Table 10.1: Summary of Project Feature

	Project	Major Work Items	Lane Nos.	Design Speed (Km/hr)	Length (m)	Carriageway (m)	Sidewalk (m)	Right-of-way (m)	Remarks
1	New Bagmati Bridge (No.2 Bagmati Bridge)	Main Bridge	2	60	140 m	10 m	3.0m(one side)	50 m	
		Intersection with Pedestrain							
		Protection of exisiting bridge							
		Removal of old truss bridge							
		Protection against river bed							
2	South Inner Ring Road								
	(i) First stage (2 lanes);	Project Road	2	60	3,750 m	10 m	3.0m(one side)	50m (min. 25m)	Right-of-way shall be acquired for
		No. 1 Bagmati Bridge	2		145 m	8 m	2.5m(both side)		4 lane roads at this first stage.
		No. 3 Bagmati Bridge	2		120 m	8 m	2.5m(both side)		
		Protection of riverside bank							Protection of river bank of Bagmati.
	(ii) Second stage; (Widening to 4 lanes)	Project Road	(total 4	60		2 x 8 m w/median (3m)	3.0m(both side)	-	with median slip (3.0m)
		No. 1 Bagmati Bridge	4		145 m	8 m	2.5m(one side)		
		No. 3 Bagmati Bridge	4		120 m	8 m	2.5m(one side)		
3	Access Roads								
	(i) Sanepa Access	Project Road	2	60	510 m	10 m	3.0m(both side)	30m (min. 20m)	
	(ii) Koteswar Access	Project Road	2	60	2,180 m	10 m	3.0m(both side)	30m (min. 20m)	
		No. 4 Bagmati Bridge	2		60 m	8 m	2.5m(both side)		
	(iii) Patan Core Access	Project Road		40	220 m	8 m	2.5 m (both side)	13 m	
	(iv) New Bus terminal Access	Project Road	2	40	1,865 m	10 m	3.0 m (both side)	30 m	
4	Improvement of Intersections	Mitighar Intersection	4						Signal with minor improvement
		Tripureswar Intersection	4						Signal with minor improvement
		Koteswor Intersection	4						Improvement of shape of intersection

本プロジェクトの意義とその効果は以下のとおりである。

(1) カトマンズ～ラリトプール間のボトルネックの解消

新バグマティ橋は、交通のネックとなっているバグマティ川の交通容量を増大させるほか、交通渋滞を解消し、タパタリ付近のボトルネックを解決し、両都市間の経済、社会活動上の連携を強化する。

(2) カトマンズ～ラリトプール間の代替ルートの確保

現在リングロード内のバグマティ川でカトマンズ市とラリトプール市を結ぶ橋梁は、既存のタパタリにかかるバグマティ橋のみである。この橋はバグマティ川の河床低下が現在も進行しているため危険な状態であり、カトマンズとラリトプールを結ぶ信頼性のある新たな代替ルートの確保が、経済活動だけでなく、地域に生活する人々の日常生活を維持するうえでも重要である。

(3) カトマンズ市内の幹線道路網の構築

南環状道路は、将来カトマンズ市の幹線道路網を構築する重要な環状道路の一部となる。したがって、南環状道路の建設は、カトマンズバレーの新しい幹線道路網を構築する第1段階として意義がある。

(4) アクセシビリティの向上と地域開発

南環状道路（含サネパ、コテスウォール連絡線）は、市内の低密地域へのアクセシビリティを高め沿道地域の開発を誘発する。

(5) バグマティ川沿いの環境改善

南環状道路やコテスウォール連絡線は、川岸ののり面保護工の整備によりバグマティ川の川岸の環境を改善する。計画道路と河川間のオープンスペースは、運動場、公園、サイクリングロード等の公共施設のために利用でき、バグマティ川沿いの環境を改善する。

10.2 提言

プロジェクトを実現するため、以下の事項を提言する。

(1) 新バグマティ橋建設の早急な実施

タパタリ～クパンドール間に架かる現橋の交通状況は、カトマンズ～ラリトプール間の交通量の急激な増加により増々悪化しており、早期に新バグマティ橋の

建設を実施することを提言する。

1992年8月に崩れた現バグマティ橋は、現在も河床が低下しているため、すぐにも防護や修復を必要とする状況にある。少なくとも、No.5橋脚（ラリトプール寄り）や20m下流に位置するギャビオンチェックダムの修復のために緊急防護工を1993年6月～9月の雨季が始まる前に行うべきである。

(2) 新バスターミナル（バラジュ）へのバス路線の確保

新バスターミナルは、1993年3月に完成する予定である。新バスターミナルはバラジュに位置するため、都市部とのアクセシビリティに難があり、適切な端末輸送体系の整備は、新バスターミナルの円滑な運行に必要不可欠である。バスサービスはカトマンズの主要な交通手段であり、バス運行に必要な適切かつ確実なバス路線を早期に確保する必要がある。新バスターミナルへの連絡路線の早期建設を提言する。

新バスターミナル連絡線の建設に関連して、バス路線として利用されるであろう以下に示す都心部付近の道路の改善もあわせて提言する。

(i) 現王宮からパクナジョールへの道路（レクナス・マルグ）

- 拡幅、舗装、および排水施設の改修。

(ii) カンチパット～サマクシ新連絡線間

- アンバサダーホテルから始まり英国、インド大使館脇を通過するフィーダー道路を一方通行のバス路線として利用するために、一部区間の拡幅と舗装。

(3) 南環状道路（4車線）の用地幅の確保

南環状道路は段階建設で実施すべきことを提言したが、将来交通量が2車線の容量を越え4車線拡幅を行う時期において、新たな用地取得することは地価上昇から非常に難しくなるであろう。したがって、南環状道路の用地は当初から4車分を確保すべきである。

(4) 用地・補償のためのネパール政府予算の配分

早急に土地・家屋調査を行い、用地・補償に必要な予算額を確保することを提言する。用地・補償スケジュール（案）を以下に示す。

年　次	用地・補償の工程
1年次（1993年）	タパタリとクパンドールの両交差点を含む新バグマティ橋近傍に位置する用地、家屋の取得
2年次（1994年）	南環状道路の起点から新バグマティ橋までの西工区の道路用地の取得（含サネパ連絡線）
3年次（1995年）	新バグマティ橋からアーニコ・ハイウェイまでの東工区の道路用地の取得（含コテスウォール、パタン連絡線）

(5) 交差点改良と交通管理

都市内の幹線道路上で交通事故の減少と円滑な交通流を確保するために、以下に示す交差点の改良と交通管理を提言する。

交差点位置	改良すべき内容と交通管理
マイティガル（アーニコ・ハイウェイの起点）	小規模改良を含む信号機の導入
トリプレスウォール（国立競技場近傍）	小規模改良を含む信号機の導入
コテスウォール（アーニコ・ハイウェイとリングロードの合流点）	交差点形状（ロータリー交差点）

参　考　資　料

APPENDICES

CHAPTER 4 ENGINEERING SURVEY AND ANALYSIS

- Appendix 4.2.1 Description of Detailed Geological Conditions
- Appendix 4.2.2 Description of Subgrade
- Appendix 4.2.3 Description of Construction Materials
- Appendix 4.2.4 Pile Foundation Analysis
- Appendix 4.3.1 Meteorological Data
- Appendix 4.3.2 Survey of River Cross Section
- Appendix 4.3.3 Rainfall Record and Probable Daily Rainfall
- Appendix 4.3.4 Flood Water Level
- Appendix 4.4.1 Seismic Data
- Appendix 4.5.1 Topographic Survey Data

CHAPTER 5 PRELIMINARY DESIGN

- Appendix 5.3.1 Alternative Study on Protection Works on Existing Bagamati Bridge
- Appendix 5.3.2 Record on Existing Bridges inside the Ring Road
- Appendix 5.5.2 Traffic Volume on the Project Roads

CHAPTER 6 COST ESTIMATES

- Appendix 6.5.1 Detailed Work Quantities
- Appendix 6.6.1 Detailed Construction Cost
  - (1) Cost of Inner Ring Road including Checkdam
  - (2) Cost of Access (Sanepa, Koteswor, Patan Core and New Bus Terminal Access)
  - (3) Cost of Bridges and Pedestrian Bridges
  - (4) Cost of Intersections at Patan and Thapathali
  - (5) Cost of Traffic Management

Appendix 4.2.1 Description of Detailed Geological Conditions

(1) General

A comparative study of the borehole logs shows that the soil in the bridge sites at Koteswor and Kuleswor show similar sequences of deposition and the predominating soil type in these sites is very soft to firm lacustrine deposit of high capacity clayey silt capped with about 1.5 m to 6.5 m thick coarse to medium sand of medium relative density. The clay layer below the sand at the top extends right down up to investigated depth of 40 m and contain seams of silty fine sands at places. On the other hand the soils at Thapathali and Chakupat are of two types and consist mainly of dark grey soft to stiff clayey silt of high plasticity and coarse to medium sand of medium to dense compactness deposited in alternate layers.

A detail description of soil encountered in bore holes is presented below. The cross sections of bridge sites showing subsoil strata presented in Fig. A4.2.1 to Fig. A4.2.4 provide better picture of stratification. To get the general idea of soil of Kathmandu valley, Fig. A 4.2.5 is presented.

Kuleswor

In this site the soil at the top is 1.5 m (right bank) to 3.00 m (left bank) thick deposit of light grey fine to coarse loose sand and fine gravel. Underlying this layer of sand and gravel, the soil upto the investigated depth of 40 m is a deposit of highly plasticity clayey silt of dark grey colour. (Fig. A4.2.1).

Thapathali

The sub-surface soil at this site consists of alternate layers of clayey silt and sand of varying density and thickness. Six different layers are seen. Thickness of individual layers varies from 2 m to 12 m.

At the top most part both the bore holes show the presence of yellow brown fine to medium dense fine to coarse sand. The right bank borehole shows presence of some gravel in the sand. The thickness is 2.5 - 5.0 m.

Further down, the sand is underlain by a 9-18m thickness of dark grey firm to stiff clayey silt of high plasticity. The thickness in the right bank is twice as much as in the left bank.

The layer of clayey silt is underlain further by 2-8.5m thickness of dark grey medium to coarse sand. This layer is also relatively thick, about 2 m in the left bank while it is about 8.5 m in the right bank. Underlying the sand is again the dark grey to light black stiff to very stiff clayey silt of high plasticity. This layer is about 3 m thick in the right bank while it is about 7 m in the left bank.

The clay layer is again underlain by light yellow brown to dark grey medium dense to dense fine to coarse sand which extends down in the right bank from EL. 1251 to EL.

1242 (depth of exploration) whereas in the left bank this sand layer of about 6 m thickness is underlain by more than 17 m thickness of dark grey firm to stiff clayey silt of high plasticity. This clayey silty layer was not encountered in the right bank within the drilled depth.

The soil profile in Fig. A4.2.2 has been prepared by interpolating the logs of the two boreholes located much apart. Given the variation in the thickness of individual of the alternating strata it can not be excluded that some of the layers are in the form of lenses.

Chakupat

In this site also the soil conditions between the left and right bank of the river differ in terms of depositional sequence. (Fig. A4.2.3). In left bank the soil at the top 2.0 m is a mixture of very loose sand and gravel. Below this layer up to a depth of 12 m the soil is a grey soft to firm highly plasticity clayey silt. Following this layer, a layer of light grey coarse to medium sand of medium to dense compactness extends to a depth of 20 m. Up to the investigated depth of 40 m the layer below 20 m is again a layer of dark grey soft to firm highly plastic clayey silt.

The soil at the right bank, on the other hand, right from the surface up to the depth of about 38 m is dark grey soft to firm, highly plastic clayey silt followed by a layer of dark grey medium to coarse sand. Explored thickness of this sand layer is 2 m which obviously may continue beyond the drilled depth.

Koteswor

The soil at this site on both banks of the river are quite similar both in terms of depth and extent (Fig. A4.2.4). The soil encountered at top 6.5 m to 7.0 m in both of the bore holes is light grey medium to fine sand of loose to medium compactness. The soil underlying the to sand layer in both of the bore holes is dark grey soft to firm high plasticity clayey silt.

Table A.4.2.1 Test Result Summary Sheet of Bridge Sites

Bridge No. 1

Location : Kuleshwor

Sample Type	B. H. No.	Depth m	Percentage							NMC %	Bulk Density gm/cm3	Speficif Gravity gm/cm3	SPT Value N	Qu kg/cm2	Consolidation mv cm2/kg	Remarks
			Gravel	Sand	Silt	Clay	LL %	PL %	PI %							
DS	Right	8	-	4	84	12	96.75	61.18	35.57	86.03	-	2.52	5			
DS	Bank	12	-	3	82.5	14.5	95.20	63.39	31.81	86.20	-	2.63	5			
UD	(1)	7	-	3	91	6	85.30	59.78	25.52	86.90	-	2.46	-			
UD		13	-	2.5	93.5	4	85.20	43.79	41.41	79.43	-	2.43	-			
DS	Left	4	-	2	75	23	83.40	45.35	38.05	72.00	-	2.49	5			
DS	Bank	14	-	5	76	19	70.40	47.22	23.18	70.07	-	2.53	5			
UD	(2)	5	-	5	72	23	82.70	55.19	27.51	63.19	1.50	2.43	-	0.55		
UD		9	-	7	79	24	83.75	43.08	40.67	78.13	1.83	2.59	-	0.65	0.0251	

Table A.4.2.2 Test Result Summary Sheet of Bridge Sites

Bridge No. 2

Location : Thapathali

Sample Type	B. H. No.	Depth m	Percentage							NMC %	Bulk Density gm/cm3	Speficif Gravity gm/cm3	SPT Value N	Qu kg/cm2	Consolidation mv cm2/kg	Remarks
			Gravel	Sand	Silt	Clay	LL %	PL %	PI %							
DS	Right	4	-	6	78.0	16.0	89.5	69.09	20.14	73.63	-	2.56	15			
DS	Bank	12	-	10	66.0	24.0	95.0	65.68	29.32	70.13	-	2.65	16			
UD	(1)	17	-	7	84.0	9.0	103.2	65.52	37.68	77.10	1.43	2.49	-	1.63	0.0201	
UD		10	-	7	80.5	12.5	100.7	60.18	40.52	79.45	1.41	2.63	15	1.32	0.0195	
DS	Left	8	-	10.5	69	20.5	102.3	57.29	45.01	95.09	-	2.66	13			
DS	Bank	11	36.8	62.0	2	1.8	-	-	-	30.71	-	2.66	-			
UD	(2)	9	-	8.0	80	12.0	78.2	38.78	39.42	55.95	-	2.56	-			
UD		28	-	5.0	77	18.0	92.2	64.33	27.67	77.63	1.54	2.46	12	1.34	0.0212	

Table A.4.2.3 Test Result Summary Sheet of Bridge Sites

Bridge No. 3 Location : Chakupat

Sample Type	B. H. No.	Depth m	Percentage							NMC %	Bulk Density gm/cm3	Speficif Gravity gm/cm3	SPT Value N	Qu kg/cm2	Consolidation mv cm2/kg	Remarks
			Gravel	Sand	Silt	Clay	LL %	PL %	PI %							
DS	Right	4	-	3	74	23	65.75	46.13	19.62	44.96	-	2.65	5			
DS	Bank	8	-	8	66.5	25.5	66.55	43.02	23.53	46.86	-	2.65	8			
UD	(1)	5	-	5	76	19	68.95	44.22	24.73	87.21	1.54	2.49	-	1.05		
UD		10	-	5	81	14	107.15	58.53	48.62	94.21	1.41	2.38	12	1.21	0.0232	
DS	Left	4	-	17	59	24	64.75	46.68	18.07	55.94	-	2.56	7			
DS	Bank	8	-	5	78	17	90.50	54.18	36.32	100.90	-	2.66	7			
UD	(2)	6	-	3	70	27	66.90	43.89	23.01	68.57	-	2.56	2			
UD		11	-	12	78	10	64.00	46.11	17.90	87.18	-	2.53	-			

Table A.4.2.4 Test Result Summary Sheet of Bridge Sites

Bridge No. 4 Location : Koteshwor

Sample Type	B. H. No.	Depth m	Percentage							NMC %	Bulk Density gm/cm3	Speficif Gravity gm/cm3	SPT Value N	Qu kg/cm2	Consolidation mv cm2/kg	Remarks
			Gravel	Sand	Silt	Clay	LL %	PL %	PI %							
DS	Right	4	35	61.5	3.5	-	-	-	-	16.28	-	2.62	17			
DS	Bank	10	-	7	78.5	14.5	90.8	57.57	33.23	92.71	-	2.46	7			
UD	(1)	7.5	-	5	87.0	8.0	90.0	55.77	34.23	88.67	1.46	2.49	-	0.84	0.0252	
UD		13	-	5	92.5	2.5	98.1	61.35	36.75	80.67	1.45	2.43	-	0.76	0.0231	
DS	Left	4	17	80	3	-	-	-	-	15.11	-	2.66	17			
DS	Bank	14	-	6	78	16	98.0	59.93	38.07	92.46	-	2.59	7			
UD	(2)	9	-	5	83	12	81.0	58.21	22.79	78.22	-	2.49	-			
UD		13	-	7	81	12	96.9	57.38	39.52	86.36	-	2.52	-			

