3-4 Levelling on the Road Bridges

The levelling work was conducted on the large road bridges on the main national roads in the nighttime when traffic subsides by intercepting the flow of traffic intermittently by policemen because levelling on such large bridges is adversely affected by the vibrations caused by the continuous flow of heavy trucks and other large vehicles. District Police Commissioners were asked to dispatch the policemen for traffic control before the work began at the respective work sites.

3-5 Safety of Transportation by Vehicles and Employment of drivers

It was a critically important issue for JICA that provided 21 four-wheel drive cars to prevent accidents (especially injuries to human body or death) in the course of fulfilling the assignment safe and sound in the current study.

Drivers were repeatedly and thoroughly instructed to drive with utmost care by swearing to abide by the traffic rules, especially the speed limit, and the "Pedestrians First" rule, and they were understood that they would be discharged on the spot when they should violate the rules after having them acknowledge the penalties clearly given in the employment contract.

Although drivers were not publicly recruited, a large number of applicants with recommendations either by themselves or others (more than 100 in the fourth year study) visited the JICA Study Team Office. A self-appointed chairman of a drivers' labor union came to the office and offered to act an agent for recruiting drivers, which was, however, cordially declined. We were able to recruit necessary drivers following the advice from the local staff of the JICA Bangladesh Office.

Although it was clearly stated in the employment contract that wages would be paid on a daily basis and the form of employment was a short-term, temporary employment, the hired drivers unexpectedly asked for bonus in a group in a manner close to force when the contract terminated, though the contract had no mentioning of bonus. However, the discharge of the hired drivers ended safely without causing any serious trouble.

The staff in charge of maintaining the vehicles and spare parts rightly take the credit for the fact that all the 21 vehicles functioned normally in good conditions all though the study operations since they never failed to pay attention to the maintenance of the vehicles before departure and after returning from the duty and also never failed to provide adequate instructions about careful driving to individual drivers.

3-6 Continuing the Tidal Observation Work

In our tidal observation work we gave guidance (including technology transfer) to the SOB counterparts each time we carried out work such as selecting sites for installing tidal observation stations, construction work, installing tide gauges, observing tide levels, testing equipment, analyzing data, and arranging data. During this time, observations were temporarily interrupted by the occurrence of events such as unforeseen equipment malfunction and the collapse of the auxiliary tide gauge station. Accidents and faults are undesirable as they have a direct effect on the quantity of data for determining mean sea level. But thanks to the efforts of all those concerned such effects were kept down to the absolute minimum in the final results. However, the fact that, owing to the occurrence of such unexpected circumstances, we exceeded the scope of normal manual-based guidance or technology transfer, and physically demonstrated specific methods of coping with each individual situation that actually arose, was a great achievement over and above the determination of mean sea level. Those in charge at the SOB have amassed valuable experience and this will be a great source of confidence to them in future as they proceed with their own maintenance and continuation of the tidal observation station and tide level observations.

(1) Matters to be borne in mind by SOB when continuing tidal observation work

1) The present system of observation should be strictly adhered to.

2) Data (e.g. monthly and yearly tabulations) should be kept in good condition.

3) Regular maintenance should be observed.

(i) Cleaning of observation wells and water inlets.

(ii) Reference level check, direct levelling (TBM-SM)

(iii) Replacing silica-gel, lubricating gear parts, refilling ink

(iv) Simultaneous comparative observation (tide pole, tide gauge)

(v) Replacing memory cassettes and back-up batteries

4) Correct processing and evaluation of data

The tidal observation work by the Study Team came to an end and we determined the mean sea level. This is a tentative figure determined on the basis of tide level observations over a relatively short period. The present mean sea level has been analyzed and computed in the period of about two years, thus in order to verify whether it accurately reflects seasonal, annual and other long-term changes in tide levels, we hope that observations will be continued for five years at the very least and that the figure for the mean sea level will thereby be reassessed.

5) Setting various datum planes

After data have been accumulated for at least five years, while the figure for the mean sea level will of course be revised, we also hope that the various datum planes listed below will be set using methods such as harmonic analysis, and that tide level observations will be made widely available for public use.

(i) Mean sea level (basic datum plane)

(ii) Absolute maximum tide level

(iii) Near maximum (minimum) high tide (low tide) levels

(iv) Absolute minimum tide level

(v) Construction datum planes

These various datum planes, as well as providing key data for disaster prevention, safety of shipping navigation, hydrographic charts, infrastructure improvement, design standards for coastal structures, and the like, will also be vital data for monitoring issues such as ground fluctuations and increases in water level over the medium/ long term. In addition, these datum planes produced from tide level observations are expected to be utilized whenever new developments take place in future in sectors such as cultivating fishery resources, or power generation using tide level differential in coastal areas that feature some of the largest tide level differentials in the world.

6) Constructing a network of tidal observation stations and tide gauge stations, and enhancing the management system

In this country, an "aquatic nation", large and small rivers are scattered in criss-cross formation even in inland areas, and in the rainy season water levels rise so high that major calamities sometimes occur. Also, in the dry season there are years when farm crops fail because of decreased water levels, water shortages, and drought. Scenes of farming people hit by such uncontrollable rises and falls in water levels are repeated year by year. Water penetrates lowland areas not only from the upper reaches but also from river basins during cyclones, thus farm land is subject to salt damage and suffers irreparable damage.

Since the lives of the people of Bangladesh are inseparable from water, some water level observatories have been set up. But these are far from adequate. The conventional way of thinking has not been one of controlling water but rather of applying knowledge on the use of water, thereby controlling it. While one would expect this to be conditional on a good knowledge of the flow of water, in reality the observation system is inadequate and greater efforts should be made to enhance it.

The Bangladesh Inland Water Transport Authority (BIWTA) maintains and manages water level observatories that severally monitor water level fluctuations in the country's major rivers, as well as issuing information on water levels. The contribution of tide and water level observations to disaster prevention is in assessing the phenomenon of wave-form effects from rises or falls in water levels, and great effects can be obtained by unifying the data.

The height correlation between the tidal observation station and the water level observatory constructed in this study should be clarified, data should be uniformly managed in future using a telemeter or similar, and information should be provided at an early stage.

7) Enhancing training of tide observation experts

In our tide observation work, we have attempted technology transfer to one SOB officer in both technical and theoretical aspects. However, it is a fact that if a malfunction were to occur in the absence of this officer, it could not be put right. This is not adequate as maintenance management. Since the tidal observation counterpart officer already has enough expertise, we think it a pressing task that a number of officers be trained.

Furthermore, it is to be hoped that BIWTA and the Chittagong Mongra Port Authority will exchange data and that exchanges will be planned with the purpose of improving technical levels amongst the officers.

3-7 Improving and Maintaining the Geodetic Network

1) Developing the control point surveying network in future

Ideally, a country's geodetic control point network should be constructed uniformly and to the same accuracy for the whole of the country's territory. A request for aid has been received from the SOB side with regard to the remaining three-tenths of the national land besides the area in which this study has been implemented. Covering the whole country with a cohesive control point network and contributing to the development of the national land and countermeasures against floods will be of great significance, quite apart from its economic effects. It is also understood to be absolutely vital in terms of the government of the country as well.

2) Publishing the results of control point surveying

We have installed 140 GPS control points and 461 first order bench marks in Bangladesh. The result is that we have completed surveying to the highest level of accuracy available in the world (as far as a geodetic control point network for a single country is concerned). The surveying results will be of significance if publicly announced and used in various ways. Therefore, domestic laws must be arranged to allow "surveying results", "point description", and other aspects to be used with ease in a large number of ways, and urgent action is required to his end from the SOB side.

During the study period, we received enquiries from a number of sources (such as UN organizations and those implementing flood action plans) on the use of the surveying results, and it is hoped that these results will be made publicly known.

Though this problem is one that concerns the domestic situation in Bangladesh, steps should be taken to reach an early solution.

3) Maintenance of control points

The control point network distributed throughout Bangladesh will be a vital scientific and cultural asset for the country. And long-term maintenance of control points, will be one of the most important tasks for the SOB in that they hold key data indispensable to surveying for the prevention of floods and disasters and the comprehensive development of the national land.

To be specific, it will need to prepare regulations on the maintenance of control points and to formulate long-term maintenance plans. For example, as concerns methods of restoration in the event of loss of control points due to flooding etc., or methods of building additionally required control points, one possible method would entail requests made to Japan for the dispatch of surveying experts, who would then create a system for maintenance after studying the issue jointly with the SOB.

4. BENCH MARK AND CONTROL POINT RESULTS

1) BENCH MARK POINT RESULTS

2) CONTROL POINT RESULTS

(1) WGS-84

(2) EVEREST (1830)

1) BENCH MARK POINT RESULTS

RESULT OF 1st ORDER LEVELLING

STANDARD DATUM
OF
LEVELLING

303= 6.4292m

1995

*** FINAL RESULT OF LEVELLING ***

(ROUTE NO.) B.M NO.	DIST. KM	ELEVATION M
(1)		
501		4.9670
	5.269	
6001		4.5022
	6.625	
502		5.2049
	6.165	
503		24.6918
	4.246	
504		7.7137
	5.732	
6002		5.5578
	5.659	
505		5.3961
	3.726	
6003		7.9626
	6.672	
506		5.0929
	4.162	
6004		8.3475
	6.031	
507		7.3285
	5.138	
6005		10.8020
	4.956	
508		11.1061
	5.339	
6006		12.3690
	4.212	
509		14.1988
	4.619	
FM 0719		13.3887
	3.648	
6007		17.0830
	5.465	
510		27.3458
	2.122	
6008		35.6071
	4.442	
511		16.3689
	4.056	
FM 0727		46.0964
	2.189	
6009		27.9920
	3.872	
512		6.4085
	5.811	
6010		6.5502
	5.248	
513		9.4613
	4.445	
6011		6.6283
	4.849	
514		6.2042
	5.453	
6012		5.8000
	4.309	
515		7.3217
	4.934	
6013		8.4958
	5.232	
516		7.2897
	5.654	
6014		6.9170
	6.906	
517		8.8680
	1.158	
GPS 3972		8.2532
	3.050	
6015		8.9562
	6.430	
518		6.8042
	4.139	
6016		9.5039
	4.963	
519		10.6684
	4.951	
6017		8.0856
	4.855	
520		7.6550
	4.884	
6018		7.3850
	5.111	
521		10.2952
	4.042	
6019		6.7855
	5.094	
522		7.0471
	2.436	
GPS 3899		7.8552
	3.236	
6020		8.2310

(ROUTE NO.) B.M NO.	DIST. KM	ELEVATION M
(1)		
6020		8.2310
	4.773	
523		6.6985
	4.207	
6021		6.5078
	4.907	
524		7.5015
	4.514	
6022		6.6041
	4.040	
GPS 3891		7.5678
	1.441	
525		6.8548
	4.351	
6023		6.8292
	3.672	
526		6.3367
	3.741	
6024		6.7427
	3.428	
527		6.6118
	3.500	
6025		6.6730
	3.429	
528		6.8741
	4.910	
6026		6.4704
	5.106	
529		6.6943
	5.729	
6071		7.3520
	5.862	
573		8.2102
(2)		
573		8.2102
	4.945	
6027		7.1394
	4.018	
530		6.8541
	3.669	
6028		6.5784
	0.512	
6028-1		6.5107
	2.300	
531-1		5.9725
	1.701	
531		7.6155
(3)		
531		7.6155
	4.174	
6029		7.1036
	5.682	
532		7.5129
	4.828	
6030		11.0237
	4.427	
533		9.8910
	5.820	
6031		6.4866
	4.917	
534		5.7366
	5.401	
6032		7.0542
	6.450	
535		7.8155
	5.634	
6033		6.1054
	5.522	
536		6.9512
	4.082	
6034		6.8367
	5.923	
537		6.1883
	5.088	
6035		6.8008
	3.763	
538		7.2401
	4.660	
6036		7.3705
(4)		
6036		7.3705
	5.425	
6037		7.5585
	6.721	
539		6.4292

(ROUTE NO.) B.M NO.	DIST. KM	ELEVATION M
(4)		
539		6.4292
	6.438	
540		7.8789
	2.907	
541		6.9231
(41)		
539		6.4292
	0.012	
A		6.5647
(42)		
539		6.4292
	0.012	
B		6.5662
(43)		
A		6.5647
	0.016	
B		6.5662
(5)		
541		6.9231
	4.838	
6038		6.1322
	4.545	
542		5.5282
	5.792	
6039		6.0089
	4.761	
543		5.9064
	5.189	
6040		5.9431
	3.719	
544		6.9665
	5.989	
6041		5.3430
	4.384	
545		5.5503
	3.216	
6042		5.2993
	2.356	
6043		5.2032
	4.948	
546		5.3223
	2.992	
6044		5.3481
	3.247	
547		4.6417
	5.401	
6045		4.7758
	5.387	
548		4.7864
	5.467	
6046		4.6764
	6.282	
549		4.6810
	4.563	
6047		4.7400
	0.930	
FM 1502		5.3024
	2.667	
550		5.1642
	5.062	
6048		5.0746
	3.739	
551		5.0013
	5.368	
6049		4.6797
	5.008	
552		4.7456
	4.963	
6050		4.7584
	4.954	
553		4.0768
	5.066	
6051		4.2790
	4.842	
554		4.8388
	4.829	
6052		4.8375
	5.388	
555		4.1779
	5.810	
6053		3.7275
	4.350	
556		5.6477

(ROUTE NO.) B.M NO.	DIST. KM	ELEVATION M
(5)		
556		5.6477
	4.794	
6054		4.2829
	6.263	
557		4.0700
	4.660	
6055		3.9512
	4.746	
558		4.0630
	3.810	
6056		4.7871
	7.108	
559		4.8523
	5.217	
6057		4.9453
	5.961	
560		5.1141
	3.663	
6058		6.2878
	5.980	
561		5.0765
	4.595	
6059		5.7057
	4.516	
562		7.1314
	5.311	
6060		7.0054
	4.606	
563		6.5267
	4.594	
6061		9.2534
	4.788	
564		6.4149
	6.867	
6062		6.5513
	6.684	
565		8.5649
	5.380	
6063		8.9390
	4.771	
566		5.9640
	3.595	
6064		5.7687
	5.735	
567		5.5342
	5.800	
6065		7.5915
	5.938	
568		7.0992
	5.062	
6066		8.5503
	5.747	
569		7.2724
	4.378	
6067		8.5736
	4.319	
570		6.3001
	4.495	
6068		6.3830
	4.811	
571		8.4805
	6.023	
6069		5.0688
	5.327	
572		3.9427
	5.934	
6070		4.5069
	5.611	
501		4.9670
(6)		
573		8.2102
	5.711	
6072		7.4076
	5.246	
574		7.5896
	6.019	
6073		6.6861
	5.170	
575		6.7031
	4.824	
6074		6.6919
	3.434	
576		8.7254
	5.125	
6075		25.6673
	5.214	
577		54.5371
	5.783	
6076		32.2475
	4.454	
578		17.6755

(ROUTE NO.) B.M NO.	DIST. KM	ELEVATION M
(6)		
578		17.6755
	2.385	
GPS 2498		15.6964
	3.341	
6077		13.2180
	5.743	
579		10.0429
	5.580	
6078		9.9523
	5.486	
580		21.1494
	5.341	
6079		43.5150
	5.038	
581		14.7681
	6.007	
6080		9.8840
	5.399	
582		10.1384
	4.999	
6081		13.2822
	5.562	
583		9.2976
	5.144	
6082		7.7717
	5.042	
584		10.7044
	6.266	
6083		10.1303
	4.642	
585		9.5088
	5.168	
6084		8.5582
	5.432	
586		8.8528
	5.292	
6085		9.5837
	5.534	
587		9.2588
	5.495	
6086		9.5947
	3.483	
588		10.0818
	5.329	
6087		10.1278
	4.307	

(ROUTE NO.) B.M NO.	DIST. KM	ELEVATION M
589		10.9005
	4.940	
6088		10.7580
	6.970	
590		11.3803
	5.082	
6089		10.3330
	4.614	
591		10.0588
	5.729	
6090		10.0301
	0.679	
GPS 2454		10.1201
	4.198	
592		9.0067
	5.178	
6091		9.2243
	5.042	
593		9.0594
	5.615	
6092		7.8093
	5.326	
594		8.3462
	5.510	
6093		8.9421
	4.497	
595		7.6606
	3.874	
6094		7.9747
	6.025	
596		8.3632
	5.606	
6095		7.6510
	4.369	
597		7.2704
	5.569	
6096		7.3309
	6.332	
598		7.4039
	5.767	
598-1		6.0011
	5.041	
598-2		6.0094
	4.974	
598-3		3.8850
	5.522	
598-4-1		6.8596

(ROUTE NO.) B.M NO.	DIST. KM	ELEVATION M
(6)		
598-4-1		6.8596
	0.301	
598-4		7.3148
	5.288	
598-5		6.7663
	5.585	
6100		8.1252
	4.774	
601		8.2708
	4.654	
6101		7.9260
	3.876	
602		8.1427
	3.732	
6102		8.0666
	5.937	
603		8.7713
	4.705	
6103		9.0408
	7.454	
604		9.0588
(7)		
604		9.0588
	3.280	
6104		8.2878
	4.720	
605		9.3040
	6.467	
6105		8.6857
	4.343	
606		7.9335
	6.095	
6106		9.2768
	5.510	
607		9.1716
	1.530	
GPS 2227		8.6030
	3.623	
6107		9.4559
	6.129	
608		8.0270
	4.731	
6108		8.0127
	3.537	

(ROUTE NO.) B.M NO.	DIST. KM	ELEVATION M
609		9.2326
	3.064	
GPS 2291		9.7681
	3.965	
6109		8.1910
	5.492	
610		7.3012
	4.469	
6110		8.3632
	6.739	
611		8.1048
	4.665	
6111		9.3284
	3.267	
612		9.2060
	4.991	
6112		8.1596
	5.220	
613		7.1935
	5.983	
6113		7.5322
	4.092	
614		7.3426
	6.305	
531		7.6155
(8)		
604		9.0588
	5.019	
6114		10.3706
	4.789	
615		9.3415
	4.476	
6115		11.0904
	4.646	
616		11.2320
	4.805	
6116		13.1194
	5.971	
617		13.3542
	3.855	
6117		13.5566
	5.334	
618		13.1002
	0.703	
GPS 2127		12.3447

(ROUTE NO.) B.M NO.	DIST. KM	ELEVATION M
(8)		
GPS 2127		12.3447
	6.011	
6118		12.9044
	5.675	
619		12.0523
	5.997	
6119		13.7202
	5.753	
620		13.4106
	4.219	
6120		13.5725
	5.524	
621		13.7067
	4.808	
6121		13.3557
	6.247	
622		15.9123
	6.015	
6122		17.9692
	5.251	
623		17.2051
	6.269	
6123		17.0103
	3.539	
624		17.1872
	5.622	
6124		17.0581
	5.570	
625		17.6630
	1.588	
FM 5904		17.4751
	2.704	
6125		17.8443
	3.436	
FM 5902		16.2520
	2.719	
626		17.4097
	3.738	
6126		17.2871
	4.398	
627		17.5942
	4.029	
FM 5126		17.0643
	3.076	
6127		17.7496
	6.095	

(ROUTE NO.) B.M NO.	DIST. KM	ELEVATION M
628		17.2404
	5.127	
6128		17.0122
	5.139	
629		15.9817
	4.406	
6129		14.3436
	5.901	
630		14.4986
	5.392	
6130		14.1997
	7.227	
631		13.5687
	5.639	
6131		13.3639
	3.591	
632		13.4769
	3.700	
FM 7813		11.8891
	1.339	
6132		12.9238
	5.101	
633		11.7216
	3.427	
6133		11.9377
	4.708	
FM 5802		11.2050
	3.070	
634		11.9774
	5.124	
GPS 481		11.2468
	0.697	
635		11.7758
(9)		
635		11.7758
	4.701	
6134		11.2044
	2.001	
FM 7902		12.5470
	3.635	
636		10.7632
	3.713	
FM 7903		10.4034
	1.776	
6135		10.6774

(ROUTE NO.) B.M NO.	DIST. KM	ELEVATION M
(9)		
6135		10.6774
	4.097	
FM 7904		11.0306
	1.815	
637		10.9474
	2.974	
FM 7905		10.4079
	2.797	
6136		9.8179
	2.964	
FM 7906		9.7773
	1.544	
638		9.8541
	2.228	
FM 7907		9.5841
	3.253	
GPS 2110		9.4878
	0.268	
6137		9.6228
	2.675	
FM 7908		10.0699
	1.624	
639		9.5184
	1.311	
FM 7909		9.3776
	2.888	
FM 7910		10.1605
	1.478	
6138		10.6525
	4.279	
640		11.6779
	5.102	
6139		11.5309
	1.547	
FM 7914		8.6346
	1.473	
641		12.1919
	1.816	
GPS 2200		12.7642
	4.219	
6140		7.9049
	6.095	
642		11.7368
	5.040	
6141		8.7602
	6.511	
6036		7.3705
(10)		
635		11.7758
	0.571	
FM.GPS726		12.3119
	2.841	
FM 5102		12.5010
	2.307	
6142		11.6788
	0.479	
FM 5103		11.5976
	2.978	
FM 5104		12.4822
	2.348	
FM 5105		13.0714
	0.598	
643		13.5275
	2.292	
FM 5106		13.0374
	2.380	
FM 5107		13.0634
	0.131	
6143		13.8729
	5.400	
644		14.2746
	1.147	
TBM 6144		9.3356
	0.100	
6145-2		8.7851
	3.320	
6145		15.2546
	0.558	
6145-1		13.9408
	2.300	
6146-1		13.7695
	0.422	
6146		13.2774
	2.493	
6147		15.1570
	1.143	
6147-1		15.0174
	2.300	
645-1		15.6019
	0.193	
FM 7201		13.2957

(ROUTE NO.) B.M NO.	DIST. KM	ELEVATION M
(10)		
FM 7201		13.2957
	0.491	
645		13.8251
	5.754	
FM 6905		13.8907
	0.306	
6148		13.9719
	3.340	
FM 6904		13.5847
	2.024	
646		13.1494
	1.302	
FM 6903		13.3518
	3.902	
6149		12.6335
	4.446	
647		12.9395
	5.225	
6150		12.3150
	5.875	
648		12.8180
	5.257	
6151		13.3280
	2.437	
FM 6718		14.0031
	2.791	
649		14.4654
	3.501	
FM 6720		14.8480
	0.710	
6152		15.8426
	2.095	
FM 6721		15.4579
	3.002	
FM 6722		15.7673
	0.239	
650		16.4248
	5.598	
FM 6723		16.6316
	0.262	
6153		16.2680
	2.256	
FM 6724		16.6145
	3.220	
651		16.9864
	3.035	

(ROUTE NO.) B.M NO.	DIST. KM	ELEVATION M
FM 6726		17.3731
	2.162	
6154		18.9694
	0.986	
FM 6727		16.3825
	2.647	
FM 6728		17.3815
	2.636	
GPS 1830		18.7859
	0.117	
652		18.2873
(11)		
652		18.2873
	5.493	
6155		17.2271
	2.845	
FM 8028		17.9129
	1.279	
653		16.9566
	1.533	
FM 8029		17.0447
	2.815	
6156		17.3887
	6.462	
654		15.9355
	1.658	
FM 8030		15.6500
	2.936	
FM 8031		14.7826
	2.303	
6157		14.2080
	3.102	
655		14.4228
	3.640	
GPS 1759		13.5711
	3.506	
6158		12.6410
	5.094	
656		13.3493
	6.082	
6159		13.6295
	2.275	
657		12.6089
	4.668	
6160		12.1596

(ROUTE NO.) B.M NO.	DIST. KM	ELEVATION M
(11)		
6160		12.1596
	4.349	
658		13.0349
	4.972	
6161		13.5273
	1.107	
GPS 1776		14.4244
	2.521	
659		14.0289
(12)		
659		14.0289
	4.587	
6162		14.0757
	4.067	
660		14.1624
	4.851	
6163		13.8365
	5.364	
661		13.1941
	4.891	
6164		12.2289
	6.596	
662		11.7740
	4.155	
6165		11.4881
	3.214	
663		13.2282
	4.817	
6166		13.4977
	5.524	
664		13.8902
	5.040	
6167		13.5904
	2.032	
FM 8236		22.3685
	2.343	
FM 8235		14.2026
	2.140	
665		16.3931
	0.566	
FM 8234		16.9218
	4.516	
FM 8233		13.1989
	0.880	
6168		14.1270
	2.206	
FM 8232		13.6448
	1.905	
666		14.0702
	1.304	
FM 8231		14.8277
	3.018	
FM 8230		13.6909
	0.530	
6169		12.3979
	2.452	
FM 8229		12.6029
	2.771	
667		13.3434
	0.439	
FM 8228		13.0527
	3.727	
6170		13.8107
	6.329	
668		12.6980
	5.934	
6171		12.3496
	4.827	
669		9.6575
	5.067	
6172		11.5939
	4.262	
670		8.0098
	4.514	
6173		10.2361
	5.663	
671		9.9902
	4.078	
6174		8.7468
	6.004	
672		8.3185
	5.716	
6175		7.5629
	2.293	
673		6.8692
	5.954	
6176		7.7423
	4.869	
674		6.8923
	5.085	
GPS 2759		6.5398

(ROUTE NO.) B.M NO.	DIST. KM	ELEVATION M
(12)		
GPS 2759		6.5398
	0.574	
6177		7.1379
	4.722	
675		7.8557
	4.357	
6178		8.8411
	5.913	
FM 6411		9.6368
	1.314	
676		9.2268
	1.700	
FM 6412		9.0871
	3.144	
6179		8.1065
	5.139	
677		7.7694
	5.186	
6180		7.1836
	5.495	
678		7.3912
	5.751	
6181		7.6735
	0.065	
GPS 2903		7.5537
	4.570	
679		8.3859
	4.429	
6182		7.5280
	5.589	
680		8.4534
	4.442	
6183		7.7724
	3.503	
681		8.3517
	4.326	
6184		8.1994
	2.390	
682		9.2908
	4.397	
6185		10.6729
	1.088	
6185-3		7.9668
	5.100	
683-3		8.5669
	0.018	

(ROUTE NO.) B.M NO.	DIST. KM	ELEVATION M
683		9.3246
	3.127	
6186		10.0841
	4.218	
684		9.9545
	5.550	
6187		9.7472
	5.081	
685		11.8169
	5.053	
6188		10.5548
	5.168	
686		9.4729
	4.991	
6189		8.3273
	5.271	
687		8.5714
	1.049	
FM 8131		7.5810
	2.756	
FM 8132		6.9384
	2.220	
6190		8.7962
	0.981	
FM 8133		7.3865
	3.387	
688		8.4402
	5.321	
6191		7.8284
	5.543	
689		11.8274
	5.182	
6192		8.3695
	1.179	
GPS 3398		10.0411
	3.180	
690		7.7353
	5.320	
6193		6.3383
	6.110	
691		6.6213
	4.617	
6194		7.1006
	7.162	
541		6.9231

(ROUTE NO.) B.M NO.	DIST. KM	ELEVATION M
(13)		
652		18.2873
	7.673	
6195		19.7224
	2.878	
FM 8025		18.4695
	1.325	
692		18.4782
	1.614	
FM 8024		19.6116
	2.859	
FM 8023		18.3691
	0.617	
6196		18.1109
	2.299	
FM 8022		18.4576
	1.524	
693		18.3851
	4.112	
6197		19.4990
	0.153	
FM 8021		19.9518
	2.475	
FM 8020		19.6607
	2.617	
FM 8019		20.0264
	0.507	
694		20.2640
	1.992	
FM 8018		20.9126
	2.325	
6198		20.6130
	0.783	
GPS 1612		20.8514
	5.954	
695		20.4305
	1.798	
FM 8017		21.5269
	3.188	
FM 8016		21.9207
	0.898	
6199		21.8308
	2.338	
FM 8015		22.3500
	2.535	
696		22.8132
	5.777	
6200		23.5113
	4.891	
697		25.2999
	2.415	
FM 8011		25.2185
	2.465	
6201		24.4680
	5.930	
698		27.9966
	5.806	
6202		28.2261
	1.891	
FM 8006		27.6920
	1.421	
699		28.1436
	4.715	
GPS 1585		28.7147
	2.030	
6203-1		29.3658
	5.542	
700		30.0926
	4.822	
6204		29.9014
	3.571	
FM 8032		30.2612
	0.642	
701		31.3199
	4.346	
6205		32.5753
	4.440	
702		33.8139
	4.619	
6206		36.1423
	4.640	
703		36.5343
	4.777	
6207		34.7472
	5.462	
704		34.2239
	5.085	
6208		34.2132
	5.168	
705		35.0537
	5.435	
6209		35.1660

(ROUTE NO.) B.M NO.	DIST. KM	ELEVATION M
(13)		
6209		35.1660
	5.773	
706		37.7537
	5.139	
6210		36.6394
	4.527	
707		36.1301
	5.379	
6211		34.8321
	5.131	
708		35.1099
	3.343	
734		34.5055
	3.960	
6212		33.9949
	3.804	
709		34.7516
	5.840	
6213		32.8624
	5.656	
710		32.7867
	4.134	
6214		31.6601
	3.265	
711		31.4734
	3.316	
GPS 1217		32.0478
	4.399	
6215		31.6017
	4.911	
712		30.5871
	5.426	
6216		29.7309
	5.387	
713		29.8833
	5.156	
6217		27.9905
	5.800	
714		26.8513
	5.558	
6218		24.5223
	5.840	
715		24.7944
	5.527	
6219		23.3565
	3.840	
716		23.1855
	5.630	
6220		20.9278
	7.253	
717		19.0313
	5.241	
6221		18.9514
	6.164	
718		19.0939
	5.824	
6222		18.3812
	6.337	
719		16.5421
	4.743	
6223		15.6914
	5.850	
720		15.4639
	3.698	
6224		14.9538
	2.594	
721		14.7635
	3.418	
6225		14.8651
	5.245	
722		15.0821
	6.545	
6226		15.5030
	5.024	
723		16.1479
	4.606	
6227		16.4112
	4.616	
724		16.7684
	3.226	
6228		16.1933
	5.632	
725		15.6195
	5.148	
6229		14.9729
	4.853	
726		15.2695
	4.910	
6230		15.8711
	5.697	
727		16.5484
	5.660	
6231		16.7411

(ROUTE NO.) B.M NO.	DIST. KM	ELEVATION M
(13)		
6231		16.7411
	2.403	
728		16.4423
	3.145	
6232		16.8089
	8.325	
729		18.4896
	4.657	
6233		17.8949
	5.461	
730		15.2650
	5.550	
6234		16.9791
	5.034	
731		14.4882
	3.400	
6235		16.6790
	4.872	
732		15.1938
	4.279	
6236		14.9474
	4.170	
733		14.9294
	4.297	
659		14.0289
(14)		
TBM		7.5766
	0.026	
TBM-1		4.5170
	5.100	
501		4.9670

END OF FINAL RESULT REC COUNT= 615

2) CONTROL POINT RESULTS

(1) WGS-84

(2) EVEREST (1830)

RESULT OF CONTROL POINT

「WGS-84」

◎X (Three dimensional Cartesian coodinates system)
◎Y 〃
◎Z 〃
◎Latitude
◎Longitude
◎Ellipsoid Height
(WGS-84 Ellipsoid)

