10	2160	1	50	50	108	0.62	66.96	60	1740	320		200
			T3	10	1550	3	40	120	186	0.62	115.32	99L	1050	300		
			T4	10	2280	1.5	10	15	34.2	0.62	21.2	60	665	190		

TOTAL = 3141.705x1.05=3298.79(3)=9896.37Ton

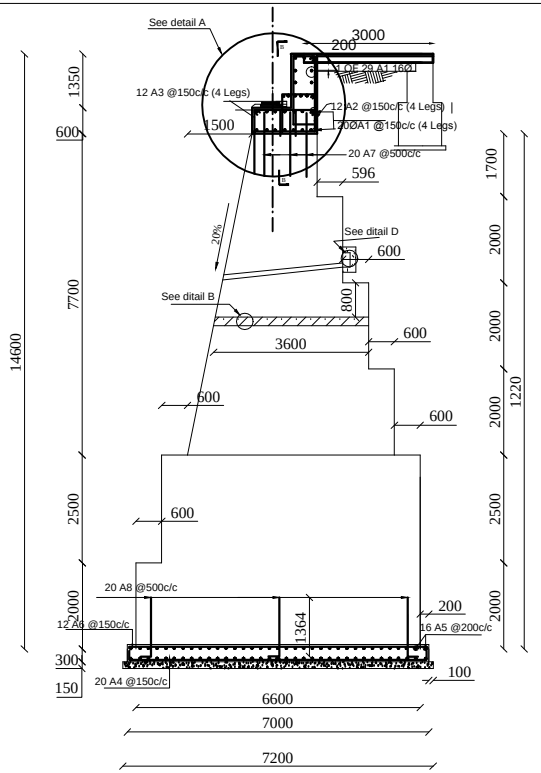
SURVEYED BY		CHECKED BY		PROVINCE	SUR-E-PUL	PROJECT NAME: KHAN AQA BRIDGE	SHEET NO	AGU 2012
DESIGNED BY		REVIEWED BY		DISTRICT	CENTER		13 of 16	Scale
ATTESTED BY		APPROVED BY		VILLAGE	KHAN AQA	DRAWING TITLE: DETAILS OF GIRDER		



ABUTMENT AND WING WALL PLAN
ALL THE WING WALL ARE THE SAME LENTHG



SECTION H-H

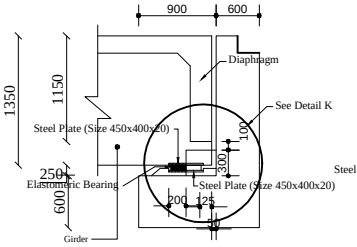


BAR BENDING SCHEDULE AND QUANTITIES FOR ABUTMENTS

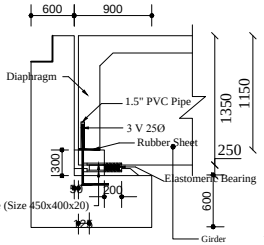
COMPONENT	BAR MARK	BAR DIA (mm)	BAR LENGTH (mm)	NO. OF MEMBER	TOTAL NO. OF BAR IN EACH MEMBER	TOTAL NO. OF BAR	TOTAL LENGTH (m)	UNIT WEIGHT OF BAR (Kg/m)	TOTAL WEIGHT (Kg)	SHAPE CODE	DIMENSIONS (mm) a	b	c	d
ABUTMENT	A1	20	7900	2	27	54	426.6	2.47	1053.7	20	7900			
	A2	12	7420	2	25	50	371	0.89	330.19	38d	1650	400	100	
	A3	12	3960	2	27	54	213.84	0.89	190.32	60	800	500	100	
	A4	20	7100	2	47	94	667.4	2.47	1648.48	38	6800	300		
	A5	16	6900	2	40	80	552	1.58	872.16	38	6700	300		
	A6	12	6900	2	46	92	634.8	0.89	564.97	21	900	150		
	A7	20	1500	2	16	32	48	2.47	118.56	21	900	300		
	A8	12	1800	2	26	52	93.6	0.89	83.30	20	1800			
	A9	12	6900	2	14	28	193.2	0.89	171.948	20	6900			
								SUB TOTAL=	5172.668					
BEARING SEAT	A	10	1375	4	9	36	49.50	0.62	30.69	38c	720	55	300	200
	B	10	1390	4	8	32	44.48	0.62	27.58	38d	300	750	140	
								SUB TOTAL=	58.27					
								TOTAL =	5230.93BTon*1.05=5492.49Ton					

BAR SHAPE

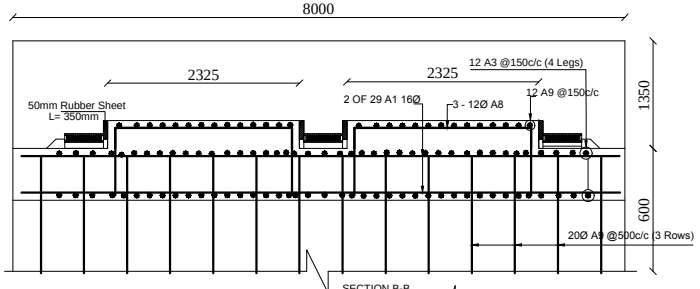
SHAPE CODE	20	60	38	21	38c	38d



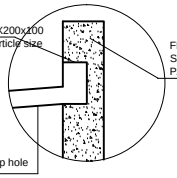
DETAIL A FOR RIGHT ABUTMENT
SCALE 1:50



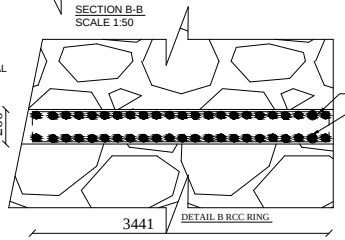
DETAIL A FOR LEFT ABUTMENT
SCALE 1:50



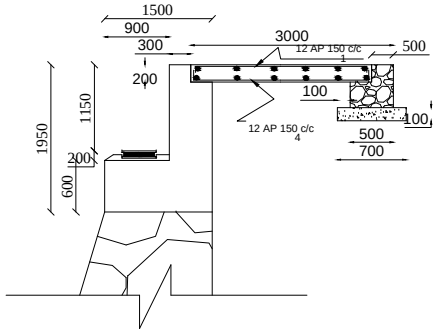
SECTION B-B
SCALE 1:50



DETAIL D



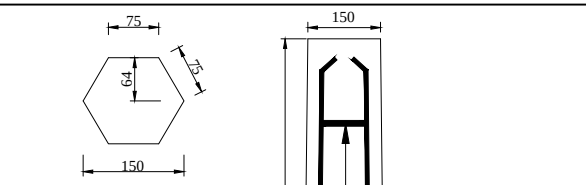
DETAIL B RCC RING



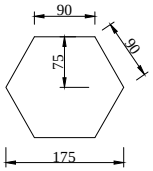
REINFORCMENT OF APPROACH SLAB

All dimentions are in millimetre unless otherwise mentioned.

SURVEYED BY			CHECKED BY			PROVINCE	SUR-E-PUL	PROJECT NAME: KHAN AQA BRIDGE	
DESIGNED BY			REVIEWED BY			DISTRICT	CENTER		
ATTESTED BY			APPROVED BY			VILLAGE	KHAN AQA	DRAWING TITLE: ABUTMENT AND APPROCH SLAB	SHEET NO 14 / 16 — Scale — AUG 2012

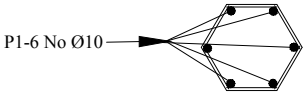


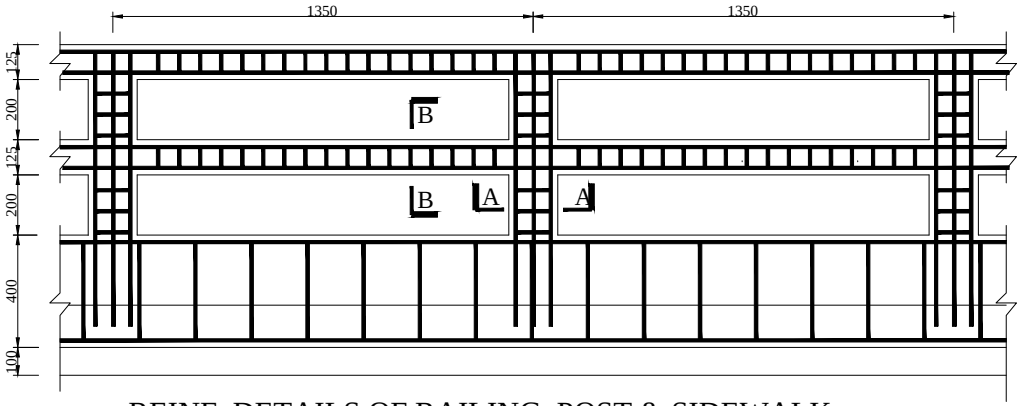
TOP SECTION



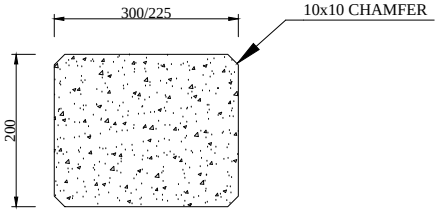
BOTTOM SECTION

GUIDE POST

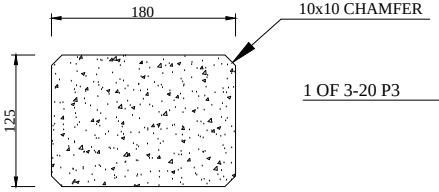




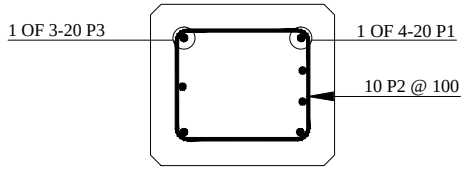
REINF. DETAILS OF RAILING, POST & SIDEWALK



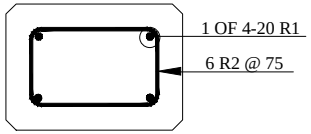
SECTION POST



SECTION RAILING



REINF. DETAILS OF RAILING
SECTION A–A.



REINF. DETAILS OF POST
SECTION B–B

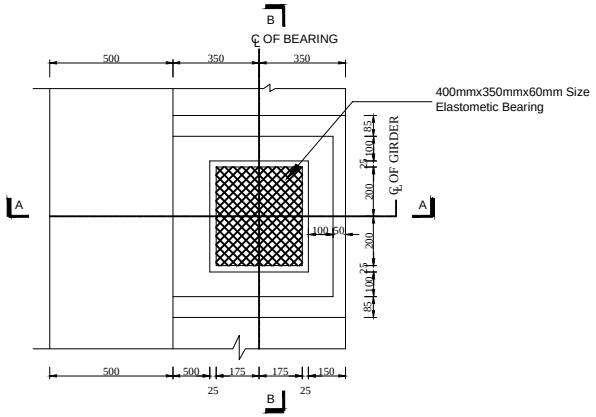
SCHEDULE AND QUANTITIES OF REINFORCEMENT FOR GUIDE POST

SHAPE CODE	BAR SHAPE	COMPONENT	BAR MARK	BAR DIA (mm)	BAR LENGTH (mm)	NO. OF MEMBER	NO. OF BAR IN EACH MEMBER	TOTAL NO. OF BAR	TOTAL LENGTH (m)	UNIT WEIGHT OF BAR (Kg/m)	TOTAL WEIGHT (Kg)	SHAPE CODE	DIMENSIONS (mm) a	b	c	d
10	a	GUIDE POST	P1	10	1850	20	6	120	222	0.616	137		1650	100	50	50
6			P2	6	450	20	6	120	54	0.222	12					
10			F	10	400	20	6	120	24	0.616	30		300	50	50	
6			P3	6	400	20	6	120	48	0.222	11					
			TOTAL = 190x1.05=200Kgs.													