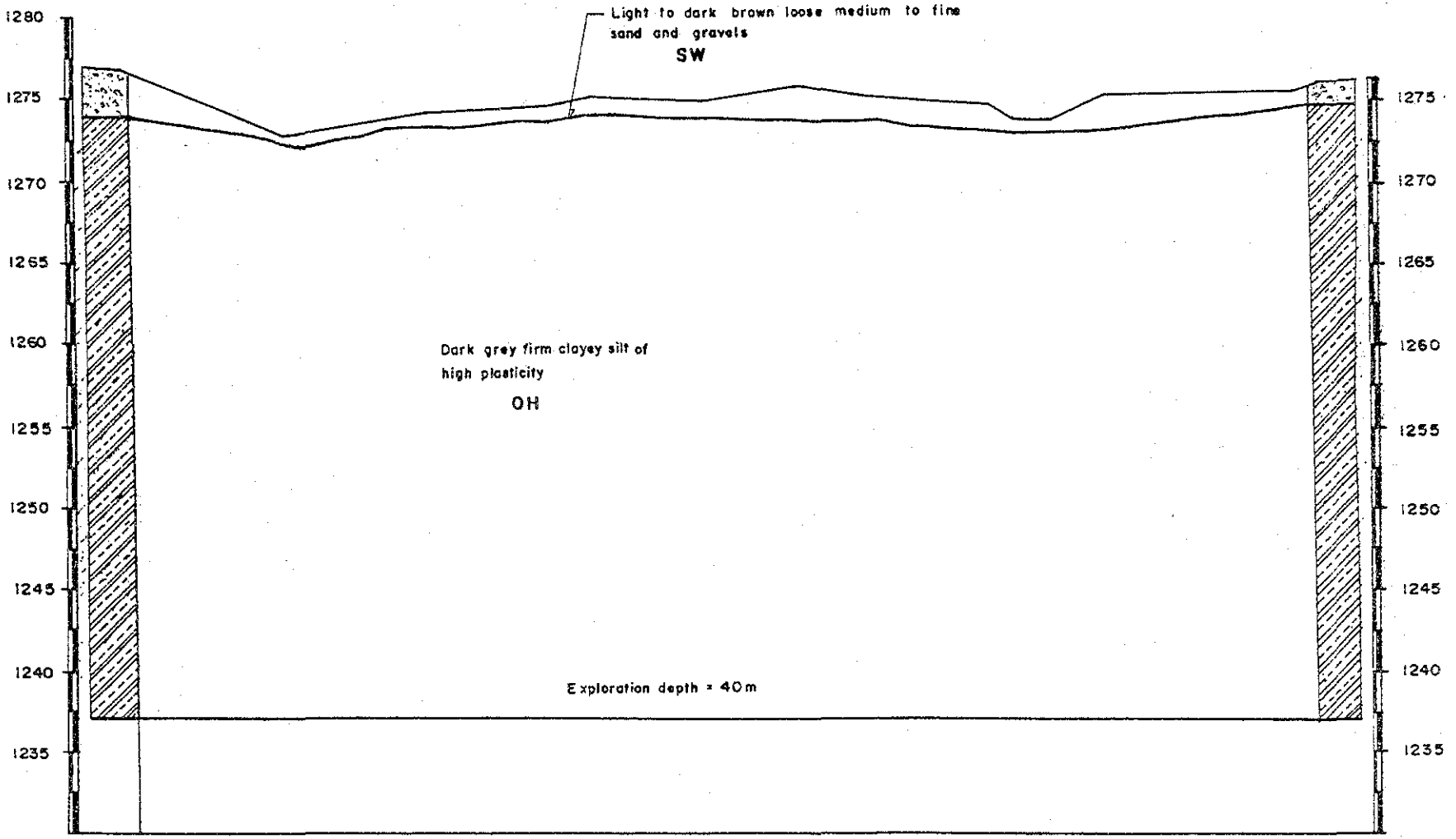


FIG. A.4.2.1 SOIL PROFILE ALONG BRIDGE AXIS
BRIDGE NO 1, KULESWOR

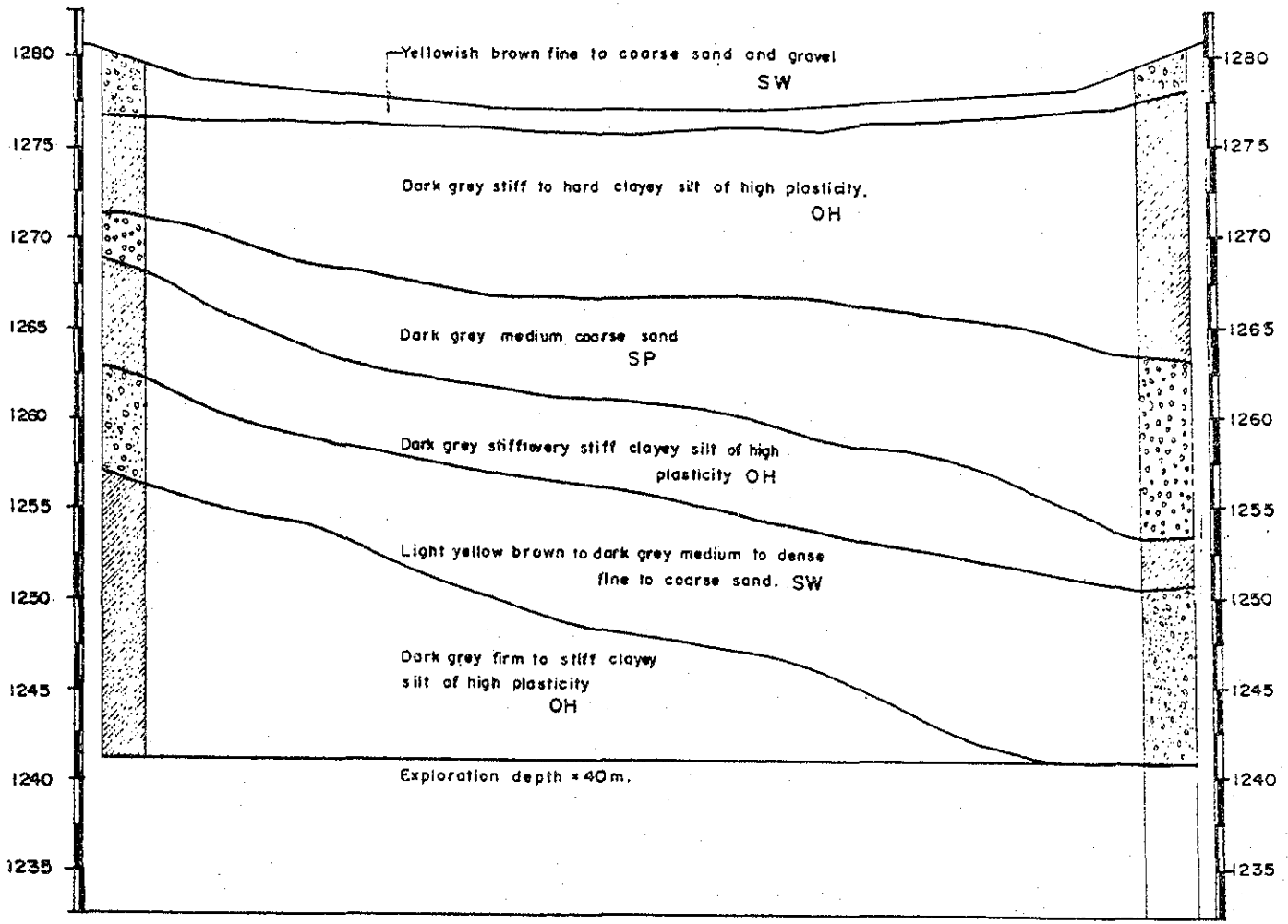


FIG. A.4.2.2 PROFILE ALONG BRIDGE AXIS
BRIDGE NO 2, THAPATHALI

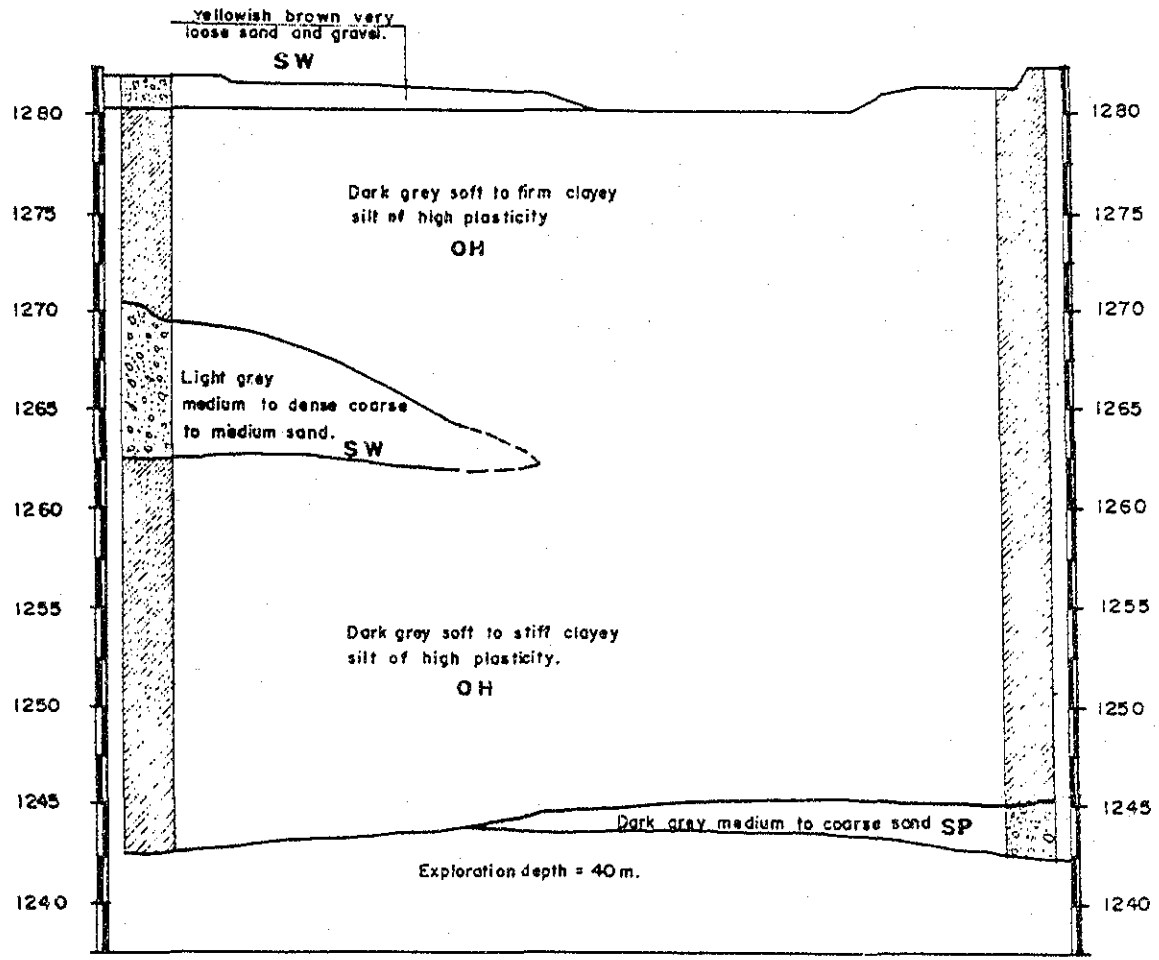
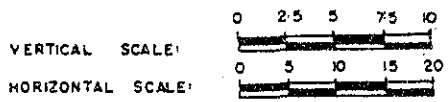


FIG. A.4.2.3 SOIL PROFILE ALONG BRIDGE AXIS
BRIDGE NO 3, CHAKUPAT



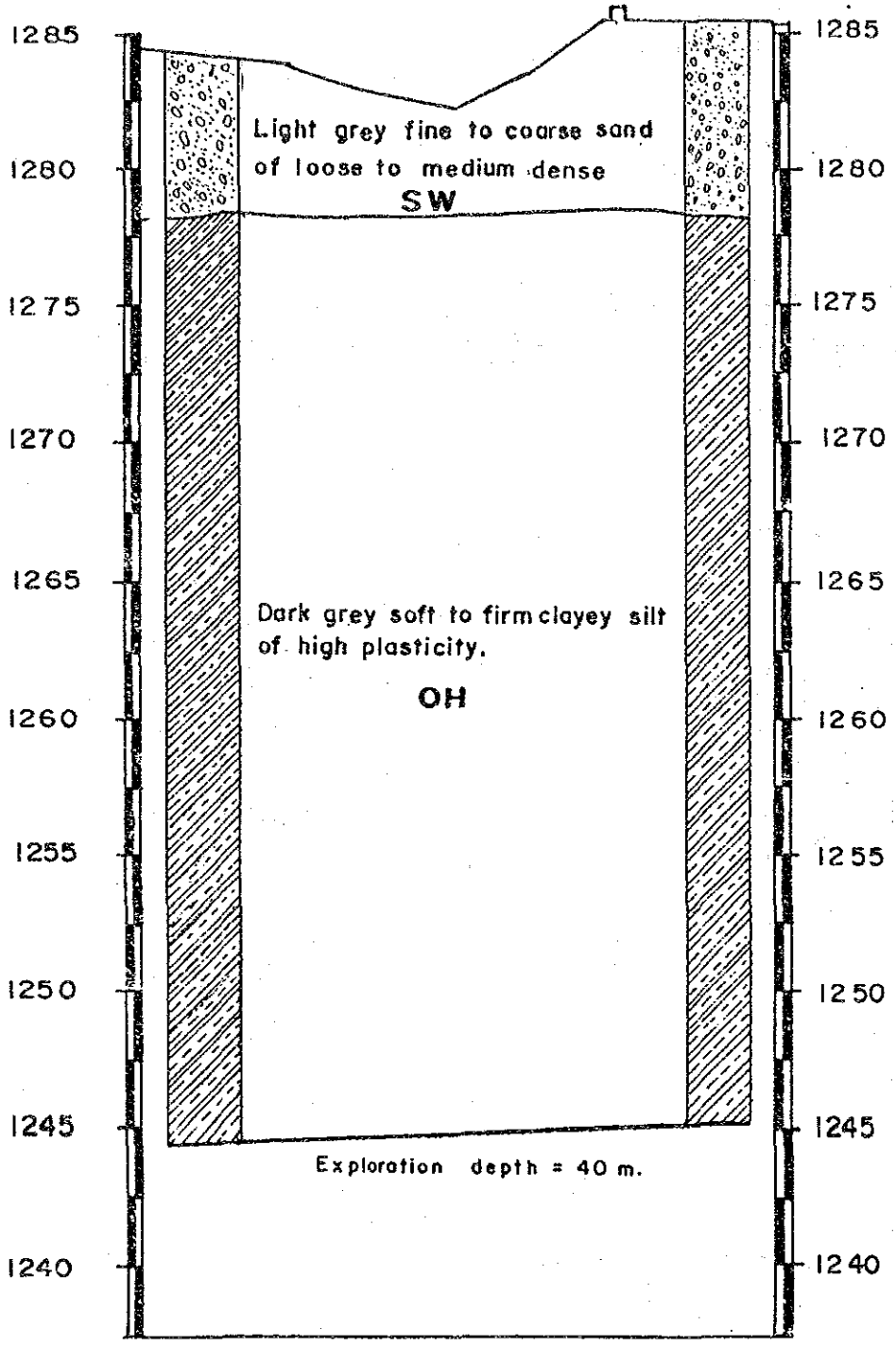


FIG. A.4.2.4 SOIL PROFILE ALONG BRIDGE AXIS
BRIDGE NO 4, KOTESWOR

TABLE A.4.2 5 FIELD DENSITY TEST

Road Pits	RP1	RP2	RP3	RP4	RP5	RP6	RP7	RP8	RP9	RP10	RP11
Field Density gm/cm^3	1.79	1.58	1.76	1.59	1.77	1.87	1.67	1.83	1.87	1.69	1.87

TABLE A. 4.2.6 LOCATIONS OF DCPT AND NUMBER OF BLOWS TO PENETRATE 80cm

Location	CP1	CP2	CP3	CP4	CP5	CP6	CP7	CP8	CP9	CP10	CP11
No of blows	10	12	6	15	17	17	12	15	22	13	25
Location	CP12	CP13	CP14	CP15	CP16	CP17	CP18	CP19	CP20	CP21	CP22
No of blows	1	8	7	7	20	22	8	16	9	11	32

TABLE A.4.2.7 CBR VALUE COMPUTED FROM GRAPH

Location	CP2	CP4	CP8	CP10	CP11	CP13	CP14	CP17	CP18	CP20	CP21
CBR (Correle-ted)	5.0	7.4	7.8	5.4	7.0	4	3.4	10.4	4.0	4.6	12

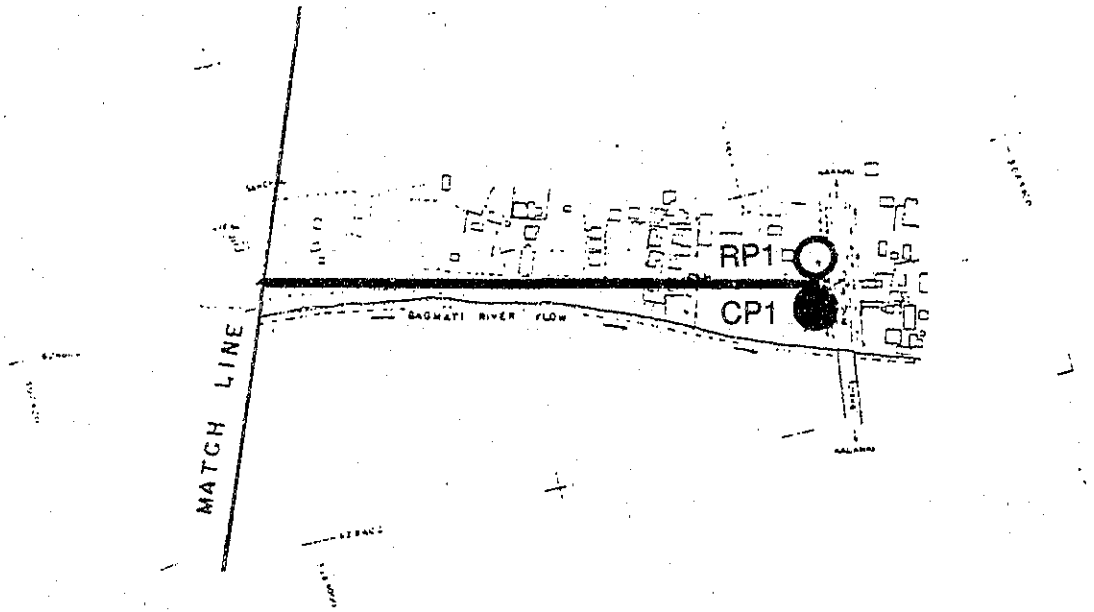
Appendix 4.2.2 Description of Subgrade

In total eleven test pits (RP) along the proposed road were excavated at an interval of 1 km. to assess their properties. Samples from those pits were collected from different depths. General description of soil strata upto 1 m for all eleven road pits (RP) are presented in following table.

Pit No	Depth (cm)	Description of soil
RP1	0-0.15 cm	Light grey silty clay with few fine sand
	0.15-0.35	Light grey clayey sandy silt with some gravels
	0.35-1.0 m	Light brown micacious silty fine sand with gravels & traces of boulders
RP2	0.0-0.25	Grey to light brown silty clay with some fine sand
	0.25-0.50	Light brown micacious silty clay with fine sand
	0.50-1.0	Light brown sandy clayey silt with traces of gravel
RP3	0.0-0.25	Grey micacious silty clay with fine sand
	0.25-1.0	Light grey micacious sandy silt with gravels and clay
RP4	0.0-0.10	Dark grey silty clay with few micacious sand
	0.10-1.0	Brown sandy silt with gravels & clay
RP5	0.0-0.15cm	Light brown micacious silty clay with some sand
	0.15-0.45	Light grey sandy silt with some gravels & traces of clay
	0.45-0.55	Light brown micacious medium to fine sand
	0.55-1.0m	Grey & brown colour mixed silty clay with few micacious sand
RP6	0.0-0.25cm	Light grey micacious silty fine sand with traces of clay
	0.25-0.45cm	Light grey silty sand with clayey gravels
	0.45-1.0m	Light grey to white micacious medium to coarse sand with some gravels
RP7	0.0-0.25cm	Light grey to brown micacious silty fine sand with clay
	0.25-0.60	Dark grey micacious sandy silt with clay and gravels
	0.60-1.0	Light brown micacious fine sand
RP8	0.0-0.20	Dark grey silty clay
	0.20-0.50	Dark grey sandy silt with clay & gravels
	0.50-1.0	Light grey to brown micacious silty medium to fine sand
RP9	0.0-0.20	Dark grey silty clay
	0.20-0.60	Dark grey sandy silt with traces of gravel & clay
	0.60-1.0	Light grey micacious silty medium to coarse sand
RP10	0.0-0.10	Light grey fine micacious silty clay with fine sand
	0.10-1.0	Light grey silty sand with traces of clayey gravels
RP11	0.0-0.15	Dark grey silty clay
	0.15-1.0	Light grey to brown sandy silt

Table A.4.2.8 **Test Result Summary Sheet of Road Pits**

S. N.	Road Pit No.	Depth	Description of Soil	Percentage of				Atterberg Limits			NMC %	Bulk Density gm/cm3	Specific Gravity gm/cm3	Compact %	CBR
				Gravel	Sand	Silt	Clay	LL %	PL %	PI %					
1.	RP1	0.30	Light Gray Clayey Sandy Silt with some Gravels	7.20	24.68	62.62	5.50	37.25			33.63	1.79	2.66	101.0	4.93
2.	RP2	0.80	Light Brown Sandy Clayey Silt with Traces of Gravels	1.18	22.00	70.32	6.50	28.20			25.68	1.58	2.59	101.5	3.04
3.	RP3	0.80	Light Grey Micacious Sandy Silt with Gravels and Clay	5.20	42.24	50.76	1.80	29.00			25.00	1.76	2.52	101.6	12.18
4.	RP4	0.25	Brown Sandy Silt with Gravels and Clay	9.48	25.40	58.12	7.00	43.65	27.95	16.7	40.00	1.59	2.66	98.0	8.89
5.	RP5	0.25	Light Grey Sandy Silt with Gravels and Traces of Clay	19.23	25.00	53.27	2.50	33.80			30.33	1.77	2.55	95.0	7.22
6.	RP6	0.25	Light Grey Silty Sand with Clay and Gravels	0.95	78.16	18.21	2.68	33.75			4.94	1.87	2.73	96.4	12.99
7.	RP7	0.45	Dark Grey Micacious Sandy Silt with Clay and Gravels	1.07	28.70	60.77	10.00	31.35			12.14	1.67	2.731	99.6	5.07
8.	RP8	0.40	Dark Grey Sandy Silt with Clay and Gravels	2.97	20.16	69.37	7.50	35.08			13.26	1.83	2.69	97.47	3.05
9.	RP9	0.50	Dark Grey Sandy Silt with Traces of Clay and Gravels and Clay	4.23	44.37	48.4	3.00	22.30			12.32	1.87	2.63	96.2	8.96
10.	RP10	0.70	Light Grey Silty Sand with Traces of Clay and Gravels and clay	0.30	60.03	38.07	1.60				25.38		2.55	97.25	8.5
11.	RP11	0.75	Light Grey to Brown Sandy Silt	11.30	65.15	19.75	3.80				13.84	1.87	2.73	100	14.98



LEGEND

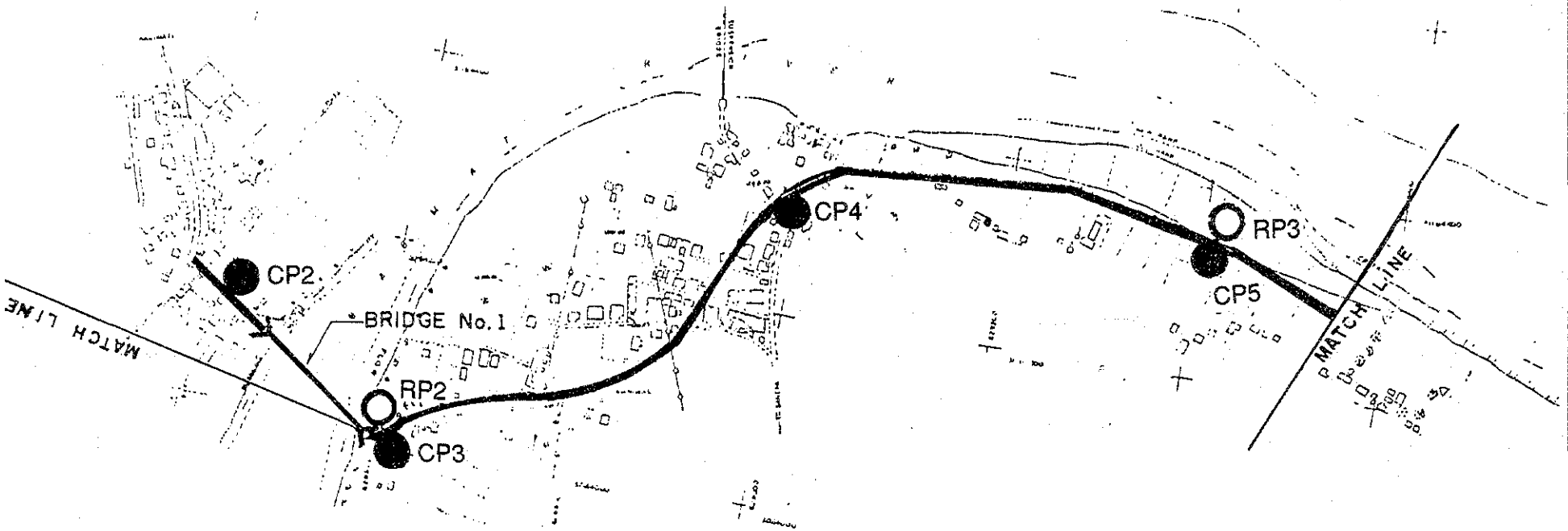
Road Alignment

RP — Excavation of Road Pits and Field density Test

CP — Cone Penetration Test

Bridge Location

FIGURE A 4.2.1 LOCATION OF ROAD PITS (1/8)



LEGEND

- Road Alignment
- RP — Excavation of Road Pits and Field density Test
- CP — Cone Penetration Test
- Bridge Location

FIGURE A 4.2.1 LOCATION OF ROAD PITS (2/8)

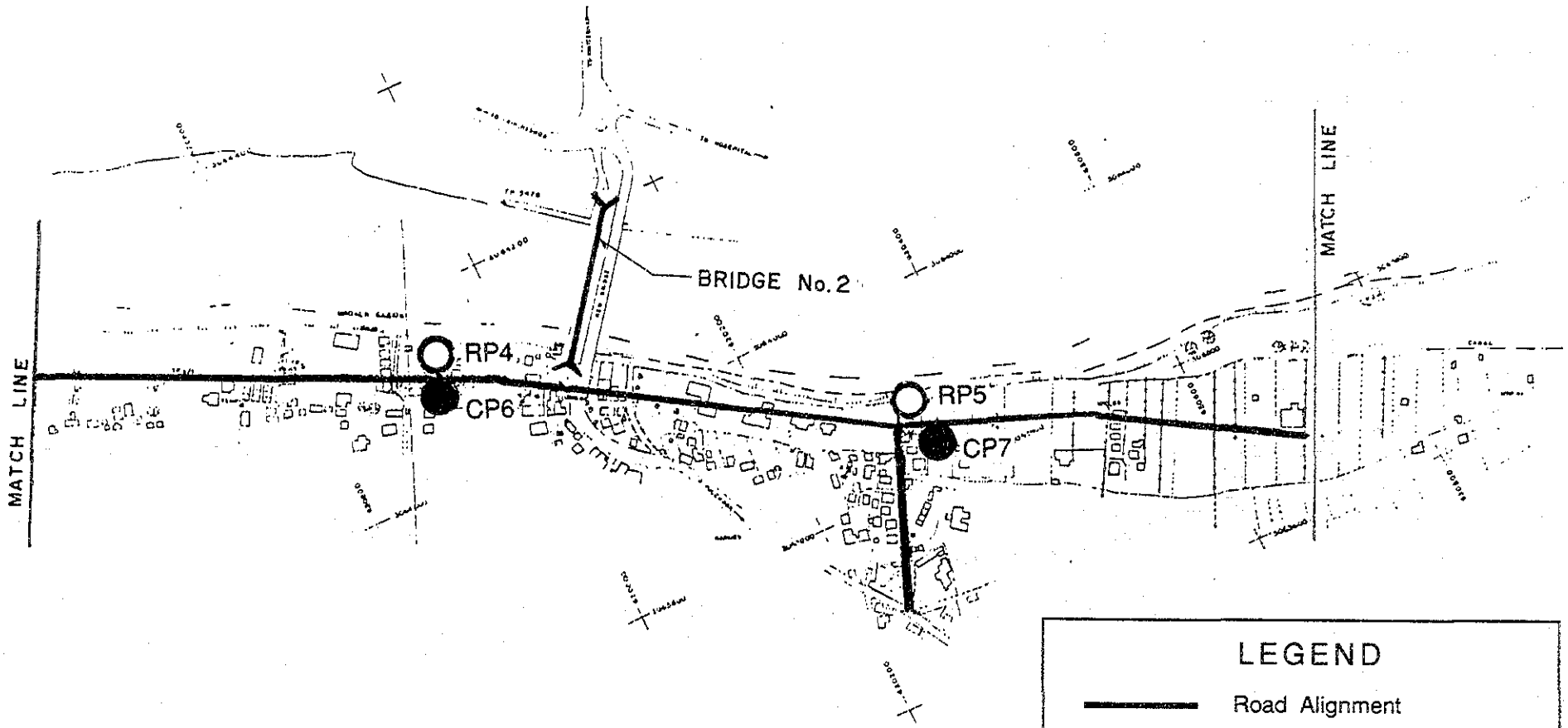


FIGURE A 4.2.1 LOCATION OF ROAD PITS (3/8)