1995

No.	POINT NAME	W X	G Y	S Z	8 Latitude	4 Longitude	Elip. H WGS-84
		m	m	m	ddmmss. sssss	dddmmss. sssss	m
1	117_LOHAGARA	163812. 664	5732176. 171	2782759. 403	260213. 71457	882147. 02104	-1. 13
2	131_GOFFARGAON	-56144. 374	5809085. 195	2623944. 005	242708. 00216	903313. 47187	-41. 09
3	181_KALI_KACHCHA	-113975. 206	5824531. 370	2587807. 552	240539. 66070	910715. 70216	-46. 61
4	193_DUPITILA	-215299. 246	5775531. 495	2688743. 757	250546. 20378	920805. 54442	43. 20
5	199_BHATURIA	82179. 515	5867995. 581	2489596. 532	230735. 66447	891151. 51220	-50. 39
6	231_CHAPANI	96548. 273	5730032. 717	2790256. 702	260644. 95989	890204. 86686	-2. 51
7	242_N. KASHADAHA	18197. 267	5837806. 162	2560381. 153	234924. 14019	894917. 04553	-45. 98
8	261_JARIA	-65522. 147	5783234. 463	2679850. 814	250028. 47734	903856. 81253	-42. 06
9	280_GRAGONJ	81611. 488	5844332. 411	2544317. 964	233953. 70784	891159. 86204	-44. 46
10	288_GOIBARI	34751. 537	5730594. 345	2790519. 614	260654. 72392	893909. 18191	-18. 19
11	295_PAKIBAR_TILA	-195333. 079	5796566. 625	2644847. 886	243934. 26081	915548. 09566	5. 69
12	303_GULSHAN	-42358. 282	5838825. 444	2557788. 698	234752. 02714	902456. 34024	-45. 45
13	333_KAKONHAT	154843. 085	5804800. 839	2629451. 001	243024. 44304	882819. 18996	-26. 08
14	343_SUNAMGONJ	-140555. 550	5779289. 503	2685434. 230	250348. 74048	912335. 48664	-41. 47
15	350_KASHDAH	48217. 422	5759696. 621	2730130. 469	253034. 99436	893113. 29015	-27. 85
16	355_CHATMOHAR	72304. 419	5818958. 443	2601723. 611	241355. 34543	891717. 15485	-42. 40
17	369_AGRABAD	-176226. 050	5815457. 414	2604601. 198	241537. 71818	914408. 53893	-28. 46
18	380_DUPCHANCHIA	83558. 602	5789321. 781	2666273. 911	245221. 78458	891023. 13971	-37. 22
19	388_DINAJPUR	137478. 356	5752990. 896	2741158. 085	253712. 10429	883751. 85896	-18. 74
20	395_BANIACHUNG	-136231. 997	5803994. 993	2632189. 760	243202. 58690	912040. 58098	-46. 82
21	430_NITPUR	155808. 485	5780728. 297	2681552. 367	250129. 27983	882721. 87198	-27. 48
22	456_POER_BARI	12954. 109	5788911. 106	2668431. 208	245339. 05070	895218. 43266	-35. 89
23	481_ICHAPUR	7496. 357	5814442. 025	2612716. 673	242027. 34011	895534. 07015	-42. 71
24	1009_TITALYA	165435. 212	5709854. 229	2827965. 149	262931. 11068	882025. 43099	35. 86
25	1055_BOALMARI	136552. 139	5722363. 118	2804234. 670	261510. 81757	883758. 85894	14. 43
26	1072_SONAHAR	125840. 636	5732250. 257	2784571. 655	260319. 24913	884432. 57627	-. 50
27	1099_BALAPARA	109792. 668	5724754. 417	2800542. 087	261257. 12248	885404. 61854	10. 19
28	1109_HARIPUR	187639. 072	5741577. 350	2761899. 655	254940. 23345	880741. 50907	-16. 73
29	1126_RANSHIA	167739. 902	5745934. 918	2754162. 812	254500. 98434	881940. 26338	-15. 06
30	1144_MUKANDAPUR	149246. 132	5743001. 691	2761295. 440	254918. 34168	883040. 90401	-11. 69
31	1180_NILPHAMARI	113777. 792	5738754. 176	2771735. 206	255535. 31143	885151. 08467	-7. 39
32	1190_SAIDPUR	109824. 950	5746222. 535	2756467. 182	254624. 11273	885418. 23406	-13. 94
33	1217_BAJITPUR	114622. 251	5758566. 559	2730544. 373	253049. 81007	885134. 91334	-22. 18
34	1234_DHAMUIRHAT	115772. 555	5775693. 447	2694300. 536	250906. 81352	885106. 01915	-32. 47
35	1252_BHOLAHAT	179708. 468	5784130. 164	2672759. 730	245614. 07593	881313. 57222	-30. 21
36	1279_ROHANPUR	169423. 183	5789970. 456	2660845. 135	244907. 21474	881926. 10547	-27. 92
37	1298CHAPAINAWABGA	174575. 224	5800252. 648	2638159. 977	243535. 73805	881633. 74319	-33. 70
38	1325_MOHADEBPUR	126725. 767	5786386. 729	2670910. 732	245507. 89775	884443. 38385	-35. 94
39	1333PARBATIPURADA	-144270. 453	5790056. 492	2662120. 093	244952. 94204	883421. 57675	-32. 75
40	1369_PABA	140795. 967	5809360. 255	2620187. 909	242453. 87173	883641. 93355	-38. 20
41	1387_SANTAHAR	102161. 961	5791957. 159	2659930. 583	244834. 65245	885922. 15676	-40. 16
42	1406_BAGMARA	120760. 937	5803231. 637	2634631. 491	243329. 70190	884828. 40207	-38. 16
43	1433_ARANI	113689. 381	5815615. 060	2607683. 808	241727. 76743	885248. 24559	-37. 94
44	1468_BHERAMARA	102666. 723	5828037. 882	2580442. 277	240117. 39214	885926. 81470	-39. 73
45	1477_JAGATBER	97195. 060	5719020. 500	2812608. 579	262014. 43243	890134. 85601	7. 24
46	1495_CHANDRAPUR	73493. 130	5735753. 547	2779231. 927	260006. 36241	891557. 24060	-13. 69
47	1504_RANACHANDI	94545. 085	5738998. 837	2771943. 025	255542. 86805	890322. 27152	-10. 42

No.	POINT NAME	W G S 8 4 X	Y	Z	Latitude	Longitude	Elip. H WGS-84
		m	m	m	ddmmss.sssss	dddmmss.sssss	m
48	1522_NAWABGANJ	93469.422	5763420.947	2721146.495	252511.59840	890415.15284	-26.03
49	1549_JOYPURHAT	97539.174	5778137.817	2689803.993	250625.42981	890158.43055	-34.08
50	1558MAHENDRANAGAR	56182.473	5742345.287	2766067.134	255210.76193	892621.99226	-19.87
51	1568_KOBARU	76474.599	5744999.498	2760107.388	254835.55284	891414.46682	-17.89
52	1585_MITHAPUKUR	72579.226	5756480.132	2736333.959	253418.37092	891639.49648	-24.65
53	1612_GOBINDAGANJ	61736.352	5777362.330	2692512.437	250802.63068	892315.95752	-33.12
54	1649_KURIGRAM	35973.978	5745603.349	2759663.937	254819.64450	893828.56580	-24.15
55	1658_NARSINGBANJ	34734.935	5755423.445	2739268.783	253604.16979	893915.17280	-28.37
56	1668_KANCHIPARA	40171.375	5768834.681	2711021.341	251907.51428	893603.69486	-30.92
57	1685_MADARGANJ	20107.533	5738442.648	2774588.012	255718.63137	894757.25000	-22.07
58	1695_RAHUMARI	17503.318	5756741.108	2736681.894	253430.95387	894932.85570	-27.76
59	1713_DIGRIRCHAR	18357.777	5768230.836	2712529.857	252001.75836	894903.55078	-31.45
60	1722_BAKSHIGONJ	13226.234	5774958.150	2698302.464	251130.51042	895207.59798	-32.10
61	1759_RANBAGHA	77184.684	5802319.848	2638242.155	243538.78918	891416.34828	-41.35
62	1776_DIGHAPATIA	100372.326	5809178.963	2622427.935	242613.87068	890036.46397	-40.75
63	1803_LALPUR	105644.374	5820928.568	2596215.798	241039.02337	885736.89886	-39.06
64	1821_PABNA	78727.509	5829077.928	2578940.444	240023.97386	891334.35750	-41.24
65	1830_BOGRA	63263.468	5790781.613	2663682.551	245048.94143	892226.67590	-35.63
66	1857_TARAS	63745.885	5810230.798	2621247.489	242531.75523	892217.09417	-42.39
67	1884_SHARIAKANDI	43104.997	5788800.827	2668351.490	245336.21207	893424.12411	-37.06
68	1902_KAZIPUR	35783.576	5799309.853	2645692.803	244005.13734	893847.29707	-38.51
69	1911_DHANGORA	47613.894	5805650.048	2631652.346	243143.30055	893148.39781	-40.97
70	1921_SIRAJGANJ	28677.837	5808679.722	2625278.200	242755.62875	894301.66523	-40.29
71	1956_SATBARIA	37490.418	5819852.264	2600465.454	241310.51307	893751.29845	-43.08
72	1992_POELSA	7632.305	5801557.031	2641022.624	243718.15255	895528.64612	-39.24
73	2010_BELTA	12704.359	5820079.074	2600199.252	241301.02340	895229.75559	-42.91
74	2019_BANI	5216.867	5826277.688	2586396.032	240449.37161	895655.30989	-44.25
75	2037_HALUAGHAT	-33958.202	5778388.860	2690801.807	250701.30749	902012.15473	-38.35
76	2064_NOKLA	-18280.270	5785369.586	2676016.611	245810.91951	901051.74122	-36.77
77	2073_ARANKHOLA	-11872.351	5799163.421	2646232.762	244024.40369	900702.27552	-35.47
78	2091_KACHUA	-20724.731	5814167.327	2613271.488	242047.01960	901215.23246	-35.04
79	2110_MIRZAPUR	-9404.598	5825263.166	2588652.352	240609.71139	900533.00399	-44.58
80	2127_RUPCHANDPUR	-44610.835	5792484.938	2660365.196	244850.21976	902628.51743	-40.56
81	2145_PHULBARIA	-30355.737	5801055.511	2641951.057	243751.36723	901759.33169	-40.63
82	2181_SRIPUR	-48630.331	5820675.919	2598463.529	241159.09180	902843.25218	-37.66
83	2200_MAUCHAK	-29899.655	5828759.258	2580676.786	240125.75891	901738.06265	-41.22
84	2227_ATHARABARI	-72718.855	5800621.221	2642067.151	243755.58153	904305.68077	-44.89
85	2272_ATPARA	-86888.721	5792083.331	2660186.442	244843.87874	905134.00608	-44.50
86	2281_TARAIL	-90109.694	5804226.530	2633652.172	243254.83593	905321.97111	-46.73
87	2291_KISHORGANJ	-78780.262	5808746.372	2624104.099	242713.76035	904637.26437	-43.94
88	2300_KATIADI	-81006.906	5817962.538	2603676.345	241504.97680	904751.76035	-44.11
89	2308_BAJITPUR	-97256.145	5819479.133	2599748.046	241244.99791	905726.81235	-46.65
90	2317_BELABA	-86372.700	5824374.324	2589221.342	240629.99137	905058.58473	-45.90
91	2337_BALIJURI	-125780.874	5777548.984	2689875.223	250628.11946	911449.80528	-42.83
92	2373_KANDIGAON	-182594.548	5779103.289	2683318.729	250232.85073	914834.90413	-41.59
93	2381_KAMDARPUR	-117431.991	5788981.161	2665717.226	245201.98936	910943.59716	-46.92
94	2400_MITAMAIN	-106988.175	5809988.362	2620371.542	242500.55344	910317.83917	-46.82

No.	POINT NAME	W X	G Y	S Z	8 Latitude	4 Longitude	Elip.H WGS-84
		m	m	m	ddmmss.sssss	dddmmss.sssss	m
95	2427_DIRAI	-136911.753	5792055.030	2658154.934	244731.15744	912114.74966	-45.27
96	2435_HABIGANJ	-143587.073	5811226.567	2615903.112	242221.07910	912455.47071	-46.46
97	2454_GOBINDAGONJ	-170094.172	5784760.561	2672002.656	245547.11275	914103.23031	-41.47
98	2471_GEAHPUR	-174906.438	5797915.653	2643210.305	243836.44879	914340.52936	-44.41
99	2481_NABIGANJ	-153234.014	5801703.519	2636276.655	243428.61698	913046.57922	-46.49
100	2498_CHUNARUGHAT	-154316.994	5818970.306	2598158.137	241148.21140	913108.78647	-37.78
101	2507_BARUTNI_TILA	-200862.593	5782109.233	2675747.120	245800.25589	915922.47797	29.48
102	2525_LAURAGA_TILA	-179005.786	5807301.271	2622398.766	242612.82671	914555.94830	-40.57
103	2561_BARADI	129084.239	5840928.981	2550128.729	234319.93321	884402.29999	-41.76
104	2597_KALIDASPUR	106949.234	5839173.908	2555131.873	234617.61114	885702.51415	-42.50
105	2615_SABDARPUR	106585.061	5852843.370	2523886.481	232749.15155	885724.16445	-44.04
106	2624_JIBANNAGAR	120121.053	5854603.624	2519217.903	232503.77377	884928.58291	-46.08
107	2661_PIPRAGACHI	103754.661	5873969.191	2474766.242	225851.68952	885917.02725	-47.70
108	2694_NALDANGA	84490.392	5854234.024	2521503.972	232624.78026	891023.31947	-47.41
109	2722_SATBARIA	56895.724	5834706.613	2566832.338	235313.38776	892628.72261	-43.95
110	2759_MAGURA	59769.620	5852525.718	2526138.015	232909.00865	892453.56917	-48.69
111	2795_KASINATHPUR	39756.077	5831742.166	2573836.303	235722.42877	893633.87603	-43.43
112	2813_RAMDIA	47770.246	5842994.286	2548221.799	234212.27543	893153.68976	-44.70
113	2849_NOHATA	48990.399	5859194.288	2510966.842	232011.62154	893115.40114	-49.14
114	2867_BHABANIPUR	46769.561	5867673.058	2491257.687	230834.40926	893235.95645	-52.06
115	2876_BABUPUR	40395.133	5873358.626	2478025.282	230046.84026	893621.39722	-52.05
116	2903_SONPACHA	22632.321	5849850.658	2532888.518	233308.29896	894641.99194	-47.40
117	2930_BANAMALIPUR	26273.401	5860976.123	2507168.514	231757.18701	894435.36876	-50.34
118	2957_BANIARI	5819.064	5873080.105	2479003.810	230121.38663	895635.63231	-50.98
119	3327_GAZIKHALI	-6637.078	5833964.519	2569120.332	235434.75526	900354.65949	-45.68
120	3344_BRAHMANGAON	-7776.949	5844543.488	2545113.828	234022.01456	900434.46284	-48.76
121	3354_BHAGYAKUL	-23297.168	5851358.881	2529418.818	233105.28663	901341.23839	-47.75
122	3398_SAVAR	-26922.684	5836097.697	2564175.310	235138.94550	901551.51986	-44.13
123	3407_SERAJDIKHAN	-37886.788	5848899.296	2534888.280	233419.21862	902216.08076	-47.71
124	3442_PALAS	-64293.487	5830627.002	2575846.826	235833.97648	903754.36023	-45.71
125	3452_GOPALDI	-72875.418	5838187.693	2558544.226	234818.91153	904254.57522	-48.49
126	3469_MUNSHIGANJ	-54968.204	5849850.251	2532394.530	233250.79896	903218.11324	-48.54
127	3479_DAUDKANDI	-72783.375	5850100.813	2531373.943	233214.60722	904246.08814	-48.18
128	3533_NABINAGAR	-98736.243	5834278.376	2566532.669	235302.77339	905810.38336	-46.62
129	3882_AKHAURA	-123375.727	5834631.585	2564677.509	235156.81832	911240.90578	-45.76
130	3891_MIRPUR	-108075.883	5841793.623	2549122.467	234244.25996	910335.55900	-45.42
131	3899_JAFARGANJ	-107492.181	5847982.781	2535012.620	233423.59115	910310.94094	-45.09
132	3908_COMILLA	-120896.806	5852463.962	2524122.433	232757.49763	911100.29281	-42.97
133	3926_LAKSAM	-114642.387	5862453.112	2501272.211	231428.50476	910713.06869	-47.39
134	3953_MOTABI	-112737.009	5873372.514	2475780.774	225927.52318	910558.68340	-48.36
135	3972_CHAUDDAGRAM	-134305.641	5862546.695	2500089.229	231346.61631	911844.51372	-44.57
136	3980_FULGAZI	-146633.215	5865608.732	2492255.431	230909.57556	912555.30015	-44.35
137	4317_MOKITALA	-204082.633	5789759.428	2658870.566	244756.60290	920107.59793	-33.65
138	4334_JURI	-214154.295	5798821.170	2638368.668	243543.32524	920654.03522	-42.29
139	4344_HARARCAJ	-206609.042	5806465.401	2622248.264	242607.28959	920216.33957	-29.45
140	4352_KHARACHARA	-239229.614	5784153.074	2668057.521	245325.67361	922206.14751	-36.65
141	TSN1_TIDAL_STA.	-188123.708	5903585.801	2398653.865	221411.32579	914930.61239	-46.97

変　　換　　定　　数

TRANSFORMATION CONSTANT

(WGS-84 → EVEREST-1830)

「 303 GULSHAN」

(BANGLADESH Origin of Longitude and Latitude)

WGS－84	EVEREST－1830	CONSTANT
m	m	m
X＝ －　42　358.282	X＝ －　42　642.011	ΔX＝－283.729
Y＝ 5　838　825.444	Y＝ 5　838　089.502	ΔY＝－735.942
Z＝ 2　557　788.698	Z＝ 2　557　527.555	ΔZ＝－261.143

(1995)

RESULT OF CONTROL POINT

「EVEREST」

◎Latitude
◎Longitude
◎Orthometric Height
◎Ellipsoid Height
(EVEREST Ellipsoid)

Orth.H
GPS Station, on the 1st order levelling line :0.0001m
GPS Station, linked with B.M. by 3rd order levelling: 0.01m
GPS Station, interpolated from Local Geoid Model : 0.1m

1995

No.	POINT NAME	EVEREST－1830 Latitude ddmmss.sssss	Longitude dddmmss.sssss	Orth.H m	Elip.H Everest m
1	117_LOHAGARA	260211.99798	882156.46738	54.644	41.32
2	131_GOFFARGAON	242705.64825	903323.79922	12.4	12.67
3	181_KALI_KACHCHA	240537.15992	910726.25716	6.824	10.27
4	193_DUPITILA	250543.93158	920816.64314	94.4	103.70
5	199_BHATURIA	230732.99813	891201.12254	5.141	－.95
6	231_CHAPANI	260643.22236	890214.63241	50.7	42.69
7	242_N.KASHADAHA	234921.64462	894926.99052	8.6924	5.26
8	261_JARIA	250026.28593	903907.22937	10.0	11.47
9	280_GRAGONJ	233951.20373	891209.51236	10.558	4.24
10	288_GOIBARI	260652.94477	893919.23463	32.900	29.67
11	295_PAKIBAR_TILA	243931.87225	915559.06326	58.5	65.74
12	303_GULSHAN	234749.48503	902506.55272	8.5344	8.53
13	333_KAKONHAT	243022.24161	882828.56880	29.2	18.44
14	343_SUNAMGONJ	250346.51299	912346.24682	8.9698	15.48
15	350_KASHDAH	253033.03539	893123.23093	25.1	20.04
16	355_CHATMOHAR	241353.00821	891726.88778	12.4	5.95
17	369_AGRABAD	241535.22403	914419.38472	24.975	31.16
18	380_DUPCHANCHIA	245219.65144	891032.86931	17.3	9.86
19	388_DINAJPUR	253710.23892	883801.39687	36.0160	25.23
20	395_BANIACHUNG	243200.20268	912051.27361	5.9	10.56
21	430_NITPUR	250127.23987	882731.28244	27.6	16.39
22	456_POER_BARI	245336.87787	895228.48476	17.5	14.23
23	481_ICHAPUR	242024.99459	895544.10291	11.2468	8.33
24	1009_TITALYA	262929.53982	882034.90352	89.3	77.82
25	1055_BOALMARI	261509.15139	883808.44883	68.5	57.81
26	1072_SONAHAR	260317.51325	884442.20101	53.8	43.51
27	1099_BALAPARA	261255.42656	885414.33053	63.5	54.73
28	1109_HARIPUR	254938.46598	880750.82919	39.6	24.96
29	1126_RANSHIA	254459.17957	881949.67052	40.7	27.53
30	1144_MUKANDAPUR	254916.54747	883050.40230	43.5	31.58
31	1180_NILPHAMARI	255533.52686	885200.75560	46.7	37.26
32	1190_SAIDPUR	254622.27737	885427.91153	40.1	31.04
33	1217_BAJITPUR	253047.89650	885144.54889	32.0478	22.86
34	1234_DHAMUIRHAT	250904.78772	885115.62239	22.1	12.92
35	1252_BHOLAHAT	245612.02354	881322.86698	25.3	12.77
36	1279_ROHANPUR	244905.11905	881935.43922	27.4	15.62
37	1298CHAPAINAWABGA	243533.57547	881643.03806	21.606	9.90
38	1325_MOHADEBPUR	245505.80650	884452.91992	18.9	9.26
39	1333PARBATIPURADA	244950.83466	883431.02640	22.3	11.82
40	1369_PABA	242451.63330	883651.36989	17.1686	7.01
41	1387_SANTAHAR	244832.51174	885931.79694	14.528	6.20
42	1406_BAGMARA	243327.49527	884837.93944	17.0	7.72
43	1433_ARANI	241725.47414	885257.79603	17.3	8.57
44	1468_BHERAMARA	240115.00947	885936.39579	15.218	7.60
45	1477_JAGATBER	262012.76636	890144.63645	59.8	52.19
46	1495_CHANDRAPUR	260004.57437	891607.10439	39.0	32.60
47	1504_RANACHANDI	255541.07126	890332.03186	43.1	35.05

No.	POINT NAME	EVEREST－1830 Latitude ddmmss. sssss	Longitude dddmmss. sssss	Orth. H m	Elip. H Everest m
48	1522_NAWABGANJ	252509. 64160	890424. 87865	28. 0	20. 01
49	1549_JOYPURHAT	250623. 37830	890208. 11395	20. 3131	12. 13
50	1558MAHENDRANAGAR	255208. 92066	892631. 92548	32. 5	27. 30
51	1568_KOBARU	254833. 70662	891424. 30144	35. 160	28. 46
52	1585_MITHAPUKUR	253416. 44764	891649. 33021	28. 7147	22. 12
53	1612_GOBINDAGANJ	250800. 56415	892325. 80665	20. 8514	14. 60
54	1649_KURIGRAM	254817. 76932	893838. 58703	27. 7	23. 96
55	1658_NARSINGBANJ	253602. 23012	893925. 18292	24. 0	20. 01
56	1668_KANCHIPARA	251905. 49061	893613. 65715	22. 3	17. 52
57	1685_MADARGANJ	255716. 79194	894807. 35695	29. 2	26. 59
58	1695_RAHUMARI	253428. 99437	894942. 94277	24. 2	21. 41
59	1713_DIGRIRCHAR	251959. 72464	894913. 61401	21. 115	17. 94
60	1722_BAKSHIGONJ	251128. 42936	895217. 67299	20. 958	17. 68
61	1759_RANBAGHA	243536. 56606	891426. 08597	13. 5711	6. 34
62	1776_DIGHAPATIA	242611. 61399	890046. 08511	14. 4244	6. 14
63	1803_LALPUR	241036. 69027	885746. 47758	16. 0	7. 94
64	1821_PABNA	240021. 57187	891344. 04514	13. 6	7. 13
65	1830_BOGRA	245046. 78719	892236. 49589	18. 7859	12. 35
66	1857_TARAS	242529. 47178	892226. 88006	12. 3	6. 08
67	1884_SHARIAKANDI	245334. 05896	893434. 03931	16. 9	11. 75
68	1902_KAZIPUR	244002. 91020	893857. 22787	15. 6	10. 88
69	1911_DHANGORA	243141. 03837	893158. 26437	13. 4733	8. 07
70	1921_SIRAJGANJ	242753. 33497	894311. 61238	13. 8213	9. 66
71	1956_SATBARIA	241308. 14997	893801. 18708	11. 4	6. 80
72	1992_POELSA	243715. 89273	895538. 70048	14. 401	11. 45
73	2010_BELTA	241258. 64356	895239. 75529	11. 3	8. 06
74	2019_BANI	240446. 94651	895705. 33253	10. 0	7. 23
75	2037_HALUAGHAT	250659. 17126	902022. 43803	13. 1614	13. 61
76	2064_NOKLA	245808. 74884	901101. 94107	15. 8	14. 66
77	2073_ARANKHOLA	244022. 14673	900712. 42203	17. 9	16. 02
78	2091_KACHUA	242044. 65723	901225. 39232	18. 7	17. 25
79	2110_MIRZAPUR	240607. 28259	900543. 09377	9. 4878	7. 52
80	2127_RUPCHANDPUR	244847. 98357	902638. 82326	12. 3447	12. 24
81	2145_PHULBARIA	243749. 08493	901809. 55803	12. 6	11. 74
82	2181_SRIPUR	241156. 66658	902853. 52503	16. 0	16. 08
83	2200_MAUCHAK	240123. 29293	901748. 23770	12. 7642	11. 90
84	2227_ATHARABARI	243753. 27086	904316. 09767	8. 6030	9. 41
85	2272_ATPARA	244841. 61293	905144. 50222	8. 2	10. 23
86	2281_TARAIL	243252. 48806	905332. 45880	6. 7	8. 47
87	2291_KISHORGANJ	242711. 39159	904647. 69322	9. 7681	10. 85
88	2300_KATIADI	241502. 54549	904802. 18200	9. 5180	11. 05
89	2308_BAJITPUR	241242. 54390	905737. 30312	6. 9	9. 31
90	2317_BELABA	240627. 51343	905109. 01824	7. 597	9. 68
91	2337_BALIJURI	250625. 91599	911500. 50300	7. 7	13. 38
92	2373_KANDIGAON	250230. 58642	914845. 85120	9. 6	17. 39
93	2381_KAMDARPUR	245159. 71887	910954. 23648	4. 8	9. 17
94	2400_MITAMAIN	242458. 15424	910328. 39092	6. 6	9. 33

No.	POINT NAME	EVEREST－1830 Latitude dddmmss. sssss	Longitude dddmmss. sssss	Orth. H m	Elip. H Everest m
95	2427_DIRAI	244728.85044	912125.46860	6.4	11.83
96	2435_HABIGANJ	242218.64126	912506.18167	6.8	11.46
97	2454_GOBINDAGONJ	245544.82355	914114.11068	10.1201	17.04
98	2471_GEAHPUR	243834.07007	914351.40451	8.3	14.67
99	2481_NABIGANJ	243426.23300	913057.35138	6.2	11.64
100	2498_CHUNARUGHAT	241145.71353	913119.52940	15.6964	20.87
101	2507_BARUTNI_TILA	245757.95544	915933.49950	81.2	89.43
102	2525_LAURAGA_TILA	242610.38324	914606.82260	13.059	18.96
103	2561_BARADI	234317.47523	884411.74175	13.6	4.85
104	2597_KALIDASPUR	234615.15485	885712.05854	12.6	4.97
105	2615_SABDARPUR	232746.60153	885733.68931	11.4	3.87
106	2624_JIBANNAGAR	232501.21788	884938.04427	9.4	1.33
107	2661_PIPRAGACHI	225848.99215	885926.53218	7.9	1.04
108	2694_NALDANGA	232622.20987	891032.94120	7.834	1.48
109	2722_SATBARIA	235310.93580	892638.49943	10.8	5.52
110	2759_MAGURA	232906.43702	892503.30416	6.5398	1.20
111	2795_KASINATHPUR	235719.98705	893643.73467	11.2	6.69
112	2813_RAMDIA	234209.76214	893203.49392	10.2	5.41
113	2849_NOHATA	232008.99836	893125.17335	6.1	1.43
114	2867_BHABANIPUR	230831.72657	893245.72470	3.2	-1.12
115	2876_BABUPUR	230044.11484	893631.18443	3.2	-.64
116	2903_SONPACHA	233305.72443	894651.89689	7.5537	4.02
117	2930_BANAMALIPUR	231754.53869	894445.23895	4.7	1.28
118	2957_BANIARI	230118.64305	895645.57261	4.0	1.94
119	3327_GAZIKHALI	235432.26990	900404.72182	8.6679	6.55
120	3344_BRAHMANGAON	234019.45712	900444.51197	5.7	3.84
121	3354_BHAGYAKUL	233102.67293	901351.34444	6.6	5.75
122	3398_SAVAR	235136.43235	901601.66872	10.0410	9.07
123	3407_SERAJDIKHAN	233416.61173	902226.25659	6.4	6.38
124	3442_PALAS	235831.47354	903804.68458	7.901	9.04
125	3452_GOPALDI	234816.35171	904304.92369	5.0	6.87
126	3469_MUNSHIGANJ	233248.17374	903228.36169	5.3	6.36
127	3479_DAUDKANDI	233211.96746	904256.41447	5.276	7.55
128	3533_NABINAGAR	235300.22000	905820.85294	6.6	9.84
129	3882_AKHAURA	235154.24292	911251.48285	7.4	11.87
130	3891_MIRPUR	234241.64910	910346.05549	7.5678	11.70
131	3899_JAFARGANJ	233420.93930	910321.42327	7.8552	12.20
132	3908_COMILLA	232754.80511	911110.82520	9.776	15.09
133	3926_LAKSAM	231425.74988	910723.55508	5.7	10.70
134	3953_MOTABI	225924.69576	910609.14111	5.1	10.01
135	3972_CHAUDDAGRAM	231343.84512	911855.08525	8.2532	14.46
136	3980_FULGAZI	230906.77362	912605.91915	8.5	15.37
137	4317_MOKITALA	244754.24976	920118.61786	18.737	26.66
138	4334_JURI	243540.90388	920705.08056	10.6	18.75
139	4344_HARARGAJ	242604.82597	920227.33625	23.9	31.42
140	4352_KHARACHARA	245323.32197	922217.33308	15.2	25.27
141	TSN1_TIDAL_STA.	221408.23014	914941.33537	6.6153	16.13

RESULT OF CONTROL POINT

「B. U. T. M」

◎Latitude
◎Longitude
◎Northing, (N)
◎Easting, (E)
◎True north (γ)
◎Scale factor (s/S)
(EVEREST Ellipsoid)

Projection	:Transverse Mercator
Semimajor Axis (m)	: 6377276.345
1/Flattening	: 300.80170000
False Northing(m)	: 0.0000
False Easting (m)	: 500000.0000
Longitude of Central Meridian	:90 0 0.00000 E
Latitude of Origin of Projection	: 0 0 0.00000 N
Scale Factor at Central Meridian	: 0.9996 N