1 -H STEEL GIRDER 6x3.37 Width=3.56 in ,Depth=6 in ,thickness flang=.35in
Web thickness=.46 in, Area=5 ^{2}in , Weight/ft=17.25 lb
2 -Steel Pipe =4 in, Steel plate=.5 in
3 -Note :Pipe welded to steel girder and girder bolded to edge curb
All bolded in the sie curb seat center to center 2.5 meter

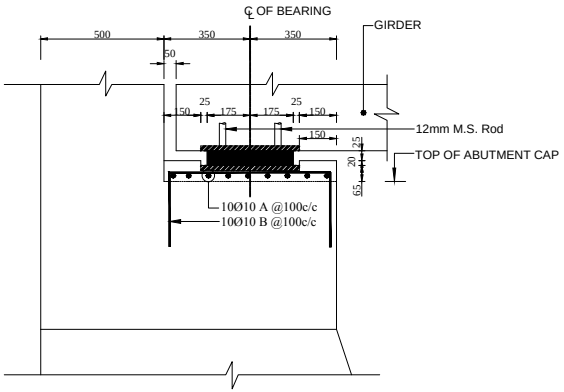
1 -H STEEL GIRDER (6x3.37) , Width=3.56 in ,Depth=6 in ,thickness flang=.35in
Web thickness=.46 in, Area=5 ^{2}in , Weight/ft=17.25 lb
2 -Steel Pipe =5 in Diameter, Steel plate=.4 in thickness
3 Pipe welded to steel girder and girder welded to steel plate
All bolded on the curb seat center to center 3 meter
Anather type fances installeted in the rigth side and left side curbs

SURVEYED BY			CHECKED BY			PROVINCE	SUR-E-PUL	PROJECT NAME: KHAN AQA RCC BRIDGE	SHEET NO 15 16
DESIGNED BY			REVIEWED BY			DISTRICT	CENTER		AGU 2012
ATTESTED BY			APPROVED BY			VILLAGE	KHAN AQA	DRAWING TITLE: Fence detail and guid post	



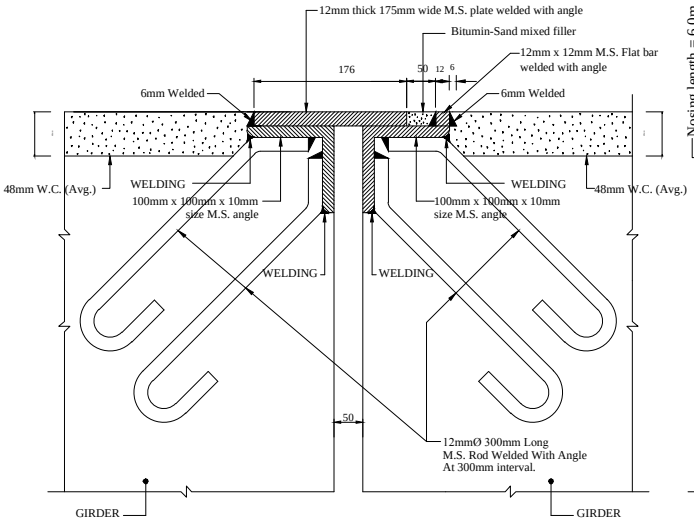
PLAN OF BEARING SEAT

SCALE 1:20



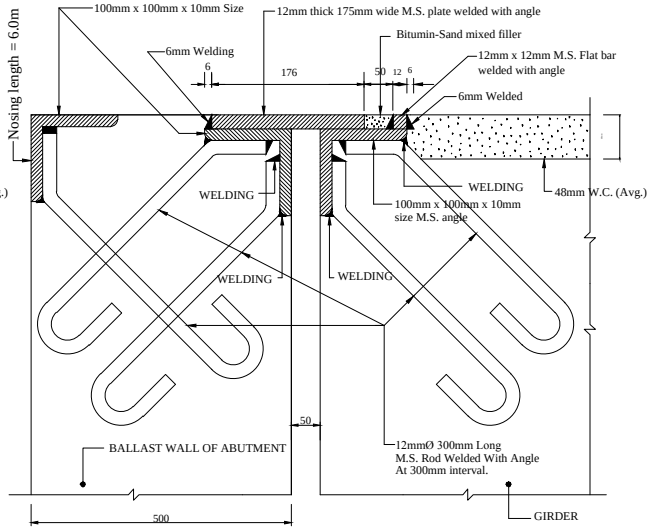
SECTION A-A

SCALE 1:20



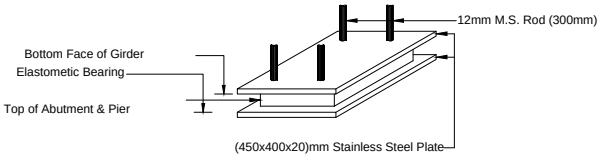
EXPANSION JOINT DETAIL OVER PIER

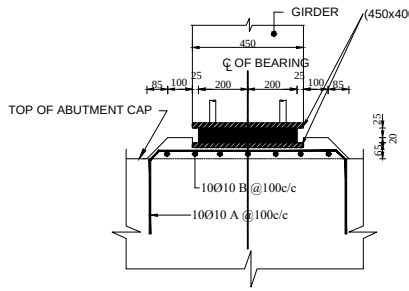
Length = 4.10m



EXPANSION JOINT DETAIL OVER ABUTMENT

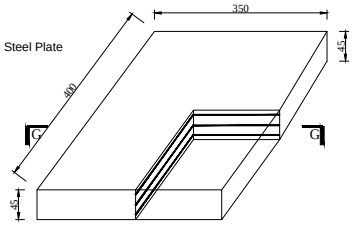
Length = 4.10m





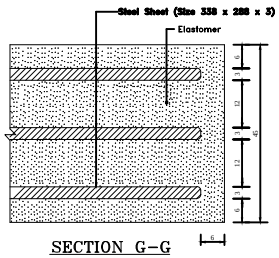
SECTION B-B

SCALE 1:20



ELASTOMERIC BEARING

SCALE 1:10



SECTION G–G

NOTES :

ELASTOMERIC (NEPRENE) BRIDGE BEARING:

a) MATERIAL USED:
ELASTOMER - 100% VIRGIN CHOLOPRENE (NEOPRENE) RUBBER MEETING THE REQUIREMENTS OF :

I) ELASTOMER HARDNESS = 60 ± 5 DURO CONFIRMING TO ASTM - D2240.

II) COMPRESSION SET = 35% MAXIMUM (22 HOURS AT 212° F) CONFIRMING TO ASTM - D395 METHOD B.
LAMINATES - ROLLED MILD STEEL SHEETS CONFIRMING TO ASTM - A570, GRADE 36 OR ASTM - A611, GRADE D

b) TYPE OF BEARING :
LAMINATED MOLDED BEARING : UNLESS OTHERWISE SHOWN ON THE DRAWING, ALL COMPONENTS OF LAMINATED BEARING SHALL BE MOLDED TOGETHER INTO AN INTEGRAL UNIT AND ALL EDGES OF STEEL LAMINATIONS SHALL BE COVERED BY A MINIMUM OF 6mm OF ELASTOMER.

All dimension are in millimetre unless otherwise mentioned.

SURVEYED BY			CHECKED BY			PROVINCE	SUR-E-PUL	PROJECT NAME: KHAN AQA RCC BRIDGE
DESIGNED BY			REVIEWED BY			DISTRICT	CENTER	DRAWING TITLE: DETAILS OF BEARING SEAT & EXPENSION JOINT
ATTESTED BY			APPROVED BY			VILLAGE	KHAN AQA	SHEET NO 16 OF 16 — SCALE :

GENERAL REQUIREMENT FOR THE CONSTRUCTION OF GIRDER BRIDGES

1. CEMENT :

PORTLAND CEMENT

a) SETTING TIME :

INITIAL SETTING TIME : NOT LESS THAN 45 MINUTES

FINAL SETTING TIME : NOT GREATER THAN 8 HOURS

b) STRENGTH :

COMPRESSING STRENGTH (STANDARD CUBE) :

28 DAYS : 30 N/mm^2 (300 kg/cm^2)

2. REINFORCEMENT :

a) STRENGTH :

YEILD STRENGTH (fy) OF MILD STEEL DEFORMED BAR SHALL NOT BE LESS THAN AND 276 N/mm^2 (40,000 psi)

FOR ALL MEMBER AND THE STEEL SHOULD CONFORM ASTM - A615- 40.0.

b) SPLICES IN REINFORCEMENT

- SPLICES IN REINFORCEMENT IF NECESSARY SHALL BE MADE ONLY AS AUTHORISED BY THE ENGINEER.
- SPLICES IN REINFORCEMENT AT POINTS OF MAXIMUM STRESS IN SLABS, BEAMS AND GIRDERS SHOULD BE AVOIDED.
- LAP LENGTH WILL BE :

i) FOR TENSION M.S. DEFORMED BAR :

- 40 BAR DIAMETER WITHOUT HOOKS
- 30 BAR DIAMETER WITH STANDARD HOOKS

ii) FOR COMPRESSION M.S. DEFORMED BAR :

- 24 BAR DIAMETER WITHOUT HOOKS

3. CONCRETE :

i) FOR DECK SLAB , GIRDER , DIAPHRAGM , PIER ,POSTS AND HAND RAILS :
28 DAYS STANDARD STRENGTH : fc' = 30 N/mm^2 (300 kg/cm^2)

ii) FOR ABUTMENT CAP & FOUNDATION :
28 DAYS STANDARD STRENGTH : fc' = 30 N/mm^2 (300 kg/cm^2)
For blending concrete 15 N/mm^2 (150 kg/cm^2)

4. MINIMUM CLEAR COVER TO MAIN REINFORCEMENT BAR :

a) FOR RAILPOST & HAND RAIL - 25 mm, ALL FACES

b) FOR SLAB :

TOP BAR - 50 mm

BOTTOM BAR - 50 mm

EDGE - 50 mm

c) FOR GIRDER AND DIAPHRAGM :

BOTTOM BAR - 50 mm

SIDE - 40 mm

d) FOR PIER, ABUTMENT AND WINGWALL :

EARTH FACE -75 mm, WHEN FORM WORK IS USED.