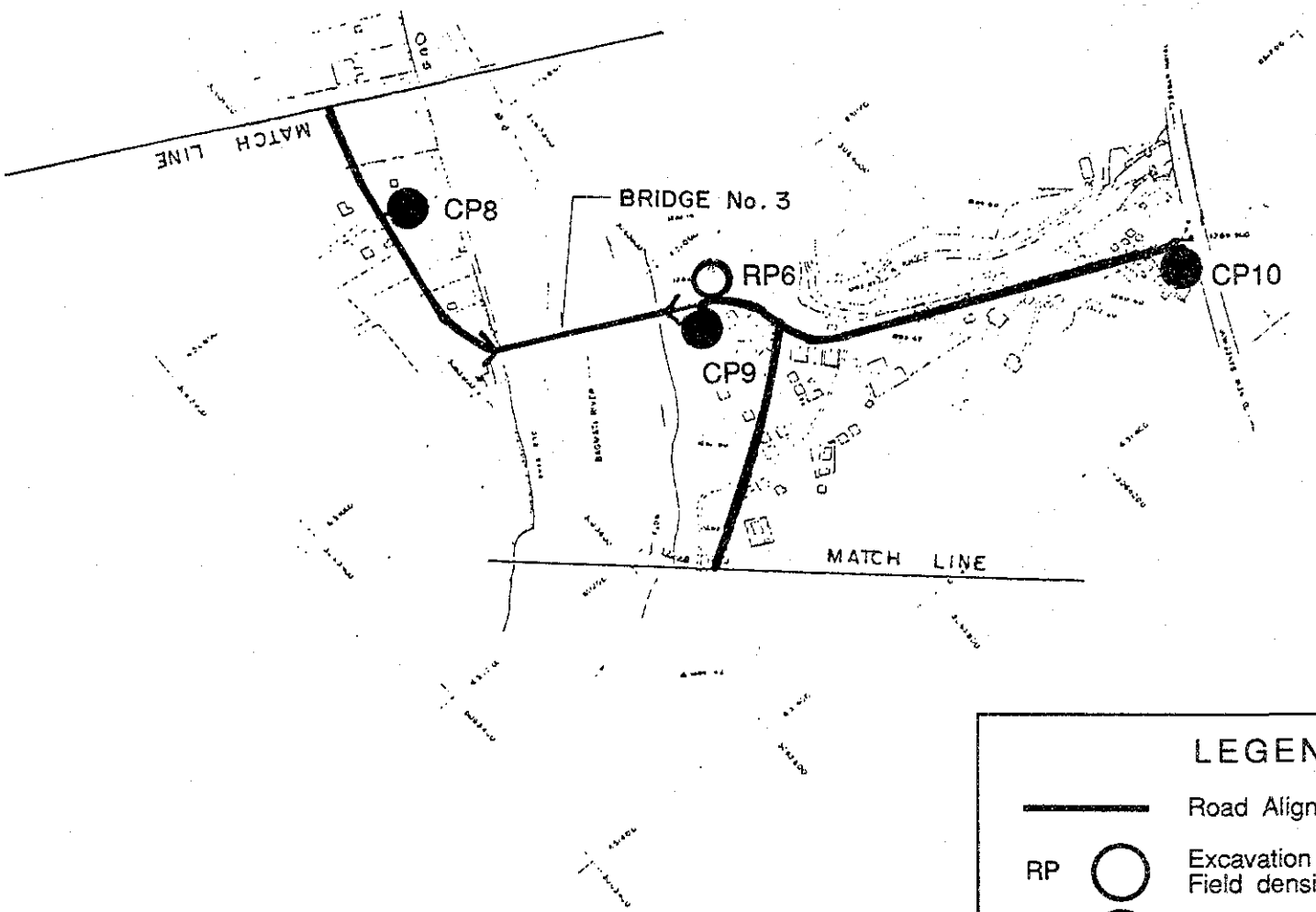
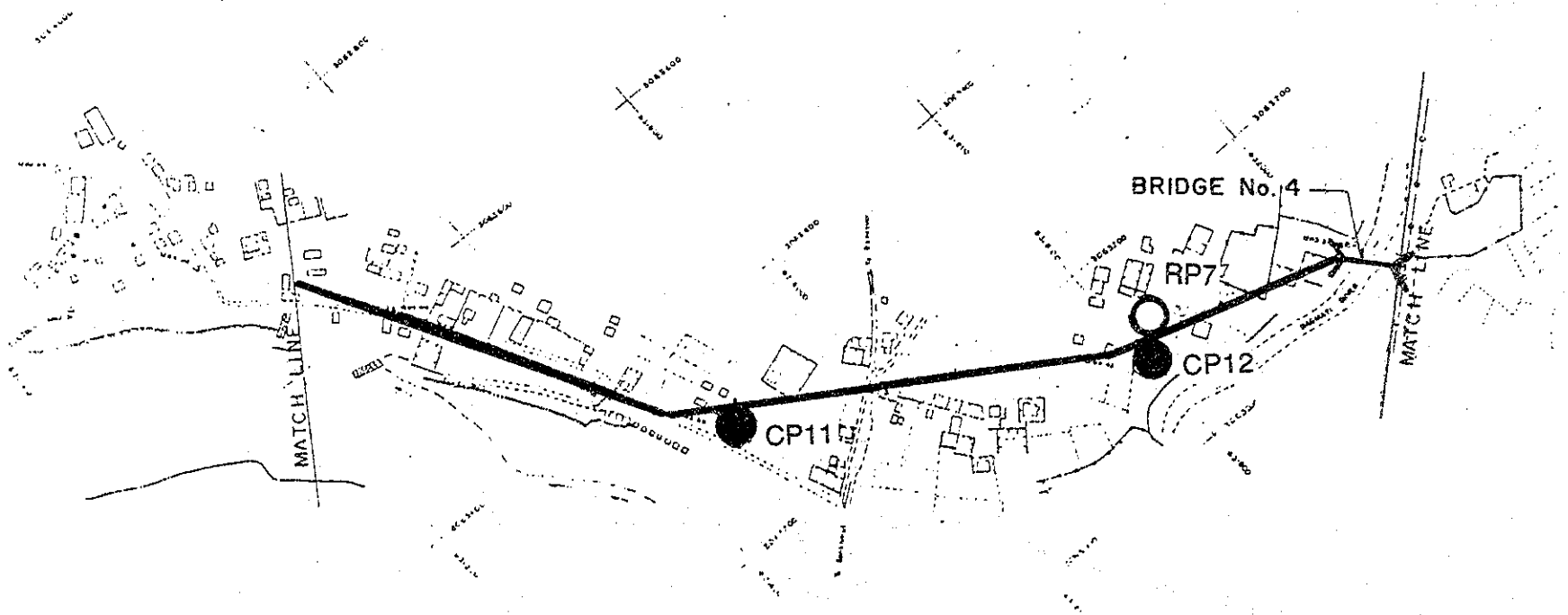


FIGURE A 4.2.1 LOCATION OF ROAD PITS (4/8)



LEGEND

- Road Alignment
- RP — Excavation of Road Pits and Field density Test
- CP — Cone Penetration Test
- Bridge Location

FIGURE A 4.2.1 LOCATION OF ROAD PITS (5/8)

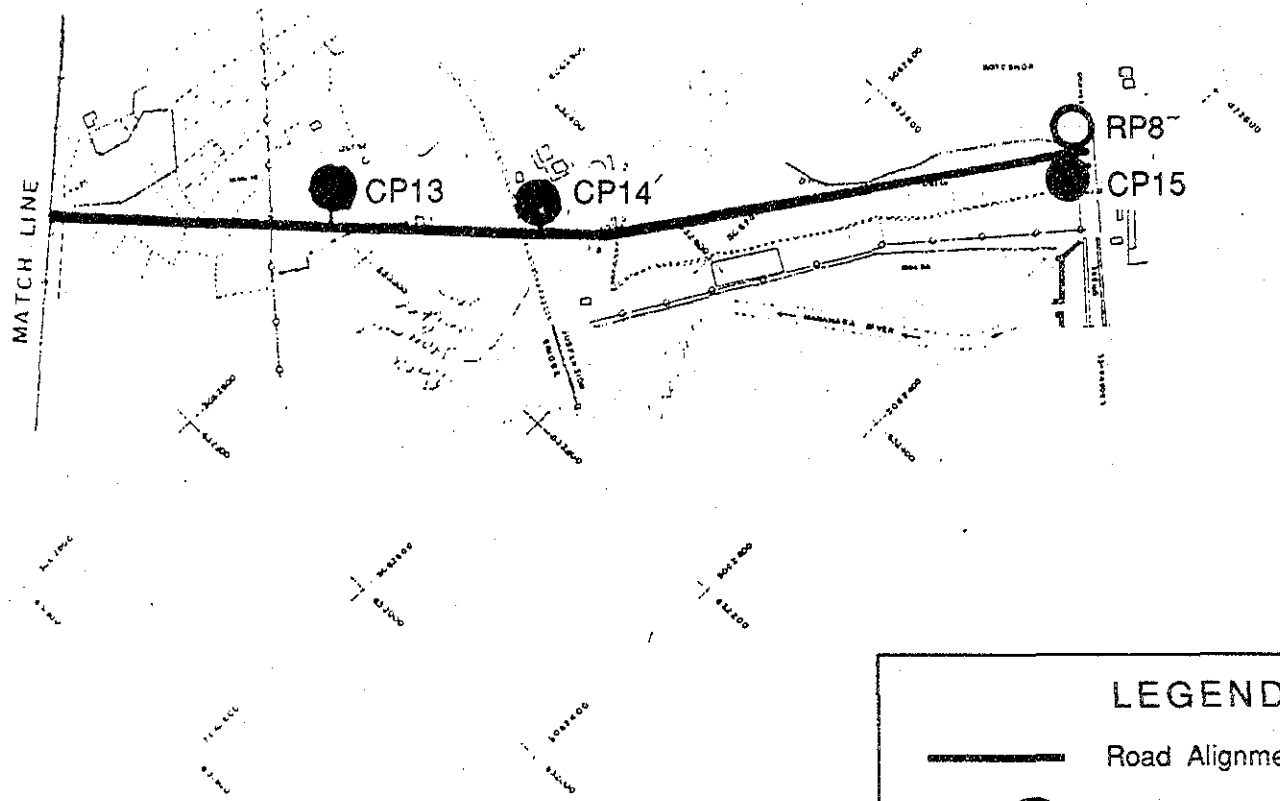


FIGURE A 4.2.1 LOCATION OF ROAD PITS (6/8)

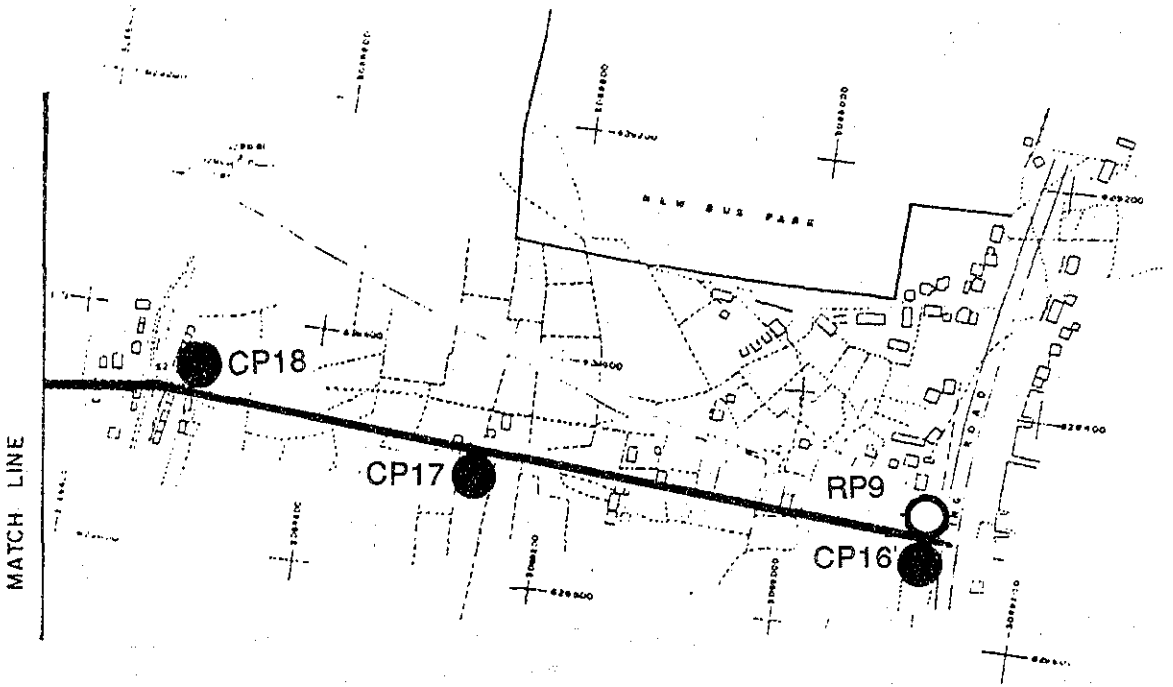


FIGURE A 4.2.1 LOCATION OF ROAD PITS (7/8)

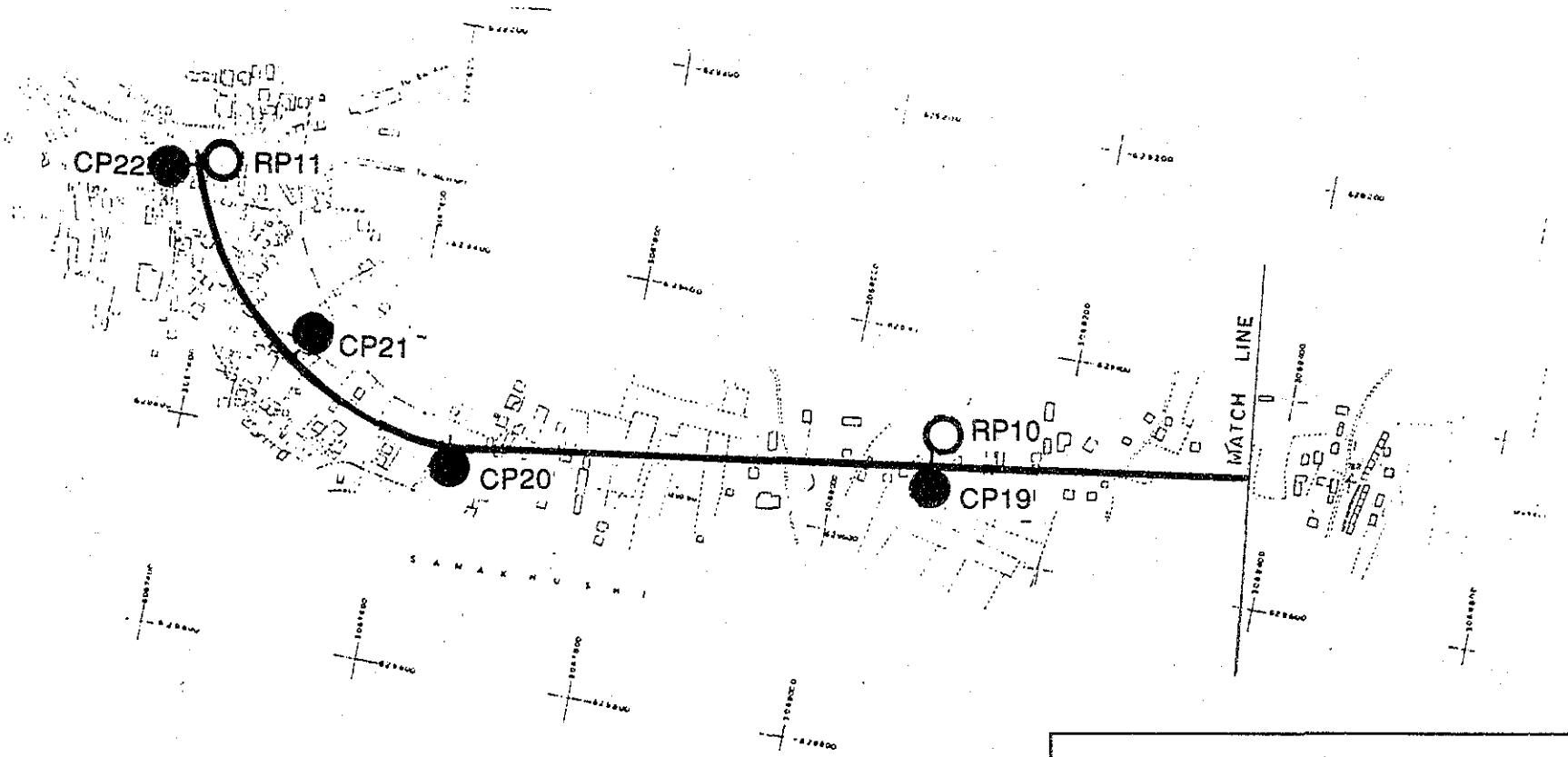


FIGURE A 4.2.1 LOCATION OF ROAD PITS (8/8)

Appendix 4.2.3 Description of Construction Materials

(1) Borrow Pits of Soils

Three sites were identified for the borrow pits of soil (subgrade materials). They were: Thimi, Gokarna Ban and Kapan:

Thimi borrow pit

Thimi borrow pit is located along the Kathmandu-Bhaktapur road. The quarry site is in the form of hillock approximately 15-20m high from sorrounding ground level. Huge quantity of soil were already exavated from that part as a filling material for construction of building complexes.

Two samples were collected from that borrow pit, one from 3 m high from ground level and another from the toe of the hillock. Both the samples were similar and according to visual classification they were classified as light grey to grey sandy silt with some clay.

It is estimated that around 15,00,000 m^3 of soil can be excavated from that area.

Gokarna Ban

The site lies just opposite of Gokarna Safari Park along Kathmandu-Sankhu road. One sample was collected from there. The soil was classified as dark grey clayey silt with medium to fine sand.

The site is accessable throughout the year and the estimated quantity which could be borrowed from there is approximately 20,00,000 m^3.

Kapan

The site is located one kilometer north from the Mahankal Chaur. At present the borrow pit is being used for extraction of sands, which is underlain by 3-5m thick soil. The soil is classified as light grey silty sand with traces of gravels. It is estimated that approximately 50,000 m^3 of soil can be borrowed from there.

(2) Borrow Pit for Gravels

Two samples of gravels were collected from chunnikhel, which is located 4 kilometer south from Nakkhu. The samples collected were dark brown sandy gravels. The estimated quantity of gravels, which can be extracted from there is approximately 1,00,000 m^3 to 2,00,000 m^3.

(3) Borrow Pit of Sands

Three sites namely Pikhel, Kapan and Basundhara were identified for quariying of sands. Two samples were extracted from each site. Brief description of site and visual classification of sands are presented below.

Pikhel

The site is situated 4 km north from Bhaktapur, Unlike in other borrow pit areas, the sands at Pikhel is being extracted by digging holes. The sand of the area is of very good quality containing less then 1% of silt. Samples were extracted from two holes. The samples collected are classified as white micacious medium to fine sand. Available quantity is estimated to be around 1,00,000 m^3 (Deposit unlimited)

Kapan

Sands were extracted from the same area, from where the soil sample was collected. Two samples; one from the lower part and another from the top was extracted for assessment of their basic properties. The sands which were available were light grey white micaceous gravelly sand with traces of silt. The estimated quantity of sand, which could be extracted from there is 1,00,000 m^3 and further extension of 1,00,000 m^3 is possible.

Basundhara

The site is located close to the Ring Road near Marajganj. Two samples were collected from there, which were similar and are classified as light grey to white micaceous sand with gravels and traces of silt. Approximately from 50,000 m^3 of sand can be extracted from that borrow area. Further extension of 1,00,000 m^3 is possible.

(4) Borrow Pits for Crushed Stone

Three sites were identified for borrow areas of crushed stones. They were:

- Godavari Marble Industries, Godavari
- Thankot crushing plants, Thankot
- Purna Roda Dhunga Udyog, Jhalungtar

Brief description about the sites and their daily capacity is given below.

Godavari Marble Industries, Godavari

The crushing plant is located 12 km south from Kathmandu. The plant produces mainly two sizes of stones; from 12.5 mm to 19.05 mm and from 19.05 mm to 50 mm. The capacity of plant in average is 60 m^3 per day.

Thankot crushing plant

In Thankot areas, there are seven crushing plant. Sources of stone quarry for all the plants is Mahadev Besi. The sizes of aggregate which they produce is also same as from Godavari. Total capacity of all the plants is 40m3 per day.

Purna Road Dhunga Udyog

The Purna Roda Udyog is located near Bajrabarahi and is approximately 12 km south of Kathmandu. The sizes of aggregate which they produce is also from 12.50 mm to 40.00 mm and from 19.05 mm to 50.00 mm. The estimated capacity of plant is 50 m^3 per day.

Table A.4.2.9 Test Result Summary Sheet of Borrow Pits

Location	No.	Description of Soil	Percentage of				Atterberg Limits			NMC %	Bulk Density gm/cm3	Specific Gravity gm/cm3	Compact %	CBR
			Gravel	Sand	Silt	Clay	LL %	PL %	PI %					
Gokarna	2.	Dark Grey Clayey Silt Medium to Fine Sand	2.12	30.88	60.20	6.80				31.36	1.93	2.73	97.6	3.13
Thimi	1.	Grey Clayey Silt with Fine Sand		21.30	78.70					32.98	2	2.63	95.3	4.13
Thimi	2.	Light Grey Micacious Sandy Silt with Clay		16.77	81.18	3.05	38.95			21.98	1.87	2.69	102.4	4.5
Kapan	3.	Light Grey Silty Sand and Traces Gravels	9.46	63.47	25.07	2.00	25.45			18.84		2.66	97.6	6.73
Chunikhel	1.	Dark Brown Sandy Gravels	76.70	20.15	2.35	0.75				12.89	1.87	2.58	98.4	38.3
Chunikhel	2.	Dark Brown Sandy Gravels	77.80	19.25	2	0.95				14.99	1.59	2.62	98.75	45.33
Kapan	Upper	Light Grey to White Micacious Gravelly Sand	14.53	84.12	1.35					5.4	1.77	2.66		
Thankot	1.	Bluish Grey Fourty Down Gravels	100.00							0.435		2.67		
Thankot	2.	Blush Grey Fifty Down Gravels	100.00							0.1		2.71		
Godawari	1.	Redish Brown Fourty Down Gravels	100.00							0.24		2.64		
Godawari	2.	Radish Brown fifty Down Gravels	100.00							0.32		2.61		
Jhalungtar	1.	Light Brown Fourty Down Gravels	100.00							0.1		2.63		
Jhalungtar	2.	LIght Brown Fifty Down Gravels	100.00							0.2		2.73		

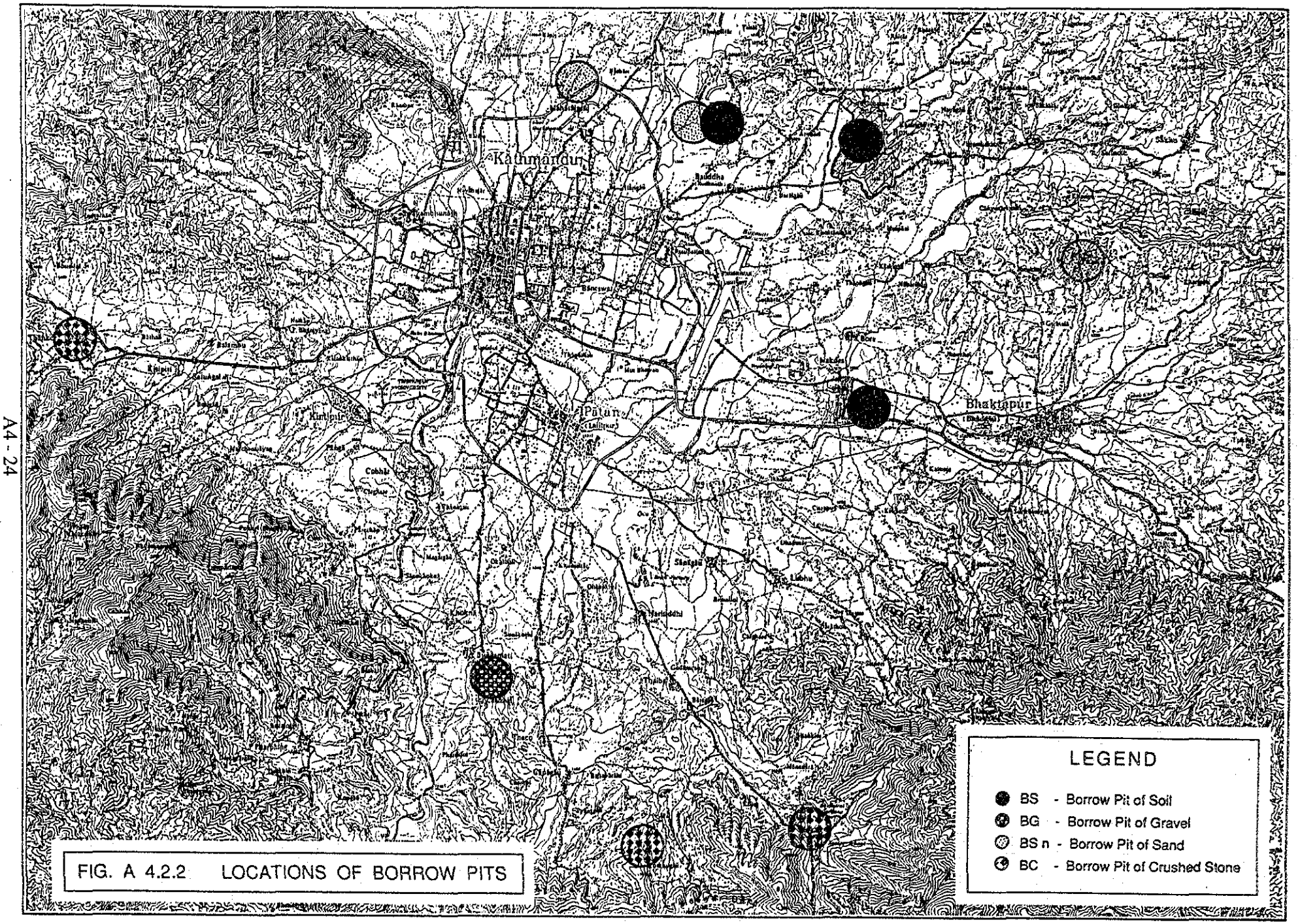


FIG. A 4.2.2 LOCATIONS OF BORROW PITS

Appendix 4.2.4 Pile Foundation Analysis

The foundation analysis was carried out for precast and driven and bored and cast-in-place piles. For both pile types analysed, the diameter assumed in case of bored and cast in place pile is 600 mm and in case of precast and driven pile, it has been assumed as 450 mm. At this stage when the actual load coming on foundation is not known, a tentative load of 1000 tons likely to be imposed on foundation soil from bridge super-structure and sub- structure, has been assumed in the analysis.

