

1.2.5 Land Sat Data

Land sat data has already been collected in order to fully understand the historical changes of the river stream line/belt. These data were downloaded from [Global Land Cover Facility Earth Science Data Interface \(ESDI\) Homepage](http://glcfapp.glc.f.umd.edu:8080/esdi/index.jsp) and the accessing link is shown below

<http://glcfapp.glc.f.umd.edu:8080/esdi/index.jsp>

Land Sat Image about 10 years interval after 1970's is shown in [Source :Edited Landsat data by JICA Team](#)

Figure 1.2.14, and comparison of river stream line traced from 4 pictures is shown in Figure 1.2.15.

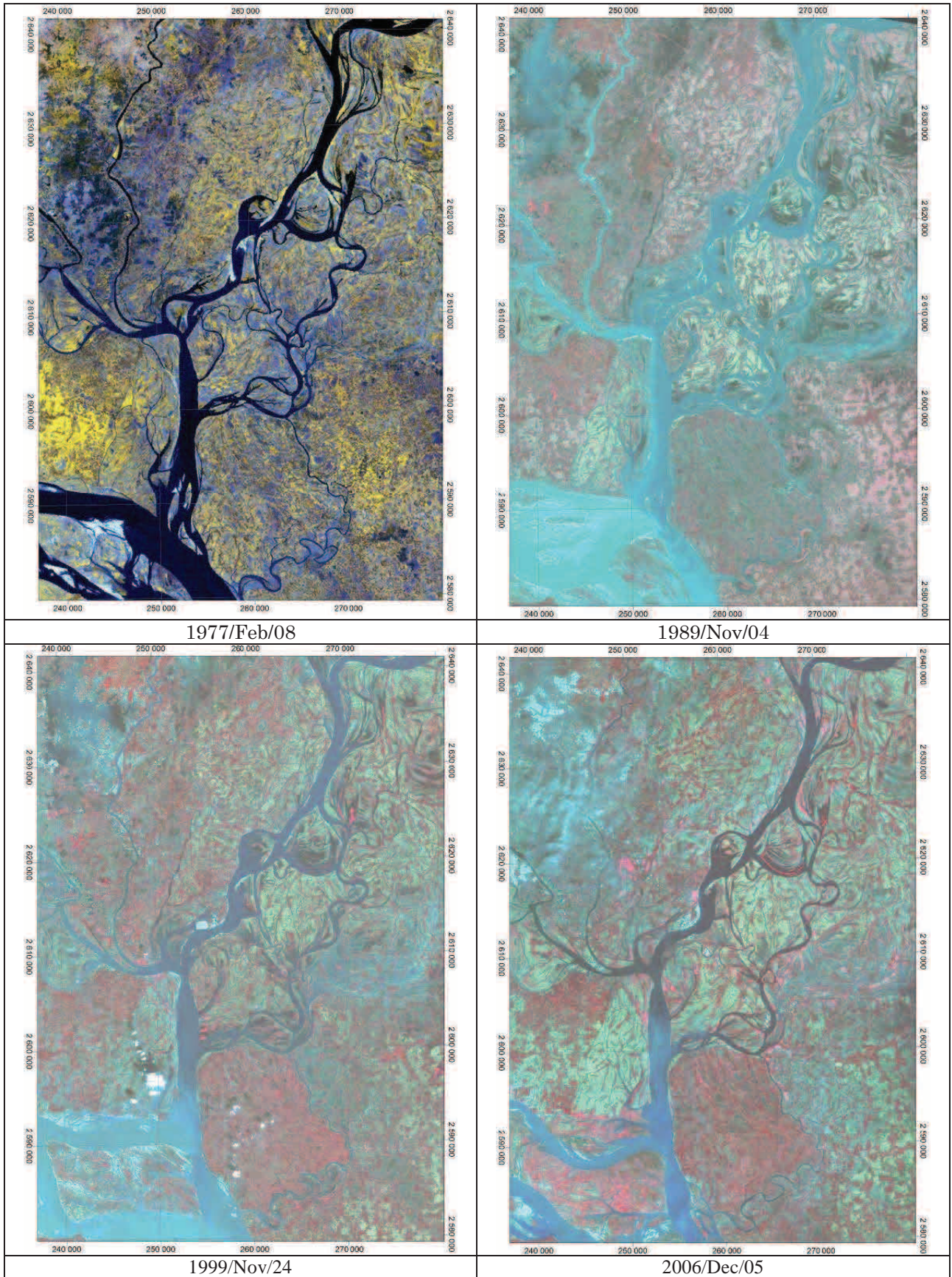
Figure 1.2.15 shows that the course of Meghna river is morphing by year, and channel width depends on river discharge. It seems that river profile of 1989 is very wider than other years because the picture in 1989 is taken in flood season (Discharge at Bhairab Bazar is 15.500m³/s)

Especially around Meghna and Gumti Bridge, it seems that stream line is almost same profile. Hence It is supposed that river shore line around Meghna and Gumti Bridge is stable in the view of morphorlogy.

Table 1.2.13 Land sat data list (collected)

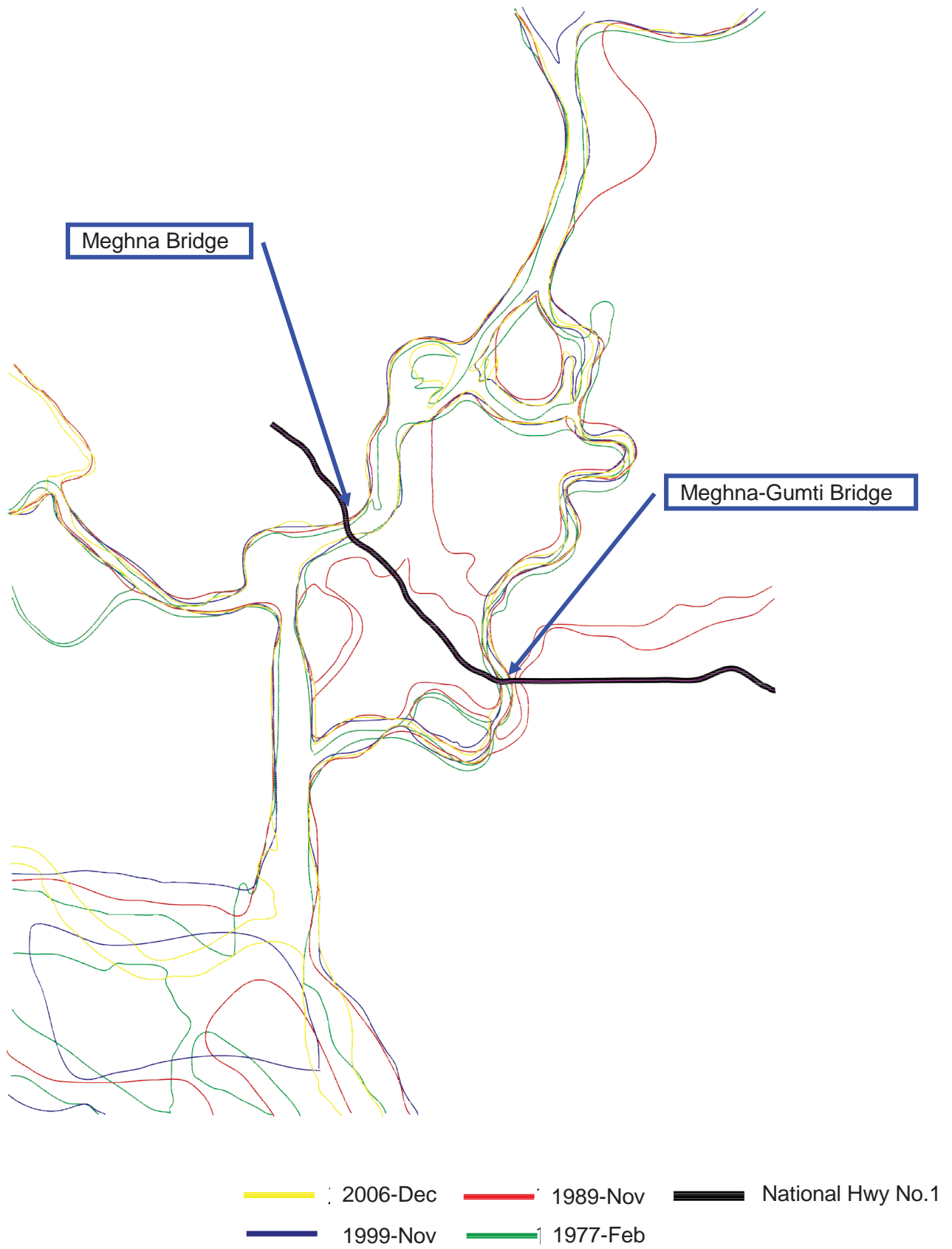
Photo Date	Preference
1972/12/28	ID: LM11470441972363AAA04 Cloud Cover: 10% Qlty: 5
1976/1/27	ID: LM21470441976027AAA01 Cloud Cover: 0% Qlty: 0
1977/2/8	ID: LM21470441977039AAA05 Cloud Cover: 0% Qlty: 5
1980/2/20	ID: LM31470441980051AAA04 Cloud Cover: 10% Qlty: 7
1980/12/4	ID: LM31470441980339AAA03 Cloud Cover: 0% Qlty: 9
Major Flood Event in 1987	
1988/9/14	ID: LT51370441988258BKT00 CC: 53% Qlty: 7 Sensor: TM
1988/11/1	ID: LT51370441988306BKT00 CC: 10% Qlty: 7 Sensor: TM
Major Flood Event in 1988	
1989/1/12	ID: LT41370441989012XXX02 CC: 10% Qlty: 7 Sensor: TM
1989/1/28	ID: LT41370441989028XXX02 CC: 10% Qlty: 9 Sensor: TM
1989/2/13	ID: LT41370441989044XXX06 CC: 0% Qlty: 7 Sensor: TM
Major Flood Event in 1998	
1999/10/7	ID: LE71370441999280SGS01 CC: 12% Qlty: 9 Sensor: ETM+
1999/10/23	ID: LE71370441999296SGS00 CC: 6% Qlty: 9 Sensor: ETM+
1999/11/24	ID: LE71370441999328SGS00 CC: 0% Qlty: 9 Sensor: ETM+
2000/2/28	ID: LE71370442000059SGS00 CC: 0% Qlty: 9 Sensor: ETM+
Major Flood Event in 2007	
2011/11/25	ID: LE71370442011329PFS00 CC: 0% Qlty: 9 Sensor: ETM+ SLC-off
2012/1/12	ID: LE71370442012012PFS00 CC: 15% Qlty: 9 Sensor: ETM+ SLC-off

#1 : <http://glcfapp.glc.f.umd.edu:8080/esdi/index.jsp>



Source : Edited Landsat data by JICA Team

Figure 1.2.14 Land sat image around Meghna River



Source :Edited by JICA Team

Figure 1.2.15 Change of shore line of Meghna River around Meghna & Gumti Br

1.2.6 River bed material and geological survey

Bed materials diameter is important to predict the scouring around piers. Table 1.2.14 is the former survey result by JICA in 1997 around Meghna Bridge. It is shown that almost of the bed material is consisted by Fine sand and Silt ($d=0.002$ to 0.425mm), and clay that has viscosity is almost nothing. D50 is about 0.1 to 0.2 mm, average of D50 is 0.167mm.

Table 1.2.14 Summary of bed material test around Meghna Bridge (1997 JICA Report)

Sample No.	Grain Size Analysis (%)						D50 (mm)	D60/10
	Clay -0.002	Silt 0.002-0.075	Fine Sand 0.075-0.425	Medium Sand 0.425-2.0	Coarse Sand 2.0-4.76	Gravel 4.76-76.1		
A-1	0	2	98	0	0	0	0.205	1.45
A-2	0	2	98	0	0	0	0.202	1.82
B-3	0	1	99	0	0	0	0.205	1.44
C-3	0	3	97	0	0	0	0.190	2.29
C-4	0	4	96	0	0	0	0.150	2.01
C-5	0	2	98	0	0	0	0.165	2.18
D-1	0	26	73	1	0	0	0.140	4.91
D-2	0	48	49	3	0	0	0.776	5.05
D-3	0	24	75	1	0	0	0.133	4.38
D-4	0	36	64	0	0	0	0.090	5.00
D-5	0	55	45	0	0	0	0.060	6.23
D-6-1	6	85	9	0	0	0	0.031	6.50
D-6-2	0	26	74	0	0	0	0.100	3.64
D-7	0	7	93	0	0	0	0.115	1.56
D-8	0	12	88	0	0	0	0.147	2.75
D-9	0	16	84	0	0	0	0.140	3.20
D-10	0	13	87	0	0	0	0.100	1.92
E-1	0	27	73	0	0	0	0.095	3.55
E-2	0	10	90	0	0	0	0.125	1.87
E-3	0	2	98	0	0	0	0.165	2.16
Average	0.30	20.05	79.40	0.25	0.00	0.00	0.167	3.20

Source :JICA Report¹

¹ Basic Design Study Report On The Project For Protection Works For Meghna Bridge In People's Republic Of Bangladesh, 1998 Feb

1.3 Topographic Survey (on river)

Topographic survey has been carried out to understand the river bed profile and to develop numerical model for each river. Survey lines are decided from the hydraulic point of view, which are also close to past survey line so that a comparative study can be easily carried out. The schematic diagram of survey lines is shown in Figure 1.3.2 and Figure 1.3.3 for Meghna Bridge and Gumti Bridge, respectively.