WATER FACE - 75 mm - DO -

e) MEMBERS CAST AGAINST AND PERMANENTLY

EXPOSED TO NON-SALINE WATER/SOIL : 75 mm

f) MEMBERS PERMANENTLY EXPOSED TO

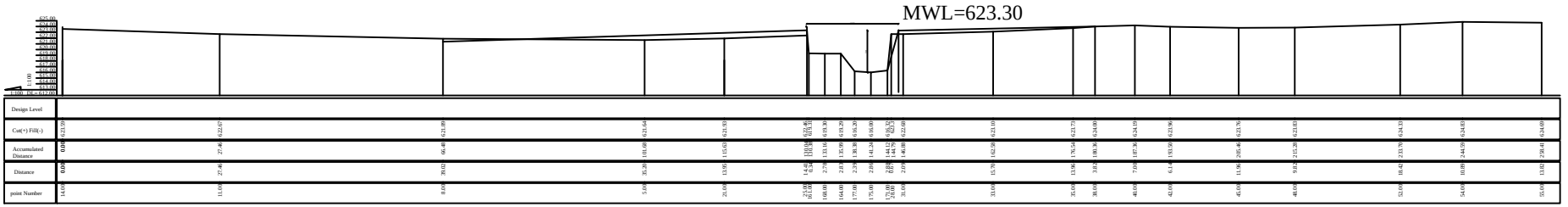
SALAINE WATER / SOIL : 100 mm

5. MIXER MACHINE AND VIBRATOR MUST BE USED IN ALL RCC CASTING.
6. WRITTEN DIMENSIONS ARE TO BE TAKEN IN PREFERENCE TO SCALED ONES.
7. CONSTRUCTION JOINTS IN ADDITION TO THE PLACES SHOWN IN THE DRAWING SHALL BE PROVIDED AS PER DIRECTION OF THE ENGINEER-IN-CHARGE.
8. ELASTOMER HARDNESS 60 $\pm$ 5 DURO.
9. ALL DIMENSIONS ARE IN MILIMETRE UNLESS OTHERWISE MENTIONED.
10. AN ELESTOMERIC BEARING PAD SHOULD BE USED JUST FOR TESTING.
11. PROVIDE TWO LAYER POLYTHENE SHEET BETWEEN THE ELESTOMERIC BEARING PAD AND THE GIRDER.
12. TOP OF BEARING SEAT IS TO BE ADJUSTED ACCORDING TO THE LONGITUDINAL SLOPE OF GIRDER RL. SHOWN ON THE ELEVATION DRAWING OF BRIDGE.
13. WING WALL HEIGHT SHALL BE ADJUST TO SITE CONDITION.
14. BEARING CAPACITY OF SOIL CONSIDERED 3 Kg/cm .^{2}
15. BEARING CAPACITY OF SOIL UNDER ABUTMENT SHELL BE TEST BEFORE IMPLEMENTATION OF ABUTMENT.
16. HEIGHT OF BRIDGE AND LENGTH,ANGLE OF WING WALL SHOULD BE ADJUSTED TO SITE CONDITION .
17. IF ELEVATION OF BRIDGE EXCEED FROM ELEVATION WHICH HAS SHOWN IN DRAWINGS, PLEASE REFER TO RITS OFFICE .

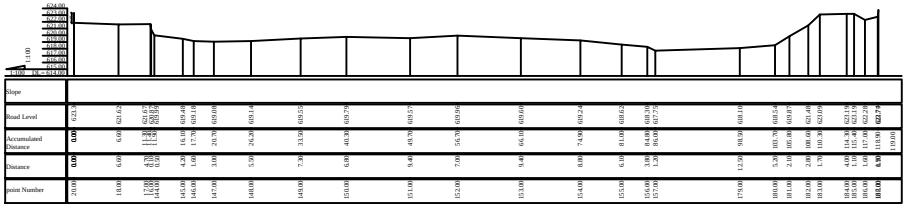
SURVEYED BY		CHECKED BY			PROVINCE	SUR-E-PUL	PROJECT NAME: KHAN AQA BRIDGE BRIDGE
DRAWN BY		REVIEWED BY			DISTRICT	CENTER	DRAWING TITLE: GENERAL REQUIREMENT OF MATERIALS
DESIGNED BY		APPROVED BY			VILLAGE	KHAN AQA	SHEET NO 1 16 · SCALE : · JAN 2012

GENRAL PLAN

SURVEYED BY			CHECKED BY			PROVINCE	Sare Pul	PROJECT NAME: Khan Aqa New Proposed Bridage
DRAWN BY			REVIEWED BY			DISTRICT	Center	DRAWING TITLE: PLAN
DESIGNED BY			APPROVED BY			VILLAGE	Khan Aqa	SHEET NO 2 of 16 — NOT TO SCALE — Date: Jan-2011



SECTION :A.A



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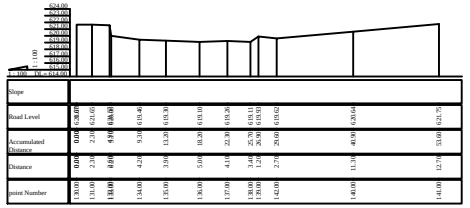
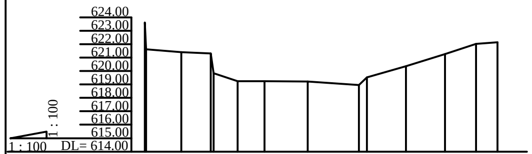


SECTION :C.C

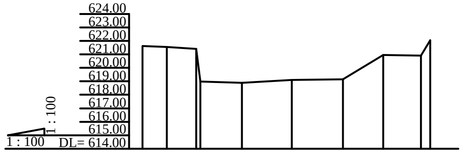
SURVEYED BY			CHECKED BY			PROVINCE	Sare Pul	PROJECT NAME: Khan Aqa RCC Bridage
DRAWN BY			REVIEWED BY			DISTRICT	Center	
DESIGNED BY			APPROVED BY			VILLAGE	Khan Aqa	DRAWING TITLE: SECTION

SHEET NO 3 OF 16 | NOT TO SCALE | Date:AUG.2012



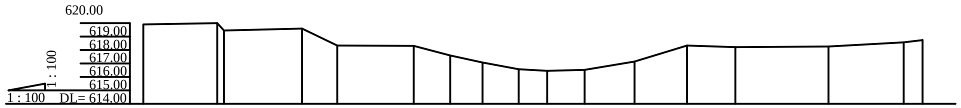
Slope															
Road Level	623.62	621.62	621.41	621.32	619.84	619.24	619.24	619.23	618.97	619.52	620.36	621.27	622.03	622.14
Accumulated Distance	0.00	0.10	2.70	4.90	5.10	6.90	8.90	12.10	15.90	16.50	19.40	22.30	24.60	26.20
Distance	0.00	0.10	2.60	2.20	0.20	1.80	2.00	3.20	3.80	0.60	2.90	2.90	2.30	1.60
point Number	106.00	107.00	108.00	109.00	110.00	111.00	112.00	113.00	114.00	115.00	116.00	117.00	118.00	119.00

SECTION :E.E



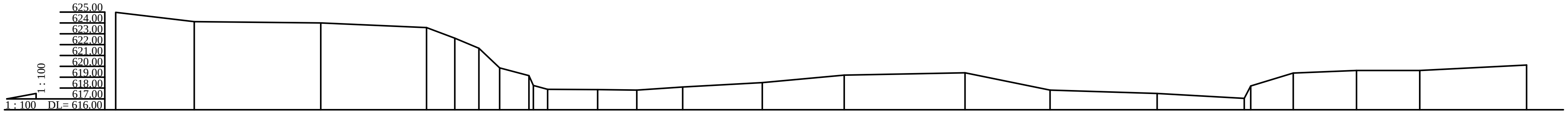
Slope											
Road Level	621.63	621.55	621.42	618.98	618.89	619.10	619.15	620.95	620.91	622.05
Accumulated Distance	0.00	1.80	4.00	4.30	7.40	11.10	14.90	17.90	20.70	21.40
Distance	0.00	1.80	2.20	0.30	3.10	3.70	3.80	3.00	2.80	0.70
point Number	129.00	128.00	127.00	126.00	125.00	124.00	123.00	122.00	121.00	120.00

SECTION :D.D



Slope																	
Road Level	619.90	620.00	619.46	619.60	618.32	618.31	617.59	617.08	616.57	616.46	616.52	617.14	618.32	618.21	618.26	618.57	618.73
Accumulated Distance	0.00	5.50	6.00	11.80	14.40	20.10	22.80	25.20	27.90	30.00	32.80	36.50	40.40	44.00	50.90	56.50	57.90
Distance	0.00	5.50	0.50	5.80	2.60	5.70	2.70	2.40	2.70	2.10	2.80	3.70	3.90	3.60	6.90	5.60	1.40
point Number	81.00	82.00	83.00	84.00	85.00	86.00	87.00	88.00	89.00	90.00	91.00	92.00	93.00	94.00	95.00	96.00	97.00

SECTION :G.G



Slope													
Road Level	624.96	624.10	623.99	623.56	622.58	621.67	619.86	618.14	618.23	617.89	617.87	617.80	618.09
Accumulated Distance	0.00	7.20	18.80	28.50	31.10	33.30	35.20	37.90	38.30	39.60	44.20	47.80	52.00
Distance	0.00	7.20	11.60	9.70	2.60	2.20	1.90	2.70	0.40	1.30	4.60	3.60	4.20
point Number	50.00	58.00	59.00	60.00	61.00	62.00	63.00	64.00	65.00	66.00	67.00	68.00	69.00

Slope												
Road Level	618.51	619.18	619.41	617.80	617.49	617.05	618.20	619.38	619.61	619.61	620.12
Accumulated Distance	59.30	66.80	77.90	85.70	95.50	103.50	104.10	108.00	113.80	119.60	129.40
Distance	7.30	7.50	11.10	7.80	9.80	8.00	0.60	3.90	5.80	5.80	9.80
point Number	70.00	71.00	72.00	73.00	74.00	75.00	76.00	77.00	78.00	79.00	80.00

SECTION :F.F

SURVEYED BY			CHECKED BY			PROVINCE	Sare Pul
DRAWN BY			REVIEWED BY			DISTRICT	Center
DESIGNED BY			APPROVED BY			VILLAGE	Khan Aqa