(1) Piles in clay

Piles in clay may fail individually or as a group. The capacity of the pile was computed considering both of the above cases and the minimum value obtained was taken as the capacity of the pile.

(a) Carrying Capacity of a Single Pile

The ultimate capacity for a single pile in clay was computed using the relation, as recommended by Simons and Menzies, 1974 (Ref. 2).

$$Q_u = A_s \cdot \alpha \cdot S_u + A_b.S_u.N_c \text{ ---------} \quad \text{Eq. (2.1)}$$

Where,

Q_u	=	ultimate capacity of a single pile
A_s	=	Area of staff
α	=	adhesion factor
	=	0.8 for driven piles (assumed)
	=	0.45 for bore piles (assumed)
S_u	=	Shear strength at base
A_b	=	Area at base
N_c	=	bearing capacity factor

The total capacity of pile in a group on the basis of piles failing individually was computed as given in Tomlinson, 1967 (Ref. 3).

$$Q_g = n\ Q_s \text{ ----------} \quad \text{Eq. (2.2)}$$

Where,

Q_g	=	carrying capacity of the pile group
n	=	number of piles
Q_s	=	carrying capacity of a single pile

(b) Carrying Capacity of Pile in a Group

The capacity of the pile foundation with the piles in group was computed by carrying out block analysis as suggested by Terzaghi and Peck (1967) (Ref. 1).

A pile spacing equal to the perimeter of the pile was used in the analysis. The recommended relationship which was utilised in the present analysis is

$$Q_g = \frac{\alpha S_u \, 2(L+B) \times D + N_c . S_b . LxB}{3} \text{ - Eq. (2.3)}$$

Where,

α	=	adhesion factor
S_u	=	average shear strength over the peripherial area of the group
S_b	=	shear strength at base
Q_g	=	carrying capacity of pile group
L	=	length of group
B	=	width of group
D	=	depth of pile

The minimum value obtained from Eq. (2.2) and Eq. (2.3) was taken as the capacity of group.

(c) Settlement of pile group

The settlement of a pile group in clay was computed using the relation proposed by Tomlinson, 1969 (Ref. 3).

$$\delta = 0.55 \, q_n \times m_v \times 1.5 \, B \text{ --------- Eq. (2.4)}$$

Where,

δ	=	settlement of pile group
q_n	=	net increase in pressure
m_v	=	co-efficient of volume compressibility
B	=	width of foundation

The settlement of the pile groups was estimated on the assumption that the group behaves as a raft having dimensions in plan equal to the overall dimensions of the group plus the additional width given by the 1 in 4 spread of load. The base of the "virtual raft foundation" was assumed to be at a depth of two-third of the length of piles.

(2) Piles in sand

(a) Ultimate capacity of a single pile

The ultimate capacity of a single pile was computed using the following relation as given in Simons & Menzies, 1974 (Ref. 2).

$$Q_u = As \, K \, p_{avg} \tan\delta + A_b \, p_o \, (N_q - 1) \text{ ___ Eq. (2.5)}$$

Where,

Q_u	=	Ultimate pile capacity
A_s	=	Area of the shaft
K	=	Co-efficient of earth pressure
p_{avg}	=	Average effective overburden pressure over the embedded length of pile.
tan	=	Co-efficient of friction between soil and pile material.
A_b	=	Area of base
p_o	=	Effective overburden pressure at base
N_q	=	Bearing capacity factor as suggested by Berezantsev (1961).

To obtain pile capacity, a factor of safety of 2.5 was used.

The capacity of the pile group is computed by the relation.

$Q_g = n Q_s$ ---------- E_q. (2.6)

Where,

n	=	number of piles
Q_s	=	capacity of a single pile

In sands, driving of piles increases the relative density of sand considerably and the average load per pile in a group at failure is more than that for the failure of single comparable pile. Therefore, check of pile group against block failure was not necessary.

b) Settlement

The settlement of the pile group in sand was computed by assuming a virtual raft foundation at the level of the base of piles. The area of "virtual raft" was taken to be equal to the plan area of the pile group, (Tomlinson, 1969) (Ref. 3) and the settlement of the pile group was estimated using the Eq. 3.

Table A.4.2.10 Foundation Analysis

Bridge Site	Type of Pile Foundation											
	Precast and Driven 450 mm spuare						Bored and cast in place 600 mm dia					
	Length m	Pile Capacity tons	Spacing m	No. of Piles	Size of Group mxm	Expected settlement mm	Length m	Pile Capacity tons	Spacing m	No. of Piles	Size of Group mxm	Expected settlement mm
Kuleswar	24	22.5	1.9	45	15.8 by 8.2	94	27	22.5	1.9	45	15.8 by 8.2	94
Thapathali	12	22.5	1.9	45	15.8 by 8.2	85	14	22.5	1.9	45	15.8 by 8.2	87
Chakupat	14	22.5	1.9	45	15.8 by 8.2	89	15	22.5	1.9	45	15.8 by 8.2	100
Koteswor	19	22.5	1.9	45	15.8 by 8.2	95	20	22.5	1.9	45	15.8 by 8.2	98

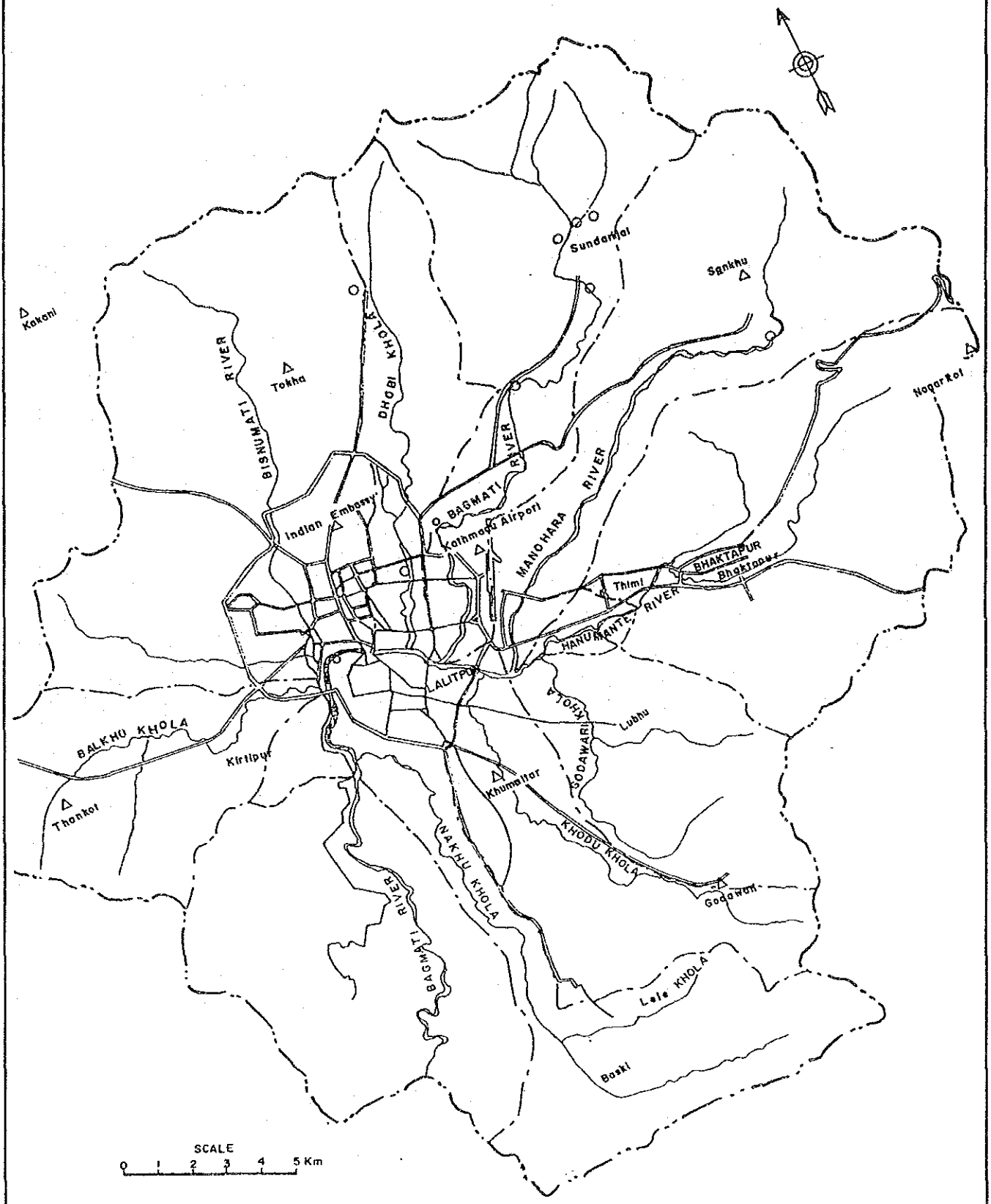


Figure A 4.3.1 LOCATION MAP OF RAINFALL STATION AND STREAM GAUGING STATION

Table A4.3.1 RAINFALL RECORD IN KATHMANDU VALLEY

YEAR	ANNUAL TOTAL							
	KTM. Airport	Godavari	Kakani	Khumaltar	Bhaktapur	Sankhu	Thankot	Nagarkot
1977	1298.0	1617.0	2392.0	1145.0	*	*	*	1798.0
1978	1556.0	2211.0	3241.0	1698.0	*	*	*	2700.0
1979	1356.0	1584.0	1734.0	950.0	*	*	*	1658.0
1980	1341.0	1548.0	2843.0	1009.0	*	*	*	1783.0
1981	1370.0	1698.0	2375.0	1159.0	*	*	*	1066.0
1982	1168.0	1672.0	*	1158.0	*	*	*	1045.0
1983	1449.0	1918.0	2986.0	1309.0	*	*	*	1266.0
1984	1313.0	2214.0	2672.0	1330.0	*	*	*	1435.0
1985	1786.0	2553.0	3288.0	1535.0	*	*	*	*
1986	1495.0	1910.0	3054.0	1367.0	*	*	*	2089.0
1987	1395.2	2061.1	2322.0	1449.2	1484.6	1728.0	2254.0	1645.2
1988	1373.8	1973.7	2774.9	1496.8	1784.8	1905.5	2024.4	1581.2
1989	1132.0	1644.7	3162.0	996.3	1095.0	2117.2	2029.6	*
1990	1532.7	2086.7	2993.8	1173.9	1752.7	2372.7	2111.6	2132.0
1991	997.5	1509.1	2689.5	870.0	896.9	1439.0	1619.6	1742.2
MEAN	1370.9	1880.0	2751.9	1243.1	1402.8	1912.5	2007.8	1687.7

Table A.4.3.2 RAINFALL AT KATHMANDU ARPORT

Year	Jan.			Feb			Mar.			Apr.			May.			Jun.			Jul.			Aug.			Sep.			Oct.			Nov.			Dec.			Annual	Annual
	max	total	mean daily	max	total	mean daily	max	total	mean daily	max	total	mean daily	max	total	mean daily	max	total	mean daily	max	total	mean daily	max	total	mean daily	max	total	mean daily	max	total	mean daily	max	total	mean daily	max	total	mean daily	max	Total
1977		12.0	0.4	12.0	12.0	0.4	9.0	17.0	0.5	21.0	104.0	3.5	27.0	90.0	2.9	50.0	266.0	8.9	51.0	323.0	10.4	58.0	338.0	10.9	18.0	79.0	2.6	10.0	29.0	0.9	8.0	14.0	0.5	10.0	14.0	0.5	58.0	1298.0
1978	3.0	5.0	0.2	8.0	11.0	0.4	39.0	69.0	2.2	14.0	42.0	1.4	18.0	143.0	4.6	36.0	299.0	10.0	67.0	324.0	10.5	71.0	392.0	12.6	30.0	160.0	5.3	71.0	109.0	3.5	0.0	0.0	0.0	1.0	2.0	0.1	71.0	1556.0
1979	2.0	6.0	0.2	22.0	39.0	1.4	0.0	1.0	0.0	12.0	42.0	1.4	12.0	37.0	1.2	48.0	258.0	8.6	86.0	447.0	14.4	76.0	320.0	10.3	52.0	99.0	3.3	12.0	36.0	1.2	4.0	6.0	0.2	51.0	65.0	2.1	86.0	1356.0
1980	1.0	1.0	0.0	9.0	18.0	0.6	19.0	46.0	1.5	7.0	10.0	0.3	32.0	124.0	4.0	100.0	349.0	11.6	50.0	296.0	9.5	31.0	238.0	7.7	54.0	184.0	6.1	38.0	69.0	2.2	0.0	0.0	0.0	6.0	6.0	0.2	100.0	1341.0
1981	11.0	14.0	0.5	0.0	0.0	0.0	22.0	60.0	1.9	38.0	101.0	3.4	54.0	216.0	7.0	35.0	141.0	4.7	36.0	304.0	9.8	47.0	267.0	8.6	50.0	225.0	7.5	0.0	0.0	0.0	16.0	42.0	1.4	0.0	0.0	0.0	54.0	1370.0
1982	9.0	14.0	0.5	10.0	22.0	0.8	16.0	36.0	1.2	10.0	49.0	1.6	14.0	40.0	1.3	88.0	200.0	6.7	52.0	238.0	7.7	52.0	384.0	12.4	38.0	155.0	5.2	8.0	9.0	0.3	18.0	18.0	0.6	3.0	3.0	0.1	88.0	1168.0
1983	16.0	18.0	0.6	2.0	4.0	0.1	15.0	30.0	1.0	14.0	79.0	2.6	29.0	110.0	3.5	39.0	81.0	2.7	72.0	500.0	16.1	45.0	194.0	6.3	44.0	288.0	9.6	43.0	130.0	4.2	0.0	0.0	0.0	15.0	15.0	0.5	72.0	1449.0
1984	14.0	14.0	0.5	14.0	17.0	0.6	14.0	14.0	0.5	21.0	60.0	2.0	19.0	96.0	3.1	70.0	275.0	9.2	30.0	250.0	8.1	77.0	302.0	9.7	45.0	260.0	8.7	17.0	18.0	0.6	0.0	0.0	0.0	7.0	7.0	0.2	77.0	1313.0
1985	6.0	10.0	0.3	3.0	3.0	0.1	4.0	4.0	0.1	13.0	25.0	0.8	22.0	133.0	4.3	36.0	161.0	5.4	51.0	418.0	13.5	52.0	434.0	14.0	69.0	376.0	12.5	52.0	167.0	5.4	0.0	0.0	0.0	28.0	55.0	1.8	69.0	1786.0
1986	0.0	0.0	0.0	20.0	23.0	0.8	7.0	16.0	0.5	24.0	93.0	3.1	21.0	97.0	3.1	65.0	316.0	10.5	78.0	381.0	12.3	62.0	219.0	7.1	48.0	221.0	7.4	26.0	80.0	2.6	0.0	0.0	0.0	32.0	49.0	1.6	78.0	1495.0
1987	2.7	3.2	0.1	25.0	43.3	1.5	9.6	35.9	1.2	11.0	34.4	1.1	18.0	57.6	1.9	16.8	116.4	3.9	86.5	498.8	16.1	39.3	256.3	8.3	45.6	171.2	5.7	124.4	159.3	5.1	0.0	0.0	0.0	18.3	18.8	0.6	124.4	1395.2
1988	0.6	0.6	0.0	9.7	19.1	0.7	21.9	68.0	2.2	14.7	42.3	1.4	37.3	152.9	4.9	36.5	239.5	8.0	66.0	397.3	12.8	60.5	278.7	9.0	27.0	134.4	4.5	11.5	17.6	0.6	7.4	11.7	0.4	7.4	11.7	0.4	66.0	1373.8
1989	31.3	47.4	1.5	9.7	10.7	0.4	5.8	12.1	0.4	3.3	4.0	0.1	46.0	148.7	4.8	29.3	135.5	4.5	57.0	328.0	10.6	27.0	206.0	6.6	38.7	196.5	6.6	18.9	42.4	1.4	0.0	0.0	0.0	0.7	0.7	0.0	57.0	1132.0
1990	0.0	0.0	0.0	18.0	42.2	1.5	15.8	59.5	1.9	26.2	116.2	3.9	73.2	108.3	3.5	47.0	285.5	9.5	56.4	345.6	11.1	53.8	308.5	10.0	39.2	188.2	6.3	48.2	78.7	2.5	0.0	0.0	0.0	0.0	0.0	0.0	73.2	1532.7
1991	14.6	20.7	0.7	10.0	11.4	0.4	19.2	45.2	1.5	17.1	26.3	0.9	42.8	145.3	4.7	24.4	114.4	3.8	36.9	190.3	6.1	44.7	280.7	9.1	27.6	137.7	4.6	0.4	0.4	0.0	0.2	0.2	0.0	21.5	24.9	0.8	44.7	997.5
Max	31.3			25.0			39.0			38.0			73.2			100.0			86.5			77.0			69.0			124.4			18.0			51.0			124.4	1786.0
Mean		11.1	0.4		18.4	0.7		34.2	1.1		55.2	1.8		113.3	3.7		215.8	7.2		349.4	11.3		294.5	9.5		191.7	6.4		63.0	2.0		6.1	0.2		18.1	0.6	74.6	1370.9

Table A.4.3.3 RAINFALL AT GODAVARI

Year	Jan.			Feb.			Mar.			Apr.			May.			Jun.			Jul.			Aug.			Sep.			Oct.			Nov.			Dec.			Annual	Annual
	max	total	mean daily	max	total	mean daily	max	total	mean daily	max	total	mean daily	max	total	mean daily	max	total	mean daily	max	total	mean daily	max	total	mean daily	max	total	mean daily	max	total	mean daily	max	total	mean daily	max	total	mean daily	max	Total
1977	7.0	12.0	0.4	15.0	18.0	0.6	6.0	11.0	0.4	20.0	104.0	3.5	26.0	135.0	4.4	56.0	194.0	6.5	114.0	656.0	21.2	51.0	299.0	9.6	28.0	90.0	3.0	12.0	35.0	1.1	7.0	7.0	0.2	56.0	56.0	1.8	114.0	1617.0
1978	2.0	2.0	0.1	10.0	25.0	0.9	51.0	78.0	2.5	34.0	66.0	2.2	21.0	128.0	4.1	71.0	368.0	12.3	83.0	414.0	13.4	87.0	626.0	20.2	67.0	374.0	12.5	99.0	124.0	4.0	0.0	1.0	0.0	4.0	5.0	0.2	99.0	2211.0
1979	5.0	6.0	0.2	30.0	52.0	1.9	1.0	1.0	0.0	16.0	48.0	1.6	24.0	64.0	2.1	81.0	330.0	11.0	97.0	548.0	17.7	93.0	345.0	11.1	21.0	70.0	2.3	14.0	34.0	1.1	5.0	7.0	0.2	63.0	79.0	2.5	97.0	1584.0
1980	0.0	0.0	0.0	7.0	12.0	0.4	8.0	25.0	0.8	15.0	19.0	0.6	31.0	111.0	3.6	103.0	440.0	14.7	68.0	439.0	14.2	45.0	390.0	12.6	54.0	75.0	2.5	16.0	31.0	1.0	0.0	0.0	0.0	6.0	6.0	0.2	103.0	1548.0
1981	10.0	30.0	1.0	0.0	0.0	0.0	12.0	45.0	1.5	24.0	96.0	3.2	24.0	138.0	4.5	32.0	186.0	6.2	36.0	420.0	13.5	58.0	350.0	11.3	169.0	413.0	13.8	0.0	0.0	0.0	18.0	20.0	0.7	0.0	0.0	0.0	169.0	1698.0
1982	10.0	15.0	0.5	6.0	16.0	0.6	31.0	55.0	1.8	16.0	44.0	1.5	20.0	80.0	2.6	55.0	304.0	10.1	68.0	375.0	12.1	65.0	523.0	16.9	66.0	229.0	7.6	6.0	11.0	0.4	14.0	18.0	0.6	2.0	2.0	0.1	68.0	1672.0
1983	18.0	21.0	0.7	4.0	8.0	0.3	5.0	7.0	0.2	17.0	59.0	2.0	51.0	214.0	6.9	23.0	91.0	3.0	84.0	587.0	18.9	65.0	455.0	14.7	48.0	298.0	9.9	56.0	164.0	5.3	0.0	0.0	0.0	14.0	14.0	0.5	84.0	1918.0
1984	26.0	26.0	0.8	17.0	20.0	0.7	12.0	12.0	0.4	25.0	65.0	2.2	43.0	158.0	5.1	71.0	417.0	13.9	49.0	449.0	14.5	61.0	490.0	15.8	110.0	538.0	17.9	25.0	28.0	0.9	0.0	0.0	0.0	10.0	11.0	0.4	110.0	2214.0
1985	9.0	20.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	16.0	27.0	0.9	23.0	140.0	4.5	42.0	226.0	7.5	120.0	847.0	27.3	62.0	484.0	15.6	90.0	455.0	15.2	82.0	274.0	8.8	0.0	0.0	0.0	47.0	80.0	2.6	120.0	2553.0
1986	0.0	0.0	0.0	20.0	24.0	0.9	10.0	25.0	0.8	24.0	85.0	2.8	35.0	133.0	4.3	80.0	461.0	15.4	96.0	432.0	13.9	60.0	316.0	10.2	51.0	314.0	10.5	13.0	56.0	1.8	3.0	3.0	0.1	36.0	60.0	1.9	96.0	1910.0
1987	2.0	3.0	0.1	30.5	74.9	2.7	19.8	60.5	2.0	23.5	56.3	1.9	12.6	38.2	1.2	79.0	198.5	6.6	83.6	801.1	25.8	86.4	430.2	13.9	46.0	181.9	6.1	172.0	201.0	6.5	0.0	0.0	0.0	15.0	15.5	0.5	172.0	2061.1
1988	2.0	3.0	0.1	16.0	25.0	0.9	28.9	81.3	2.6	23.2	68.8	2.3	21.7	125.4	4.0	48.5	279.5	9.3	57.5	465.1	15.0	52.5	523.7	16.9	53.5	253.7	8.5	14.0	15.3	0.5	24.7	30.7	1.0	63.5	102.2	3.3	63.5	1973.7
1989	33.3	53.0	1.7	9.7	12.3	0.4	11.3	16.3	0.5	2.8	2.8	0.1	30.2	155.3	5.0	27.7	150.0	5.0	61.8	541.3	17.5	68.2	321.3	10.4	46.8	339.7	11.3	17.2	52.7	1.7	0.0	0.0	0.0	0.0	0.0	0.0	68.2	1644.7
1990	0.0	0.0	0.0	23.5	60.4	2.2	12.2	60.5	2.0	22.4	68.9	2.3	32.9	148.6	4.8	44.0	241.5	8.1	91.3	659.3	21.3	110.0	576.7	18.6	58.0	244.8	8.2	9.4	24.6	0.8	0.0	0.0	0.0	1.4	1.4	0.0	110.0	2086.7
1991	23.2	38.7	1.2	10.5	15.5	0.6	35.4	61.1	2.0	42.0	63.0	2.1	11.2	45.7	1.5	49.8	228.0	7.6	92.8	356.8	11.5	57.4	506.3	16.3	31.0	168.2	5.6	0.0	0.0	0.0	0.0	0.0	0.0	24.5	25.8	0.8	92.8	1509.1
Max	33.3			30.5			51.0			42.0			51.0			103.0			120.0			110.0			169.0			172.0			24.7			63.5			172.0	2553.0
Mean		15.3	0.5		24.2	0.9		36.0	1.2		58.2	1.9		120.9	3.9		274.3	9.1		532.7	17.2		442.4	14.3		269.6	9.0		70.0	2.3		5.8	0.2		30.5	1.0	104.4	1880.0