As there are no survey results/ survey records for Kanchpur Bridge, therefore, the survey lines have been selected at 200 m intervals in u/s and d/s of existing bridges, which are shown in Figure 1.3.4.

Survey type

- River Bathymetric Survey (under the river flow, water)
- Using Echo- Sounding device (Figure 1.3.1)
- River Topographic Survey (on the land)

The above survey results will be formulated soon.



(GPS)



Echo-sounding device -Echotrac DF3200 MKII
Odom Hydrographical Systems Inc.)

Figure 1.3.1 bathymetric survey device.

1.2.6 River bed material and geological survey

Bed materials diameter is important to predict the scouring around piers. Table 1.2.14 is the former survey result by JICA in 1997 around Meghna Bridge. It is shown that almost of the bed material is consisted by Fine sand and Silt ($d=0.002$ to 0.425mm), and clay that has viscosity is almost nothing. D50 is about 0.1 to 0.2 mm, average of D50 is 0.167mm.

Table 1.2.14 Summary of bed material test around Meghna Bridge (1997 JICA Report)

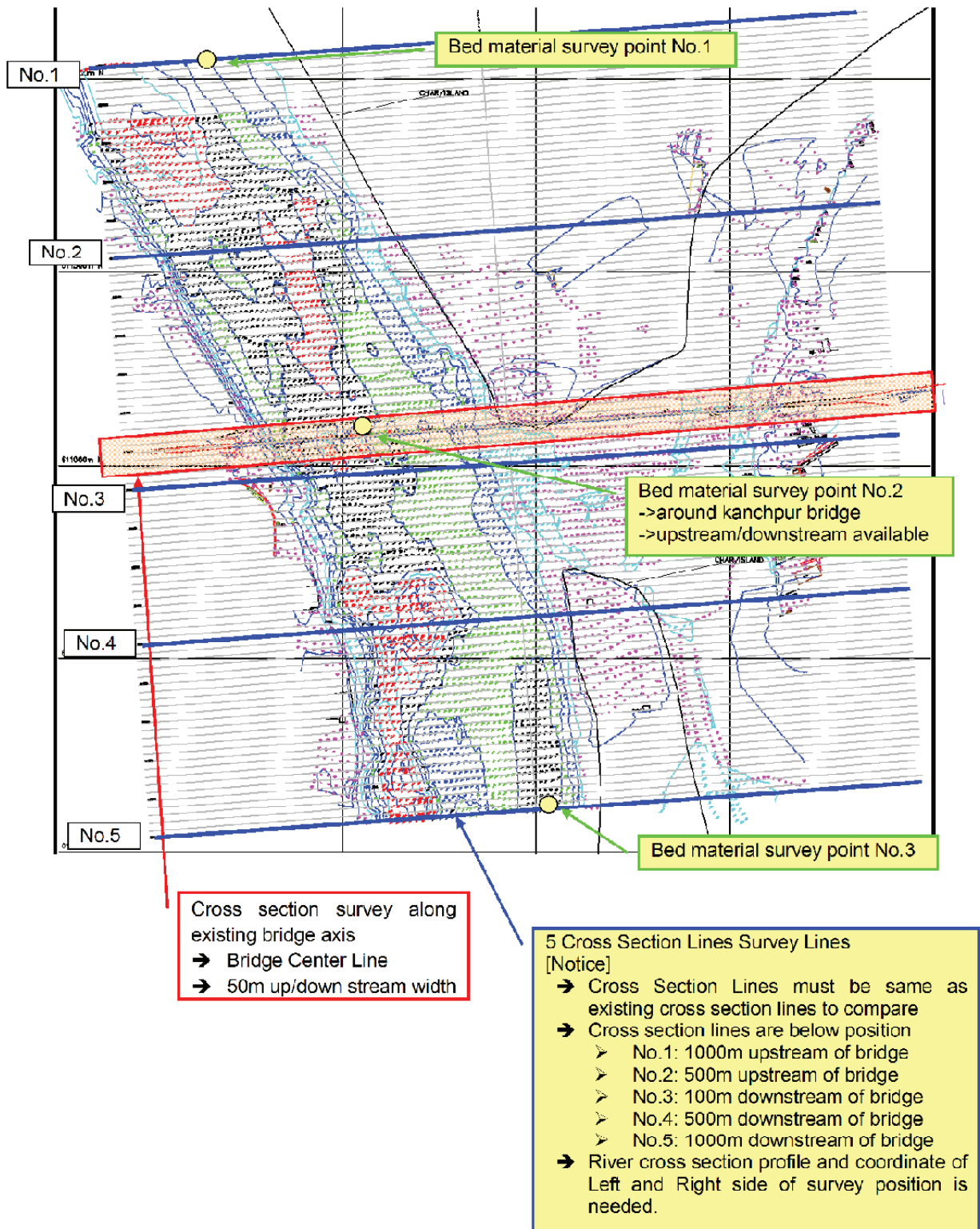
Sample No.	Grain Size Analysis (%)						D50 (mm)	D60/10
	Clay -0.002	Silt 0.002-0.075	Fine Sand 0.075-0.425	Medium Sand 0.425-2.0	Coarse Sand 2.0-4.76	Gravel 4.76-76.1		
A-1	0	2	98	0	0	0	0.205	1.45
A-2	0	2	98	0	0	0	0.202	1.82
B-3	0	1	99	0	0	0	0.205	1.44
C-3	0	3	97	0	0	0	0.190	2.29
C-4	0	4	96	0	0	0	0.150	2.01
C-5	0	2	98	0	0	0	0.165	2.18
D-1	0	26	73	1	0	0	0.140	4.91
D-2	0	48	49	3	0	0	0.776	5.05
D-3	0	24	75	1	0	0	0.133	4.38
D-4	0	36	64	0	0	0	0.090	5.00
D-5	0	55	45	0	0	0	0.060	6.23
D-6-1	6	85	9	0	0	0	0.031	6.50
D-6-2	0	26	74	0	0	0	0.100	3.64
D-7	0	7	93	0	0	0	0.115	1.56
D-8	0	12	88	0	0	0	0.147	2.75
D-9	0	16	84	0	0	0	0.140	3.20
D-10	0	13	87	0	0	0	0.100	1.92
E-1	0	27	73	0	0	0	0.095	3.55
E-2	0	10	90	0	0	0	0.125	1.87
E-3	0	2	98	0	0	0	0.165	2.16
Average	0.30	20.05	79.40	0.25	0.00	0.00	0.167	3.20

Source :JICA Report¹

¹ Basic Design Study Report On The Project For Protection Works For Meghna Bridge In People's Republic Of Bangladesh, 1998 Feb

Meghna-Gumti Bridge

Meghna-Gumti River Bathymetry by Sounding Survey by JPZ in 2010



Source :Edited RHD Report³ by JICA Team

Figure 1.3.3 Topographic Survey Line at Gumti Bridge

³ Rehabilitation of Existing Meghna Bridge & Gumti Bridge Protective Works of Pier Foundation Design Report, Roads & Highways Department, Feb 2011