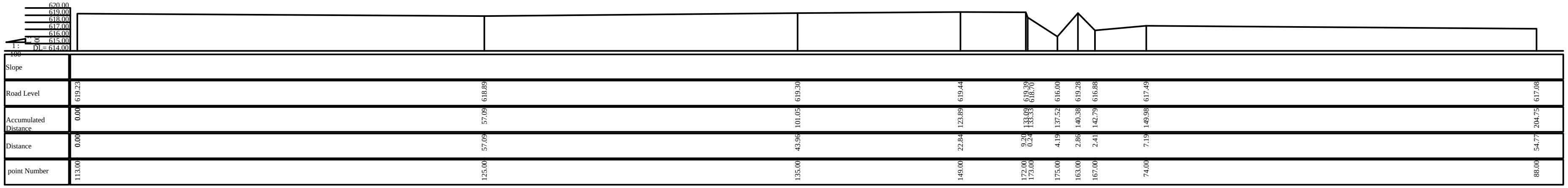
PROJECT NAME: Khan Aqa RCC Bridage

DRAWING TITLE: SECTION

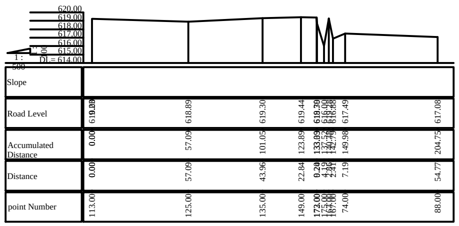
SHEET NO 4 / 16

NOT:SCALE

Date:AUG.2012



Loing section

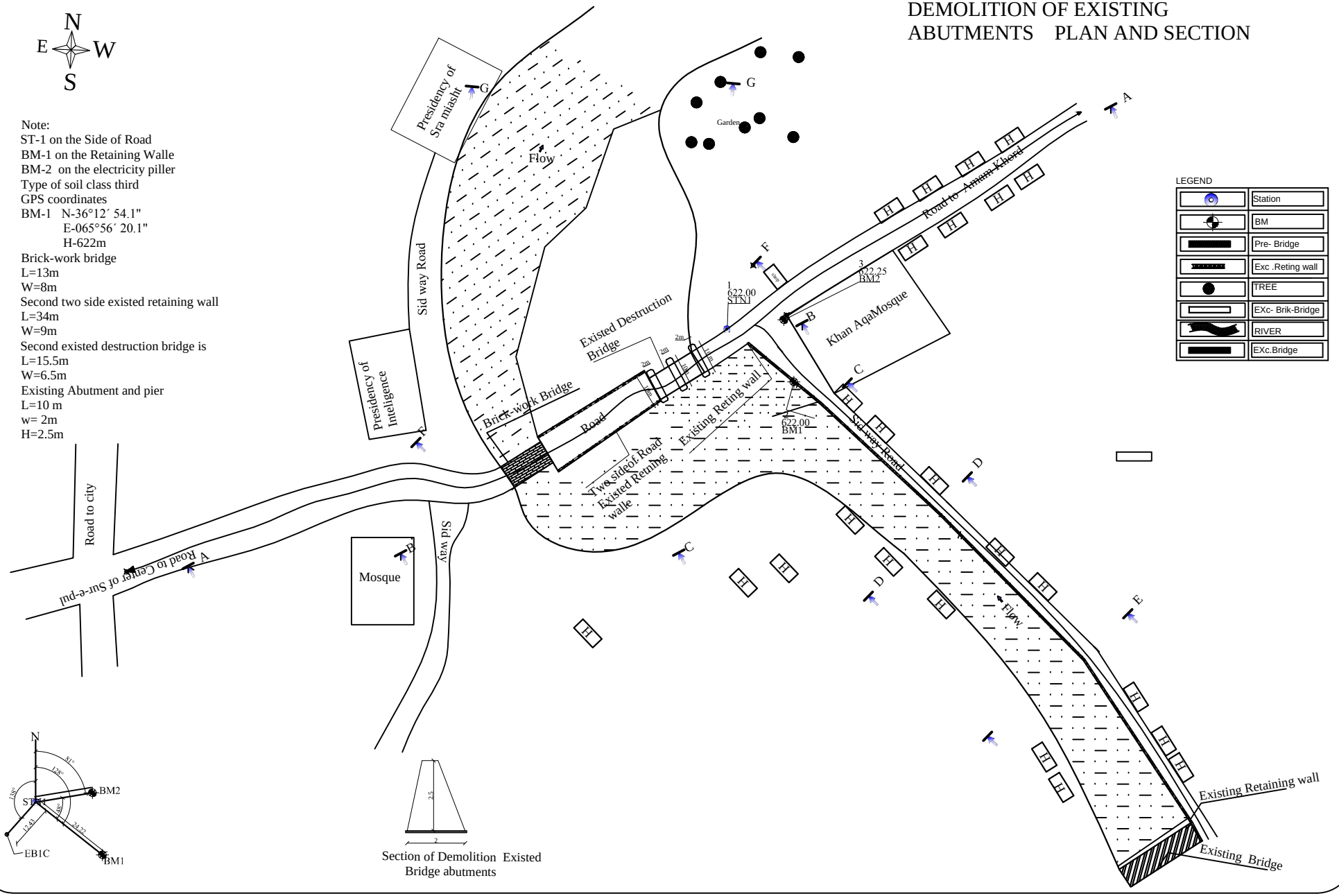


Loing section

SURVEYED BY	CHECKED BY	PROVINCE	Sare Pul	PROJECT NAME: Khan Aqa New RCC Bridage	SHEET NO 5 / 16
DRAWN BY	REVIEWED BY	DISTRICT	Center	DRAWING TITLE: LONG SECTION	NOT-SCALE
DESIGNED BY	APPROVED BY	VILLAGE	Khan Aqa		Date Aug.2012

DEMOLITION OF EXISTING ABUTMENTS PLAN AND SECTION

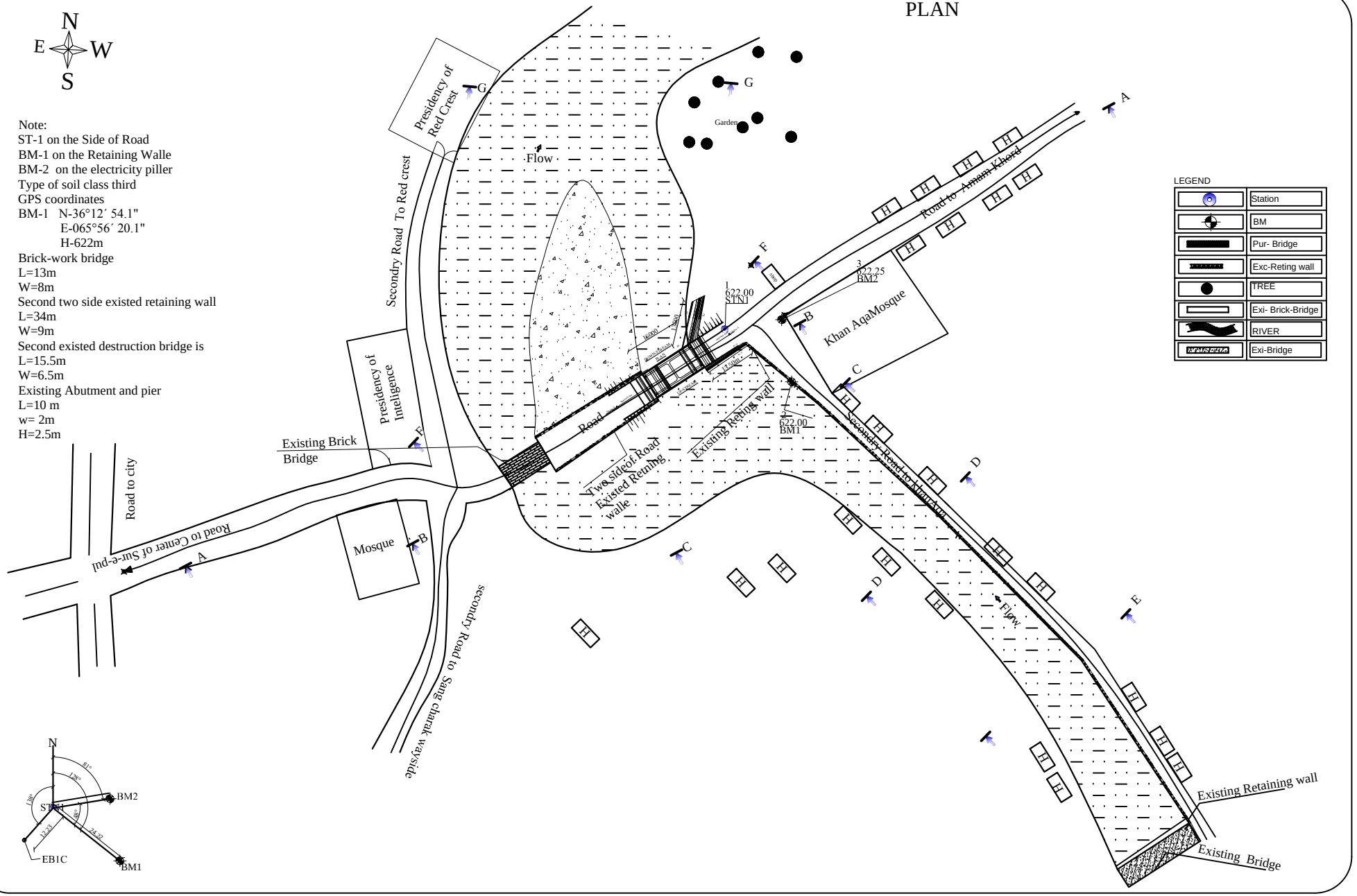
Note:
ST-1 on the Side of Road
BM-1 on the Retaining Walle
BM-2 on the electricity piller
Type of soil class third
GPS coordinates
BM-1 N-36°12′ 54.1"
E-065°56′ 20.1"
H-622m
Brick-work bridge
L=13m
W=8m
Second two side existed retaining wall
L=34m
W=9m
Second existed destruction bridge is
L=15.5m
W=6.5m
Existing Abutment and pier
L=10 m
w= 2m
H=2.5m



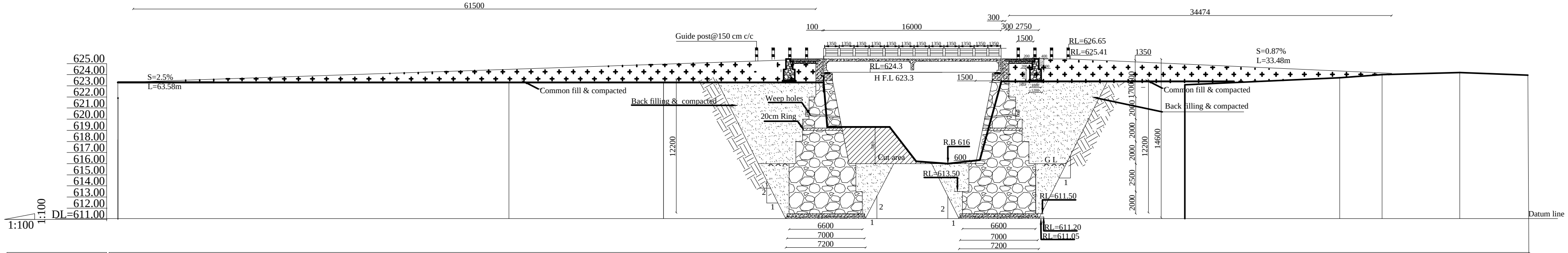
Section of Demolition Existed Bridge abutments

SURVEYED BY			CHECKED BY			PROVINCE	Sare Pul	PROJECT NAME: Khan Aqa RCC Bridage
DESIGNED BY			REVIEWED BY			DISTRICT	Center	DRAWING TITLE: DEMOLITION OF ABUTMENTS PLAN AND SECTION
ATTESTED BY			APPROVED BY			VILLAGE	Khan Aqa	SHEET NO 6 OF 16 — NOT-SCALE — Date: AUG.2012

PLAN

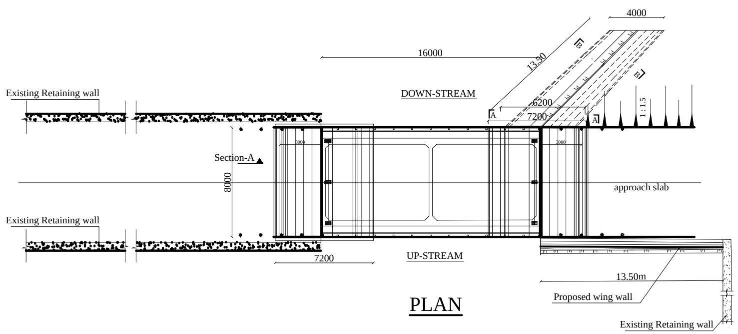


SURVEYED BY			CHECKED BY			PROVINCE	Sare Pul	PROJECT NAME: Khan Aqa RCC Bridage
DESIGNED BY			REVIEWED BY			DISTRICT	Center	DRAWING TITLE: PLAN
ATTESTED BY			APPROVED BY			VILLAGE	Khan Aqa	SHEET NO 7 OF 16 · NOT TO SCALE · Date: AUG 2021



Design Level	623.31	624.47	624.94	624.91	619.31	616.00	616.00	616.00	616.00	616.00	623.34	623.3	624.29	624.77	624.21	624.00	624.19	623.96
Cut(+) Fill(-)	0.00	+1.17	+1.64	+1.61	0.00	-3.30	-3.29	-0.20	0.00	-0.32	+0.63	0.00	+1.61	+1.47	+0.48	0.00	0.00	0.00
Road Level	623.31	623.3	623.3	623.3	619.31	619.30	619.29	616.20	616.0	616.32	622.67	623.3	622.68	623.30	623.73	624.00	624.19	623.96
Accumulated Distance	0.00	35.22	49.17	63.58	63.92	66.70	69.53	71.92	74.78	77.66	78.33	79.58	80.42	96.12	110.08	113.9	120.9	127.04
point Number	8.00	5.00	21.00	25.00	161.00	168.00	164.00	177.00	175.00	171.00	28.00		31.00	33.00	35.00	38.00	40.00	42.00

CROSS SECTION



PLAN

Note:
Right & left abutment Excavation area:122.4m²
Common fill area:107m²
Back filling of Abutments area:33m²
Back filling area:87m²
Cutting area:18m²

NOTE:
BEARING CAPACITY OF SOIL CONSIDERED 3 Kg/cm^2.