Table A4.3.4 TEMPERATURE AT KATHMANDU AIRPORT

Year	Jan.			Feb			Mar.			Apr.			May.			Jun.			Jul.			Aug.			Sep.			Oct.			Nov.			Dec.			Mean in Year
	mean			mean			mean			mean			mean			mean			mean			mean			mean			mean			mean			mean			
	max	min	daily	max	min	daily	max	min	daily	max	min	daily	max	min	daily	max	min	daily	max	min	daily	max	min	daily	max	min	daily	max	min	daily	max	min	daily	max	min	daily	
1977	16.8	0.5	8.7	20.3	3.0	11.7	25.4	7.1	16.3	25.0	11.3	18.2	25.7	13.5	19.6	27.9	17.6	22.8	27.8	19.7	23.8	27.6	19.0	23.3	27.1	17.4	22.3	24.0	11.6	17.8	21.7	8.6	15.2	17.6	2.2	9.9	17.4
1978	16.1	-0.4	7.9	18.7	2.0	10.4	21.6	5.1	13.4	25.6	10.4	18.0	27.2	17.0	22.1	27.4	19.2	23.3	27.4	19.8	23.6	28.4	20.0	24.2	26.7	18.5	22.6	24.6	13.8	19.2	21.0	9.0	15.0	19.8	3.3	11.6	17.6
1979	18.4	2.5	10.5	18.8	4.1	11.5	24.0	6.2	15.1	27.4	12.6	20.0	30.4	15.6	23.0	28.9	19.2	24.1	27.7	20.5	24.1	27.2	20.1	23.7	26.7	17.6	22.2	24.9	13.3	19.1	22.7	9.8	16.3	17.9	5.0	11.5	18.4
1980	17.5	1.9	9.7	19.5	4.9	12.2	23.0	8.0	15.5	29.4	12.1	20.8	28.2	16.9	22.6	27.8	20.2	24.0	27.8	20.8	24.3	27.8	20.4	24.1	26.9	19.0	23.0	24.5	12.1	18.3	22.4	7.2	14.8	19.3	4.1	11.7	18.4
1981	16.8	2.9	9.9	20.3	4.8	12.6	22.2	8.2	15.2	24.2	12.5	18.4	26.1	16.3	21.2	28.0	19.1	23.6	27.0	20.6	23.8	27.8	20.4	24.1	26.7	18.6	22.7	25.6	13.3	19.5	22.7	6.8	14.8	19.4	2.1	10.8	18.0
1982	18.9	2.8	10.9	18.5	3.5	11.0	22.8	7.5	15.2	26.5	10.9	18.7	29.9	14.4	22.2	28.5	18.5	23.5	28.7	19.6	24.2	28.9	20.2	24.6	27.3	17.8	22.6	25.6	11.2	18.4	21.3	7.9	14.6	18.8	3.9	11.4	18.1
1983	17.1	0.1	8.6	20.7	2.4	11.6	26.0	8.3	17.2	28.3	11.2	19.8	27.5	17.1	22.3	28.2	20.0	24.1	28.1	20.3	24.2	29.2	19.8	24.5	26.3	17.3	21.8	27.2	14.4	20.8	22.6	5.8	14.2	19.4	3.4	11.4	18.4
1984	16.7	1.0	8.9	19.0	1.6	10.3	23.4	5.8	14.6	25.1	10.2	17.7	26.8	15.3	21.1	30.4	18.1	24.3	28.3	20.5	24.4	28.7	20.2	24.5	27.8	19.1	23.5	26.0	13.7	19.9	22.9	7.0	15.0	18.9	1.5	10.2	17.8
1985	18.1	2.4	10.3	20.1	3.7	11.9	26.3	9.0	17.7	28.6	12.1	20.4	28.0	15.5	21.8	28.9	19.2	24.1	27.1	19.6	23.4	28.8	20.2	24.5	26.7	18.3	22.5	24.4	13.7	19.1	22.2	7.0	14.6	19.3	4.8	12.1	18.5
1986	18.3	2.7	10.5	20.1	3.5	11.8	24.6	7.2	15.9	26.4	11.1	18.8	27.1	13.9	20.5	28.9	18.9	23.9	28.2	20.1	24.2	28.7	19.5	24.1	26.9	18.0	22.5	24.8	12.3	18.6	22.3	8.1	15.2	18.7	2.8	10.8	18.0
1987	18.5	2.4	10.5	20.6	5.3	13.0	23.2	8.0	15.6	27.1	10.9	19.0	29.1	13.4	21.3	28.8	19.0	23.9	27.6	20.1	23.9	27.5	19.4	23.5	27.4	18.4	22.9	25.6	12.9	19.3	23.4	7.8	15.6	20.6	4.2	12.4	18.4
1988	19.1	3.0	11.1	21.6	5.3	13.5	23.9	7.6	15.8	28.6	10.9	19.8	28.9	15.7	22.3	28.4	18.5	23.5	28.3	19.9	24.1	27.9	19.7	23.8	28.6	18.5	23.6	28.4	13.3	20.9	24.4	6.4	15.4	20.3	5.0	12.7	18.8
1989	17.5	2.7	10.1	21.7	2.3	12.0	25.6	7.0	16.3	30.0	8.6	19.3	29.7	15.6	22.7	29.4	18.9	24.2	28.1	19.5	23.8	29.5	19.2	24.4	28.9	18.6	23.8	28.6	13.3	21.0	23.7	6.0	14.9	20.7	1.8	11.3	18.6
1990	22.2	3.2	12.7	19.9	5.2	12.6	22.1	7.0	14.6	26.2	10.8	18.5	27.1	16.1	21.6	29.2	19.6	24.4	27.6	20.1	23.9	28.3	19.4	23.9	27.5	18.5	23.0	25.6	13.0	19.3	24.4	7.3	15.9	20.2	3.7	12.0	18.5
Mean	18.0	2.0	10.0	20.0	3.7	11.8	23.9	7.3	15.6	27.0	11.1	19.1	28.0	15.5	21.7	28.6	19.0	23.8	27.8	20.1	24.0	28.3	19.8	24.1	27.3	18.3	22.8	25.7	13.0	19.3	22.7	7.5	15.1	19.4	3.4	11.4	18.2
Max	22.2			21.7			26.3			30			30.4			30.4			28.7			29.5			28.9			28.6			24.4			20.7			
Mini		-0.4			1.6			5.1			8.6			13.4			17.6			19.5			19			17.3			11.2			5.8			1.5		

Table A4.3.5 RELATIVE HUMIDITY AT KATHMANDU AIRPORT

Year	Jan.			Feb			Mar.			Apr.			May.			Jun.			Jul.			Aug.			Sep.			Oct.			Nov.			Dec.			Mean in Year
	mean			mean			mean			mean			mean			mean			mean			mean			mean			mean			mean			mean			
	max	min	daily	max	min	daily	max	min	daily	max	min	daily	max	min	daily	max	min	daily	max	min	daily	max	min	daily	max	min	daily	max	min	daily	max	min	daily	max	min	daily	
1977	96.0	66.0	81.0	90.0	50.0	70.0	79.0	46.0	62.5	78.0	57.0	67.5	78.0	58.0	68.0	77.0	71.0	74.0	86.0	80.0	83.0	86.0	80.0	83.0	86.0	76.0	81.0	89.0	72.0	80.5	91.0	75.0	83.0	96.0	73.0	84.5	76.5
1978	94.0	65.0	79.5	92.0	59.0	75.5	83.0	51.0	67.0	75.0	54.0	64.5	81.0	67.0	74.0	83.0	74.0	78.5	85.0	78.0	81.5	85.0	70.0	77.5	90.0	80.0	85.0	94.0	75.0	84.5	95.0	77.0	86.0	97.0	65.0	81.0	77.9
1979	99.0	66.0	82.5	96.0	61.0	78.5	85.0	41.0	63.0	92.0	56.0	74.0	87.0	46.0	66.5	90.0	65.0	77.5	94.0	80.0	87.0	96.0	82.0	89.0	96.0	75.0	85.5	98.0	76.0	87.0	97.0	72.0	84.5	97.0	74.0	85.5	80.0
1980	95.0	64.0	79.5	90.0	52.0	71.0	80.0	50.0	65.0	65.0	41.0	53.0	72.0	58.0	65.0	82.0	74.0	78.0	84.0	78.0	81.0	84.0	77.0	80.5	88.0	79.0	83.5	91.0	72.0	81.5	92.0	72.0	82.0	97.0	68.0	82.5	75.2
1981	96.0	65.0	80.5	90.0	55.0	72.5	84.0	57.0	70.5	78.0	56.0	67.0	80.0	66.0	73.0	79.0	68.0	73.5	86.0	81.0	83.5	85.0	78.0	81.5	89.0	75.0	82.0	91.0	67.0	79.0	95.0	78.0	86.5	97.0	73.0	85.0	77.9
1982	97.0	67.0	82.0	95.0	62.0	78.5	80.0	52.0	66.0	71.0	47.0	59.0	61.0	44.0	52.5	76.0	67.0	71.5	83.0	71.0	77.0	83.0	81.0	82.0	88.0	79.0	83.5	93.0	71.0	82.0	95.0	77.0	86.0	97.0	70.0	83.5	75.3
1983	94.0	68.0	81.0	91.0	65.0	78.0	81.0	61.0	71.0	78.0	60.0	69.0	77.0	73.0	75.0	73.0	64.0	68.5	87.0	83.0	85.0	82.0	81.0	81.5	85.0	80.0	82.5	89.0	76.0	82.5	98.0	72.0	85.0	98.0	70.0	84.0	78.6
1984	96.0	62.0	79.0	95.0	52.0	73.5	81.0	48.0	64.5	66.0	43.0	54.5	78.0	68.0	73.0	82.0	77.0	79.5	85.0	82.0	83.5	82.0	79.0	80.5	90.0	78.0	84.0	88.0	71.0	79.5	89.0	64.0	76.5	93.0	67.0	80.0	75.7
1985	94.0	66.0	80.0	90.0	58.0	74.0	74.0	41.0	57.5	65.0	38.0	51.5	72.0	58.0	65.0	76.0	68.0	72.0	84.0	82.0	83.0	84.0	79.0	81.5	87.0	79.0	83.0	91.0	77.0	84.0	98.0	72.0	85.0	97.0	72.0	84.5	75.1
1986	97.0	65.0	81.0	96.0	58.0	77.0	79.0	43.0	61.0	74.0	54.0	64.0	73.0	58.0	65.5	79.0	71.0	75.0	84.0	81.0	82.5	84.0	78.0	81.0	87.0	81.0	84.0	93.0	71.0	82.0	97.0	72.0	84.5	98.0	68.0	83.0	76.7
1987	97.7	64.5	81.1	95.8	58.0	76.9	93.2	58.4	75.8	74.8	50.8	62.8	65.0	50.5	57.8	75.6	70.2	72.9	86.2	84.8	85.5	87.3	79.4	83.4	87.3	76.9	82.1	92.3	73.9	83.1	96.1	68.7	82.4	96.6	64.3	80.5	77.0
1988	96.3	57.8	77.1	92.2	52.6	72.4	86.3	49.5	67.9	69.6	45.0	57.3	75.1	58.6	66.9	78.8	70.9	74.9	83.4	80.7	82.1	87.6	80.2	83.9	87.3	74.8	81.1	91.5	73.0	82.3	91.6	60.2	75.9	93.3	67.2	80.3	75.1
1989	96.1	72.2	84.2	93.9	56.3	75.1	82.5	45.4	64.0	61.8	30.7	46.3	69.7	60.8	65.3	75.6	71.4	73.5	83.9	79.1	81.5	85.4	77.9	81.7	85.8	79.6	82.7	89.6	74.5	82.1	94.0	67.3	80.7	94.5	66.9	80.7	74.8
1990	90.6	59.3	75.0	95.5	66.7	81.1	84.7	53.5	69.1	76.6	57.0	66.8	75.4	62.2	68.8	77.5	74.1	75.8	84.4	81.8	83.1	86.1	78.1	76.2	86.9	77.3	82.1	87.0	71.9	79.5	92.4	62.6	77.5	95.4	61.2	78.3	76.1
Mean	95.6	64.8	80.2	93.0	57.5	75.3	82.3	49.8	66.1	73.2	49.3	61.2	74.6	59.2	66.9	78.9	70.4	74.6	85.4	80.2	82.8	85.5	78.6	89.0	88.1	77.9	83.0	91.2	73.0	82.1	94.4	70.7	82.5	96.2	68.5	82.4	76.6
Max	99.0	72.2	84.2	96.0	66.7	81.1	93.2	61.0	75.8	92.0	60.0	74.0	87.0	73.0	75.0	90.0	77.0	79.5	94.0	84.8	87.0	96.0	82.0	77.5	96.0	81.0	85.5	98.0	77.0	87.0	98.0	78.0	86.5	98.0	74.0	85.5	80.0
Mini	90.6	57.8	75.0	90.0	50.0	70.0	74.0	41.0	57.5	61.8	30.7	46.3	61.0	44.0	52.5	73.0	64.0	68.5	83.0	71.0	77.0	82.0	70.0	76.2	85.0	74.8	81.0	87.0	67.0	79.0	89.0	60.2	75.9	93.0	61.2	78.3	74.8

Table A.4.3.6 TEMPRATURE AT GODAVARI

Year	Jan.			Feb			Mar.			Apr.			May.			Jun.			Jul.			Aug.			Sep.			Oct.			Nov.			Dec.			Mean In Year
	mean			mean			mean			mean			mean			mean			mean			mean			mean			mean			mean			mean			
	max	min	daily	max	min	daily	max	min	daily	max	min	daily	max	min	daily	max	min	daily	max	min	daily	max	min	daily	max	min	daily	max	min	daily	max	min	daily	max	min	daily	
1977	14.2	2.1	8.2	17.4	4.3	10.9	23.0	8.8	15.9	23.0	10.6	16.8	23.0	12.2	17.6	25.6	15.7	20.7	24.8	17.6	21.2	25.0	17.0	21.0	24.2	16.2	20.2	21.1	12.2	16.7	18.7	9.1	13.9	15.0	4.7	9.9	16.1
1978	12.9	2.0	7.5	15.9	4.4	10.2	18.6	7.6	13.1	23.4	11.7	17.6	25.3	15.5	20.4	24.7	17.4	21.1	24.8	12.6	18.7	25.1	18.1	21.6	23.8	16.0	19.9	22.2	12.4	17.3	18.4	8.2	13.3	16.8	4.8	10.8	15.9
1979	15.3	3.9	9.6	15.6	4.3	10.0	21.2	7.2	14.2	24.8	12.2	18.5	27.6	14.8	21.2	26.3	17.4	21.9	25.0	18.4	21.7	24.6	17.8	21.2	24.1	15.6	19.9	21.6	12.2	16.9	19.5	9.9	14.7	14.1	4.8	9.5	16.6
1980	13.9	2.9	8.4	16.0	4.9	10.5	20.3	8.2	14.3	27.1	13.0	20.1	25.7	14.9	20.3	24.9	18.1	21.5	24.5	18.5	21.5	24.2	18.1	21.2	21.9	16.0	19.0	19.7	10.5	15.1	18.4	7.9	13.2	15.2	5.4	10.3	16.3
1981	13.0	3.9	8.5	17.6	6.1	11.9	19.6	8.7	14.2	22.0	11.8	16.9	23.9	14.7	19.3	25.8	17.5	21.7	24.0	18.9	21.5	24.7	18.5	21.6	23.5	16.8	20.2	22.1	12.5	17.3	17.7	7.6	12.7	13.7	4.3	9.0	16.2
1982	15.1	3.7	9.4	14.8	4.1	9.5	19.2	8.4	13.8	23.3	11.7	17.5	26.3	15.1	20.7	25.2	17.6	21.4	25.5	18.6	22.1	24.9	18.4	21.7	23.2	16.7	20.0	21.3	11.9	16.6	16.8	8.5	12.7	14.4	4.9	9.7	16.2
1983	12.5	2.7	7.6	15.4	3.4	9.4	20.9	8.0	14.5	22.8	11.3	17.1	24.0	14.3	19.2	26.9	17.5	22.2	25.2	18.6	21.9	24.9	18.5	21.7	23.9	17.5	20.7	21.2	13.1	17.2	17.3	8.3	12.8	13.9	3.4	8.7	16.1
1984	12.9	1.8	7.4	16.7	4.1	10.4	22.3	9.8	16.1	24.9	12.5	18.7	24.5	16.0	20.3	25.0	18.4	21.7	23.8	18.6	21.2	24.9	17.9	21.4	22.3	15.6	19.0	22.2	13.9	18.1	17.1	7.5	12.3	14.6	4.3	9.5	16.3
1985	13.8	3.5	8.7	16.2	4.6	10.4	23.4	10.7	17.1	25.6	13.6	19.6	24.9	14.6	19.8	25.7	17.8	21.8	23.2	18.3	20.8	24.9	18.7	21.8	22.6	16.6	19.6	20.5	13.1	16.8	17.2	7.7	12.5	14.8	5.0	9.9	16.5
1986	13.8	3.6	8.7	16.5	5.0	10.8	20.9	8.6	14.8	23.4	11.7	17.6	24.1	13.5	18.8	25.6	18.3	22.0	24.7	16.0	20.4	25.0	14.9	20.0	22.7	13.4	18.1	20.4	10.2	15.3	17.3	8.4	12.9	14.5	4.3	9.4	15.7
1987	14.3	3.9	9.1	16.7	5.9	11.3	19.5	8.2	13.9	24.0	12.1	18.1	26.0	13.4	19.7	26.2	15.0	20.6	24.1	15.7	19.9	24.2	15.2	19.7	23.8	15.8	19.8	21.3	12.2	16.8	18.3	7.3	12.8	15.8	4.4	10.1	16.0
1988	14.7	4.1	9.4	17.2	5.7	11.5	20.3	8.0	14.2	25.1	11.4	18.3	25.4	15.4	20.4	25.2	17.8	21.5	24.8	19.1	22.0	24.1	18.6	21.4	24.4	17.4	20.9	22.8	12.8	17.8	18.8	7.4	13.1	15.5	5.7	10.6	16.7
1989	12.7	3.0	7.9	16.5	3.5	10.0	20.8	8.5	14.7	25.9	11.9	18.9	26.0	16.0	21.0	25.6	17.8	21.7	24.5	18.4	21.5	24.4	18.2	21.3	23.5	17.5	20.5	22.3	13.1	17.7	17.6	7.3	12.5	14.7	3.8	9.3	16.4
1990	16.4	5.5	11.0	15.1	5.4	10.3	18.2	7.3	12.8	23.4	11.1	17.3	24.3	15.1	19.7	26.6	18.6	22.6	24.0	18.9	21.5	24.7	18.6	21.7	23.7	17.5	20.6	21.1	12.7	16.9	19.5	8.8	14.2	15.8	5.5	10.7	16.6
Mean	14.0	3.3	8.6	16.3	4.7	10.5	20.6	8.4	14.5	24.2	11.9	18.0	25.1	14.7	19.9	25.7	17.5	21.6	24.5	17.7	21.1	24.7	17.8	21.2	23.4	16.3	19.9	21.4	12.3	16.9	18.0	8.1	13.1	14.9	4.7	9.8	16.3
Max	16.4			17.6			23.4			27.1			27.6			26.9			25.5			25.1			24.4			22.8			19.5			16.8			
Mini		1.8			3.4			7.2			10.6			12.2			15			12.6			14.9			13.4			10.2			7.3			3.4		

Table A.4.3.7 RELATIVE HUMIDITY AT GODAVARI

Year	Jan	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Mean In Year
	'0845	'0845	'0845	'0845	'0845	'0845	'0845	'0845	'0845	'0845	'0845	'0845	
1977	78.0	72.0	67.0	66.0	69.0	74.0	84.0	78.0	81.0	81.0	82.0	82.0	76.2
1978	75.0	75.0	66.0	64.0	76.0	83.0	85.0	81.0	83.0	80.0	67.0	74.0	75.8
1979	72.0	72.0	55.0	57.0	60.0	69.0	83.0	84.0	81.0	84.0	82.0	82.0	73.4
1980	76.0	78.0	65.0	50.0	68.0	83.0	89.0	90.0	90.0	82.0	78.0	81.0	77.5
1981	89.0	81.0	78.0	78.0	80.0	81.0	93.0	92.0	91.0	77.0	79.0	82.0	83.4
1982	77.0	79.0	77.0	69.0	65.0	85.0	86.0	86.0	86.0	84.0	87.0	86.0	80.6
1983	80.0	75.0	70.0	68.0	82.0	80.0	95.0	94.0	93.0	84.0	82.0	77.0	81.7
1984	74.0	70.0	80.0	72.0	84.0	90.0	94.0	90.0	93.0	84.0	85.0	85.0	83.4
1985	83.0	84.0	71.0	68.0	82.0	86.0	95.0	93.0	94.0	89.0	85.0	87.0	84.8
1986	83.0	78.0	73.0	74.0	79.0	85.0	91.0	86.0	91.0	85.0	86.0	80.0	82.6
1987	82.1	81.1	84.9	72.1	65.7	80.6	92.3	90.6	92.6	89.9	80.3	80.3	82.7
1988	84.1	82.2	81.4	72.2	84.8	91.1	95.1	94.9	93.8	85.0	80.8	85.9	85.9
1989	86.2	70.5	76.2	63.0	76.7	86.5	88.2	93.9	94.7	87.7	82.2	77.0	81.9
1990	85.3	81.0	81.1	76.2	84.8	87.9	93.3	93.9	91.6	81.1	76.2	80.4	84.4
Mean	80.3	77.1	73.3	67.8	75.5	83.0	90.3	89.1	89.7	83.8	80.9	81.4	81.0
Max	89.0	84.0	84.9	78.0	84.8	91.1	95.1	94.9	94.7	89.9	87.0	87.0	
Mini	72.0	70.0	55.0	50.0	60.0	69.0	83.0	78.0	81.0	77.0	67.0	74.0	