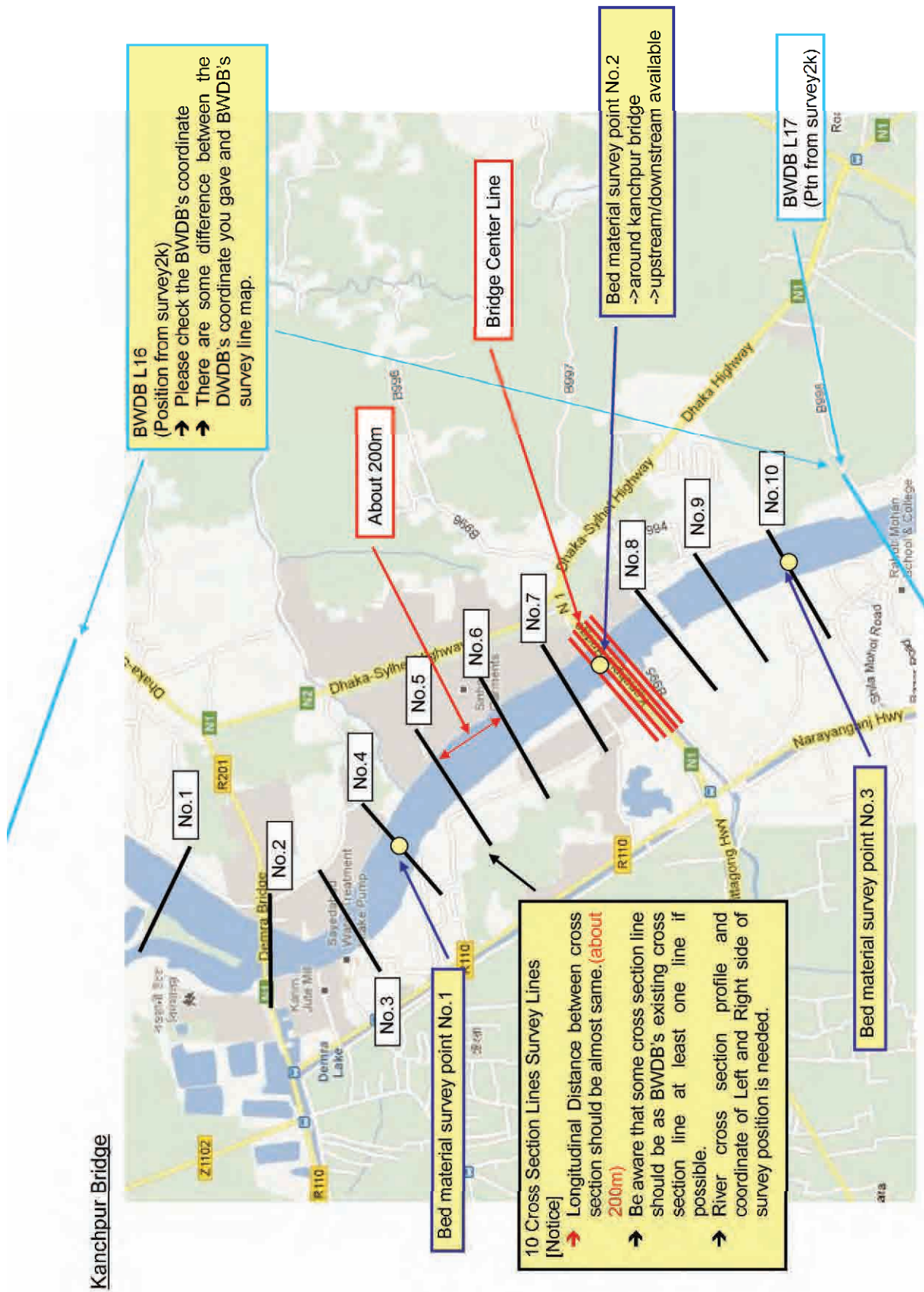


Figure 1.3.4 Topographic Survey Line at Kanchpur Bridge

1.3.1 Kanchpur Bridge

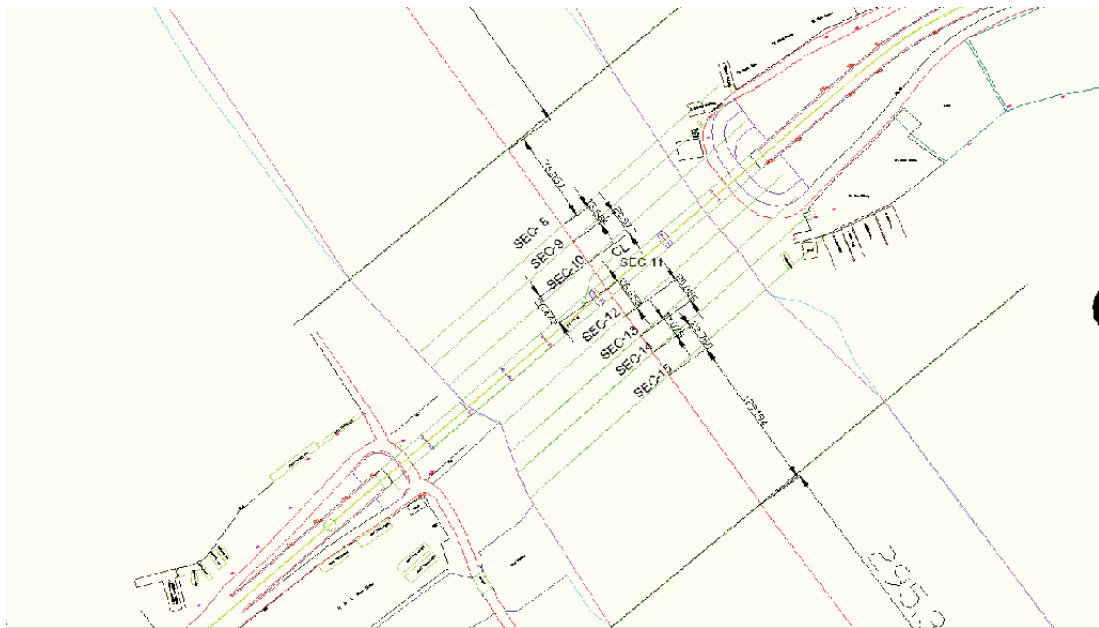
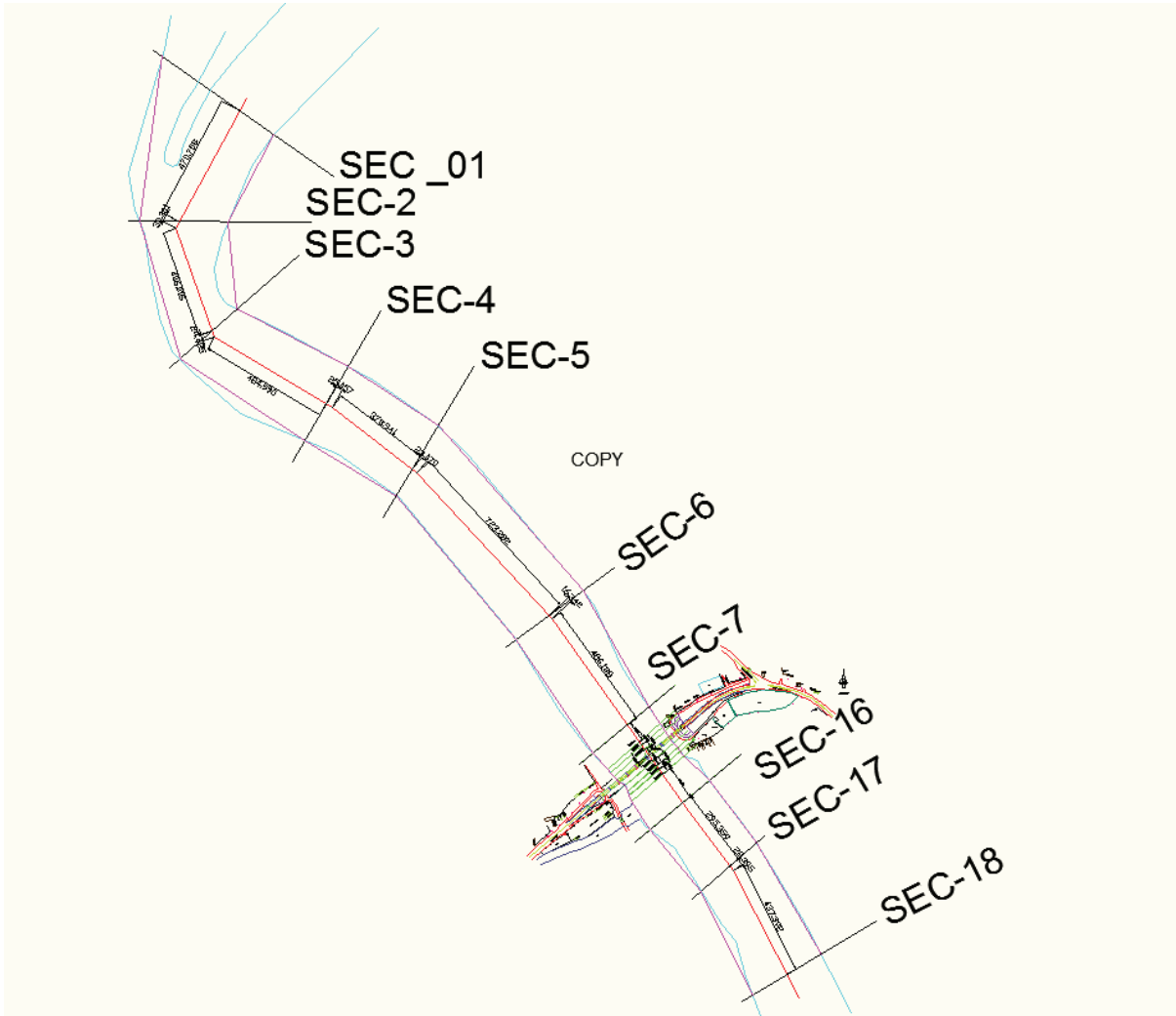


Figure 1.3.5 Topographic Survey Line at Kanchpur Bridge

Table 1.3.1 Longitudinal River Bed Profile of Lahkya River

Sec No.	Distance Between Cross section (m)	Distance from Cross Sec18 (m)	Lowest Bed Level	Average Bed Level
			R.L.m	R.L.m
SEC18	-	0.0	-8.85	-5.36
SEC17	459.8	459.8	-9.39	-5.97
SEC16	295.4	755.1	-10.20	-5.81
SEC15	129.2	884.3	-11.56	-7.31
SEC14	22.8	907.1	-11.81	-7.89
SEC13	17.1	924.2	-13.40	-8.08
SEC12	20.9	945.0	-12.95	-8.09
SEC11	26.7	971.7	-11.11	-7.27
SEC10	26.4	998.1	-11.42	-7.12
SEC9	21.0	1,019.1	-11.22	-7.33
SEC8	15.7	1,034.8	-10.37	-7.20
SEC7	76.3	1,111.0	-9.87	-5.60
SEC6	502.5	1,613.6	-9.71	-5.52
SEC5	746.4	2,359.9	-14.93	-7.50
SEC4	404.0	2,763.9	-8.07	-4.59
SEC3	509.5	3,273.4	-11.59	-6.91
SEC2	436.3	3,709.7	-14.08	-5.88
SEC1	470.8	4,180.5	-6.97	-3.26

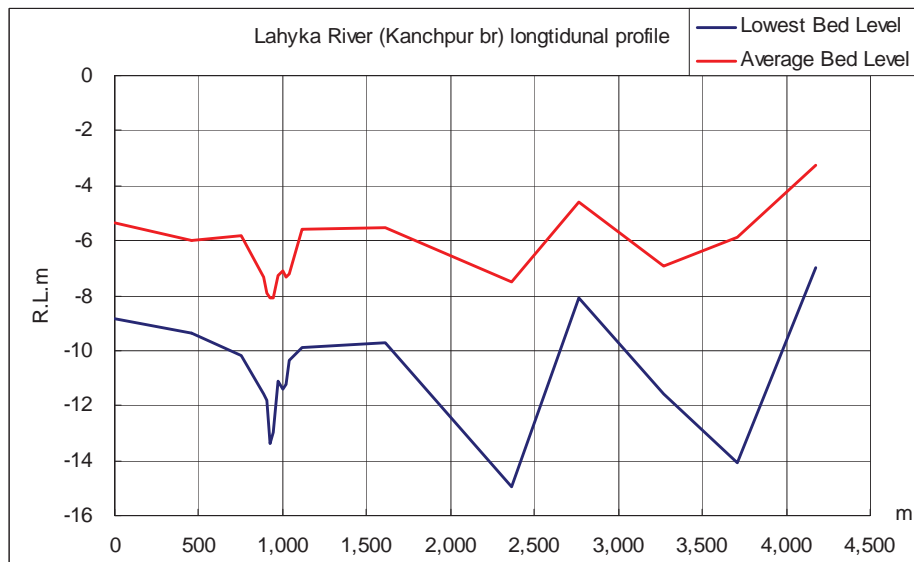


Figure 1.3.6 Longitudinal River Bed Profile of Lahkya River

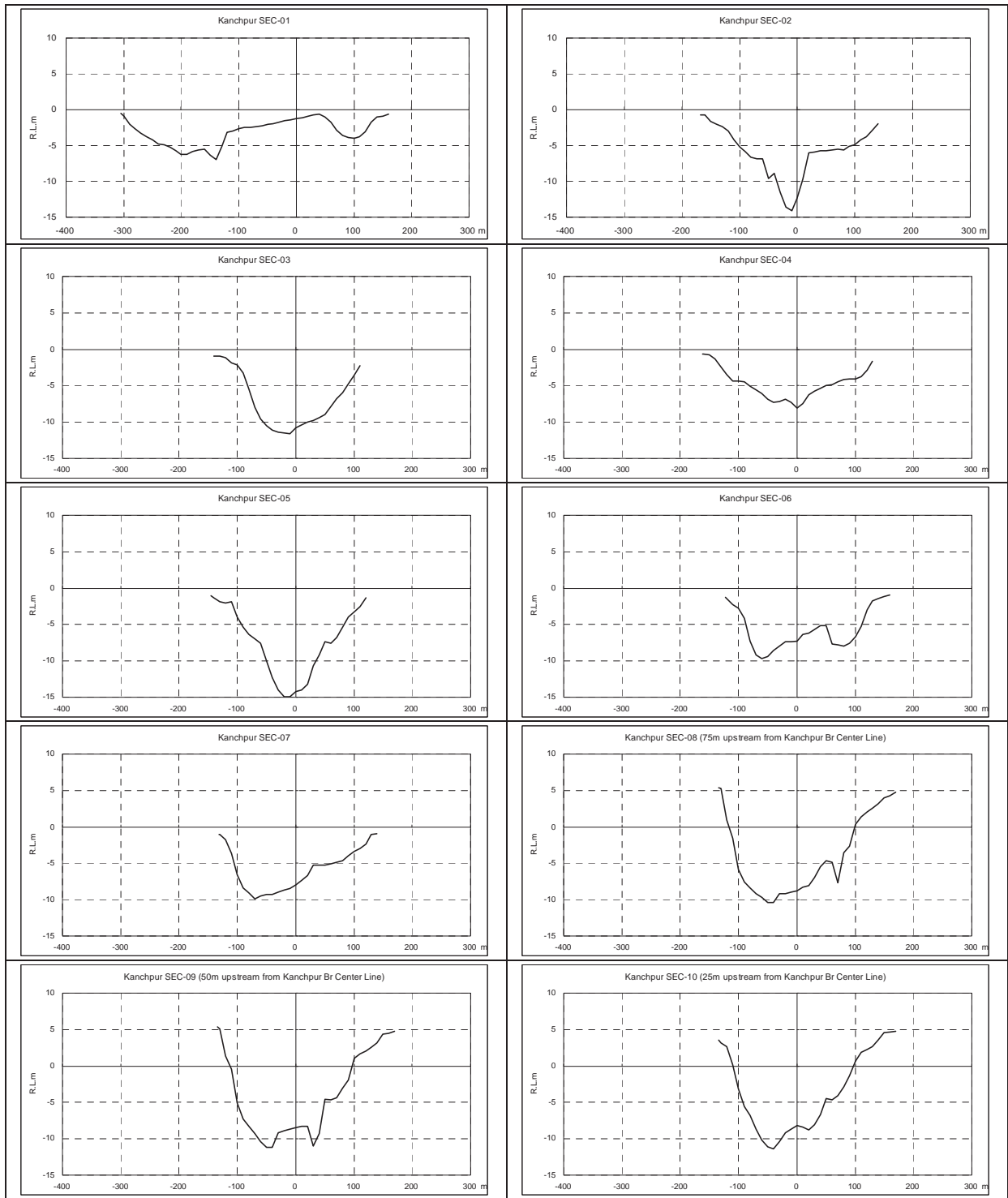


Figure 1.3.7 Cross Section Profile of Lahkya River(1/2)