BEARING CAPACITY OF SOIL UNDER ABUTMENT SHELL BE TEST BEFORE IMPLEMENTATION OF ABUTMENT.

SURVEY BY		CHECKED BY		PROVINCE	SUR-E-PUL	PROJECT NAME: KHAN AQA BRIDGE	SHEET NO 8 / 16
DESIGNED BY		REVIEWED BY		DISTRICT	CENTER	DRAWING TITLE: PLAN &CROSS SECTION	NOT-SCALE
ATTESTED BY		APPROVED BY		VILLAGE	KHAN AQA		AUG 2012

APPENDIX C – TECHNICAL SOW FOR RUN-P-SAR-PFA-007-RCC VEHICLE BRIDGE

Regional Afghan Municipalities Program for Urban Populations (RAMP UP) – Regional Command (RC) NORTH

Contract No. 306-C-00-11-00510-00

Sar-e-Pul Post-Flood Assistance Project
Scope of Works: Vehicle RCC Bridge Reconstruction Works

OBJECTIVE

The key objectives is to reconstruct 16m reinforced concrete vehicle bridge located near the existing Khisti bridge at Sharwaly in Khanaqa community in Sar-e-Pul city that will improve and ease access to Sar-e-Pul city center and reduce the risk of damage caused by flood.

STATEMENT OF WORK AND DESCRIPTION OF DELIVERABLES

A. GENERAL CONDITIONS

Please note that where the term 'RU-N Engineer' is mentioned in this subcontract, it means the Engineers and staff of the RU-N engineering department.

The sub-contractor shall provide the following:

The Sub-contractor shall provide all technical staff, skilled and unskilled labor, equipment and material to execute the construction works to be done and as described in this subcontract, and to execute this work safely, timely, professionally and economically. The Sub-contractor's responsibilities shall include:

1. The Sub-contractor shall execute and complete the Works in accordance with the Drawings provided by RU-N, subcontract and with the RU-N Engineer's instructions, and shall remedy all defects in the Works.
2. The Sub-contractor shall provide the Plant and Sub-contractor's Documents specified in the subcontract, and all Sub-contractor's Personnel, Goods, Consumables and other things and services, whether of a temporary or permanent nature, required in and for this execution, completion of the Works and remedying of defects.
3. The Sub-contractor shall be responsible for the adequacy, stability and safety of all Site operations and of all methods of construction. Except to the extent specified in the subcontract, the Sub-contractor (i) shall be responsible for all sub-contractor's Documents, Temporary Works, and such design of each item of Plant and Materials as is required for these temporary works item to be in accordance with the subcontract, and (ii) shall not otherwise be responsible for the design or specification of the Permanent Works.
4. The sub-contractor shall, whenever required by RU-N's Engineer, submit details of the arrangements and methods which the sub-contractor proposes to adopt for the execution of the Works. No significant alteration to these arrangements and methods shall be made without these having previously submitted to and approved by RU-N's Engineer.
5. The Sub-contractor is encouraged to maximize the labor content of the subproject to the maximum extent practical
6. The Sub-contractor shall take all necessary measures to control dust and mud from the operations, and to prevent spillage of excavated materials on public and private roads and facilities

7. The Sub-contractor shall employ the best practical means to minimize noise and vibration produced by the operations
8. Disbursement Schedule: **There will be no advance paid for mobilization.**
9. **The contractor shall prepare as-built drawings and submit to RU-N prior to final completion 1 hard copy and 1 set of editable digital format – AutoCAD release of 2010/2013.** The scale of the drawing shall be horizontal alignment 1:1000, vertical alignment 1:100 and with cross sections at 20m intervals on a scale of 1: 100.

B. SPECIFICATIONS FOR RCC VEHICLE BRIDGE RECONSTRUCTION

SUBPROJECT DESCRIPTION

The reinforced concrete vehicle bridge of 16m span length and of height and width as shown in the drawings shall be constructed for this subproject and shall be at the following location as stipulated in the drawings:

- Near the existing Khisti bridge at Sharwaly in Khanaqa community in Sar-e-Pul city as shown in the drawings

The proposed improvements will include:

- All necessary demolition works and removal of debris, etc. created by said works
- The diversion of flow and bailing out of water
- Excavations for foundation
- Stone masonry works as speciified in this scope of work and subproject drawings
- Plain cement concrete and reinforced concrete works respectively as specified in this scope of works and subproject drawings
- Construction of 16 meters reinforced concrete vehicle bridge with metal hand and guard rails painted as specified in the drawings

1. MOBILIZATION AND DEMOBILISATION

1.1 Mobilization

This work consists of moving personnel, equipment and material to the subproject site and performing all preparatory work necessary before starting construction. The cost of mobilization is included in the BOQ shall include establishing construction compound, transporting plant, equipment and personnel to the site and shall include (but not necessarily be limited to):

a) Transport of plant, renting of buildings for office and accommodation and all temporary facilities to the site.
b) Provision and erection of temporary buildings, office facilities on the site.
c) Provision of access and detour roads, sanitary facilities, water supply, and changing room, dining facilities within and outside the construction camps.
d) Provision of transportation for all personnel as necessary.

e) Provision of staff housing as necessary

1.2 Demobilization

Payment for demobilization shall be compensation in full for the costs of removing plant, equipment, facilities, and personnel from the site and shall include (but not necessarily be limited to):

a) Transport plant, buildings, and temporary facilities from the site;
b) Dismantling, demolishing, and removing of all temporary facilities on the site;
c) Restoration of all construction camp areas to a satisfactory condition;
d) Cleaning up the site.

The cost of demobilization is specified in the BOQ and must be completed to the satisfaction of the RU-N Engineer. This item shall be payable only in respect of the whole of the Works and shall not apply in cases of sectional completion.

2. DEMOLITION, SITE CLEARANCE, SETTING OUT ALLIGNMENTS, EARTHWORKS

2.1 DEMOLITION

Demolition works shall include but not limited to the dismantling and knocking down of the existing damaged bridge including stone masonry and concrete abutments, piers, deckings and walls, as well as pipes, soil and gravel etc.

All demolished debris, heaps; materials, items, scraps, etc shall be removed from the site and its premises and carted away at specified location as instructed by the RU-N engineer.

The Sub-contractor shall take care and ensure no operational structure, utility lines, cables or pipes are damaged during demolition. The Sub-contractor shall be responsible to replace at its own costs any damage operational structure, utility lines, cables, or pipes.

All materials or scraps demolished shall be the property of Sar-e-Pul Municipality, and any scrap or materials considered for use in the construction of this subproject shall be approved by Sar-e-Pul Municipality before such item can be used by the Sub-contractor. The Sub-contractor shall only take action including instructions concerning all demolition and carting away works from the RU-N engineer.

2.2 SITE CLEARANCE

The site shall be cleared of rubbish / debris of all kinds, loose rocks, small trees, shrubs, stumps, grass, bushwood, undergrowth and any other vegetation, superficial earth etc. as directed by the RU-N Engineer. The site clearance shall be done twenty meters around the periphery of the proposed construction. Such site clearance shall be done in advance of the earth work and excavation operations.

All materials arising from site clearance shall be the property of the Sar-e-Pul Municipality and shall be disposed off by the Sub-contractor at locations designated by the Sar-e-Pul Municipality or as instructed by RU-N Engineer, as herein provided. All serviceable materials shall be temporarily stacked in separate lots at the site, at places as directed by the RU-N Engineer. These materials shall be transported to any place within Sar-e-Pul Municipality premises and stacked properly as and where directed by the RU-N Engineer.

All products of site clearance which, in the opinion of the RU-N Engineer are not useable, shall be carted away by the Sub-contractor to disposal areas designated by the Sar-e-Pul Municipality or instructed by the RU-N Engineer, spread and levelled evenly in layers or the Sub-contractor shall cart away the same outside Sar-e-Pul Municipality premises as directed by the RU-N Engineer.

The site clearance shall cover all the operations required in full for clearing the site and its surroundings, including providing labour, materials, tools, equipments and incidentals necessary to complete the work. It will also include handling, salvaging, piling or stacking or collecting and disposing off cleared materials.

2.3 SETTING OUT

After the site clearance operations have been carried out the limits of excavation shall be set to true levels, lines, curves, slopes, grades and sections, etc. as shown on the drawings or as directed by the RU-N Engineer.

Setting out the alignment and elevation levels shall consist of the provision and placement of ranging rods and profile boards to determine the exact alignment of the vehicle bridge. Ranging rods and profile boards shall be of good quality metal or timber and their finish of such a standard that they can be used for good and correct setting out. The setting out shall include vertical as well as horizontal alignment. In this subproject the Sub-contractor shall be required to ensure that the setting out is maintained for the entire period required to achieve the dimensions of the vehicle bridge according to the drawings.

The Sub-contractor shall do all setting out required. The setting out shall ensure that the dimensions of the vehicle bridge are according to the drawings and shall be maintained by the sub-contractor for the time required to complete the works. Both alignments shall follow as closely as appropriate to the existing terrain and bridge and water lines and they shall be established by pegging the center line, edge of bridge and water lines. Reference pegs shall be provided at intervals outside the vehicle bridge lines to allow for the re-establishment of the alignment during construction. Chainage shall be clearly marked on pegs at not less than 15 meter intervals.

The Sub-contractor shall set out, using pegs and string lines if necessary, the various construction operations in sufficient detail to ensure that the required standards and tolerance are achieved, and in such a way that any task work system adopted may be easily checked by the RU-N Engineer.

The limits of the bridge shall be marked by fixing out wooden pegs (at least 50mm diameter and 500mm long) at 15m intervals or closer if desired by the RU-N Engineer. The pegs shall be fixed at about 0.5m beyond the actual limits of the fill and painted in a distinctive color.

3. SOIL TESTING

The Sub-contractor, in coordination with RU-N Engineer and RU-N's designated testing agent, shall conduct boring/piling to collect soil specimen at a depth specified in the drawings and/or as instructed by RU-N engineer or RU-N designated testing agent.

The Sub-contractor shall be responsible to provide all specimens including moulding, cylinders, etc. and other equipments that shall be required to collect the soil specimens required.

No works shll be undertaken or commenced until the RU-N engineer have received soil test results and confirm its bearing capacity and scouring resistance and have instructed the Sub-contractor to commence further works.