1995

BANGLADESH (Coordinate of B. U. T. M) Z O N E : 45 1/2 P. 1/3

No.	POINT NAME	EVEREST－1830 Latitude dddmmss. sssss	Longitude dddmmss. sssss	B U T M N m	E m	γ dddmmss. ss	s/S
1	117_LOHAGARA	260211.99798	882156.46738	2880527.260	336501.644	4303.13	.999930
2	131_GOFFARGAON	242705.64825	903323.79922	2704111.945	556406.895	-1349.44	.999639
3	181_KALI_KACHCHA	240537.15992	910726.25716	2664832.188	614225.291	-2731.98	.999761
4	193_DUPITILA	250543.93158	920816.64314	2777001.752	715575.507	-5425.63	1.000174
5	199_BHATURIA	230732.99813	891201.12254	2557462.956	418132.452	1850.75	.999683
6	231_CHAPANI	260643.22236	890214.63241	2888202.081	403767.286	2525.32	.999714
7	242_N.KASHADAHA	234921.64462	894926.99052	2634387.937	482093.595	415.68	.999604
8	261_JARIA	250026.28593	903907.22937	2765684.310	565781.774	-1632.29	.999653
9	280_GRAGONJ	233951.20373	891209.51236	2617062.841	418700.411	1912.21	.999682
10	288_GOIBARI	260652.94477	893919.23463	2888190.940	465545.804	906.15	.999615
11	295_PAKIBAR_TILA	243931.87225	915559.06326	2728324.341	695598.005	-4824.35	1.000073
12	303_GULSHAN	234749.48503	902506.55272	2631605.718	542625.533	-1007.90	.999622
13	333_KAKONHAT	243022.24161	882828.56880	2710897.723	345472.605	3758.25	.999895
14	343_SUNAMGONJ	250346.51299	912346.24682	2772410.942	640805.532	-3529.54	.999845
15	350_KASHDAH	253033.03539	893123.23093	2821180.587	452084.727	1219.35	.999628
16	355_CHATMOHAR	241353.00821	891726.88778	2679805.828	428005.120	1727.90	.999664
17	369_AGRABAD	241535.22403	914419.38472	2683866.766	676483.463	-4252.49	.999985
18	380_DUPCHANCHIA	245219.65144	891032.86931	2750811.565	416753.827	2048.03	.999686
19	388_DINAJPUR	253710.23892	883801.39687	2834018.872	362839.599	3527.10	.999832
20	395_BANIACHUNG	243200.20268	912051.27361	2713723.484	636481.778	-3334.68	.999830
21	430_NITPUR	250127.23987	882731.28244	2768285.569	344506.975	3907.59	.999899
22	456_POER_BARI	245336.87787	895228.48476	2752940.625	487334.700	310.06	.999602
23	481_ICHAPUR	242024.99459	895544.10291	2691679.227	492790.264	145.47	.999601
24	1009_TITALYA	262929.53982	882034.90352	2930940.113	334879.623	4421.43	.999937
25	1055_BOALMARI	261509.15139	883808.44883	2904126.185	363766.566	3612.85	.999829
26	1072_SONAHAR	260317.51325	884442.20101	2882122.594	374477.929	3304.62	.999795
27	1099_BALAPARA	261255.42656	885414.33053	2899757.822	390525.027	2903.16	.999748
28	1109_HARIPUR	254938.46598	880750.82919	2857657.278	312666.346	4852.49	1.000033
29	1126_RANSHIA	254459.17957	881949.67052	2848795.236	332572.989	4331.75	.999946
30	1144_MUKANDAPUR	254916.54747	883050.40230	2856492.825	351070.790	3850.53	.999874
31	1180_NILPHAMARI	255533.52686	885200.75560	2867737.458	386540.001	2943.68	.999759
32	1190_SAIDPUR	254622.27737	885427.91153	2850745.115	390492.342	2829.86	.999748
33	1217_BAJITPUR	253047.89650	885144.54889	2822040.612	385695.356	2924.19	.999761
34	1234_DHAMUIRHAT	250904.78772	885115.62239	2781963.440	384544.962	2913.10	.999765
35	1252_BHOLAHAT	245612.02354	881322.86698	2758879.428	320599.970	4457.86	.999998
36	1279_ROHANPUR	244905.11905	881935.43922	2745613.810	330888.894	4209.34	.999953
37	1298CHAPAINAWABGA	243533.57547	881643.03806	2720708.531	325735.025	4259.61	.999975
38	1325_MOHADEBPUR	245505.80650	884452.91992	2756251.701	373592.131	3139.20	.999797
39	1333PARBATIPURADA	244950.83466	883431.02640	2746734.641	356046.634	3554.23	.999856
40	1369_PABA	242451.63330	883651.36989	2700579.454	359521.349	3422.30	.999844
41	1387_SANTAHAR	244832.51174	885931.79694	2743950.046	398153.940	2522.51	.999728
42	1406_BAGMARA	243327.49527	884837.93944	2716261.140	379556.775	2939.88	.999779
43	1433_ARANI	241725.47414	885257.79603	2686611.472	386627.891	2734.76	.999759
44	1468_BHERAMARA	240115.00947	885936.39579	2656679.318	397649.272	2435.19	.999729
45	1477_JAGATBER	262012.76636	890144.63645	2913112.182	403120.758	2550.83	.999716
46	1495_CHANDRAPUR	260004.57437	891607.10439	2875788.836	426817.038	1914.29	.999666
47	1504_RANACHANDI	255541.07126	890332.03186	2867817.346	405769.993	2441.47	.999710

No.	POINT NAME	EVEREST－1830 Latitude ddmmss. sssss	Longitude dddmmss. sssss	B U T M N m	E m	γ ddmmss. ss	s/S
48	1522_NAWABGANJ	252509. 64160	890424. 87865	2811471. 379	406845. 233	2351. 67	. 999707
49	1549_JOYPURHAT	250623. 37830	890208. 11395	2776855. 771	402776. 093	2433. 24	. 999717
50	1558MAHENDRANAGAR	255208. 92066	892631. 92548	2861072. 133	444122. 421	1436. 18	. 999639
51	1568_KOBARU	254833. 70662	891424. 30144	2854553. 692	423836. 317	1951. 12	. 999672
52	1585_MITHAPUKUR	253416. 44764	891649. 33021	2828162. 173	427730. 571	1838. 27	. 999665
53	1612_GOBINDAGANJ	250800. 56415	892325. 80665	2779636. 350	438570. 194	1531. 97	. 999647
54	1649_KURIGRAM	254817. 76932	893838. 58703	2853891. 817	464323. 788	917. 82	. 999616
55	1658_NARSINGBANJ	253602. 23012	893925. 18292	2831264. 416	465562. 347	853. 56	. 999615
56	1668_KANCHIPARA	251905. 49061	893613. 65715	2800007. 006	460127. 898	1009. 98	. 999620
57	1685_MADARGANJ	255716. 79194	894807. 35695	2870438. 206	480184. 144	511. 90	. 999605
58	1695_RAHUMARI	253428. 99437	894942. 94277	2828363. 290	482787. 315	426. 38	. 999604
59	1713_DIGRIRCHAR	251959. 72464	894913. 61401	2801628. 207	481933. 184	436. 58	. 999604
60	1722_BAKSHIGONJ	251128. 42936	895217. 67299	2785896. 791	487062. 690	316. 79	. 999602
61	1759_RANBAGHA	243536. 56606	891426. 08597	2719922. 887	423126. 150	1857. 85	. 999673
62	1776_DIGHAPATIA	242611. 61399	890046. 08511	2702693. 440	399943. 305	2430. 33	. 999724
63	1803_LALPUR	241036. 69027	885746. 47758	2673976. 248	394672. 030	2529. 22	. 999737
64	1821_PABNA	240021. 57187	891344. 04514	2654884. 742	421583. 723	1849. 41	. 999676
65	1830_BOGRA	245046. 78719	892236. 49589	2747847. 598	437043. 525	1542. 72	. 999649
66	1857_TARAS	242529. 47178	892226. 88006	2701184. 113	436561. 192	1531. 70	. 999650
67	1884_SHARIAKANDI	245334. 05896	893434. 03931	2752914. 743	457195. 296	1042. 32	. 999623
68	1902_KAZIPUR	244002. 91020	893857. 22787	2727947. 220	464514. 047	847. 03	. 999616
69	1911_DHANGORA	243141. 03837	893158. 26437	2712547. 675	452687. 957	1138. 17	. 999628
70	1921_SIRAJGANJ	242753. 33497	894311. 61238	2705493. 768	471617. 104	657. 61	. 999610
71	1956_SATBARIA	241308. 14997	893801. 18708	2678292. 248	462807. 811	901. 02	. 999617
72	1992_POELSA	243715. 89273	895538. 70048	2722767. 432	492654. 373	148. 86	. 999601
73	2010_BELTA	241258. 64356	895239. 75529	2677956. 567	487584. 338	300. 58	. 999602
74	2019_BANI	240446. 94551	895705. 33253	2662831. 470	495068. 839	111. 27	. 999600
75	2037_HALUAGHAT	250659. 17126	902022. 43803	2777652. 450	534228. 491	-838. 88	. 999614
76	2064_NOKLA	245808. 74884	901101. 94107	2761308. 694	518556. 583	-439. 43	. 999604
77	2073_ARANKHOLA	244022. 14673	900712. 42203	2728498. 797	512151. 202	-300. 51	. 999602
78	2091_KACHUA	242044. 65723	901225. 39232	2692297. 700	521000. 076	-507. 28	. 999605
79	2110_MIRZAPUR	240607. 28259	900543. 09377	2665304. 385	509684. 448	-220. 11	. 999601
80	2127_RUPCHANDPUR	244847. 98357	902638. 82326	2744122. 991	544877. 262	-1110. 98	. 999625
81	2145_PHULBARIA	243749. 08493	901809. 55803	2723819. 984	530627. 390	-734. 09	. 999612
82	2181_SRIPUR	241156. 66658	902853. 52503	2676129. 448	548895. 332	-1150. 60	. 999630
83	2200_MAUCHAK	240123. 29293	901748. 23770	2656599. 856	530171. 480	-714. 89	. 999611
84	2227_ATHARABARI	243753. 27086	904316. 09767	2724106. 416	572976. 468	-1802. 06	. 999666
85	2272_ATPARA	244841. 61293	905144. 50222	2744129. 283	587142. 878	-2142. 84	. 999694
86	2281_TARAIL	243252. 48806	905332. 45880	2714957. 272	590363. 208	-2214. 72	. 999701
87	2291_KISHORGANJ	242711. 39159	904647. 69322	2704397. 839	579036. 287	-1922. 30	. 999677
88	2300_KATIADI	241502. 64549	904802. 18200	2681994. 561	581262. 387	-1943. 86	. 999682
89	2308_BAJITPUR	241242. 54390	905737. 30312	2677791. 198	597508. 332	-2337. 99	. 999717
90	2317_BELABA	240627. 51343	905109. 01824	2666186. 469	586626. 975	-2053. 63	. 999693
91	2337_BALIJURI	250625. 91599	911500. 50300	2777170. 077	626030. 356	-3149. 88	. 999796
92	2373_KANDIGAON	250230. 58642	914845. 85120	2770573. 616	682854. 839	-4603. 03	1. 000013
93	2381_KAMDARPUR	245159. 71887	910954. 23548	2750449. 882	617681. 852	-2923. 91	. 999771
94	2400_MITAMAIN	242458. 15424	910328. 39092	2700487. 001	607238. 970	-2614. 39	. 999742

No.	POINT NAME	EVEREST－1830 Latitude ddmmss.sssss	Longitude dddmmss.sssss	B U T M N m	E m	γ ddmmss.ss	s/S
95	2427_DIRAI	244728.85044	912125.46860	2742297.522	637161.546	-3408.87	.999832
96	2435_HABIGANJ	242218.64126	912506.18167	2695907.086	643837.440	-3507.46	.999856
97	2454_GOBINDAGONJ	245544.82355	914114.11068	2757927.142	670349.896	-4240.84	.999958
98	2471_GEAHPUR	243834.07007	914351.40451	2726273.190	675163.831	-4318.91	.999979
99	2481_NABIGANJ	243426.23300	913057.35138	2718392.410	653485.756	-3749.98	.999891
100	2498_CHUNARUGHAT	241145.71353	913119.52940	2676550.014	654568.712	-3726.29	.999895
101	2507_BARUTNI_TILA	245757.95544	915933.49950	2762440.786	701129.863	-5028.82	1.000100
102	2525_LAURAGA_TILA	242610.38324	914606.82260	2703443.751	679264.583	-4354.53	.999997
103	2561_BARADI	234317.47523	884411.74175	2623749.773	371233.568	3029.98	.999805
104	2597_KALIDASPUR	234615.15485	885712.05854	2629034.848	393367.282	2518.93	.999740
105	2615_SABDARPUR	232746.60153	885733.68931	2594939.025	393731.393	2451.76	.999740
106	2624_JIBANNAGAR	232501.21788	884938.04427	2589956.725	380196.509	2758.09	.999777
107	2661_PIPRAGACHI	225848.99215	885926.53218	2541482.493	396561.380	2338.68	.999732
108	2694_NALDANGA	232622.20987	891032.94120	2592200.647	415822.138	1940.31	.999688
109	2722_SATBARIA	235310.93580	892638.49943	2641538.828	443409.210	1330.48	.999640
110	2759_MAGURA	232906.43702	892503.30416	2597130.054	440536.186	1355.58	.999644
111	2795_KASINATHPUR	235719.98705	893643.73467	2649140.377	460542.978	926.93	.999619
112	2813_RAMDIA	234209.76214	893203.49392	2621173.961	452531.638	1113.95	.999628
113	2849_NOHATA	232008.99836	893125.17335	2580564.236	451311.875	1119.29	.999629
114	2867_BHABANIPUR	230831.72657	893245.72470	2559116.670	453531.930	1042.30	.999627
115	2876_BABUPUR	230044.11484	893631.18443	2544719.996	459904.107	910.75	.999620
116	2903_SONPACHA	233305.72443	894651.89689	2604384.545	477660.270	514.91	.999606
117	2930_BANAMALIPUR	231754.53869	894445.23895	2576372.437	474020.585	601.81	.999608
118	2957_BANIARI	230118.64305	895645.57261	2545729.131	494466.879	116.04	.999600
119	3327_GAZIKHALI	235432.26990	900404.72182	2643930.385	506918.035	-139.18	.999601
120	3344_BRAHMANGAON	234019.45712	900444.51197	2617706.786	508057.454	-154.23	.999601
121	3354_BHAGYAKUL	233102.67293	901351.34444	2600602.711	523571.551	-531.73	.999607
122	3398_SAVAR	235136.43235	901601.66872	2638547.261	527195.657	-629.00	.999609
123	3407_SERAJDIKHAN	233416.61173	902226.25559	2606597.020	538155.668	-858.36	.999618
124	3442_PALAS	235831.47354	903804.68458	2651429.703	564553.504	-1528.40	.999651
125	3452_GOPALDI	234816.35171	904304.92369	2632554.028	573133.018	-1723.37	.999666
126	3469_MUNSHIGANJ	233248.17374	903228.36169	2603932.033	555231.161	-1258.38	.999638
127	3479_DAUDKANDI	233211.96746	904256.41447	2602896.677	573040.993	-1708.90	.999666
128	3533_NABINAGAR	235300.22000	905820.85294	2641438.266	598988.181	-2337.53	.999721
129	3882_AKHAURA	235154.24292	911251.48285	2639599.370	623625.285	-2928.86	.999789
130	3891_MIRPUR	234241.64910	910346.05549	2622480.981	608326.513	-2538.73	.999745
131	3899_JAFARGANJ	233420.93930	910321.42327	2607077.373	607742.870	-2520.37	.999743
132	3908_COMILLA	232754.80511	911110.82520	2595306.466	621146.384	-2820.82	.999781
133	3926_LAKSAM	231425.74988	910723.55508	2570374.190	614892.413	-2635.73	.999763
134	3953_MOTABI	225924.69576	910609.14111	2542649.186	612987.205	-2550.41	.999758
135	3972_CHAUDDAGRAM	231343.84512	911855.08525	2569250.500	634555.245	-3107.82	.999824
136	3980_FULGAZI	230906.77362	912605.91915	2560845.219	646883.859	-3351.45	.999867
137	4317_MOKITALA	244754.24976	920118.61786	2743910.156	704353.845	-5053.91	1.000116
138	4334_JURI	243540.90388	920705.08056	2721494.361	714432.590	-5254.75	1.000168
139	4344_HARARGAJ	242604.82597	920227.33625	2703652.688	706881.714	-5040.35	1.000129
140	4352_KHARACHARA	245323.32197	922217.33308	2754604.990	739529.431	-5954.86	1.000309
141	TSN1_TIDAL_STA.	221408.23014	914941.33537	2459842.643	688386.524	-4131.22	1.000039

APPENDICES

MINUTES OF MEETINGS AND REPORTS

APPENDIX 1

SCOPE OF WORK (ENGLISH VERSION) (5.12.1991)

SCOPE OF WORK

FOR

THE STUDY ON THE GEODETIC SURVEY

IN

THE PEOPLE'S REPUBLIC OF BANGLADESH

AGREED UPON BETWEEN

SURVEY OF BANGLADESH

AND

JAPAN INTERNATIONAL COOPERATION AGENCY

DHAKA, 5TH DECEMBER, 1991

MR. MD MAHBUBUL KARIM
SURVEYOR GENERAL,
SURVEY OF BANGLADESH,
MINISTRY OF DEFENCE

MR. KOKICHI KIMURA
LEADER,
PREPARATORY STUDY TEAM,
JAPAN INTERNATIONAL
COOPERATION AGENCY

I. INTRODUCTION

In response to the request of the Government of the People's Republic of Bangladesh(hereinafter referred to as "the Government of Bangladesh"), the Government of Japan has decided to conduct the Study on the Geodetic Survey in the People's Republic of Bangladesh (hereinafter referred to as "the Study") in accordance with the relevant laws and regulations in force in Japan and in Bangladesh.

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programmes of the Government of Japan, will undertake the Study in close cooperation with the authorities concerned of the Government of Bangladesh.

The present document sets forth the Scope of Work with regard to the Study.

II. OBJECTIVES OF THE STUDY

The objectives of the Study are as follows;

1. to establish the first order control point network,
2. to establish the first order levelling network,
3. to determine the mean sea level,
4. to transfer modern technology in geodesy.

III. SCOPE OF THE STUDY

In order to achieve the above-mentioned objectives, the Study will cover the following items (The outline of the Study sites are shown in Appendix-1 for control point survey and Appendix-2 for levelling survey and the technical details are shown in Appendix-3).

1. Establishment of Control Point Network

(1) Reconnaissance and monumentation

The sites of control point survey, 140 points at most, shall be reconnoitered and the monumentation shall be done for 26 A-type and 81 B-type at most at the control point site. The

design of monuments are shown in Appendix-3. One A-type and 32 B-type monuments are in existence on the ground.

(2) Control point survey

The network shall be observed by the Global Positioning System (hereinafter referred to as "GPS"). Final result of data observed by GPS shall be manifested on the Everest coordinate system.

(3) Net adjustment

Net adjustment of control points shall be done, taking the data of Gulshan point and other existing points into consideration.

2. Establishment of Levelling Network

(1) Reconnaissance and monumentation

The levelling route, approximately 2,200km and the monumentation sites, approximately 220 points at 10km apart, shall be reconnoitered and the standard bench marks shall be established on the sites. The design of standard bench marks shall be subject to the Appendix-3. Smaller bench marks shall be established in between two main bench marks to facilitate users in levelling survey. Their numbers shall be decided by the Japanese study team.

(2) Levelling

1) The route on the road shall be surveyed by the direct levelling method.

2) The river crossing operation shall be done by reciprocal, tilting screw or trigonometric method.

(3) Net adjustment

Net adjustment of standard bench marks shall be done taking the data of mean sea level determined in the Study.

3. Determination of Mean Sea Level

(1) Construction of tidal station

A tidal station shall be constructed at Chittagong.

(2) Tidal observation

Sea level shall be observed at the station by the staff of the Survey of Bangladesh (hereinafter referred to as "SOB").

(3) Analysis of the tidal observation data

The observed data shall be analyzed to determine the mean sea level of Bangladesh.

Ⅳ. STUDY SCHEDULE

The Study will be carried out in accordance with the tentative schedule as shown in Appendix-4.

Ⅴ. REPORTS AND FINAL RESULT

The report and all results of the survey and observation including the items mentioned in Appendix-5 shall be submitted in English to SOB after the completion of the Study.

Ⅵ. UNDERTAKING OF THE GOVERNMENT OF BANGLADESH

1. To facilitate smooth conduct of the Study, the Government of Bangladesh shall take the following necessary measures;

(1) to secure the safety of the Japanese study team,

(2) to permit the members of the Japanese study team to enter, leave and stay in Bangladesh for the duration of their assignment therein, and exempt them from foreign registration requirements and consular fees,

(3) to exempt the members of the Japanese study team from taxes, duties and other charges on equipment, machinery, vehicles and other materials brought into and taken out of Bangladesh for the conduct of the Study,

(4) to exempt the members of the Japanese study team from income tax and charges of any kind imposed on or in connection with any emolument or allowance paid to the members of the Japanese study team for their services in connection with the implementation of the Study,

(5) to provide necessary facilities to the Japanese study team for the remittance as well as the utilization of the funds introduced into Bangladesh from Japan in connection with the implementation of the Study,

(6) to secure permission for entry into private properties or restricted areas for the implementation of the Study,

(7) to secure permission for the Japanese study team to take all data and documents, including topographical maps and aerial

photographs, related to the Study out of Bangladesh to Japan,

(8) to provide medical services as needed. Their expenses will be chargeable on members of the Japanese study team.

2. The Government of Bangladesh shall bear claims, if any arises, against the members of the Japanese study team resulting from, occurring in the course of, or otherwise connected with the discharge of their duties in the implementation of the Study, except when such claims arise from negligence or willful misconduct on the part of the members of the Japanese study team.

3. SOB shall act as counterpart agency to the Japanese study team and also as coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

4. SOB shall, at its own expense, provide the Japanese study team with the following, in cooperation with other organizations concerned;

(1) available data and information related to the Study,

(2) counterpart personnel,

(3) credentials or identification cards.

5. To facilitate smooth conduct of the Study, SOB shall make necessary arrangement to secure permission for the use of radio communication facilities, including transceiver, which may be used in Japanese language with allocated frequency.

Ⅶ. UNDERTAKING OF JICA

For the implementation of the Study, JICA shall take the following measures;

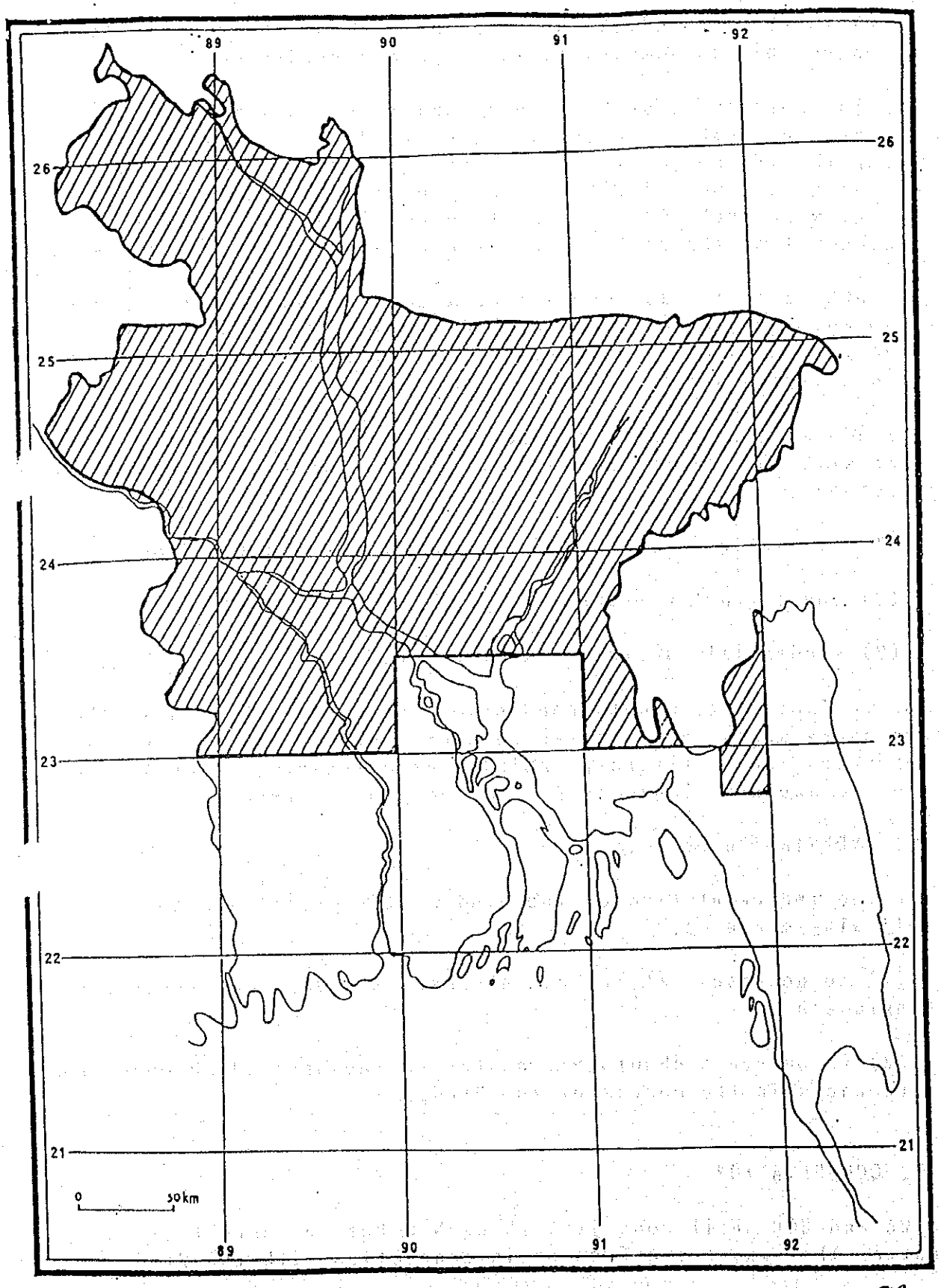
(1) to despatch, at its own expense, the Japanese study team to Bangladesh,

(2) to pursue technology transfer to the Bangladesh counterpart personnels in the course of the Study.

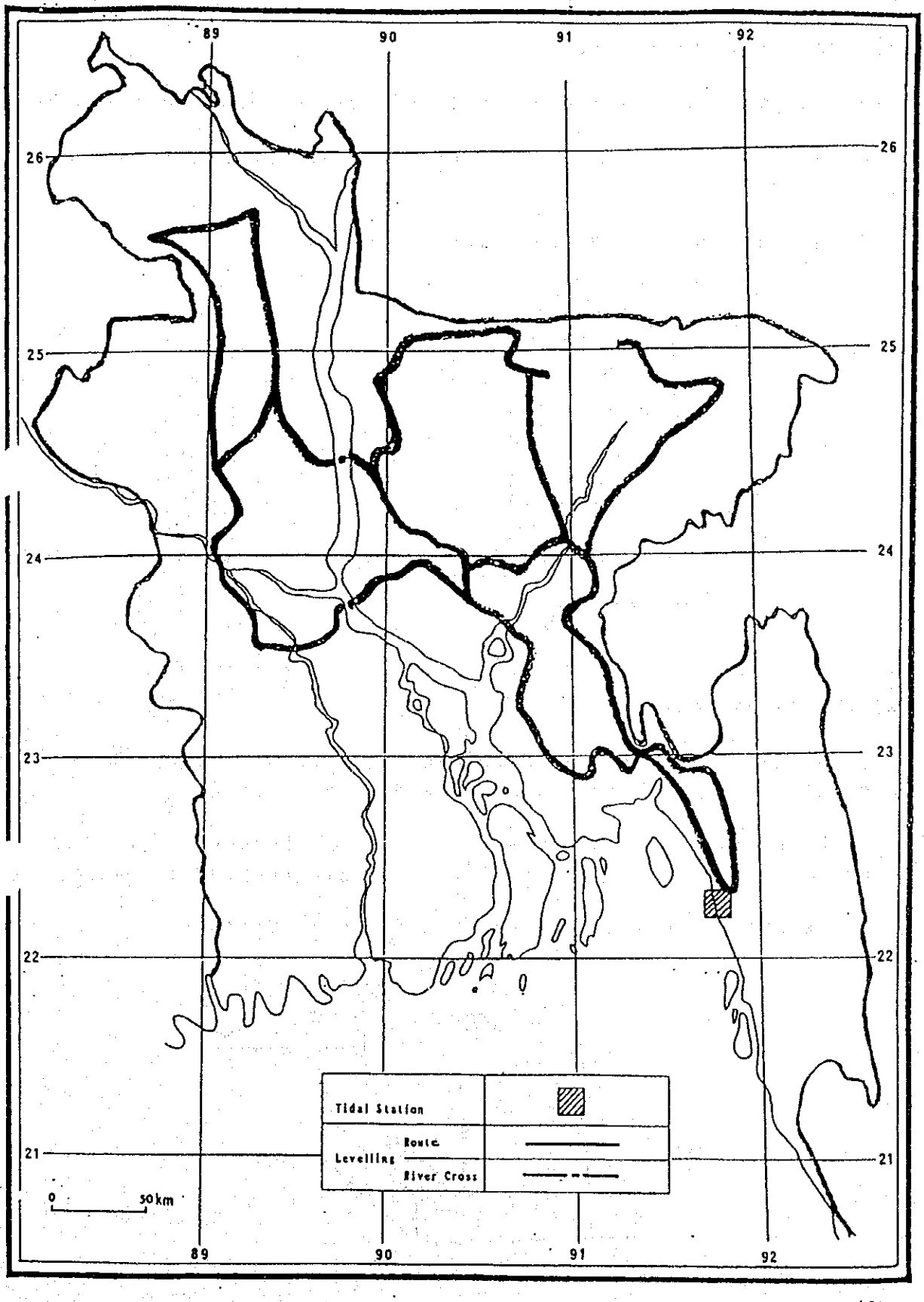
Ⅷ. CONSULTATION

JICA and SOB shall consult with each other in respect of any matter that may arise from or in connection with the Study.

APPENDIX-1 Control Points Site



APPENDIX-2 Map showing Levelling Route



APPENDIX-3 Principal Technical Specification

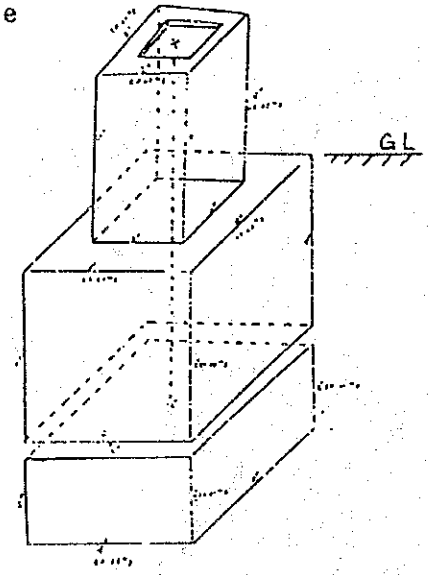
(1) Control point network

1) The intervals of the control points are approximately 30km.

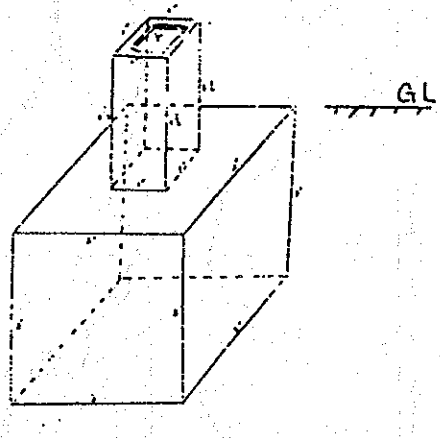
2) The relative accuracy of control point network is better than 1/100,000.

3) The designs of monuments are as follows:

A type



B type

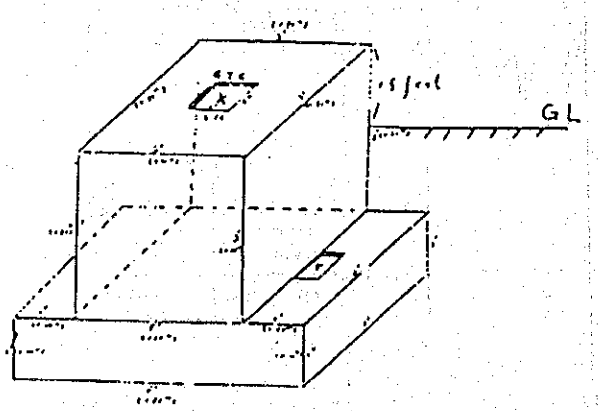


(2) Levelling network

1) The difference of double running is within 4 times the square root of S mm. S:length of single running in km

2) The closure of loop is within 4 times the square root of S mm. S:length of single running in km

3) The design of standard bench mark is as follows:



APPENDIX-4 Tentative Schedule

		First Year (FY1992) 4 6 8 10 12 2	Second Year (FY1993) 4 6 8 10 12 2	Third Year (FY1994) 4 6 8 10 12 2 4
Control Points Network Survey	Reconnaissance Monumentation	— —		
	Control Points Survey	——	——	
	Study about Datum Net Adjustment			····· ···
Levelling Network Survey	Reconnaissance Monumentation	— —		
	Levelling		——	—— ——
	Net Adjustment			..
Determination of Mean Sea Level	Construction of Tidal Station	— ——		
	Tidal Observation	——	——	——
	Analysis	..	..	...
Compile of Final Reports				....