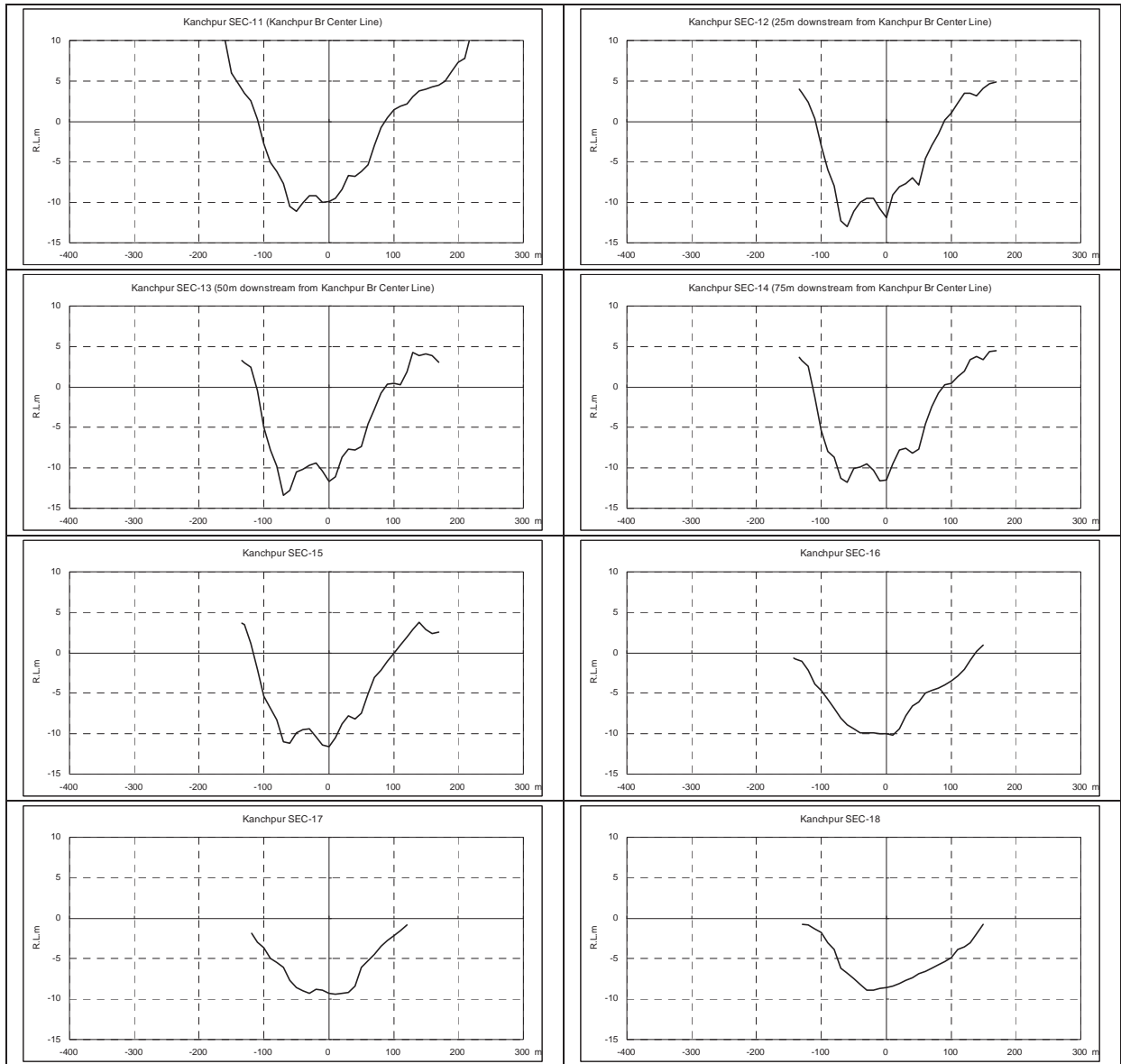


Figure 1.3.8 Cross Section Profile of Lahkya River(2/2)

1.3.2 Meghna Bridge (Meghna River)

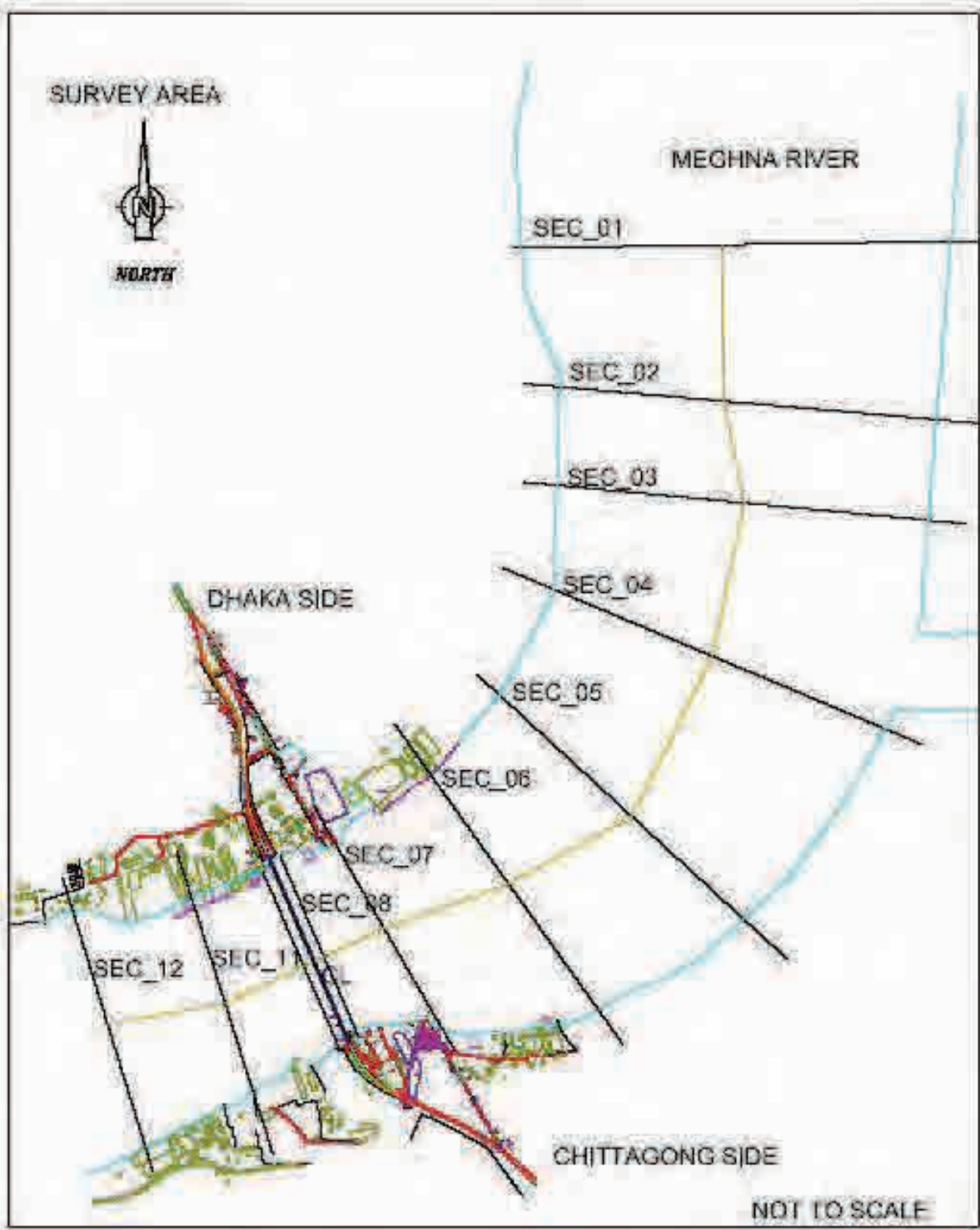


Figure 1.3.9 Topographic Survey Line at Meghna Bridge

Table 1.3.2 Longitudinal River Bed Profile of Meghna River

Sec No.	Distance Between Cross section (m)	Distance from CrossSec12 (m)	Lowest Bed Level R.L.m	Average Bed Level R.L.m
SEC12	-	0.0	-20.68	-14.98
SEC11	538.4	538.4	-22.19	-14.31
SEC10	316.1	854.6	-27.50	-13.92
SEC9	139.4	994.0	-23.02	-12.40
SEC8	63.9	1,057.8	-22.17	-11.92
SEC7	274.1	1,331.9	-25.82	-13.41
SEC6	597.4	1,929.4	-23.61	-15.79
SEC5	634.2	2,563.6	-23.66	-15.78
SEC4	810.9	3,374.5	-21.57	-15.91
SEC3	707.2	4,081.7	-20.05	-14.44
SEC2	468.5	4,550.2	-22.05	-16.48
SEC1	706.2	5,256.4	-22.49	-13.34