4. EXCAVATION

Excavation shall include site clearance, careful removal of all the materials of whatever nature and whether dry or wet, exactly in accordance with the lines, levels, grades, curves and dimensions etc. shown on the drawings or as directed by the RU-N Engineer. It shall be taken to exact widths and levels of the lowest step of the foundations, footing, basement, etc. and the sides shall be left plumb where the nature of soil permits its. The Sub-contractor shall do shoring, strutting, planking, bracing, timbering, and or cutting of extra width of excavation required for providing working space in any location, including for basement. Bottom surfaces and sides of all excavation shall be trimmed and formed to required levels, slopes, etc. as directed by the RU-N Engineer. The bottom surface of the excavation in rock shall be made as level and true as possible. In the event of the Sub-contractor excavating more in rock, below the proper levels, the Sub-contractor shall, at own expense, fill-up the extra portion with 1:2:4 nominal mix cement concrete well rammed in position until it is brought to the proper level. Similarly, excess width dug out in error, shall also be filled in layers, 200 mm thick each with selected soil, by the Sub-contractor, at own expense. The bottom surface of excavation shall be free of loose unconsolidated material. Before the laying of the foundation concrete, metalling, etc. the bottom surfaces of foundation shall be sufficiently watered and thoroughly rammed.

All materials excavated of whatever kind they may be, shall be placed at a distance more than one and half meter clear of the excavation, as directed by the RU-N Engineer. Rate for excavation shall also include for the sorting out of useful materials and stacking them separately as directed. Materials suitable for back filling or for other work / future use in the work shall be sorted out and stacked at convenient places by the Sub-contractor and any additional handling, lift, lead, transportation and all other operations required for utilizing such material for back filling in the final place of back fill or other use in the work shall also be included in the quoted rates. Unsuitable and surplus materials, which in the opinion of the RU-N Engineer are not intended for any use shall be carted away and disposed off outside the premises by the Subcontractor.

All water, which may be accumulated in excavation during the progress of the work, from springs, rains or other causes, shall be bailed/ pumped out or otherwise removed till the work is completed and all such operations towards dewatering for the entire duration of the complete project, if not included in Tender Excavation and if not included in the lump sum rate quoted by the Tenderer for the item “dewatering” provided in the Schedule of quantities the cost shall be covered by the Sub-contractor at own cost.

If there are any slips and bows in excavation, these shall be removed by the Sub-contractor. Any overhang of existing pavements, existing foundations, etc., arising due to undermining or any other causes shall be removed by the Sub-contractor and any damage to existing pavements etc. due to additional excavation carried out by the Sub-contractor or due to undermining, or due to any other reason, shall be made good to the original condition by the Sub-contractor at own cost, as instructed by the RU-N Engineer.

Pipes, cables and all underground services met during the excavation shall be properly slung or otherwise supported by the Sub-contractor. During excavation the Sub-contractor should take particular care to avoid

injury to personnel from live cables, etc. and to avoid damage to drains, water mains, and cable and underground services. Damage, if any, shall be made well by the Sub-contractor, at own cost, to the satisfaction of the Sar-e-Pul Municiplaity and RU-N Engineer. Any other services met with during the excavation, shall be brought to the notice of the RU-N Engineer immediately. Any disused or duly disconnected pipe lines, cables, etc. in excavation shall be removed by the Sub-contractor at no extra cost, as and when instructed by the RU-N Engineer. Any extra excavation involved due to such operations, which are carried out with the prior permission of the RU-N Engineer only shall be measured under the respective items and no additional rate, other than what is quoted, shall be given for such works. All materials removed out by such operations shall be treated as excavated materials and disposed off by the Sub-contractor at own cost, as directed by the RU-N Engineer in the same manner as specified for excavated materials.

Any shoring, strutting, bracing, planking and timbering required for protecting the sides of excavation and for ensuring the safety of workmen and equipments shall be done by the Sub-contractor at own cost. The Sub-contractor shall provide and fix the same as the work proceeds. The Sub-contractor shall ensure and hold all responsibilities for the design of the same which shall be strong enough to resist side thrusts, and ensure safety from slips, bows and damage to adjacent work and property or injury to persons. It shall be removed after all the items of work for which it is required are completed.

The Sub-contractor shall, at own expense, ensure that the area under excavation is securely fenced, provided with proper caution signs and marked with RED LIGHTS at nights to avoid accidents. The Sub-contractor shall also at own cost take all necessary protective measures, and ensure that the excavation for foundations, basements, etc. does not affect or damage any services, adjoining structures, etc. The Sub-contractor shall be entirely responsible for any injury to lives or damage to property caused by own and self negligence or any accident due to own or self constructional operations.

As far as possible, all backfilling in the foundations, trenches, etc. shall be done from the selected materials from the excavation. Selected material filling shall be free from roots, debris or any other foreign matter. All clods of selected material shall be broken or removed. Where the excavated material is mostly rock, the boulders shall be broken into pieces not bigger than 15 cm in size in any direction, and shall be mixed with fine materials and fill the voids as far as possible. Only when the selected material from excavation is not adequate or suitable for backfilling, approved materials from outside will be used for the purpose with the prior concurrence of the RU-N Engineer.

The approved material for filling shall be generally uniform to colour, hard, free from roots, bushes, other foreign matter or any organic impurities. It shall have coarse siliceous grains, gritty to touch. The silt content i.e. fines passing through 75 micron sieve, shall not exceed 20%. The area to be filled shall be first dewatered, cleared of all debris, bricks, etc. and the entire area, except for that in pits, shall be consolidated to the satisfaction of the RU-N Enginerr.

The filling then shall be done in layers, not exceeding 20 cm each layer. Each layer in trenches shall be watered, well rammed and consolidated before the succeeding one is laid. The layers shall be rammed with butt end of crow bar, where the rammer cannot be used or by any other agreed method with the prior concurrence of the RU-N Engineer. Back filling shall be done to the original ground level or the elevation shown on the drawings or as directed by the RU-N Engineer. Back filling shall be done after the concrete

or masonry etc. has fully set and shall be done in such a manner as not to cause undue thrust on any part of the structure

4.1 CLASSIFICATION

All materials involved in excavation shall be classified into (a) "all sorts of soil" and (b) "rock" as under, by the RU-N Engineer and the RU-N Engineer's decision shall be final and binding on the Sub-contractor, for measurement and payment.

"All sorts of soil" shall include dry and wet soil, sand, gravel, soft / hard compact murrum, ordinary / stiff clay, rubble soiling, metalling, lime, concrete, brick stone and other masonry, small size stones and other similar materials which can be excavated by spade, pick, shovel, etc. without resorting to barring, or to wedging, chiselling, etc. (This item includes all types of materials to be excavated excluding "Rock" defined below). The surfaces of any description (waterbound, grouted tarmac, etc.) shall also be included in this classification and measured under this item.

"Rock" shall include weathered rock or solid rock, plain cement concrete, reinforced cement concrete and all boulders, which can only be removed by barring, wedging, chiselling.

4.2 BLASTING

No blasting shall be allowed at site for excavation or for carrying out any other operation.

4.3 VISITING AND TESTING

Routine inspection and testing will be carried out by RU-N independent testing Subcontractor or the RU-N Engineer to test the quality of materials and workmanship for compliance with the requirements of this section.

The Sub-contractor shall furnish the specimens (soil, concrete, steel, etc.) necessary for providing test in the field and laboratory. The Sub-contractor will supply all molds and labor necessary to test the specimens. The RU-N Engineer of RU-N independent testing Subcontractor will designate the frequency of sampling the fresh concrete. The method of making and curing test specimens will be in accordance with IS:1200 (Part I) 1992 (Method of Measurement of Earthwork, 4th revision) IS:3764 1992 (Safety Code for Excavation works, 1st revision), IS: 9759 : 1981 (Guidelines for dewatering during construction) and IS: 6313 - Part II) 1981. Test specimen shall be provided by the Sub-contractor at his expense if required by the RU-N Engineer at locations selected by the RU-N.

4.3.1 MEASUREMENT AND PAYMENT

The classification of excavated material for measurement purposes shall be as given in specification 3.1 above.

Excavation shall be measured in cubic meters for each class of material encountered. No separate measurements shall be taken or payment made for providing (1) Fixing & removing: shoring, strutting, planking, bracing, timbering (2) Additional width excavated including for foundation walls, and its waterproofing treatment for convenience of working space or for any other reason (3) back-filling with selected excavated material, watering, consolidation of the sub-grade base and filling, etc. The driving of sounding bars or jumping small drill holes to expose the nature of sub-stratum up to a total depth one

meter below the bed of excavation and distribution in 2 or 3 locations in each foundations, if required by the RU-N Engineer, shall be considered included in the item of work and will not be paid separately. In particular, excavation shall be measured limited to the dimensions shown on the drawings (e.g. excavation measurement for the foundation PCC multiplied by the depth of excavation) or as directed by the RU-N Engineer. Trenches with "Grips" for pipes, etc. shall be measured up to the depth exclusive of "Grips". In case of rock, the measurement shall be on stack basis less 33% for voids.

Where excavation is in trenches or in fairly uniform ground "Dead Men" or "Tell Tales" shall be left at suitable intervals, as instructed by the RU-N Engineer, to determine the average depth of excavation. Where the ground is not uniform, levels shall be taken before the start, after the site clearance and after completion of the work and the quality of excavation shall be computed from these levels.

For backfill of spaces excavated for foundations, trenches etc. using selected excavated material which shall also include mixture of broken pieces of rock and fine material, no additional payment shall be made. The excavation rate shall be inclusive of such backfill including backfill beyond the payable volume of excavation. If instead of fully backfilling with the selected excavated material, the Sub-contractor is instructed to backfill with approved material brought from outside, the measurement of such filling shall be the volume of payable excavation as in para 4.0 above less the volume of soling, metalling, concrete or masonry or foundation construction if any etc., provided within the excavation and also less the volume of filling executed with selected excavated materials.

Measurement of the volume of filling in foundation, sub-grade and similar locations whether with selected excavated materials or approved materials brought from outside shall be specified area multiplied by actual consolidated depth of fill. The fill shall be levelled / finished to the profile as directed. The quoted rates for excavation and filling shall include the cost of labour, plant and equipments, tools, safeguards and incidentals necessary to complete the work to the specifications.

5. BARRIER AND METHOD OF APPLICATION

Conditions of formation for barrier shall be complete and continuous around the whole of the structure to be protected. All foundations shall be fully surrounded by in close contact with the barrier of treated soil.

6. CONSTRUCTION

6.1 General

The requirements for concrete formwork, falsework, reinforcement, placing concrete, removal of forms and falsework, removal of defective concrete, and curing and protection of concrete shall be as defined in specification and approved by the RU-N Engineer, "Concrete Structures" shall apply to the construction of cast-in-place concrete except as modified in the Specifications. Concrete materials, proportioning, mixing, and delivery shall conform to Specification Section 2, "Concrete". The foundation trenches shall be carefully shaped to the substructure footing section and grades shown on the Plans and compacted to provide a firm foundation for the substructure in conformance with this subproject Specification.

6.2 Bedding

The Bedding for foundation substructure, when required by the subproject or as shown in the drawings shall consist of a thickness specified by the RU-N Engineer and compacted to conform to the shape of the bottom of the substructure.

6.3 Joints & Bearing

Joints

Contraction joints shall not be used except said joints are approved by the RU-N Engineer. The location of joints shall be predetermined, and when practical, placed based on existing conditions.

Construction joints shall be placed between the deck and the base of parapets. Using this method of construction, any necessary construction joints shall be at right angels to the axis of the bridge. Unless otherwise specified on the drawings, transverse contraction joints shall be plain butt joints and longitudinal reinforcement shall extend across the joint.