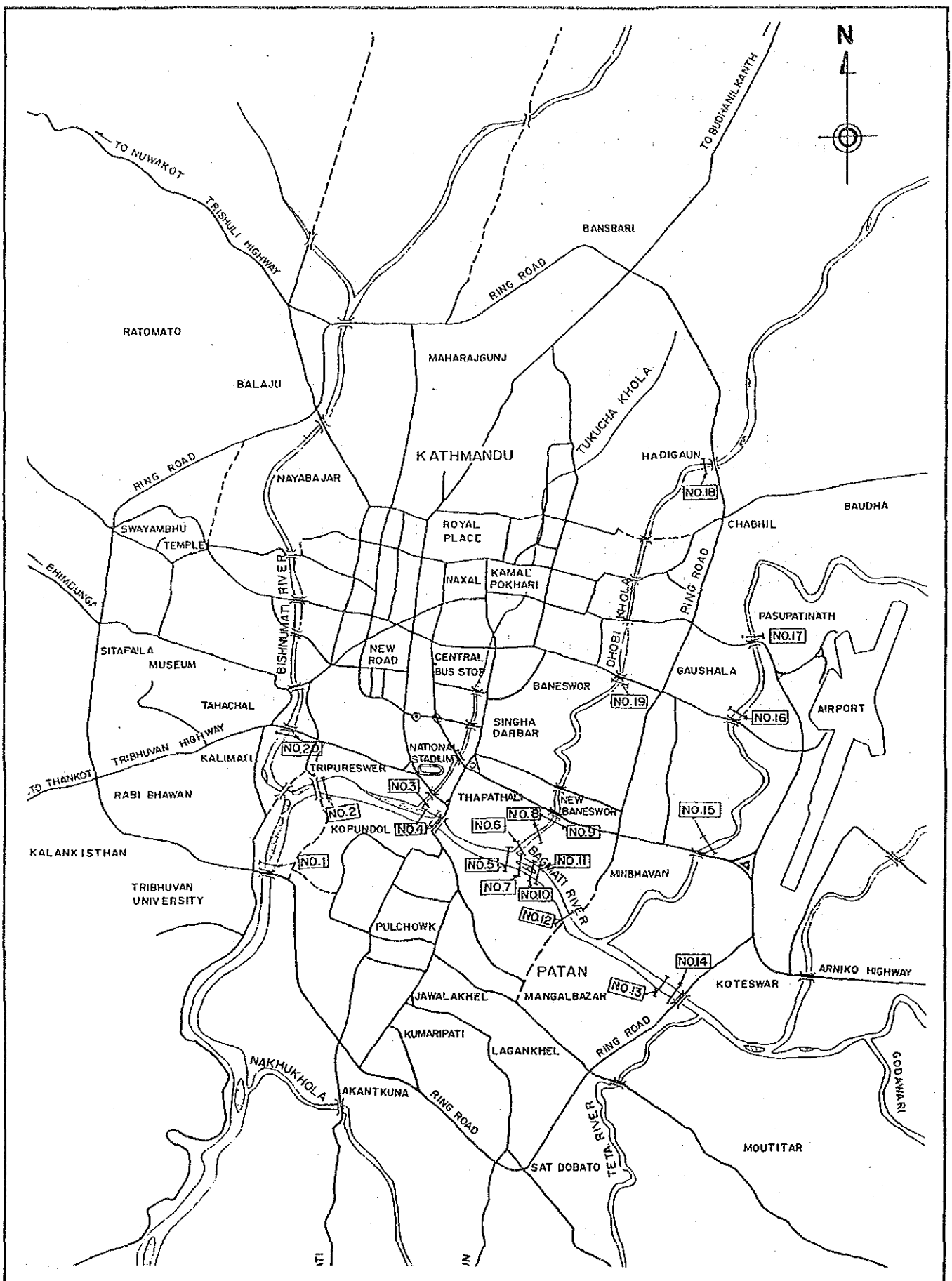
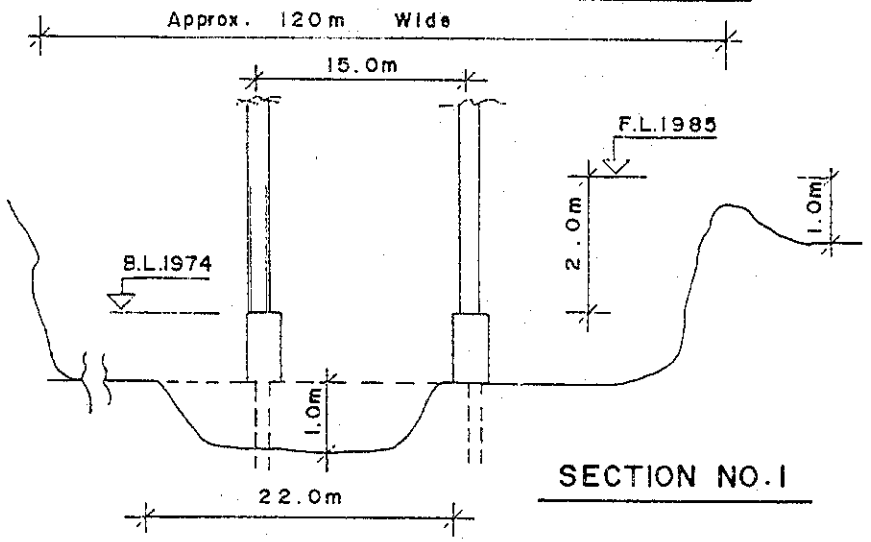


Figure A 4.3.2 LOCATION OF REFERED FLOOD LEVEL ENQUIRY SECTION

DATE : 6|9|92

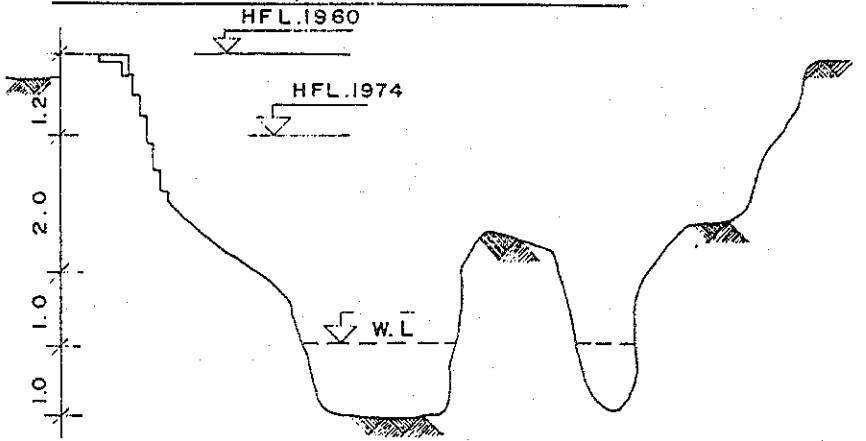
BAGMATI BRIDGE; BALKHU, RING ROAD (Br. No.7)



SECTION NO.1

DATE: 14|9|92

BAGMATI RIVER; BIRAUTA, KOPUNDOL

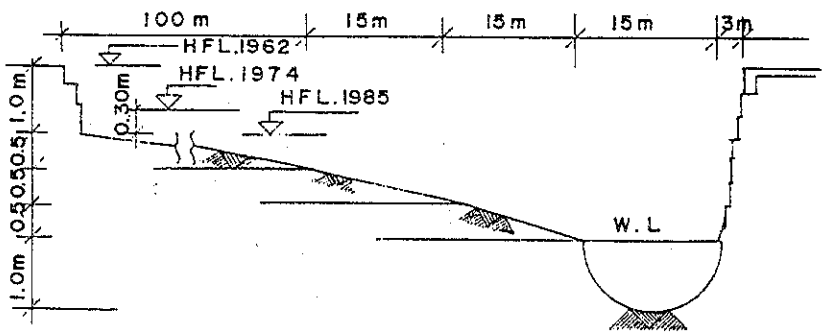


SECTION LOCATION: 200m D S OF BAGMATI BRIDGE

SECTION NO.3

DATE: 14|9|92

BAGMATI RIVER; RAJDAHA TIRTHA, SANEPA

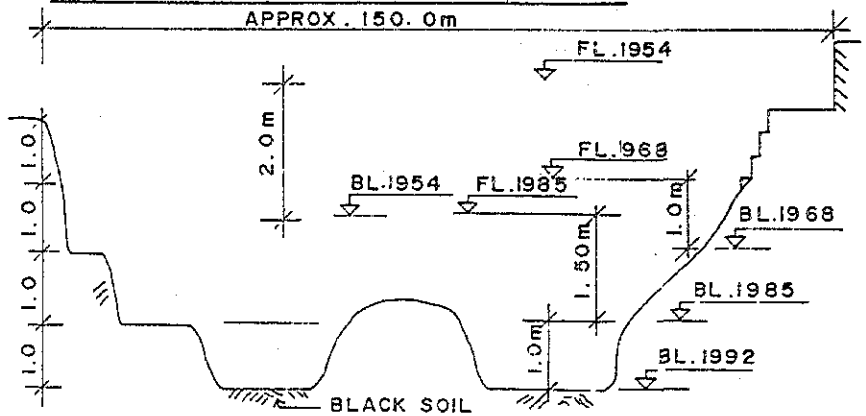


SECTION LOCATION: 100m U/S OF SUSPERISION BRIDGE, TEKU

SECTION NO.2

DATE: 7|9|92

BAGMATI BRIDGE; THAPATHALI, Br. No.5

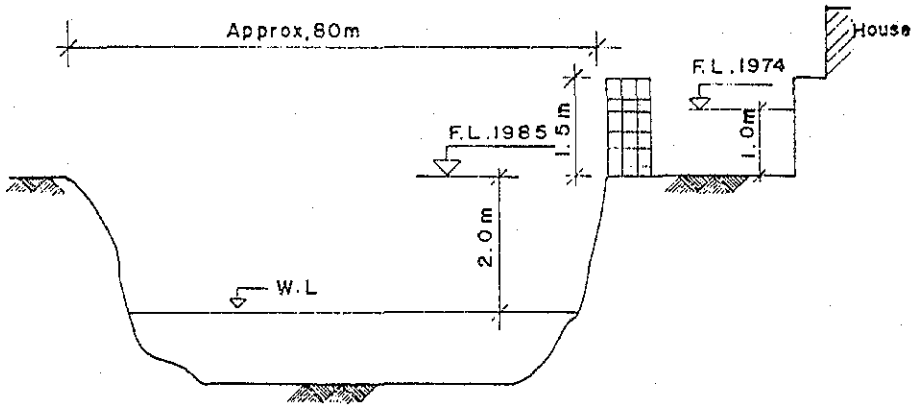


SECTION LOCATION; 40m D/S OF BRIDGE

SECTION NO.4

DATE: 8|9|92

BAGMATI RIVER; D/S OF DHOBIKHOLA

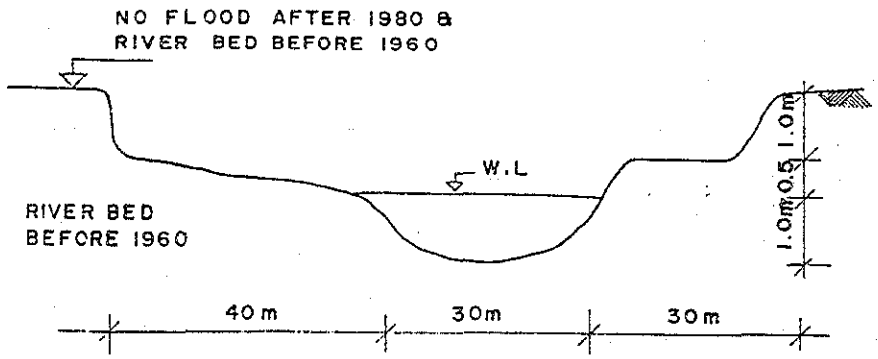


SECTION LOCATION: 20m D/S OF CONFLUENCE OF DHOBI KHOLA

SECTION NO. 5 (SURVEY SECTION NO 7)

DATE: 11|9|92

BAGMATI RIVER U/S OF DHOBI KHOLA CONFLUENCE

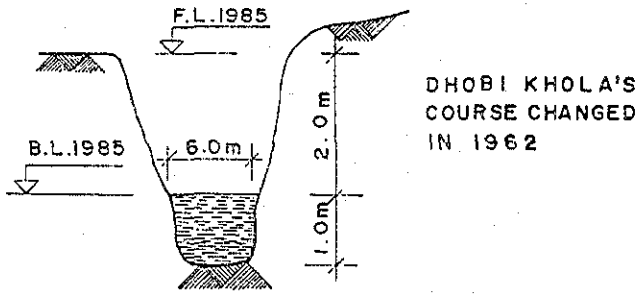


SECTION LOCATION: 150m DIS OF PHANTAL BARAHI AT L/S

SECTION NO.7

DATE: 8|9|92

DHOBI KHOLA; CONFLUENCE WITH BAGMATI

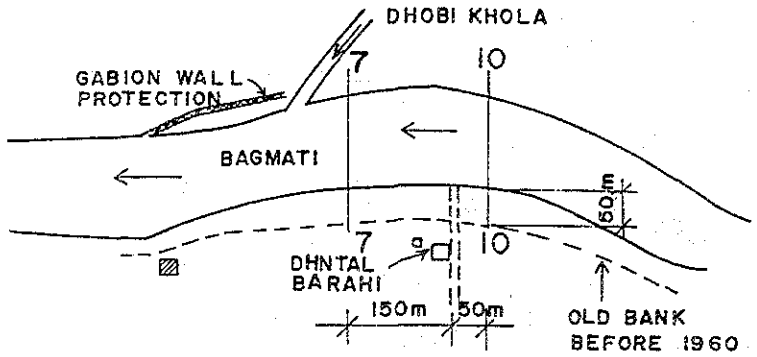


SECTION LOCATION: 15m U/S OF CONFLUENCE WITH BAGMATI

SECTION NO.6

DATE: 11|9|92

LOCATION PLAN OF SECTIONS AT DHNTAL BARAHI

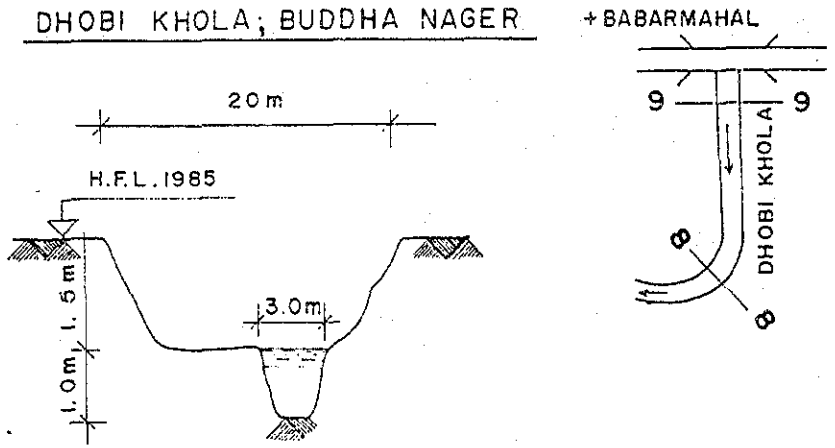


LOCATION: DHOBI KHOLA CONFLUENCE WITH BAGMATI

FOR SECTION NO.7 & 10

DATE: 8|9|92

DHOBI KHOLA; BUDDHA NAGER

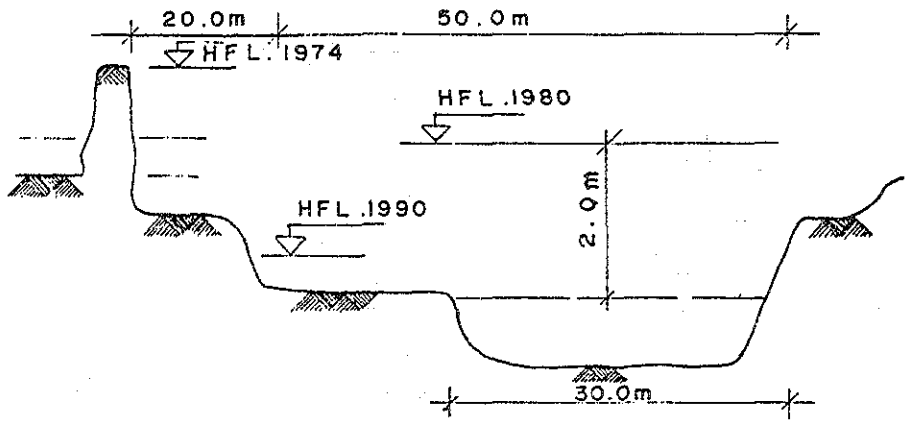


SECTION LOCATION: 500m D/S OF BRIDGE (BABARMAHAL)

SECTION NO. 8

DATE: 11|9|92

BAGMATI AT DHANTAL BARAHI

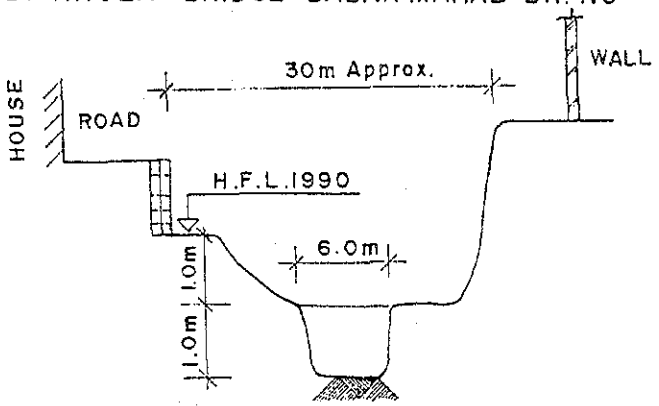


SECTION LOCATION: 50m U/S OF DHANTAL BARAHI AT L|B

SECTION NO. 10

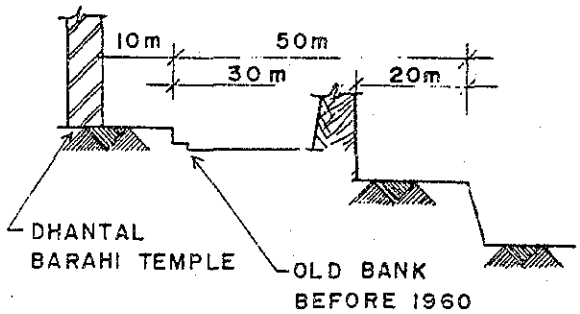
DATE: 8|9|92

DHOBI KHOLA BRIDGE BABAR MAHAL BR. NO



SECTION LOCATION: 15 m D/S OF DHOBIKHOLA BRIDGE

SECTION NO.9 (SURVEY SECTION NO.10)

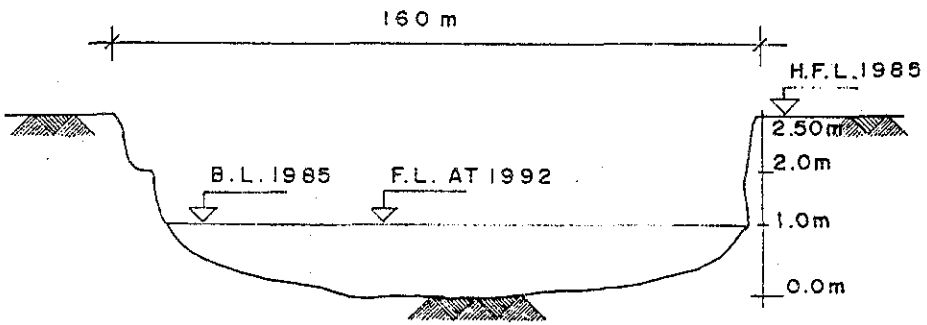


SECTION LOCATION: 50m U/S OF DHANTAL BARAHI AT L|B

SECTION:NO. 10 CONTINUED

DATE : 8|9|92

BAGMATI RIVER, BUDDHANAGAR

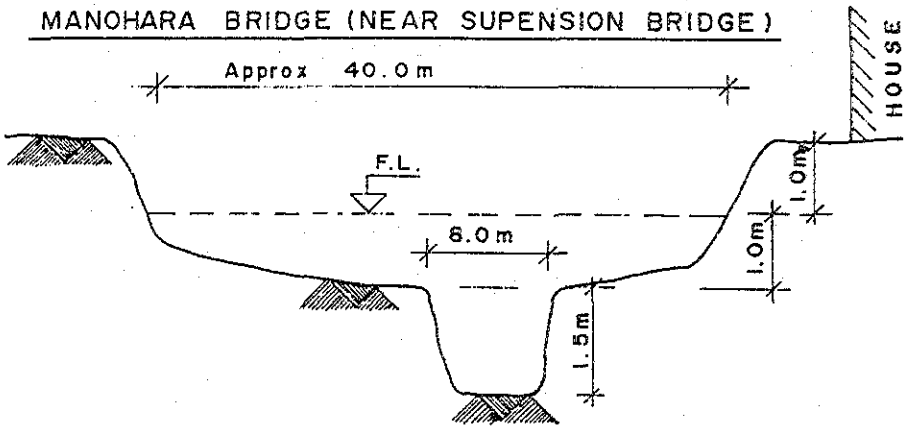


SECTION LOCATION : 400 m U/S OF DHOBIKHOLA CONFLUENCE

SECTION NO. 11

DATE : 8|9|92

MANOHARA BRIDGE (NEAR SUPENSION BRIDGE)

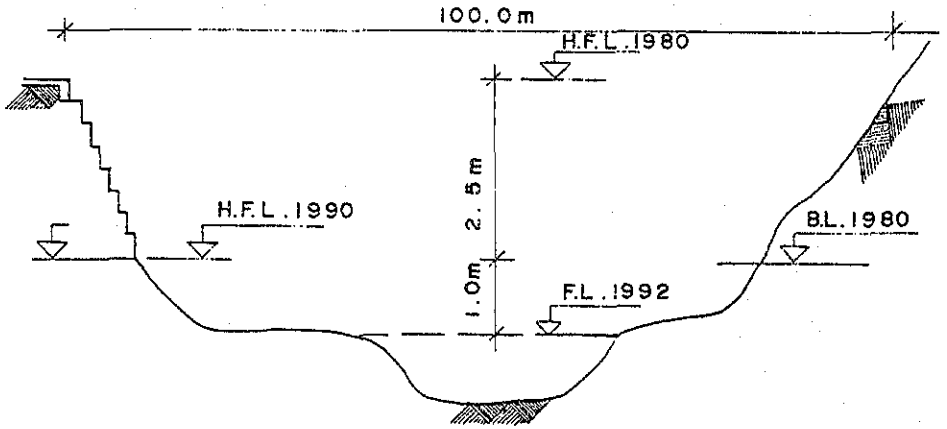


SECTION LOCATION : 100m U/S OF SUSPENSION BRIDGE

SECTION NO. 13

DATE : 8|9|92

BAGMATI BRIDGE SANKHAMUL PEDESTRAN CROSSING

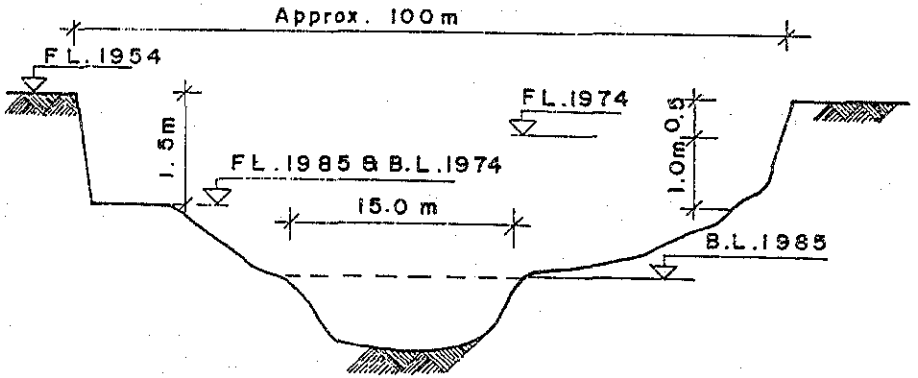


SECTION LOCATION : 10m D/S OF PEDESTRIAN CROSSING

SECTION NO.12

DATE : 7|9|92

MANOHARA BRIDGE ; RING ROAD, BALKUMARI

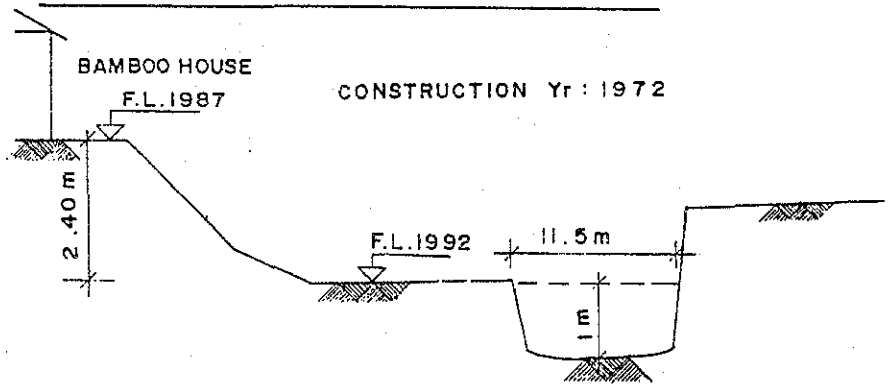


SECTION LOCATION : 15m D|S OF BRIDGE

SECTION NO.14

DATE: 6|9|92

BAGMATI BRIDGE; MINBHAWAN (Br. No.3)