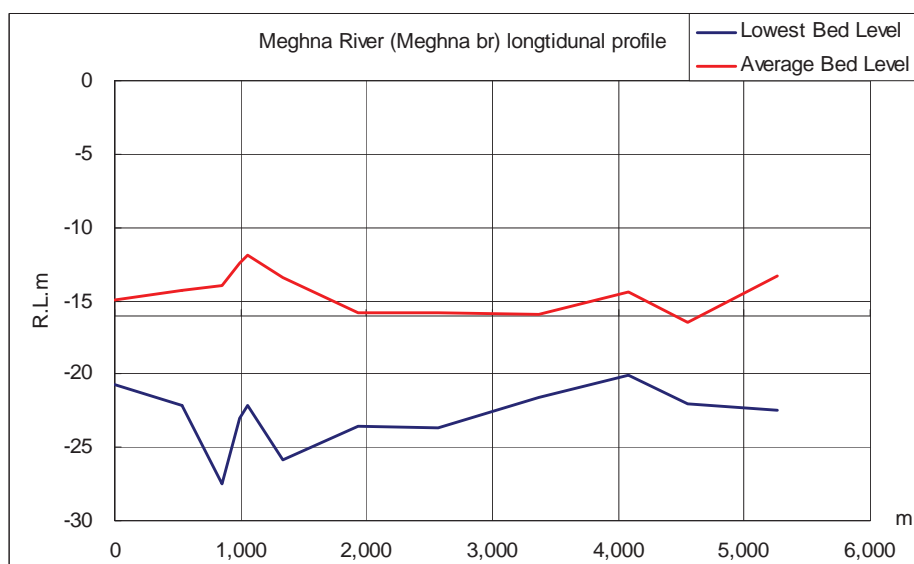


Figure 1.3.10 Longitudinal River Bed Profile of Meghna River

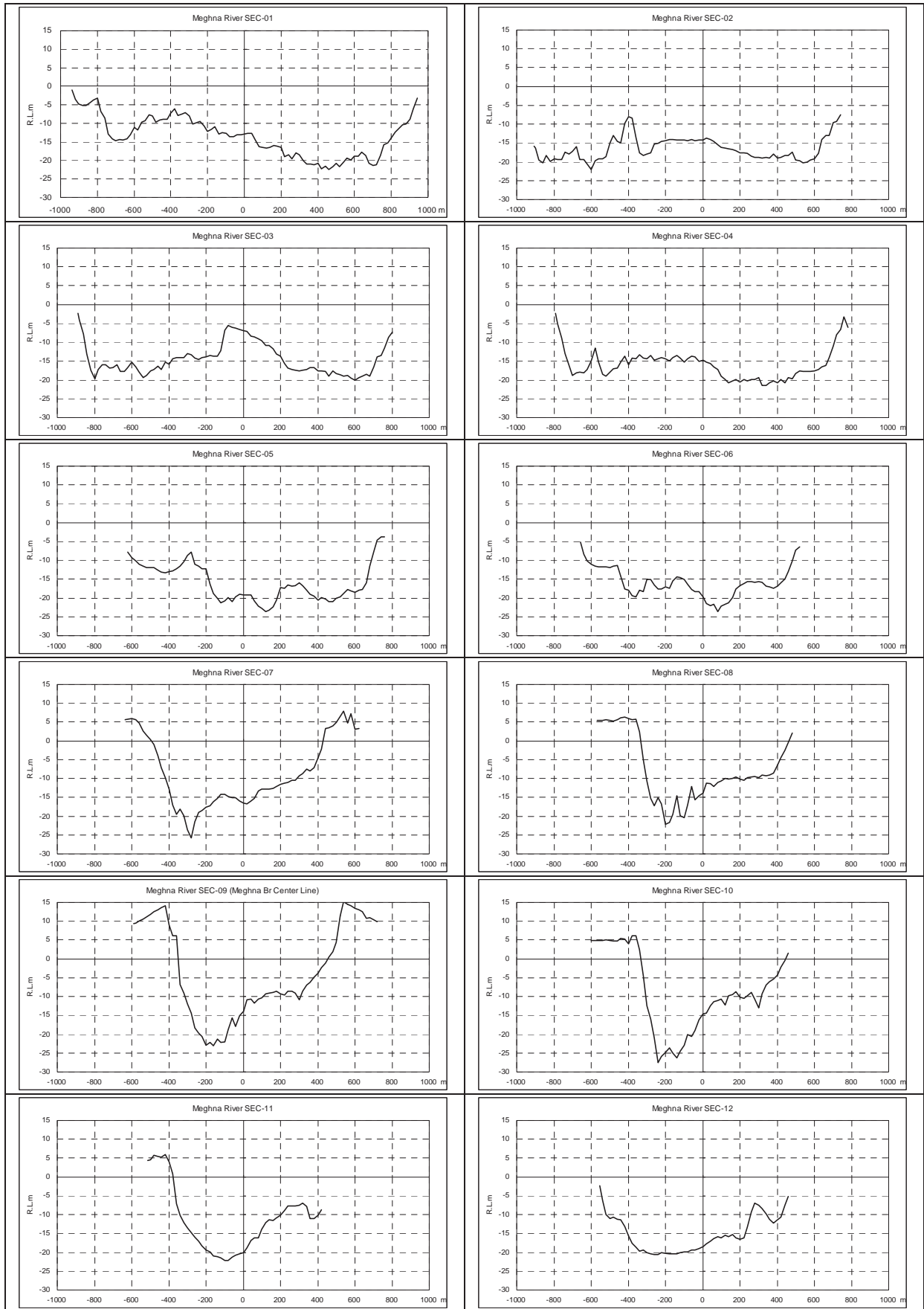


Figure 1.3.11 Cross Section Profile of Meghna River

1.3.3 Gumti Bridge

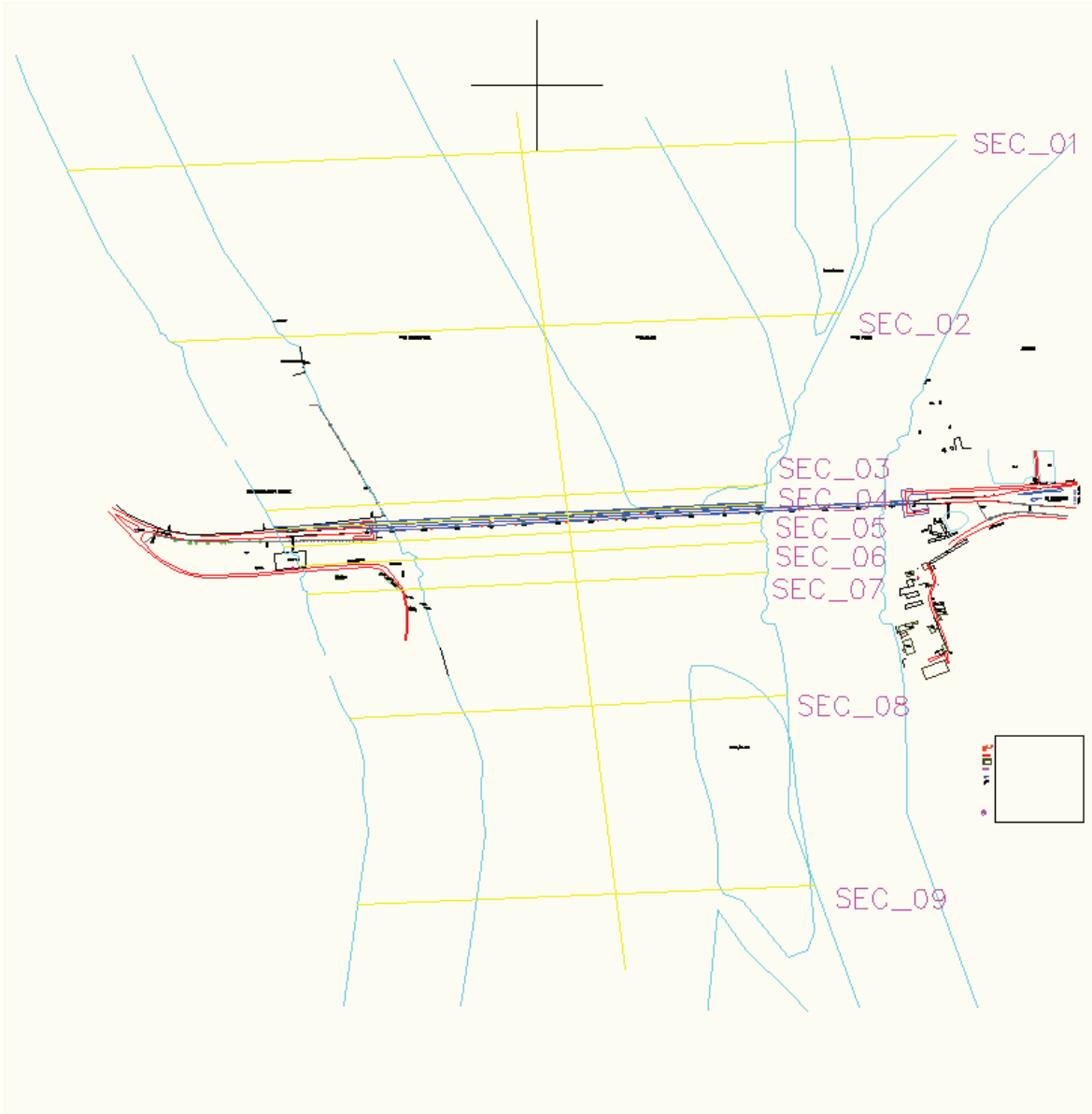


Figure 1.3.12 Topographic Survey Line at Gumti Bridge

Table 1.3.3 Longitudinal River Bed Profile of Gumit River

Sec No.	Distance Between Cross section (m)	Distance from Cross Sec9 (m)	Lowest Bed Level R.L.m	Average Bed Level R.L.m
SEC9	-	0.0	-13.64	-6.99
SEC8	496.4	496.4	-16.32	-8.88
SEC7	328.5	824.9	-9.11	-5.09
SEC6	78.7	903.6	-9.85	-5.20
SEC5	50.1	953.8	-8.57	-4.36
SEC4	50.1	1,003.9	-9.80	-6.09
SEC3	50.1	1,054.0	-7.73	-5.38
SEC2	445.6	1,499.6	-9.23	-6.82
SEC1	458.9	1,958.6	-21.71	-12.28

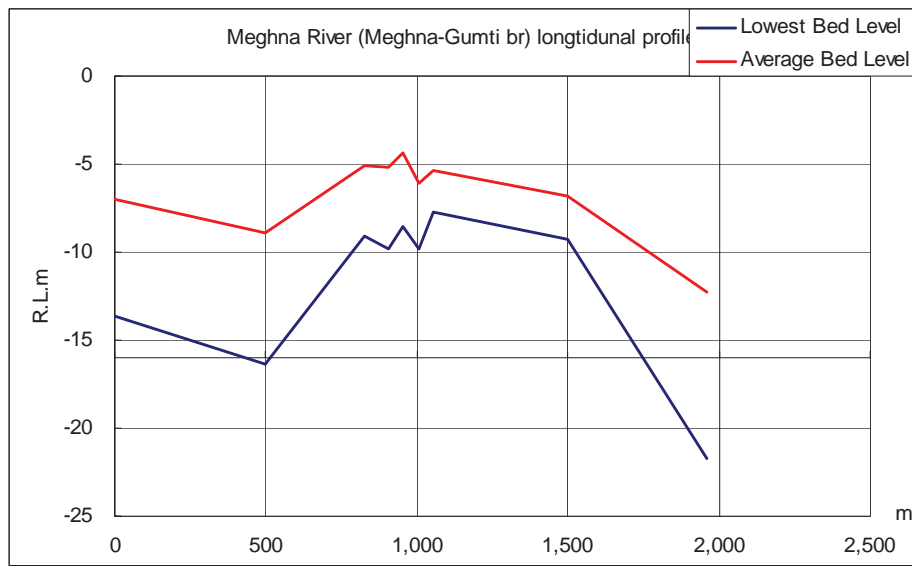


Figure 1.3.13 Longitudinal River Bed Profile of Gumti River

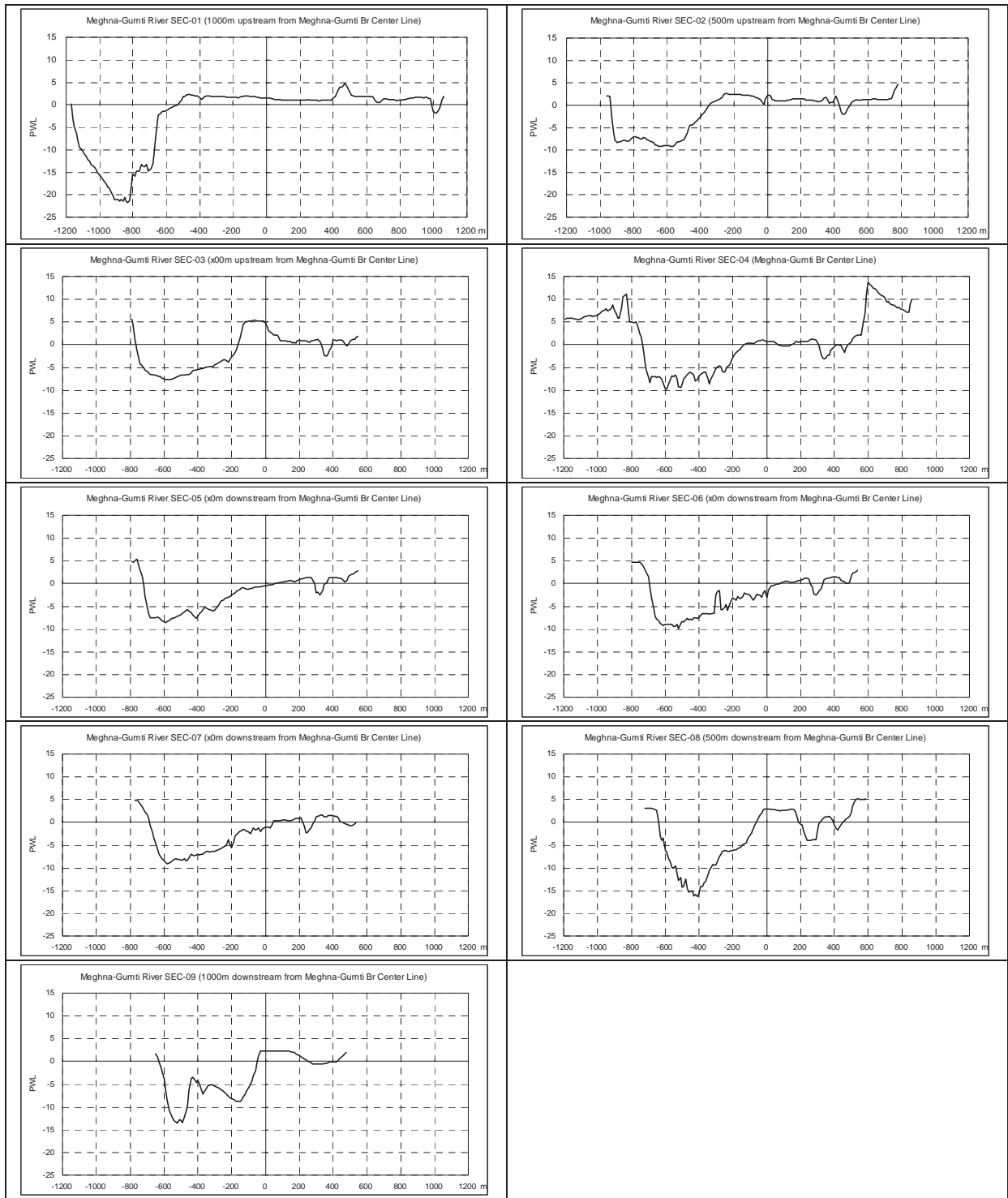


Figure 1.3.14 Cross Section Profile of Gumti River

1.4 River Current Velocity Survey

1.4.1 Overall

In order to protect the existing bridge and new bridge from scouring around piers, it is necessary to predict current velocity in design flood event. River current velocity survey is held to collect the basic hydrological data of the river, and data measured will be used to check the numerical analysis.