Expansion joints shall be sealed joints. The joints shall include 12mm thick, 175mm wide M.S. plate welded with angle, 12mm x 12mm M.S. Flat bar, Welded 100mm x 100mm x 10mm size M.S. angle, 12mm thick 300mm long M.S. Rod Welded with Angle At 300mm interval and bitumin-sand mixed filler.

Bearings

Bearings materials shall be elastomer - 100% virgin choloprene (neoprene) rubber and shall meet the required hardness of 60 + 5 duro confirming to ASTM D2240, and a compression test of 35% maximum (22 hours at 212ºF) confirming to ASTM - D395 Method B. Lamination shall be rolled mild steel sheets confirming to ASTM - A570, Grade 36 or ASTM -A611, Grade D. The bearing type shall be Laminated Molded Bearing. Unless otherwise shown on the drawing all components of laminated bearing molded together shall be covered by a minimum of 6mm of elastomer.

Unless otherwise specified by the RU-N engineer, bearing shall be placed on top of the abutement cap.

6.4 Finish.

Sidewalls and top of walls shall be given a Class 1, ordinary cement-mortar surface finish and the bottom footing or top of substructure, unless otherwise specified on the drawings, shall be given a Class 3, float finish as defined in this subproject Specification.

6.5 Connecting to existing Bridge, Flood Wall, Storm Drains, etc

The Sub-contractor shall take all necessary preacuation, steps and efforts to emsure the contsruction of the abutments and wing walls under this subproject does not cause damage or cracks to the existing bridge walls, storm drains or other structures already on the site. Any damage done to existing structures as indicated by the RU-N Engineer shall be repaired at the full cost of the Sub-contractor. RU-N shall not compensate or reimburse the Sub-contractor for repair works to the existing nearby structures except as instructed by the RU-N Engineer.

In case the Sub-contractor see it impossible to carry out the construction of the proposed vehicle bridge as specified under this subproject, the Sub-contractor shall notify the RU-N Engineer and show justification of this avoidance and await instructions from the RU-N Engineer as to how to proceed thereof.

Backfill shall not be placed until representative test samples of the concrete used in the abutements and wing walls attain the compressive strength required on the drawings. In addition, the concrete shall have been placed minimum 7 days (not counting days of 24 hours each when the temperature is below 40 degrees F.) or 21 calendar days whichever comes first. Backfill shall be carried up simultaneously behind the sidewalls to maintain uniform loading. Backfill above and around the filter cloth closure shall be suitable nonporous material. Placement and compaction of the backfill and final cleanup shall be in accordance with this Subproject Specification.

7. Concrete Work

7.1 General:

Concrete shall consist of cement, graded aggregate and water thoroughly mixed, placed and compacted as specified. Before starting concreting the Sub-contractor shall obtain formal permission for concreting from the RU-N Engineer on site. The RU-N Engineer shall allow concreting after determining required lines and levels, suitability of formwork, availability of required plant and labor, proper fabrication and spacing of the steel bars and quality and quantity of cement and aggregates.

7.2 Materials

7.2.1 Steel

Steel shall be deformed reinforcement, except that plain reinforcement shall be permitted for spiral stirrups or ties and reinforcement of structural steel shall be permitted by construction codes. The yield strength of the construction steel shall not be less than 4200 kg/cm2 (60,000psi). The steel shall be free from corrosion, loose ruts, scales, oil, grease, paint, etc. The steel shall be round and capable of being bent (doubled over) without fracture. Bars shall be hooked and bent accurately and placed in position as per design and drawing.

Joints in the bar shall be avoided as much as possible. All rebar joints shall be in compliance with ACI codes in the event a conflict between the drawings and ACI codes exists.

Steel bars shall maintain proper concrete coverage on all sides. Sides and bottom of concrete placements shall utilize concrete dobbies to maintain proper concrete cover over rebar. The concrete dobbies shall match or exceed the strength of the concrete placed within. During concrete placement, the reinforcing bars should not move from their position. For beams, utilize 5 cm concrete cover. For slabs, utilize 2.5 cm concrete cover. For footings, utilize 7.5 cm concrete cover.

7.2.2 Cement

Cement shall be Portland type I. All cement must be fresh and dry. For utilization of cement the following conditions are required:

a) Utilize any other equivalent Type 1 cement as approved by the RU-N Engineer. If water and soils are saline Type 5 is required.
b) Provide new cement showing it is not older than 3 months.
c) Secure adequate amounts of cement for the work from a single source. Do not change brands or type of cement without approval of the RU-N Engineer.
d) Cement shall be stored in a watertight and well ventilated building.

7.2.3 Aggregate

Aggregate shall be of inert materials and should be clean, dense, hard, sound, durable, non-absorbent and capable of developing good bond with mortar. Coarse aggregate shall be of hard broken granite or similar stone, free from dust, dirt and other foreign matter. The stone ballast shall be of 20mm (3/4") size and down and all should be retained in 5mm square mesh (1/4" square) and well graded such that the voids do not exceed 42 percent. Gravel shall be screened to sizes and if so required, thoroughly washed using methods approved by the RU-N Engineer. Nominal maximum size of coarse aggregate shall not be larger than:

a) One-fourth the narrowest dimension between sides of forms, nor
b) One-third the depth of the slab, nor
c) One-fourth the minimum clear spacing between individual reinforcing bars or wires.
d) Bundles of bars, individual tendons or ducts - This limitation shall not apply if, in the judgment of the

RU-N Engineer, workability and methods of consolidation are such that concrete can be placed without honey-comb or voids.

7.2.4 Water

Water used in mixing and curing concrete shall be clean and free from injurious amounts of oils, acids alkalis, salts, organic materials, or other substances deleterious to concrete or reinforcement. Non potable water shall not be used in concrete.

7.2.5 Sand

Sand shall consist of hard, sharp, angular grains and shall pass through a screen of 5mm (3/16") square mesh. Sand shall be of standard specification clean and free from dust, dirt and organic matters.

7.3 Construction Method

7.3.1 Mixing of Concrete

Hand mixing of concrete shall not be allowed.

All concrete mixes shall be machine mixing. During machine mixing, aggregate sand and cement shall be put into the cement concrete mixer to the required proportion. For concrete mix, first gravel, then sand, then cement shall be put into the cement concrete mixer. The machine shall then be rotated to mix the materials dry. Then water shall be added gradually to the required quantity; 25 to 30 liters (5 to 6 gallons) per bag of cement unless otherwise noted by the approved mix design. The mixing shall be thorough to have a plastic mix of uniform color. It shall require 1-1/2 to 2 minutes of rotation for thorough mixing. Mixed concrete shall be unloaded on a masonry platform or on an iron sheet. Output of concrete mixer is 15 to 20 mixes per hour.

7.3.2 Slump

Regular slump tests should be carried out to control the addition of water and to maintain required consistency. See Recommended Slumps for Various Types of Construction (ACI 318-2005) below:

No.	Type of Concrete	Slump Adopted in mm
1	Reinforced Foundation, Walls and Footings	20 to 80
2	Plain Footing, Substructure Walls	20 to 80
3	Beams and Reinforced Walls	20 to 100
4	Mass Concrete	20 to 80

7.4 Shuttering

7.4.1 Main Requirement of Shuttering

Centering and shuttering shall be made with timber or steel close and tight to prevent leakage, with necessary props, bracings and wedges sufficiently strong and stable and should not yield on laying concrete. The formwork should satisfy the following requirements:

a) It should be strong enough to withstand all types of dead and live loads such as self weight, weight of reinforcement, weight of concrete, loads due to workmen, construction, construction equipment, other incidental loads and forces caused by dumping and consolidation of concrete imposed upon it during and after placement of concrete.
b) It should be rigidly constructed and efficiently propped and braced (both horizontal and vertical) so as to retain its shape without undue deflection.
c) The joints in the formwork should be tight to prevent leakage or cement grout.
d) The formwork should be constructed in such a manner that it may permit the removal of various parts in desired sequences without jarring or damaging the concrete.
e) The formwork should be set accurately to the desired lines/grades and elevations and have plan surfaces.
f) The material of the formwork should not warp or get distorted when exposed to the sun, rain or water during concrete operations.
g) The formwork should rest on a firm base and be anchored properly to prevent movement.

7.4.2 Surface Treatment for Shuttering

The surfaces of timber shuttering that would come in contact with concrete shall be thoroughly cleaned and well wetted and coated with raw linseed oil, or form oil of approved manufacturer, or any other material such as polyethylene sheets to prevent adhesion of concrete to formwork.

The RU-N Engineer shall inspect and accept the formwork as to its strength, alignment and general fitness before placing any concrete in the forms. However, such inspection does not relieve the Sub-contractor from the responsibility for safety of man, machinery, materials and for results obtained.

7.4.3 Removal of Formwork

The formwork shall be removed avoiding shock or vibration that may cause any damage to the concrete. In slab and beam construction, sides of the beam shall be stripped first, then the under sides of the slab and lastly, the underside of the beam. The period that shall elapse after concrete placement before initiating easing and removal of centering and shuttering shall be as given below:

Type of Structure	Where Ordinary PCC is used, forms may be removed after the following time periods:
Walls, Columns and Vertical Faces of All Structural Members	24 to 48 hours (as directed by the DAI Representative)
Slabs (props left under)	3 days
Beams, Soffits (props left under)	7 days
Removal of Props Under Slabs: Spanning up to 4.5 m Spanning over 4.5 m	7 to 14 days
Removal of Props Under Beam/Arches: Spanning up to 6 m Spanning over 6 m	14 to 21 days

In case of cantilever slabs and beams, the centering shall remain till structures for bearing down have been erected and have sufficient strength.

7.5 Placing of Concrete

7.5.1 Placement of Concrete into Forms

Placing of concrete shall be commenced only after the RU-N Engineer has inspected centering, shuttering and reinforcement as placed and approved the same. Shuttering shall be clean and free from all saw dust, pieces of wood or other foreign materials and shall be treated as prescribed in surface treatment for shuttering.

In case of casting of concrete slabs and beams, wooden planks or cat-walks support directly on the centering by means of wooden blocks shall be provided to convey the concrete to the place of deposition without disturbing the reinforcement. Laborers shall minimize walking directly on the reinforcement.

In deep trenches and footings, concrete shall be placed through chutes as directed by the RU-N Engineer. In case of columns and walls, the shuttering shall be so adjusted that the vertical free-fall of concrete is not more than 1.5 meters. During cold weather (below 4.5ºC), concrete shall not be placed unless specific approved plans for cold-weather concrete placement have been submitted and approved by the RU-N Engineer During hot weather, precaution shall be taken to ensure the temperature of wet concrete does not exceed 38ºC. Unless permitted by the RU-N Engineer, no concrete shall be placed within ½ hour of the closing time of the day. The time between mixing and placing of concrete shall not exceed the initial setting time of cement of 30 minutes.

7.5.2 Strength of Concrete for Various Applications

For various concrete work the following strengths are recommended: cm^2

Concrete Application	Strength (kg/ cm^2)
Plain Concrete for Foundations	100
RCC for Foundations	200
RCC for Columns	210
RCC for Slabs and Beams	210

7.5.3 Consolidation of Concrete

Concrete shall be consolidated into a dense mass immediately after placing by means of mechanical vibrators designed for continuous operation during the whole period occupied for placing concrete. The vibrators shall be so adjusted that the center of vibrations approximates to the center of mass being consolidated at the time of placing. For certain situation, depending on the thickness of the members and feasibility of vibrating the same, the layer of concrete shall be so placed that the bottom layer does not finally set before the top layer is placed.