Note: — JICA, — SOB, work in Bangladesh
··· JICA, work in Japan

APPENDIX-5 Final Delivery Items

(1) Control Point Survey

1) Tables of control points (Longitude, latitude and elevation are shown), 3 sets

2) Descriptions of control points (Including a sketch showing the detailed location of the point), 3 sets

3) Distribution map of the control points (A 1/1,000,000 map), 3 sheets

4) Monuments of control points

5) Ornament of original point for control point network

(2) Levelling

1) Tables of bench marks (Elevation is shown), 3 sets

2) Descriptions of bench marks (Including a sketch showing the detailed location of the point), 3 sets

3) Route map of levelling (1/50,000 map series), 3 sets

4) Network map of levelling (A 1/1,000,000 map), 3 sheets

5) Monuments of bench marks

(3) Determination of Mean Sea Level

1) Document on determination of mean sea level, 3 sets

2) Monument of original point for levelling survey at Dhaka

3) Monument of special bench mark close to tidal station at Chittagong

MINUTES OF MEETING

FOR

THE STUDY ON THE GEODETIC SURVEY

IN

THE PEOPLE'S REPUBLIC OF BANGLADESH

HELD ON 26th NOVEMBER-4th DECEMBER, 1991
BETWEEN
SURVEY OF BANGLADESH (SOB)
AND
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

DHAKA, 5TH DECEMBER, 1991

MR. MD MAHBUBUL KARIM
SURVEYOR GENERAL,
SURVEY OF BANGLADESH,
MINISTRY OF DEFENCE

MR. KOKICHI KIMURA
LEADER,
PREPARATORY STUDY TEAM,
JAPAN INTERNATIONAL
COOPERATION AGENCY

1.0 The meeting on the "Scope of Work"(S/W) of the Study on the Geodetic Survey in Bangladesh was held from 26th November to 4th December, 1991 between SOB and JICA Preparatory Study Team to discuss and finalize it.

2.0 The list of participants is enclosed as Appendix-1.

3.0 "Scope of Work" submitted by the JICA was discussed in details by both parties, whereupon both parties have agreed upon it in principle, with the following decisions/adjustments.

3.1 Undertaking of Bangladesh Side

The Study has been based on the formal request from the Government of the People's Republic of Bangladesh and will be conducted under the mutual cooperation between SOB and JICA. JICA team has strongly requested SOB that the undertaking should be ensured, especially the exemption from various taxes.

3.2 SOB Counterparts

SOB has confirmed that the appropriate number of Counterpart Persons would be assigned for the Study and it is shown in Appendix-2.

3.3 Technology Transfer in Geodesy to SOB

JICA will ensure the OJT in Bangladesh, and JICA Preparatory Study Team has promised to convey the request of the Counterpart Training in Japan to Japanese Government.

3.4 Procurement of Necessary Transportation (Vehicles and Speed Boats)

As for necessary transportation for the Study, both parties

have decided through mutual discussion that the Study would require necessary number of vehicles and speed boats.
The exact number will be intimated by JICA by the end of December, 1991 and this will not exceed the figure mentioned in the TAPP.
These transport facilities will be procured jointly by SOB and JICA in accordance with following measures:

3.4.1 General Definition of Procurement

Necessary number of vehicles and speed boats will be purchased by JICA and transported them from Japan to Bangladesh at its own expense on the conditions that SOB shall bear CDST and VAT on their arrival to Bangladesh.
After the registration of vehicles in SOB's name, they will be controlled by JICA under its management, which shall be utilized exclusively for the Study.
SOB has no claim to JICA for damages, if any, of vehicles and speed boats during the Study period.

3.4.2 Tendering

On the basis of specifications decided, JICA will float tender in Japan.
Tender result will be reported to SOB for their internal formalities, if necessary.

3.4.3 Shipping

Soon after they will be shipped, JICA will inform SOB of it together with necessary documents such as bill of lading, invoice, packing list and so on.

3.4.4 Payment of CDST and VAT

SOB shall prepare CDST and VAT according to information from JICA regarding shipping and pay them to NBR as soon as possible after arrival at Chittagong.

3.4.5 Customs Clearance, Registration and Insurance

SOB and JICA in collaboration will carry out above matters. Necessary cost will be borne by JICA in principle.

3.4.6 Running cost

JICA will bear cost for fuel and daily maintenance for the Study period and will also bear salaries and allowances of the drivers and cleaners for the Study period.

3.4.7 Tentative Procurement Schedule

Both parties shall try to undertake each parts according to the attached Tentative Schedule of Preparation of the Study as appendix-3.

3.4.8 Handing Over of Vehicles and Speed boats

JICA is required to hand over all vehicles and speed boats to SOB at the end of the Study and these will be used for nation building activities by the Government of Bangladesh.

3.5 Tidal Station

3.5.1 Two sets of equipment

JICA will be required to install one set of tidal gauge equipments at the tidal station and keep another set in the SOB's observer's house at Chittagong for immediate replacement in case of emergency.

3.5.2 Location

SOB will confirm to JICA regarding availability of the selected site for the tidal station by the end of December, 1991.

3.6 Office Space (Dhaka)

JICA is required to arrange the office accommodation with necessary furniture at Dhaka within the Study cost, while SOB will provide liaison desk within SOB's premises.

3.7 Provision of radio communication facilities

Due to less communication facilities in the remote area JICA will provide the radio communication system to facilitate the Study.

SOB shall clear the formalities with concerned agency.

JICA will provide necessary information regarding communication equipment.

3.8 Permission to take away Data

Data, documents, photographs and maps related to study can be taken out of Bangladesh to Japan with written permission and as per prescribed condition of the Government of Bangladesh.

JICA requested SOB to make necessary arrangement for the permission as soon as possible after receipt of the list from the Study team.

3.9 List of Personnel and equipment

3.9.1 List of Personnel

JICA will furnish the name and particulars of members of the

Study team before their arrival to Bangladesh.

3.9.2 List of equipment

JICA will be required to provide the list of equipment, machinery, vehicles and other materials which will be brought into and taken out of Bangladesh to get necessary clearance.

3.10 Consulation

SOB will provide coordinations for smooth conduct of the Study through following officers:

(1) A Project Director
(2) Counterpart personnel
(3) A project liaison officer

4.0 Maintenance of monuments

SOB will maintain control point monuments, bench marks and the tidal station constructed.

APPENDIX-1 The list of participants

Bangladesh side

Col.Md Mahbubul Karim	Surveyor General
Mr. A.K.M.Shamsul Alam	Director
Mr. Noor Muhammad Mia	Officer In Charge, Geodesy
Mr. Mohammad Nurul Baset	Research Officer, Ministry of Defence
Mr. A.N. Wahid	Technical Assistant (Geodesy)

Japanese Side

Mr. Kokichi Kimura	JICA Preparatory Study Team
Mr. Seiichi Tanioka	〃
Mr. Yoshio Sasaki	〃
Mr. Kazushi Maruyama	〃
Mr. Akihiro Matumoto	〃
Mr. Minoru Masuda	〃
Mr. Masaaki Yamada	〃
Mr. Takeshi Naruse	JICA Bangladesh Office

APPENDIX-2 Assignment and Number of Counterpart

		First Year (FY1992) 4 6 8 10 12 2	Second Year (FY1993) 4 6 8 10 12 2	Third Year (FY1994) 4 6 8 10 12 2 4
Control Points Network Survey	Reconnaissance Monumentation	5 persons / 5		
	Control Points Survey	12	12	
	Study about Datum Net Adjustment			....
Levelling Network Survey	Reconnaissance Monumentation	4 / 4		
	Levelling		8	14
	Net Adjustment			...
Determination of Mean Sea Level	Construction of Tidal Station	1 / 1		
	Tidal Observation	2	2	2
	Analysis	...	...	...
Compile of Final Reports				...

Note: — JICA, — SOB, work in Bangladesh
··· JICA, work in Japan

APPENDIX-3

Tentative Schedule of Preparation of the Study

	NOV. 91	DEC. 91	JAN. 92	FEB. 92	MAR. 92	APR. 92	MAY. 92	JUN. 92	JUL. 92
S/W MISSION	———	△ S/W SIGNING							
PROCUREMENT OF VEHICLES AND SPEED BOATS		△ SPEC. DETERMINATION		△ TENDER IN JAPAN	——— MANUFACTURING	——— △ SHIPPING	——— △ ARRI. CHT.	△ READY FOR USE	
MAIN STUDY TEAM									
PREPARATIONS BY JAPANESE SIDE	*NEGOTIATION & DETERMINATION OF TECHNICAL SPEC., TENTATIVE SCHEDULE, SPEC. OF VEHICLES & PROCEDURAL MATTER	*SIGNING OF S/W *COMMENCEMENT OF VEHICLE PROCUREMENT *FINALIZATION OF MAIN STUDY TOR	*PREPARETION OF TENDER DOCUMENT of VEHICLE	*TENDERING *COMMENCEMENT OF PROCEDURE FOR CONSUL. SELECTION	*SELECTION OF CONSULTANT	*CONSULTANT CONTRACT	*CUSTOMS CLEARANCE, REGISTRATION & INSSURANCE IN COLLABORATION WITH SOB *DESPATCH MAIN STUDY TEAM		
PREPARATIONS BY BANGLADESH SIDE	*DITTO	*CLEARANCE OF FORMALITIES FOR IMPLEMENTATION *REVISION OF TAPP IF NECESSARY	*COMMUNICATION WITH JICA	*ASSURE COST & VAT PAYMENT IN ACCORDANCE WITH TENDER RESULTS	*COMMUNICATION WITH JICA	*COMMUNICATION WITH JICA *ASSURE EVERY FORMALITIES	*COST & VAT PAYMENT TO NBR *ASSIST JICA FOR ABOVE		

APPENDIX 2

MINUTES OF MEETING FOR PHASE I PLAN OF OPERATION (P/O) (17.5.1992)

MINUTES OF THE MEETING

FOR

THE STUDY ON THE GEODETIC SURVEY

IN

THE PEOPLE'S REPUBLIC OF BANGLADESH

PHASE I

HELD ON 2nd – 17th MAY, 1992
BETWEEN
SURVEY OF BANGLADESH (SOB)
AND
JICA STUDY TEAM

DHAKA, 17TH MAY, 1992

COL. MD. MAHBUBUL KARIM
SURVEYOR GENERAL,
SURVEY OF BANGLADESH,
MINISTRY OF DEFENCE

DR. MINORU TAJIMA
LEADER,
STUDY TEAM,
JAPAN INTERNATIONAL
COOPERATION AGENCY

On the basis of the Scope of Work agreed between SOB and JICA on 5th December, 1991, the Japanese Study Team, organized by JICA, headed by Dr. Minoru Tajima, arrived Dhaka on May 1st, 1992, to carry out the Study on the Geodetic Survey in Bangladesh1(Phase I).

Prior to the commencement of the Phase I Study, a series of meetings were held from 2nd to 17th May, 1992 and the following items have been confirmed and agreed by the SOB and the JICA Study Team:

(1) The Plan of Operation for the Phase I Study, prepared by JICA Study Team, has been agreed by SOB, after minor corrections and additions.

(2) Field parties of the Study Team for site locationning of geodetic controls and bench marks are already mobilized in Sylhet area with SOB Counterpart officials and now in operation.

(3) Proposed Tidal Observation Station site, in the water area of CUFL in Chittagong, was not accepted by CUFL Management.

Therefore, the site study is now carrying out at the neighbouring water area of CUFL Mooring Dolphin and this is under the adminis-trative control of Chittagong Port Authority.

(4) Approval from Port Authority to work on that area has been issued already.

(5) The use of radio communication equipment for long distance has not been accepted by T & T Board, unless the output be reduced to 60 Watts or less.

Approval for the use of tranceivers for short distance is still in process.

The Study Team stressed the need of tranceivers to communicate between their field parties.

SOB has promissed to continue the efforts for early obtaining of the approval.

LIST OF ATTENDANTS

1. Survey of Bangladesh

Col. Md Mahbubul Karim	Surveyor General
Mr. A. K. M. Shamsul Alam	Director
Mr. Noor Muhammad Mia	Officer in Charge, Geodesy
Mr. A. N. Wahid	Technical Assistant

2. JICA Study Team

Dr. Minoru Tajima	Team Leader
Mr. Shigehiko Shino	Dupty Leader
Mr. Yoshio Sasaki	Planner
Mr. Masaji Koyama	Chief Surveyer (GPS)
Mr. Masanori Teshima	Chief Surveyor (Levelling)
Mr. Shigeru Miyamura	Coastal Engineer

PLAN OF OPERATION

FOR

THE STUDY ON THE GEODETIC SURVEY

IN

THE PEOPLE'S REPUBLIC OF BANGLADESH

MAY 1992

JAPAN INTERNATIONAL COOPERATION AGENCY

I. INTRODUCTION

The Government of the People's Republic of Bangladesh have requested the Technical Assistance Program on The Establishment of National Geodetic Control Net" in the country to the Government of Japan.

In response to the request, Japan International Cooperation Agency (hereinafter referred to as JICA) despatched Preliminary Study Team in 1990 (from July 30 to August 15) and Preparatory Study Team in 1991 (from October 29 to December 8).

During the periods, field investigation had been carried out, and series of technical discussions had been exchanged between Survey of Bangladesh (hereinafter referred to as SOB) and JICA Study Teams.

And as a result, Scope of Work (hereinafter referred to as S/W) had been signed by both parties on December 5, 1991.

This Plan of Operation (hereinafter referred to as P/O) is prepared in accordance with the S/W which describes the outline of the Study to be carried out by JICA and also the undertaking of the Government of Bangladesh and JICA.

The P/O consists of tentative overall plan of four years program and the implementation plan for the first Fiscal Year (Phase I).

The Study shall be carried out according to this P/O and also to the results of discussions during implementation between SOB and the Study Team.

II. OBJECTIVES OF THE STUDY

The objectives of the Study are as follows;

1. to establish the first order horizontal control point network, for covering approximately 70% of Bangladesh (See Figure 1),

2. to establish the first order vertical control (levelling) network for the same area, (Figure 2)

3. to determine the mean sea level,

4. to transfer modern technology in geodesy.

III. OVERALL PLAN OF THE STUDY

Tentative 4 years study schedule is described below and shown in Appendix 1.

1. Horizontal Control Point Survey.

(1) Reconnaissance of 140 sites of control points including 33 existing triangulation points, shall be done in Phase I.

(2) Construction of 107 new control points and ornamentation for Gulshan Point shall be done in Phase II.

(3) GPS observation for 60 points and 80 points shall be executed in Phase II and Phase III respectively.

(4) Geodetic control network adjustment shall be analyzed and processed in Phase IV.

2. First Order Levelling Survey.

(1) Reconnaissance of levelling routes in length of approximately 2,200 km and locationing of bench marks shall be done in Phase I.

(2) Construction of about 440 bench marks shall be done in Phase II.

(3) First order levelling survey of approx. 700 km and approx. 1,500 km shall be executed in Phase III and Phase IV respectively.

(4) Adjustment of entire levelling network shall be done in Phase IV and linked with mean sea level observed at Chittagong Tidal Station.

3. Determination of Mean Sea Level.

(1) The study for locationing the construction site of Tidal Observation Station and preliminary design of tidal station shall be done in Phase I.

(2) Detailed design and construction work of tidal station shall be done in Phase II.

(3) Installation of tidal gauge shall be executed by JICA, immediately after construction of building components has been completed in Phase II.

(4) Technical instruction for data collection and methodology for data check shall be given to the SOB counterparts in charge.

(5) Data collection of tidal level observation and maintenance of tidal gauge shall be expected to carry out by SOB counterparts throughout the study period.

(6) Determination of mean sea level shall be done in Phase IV, by analyzing collected continuous tidal observation data for two years.

4. Technology Transfer.

Technology transfer for SOB Counterpart personnels shall be made On the Job Training" (OJT) basis during the field work.

5. Organization of the Field Study Teams.

Organization of the field study teams shall be composed in each category and phase of the Study as shown in Appendix 2–1, 2–2 and 2–3.

IV. IMPLEMENTATION PLAN FOR THE PHASE I

1. Locationing of Geodetic Control Points

(1) General Consideration.

Geodetic control point network shall be established with the Global Positioning System (GPS).

Total number of GPS observation sites shall be 140 at most, in which 33 existing triangulation points are included.

These points shall be located to satisfy with the following conditions;

1) to be distributed homogeneously in the area.
2) accessible.
3) stable ground condition and preferably lesser risk of flood damage.
4) wider sky window.
5) possibly better horizontal sight for future ground survey.
6) to assure the right or permission to occupy monuments, the site shall be better chosen in the compound of school, government office and local administrative office.

(2) Paper Locationing on Map.

Before starting field reconnaissance, paper locationing shall be studied on existing topographic map of 1/1,000,000 , 1/250,000 and 1/50,000.

Interpretation of maps on planimetry, topography and geomorphology shall be made to fulfill the condition stated in IV,1, 1) to 6) .

Stable ground foundations to support the monument may be expected on natural levees and alluvial fans.

Approximate location of proposed sites for geodetic controls and classification of Type A and Type B stations shall be shown on 1/50,000 maps. (Figure 3)

Geographical coordinates of proposed sites shall be read and recorded for successive field reconnaissance operation.

(3) Reconnaissance for Site Location.

Exact locations of construction site of geodetic control points shall be fixed on this reconnaissance.

Reconnaissance mission shall be consisting of 3 parties as shown in Appendix 2–1, one SOB counterpart personnel shall be requested to deploy with each party.

The following six sessions of reconnaissance have been planned, subject to alter by the climatic condition.

Session 1: DHAKA ——————— SYLHET ——————— DHAKA

Session 2: DHAKA ———— COMILLA (CHITTAGONG) ——DHAKA

Session 3: DHAKA ———————— MYMENSINGH ———————— DHAKA

Session 4: DHAKA ———— JESSORE —— FARIDPUR —— DHAKA

Session 5: DHAKA ———— RANGPUR —— BOGRA —— DHAKA

Session 6: DHAKA ———— RAJSHAHI — PABNA ———— DHAKA

Access to the site of planned geodetic controls shall be executed with maps on which proposed site have already been plotted in the phase of paper location, and also by the aid of handy GPS instruments.

At site, exact position should be fixed and marked for the construction work of monumentation.

For this purpose, the survey shall be done to fulfill the conditions stated in IV, 1. (1) .

All data of the monumentation site shall be recorded on " TABLE OF LOCATION SURVEY" as per Appendix 3.

The task of SOB counterpart personnels can be described as follows;

1) Assure the safety operation of JICA Study Team.

2) Public relations for local authority and people on the project.

3) To obtain permission or approval to construct monuments from land owner or authority concerned.

4) Hearing with local authority or people on availability of monumentation materials i.e., sand and crushed stones.

5) Translation into Bengali on Access Route Description.

(4) Obtaining data of construction cost.

After field reconnaissance had been made, several quotations and proposals by contractors shall be collected with specification to be satisfied with SOB.

Capability and proposal of contractors shall be examined by the Study Team.

2. Locationning of Bench Marks.

(1) General Consideration.

The First Order Levelling Network shall be established in length of approximately 2,200 kilometers.

About 220 Standard Bench Marks shall be constructed along the levelling routes with the interval of 10 km and about 220 smaller type bench marks shall be constructed in between. (Figure 4)

These bench marks shall be located to satisfy with the following conditions;

1) to be placed along the road or nearby.
2) stable ground condition.

(2) Paper Locationning on Map.

Same procedures with locationning geodetic controls shall be exercised.

(3) Reconnaissance for Site Location.

Exact locations of construction site of Bench Marks shall be fixed on this reconnaissance.

Reconnaissance mission shall be consisting of 3 parties as shown in Appendix 2–2, and three SOB counterpart personnels shall be requested to deploy with the mission.

Activities and sessions of reconnaissance are identical with the geodetic control mission.

To locate proposed National Vertical Datum Point in Dhaka and Annex Bench Mark for associating with Tidal Observatory in Chittagong, site study shall be carried out with utmost care.

About fifty (50) existing and new control points shall be selected to link with 1st Order Levelling Net to get the value of the difference between Geoidal and Ellipsoidal Height at the spot in order to analyze Geoidal Undulation Model in the area.

(4) To obtain data of construction cost, same procedure shall be applied as that of geodetic controls.

3. The Study of Tidal Observation Station.

Tidal Observation Station will be constructed, primarily, for obtaining mean sea level to determine the vertical datum of Bangladesh.

Appropriate site to construct tidal observation station is neighbouring place of CUFL jetty in Chittagong as reported by the JICA Preparatory Study Team.

In this phase of study, all necessary data shall be collected and analyzed to determine exact location of construction site for tidal station, and to prepare preliminary design which will be used for the detail design of the station, by two coastal engineers. (Appendix 2-3)

(1) Preparatory Study.

1) Data collection and study.

The following data, necessary to determine construction site and to make structural design of tidal observation station, shall be collected.

a. Topographic condition;

Sea bottom feature and surrounding topography.
Boring data (columner sections).

b. Meteorological condition;

Prevailing wind, maximum wind speed and direction.
Statistics of rain and atomospheric pressure.

c. Oceanographic condition;

Maximum high and low water level.
Maximum wave height, cycle and length.
Annual and seasonal prevailing wave direction.
Tidal observation data from IWTA.
Tidal current.

d. Hearing from neighbourhood;

Historical record of natural disasters caused by Cyclone and flood.
Historical change on surrounding coast and river mouth.

(2) Reconnaissance and Site Locationning.

After analyzing on the above mentioned collected data, following study shall be made.

1) Boring and bathymetric survey shall be done.

2) Investigation on availability of construction materials i.e., supporting pillars and observation well.

3) Investigation on capability of local contractors.

(3) Preliminary Design.

Preliminary design of Tidal Observation Station shall be done at site in 1:100 scale.

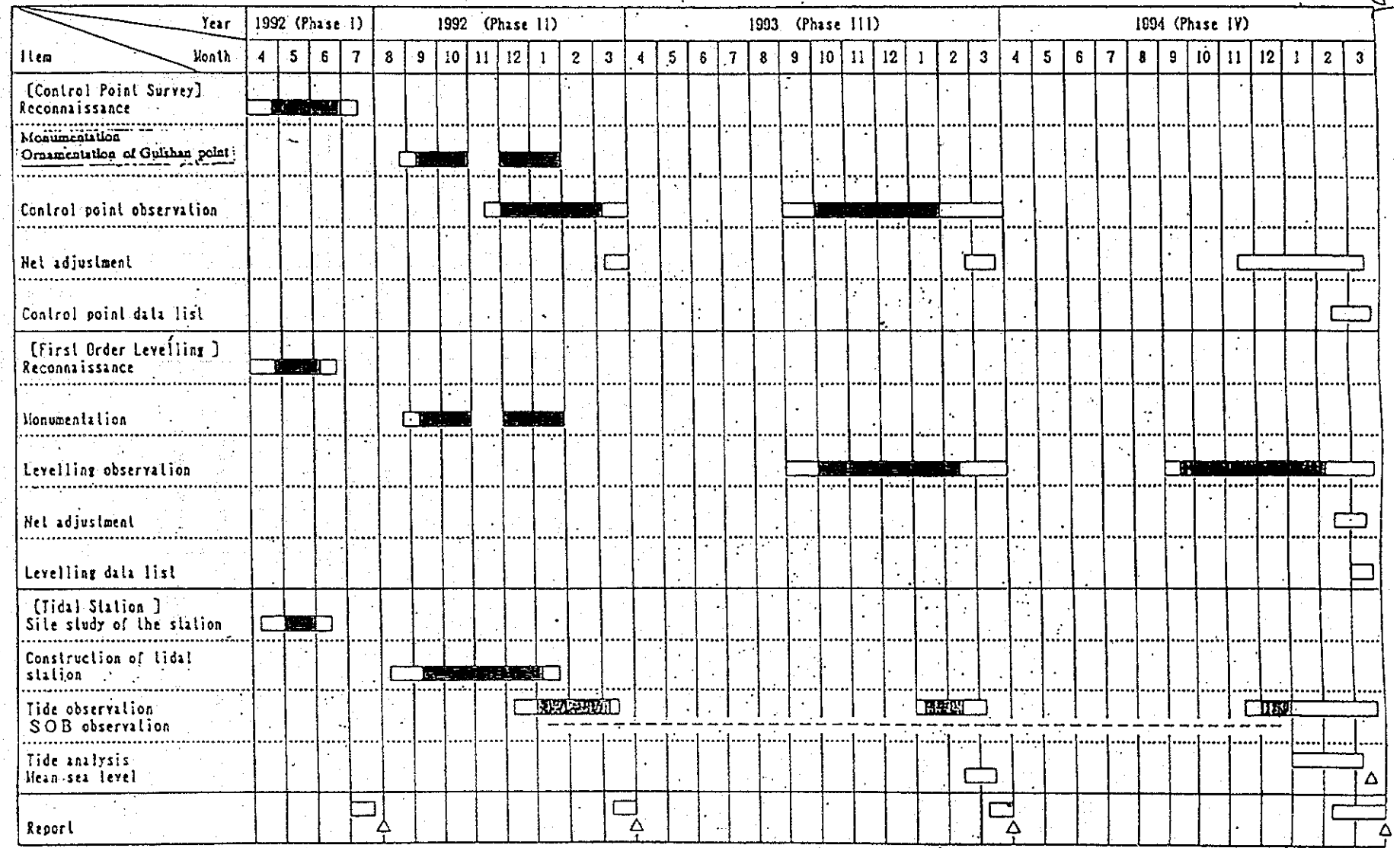
V. PROGRAM AND PROGRESS

The Study Team shall inform to SOB on their tentative field activity schedule in advance.
Any changes of activity area and sub-base shall be reported to both SOB and the Study Team HQs by counterpart officer in charge and Team field party chief.

Progress of the Study in field shall be reported by the Study Team to SOB on monthly basis.

STUDY SCHEDULE

Appendix 5



Appendix 2

STUDY SCHEDULE (First Year) Phase I

Item \ 1992	April	May	June	July
Preparatory work in Japan				
Control point (Reconnaissance)	30		24	
First order levelling (Reconnaissance)	30		14	
Tidal station (Site, Study)		6	4	
Work in Japan				

Field Work in Bangladesh Work in Japan

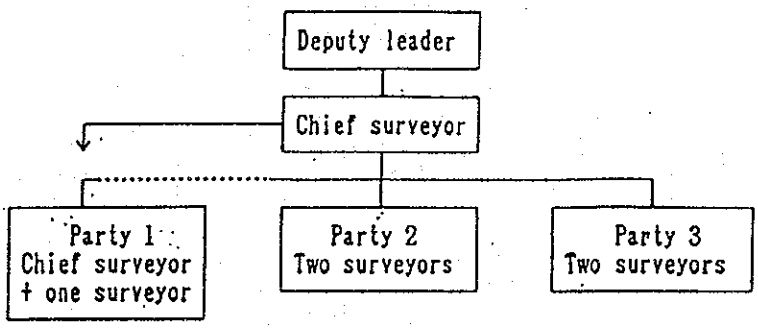
LIST AND ASSIGNMENT OF TEAM (First Year) Phase I

Organization	Names	Assignment	April	May	June	July
Headquarters	Minoru TAJIMA	Leader	30		19	
	Shigehiko SHINO	Deputy Leader	30		24	
	Yoshio SASAKI	Planner	30		24	
Control Point Network	Masaji KOYAMA	Chief Surveyor	30		24	
	Takashi ITOU	Surveyor		6	19	
	Mitsuru HAMADA	Surveyor		6	18	
	Isao YAMAMOTO	Surveyor		6	19	
	Megumi SHIMIZU	Surveyor		6	19	
	Kousuke INADA	Surveyor		6	19	
First Order Levelling Network	Masanori TESHIMA	Chief Surveyor	30		14	
	Kenlarou USUDA	Surveyor		6	10	
	Takashi KITANI	Surveyor		6	10	
Tidal Station	Shigeru MIYAMURA	Hydrographer		6	4	
	Kouichi MORIE	Hydrographer		6	4	

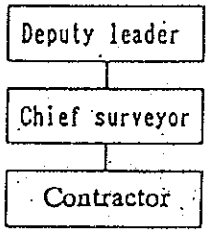
STUDY TEAM

(CONTROL POINT)

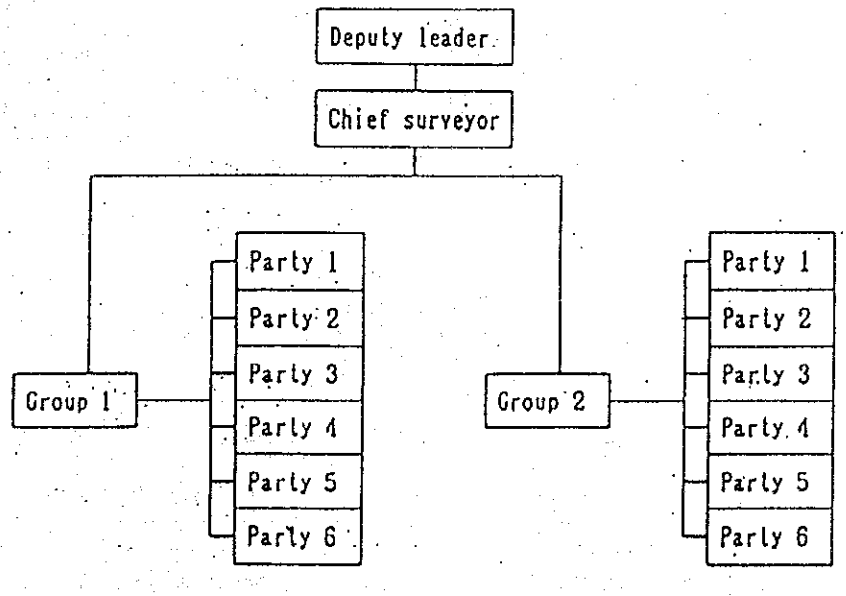
1st F/Y (Phase I) Reconnaissance



2nd F/Y (Phase II) Monumentation



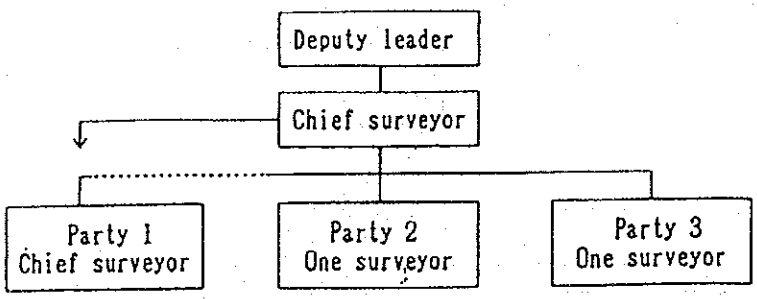
2nd & 3rd F/Y (Phase II & III)



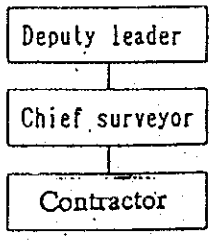
STUDY TEAM

(FIRST ORDER LEVELLING)

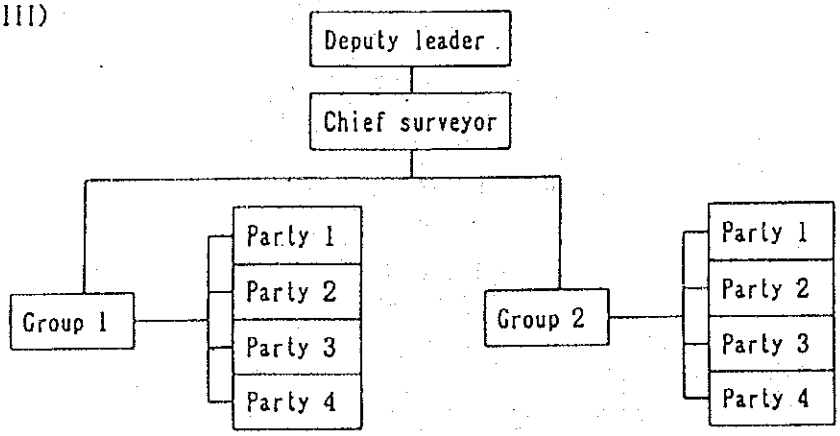
1st F/Y (Phase I)
Reconnaissance



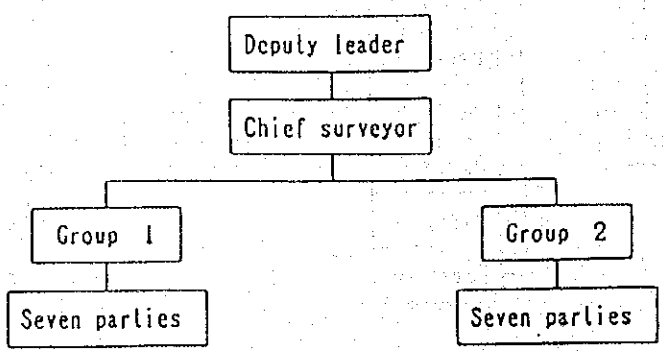
2nd F/Y (Phase II)
Monumentation



3rd F/Y (Phase III)



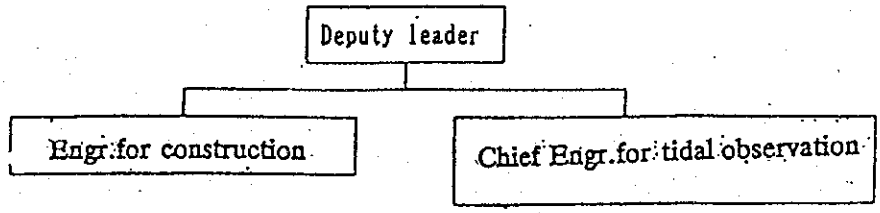
4th F/Y (Phase IV)



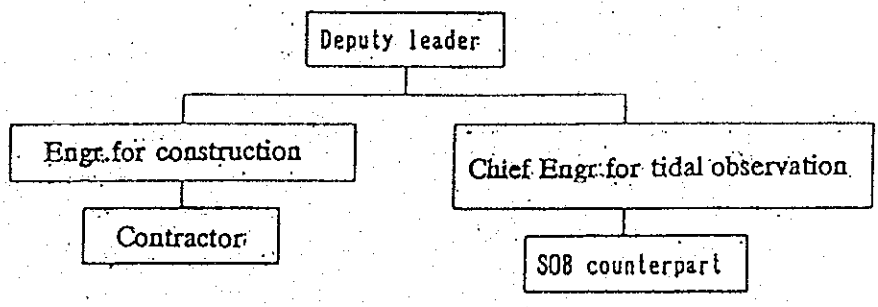
STUDY TEAM

(TIDAL STATION)

1st F/Y (Phase I) Selection of Tide Observation Station



2nd F/Y (Phase II) Construction and Observation of Tidal Station



3rd & 4th F/Y (Phase III & IV) Tide Observation.