River current velocity survey is carried out from July 30th 2012 by ADCP device which can measure river current velocity, flow direction and total discharge measurement along the cross section of the river.

1.4.2 Method

Discharge measurement has been conducted at Kanchpur, Megnha and Meghna-gumti Rivers using Acoustic Doppler Current Profiler (ADCP) and DGPS System on 30th July 2012.

The R D Instruments state-of-the earth Workhorse Rio-grande ADCP (600 Khz) with bottom tracking option has been used for the survey. The instrument is capable of velocity profiling upto 45m depth. The measurement has been done following WinRiver User Guide supplied by the manufacturer of the instrument. The instrument is used for measuring velocity at a fixed time interval (known as ensemble) without anchoring at desired transects location (moving boat condition). It measures flow velocity at each ensemble (around 2.5 second intervals) at 50cm interval throughout the water column.

Thus a series of velocity data is recorded along the whole transect line. However, it estimates the discharge of unmeasured areas (the top of instrument face, near bottom part and at edges). The river flow is calculated online by the WinRiverII Software adding discharge of each ensemble as it moves along the transect line. As the river carries considerable amount of sediment and have a higher velocity, the bias bottom tracking condition was observed. To overcome this, GPS (GGA) has been used as reference for velocity and discharge computation. Necessary compass calibration has been made earlier as per guidelines set in the User Manual supplied by RD Instruments. The observed data has been found very consistent. The discharge data provides good indication of the distribution of flow. It also provides velocity distribution across the full channel.

Table 1.4.1 Instruments and Software on Current Velocity Survey

	Supplier
ADCP Device	Workhouse Rio Grande 600 khz
RTK GPS Device	Trimble 5700
Software	Winriver II



Figure 1.4.1 ADCP Device (Workhorse Rio Grande 600khz)

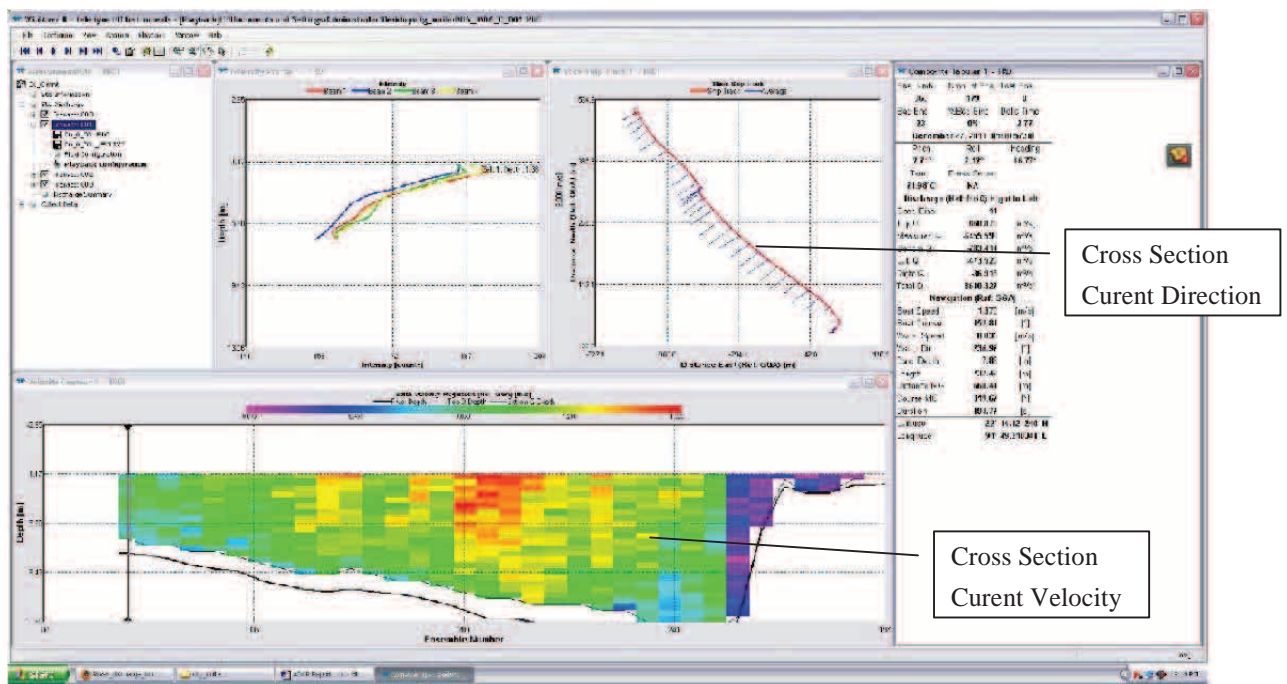


Figure 1.4.2 ADCP Software Main Window

1.4.3 Survey Result

(1) Overall

Total discharge , average flow area and average velocity of three bridges by ADCP survey are shown in Table 1.4.2.

In this result, discharge at Meghna bridge is about 10 times more than discharge at Gumti bridge,. Both river flow originally one channel at upstream of the bridges, and after Bhairab Bazar, station, both river channel are separated. Hence it seems that the discharge at Bhairab Bazar almost flows along Main Meghna river through Meghna Bridge.

Table 1.4.2 Measurement Result at Meghna Bridge

	Unit	Meghna	Meghna-Gumti	Kanchpur
Water Level	M.S.L	3.72	3.69	3.96
Total Discharge	m ³ /s	11637.0	1063.5	1248.4
Average Flow Area	m ²	13245.9	7416.0	2267.5
Average Velocity	m/s	0.892	0.143	0.554

(2) Meghna Bridge (Meghna River)

Table 1.4.4 Measurement Result at Meghna Bridge

	Unit	Result
Water Level	M.S.L	3.72
Total Discharge	m ³ /s	11637.0
Average Velocity	m/s	0.892

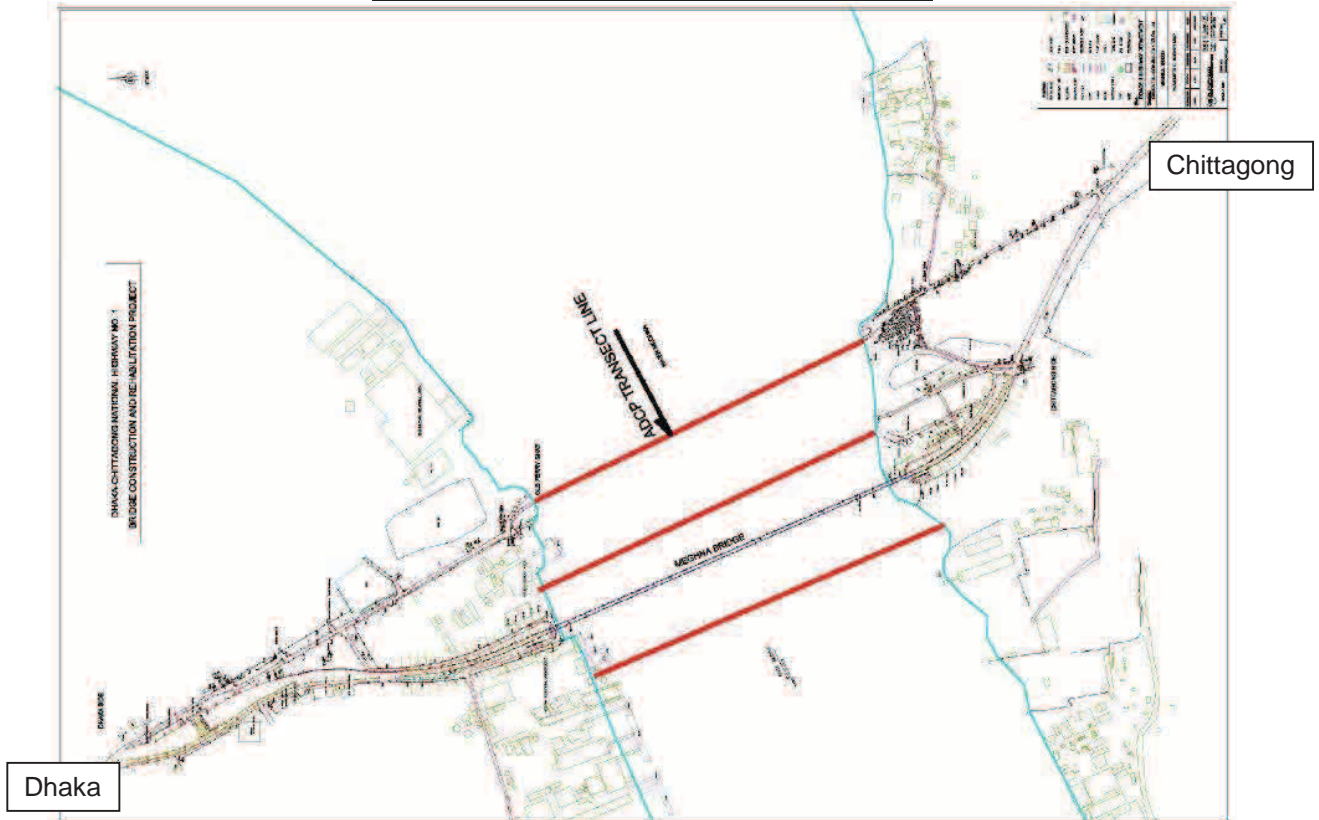


Figure 1.4.3 Transect Lines at Meghna Bridge Site

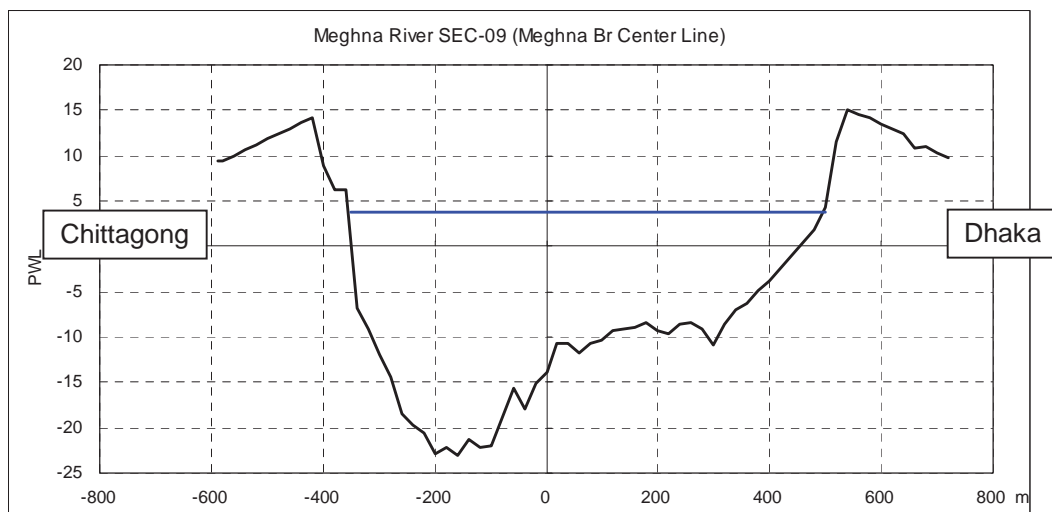


Figure 1.4.4 Water Level on the Measured Period (July 30th 2012)