Consolidation shall be continued until the mortar fills the spaces between the coarse aggregate and beings the cream up to form an even surface. Needle vibrators shall be withdrawn slowly to prevent formation of loose pockets in the case of internal vibrators. The specific instructions of makers of the particular type of vibrator shall be strictly complied with. Shaking of reinforcement for the purpose of compaction shall be avoided. Consolidation shall be completed before the initial setting starts. Over vibration of very wet mixes is harmful and shall be avoided. Under vibration is also harmful. An experienced concrete worker shall be present for this phase of work.

7.5.4 Finishing of Concrete

Unless otherwise noted, concrete shall be finished with a bull-float to provide a good an adequate finished concrete surface. Walking surfaces shall be broom finished after the (bull-float finish) in the transverse direction to provide an anti-slip surface for pedestrians.

7.5.5 Curing of Concrete

After about two hours after concrete placement when the concrete begins to harden, it shall be kept damp by covering with wet gunny bags or wet sand for 24 hours. The surface shall be cured by flooding with continuous water making mud walls 7.5cm (3") high or by covering with wet sand or earth and kept damp

continuously for 7 days unless otherwise noted or approved by the RU-N Engineer. Curing may also be accomplished by covering concrete with special type of waterproof materials to prevent water from escaping or evaporating.

8. Stone Masonry Works

8.1 General

This specification covers furnishing, installation, finishing, curing, protection, maintenance and handing over of stone masonry works for use in structures and locations covered under the scope of this subproject subontract.

Stone masonry shall consist of cement mortar thoroughly mixed, placed and compacted as specified. Before starting masonry works the Sub-contractor shall obtain formal permission for cvonstruction from the RU-N Engineer on site. The RU-N Engineer shall allow cmasonry works after determining required lines and levels, suitability of stones, availability of required plant and labor, proper fabrication and spacing of the steel bars and quality and quantity of cement and aggregates.

8.2 Materials

8.2.1 Stones

Hard, un-seamed, elongated, jagged or angular shaped stone shall be used (as opposed to rounded river stone) because the odd shaped pieces interlock better providing greater strength and produces stronger structures. Stone for pitching and masonry shall be sound, tough and durable, with no stone less than 200 mm in minimum dimension, except that smaller pieces or spalls may be used for filling spaces between the larger stones. All stone intended for use on any particular pitching or masonry job shall receive the prior approval of the RU-N Engineer

8.2.2 Mortar

Mortar shall consist of a mixture of sand, lime, Portland cement and water mixed in proper proportions. A 1:4 cement to sand mix for stone masonry and 1:3 cement to sand mix for pointing works is desirable (by weight or volume); with the cement consisting of about 3 parts Portland cement to 1 part powdered lime. If lime is not available, the cement shall be 100 percent Portland cement. The sand shall be well screened and only materials sized between 0.16 and 0.6 mm shall be used in the mix. Use 1:2 potable water to cement ratio by weight (1:1-½ ratios by volume). Ensure ingredients are adequately mixed with duration of about 5 minutes per batch in a mechanical mixer, or longer if by hand in a container. No foreign objects shall be in the mortar mix.

8.2.3 Stone Masonry Walls:

The dimensions of the walls must accurately follow the drawing.

The stone should be woven very well and should be placed with the greatest dimension in the horizontal direction. Large oversized stones must be avoided. No cavity is allowed in the stone masonry wall. The walls need to be vertical and plumbed in with a plumb–line to avoid a turning moment.

Water needs to be sprayed onto the wall for two weeks after placement to ensure adequate curing.

8.2.4 Stone Masonry Installation

Elongated, jagged or angular stones shall be placed in layers in an interlocking fashion with mortar completely filling all voids. The work shall progress in layers so mortar can fill all voids from above. Continuously check each stone masonry layer to ensure it is plumb (vertical) and level (horizontal) as work progresses. Pointing shall be done with the same mortar mixture as specified above to clean up any joints between rocks on the wall face. For walls, vertical control joints shall be required every 8 meters on center. These vertical control joints shall have a clear space about 2-3 centimeters wide between the masonry that is filled with an expandable material to allow expansion and contraction of the wall. If required by the drawings, a ring beam within the stone masonry structure shall be continuous through control joints.

8.2.5 Weepers (Weep Holes)

Unless otherwise indicated on the plans, the Sub-contractor shall furnish and place 3in. (76 mm) diamter PVC pipe as weeper in all indicated sections of abutments and retaining walls. These weepers shall be approximately 10 ft. (3 m) apart and placed at the elevation which will best drain backfill. Stone or coarse gravel shall be placed adjacent to the fill face of such walls and at such elevations as will permit drainage to and outletting into the weepers.

8.2.6 Visiting and Testing:

Routine inspection and testing will be carried out by RU-N independent testing Subcontractor or the RU-N Engineer to test the quality of materials and workmanship for compliance with the requirements of this section.

The Sub-contractor shall furnish the concrete, stones and masnory necessary for providing test specimens in the field. The Sub-contractor will supply all molds and labor necessary to test the specimens. The RU-N Engineer of RU-N independent testing Subcontractor will designate the frequency of sampling the fresh concrete. The method of making and curing test specimens will be in accordance with IS: 1121/ IS: 1124. Test specimen shall be provided by the Sub-contractor at his expense if required by the RU-N Engineer at locations selected by the RU-N.

8.2.7 Measurement and Payment:

The unit of measurement for stone masonry walls shall be the cubic meter of actual walling constructed and accepted.

The tendered rate for each type shall include full compensation for furnishing all materials, trimming of areas, placing of stones and cement mortar where necessary and all other work necessary to complete the walls as specified.

8.2.8 Bitumin-Sand Mix

The bitumin-sand material shall be mixed based on the instruction of RU-N engineer.

In order to produce a mix which is workable, strong, durable and economical, the Sub-contractor shall prepare a sample portion that shall be approved by RU-N engineer before the final mix is prepared and placed.

The surface shall be cleaned and treated to the satisfaction of the RU-N Engineer. The mix shall be uniformly sprayed over the surface by means of a pressure distributor that maintains a pressure of at least 20 psi [140 kPa], but not more than 75 psi [520 kPa], or other methods approved by the RU-N engineer. Use a distributor

The Sub-contractor shall take special precautions to obtain an even and uniform distribution of bituminous-sand mixed material, and adjust and operate the process so as to maintain uniform, even distribution of the application. The Sun-contractor shall emove excessive deposits of bituminous material upon the bridge surface caused by the application process, by leakage, or otherwise

The Sub-contractor shall spread the cover material immediately following each application of the mixed material. No trucks or spreaders shall be driven on the uncoveredmixed material immediately after each application of cover material, broom the surface in order to secure a uniform distribution of cover material and a smooth surface. Place additional aggregate by hand on any areas not properly covered. If deemed necessary by the RU-N Engineer, the Sub-contractor shall drag the surface with a light drag broom or other dragging equipment approved by the RU-N Engineer, of a type that will not disturb the embedded aggregate.

APPENDIX D – VEHICLE BRIDGE BILL OF QUANTITIES

Bill of Quantities & Cost Estimates

PROJECT NAME:	**Construction of 16 m Reinforced Cement Concrete Vehicle Bridge (Sharwaly)**
PROJECT LOCATION:	**Khanaqa, Sar-e- Pul City, Sar-e-Pul Province, Afghanistan**
DATE:	**16-Sep-12**

S/N	Work Description	Unit	Qty.	Unit Rate in (AFS)				Total Cost in (AFS)
	VEHICLE BRIDGE			**Materials**	**Tools, Equipment, etc.**	**Labour**	**Services & Other Costs**	
1	Mobilization at site including establishment of plant,. Equipment and personnel, etc.	Lump sum	1	-	-	-	-	-
2	Demobilization from site to include full compensation for removing plant, equipment, and personnel, etc.	Lump sum	1	-	-	-	-	-
3	Demolition including all other requirements, of existing damaged bridge (stone masonry, concrete, pipes, soil and gravel etc) abutments, piers and deckings, and complete removal of all debris, materials, etc. from the site	Lump sum	1		-	-	-	-
4	Cutting of specified areas for foundation abutment	Cum	68	-	-	-	-	-
5	Diversion of flow and bailing out water/dewatering work for construction works including supply, operation and maintenance of water pumps and excavation for canals, open drains, dykes, etc.	Lump sum	1	-	-	-	-	-
6	Excavation in earth type (3) of foundations for structures, including transportation from site of extra material and all requirement activities including the protection of pits/holes to avoid accidents, etc.	Cum	863	-	-	-	-	-
7	Stone masonry with cement and sand mortar 1:4 as per drawing and specifications	Cum	1,648	-	-	-	-	-
8	Construction of Plain Cement Concrete in foundation and top of wing walls as per drawing and specification (strength of strucutre at 28 day cylinder crushing : strength of minimum 15MPa)	Cum	35	-	-	-	-	-
9	Pointing as per drawing and specifications with cement and sand mortar 1:3	Sqm	572	-		-	-	-
10	Construction of reinforced cement concrete including shuttering and steel bar bending for deck slab, parapet wall, girders, diapragms, peirs, columns, and beams as per drawing and specification (required strength of strucutre at 28 day cylinder crushing : minimum 30MPa)	Cum	61.5	-	-	-	-	-
11	Construction of Reinforced cement concrete including shuttering and steel bar bending for Abutment Cap, Abutment Foundation, Approach slab, Ring of Abutment and Ring of wing walls as per drawings and specification (required strength of strucutre at 28 day cylinder crushing: minimum 25MPa)	Cum	93.13	-	-	-	-	-
12	Construction of cement concrete wearing course as per drawing and specifications (required strength of structure at 28 day cylinder crushing: minimum 25 Mpa)	Cum	6.14	-	-	-	-	-
13	Filling of Right and Left abutments with natural materials, and compacting and watering as per the drawings and specifications	Cum	1,691	-	-	-	-	-
14	Earth filling of both side of bridge Approach (Road) with gravel from 12mm to 40mm	Cum	5,502	-	-	-	-	-
15	Supply and installation of expansion joints as per drawing and specifications	Meter	16	-	-	-	-	-
16	Supply and installation of bridge bearings include rubber and steel plate as per drawings and specifications	Set	6	-	-	-	-	-
17	Preparation of Soil specimens for foundation soil bearing capacity test for the depth given by theengineer. The test result shall be officially submitted and approve before start of project activities.	Lump sum	1	-	-	-	-	-
18	Supply and installation of 75 mm dia PVC pipe for weep hole, slab drainage and outlet as per drawing	Meter	30.0	-	-	-	-	-
19	Supply and installation of 102mm dia, GI pipe Guard Post on approach road as per drawaings and engineer's instructions	Sqm	6.0	-	-	-	-	-
20	Construction of Reinforced Cement Concrete including shuttering steel bar bending for Post and Handrail as per drawings and specification (required strength of structures at 28 days cylinder crushing: minimum 25MPa)	Cum	2.0	-	-	-	-	-
21	Supply and installation of 38mm dia. PVC pipe as support hinge as per drawings and specifications	Meter	16	-	-	-	-	-
22	Supply, prepare and pour Bitumin with sand mix as per drawings, specifications and engineer's instructions	Meter	16	-	-	-	-	-
							Total Project Cost in (AFA)	[redacted]
							Total Profit (%) in (AFA)	
	Grand Total Cost in (AFA)							