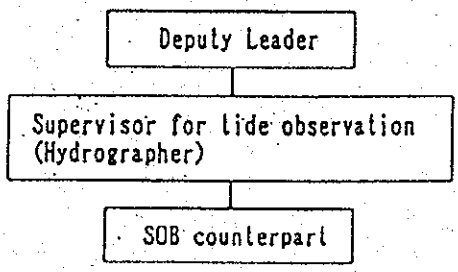


Figure 1

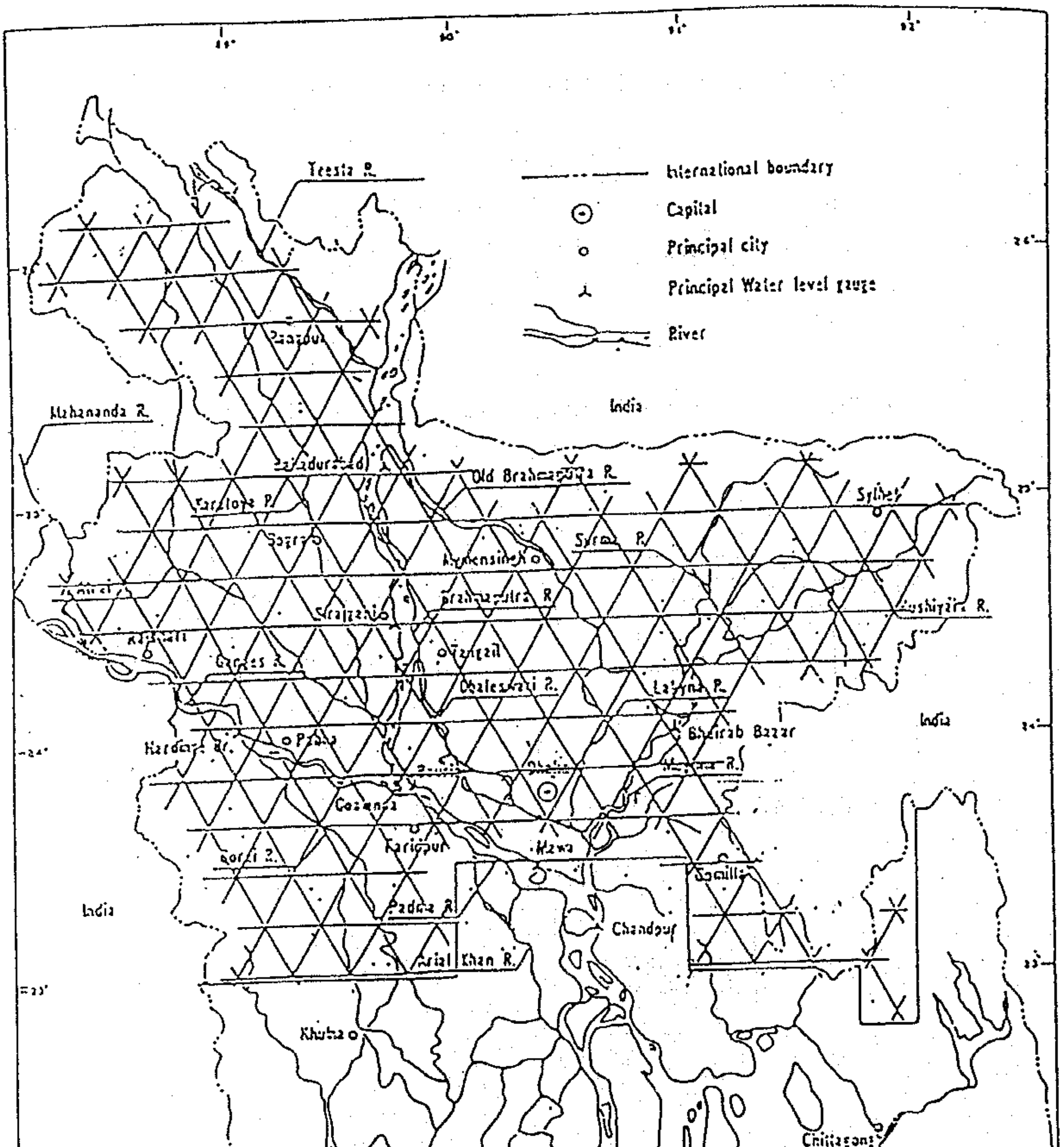

International boundary
Capital
Principal city
Principal Water level gauge
River
Teesta R.
Mahananda R.
Old Brahmaputra R.
Karatoya R.
Bogra
Mymensingh
Brahmaputra R.
Sylhet
Kushiyara R.
Rajshahi
Ganges R.
Tangail
Dhaleswari R.
Bhairab Bazar
Pabna
Faridpur
Mawa
Padma R.
Arial Khan R.
Chandpur
Comilla
Khulna
Chittagong
India
BAY OF BENGAL
Cox's Bazar

Figure 2

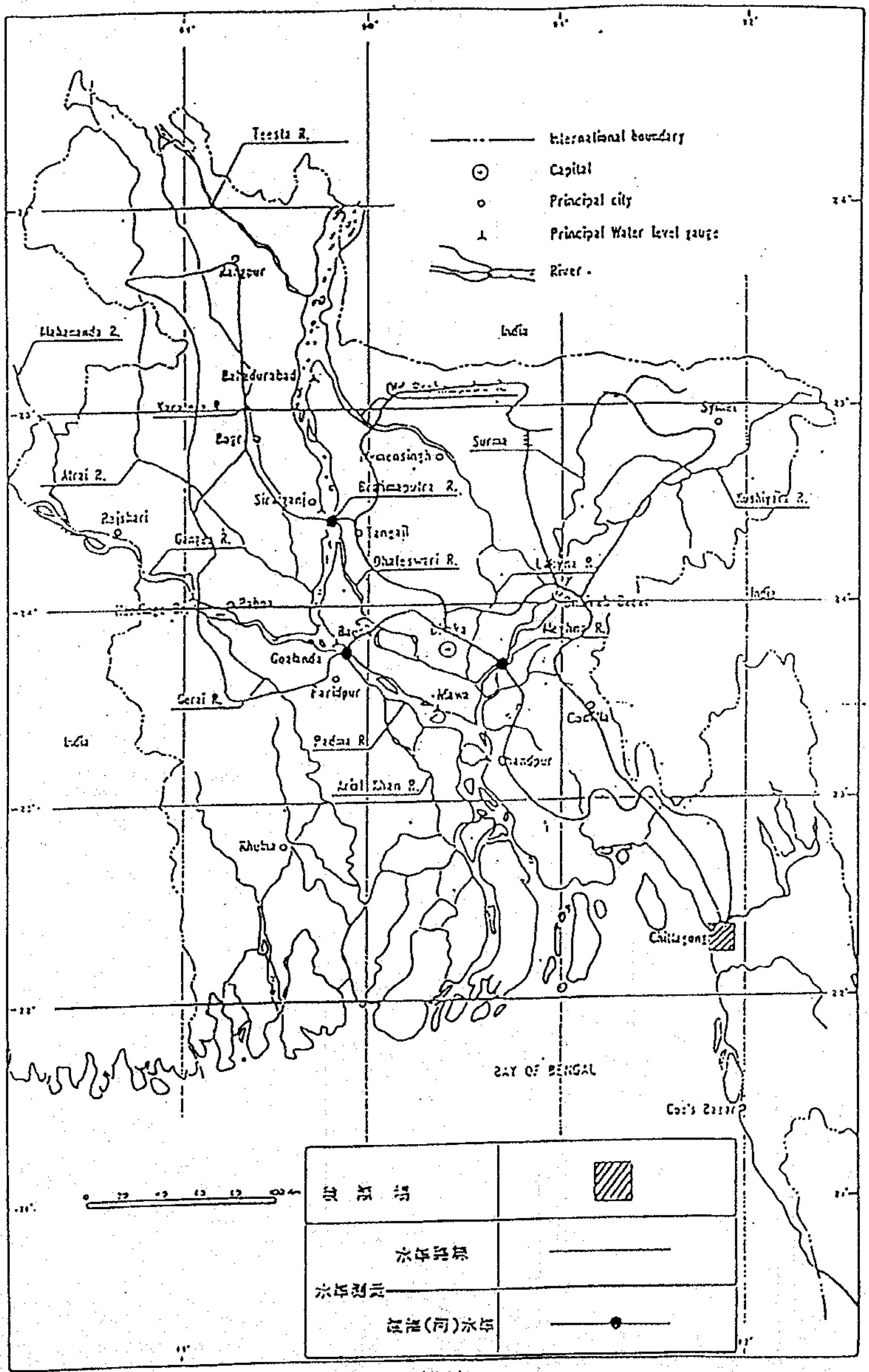
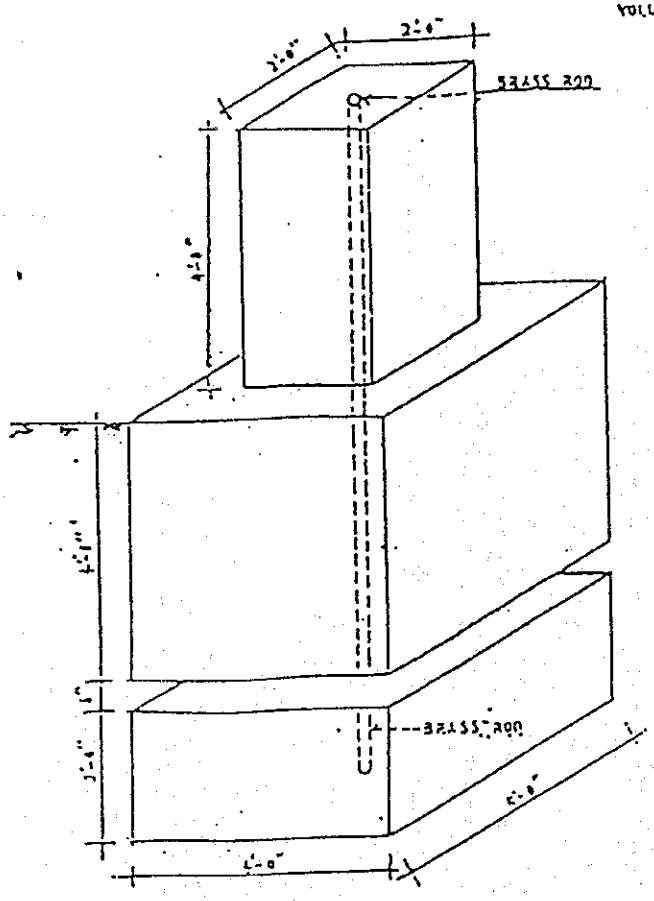

International boundary
Capital
Principal city
Principal water level gauge
River
Teesta R.
Rangpur
Bahadurabad
Atrai R.
Rajshahi
Ganges R.
Sirajganj
Tangail
Dhaleswari R.
Meghna R.
Dhaka
Goalundo
Faridpur
Mawa
Gorai R.
Padma R.
Chandpur
Khulna
Surma
Sylhet
India
Chittagong
BAY OF BENGAL

Figure 3



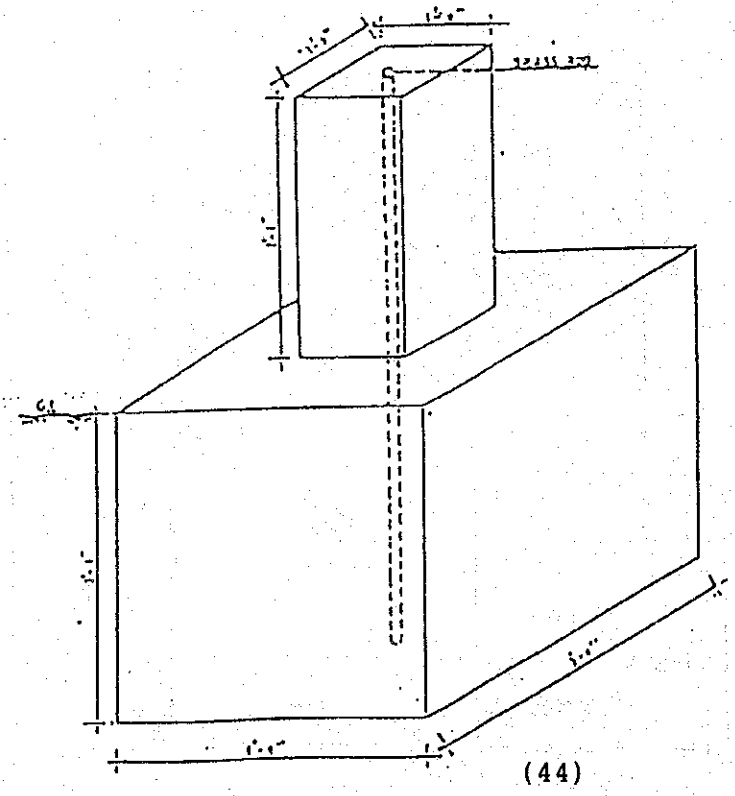
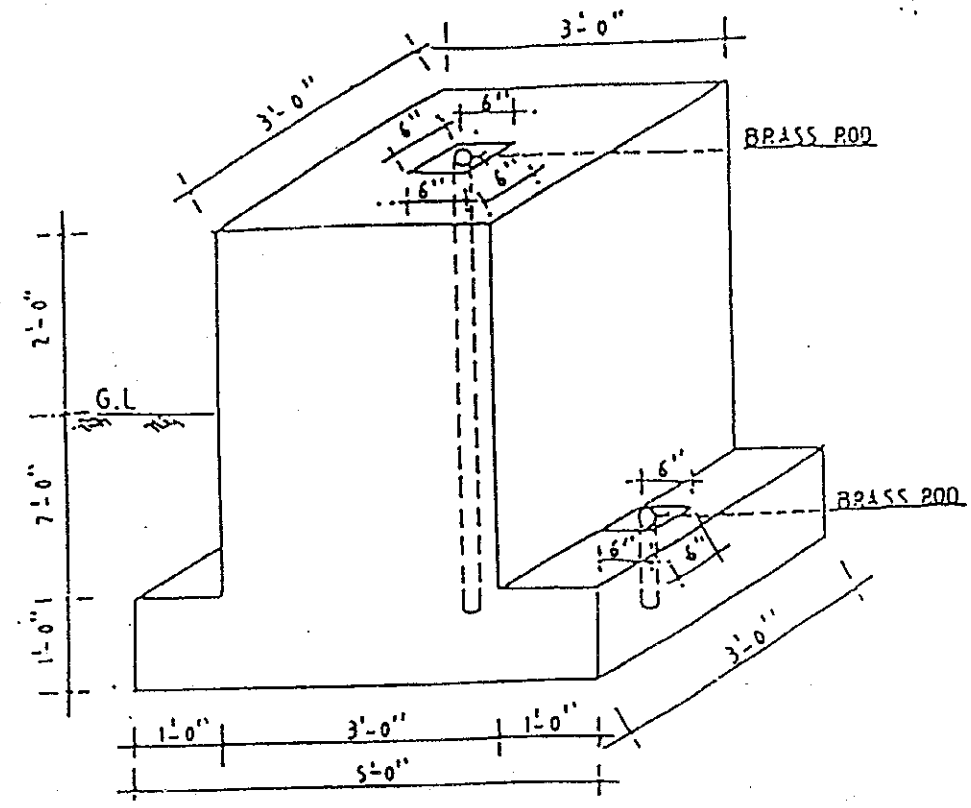
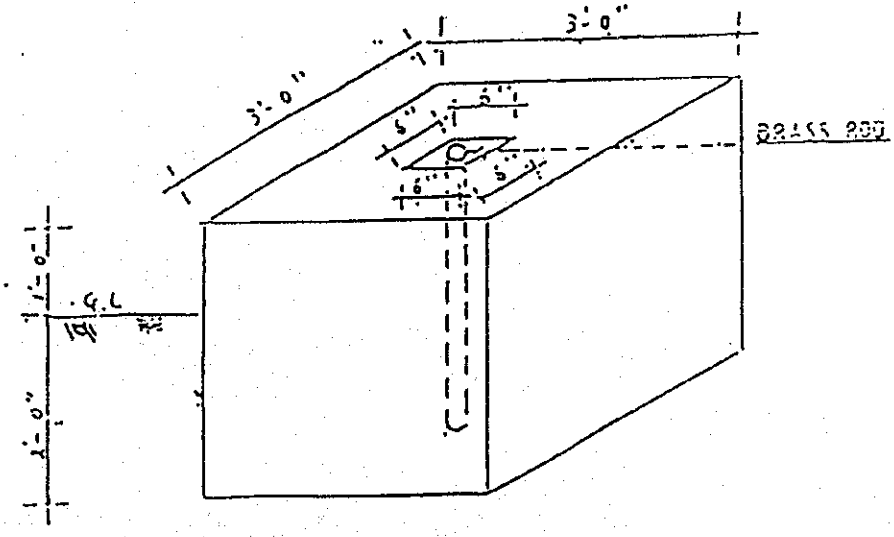


Figure 4


3'-0"
3'-0"
6"
6"
6"
6"
BRASS POD
2'-0"
G.L
2'-0"
1'-0"
6"
BRASS POD
6"
6"
3'-0"
1'-0"
3'-0"
1'-0"
5'-0"


3'-0"
3'-0"
5"
5"
BRASS POD
1'-0"
G.L
2'-0"

APPENDIX 3

MINUTES OF MEETING ON PHASE I FIELD STUDY REPORT (22.6.1992)

Dhaka,22,06,1992
SS-11

To : The Surveyor General of Bangladesh
Tejgon Industrial Area
Dhaka-1208

From: The Deputy Leader
JICA Study Team
for The Establishment of Geodetic
Control Network in Bangladesh

Subject: Progress and some remarks on the Phase I Study for the Establishment of Geodetic Control Network in the People's Republic of Bangladesh

I. It is my great pleasure to inform you that we have completed all works for the Phase I Study with success.

Following are the result of locationing of Horizontal and Vertical Geodetic Controls.

1. Newly establish GPS Points ;	Type A	26 pts.
	Type B	89 pts.
	Total	115 pts.
Existing Triangulation Points to be occupied by GPS ;	Type A	3 pts.
	Type B	21 pts.
	Total	24 pts.
National Geodetic Datum Point (Gulshan) ;		1 pt.
	Grand Total	140 pts.

Notes; Due to the obstructions for GPS observation, 9 planned existing Triangulation Points are converted as new GPS Points.

2. The First Order Bench Marks:	Standard Bench Marks	228 pts.
	Smaller Type Bench Marks	227 pts.
	River Crossing Points (ditto)	6 pts.
	Vertical Datum Point (Gulshan)	1 pt.
	Annex B.M. for Tidal Station	1 pt.
	Grand Total	463 pts.

Notes; 1)Total length of levelling lines are counted approx. 2,280 km. on 1:50,000 Topographic Maps.
2)Total of river crossing levelling sites are 8 (eight).
(abt. 4 km: 1, abt. 3 km: 1 and less 2 km: 6)
3)Levelling lines to be linked with 41 GPS Points are total about 58 km.
4)Existing 2 B.M.s are included in planned levelling routes.

II. Specification of monument are discussed and kept in record as

" Discussion on the Specification on Monument" .

It is to be added that Vertical Datum Point and Annexed Bench Mark for Tidal Observation Station, shall be supported by bearing piles which are reached to sub-soil bearing layer.

III. Concept design of Vertical Datum Point housing is shown, and final design shall be completed soon in Japan with consideration of your coment.

IV. Preliminary Plan of Tidal Observation Station with alternatives are shown, and we will complete detailed design in Japan.

V. I request you to obtain Frequency Allocation for transceivers,which are essential tools for GPS Observation.

On leaving temporarily from your country, on behalf of JICA Study Team I express my sincere thanks to your kind cooperation during our stay.

And I believe that same friendship and cooperation shall be given to us on our next Phase of Study.

Yours Truely;

Shigehiko Shino
Deputy Leader
JICA Study Team

Attachments; Specification of Monuments
Drawings

Received a copy of the report
22-6

Discussion
on the Specification of Monument

1. Size and dimentions are shown in Appendix A, for ;

   1) First Order Control Station ; Type A

   2) First Order Control Station ; Type B

   3) Standard Bench Mark

   4) Smaller Type Bench Mark

2. Top of the Monument

   1) Top of centre brass rod shall be cross-marked with V groove.

   2) Top surface of Control Station shall be finished in level and flush.

   3) Top surface of Bench Mark shall be finished with very flat pyramid shape with 1:5 slope.

   4) Side edges of top of monument shall be bevelled with about 30 m/m to avoid chipping off.

3. Inscription

   1) On front face of monument, following inscription shall be engraved;

SURVEY
OF
BANGLADESH

point designation number

   2) On back face of monument, following inscription shall be engraved;

JICA
1992

   3) Formal point designation numbers shall be prepared by SOB, in form of comparison list or table with temporary number on this field locationing survey.

Note : . In case of GPS normally North face is the front face.

4) The type and size of lettering will be specified by SOB, before the commencement of monumentation.

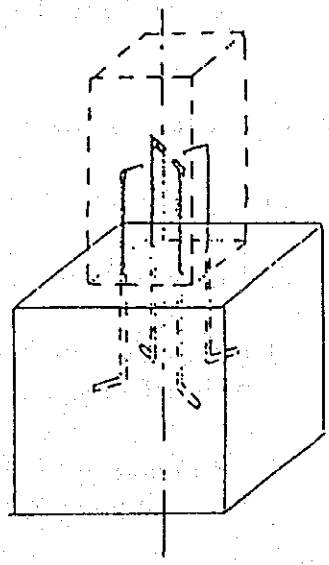
4. Monumentation;

1) After excavation work, bottom surface must be sufficiently compacted with sand and crushed stones.

2) Space between foundation slab and base cube of First Order Control Station Type A, must be filled with Sylhet Sand with compactness of 90% or more.

3) For anchoring pillar with base cube, double hooked M.S. bar with diameter 12 m/m shall be plugged as showing.

Numbers of M.S. bar, for 1st Order Control Station Type A and Standard Bench Mark, are 9 pcs. each, and for Type B Station are 4 pcs. each.



4) Volume of concrete for each type of monuments are approximately;

First Order Control Station Type A	: 3.0 cubic meters
First Order Control Station Type B	: 0.8 cubic meters
Standard Bench Mark	: 1.4 cubic meters
Smaller Type Bench Mark	: 1.0 cubic meters

5) Cement

Factory fresh domestic made normal cement or imported cement, directly procured from importers, shall be used.

6) Aggregate

Sylhet Sand and crushed stones must be used, as standard.
In case, the area where crushed stones are not available, crushed high quality bricks may be used as exception, subject to approval from supervising engineer.

7) Mix Proportion

1 : 1.5 : 3	;	for standard aggregate.(sand and crushed stones)
1 : 2 : 4	;	for crushed brick

5. Approval to occupy the land;

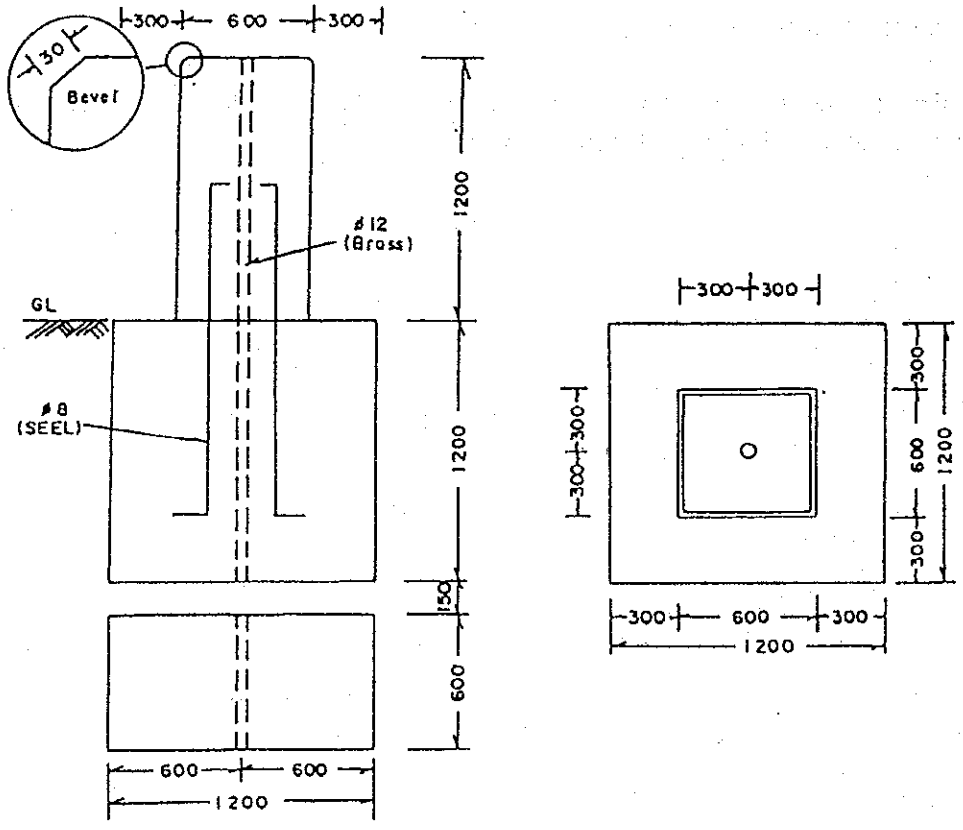
Approval to occupy the land for the monuments from land owners and administrative agencies, shall be obtained by SOB.