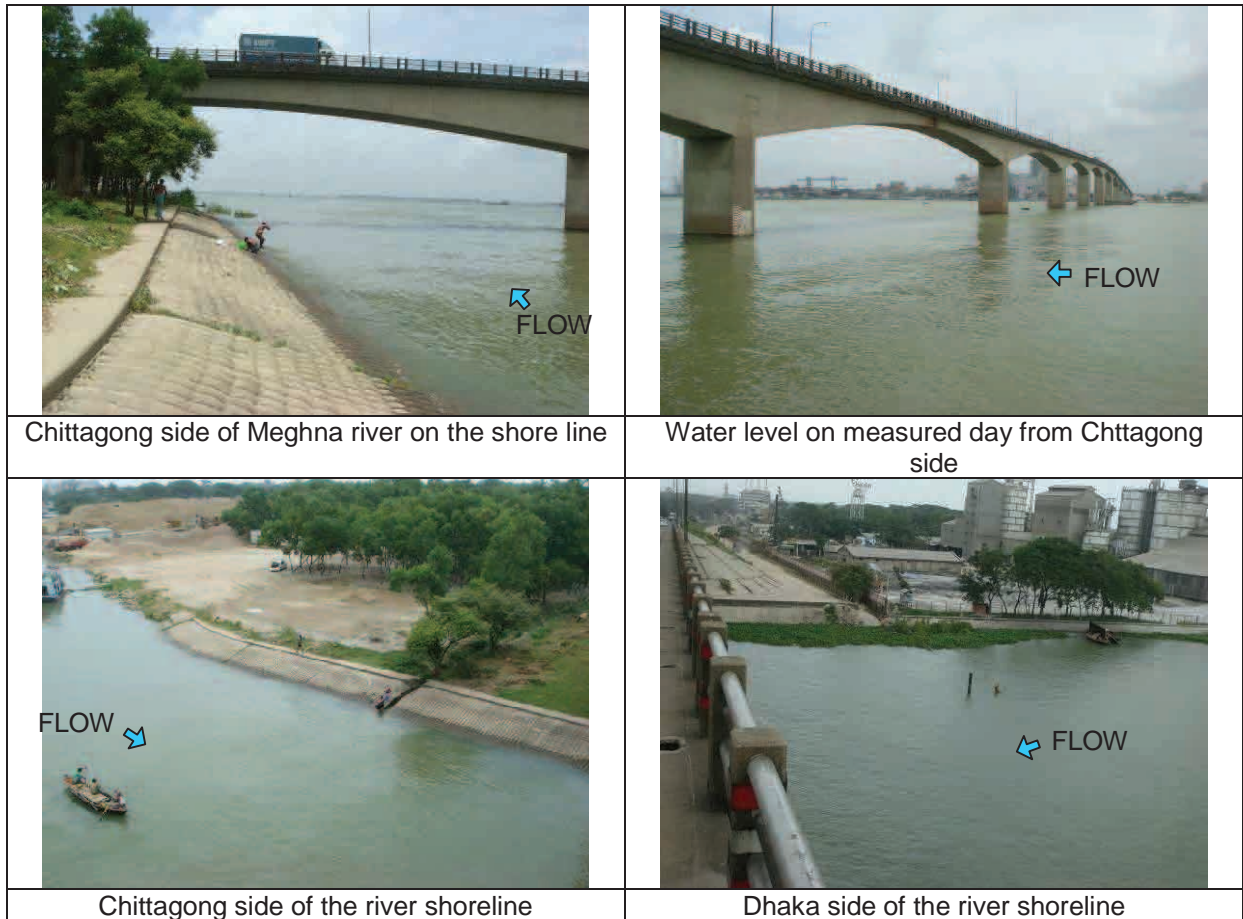


Figure 1.4.5 Water Level on the Measured Day at Meghna Bridge (July 30th 2012)

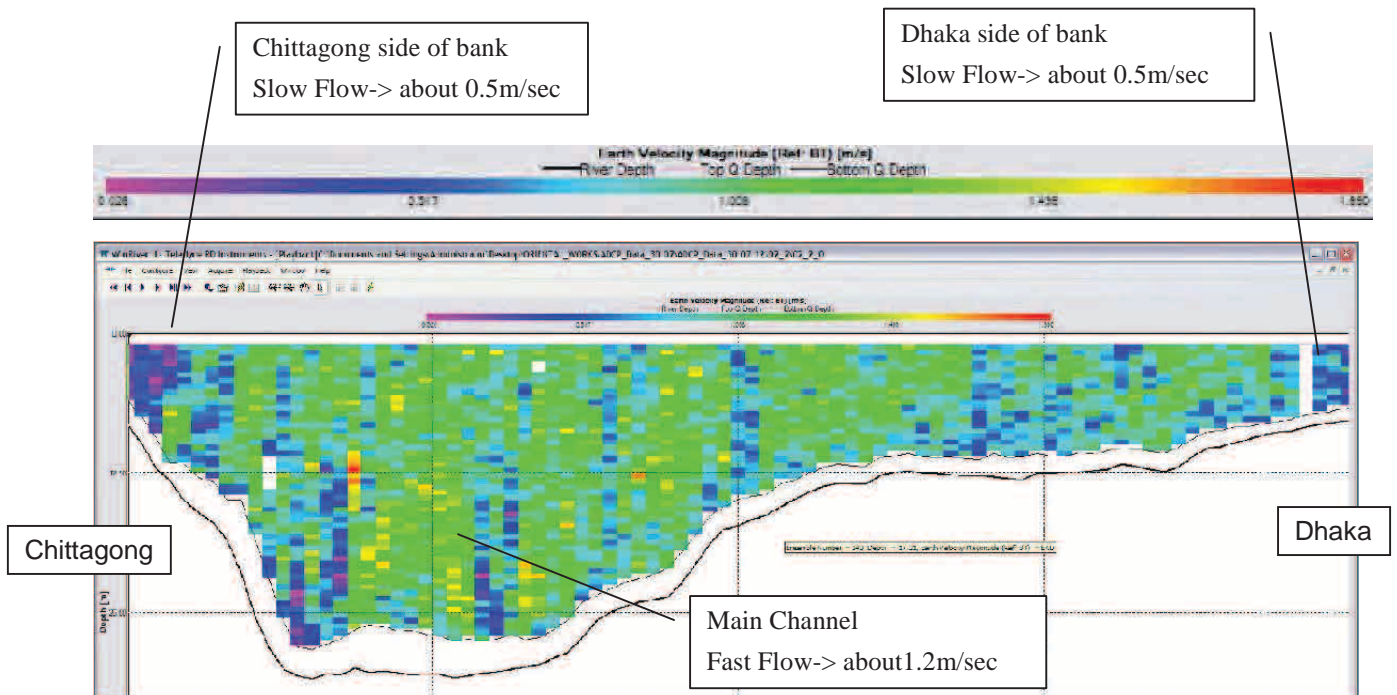


Figure 1.4.6 Cross Section Velocity Contour at Meghna Bridge

(3) Gumti Bridge

Table 1.4.5 Measurement Result at Gumti Bridge

	Unit	Result
Water Level	M.S.L	3.69
Total Discharge	m ³ /s	1063.5
Average Velocity	m/s	0.143

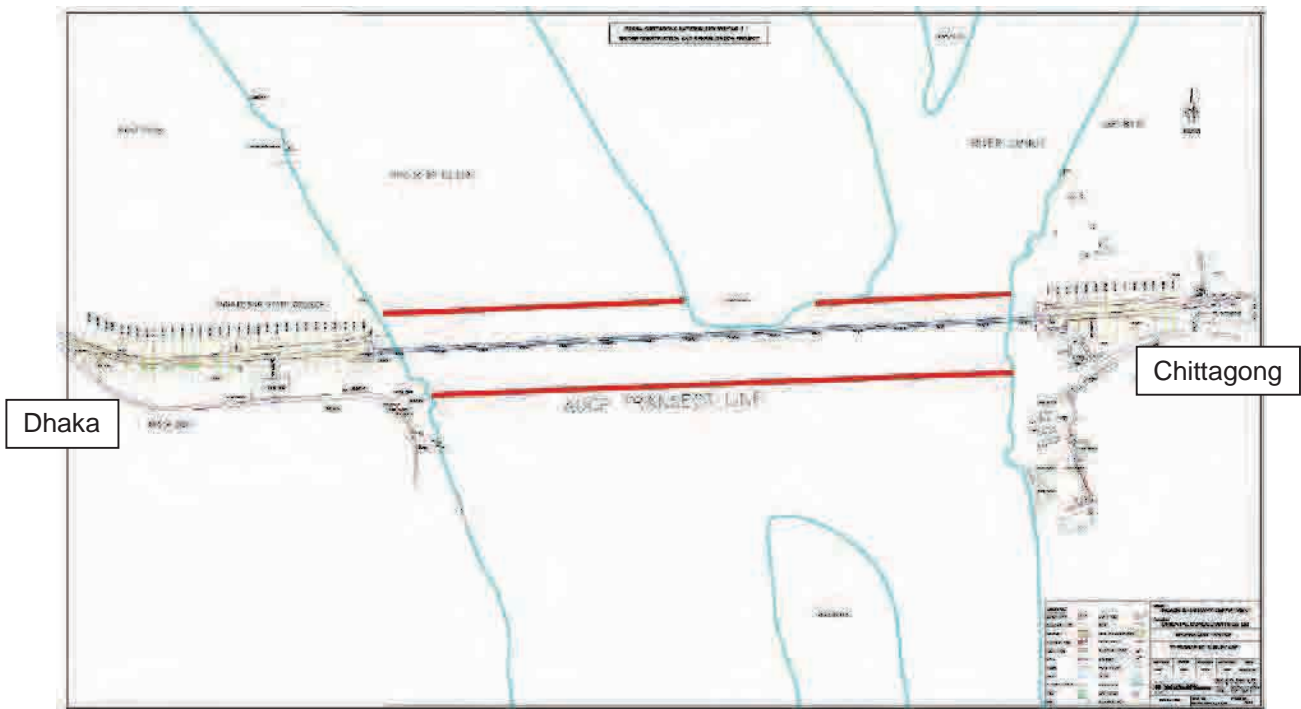


Figure 1.4.7 Transect Lines at Gumti Bridge Site

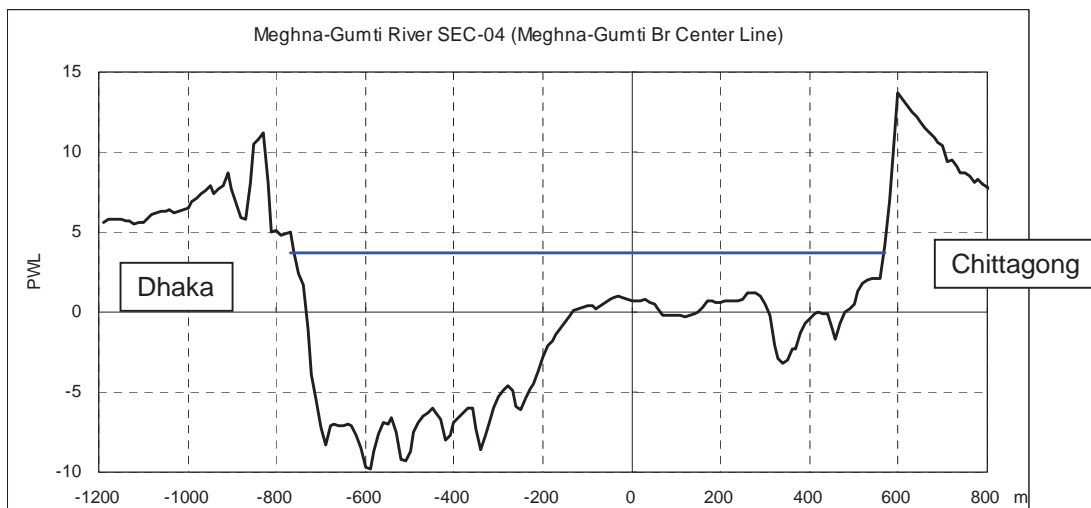


Figure 1.4.8 Water Level on the Measured Period (July 30th 2012)



Figure 1.4.9 Water Level on the Measured Day at Gumti Bridge (July 30th 2012)

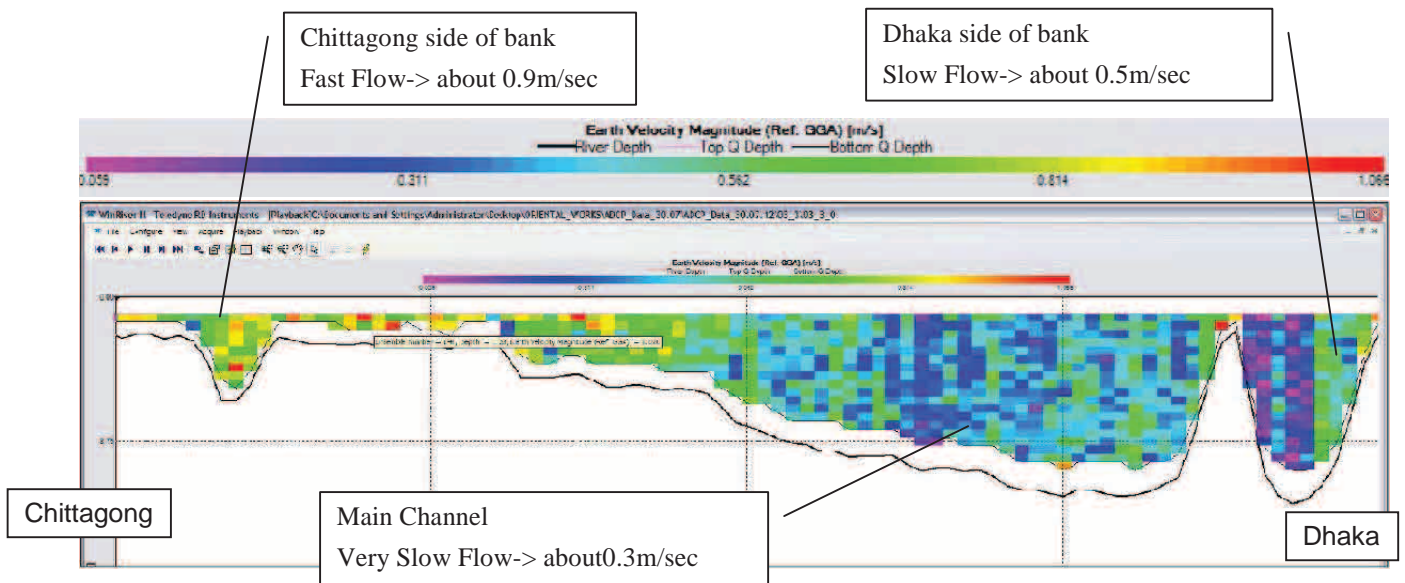


Figure 1.4.10 Cross Section Velocity Contour at Gumti Bridge

(4) Kanchpur Bridge

Table 1.4.6 Measurement Result at Kanchpur Bridge

	Unit	Result
Water Level	M.S.L	3.96
Total Discharge	m ³ /s	1248.4
Average Velocity	m/s	0.554