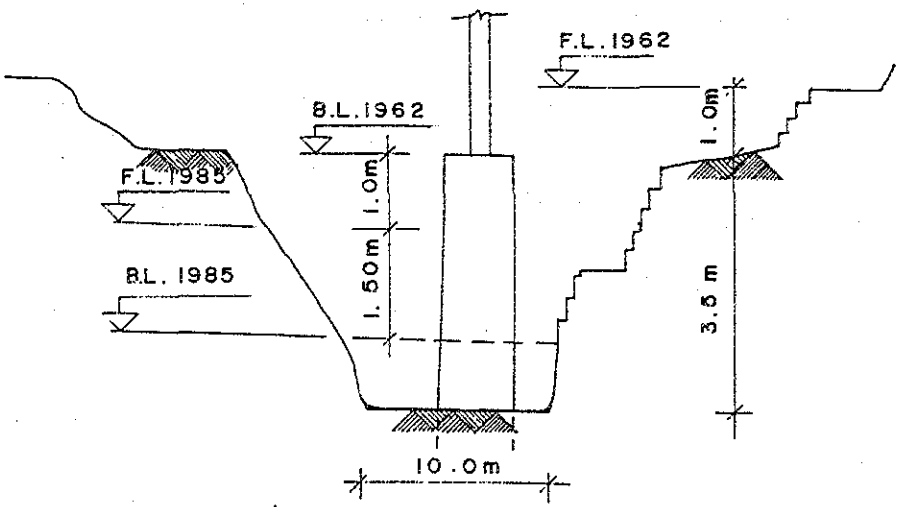


SECTION LOCATION: 30m U/S OF BRIDGE

SECTION NO. 15

DATE: 7|9|92

BAGMATI BRIDGE, PRAYAG GHAT (Br. No 2)



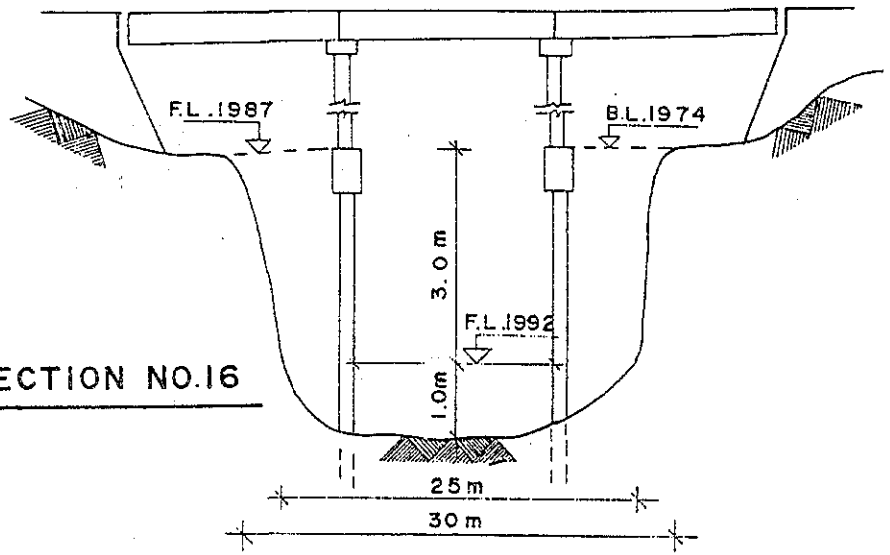
LOCATION: 20m U/S OF BRIDGE

SECTION NO. 17

DATE: 6|9|92

BAGMATI BRIDGE; TILGANGA, PASUPATI (Br. No 1)

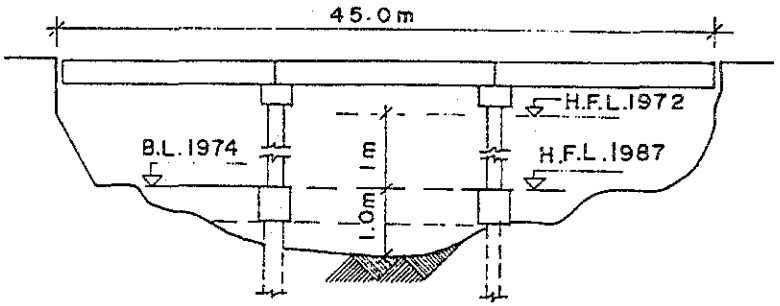
CONSTRUCTION 1974



SECTION NO.16

DATE: 6|9|92

DHOBI KHOLA; CHABAHIL RING ROAD (Br.No II)

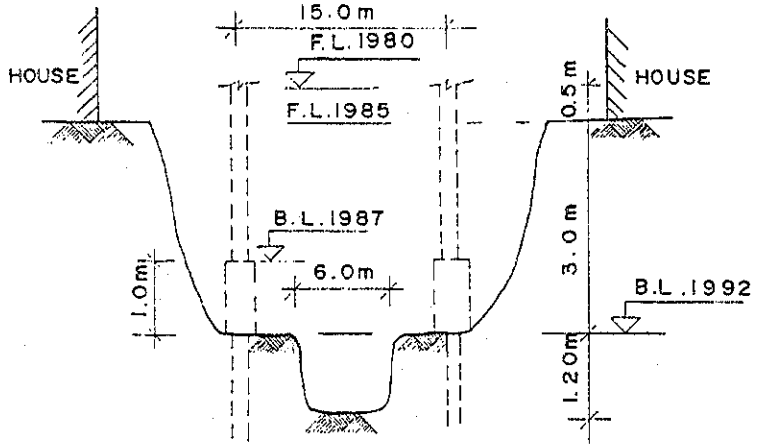


SECTION LOCATION: 15m D|S OF BRIDGE

SECTION NO.18

DATE: 7|9|92

DHOBI KHOLA; MAITI DEVI (Br. No13)

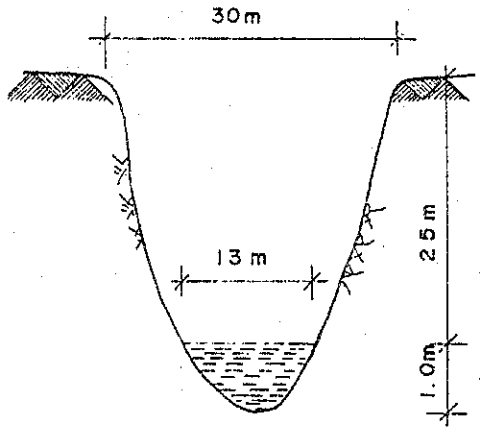


SECTION LOCATION: 10m D/S OF BRIDGE

SECTION NO.19

DATE: 24|9|92

BAGMATI RIVER, CHOVAR

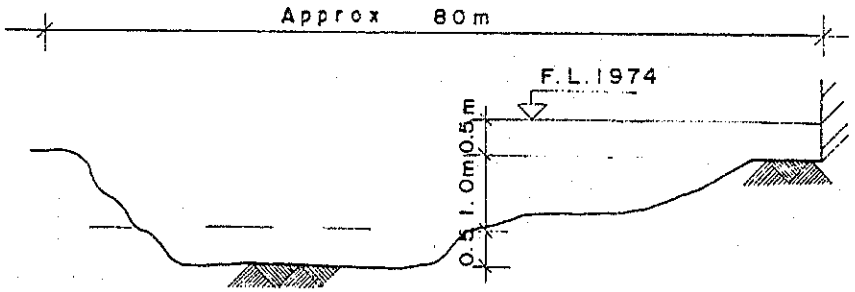


SECTION LOCATION: 15m U/S OF BRIDGE AT CHOVAR

SECTION NO.21

DATE: 6|9|92

BISHNUMATI BRIDGE; TEKU (Br. No.10)

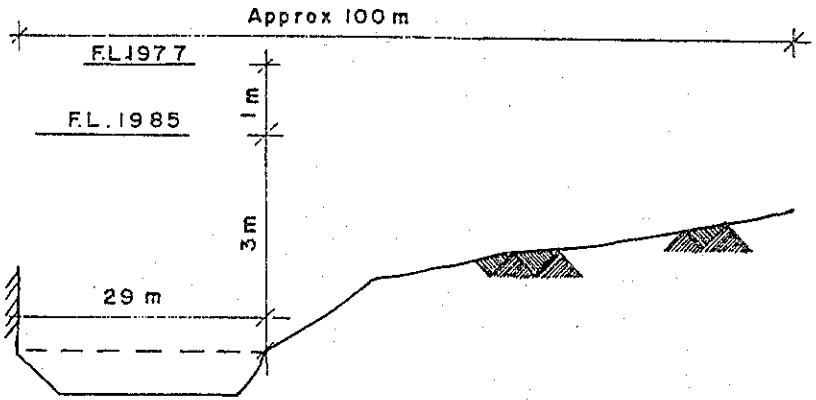


SECTION LOCATION: 15m D/S OF BRIDGE.

SECTION NO.20

DATE: 24|19|92

BAGMATI RIVER, KHOKANA VILLAGE, KHOKANA BRIDGE



SECTION LOCATION: 10m U/S OF KHOKANA BRIDGE

SECTION NO.22

Table A.4.3.3(1) MAXIMUM DAILY RAINFALL RECORD (1)

YEAR	KAKANI		TOKHA		SUNDARIJAL		INDIAN EMBASSY	
	DATE	RAINFALL	DATE	RAINFALL	DATE	RAINFALL	DATE	RAINFALL
1940	-	-	-	-	*	*	-	-
1941	-	-	-	-	AUG.08	102.1	-	-
1942	-	-	-	-	AUG.14	111.8	-	-
1943	-	-	-	-	JUL. 20	137.4	-	-
1944	-	-	-	-	AUG. 10	91.4	-	-
1945	-	-	-	-	AUG. 02	126.5	-	-
1946	-	-	-	-	JUL. 05	147.6	-	-
1947	-	-	-	-	*	*	*	*
1948	-	-	-	-	AUG.26	95.0	AUG. 27	81.8
1949	-	-	-	-	JUL. 01	58.0	MAY. 18	61.0
1950	-	-	-	-	JUL. 14	87.1	JUN. 21	104.6
1951	-	-	-	-	AUG. 17	51.3	JUN. 30	66.0
1952	-	-	-	-	AUG.27	74.7	AUG. 27	58.7
1953	-	-	-	-	JUL. 01	105.9	JUL. 02	115.6
1954	-	-	-	-	JUL. 27	162.6	JUL. 27	173.2
1955	-	-	-	-	*	*	JUL. 26	52.8
1956	-	-	-	-	AUG.17	72.4	MAY. 25	54.4
1957	-	-	-	-	AUG. 30	58.4	AUG. 06	57.9
1958	-	-	-	-	*	*	SEP. 06	58.9
1959	-	-	-	-	AUG.11	86.4	JUL. 14	48.1
1960	-	-	-	-	JUL. 25	61.0	JUL. 29	59.4
1961	-	-	-	-	MAR. 16	127.0	AUG. 13	87.4
1962	JUN. 13	146.8	-	-	JUN. 10	116.8	JUN.10	72.4
1963	AUG. 19	92.2	-	-	AUG.31	121.9	JUL. 21	54.0
1964	AUG. 18	127.5	-	-	JUL. 14	83.8	JUN. 21	84.2
1965	JUL. 09	73.4	-	-	JUL. 08	66.5	JUN. 18	72.0
1966	-	-	-	-	JUN. 30	86.4	AUG. 24	115.2
1967	-	-	-	-	AUG. 23	85.0	JUL. 10	134.0
1968	-	-	-	-	JUL. 15	82.0	OCT. 05	75.4
1969	-	-	-	-	AUG.19	77.4	AUG. 19	59.1
1970	-	-	-	-	MAY. 21	95.2	JUL. 15	68.0
1971	-	-	-	-	JUN. 11	93.1	JUN. 12	109.0
1972	JUL. 28	161.0	-	-	NOV. 27	92.4	JUL. 28	107.4
1973	SEP. 18	160.0	JUL. 19	120.0	*	*	AUG. 11	96.9
1974	MAR. 30	100.0	JAN. 15	83.5	MAY. 31	90.2	SEP.11	53.4
1975	JUL. 08	74.0	JUL. 30	94.4	AUG. 03	131.2	JUL. 28	89.9
1976	JUL. 23	80.0	JUL. 10	71.2	MAY. 21	99.4		
1977	JUL. 04	100.0	AUG. 01	80.4	AUG. 22	87.4		
1978	JUN . 06	148.7	MAR.12	61.4				
1979	JUL. 02	139.0	JUL. 23	90.6				
1980	JUN. 25	156.0	JUN. 19	130.0				
1981	AUG. 30	131.0						
1982	*	*						
1983	JUN. 24	144.0						
1984	AUG. 26	124.0						
1985	AUG. 04	100.0						
1986	JUL. 16	116.0						
1987	OCT. 20	88.0						
1988	AUG. 07	83.2						
1989	JUL. 30	132.0						
1990	AUG. 15	97.6						
1991	AUG. 07	85.5						

Table A.4.3.3(2) MAXIMUM DAILY RAINFALL RECORD (2)

	SANKHU		KATHMANDU AIRPORT		NAGARKOT		THANKOT	
YEAR	DATE	RAINFALL	DATE	RAINFALL	DATE	RAINFALL	DATE	RAINFALL
1940	-	-	-	-	-	-	-	-
1941	-	-	-	-	-	-	-	-
1942	-	-	-	-	-	-	-	-
1943	-	-	-	-	-	-	-	-
1944	-	-	-	-	-	-	-	-
1945	-	-	-	-	-	-	-	-
1946	-	-	-	-	-	-	-	-
1947	-	-	-	-	-	-	-	-
1948	-	-	-	-	-	-	-	-
1949	-	-	-	-	-	-	-	-
1950	-	-	-	-	-	-	-	-
1951	-	-	-	-	-	-	-	-
1952	-	-	-	-	-	-	-	-
1953	-	-	-	-	-	-	-	-
1954	-	-	-	-	-	-	-	-
1955	-	-	-	-	-	-	-	-
1956	-	-	-	-	-	-	-	-
1957	-	-	-	-	-	-	-	-
1958	-	-	-	-	-	-	-	-
1959	-	-	-	-	-	-	-	-
1960	-	-	-	-	-	-	-	-
1961	-	-	-	-	-	-	-	-
1962	-	-	-	-	-	-	-	-
1963	-	-	-	-	-	-	-	-
1964	-	-	-	-	-	-	-	-
1965	-	-	-	-	-	-	-	-
1966	-	-	-	-	-	-	*	*
1967	-	-	-	-	-	-	*	*
1968	-	-	OCT. 05	80.4	-	-	*	*
1969	-	-	AUG. 19	48.5	-	-	AUG.12	46.2
1970	-	-	JUL. 16	73.5	-	-	May-18	92.0
1971	AUG.07	44.0	JUN. 12	83.6	*	*	JUN. 12	126.8
1972	JUN. 03	90.0	JUL. 28	102.8	JUL. 16	60.8	JUL. 28	134.8
1973	JUL. 05	46.0	JUL. 25	102.0	AUG. 07	94.0	OCT. 13	112.0
1974	JUL. 31	46.0	AUG. 21	71.2	JUL. 23	80.8	May-02	132.4
1975	SEP. 27	44.0	AUG. 03	89.2	JUL. 28	81.2	JUL. 28	100.4
1976	May-11	40.8	JUN. 10	73.2	AUG. 23	82.0	JUN. 02	106.4
1977	JUL. 02	40.8	AUG. 05	57.6	JUN. 20	88.5	AUG. 10	60.8
1978	JUL. 16	126.0	AUG.10	71.2	JUL. 28	92.1	JUL. 16	135.0
1979	AUG. 14	90.0	JUL. 24	86.0	JUL. 24	96.4	JUL. 24	132.0
1980	JUL. 14	80.0	JUN. 09	100.1	JUN. 09	95.5	JUN. 09	84.4
1981	May-16	67.5	May-21	53.5	JUL. 29	79.3	SEP. 29	100.3
1982	JUL. 06	60.0	JUN. 28	87.6	AUG. 15	69.0	SEP. 14	41.3
1983	JUL. 22	102.0	JUL. 17	72.0	AUG. 02	72.5	SEP. 22	75.9
1984	AUG. 13	85.0	AUG. 16	76.5	JUN. 28	85.0	SEP. 08	75.1
1985	May-01	80.5	SEP. 17	69.3	*	*	SEP. 15	80.1
1986	JUL. 31	80.0	JUL. 16	77.6	JUL. 31	179.4	JUN. 24	100.5
1987	OCT. 20	95.5	OCT. 20	124.4	OCT. 20	90.6	OCT. 20	157.4
1988	AUG.1,JUN18	65.0	JUL. 12	66.0	AUG. 01	72.4	SEP. 08	122.4
1989	AUG. 08	82.0	JUL. 30	57.0	AUG. 08	97.6	JUL. 16	70.3
1990	JUL.9, AUG. 9	92.0	May-29	73.2	JUL. 14	101.2	AUG. 27	116.2
1991	AUG. 08	91.0	AUG. 15	44.7	JUN.01	92.5	AUG.28	54.3

Table A.4.3.3(3) MAXIMUM DAILY RAINFALL RECORD (3)

YEAR	BHAKTAPUR		KHUMALTAR		GODAVARI	
	DATE	RAINFALL	DATE	RAINFALL	DATE	RAINFALL
1940	-	-	-	-	-	-
1941	-	-	-	-	-	-
1942	-	-	-	-	-	-
1943	-	-	-	-	-	-
1944	-	-	-	-	-	-
1945	-	-	-	-	-	-
1946	-	-	-	-	-	-
1947	-	-	-	-	-	-
1948	-	-	-	-	-	-
1949	-	-	-	-	-	-
1950	-	-	-	-	-	-
1951	-	-	-	-	-	-
1952	-	-	-	-	-	-
1953	-	-	-	-	JUL. 27	57.2
1954	-	-	-	-	JUL. 26	174.0
1955	-	-	-	-	AUG. 06	83.2
1956	-	-	-	-	May-24	90.0
1957	-	-	-	-	AUG. 05	66.2
1958	-	-	-	-	OCT. 03	60.7
1959	-	-	-	-	JUL. 25	111.5
1960	-	-	-	-	JUL. 06	77.5
1961	-	-	-	-	*	*
1962	-	-	-	-	JUN. 28	97.2
1963	-	-	-	-	*	*
1964	-	-	-	-	*	*
1965	-	-	-	-	*	*
1966	-	-	-	-	*	*
1967	-	-	*	*	*	*
1968	-	-	OCT. 05	117.0	*	*
1969	-	-	AUG. 19	45.0	-	-
1970	-	-	JUL. 16	100.0	*	*
1971	*	*	JUN. 12	90.0	JUN.11	123.0
1972	JUL. 28	58.8	JUL. 28	48.0	JUL. 20	109.4
1973	*	*	JUL. 25	85.0	JUL. 25	122.2
1974	*	*	-		JUL. 15	88.0
1975	JUN. 28	41.6	JUL. 28	101.6	JUL. 28	159.6
1976	AUG. 08	54.4	SEP. 19	62.0	JUN. 10	117.4
1977	AUG. 28	67.2	JUN. 07	60.2	JUL. 08	114.2
1978	OCT. 06	74.3	JUL. 03	135.0	OCT. 06	99.4
1979	JUL. 24	73.8	AUG. 21	86.0	JUL. 24	96.8
1980	JUN. 09	69.5	JUN. 09	58.2	JUN. 19	103.1
1981	SEP.29	51.9	SEP. 29	85.5	SEP. 30	168.5
1982	JUL. 04	41.3	APR. 27	76.0	JUL. 07	68.0
1983	JUL. 16	80.5	JUL. 05	70.0	JUL. 04	84.0
1984	AUG. 26	69.1	SEP. 06	65.5	SEP. 06	110.0
1985	SEP. 05	78.6	SEP. 05	71.5	JUL. 07	119.5
1986	JUN.29	107.6	JUN. 29	73.0	JUL. 26	96.0
1987	AUG. 06	62.0	OCT. 21	118.0	OCT. 20	172.0
1988	JUN. 18	96.0	DEC. 27	78.0	DEC. 26	63.5
1989	SEP. 21	68.8	JUL. 01	51.0	AUG. 07	68.2
1990	AUG. 12	62.6	JUL. 14	62.6	AUG. 13	110.0
1991	JUL. 08	41.0	APR. 01	44.2	JUL. 08	92.8

Table A.4.3.3(4) PROBLE DAILY RAINFALL

Return Period (Years)	Method		
	Hazen	Gambel	Pearson III
2	98.79	98.60	98.29
5	128.26	130.90	127.43
10	146.35	152.29	146.48
20	164.45	172.80	164.23
50	186.89	199.35	188.18
80	198.40	212.86	200.05
100	203.71	219.25	205.94
200	220.30	239.07	223.91

Table A.4.3.8 **Calculation Of Flood Water Level**

	Return Period (Years)	W.D. (m)	A (Sq. m.)	P (m)	R (m)	I	V (m/s)	Q=A.V (m^3/s)	Design F.D. (m^3/s)	W.L. Of Flood
Bagmati	100	4.30	500.00	220.00	2.27	1/400	2.88	1440.51	1367.49	1277.30
Bridge NO. 1	10	4.10	410.00	210.00	1.95	1/400	2.60	1067.44	972.66	1277.10
Bagmati	100	4.20	354.00	129.18	2.74	1/400	3.26	1155.38	1121.01	1280.10
Bridge NO. 2	10	3.70	285.00	125.00	2.28	1/400	2.89	822.84	797.35	1279.60
Bagmati	100	4.20	390.00	182.00	2.14	1/400	2.77	1080.38	1061.28	1284.20
Bridge NO. 3	10	3.48	324.54	182.09	1.78	1/400	2.45	795.13	754.86	1283.68
Bagmati *	100								217.17	1286.45
Bridge NO. 4	10								154.47	1285.94
Manahara Ri.	100	4.64	280.00	117.00	2.39	1/400	2.98	834.94	822.14	1286.07
(C.S.-16-16)	10	4.14	240.00	107.00	2.24	1/400	2.86	685.40	584.77	1285.57
Dhobi Khola	100	3.01	60.72	62.45	0.97	1/250	2.07	125.63	104.68	1284.15
(C.S. 18-18)	10	2.50	45.00	50.00	0.90	1/250	1.97	88.43	74.45	1283.60