SOB and JICA Study Team

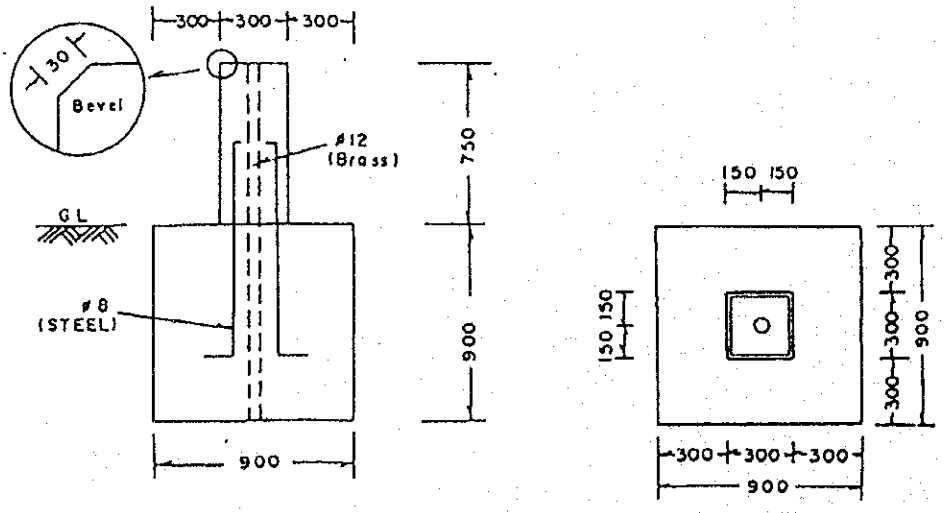
June, 1992

1st Order Control Station

A–type Scale 1:30



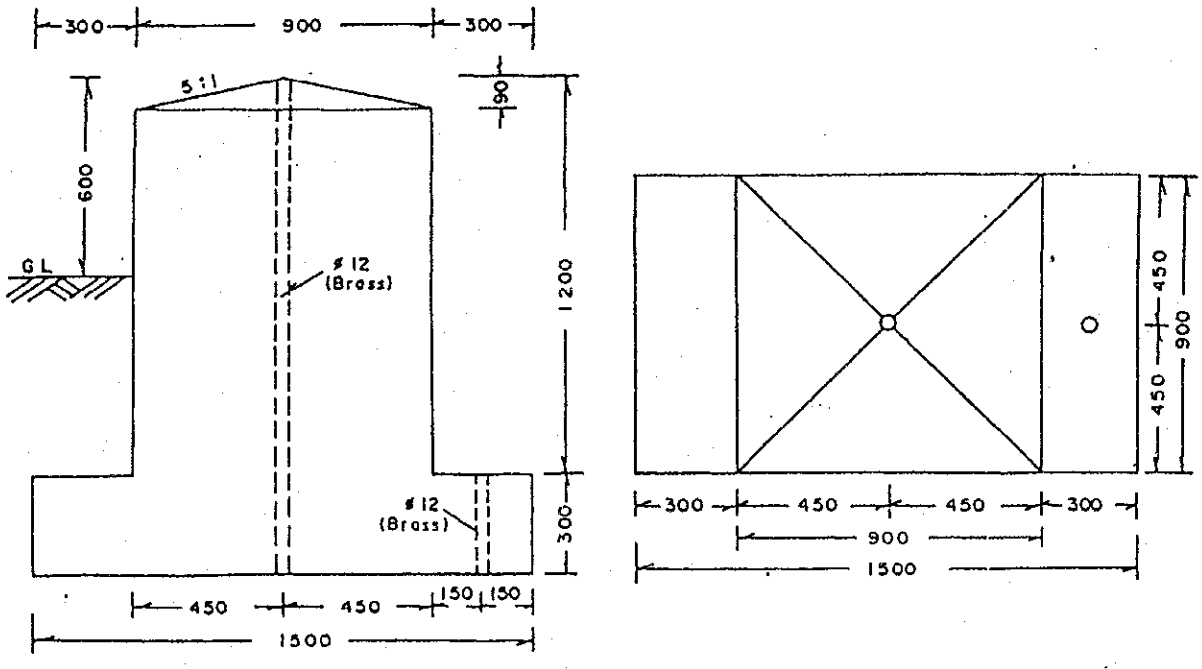
B–type



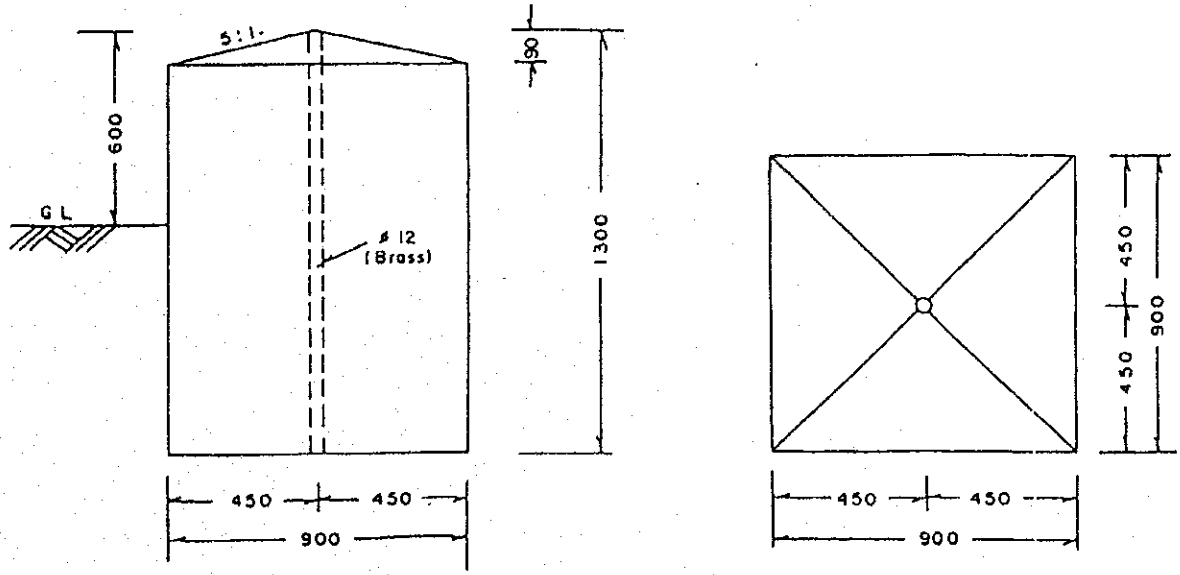
1st Order Bench Mark

Scale 1:20

Standard Type



Smaller Type



APPENDIX 4

MINUTES OF MEETING FOR PHASE II PLAN OF OPERATION (P/O) (7.10.1992)

MINUTES OF MEETINGS

FOR

THE STUDY ON THE GEODETIC SURVEY

IN

THE PEOPLE'S REPUBLIC OF BANGLADESH

PHASE II

HELD ON 22nd SEPTEMBER – 7th OCTOBER, 1992
BETWEEN
SURVEY OF BANGLADESH (SOB)
AND
JICA STUDY TEAM

DHAKA, 7th OCTOBER, 1992

7-10-92

MR.A. K. M. SHAMSUL ALAM
SURVEYOR GENERAL (C.D.),
SURVEY OF BANGLADESH,
MINISTRY OF DEFENCE

DR. MINORU TAJIMA
LEADER,
JICA STUDY TEAM

On the basis of the Scope of Work agreed upon between SOB and JICA on 5th December, 1991, the JICA Study Team, headed by Dr. Minoru Tajima, arrived Dhaka on September 20th, 1992, to carry out the Phase II work of " the Study on the Geodetic Survey in the People's Republic of Bangladesh" (the Study).

Prior to the commencement of the Phase II work of the Study, a series of meetings were held from 22nd of September to 7th of October, 1992 and the followings were confirmed and agreed upon between SOB and the JICA Study Team:

(1) The Plan of Operation (P/O) for the Phase II work of the Study, was submitted by the JICA Study Team to SOB and SOB agreed on the contents of P/O with minor corrections and additions.

(2) On the basis of the study results of the Phase I work of the Study, the JICA Study Team, in connection with the tidal observation in the Chittagong area, pointed out the necessity of undertaking an auxiliary tidal observation at the seashore directly facing the outer ocean (the Bay of Bengal), and proposed to SOB the installation of such observatory.

In the mean time, the JICA Study Team, after arriving in Bangladesh, carried out a field survey in the Chittagong area, and selected a possible site for the auxiliary tidal observation.

SOB recognized the necessity of such auxiliary tidal observation, and agreed on the JICA Study Team's proposals, such as the site of installation and the method of observation (details as described in P/O).

Official approval of the installation shall be obtained by SOB from the Port Authority of Chittagong.

(3) In order to enable the smooth implementation of the monumentation work of the Geodetic Control Points and the Bench Marks, SOB promised to provide at least two (2) numbers of counterpart personnel during the course of the monumentation work, one for the A area, West of the Jamuna River, and the other for the B area, east of the Jamuna River.

Necessary approval from the relevant authorities, organizations and individuals for the monumentation shall be obtained by these SOB counterpart personnel.

(4) In connection with the use of radio communication equipments necessary for the GPS observation, SOB shall make an ammendment of the allocated numbers (currently six (6) to thirteen (13) for vehicle-mounted type and eight (8) for hand-carried type) when making an application of use against T & T Board.

Also, the JICA Study Team stated that they prefer to use the frequency of either 465.075 MHz or 465.125 MHz from among the allocated frequencies.

(5) Following equipments, for Auxiliary Tidal Station and G.P.S. observation, will be brought from Japan to Bangladesh as temporary import.

During the Study period, SOB will confirm as to whether those items will be required by them for future observation.
If " YES" , necessary actions will be taken by SOB.

Item 1. One (1) Pressure Sensing Tidal Gauge.

Item 2. Thirteen (13) Poles for GPS Antenna.

(6) SOB and the JICA Study Team reconfirmed to consult on any future problem that may arise in the course of the implementation of the Study.

LIST OF ATTENDANTS

1. Survey of Bangladesh

Mr. A. K. M. Shamsul Alam	Surveyor General (C.D.)
Mr. Noor Muhammad Mia	Officer in Charge, Geodesy
Mr. A. N. Wahid	Technical Assistant (Geodesy)
Mr. Golam Rahman	Technical Assistant (Photogrammetry)

2. JICA Study Team

Dr. Minoru Tajima	Team Leader
Mr. Shigehiko Shino	Deputy Leader
Mr. Yoshio Sasaki	Planner
Mr. Masaji Koyama	Chief Surveyer (GPS)
Mr. Masanori Teshima	Chief Surveyor (Levelling)
Mr. Shigeru Miyamura	Coastal Engineer
Mr. Atushi Okuizumi	Coordinator
Mr. Tetsuro Imakiire	JICA Advisory Member
Mr. Atsushi Hanatani	JICA Headquarters
Mr. Akashi Ito	Embassy of Japan
Mr. Kozo Yamakawa	JICA Bangladesh Office

PLAN OF OPERATION

FOR

THE STUDY ON THE GEODETIC SURVEY

IN

THE PEOPLE'S REPUBLIC OF BANGLADESH

PHASE II

(September 1992 – March 1993)

SEPTEMBER 1992

JAPAN INTERNATIONAL COOPERATION AGENCY

I. INTRODUCTION

The Government of the People's Republic of Bangladesh has requested a Technical Assistance Program on The Establishment of National Geodetic Control Net in the country to the Government of Japan.

In response to the request, Japan International Cooperation Agency (hereinafter referred to as JICA) despatched a Preliminary Study Team in 1990 (July 30 to August 15) and a Preparatory Study Team in 1991 (October 29 to December 8).

During these periods, field investigation were carried out, and a series of technical discussions had been exchanged between Survey of Bangladesh (hereinafter referred to as SOB) and JICA Study Teams.

As a result, a Scope of Work (hereinafter referred to as S/W) was signed by both parties on December 5, 1991.

Consequently, JICA despatched a Study Team to Bangladesh for the Phase I Study, from April 1992 to June 1992.

In the Phase I Study, the Study Team in cooperation with SOB's counterpart officials had reconnoitred and marked location of the following,

1) Newly establish GPS Points ;		Type A	26 pts.
		Type B	89 pts.
		Sub Total :	115 pts.
	Existing Triangulation Points, to be occupied by GPS ;	Type A	3 pts.
		Type B	21 pts.
		Sub Total :	24 pts.
	National Geodetic Datum Point in Gulshan ;		1 pt.
		Total :	140 pts.
		(See Figure 1)	

2) First Order Bench Marks ;	Standard Bench Mark	228 pts.
	Smaller Type Bench Mark	227 pts.
	River Crossing Levelling Points	6 pts.
	Vertical Datum Point	1 pt.
	Annex B.M. for Tidal Station	1 pt.
	Total :	463 pts.

3) Construction site of Tidal Observation Station.

This Plan of Operation (hereinafter refered to as P/O) is to describe the implementation plan for the Phase II (2nd fiscal year) Study.

The Study shall be carried out according to this P/O and also to the results of discussions during implementation between SOB and the Study Team.

II. IMPLEMENTATION PLAN FOR THE PHASE II STUDY

The activities of this Phase of Study shall be divided into the first part and the second part, and the former shall be the construction period and the latter shall be the observation period as described below.

1. Construction Period.

1) Monumentation of Geodetic Control Points.

2) Monumentation of First Order Bench Marks.

3) Construction of National Geodetic Datum Yard in Gulshan Park.

- Ornamentation of Geodetic (Horizontal) Datum Point.
- Construction of Vertical Datum Point.
- Construction of boundary fence.

4) Construction of Tidal Observation Station.

2. Observation Period.

1) GPS observation of 60 Geodetic Control Points.

2) Tidal observation, including technical and operational instruction of the Tidal Gauge.

The Study Schedule and the list of Study Team Members and their assignment are shown in Appendix 1 and 2.

III. MONUMENTATION OF GEODETIC CONTROLS, FIRST ORDER BENCH MARKS AND CONSTRUCTION OF TIDAL OBSERVATORY

1. Specifications of the Monument.

The specification of the Monument were reached in an agreement on June 22, 1992 between SOB and the Study Team in the Phase I Study and kept on record

Monumentation work shall be carried out based on these specification.

The followings are important remarks worth iterating.

1) size and dimensions are shown in Figure 2 and Figure 3.

2) Inscription:

On the front face of the Monument, the following inscription shall be engraved.
(Note; In case of GPS point, North face is the front face.)

SURVEY
OF
BANGLADESH
point designation number

On the back face of the Monument, the following inscription shall be engraved.

JICA
1992

Type and size of lettering shall be specified by SOB, before building of the monumences.

3) Concrete materials.

Factory fresh or imported fresh normal cement must be used.

Sylhet Sand and crushed stone for aggregate must be used as standard.

Mix Proportion of 1 : 1.5 : 3 shall be used for standard aggregate.

4) Approval to occupy the land, for the Monuments, shall be obtained by SOB from the land owners and/or administrative agencies before the commencement of monumentation.

2. Monumentation Site.

1) Monumentation sites of Geodetic Control Point are shown on Figure 1 and marked on the 1:50,000 Topographic Map and are also listed on Table 1 .

2) Monumentation sites of Bench Mark are on the planned First Order Levelling Routes, shown on Figure 4, and also marked on the 1:50,000 Topographic Maps.

3) Access to each monumentation site for both Control Station and Bench Mark is easily possible by the help of " TABLE OF LOCATION SURVEY" shown on Figure 5 and 6.

4) Quantities of newly establish monuments.

Geodetic Control (GPS) Points;

Type A	26	pts.
Type B	89	pts.
Total	115	pts.

In addition to above, ornamentation for Station No. 303 (Gulshan Point) shall be made.

First Order Bench Marks;

Standard Bench Mark	228	pts.
Smaller Type Bench Mark	227	pts.
River Crossing Levelling Points	6	pts.
Vertical Datum Points in Gulshan	1	pt.
Annex B.M. for Tidal Station	1	pt.
Total	463	pts.

3. Construction of National Geodetic Datum Yard in Gulshan North Park.

1) Ornamentation of Geodetic (Horizontal) Datum Point.

Existing Station No. 303 shall be covered with cement and mortar, and the proper inscription or plaque to designate National Datum Point shall be fixed as shown in Figure 7.

2) Construction of Vertical Datum Point.

Vertical Datum Point shall be constructed as shown in Figure 8.
A supporting steel/concrete pile should be firmly anchored in bearing layer to ensure the stability of the monument block.

3) Boundary fence of the yard shall be constructed as shown in Figure 9.

4. Construction of Tidal Observation Station.

Tidal Observation Station shall be constructed at the neighbouring water area of CUFL Rangadia, Chittagong.

Observation Station and Obsevation Well shall be supported by eight (8) cast-in-situ steel/concrete piles, which are firmly engaged into sub-soil bearing foundation.

For the convenience of access and levelling work, a stable cat-walk bridge shall also be constructed.

An Annex Bench Mark for Tidal Observation Station, shall be constructed in the CUFL compound.

These layout are shown on Figure 10.

Installation and adjustment of Tide Gauge shall be conducted after the construction of Tidal Observation Station has been completed.

Construction of Auxiliary Tide Gauge Station:

The Study Team is intending to construct an Auxiliary Tide Gauge Station, at the shore line in Chittagong area facing to the Bay of Bengal, to obtain the data for compensating the possible influences of river flow especially during the rainy season.

This Station shall be a temporal construction, and a pressure sensing Tide Gauge with memory card recording system shall be mounted below I.S.L.W. level. (Figure 11)

A Tide Pole to observe mean high water level shall also be constructed. (Figure 12)

The proposed site of this Auxiliary Tide Gauge Station is shown on Figure 13.

IV. GPS OBSERVATION AND TIDAL OBSERVATION

1. GPS Observation.

Sixty (60) of total one hundred forty (140) geodetic control stations, shown on Figure 14 and Table 2, shall be observed by GPS Method, from the first half of December 1992 to the beginning of March 1993.

The GPS observation shall be conducted by twelve (12) survey teams, each consisting of one Japanese surveyor, one SOB Counterpart (if needed), one local assistant and a few laborours.

One campaigne of GPS observation shall be comprised by two sessions with a interval of more than five (5) hours, and each session continues two hours simultaneous observation to receive more than four (4) GPS Satellite signals.

Numbers of GPS party for each campaign are varied by the configulation of GPS Satelltes at the date of observation, geographical conditions and the formation of network.

To avoid any observation vacancies during each session, and to conduct safety operation, frequent communication between each party, and also parties and commanding station is essential.

In this connection, the Study Team will bring into Bangladesh thirteen (13) Car Transcievers and eight (8) Handy Transcievers.

Primary network computations and quality controls shall be carried out during field work.

Provisional and precise Network adjustment shall be carried out in Japan in this Phase II Study.

2. Tidal Observation.

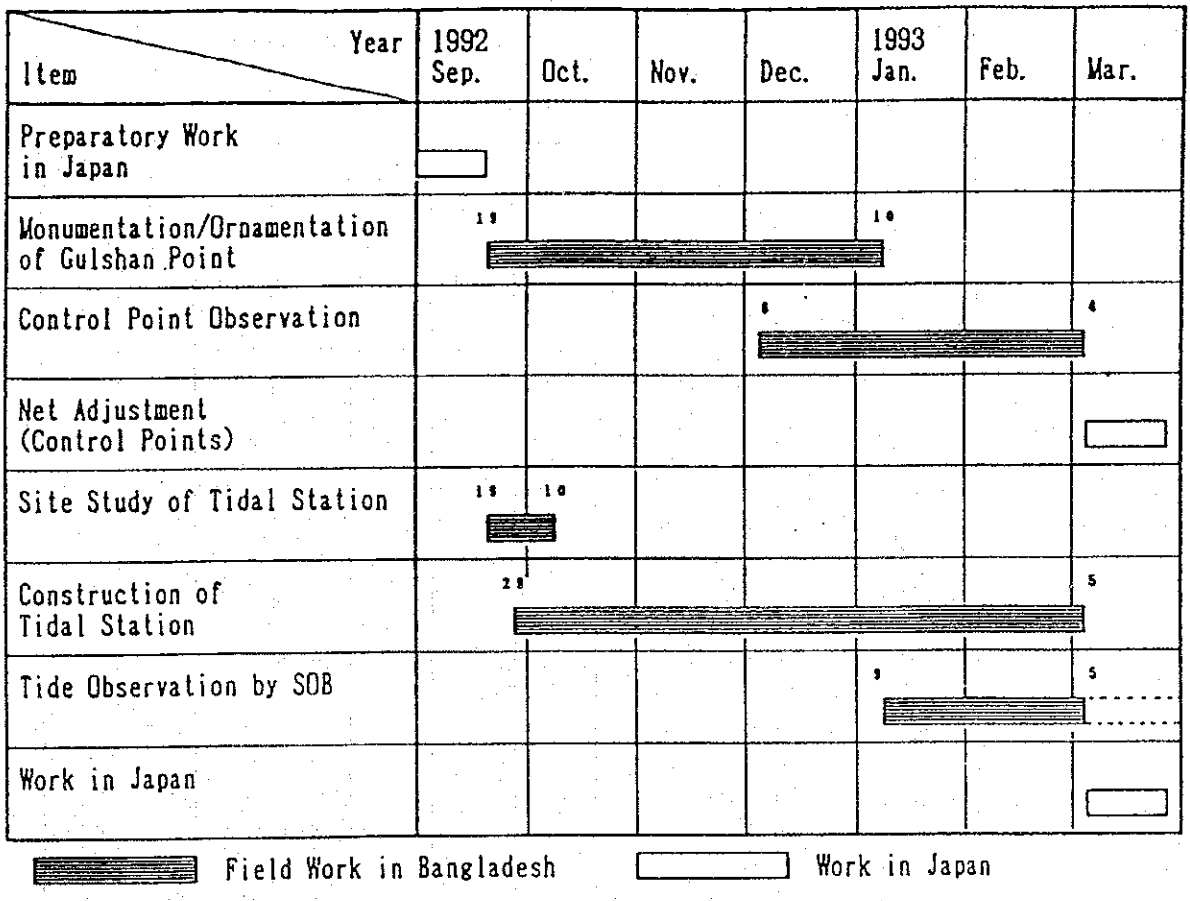
After the completion of construction work of Tidal Observation Station, Fuess Type Tidal Gauge shall be installed in Tidal Observatory, and be adjusted.

Necessary technical and operational instructions for Tidal Gauges to two SOB Counterparts shall be given to enable to continue tidal observation during the absence of the coastal engineer of the Study Team.

The tidal observation data, obtained during the Phase II Study, shall be reviewed and analized in Japan.

Appendix 1

STUDY SCHEDULE Phase II



LIST AND ASSIGNMENT OF TEAM (Phase II)

Appendix 2

Organization	Names	Assignment	1992 Sep.	Oct.	Nov.	Dec.	1993 Jan.	Feb.	Mar.
Headquarters	Minoru TAJIMA	Leader	28—13					22—8	
	Shigehiko SHIND	Deputy Leader	11				10	7	8
	Yoshio SASAKI	Planner	11			20	7		8
	Hironori KOBAYASHI	Mechanic	28			20	7		8
	Atsushi OKUIZUMI	Coordinator	12—26						
	Noriyuki TOMIZAWA	Coordinator						25—11	
Control Point Network	Masaji KOYAMA	Chief Surveyor	11		21	6			8
	Takashi ITO	Surveyor				8			4
	Takashi HARADA	Surveyor				8			4
	Mitsuru HAMADA	Surveyor				8			4
	Sachio TAZUKI	Surveyor				8			4
	Isao YAMAMOTO	Surveyor				8			4
	Megumi SHIMIZU	Surveyor				8			4
	Uichi ISHIMURA	Surveyor				8			4
	Masamichi YOSHIDA	Surveyor				8			4
	Yuji KIMURA	Surveyor				8			4
	Kosuke INADA	Surveyor				8			4
	Shinobu IDE	Surveyor				8			4
	Hiroyuki KAWAKAMI	Surveyor				8			4
First Order Levelling Network	Masanori TESHIMA	Chief Surveyor	11		17				
Tidal Station	Shigeru MIYAMURA	Coastal Engineer	11	10			9		5
	Koichi MORIE	Coastal Engineer		21					5

Fig. 1

Distribution Map of Control Station

(Monumentation Plan)

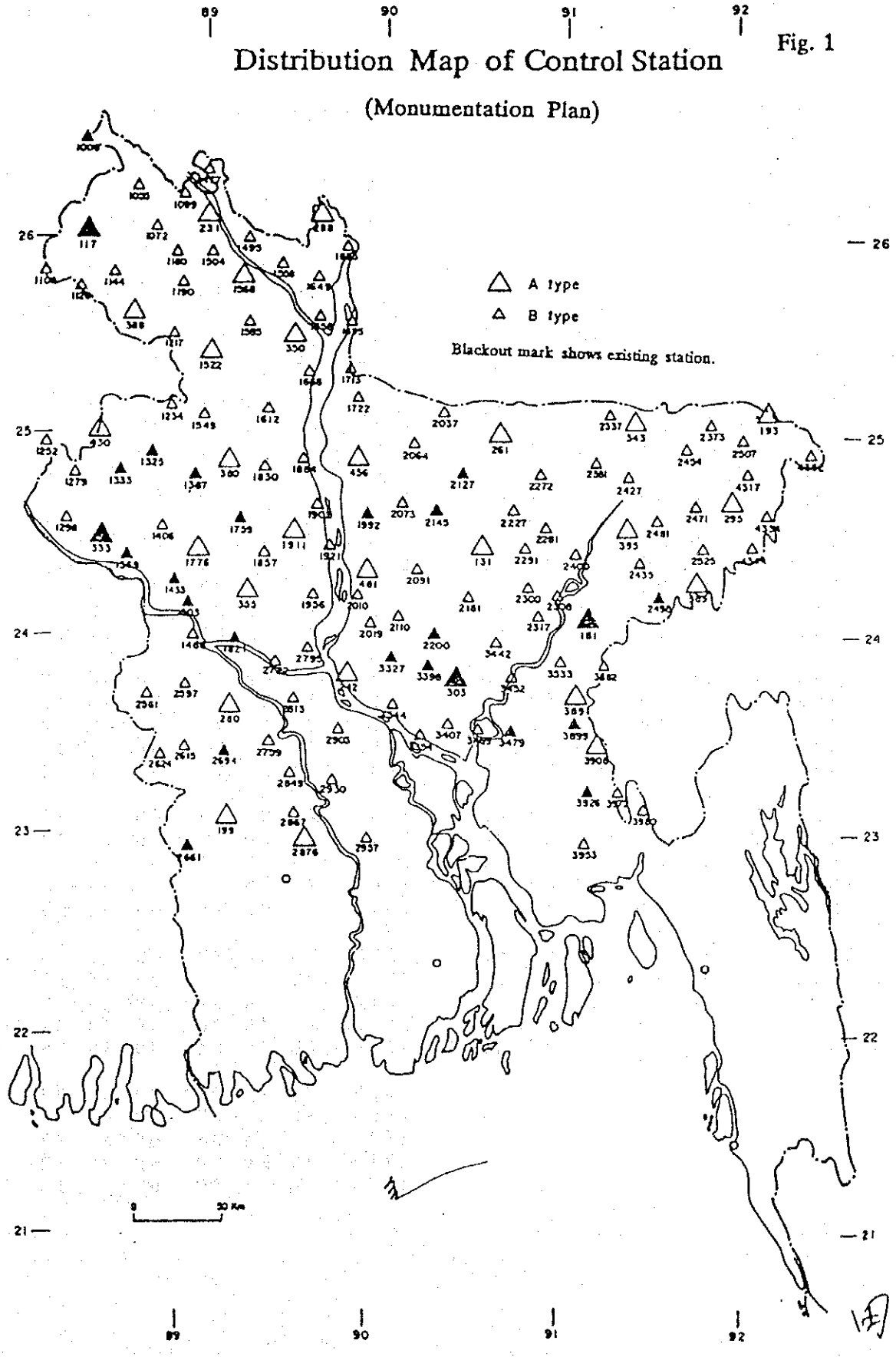


Table 1

LIST OF GEODETIC CONTROLS

(Longitudes and Latitudes, shown in this table, are approximate only.)

Type A

No.	Long.	Lati.
117E	26° 02′ 15″	88° 21′ 47″
131	24 27 05	90 33 22
181E	24 05 36	91 07 22
193	25 05 44	92 08 14
199	23 07 30	89 12 00
231	26 06 43	89 02 12
242	23 49 24	89 49 24
261	25 00 26	90 39 05
280	23 39 48	89 12 18
288	26 06 55	89 39 17
295	24 39 39	91 55 58
303EE	23 47 50	90 25 04
333E	24 30 21	88 28 26
343	25 03 47	91 23 44
350	25 30 37	89 31 15
355	24 14 00	89 17 30
369	24 15 42	91 44 08
380	24 52 48	89 10 42
388	25 37 12	88 37 52
395	24 32 00	91 20 48
430	25 01 29	88 27 21
456	24 53 38	89 52 26
481	24 20 26	89 55 41
1522	25 25 11	89 04 16
1568	25 48 34	89 14 22
1776	24 26 36	89 00 48
1911	24 31 43	89 31 50
2876	23 00 48	89 36 48
3891	23 42 45	91 03 35
3908	23 27 57	91 10 59

Type B

No.	Long.	Lati.
1009	26° 29′ 31″	88° 20′ 26″
1055	26 15 11	88 38 01
1072	26 03 20	88 44 33
1099	26 12 59	88 54 06
1109E	25 49 39	88 07 40
1126	25 45 01	88 19 39
1144	25 48 19	88 30 40
1180	25 55 36	88 51 50
1190	25 46 27	88 54 16
1217	25 30 50	88 51 35
1234	25 09 05	88 51 08
1252	24 58 09	88 09 34
1279	24 49 08	88 19 27
1298	24 35 34	88 16 40
1325E	24 55 09	88 44 44
1333E	24 49 57	88 34 19
1369E	24 24 53	88 36 47
1387E	24 48 35	88 59 22
1406	24 33 27	88 48 34
1433E	24 17 24	88 52 54
1468	24 01 24	88 59 30
1477	26 20 13	89 01 42
1495	26 00 06	89 16 05
1504	25 55 41	89 03 30
1549	25 06 25	89 01 59
1558	25 50 12	89 26 30
1585	25 34 18	89 16 37
1612	25 08 02	89 23 15
1649	25 48 18	89 38 37
1658	25 36 04	89 39 16
1668	25 19′ 09″	89 36 03″
1685	25 57 17	89 48 05
1695	25 34 31	89 49 32
1713	25 20 00	89 49 12
1722	25 11 30	89 52 18

Table 1-2

Type B

No.	Long.	Lati.	No.	Long.	Lati.
	° ′	° ′		° ′	° ′
1759E	24 35 36"	89 24 30	2561	23 43 18"	88 44 12
1803E	24 10 38	88 57 45	2597	23 46 18	88 57 18
1821E	24 00 12	89 13 30	2615	23 47 48	88 57 30
1830	24 51 00	89 22 24	2624	23 25 12	88 49 12
1857	24 25 30	89 22 30	2661E	22 58 48	88 59 06
1884	24 53 30	89 34 30	2694E	23 26 46	89 10 18
1902	24 40 00	89 39 00	2722	23 53 14	89 26 28
1921	24 27 56	89 43 02	2759	23 29 06	89 24 48
1956	24 13 11	89 37 51	2795	23 57 23	89 36 34
1992E	24 37 14	89 55 34	2813	23 42 06	89 32 12
2010	24 13 02	89 52 31	2849	23 20 00	89 31 24
2019	24 04 47	89 57 02	2867	23 08 24	89 32 54
2037	25 07 02	90 20 14	2903	23 23 00	89 46 42
2064	24 58 12	90 10 59	2930	23 18 00	89 44 42
2073	24 40 23	90 07 11	2957	23 01 24	89 56 42
2091	24 20 46	90 12 15	3327E	23 54 35	90 03 55
2110	24 06 42	90 06 00	3344	23 40 20	90 04 32
2127E	24 48 51	90 26 39	3354	23 31 05	90 13 41
2145E	24 37 51	90 18 08	3398E	23 51 39	90 15 52
2181	24 12 00	90 28 43	3407	23 34 19	90 22 15
2200E	24 01 24	90 17 45	3442	23 58 45	90 37 55
2227	24 37 55	90 43 06	3452	23 48 21	90 42 57
2272	24 48 28	90 51 51	3469	23 32 49	90 32 27
2281	24 32 55	90 53 30	3479E	23 32 16	90 42 46
2291	24 27 03	90 46 48	3533	23 53 00	90 58 18
2300	24 15 07	90 48 01	3882	23 51 53	91 12 49
2308	24 12 45	90 57 28	3899E	23 34 26	91 03 09
2317	24 06 30	90 51 03	3926E	23 14 25	91 07 21
2337	25 06 26	91 14 58	3953	22 59 24	91 06 06
2373	25 02 30	91 48 43	3972	23 13 44	91 18 54
2381	24 52 00	91 09 54	3980	23 09 08	91 26 04
2400	24 25 00	91 03 17	4317	24 47 53	92 01 15
2427	24 47 32	91 21 14	4334	24 35 40	92 07 23
2435	24 22 19	91 25 05	4344	24 26 08	92 02 26
2454	24 55 49	91 41 02	4352	24 53 20	92 22 14
2471	24 38 33	91 43 48			
2481	24 34 32	91 30 54			
2498E	24 11 44	91 31 15			
2507	24 57 51	91 59 37			
2525	24 26 10	91 46 05			

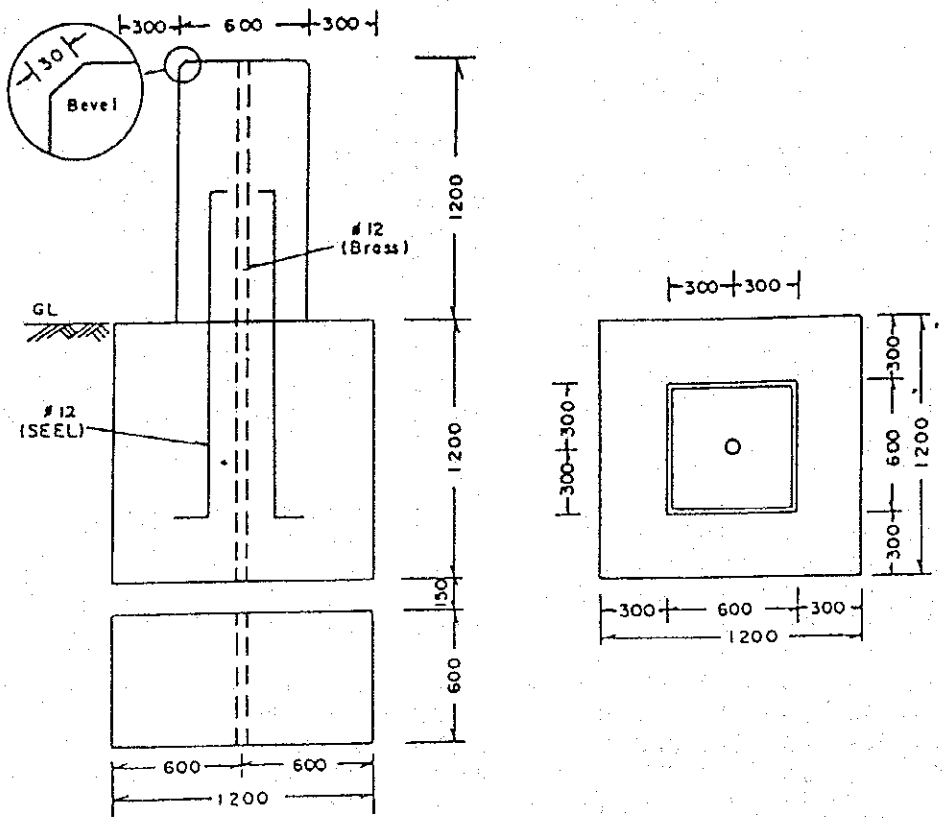
Note; Point Number ending E shows existing station.
Point Number ending EE shows Gulshan Point.