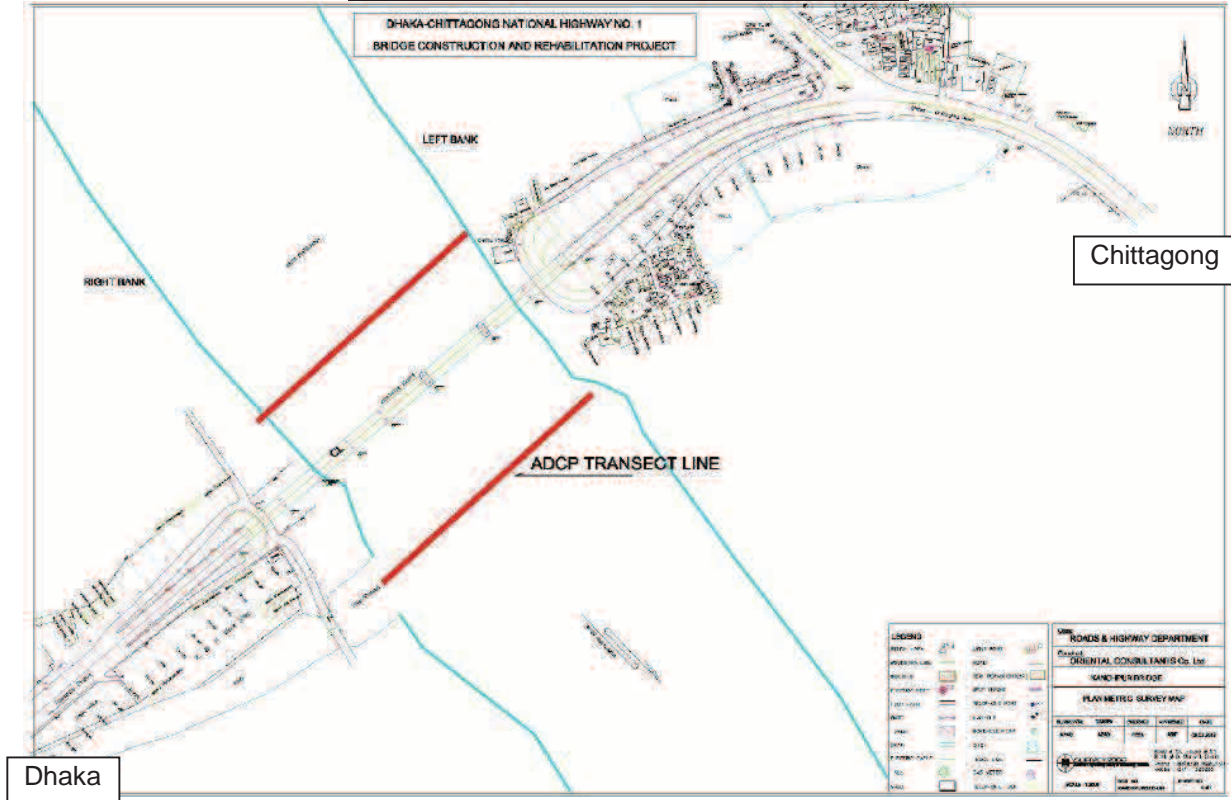


Figure 1.4.11 Transect Lines at Kanchpur Bridge Site

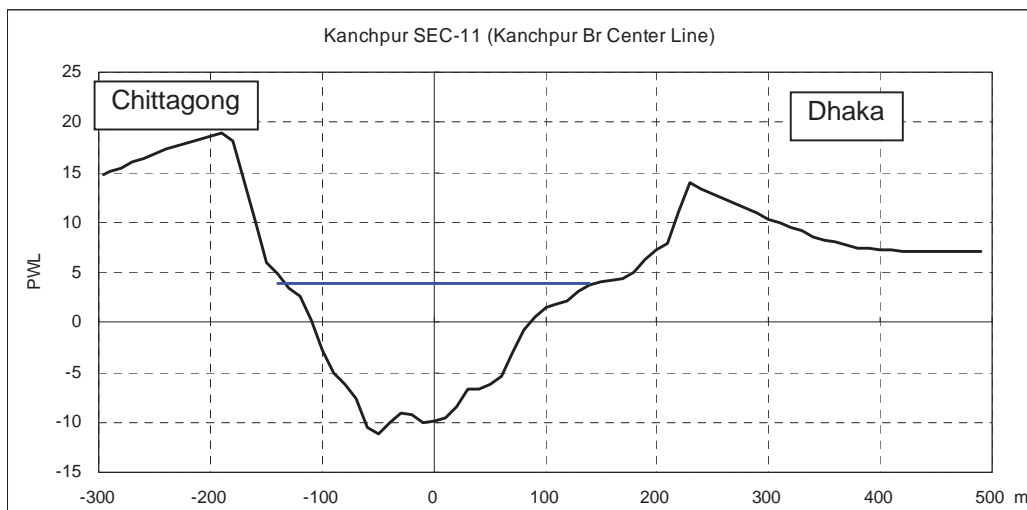


Figure 1.4.12 Water Level on the Measured Period (July 30th 2012)

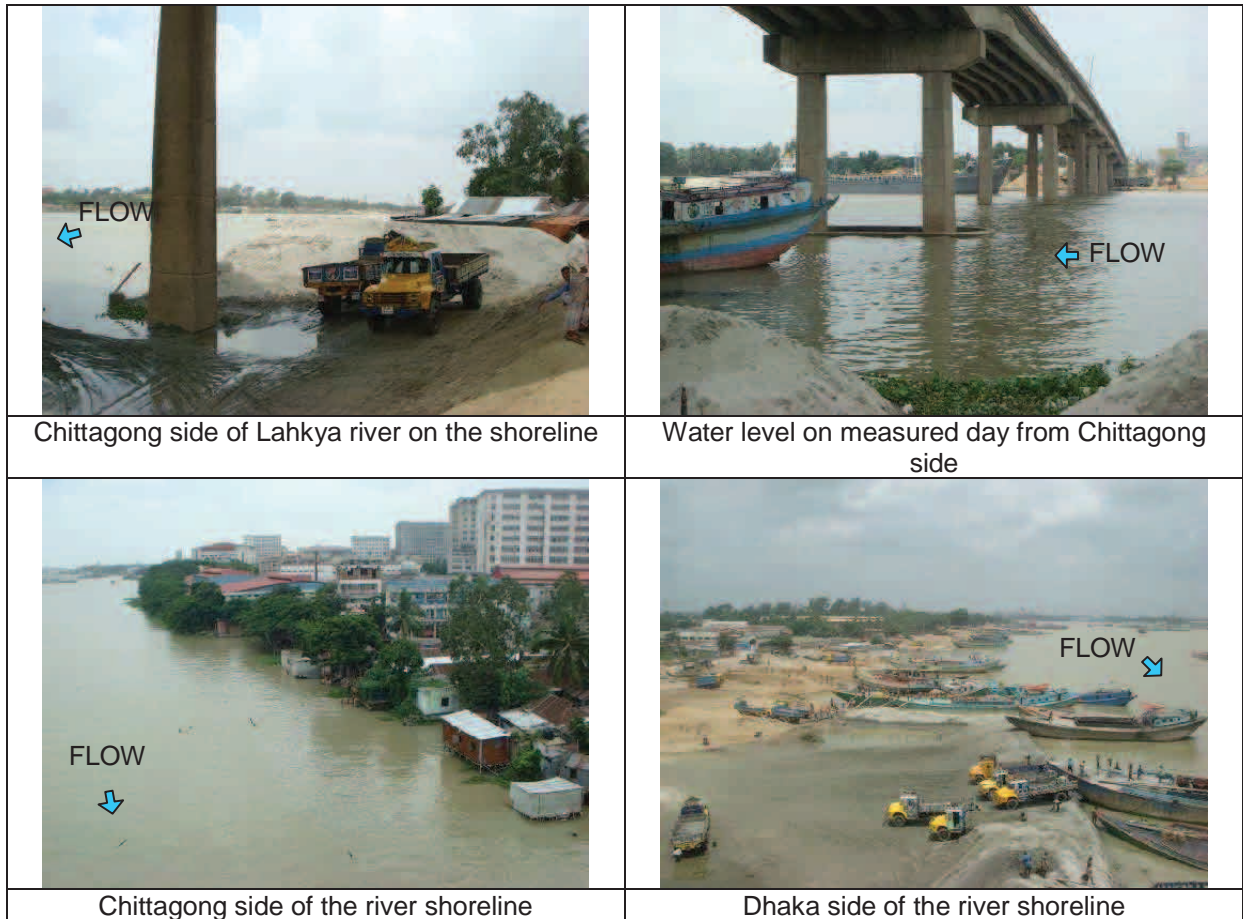


Figure 1.4.13 Water Level on the Measured Day at Kanchpur Bridge (July 30th 2012)

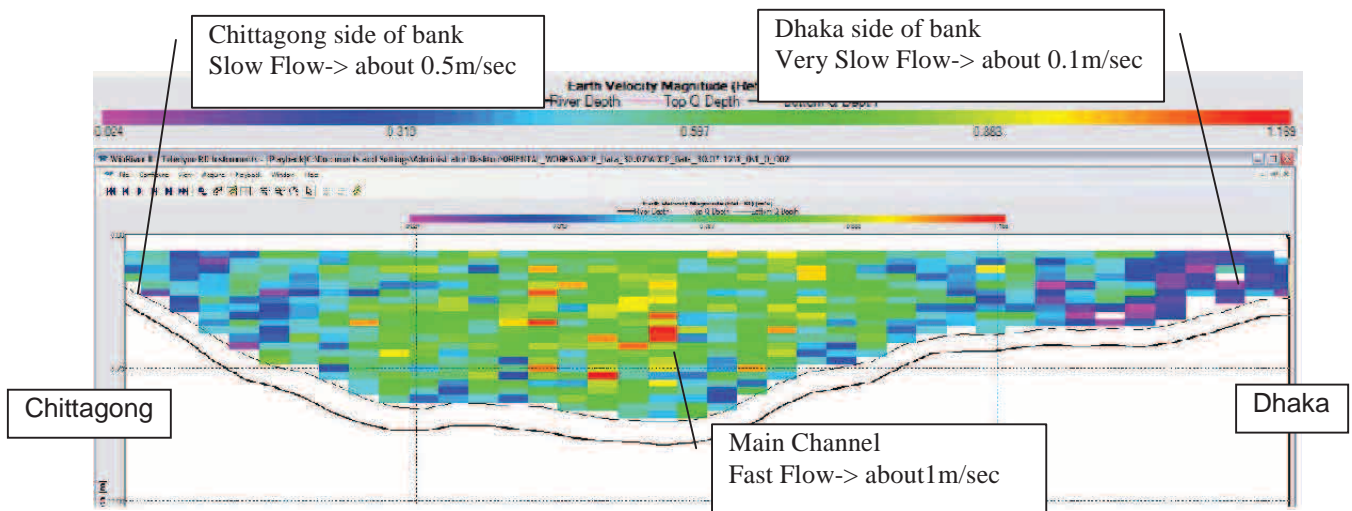


Figure 1.4.14 Cross Section Velocity Contour at Kanchpur Bridge