Fig. 2

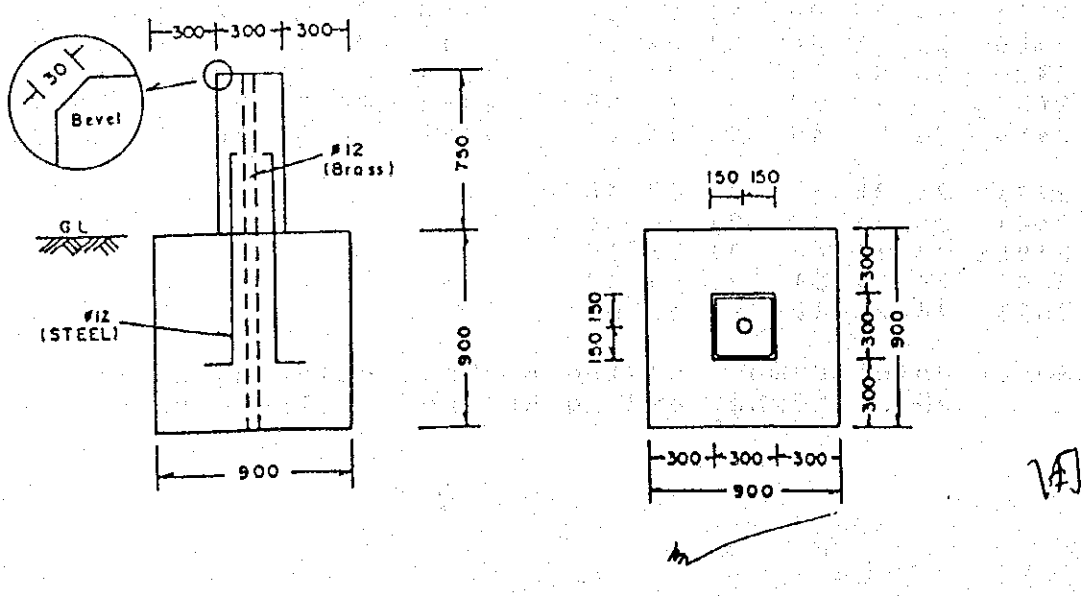
1st Order Control Station

A–type

Scale 1:30



B–type

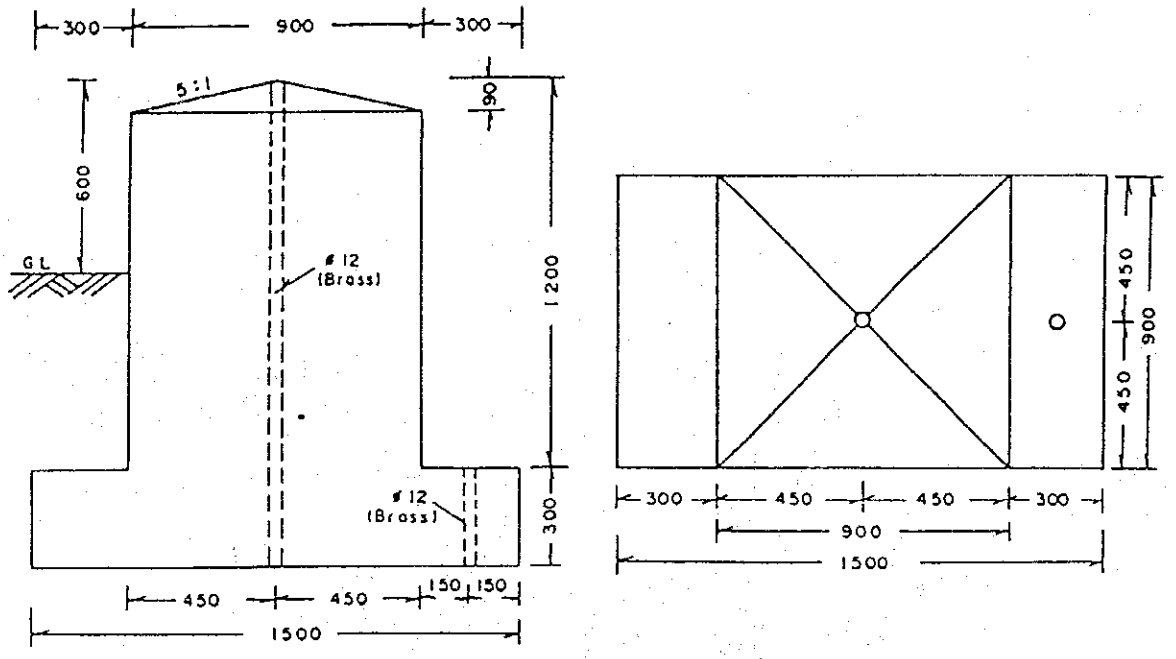


1st Order Bench Mark

Fig.3

Scale 1:20

Standard Type



Smaller Type

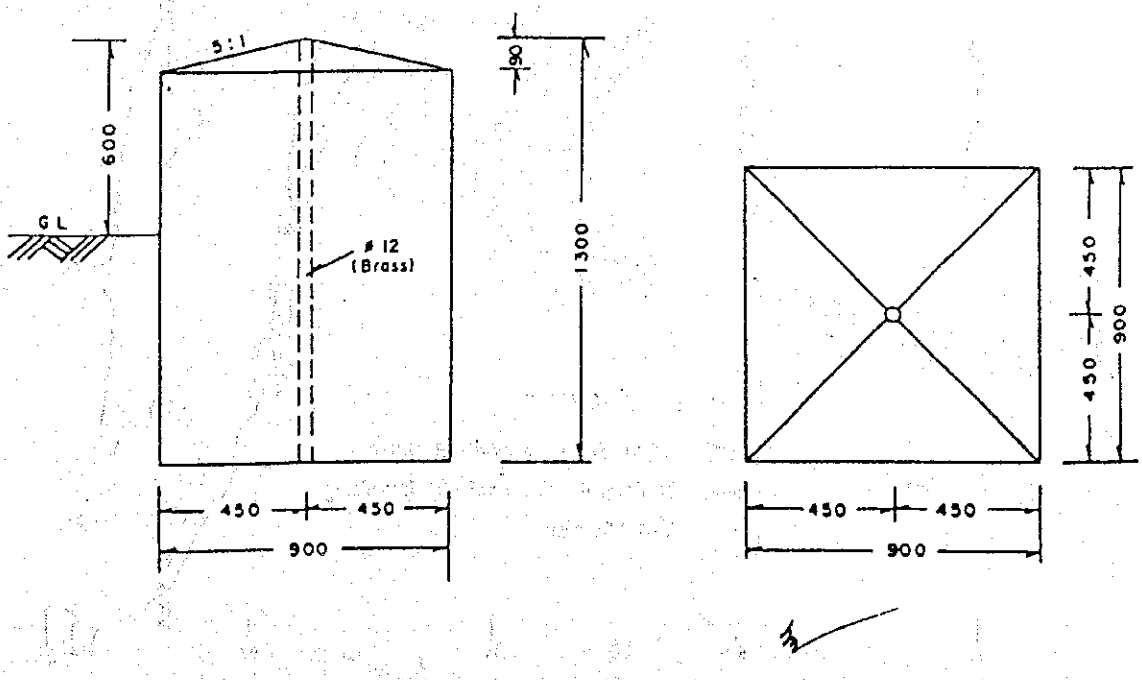


Fig. 4

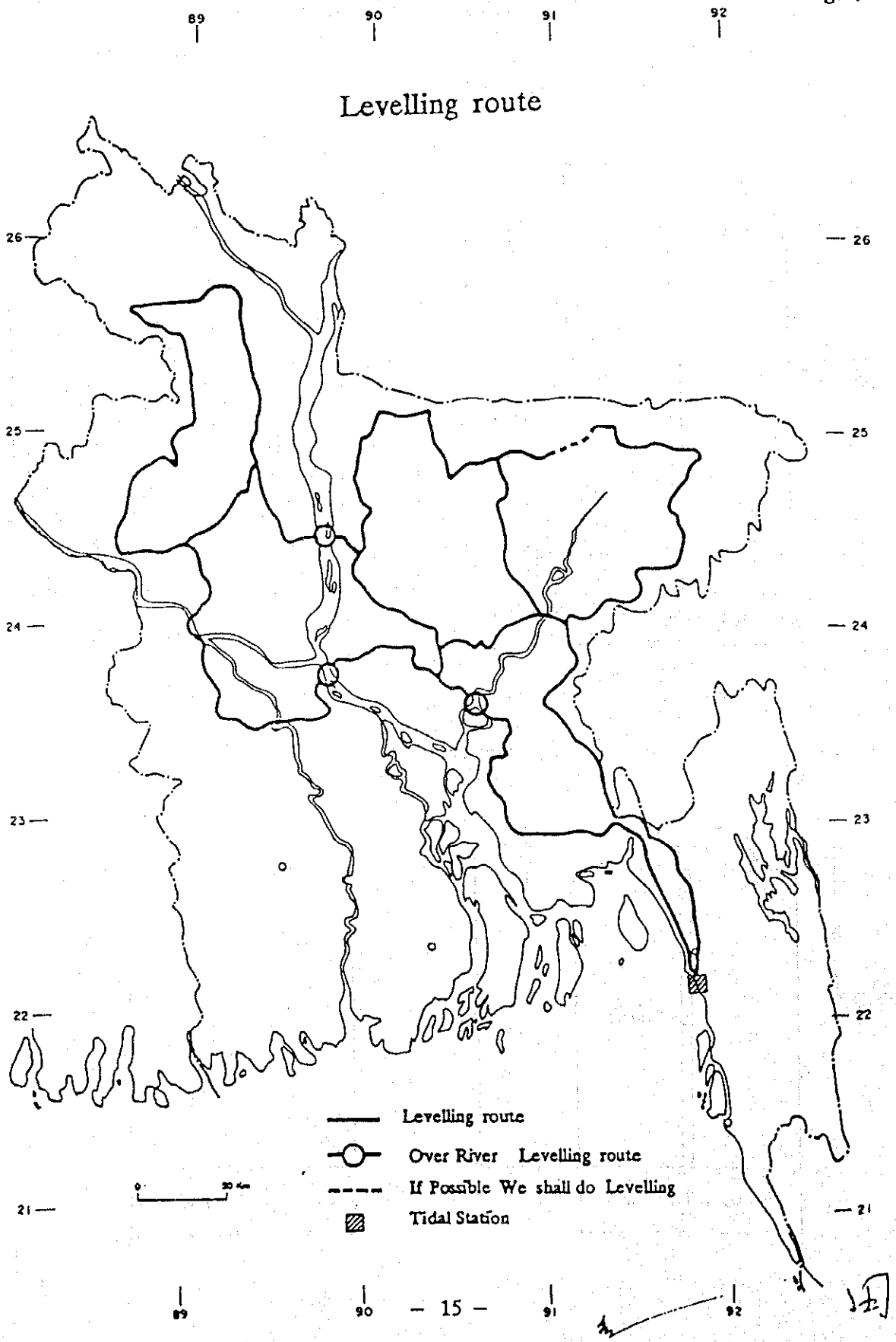

Levelling route
89
90
91
92
26
25
24
23
22
21
Levelling route
Over River Levelling route
If Possible We shall do Levelling
Tidal Station
0
30 Km

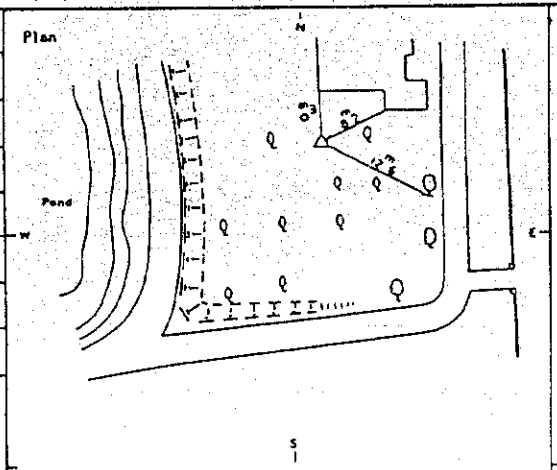
TABLE OF LOCATION SURVEY

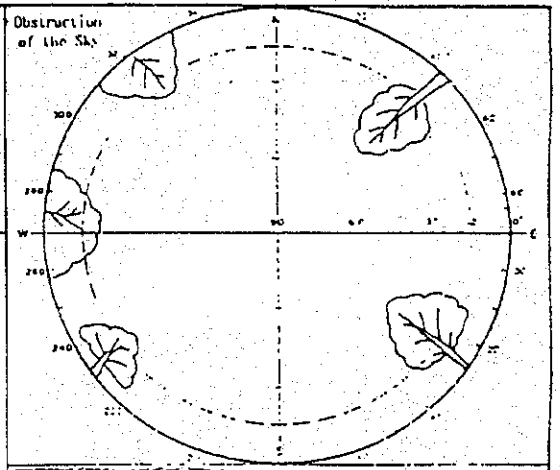
Point Designation	303 / GULSHAN	Date of Survey	June 14, 1992
		Surveyer	H. SHIMIZU, A.K. FARID
Geographic Position	Lon 90 25 03.9 / Lat 23 47 50.0	Point Status	(Exist) New
Condition of the Surrounding	Field	Map No. 791/5	Access 0°
Location	Gulshan-2 Park, Dhaka.		
Land Owner — Address	Gulshan-2, Dhaka.		
Land Owner — Name	Govt. of Bangladesh.		
Antenna Height	10.0 m	Others	

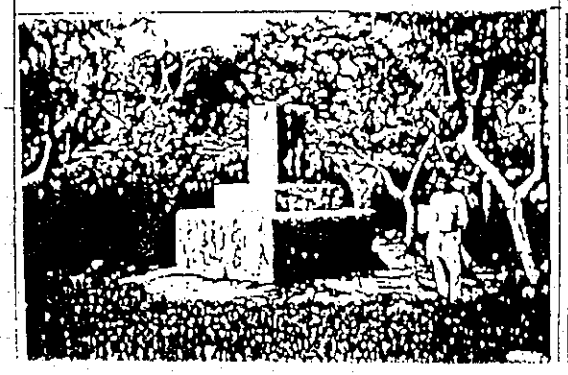
Access Route Description

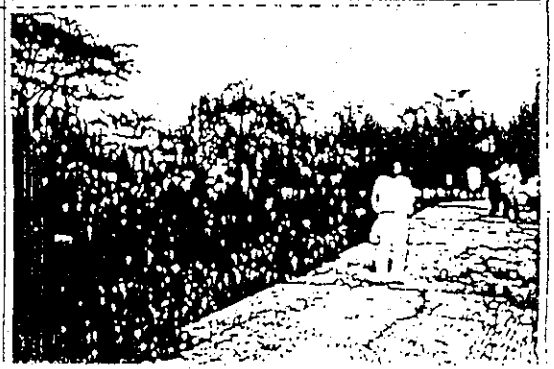
本点はダッカ市内、グルシャン北公園の南東にある。

F-Type pillar is in south-east corner of Gulshan North Park Gulshan-2. South-east corner from the pond of this park, it is situated on the lurland of the park.









(79)

Fig. 5

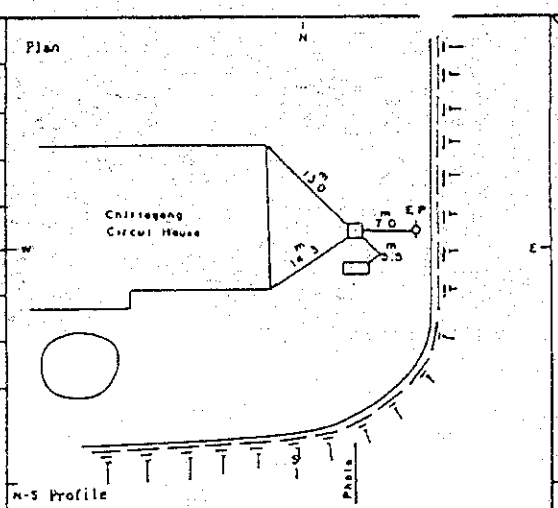
TABLE OF LOCATION SURVEY

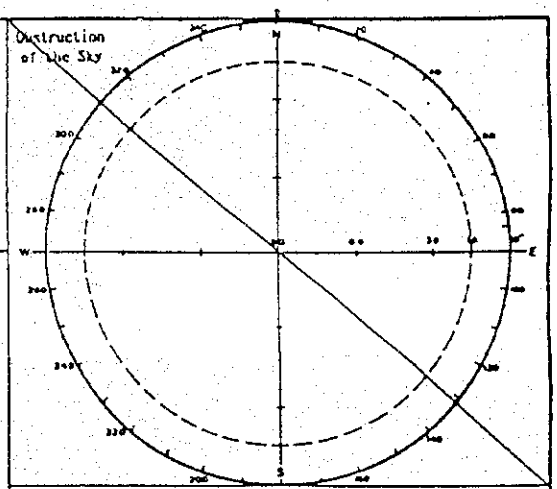
Point Designation	1-04 (A)	Date of Survey	June 9, 1992
	———	Surveyer	K. KOYAMA, A. M. HABIB, K. L. SHAFIQUL
Geographic Position	Lon 91 49 27.4 / Lat 22 20 55.8	Point Status	Exist (New)
Condition of the Surrounding	Circuit house area	Map No.	79K/15
Access	0'		
Location	Chittagong Circuit House compound.		
Land Owner Address	Chittagong Circuit House, Chittagong.		
Land Owner Name	Deputy Commissioner, Chittagong.		
Antenna Height	———	Others	

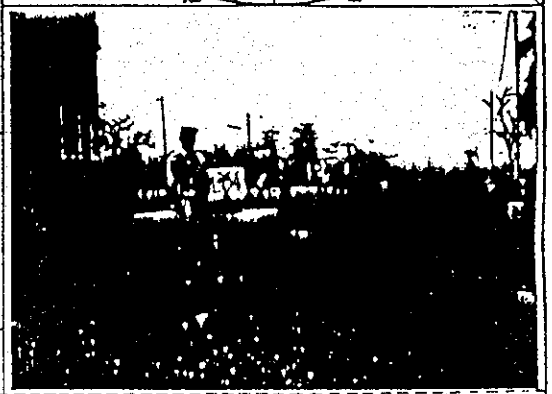
Access Route Description

チッタゴング市内にチッタゴングサーキットハウスがあり、
本点はそのサーキットハウス東方にある。

The B.M is situated east side of Chittagong Circuit House.
7.4m east of the foundation of the circuit house.







(08)

Fig.7

Geodetic Datum Point

Scale 1:30

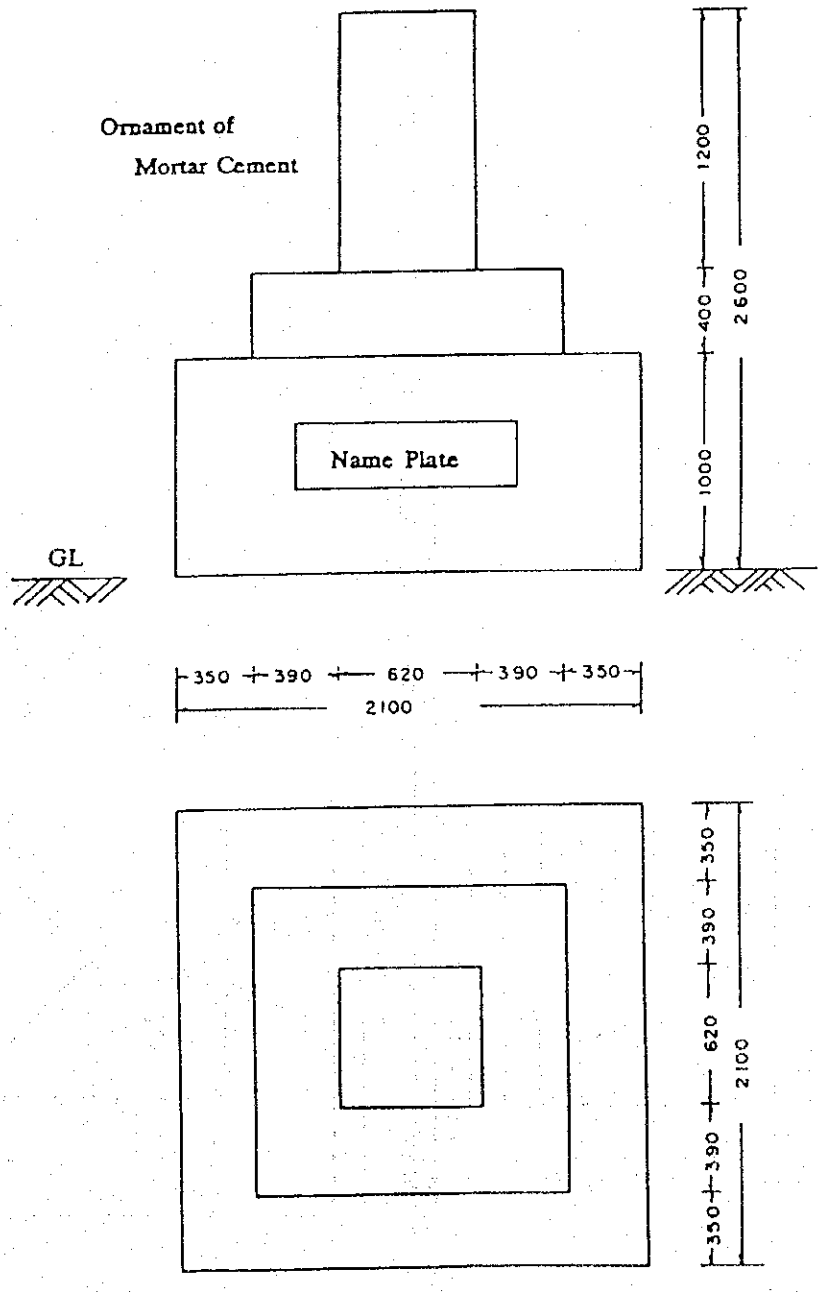


Fig. 8

Layout of Vertical Datum Point

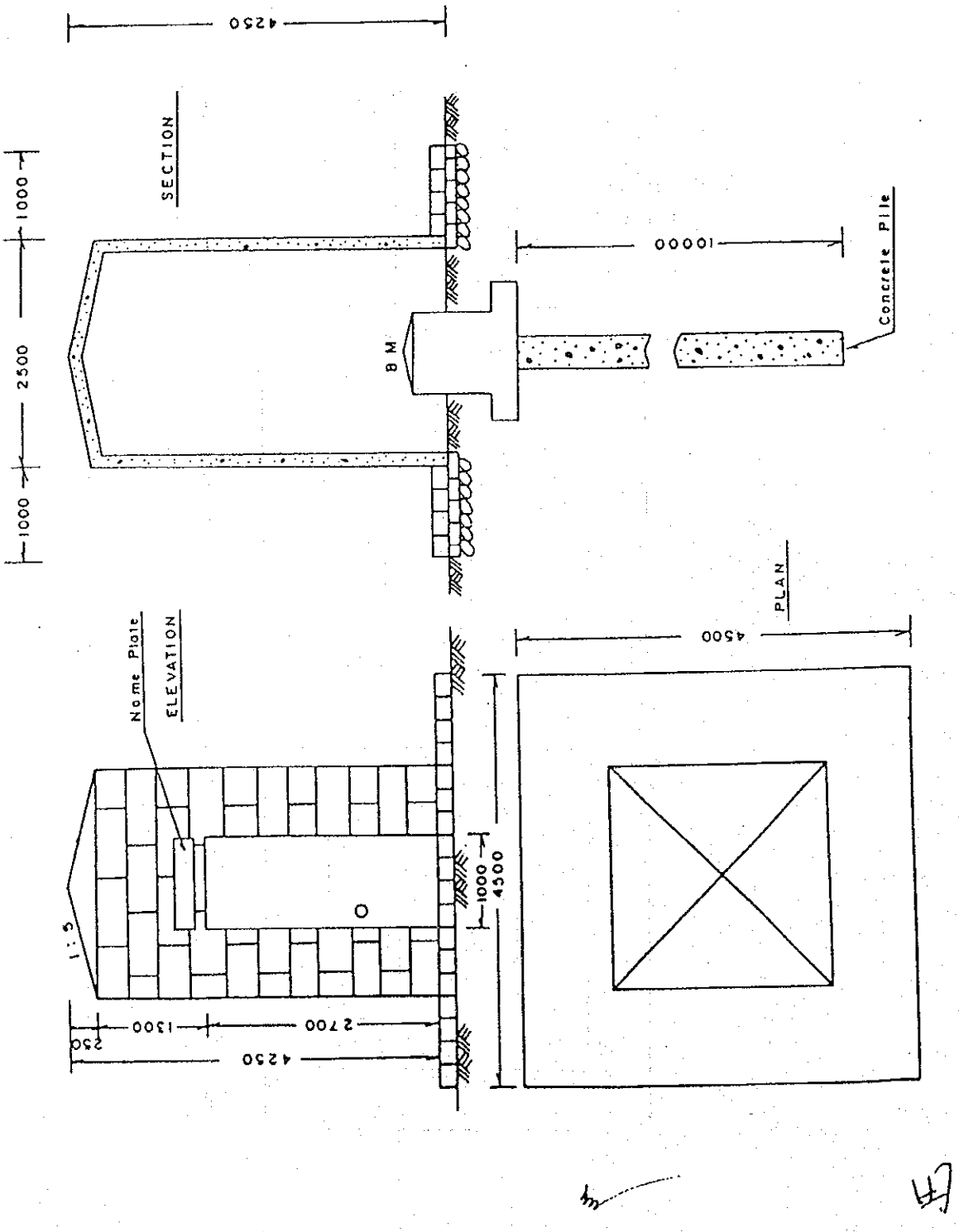
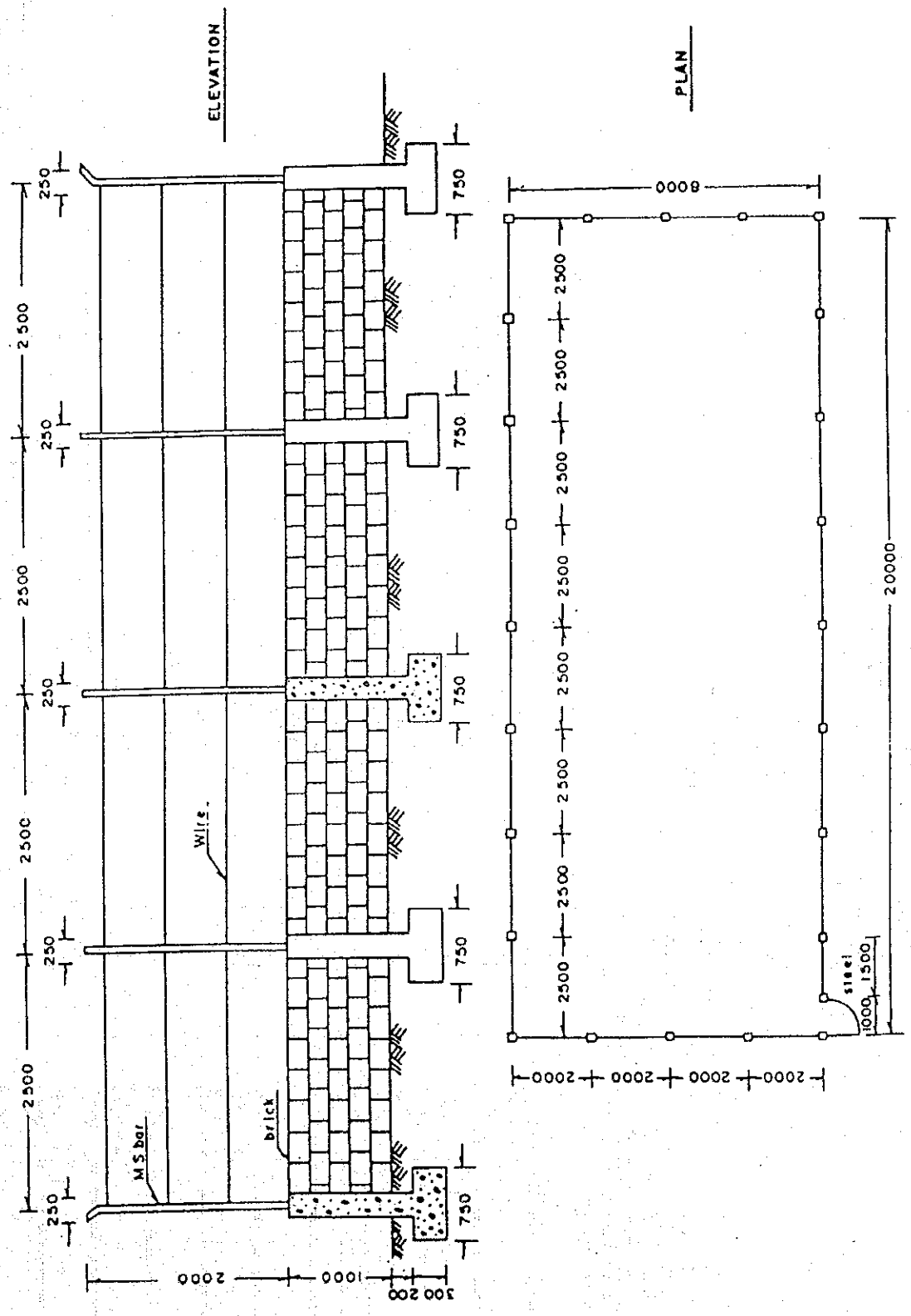
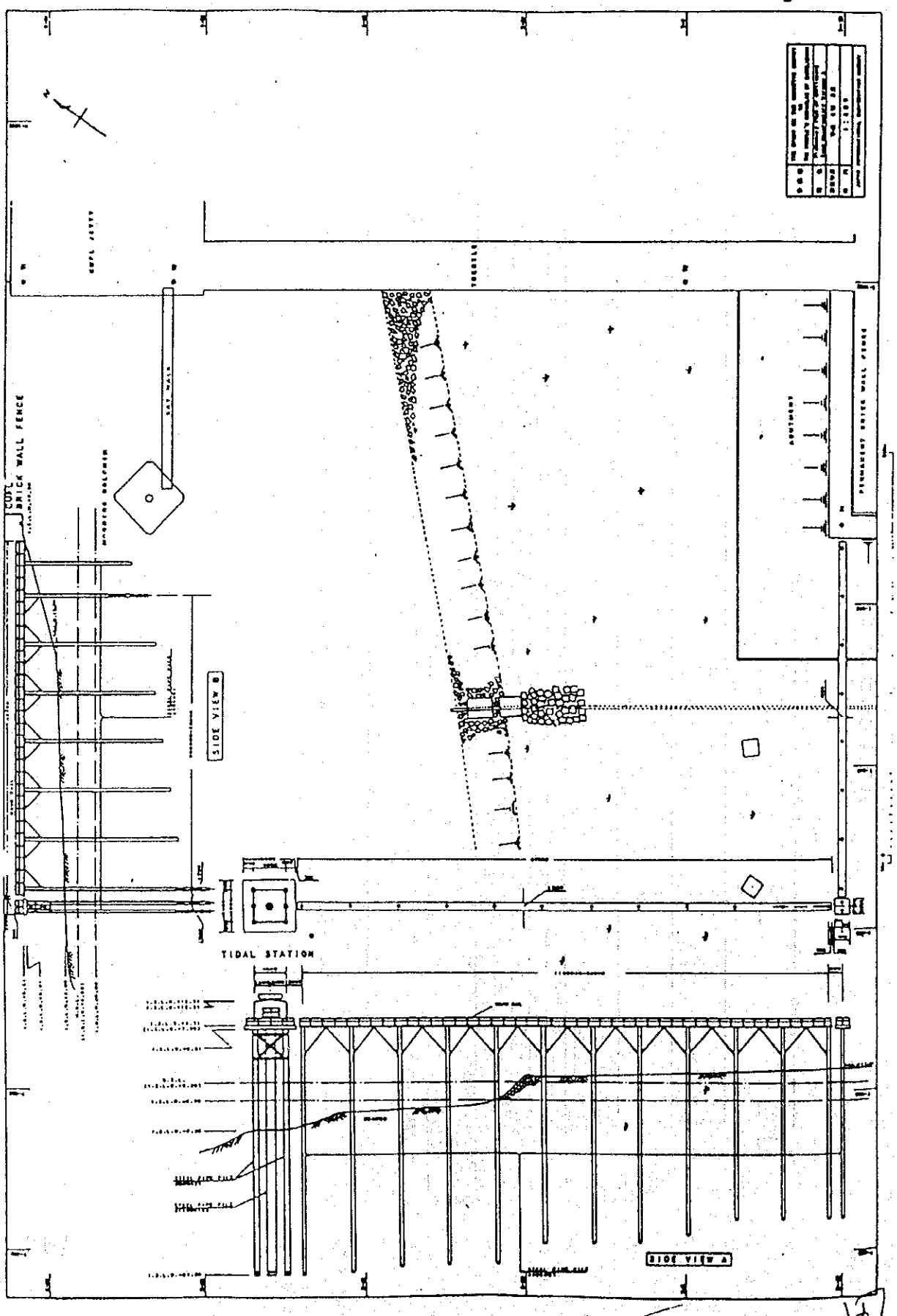


Fig. 9



Layout of Boundary Wall

Fig.10



Auxiliary Tidal Station

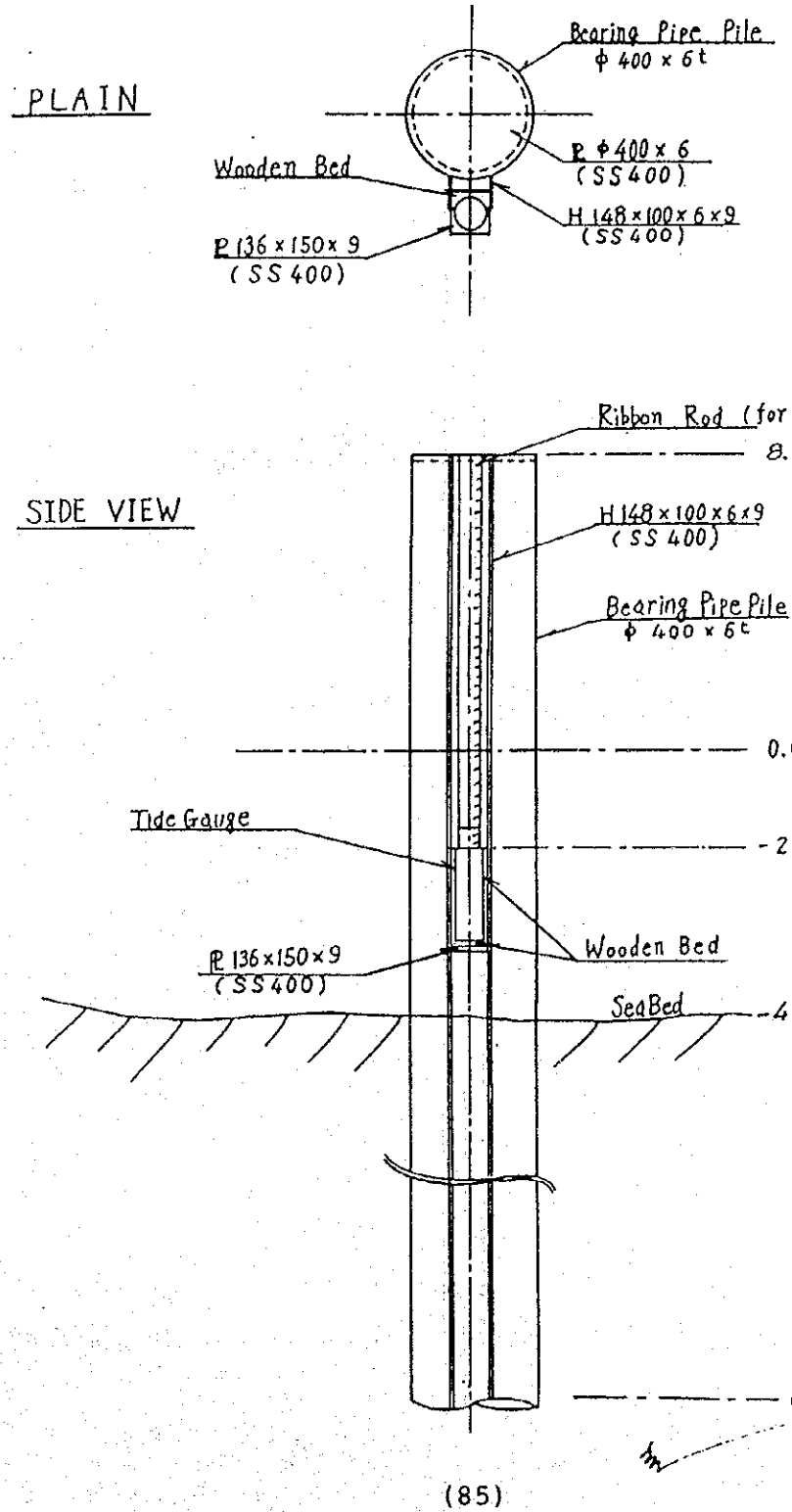


Fig 12

Tide Pole

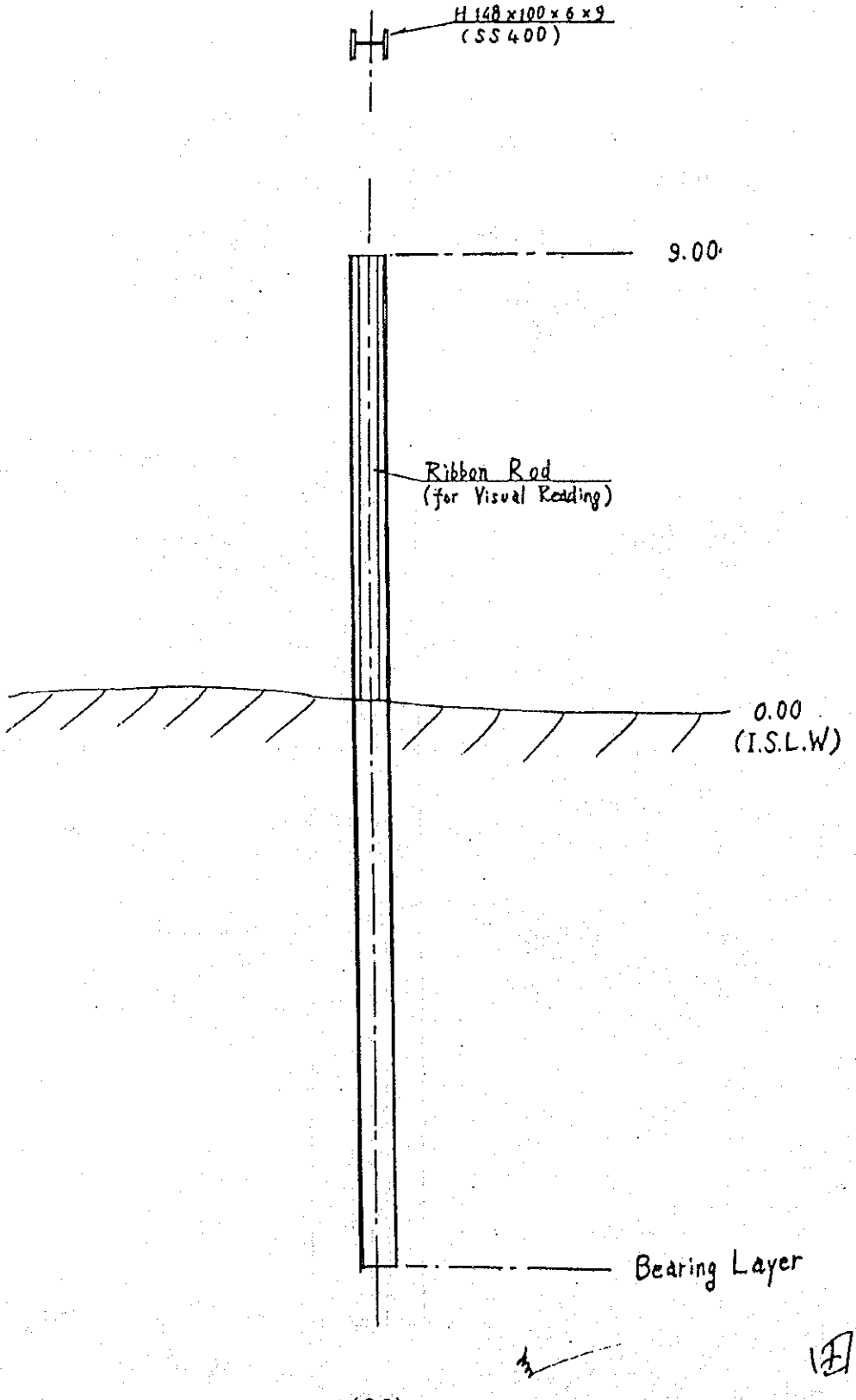
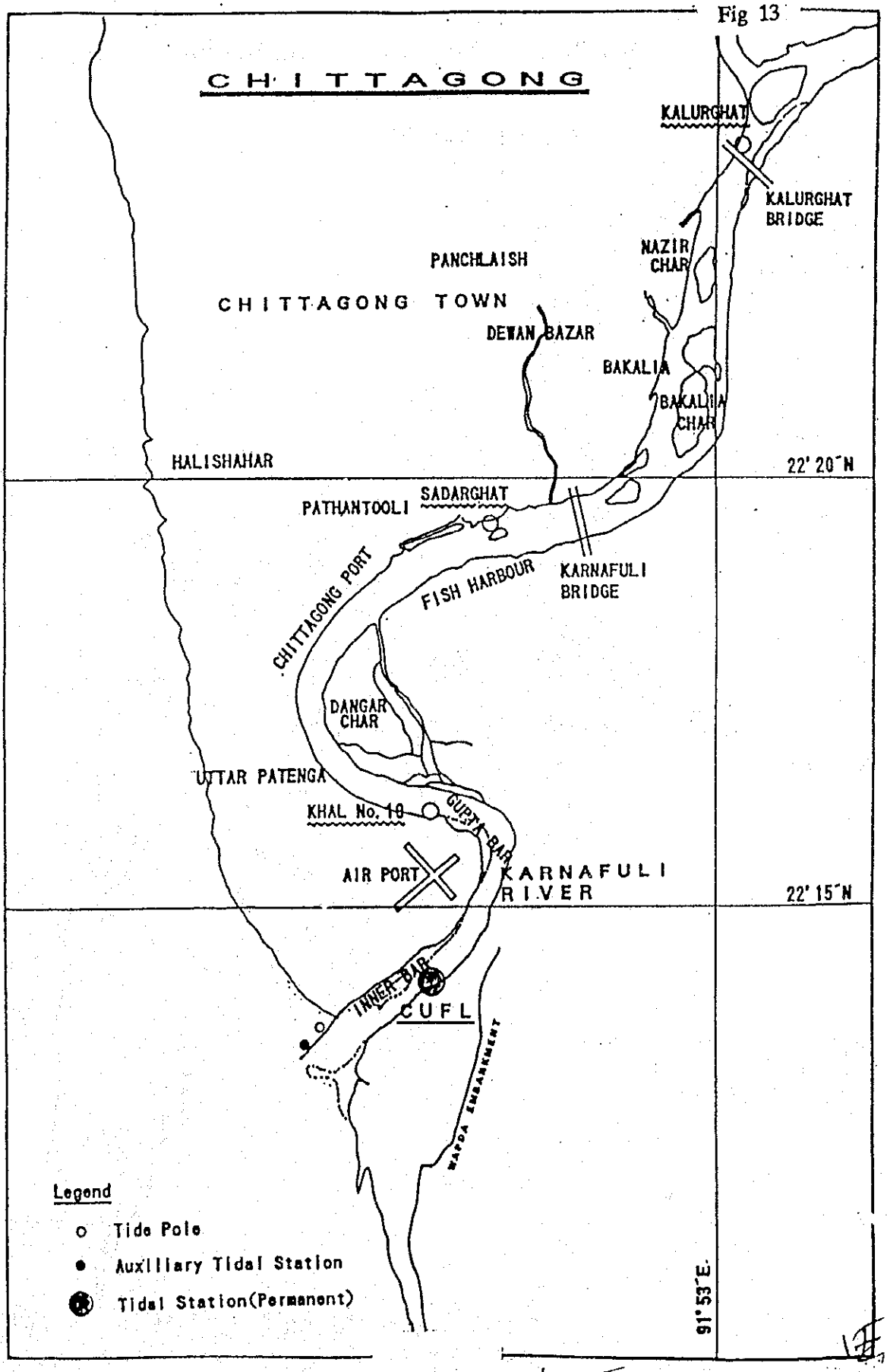


Fig 13


CHITTAGONG
KALURGHAT
KALURGHAT BRIDGE
NAZIR CHAR
PANCHLAISH
CHITTAGONG TOWN
DEWAN BAZAR
BAKALIA
BAKALIA CHAR
HALISHAHAR
22° 20'N
PATHANTOOLI
SADARGHAT
CHITTAGONG PORT
FISH HARBOUR
KARNAFULI BRIDGE
DANGAR CHAR
UTTAR PATENGA
KHAL No. 10
GUPTA BAR
AIR PORT
KARNAFULI RIVER
22° 15'N
INNER BAR
CUFL
WAPDA EMBANKMENT
91° 53'E.
Legend
Tide Pole
Auxiliary Tidal Station
Tidal Station(Permanent)

Distribution Map of Control Station

Fig 14

(GPS Observation Plan)

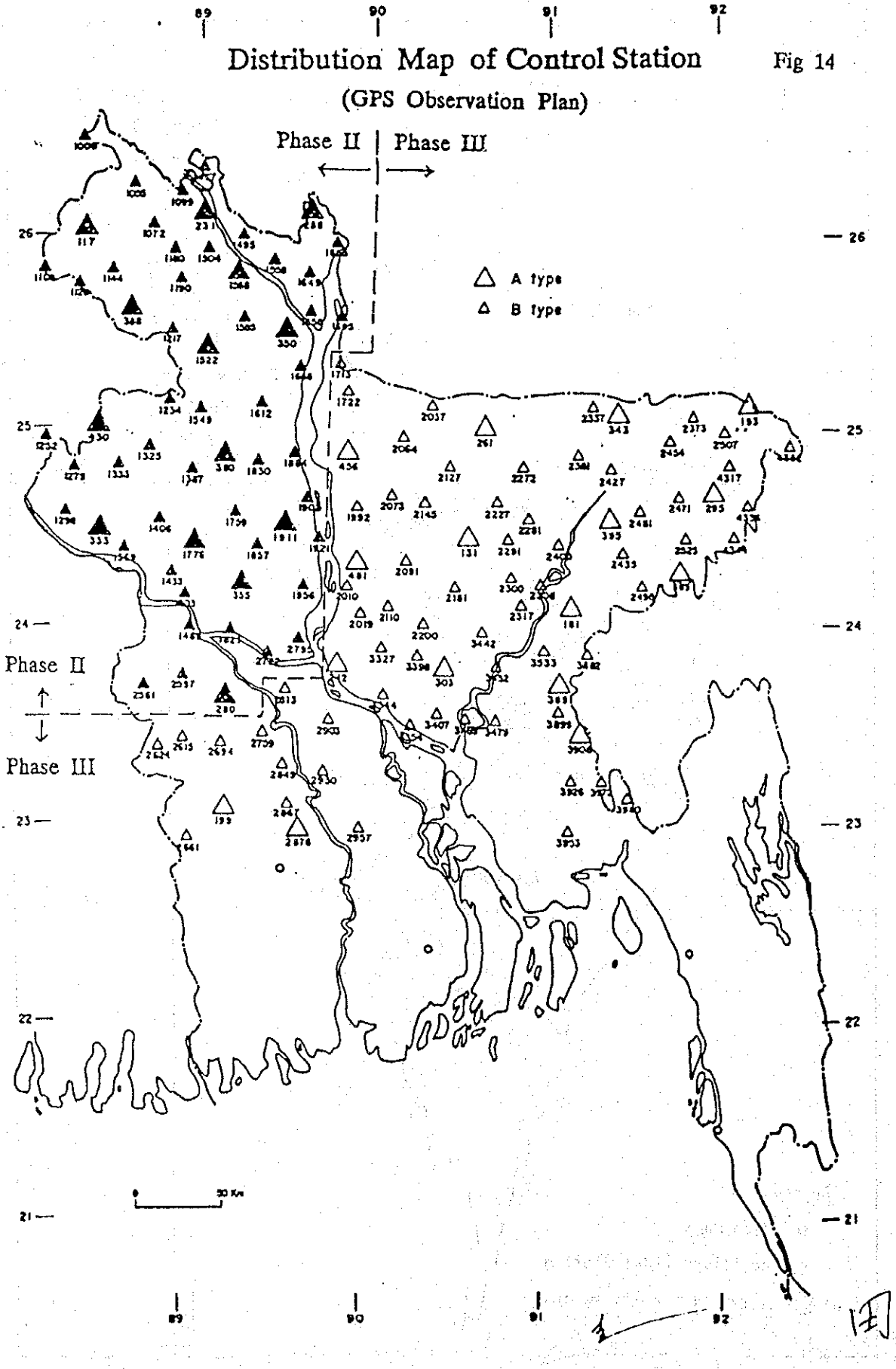


Table 2

GEODETIC CONTROL POINTS TO BE OBSERVED BY GPS IN PHASE II STUDY

TYPE A	TYPE B	TYPE B
117 (E)	1009	1504
231	1055	1549 (V)
280 (V)	1072	1558
288	1099	1585 (V)
333 (E)	1109 (E)	1612 (V)
350	1126	1649
355	1144	1658
380	1180	1668
388 (V)	1190	1685
430	1217 (V)	1695
1522	1234	1759 (E,V)
1568 (V)	1252	1803 (E)
1776 (V)	1279	1821 (E)
1911 (V)	1298	1830 (V)
	1325 (E)	1857
	1333 (E)	1884
	1369 (E,V)	1902
	1387 (E,V)	1921 (V)
	1406	1956
	1433 (E)	2561
	1468	2597
	1477	2722
	1495	2795

Total; Type A 14 points
Type B 46 points

Grand total; 60 points

Notes; E = Existing Geodetic Control.
V = Elevation shall be linked with First Order Levelling Net.

APPENDIX 5

MINUTES OF MEETING ON PHASE II FIELD STUDY REPORT (1.3.1993)

MINUTES OF MEETINGS

FOR

THE STUDY ON THE GEODETIC SURVEY

IN

THE PEOPLE'S REPUBLIC OF BANGLADESH

PHASE II

(COMPLETION)

HELD ON 24th FEBRUARY–1ST MARCH, 1993

BETWEEN

SURVEY OF BANGLADESH

AND

JICA STUDY TEAM

DHAKA, 1ST MARCH, 1993

BRIG. MD MAHBUBUL KARIM
SURVEYOR GENERAL
SURVEY OF BANGLADESH,
MINISTRY OF DEFENCE

DR. MINORU TAJIMA
LEADER,
JICA STUDY TEAM

According to the Scope of Work for " the Geodetic Survey in the People's Republic of Bangladesh" (the Study), and the Plan of Operation for the Phase II Study, the JICA Study Team (Phase II) was dispatched for the period of 20th September, 1992 to 11th March, 1993.

On the occasion of the completion of the Phase II Study in Bangladesh, a series of meetings were held from 24th February to 1st March, 1993, and the followings were confirmed and agreed upon between Survey of Bangladesh (SOB) and the JICA Study Team.

I . The Work Undertaken during the Phase II Study

1. Construction

a. Monumentation of Geodetic Control (GPS) Stations and Bench Marks
The following numbers of monument were constructed in accordance with the specification agreed upon in the Phase I Study, during the period of 15/10/92 to 15/01/93.

Geodetic Control (GPS) Station :

Type A		26 nos.
Type B		89 nos.
	Total	115 nos.

First Order Bench Mark :

Standard Type BM	228 nos.
Smaller Type BM	227 nos.
River Crossing BM	6 nos.
Vertical Datum Point	1 no.
Annex Datum Point	2 nos.
Annex BM for Tidal Station	1 no.
Total	465 nos.

b. Construction of the Geodetic Datum Yard at Gulshan Park

Ornamentation of the existing station No. 303 was carried out, and marble plates to designate it as Horizontal Datum were affixed onto its front surface.
Housing of the Vertical Datum Point was also constructed, and marble plates were affixed on the wall of the housing.
Inscriptions of the marble plates for both Datum Points are :

NATIONAL HORIZONTAL DATUM
SURVEY OF BANGLADESH

Renovation : 1992
Satellite Observation : 1992–94
Net Adjustment : 1993–95
JAPAN INTERNATIONAL COOPERATION AGENCY

and

NATIONAL VERTICAL DATUM
SURVEY OF BANGLADESH

Construction : 1992
1st Order Levelling : 1993–95
Net Adjustment : 1994–95
JAPAN INTERNATIONAL COOPERATION AGENCY

Fence with a steel entrance door, walkway were constructed.
Ground surface in the yard was turfed.

Construction period was from 15/10/92 to 3/01/93.

c. Construction of the Tidal Observation Station

Mobilization of the construction equipments, materials and labourers commenced from 20/10/92 and construction of the station in the neighbouring water area of CUFL Rangadia, Chittagong, and an auxiliary tide gauge station together with tide poles in the Bay of Bengal, outside the training wall at the Karnafuli River mouth, have been completed by this date.

Finishing work is expected to be completed by 10/ 3/93.
A warning for vessels and boats to be away from the tidal station in both Bengali and English shall be painted on the river side wall of the observation housing and a warning board in Bengali to prohibit local people from entering into the facility shall be installed.

2. GPS Observation

Thirteen (13) members of GPS observation team arrived at Dhaka on 5 & 7/12/92. Before their deployment to the project area, trial observations were undertaken in the Dhaka area to check the function of all GPS receivers and to get themselves well accustomed to the operation of GPS receivers and extention poles for GPS antennas.

GPS observation in the project area commenced from 22/12/93 and was completed on 11/02/93 .
Average twelve (12) stations were occupied by GPS antennas for one (1) session. In each session, GPS signals from minimum four (4) GPS satellites were received simultaneously for continuous three (3) hours, and twice with minimum five (5) hours intervals.

Total ten (10) sessions of GPS observation were carried out, and total seventy-four (74) GPS stations were observed during this GPS observation campaign of Phase II, out of which fourteen (14) are meant for tying to the Phase III network.

The quality and precision of observation were verified by the JICA Study Team in Dhaka after processing and analyzing the data obtained at the field.
The result of this GPS observation is so far excellent as shown in the attached table and index map.

3. Installation of Tide Gauges and Operating Instructions to SOB Counterpart Officials

Mounting of the pressure sensing type tide gauge and installation of tide gauge onto the tide well were carried out on 1/02/93 and 17/02/93 respectively.
Water level reading on tide poles started on 28/01/93.

Necessary operating, maintenance and data processing instructions have been given to two (2) SOB counterpart officials to maintain two tide gauges and to collect data after the departure of the JICA Study Team in March 1993 and onward.

II. Phase II Study Office Work in Japan

1. The collation of GPS observation data, preliminary computation, network adjustment and evaluation of the result shall be done in Japan.

2. The collation of initial tidal observation data and analysis of these data shall also be done in Japan.

III. The Observation and Maintenance of Tide Gauges

Data retrieval from both tide gauges, observation of water level on tide poles and the collation and processing of the data will be done by SOB counterpart officials from March 1993 onward.

JICA Study Team coastal engineer will supervise the above work during his stay in Bangladesh.

IV. Tentative Schedule and Plan of Operation for the Phase III Study

1. Tentative Study Schedule : October 1993 to March 1994

2. Work to be done :

- GPS observation for the remaining 80 GPS Stations.
- First order levelling for approximately 900 line kilometers.
- Tidal observation supervision and data analysis.

Unveilling ceremony of the National Geodetic Datum Yard and press release will be decided in consultation with Ministry of Defence, SOB and JICA Bangladesh.

On concluding the meetings, Surveyor General expressed his appreciation to the JICA Study Team of their successful implementation of the Study so far, and JICA Study Team leader expressed his heartfelt thanks to SOB for its dedicated cooperation extended to the Team.

LIST OF PARTICIPANTS

SURVEY OF BANGLADESH

Brig. Md Mahbubul Karim	Surveyor General
Mr. A.K.M. Shamsul Alam	Director
Maj. Kazi Shafayetul Haque	Assistant Surveyor General
Mr. Noor Muhamad Mian	In Charge, Geodetic Detachment
Capt. S B M Badruzzaman	Project Officer
Mr. Abu Naser Wahid	Assistant Superintendent of Survey (CD)

JAPAN INTERNATIONAL COOPERATION AGENCY

JICA Study Team

Dr. Minoru Tajima	Leader
Mr. Shigehiko Shino	Deputy Leader
Mr. Yoshio Sasaki	Planner
Mr. Masaji Koyama	Chief Surveyor

Advisory Commitee

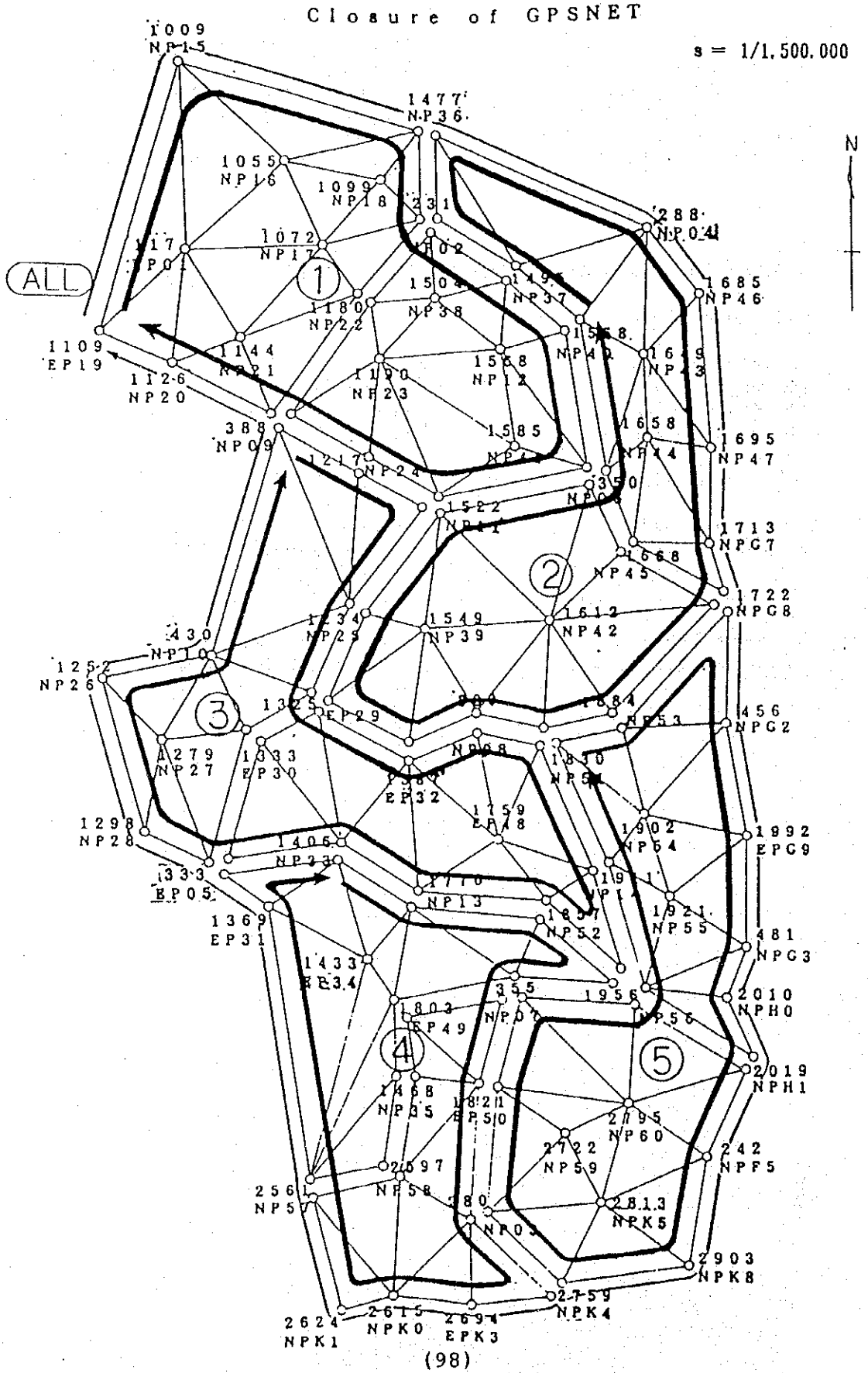
Mr. Teturo Imakiire	Advisor (Geographical Survey Institute)
Mr. Atushi Hanatani	Coordinator (JICA HQs)

Observer

Mr. Akashi Itoh	Embassy of Japan
Mr. Kouzoh Yamakawa	JICA Bangladesh Office

Closure of GPSNET

s = 1/1,500,000



Closure of GPSNET

Section	Day-wise	Latitude difference	Longitude difference	Distance travelled	Height difference	△x	△y	△z	△s	Precision (ppm)
1	1	-0.00008	+0.00166	412873.681	+0.007	-0.046	+0.009	+0.001	0.047	0.11
	2	+0.00030	+0.00106	.706	+0.059	-0.028	+0.050	+0.034	0.067	0.16
difference				- 0.025	-0.052					-0.05
2	1	+0.00057	+0.00141	534628.740	-0.091	-0.040	-0.089	-0.024	0.100	0.19
	2	+0.00135	+0.00048	.816	+0.057	-0.013	+0.033	+0.062	0.071	0.13
difference				- 0.076	-0.148					+0.06
3	1	-0.00044	+0.00125	541592.705	-0.015	-0.035	-0.007	-0.019	0.040	0.07
	2	-0.00022	-0.00025	.648	-0.006	+0.007	-0.003	-0.009	0.012	0.02
difference				+ 0.057	-0.009					+0.05
4	1	-0.00065	+0.00068	450649.248	+0.111	-0.017	+0.110	+0.028	0.115	0.25
	2	-0.00065	+0.00104	.200	+0.162	-0.026	+0.156	+0.049	0.166	0.37
difference				+ 0.048	-0.051					-0.12
5	1	-0.00012	+0.00088	493512.845	+0.065	-0.024	+0.061	+0.024	0.070	0.14
	2	+0.00051	+0.00060	.808	+0.005	-0.017	-0.002	+0.016	0.023	0.05
difference				+ 0.037	+0.060					+0.09
ALL	1	-0.00063	+0.00336	950618.599	-0.095	-0.096	-0.074	-0.059	0.135	0.14
	2	-0.00126	+0.00442	.555	+0.289	-0.114	+0.281	+0.091	0.317	0.33
difference				+ 0.044	-0.384					-0.19