* Given by non-uniform flow calculation

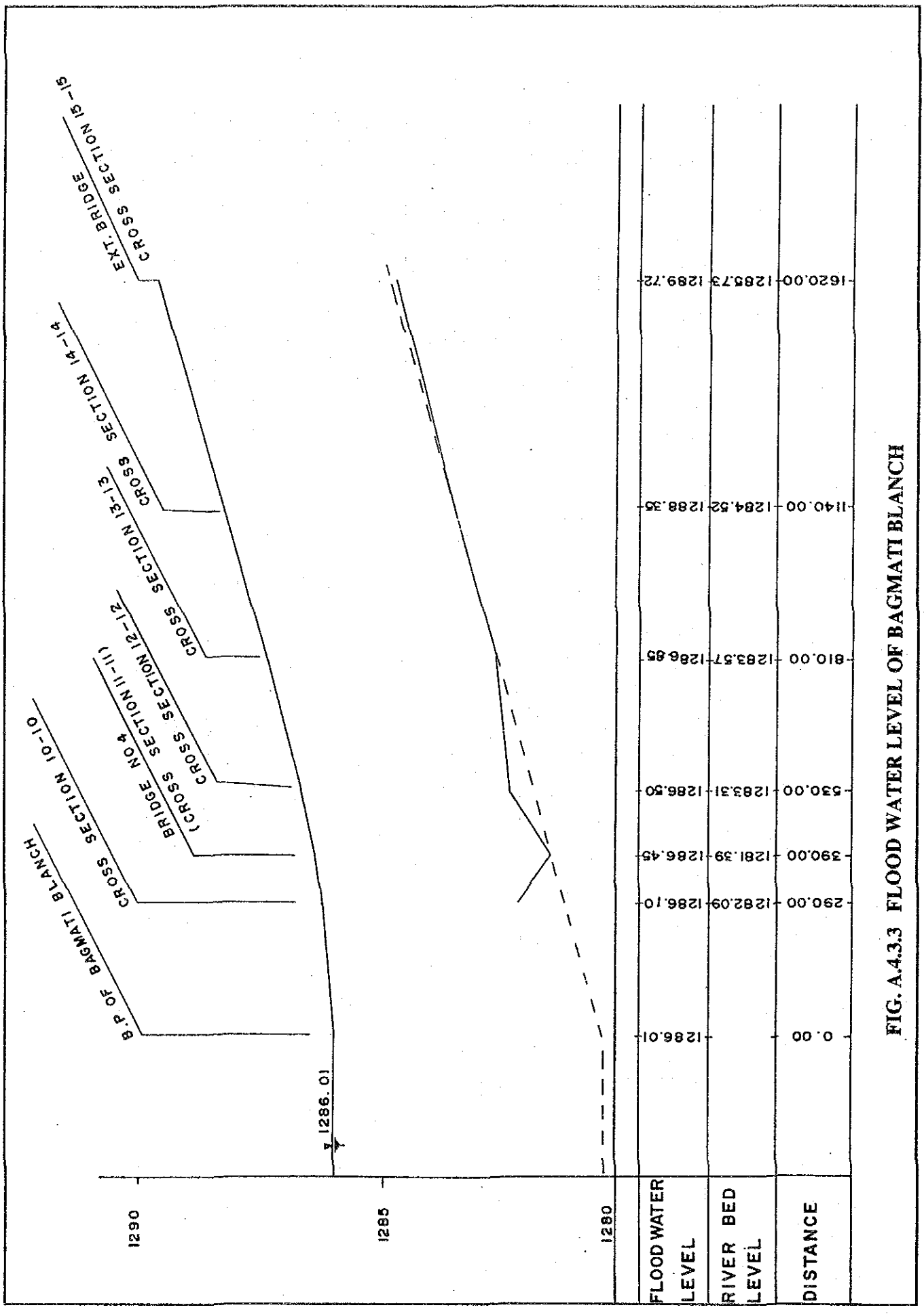


FIG. A.4.3.3 FLOOD WATER LEVEL OF BAGMATI BLANCH

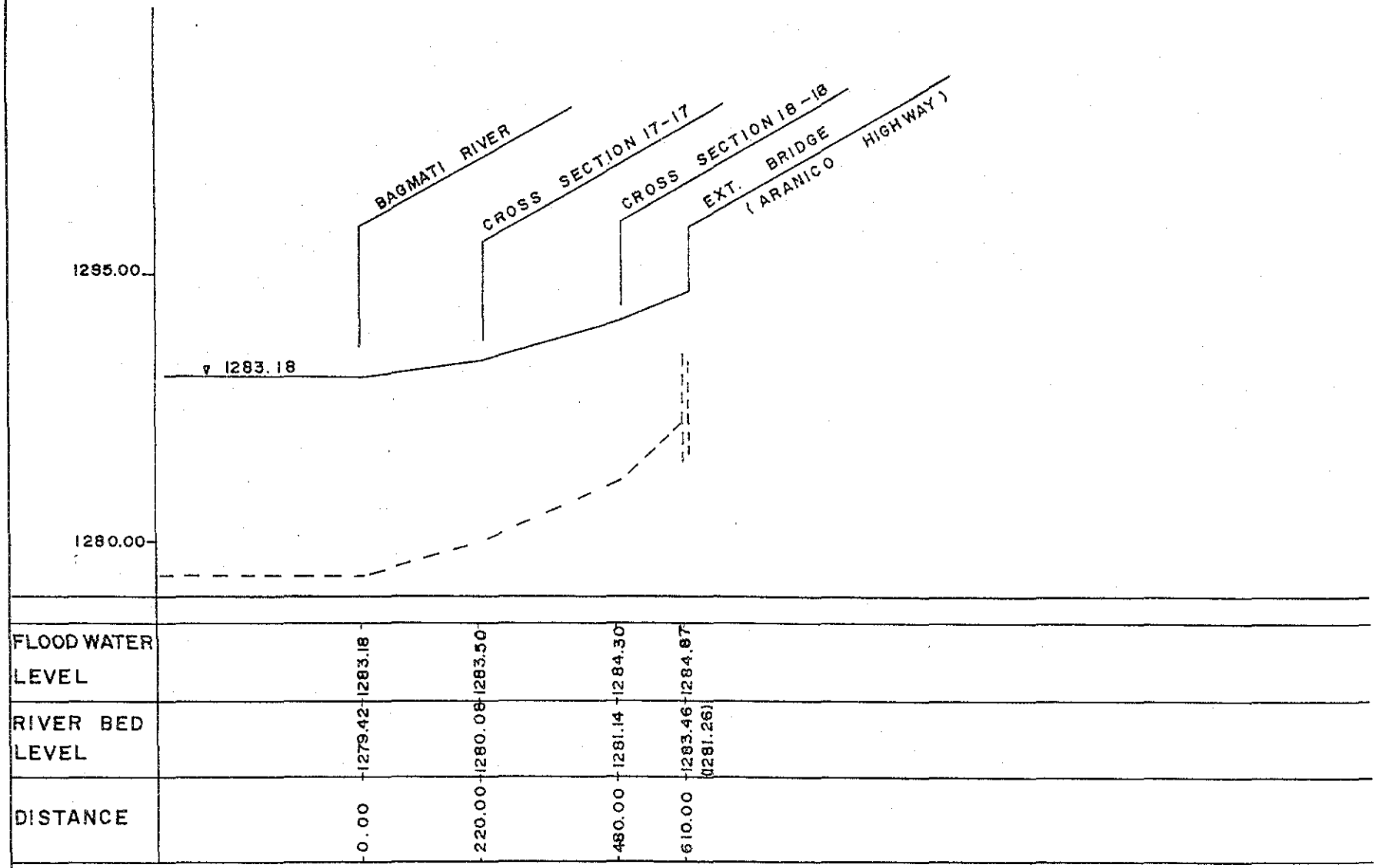


FIG. A.4.3.4 FLOOD WATER LEVEL OF DHOBI KHOLA

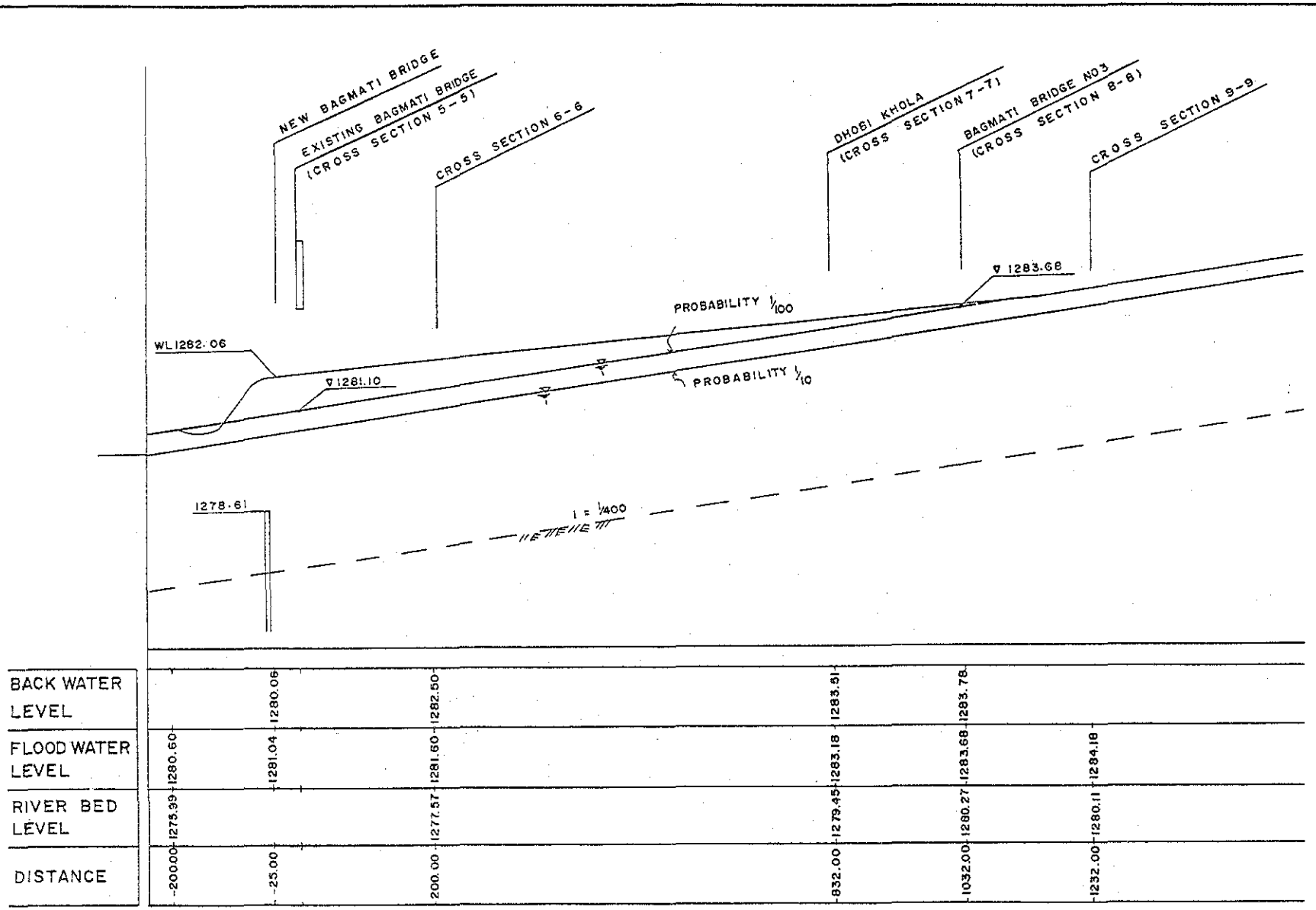


FIG. A.4.3.5 (1/2) BACK WATER BY GROUND SILL AT DOWNSTREAM OF BAGMATI BRIDGE NO. 2

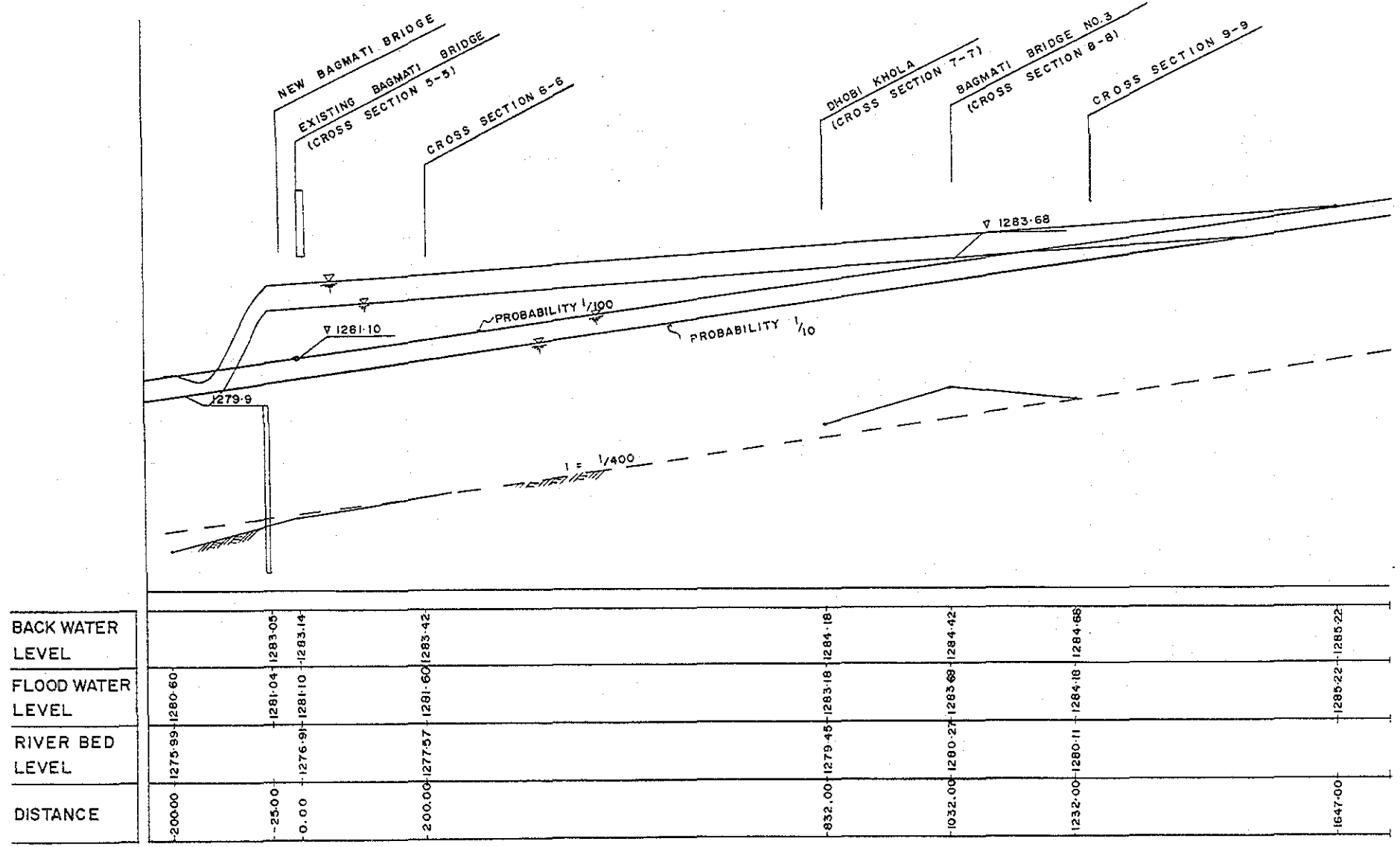


FIG. A.4.3.5 (2/2) BACK WATER BY GROUND SILL AT DOWNSTREAM OF BAGMATI BRIDGE NO. 2

Proposed Ground Sill for New Bagmati Bridge

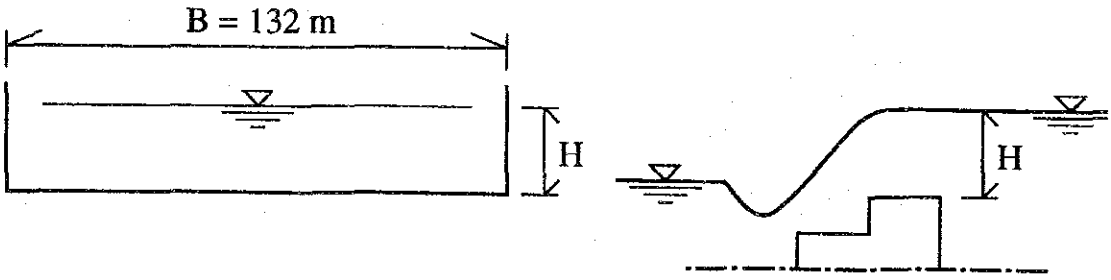
Existing ground sill is constructed to protect piers of Bagmati Bridge at Thapathali when New Bridge is constructed the ground sill should be reconstructed to maintain present condition.

In view point of hydraulics, high ground sills have disadvantages of inundation problems in upstream area. Back water calculation is performed on the following two alternative to study the effect due to change height of ground sill.

Alternative 1

Crest of proposed ground sill is 1279.9 of the same level as one of existing ground sill.

Design discharge	1,121.01 m^3/s
Crest width	132.0 m



Calculation of head over crest is performed by following formula.

$$Q = 0.35\ B\ \sqrt{2}\ g\ H^{3/2}$$

where, Q : discharge (m^3/s)
B : width of crest (m)
g : acceleration due to gravity = 9.8 m/sec^2
H : head over crest

given H = 3.15
Q = 1143.5m/s > 1121.2 m^3/s ------- OK

Water elevation at control point over crest is;

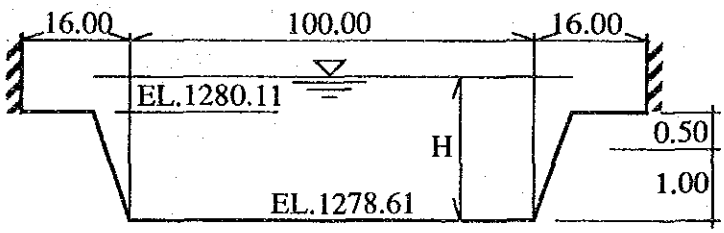
1279.9 + 3.15 = 1283.05

The result of calculation of back water is shown on Fig.A4.3.5 (1/2). In this case, innandation area due to backwater upstream is approximately 60 ha.

Alternative (2)

Crest of proposed ground sill is 1278.56 of the same level as top of footing of pier of Bagmati Bridge at Thapathali.

Design discharge	1,121.7 m^3/s
Under Crest width	130 m
Upper Crest Width	132



given H = 3.5 m

Q = 1128.5 m^3/sec > 1121.7 m^3/s OK

Water elevation at control point over crest is;

1278.56 + 3.50 = 1282.06 m

The result of calculation of back water is shown on Fig.A4.3.5 (2/2). In this case, innandation problem due to back water upstream is almost evaded.

Therefore it is recommended that crest of proposed ground sill is lowered upto 1278.56 on the basis of view point of hydraulics.

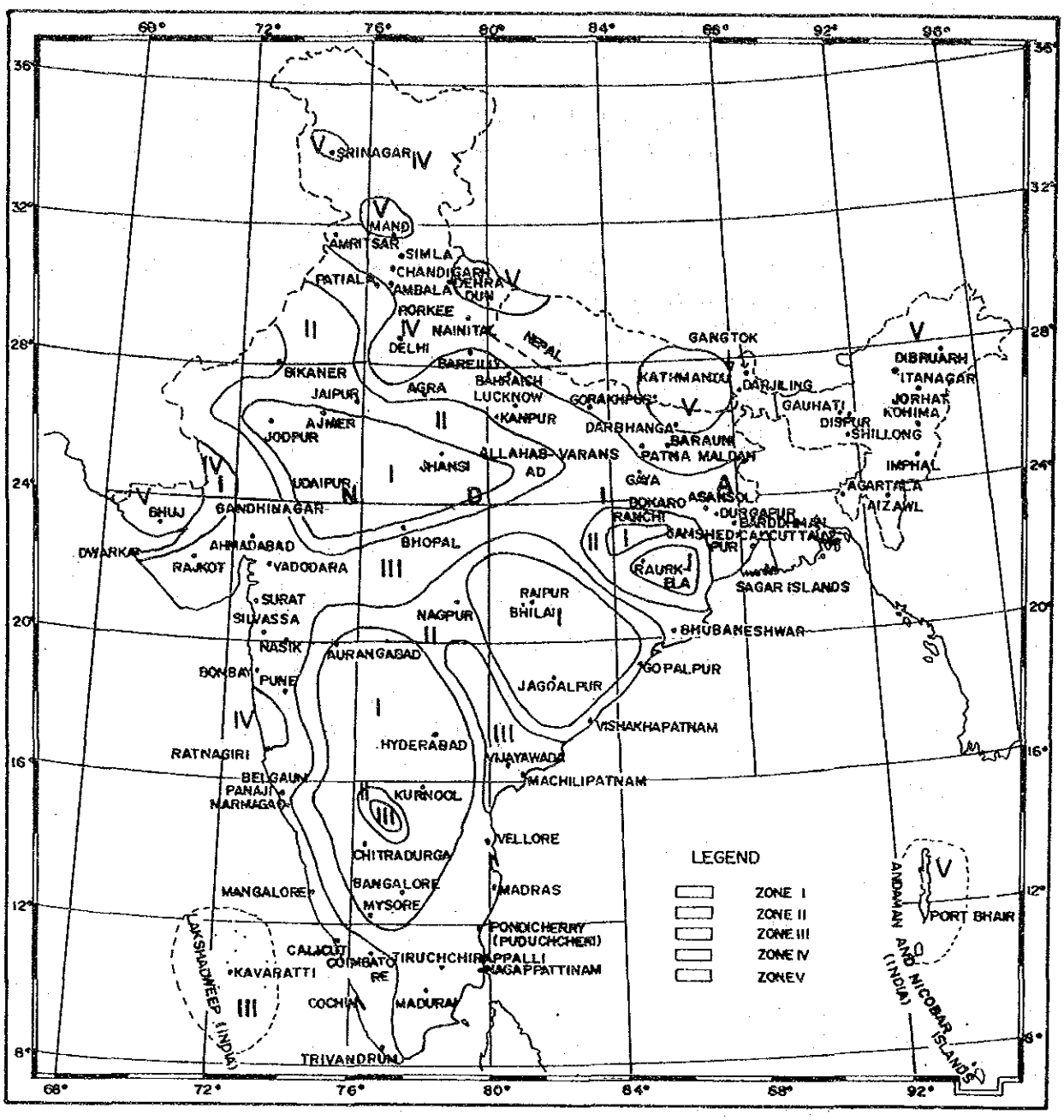


Figure A.4.4.1 MAP OF INDIA SHOWING SEISMIC ZONES

Table A.4.4.1 SEISMIC COEFFICIENTS FOR SOME IMPORTANT TOWNS (BNCI)

Town	Zone	Horzontal Seismic Coefficient
Agra	III	0.0 4
Ahmadabad	III	0.0 4
Ajmer	I	0.0 1
Allahabad	II	0.0 2
Almora	IV	0.0 5
Ambala	IV	0.0 5
Amristar	IV	0.0 5
Asansol	III	0.0 4
aurangabad	I	0.0 1
Bahraich	IV	0.0 5
Bangalore	I	0.0 1
Barauni	IV	0.0 5
Bareilly	III	0.0 4
Baroda	III	0.0 4
Bhatinda	III	0.0 4
Bhilai	I	0.0 1
Bhopal	II	0.0 2
Bhubaneswar	III	0.0 4
Bhuj	V	0.0 8
Bikaner	III	0.0 4
Bokaro	III	0.0 4
Bombay	III	0.0 4
Burdwan	III	0.0 4
Calcutta	III	0.0 4
Calicut	III	0.0 4
Chandigarh	IV	0.0 5
Chitradurga	I	0.0 1
Coimbatore	III	0.0 4
Cuttack	III	0.0 4
Darbhanga	V	0.0 8
Darjiling	IV	0.0 5
Dehra Dun	IV	0.0 5
Delhi	IV	0.0 5
Durgapur	III	0.0 4
Gangtok	IV	0.0 5
Gauhati	V	0.0 8
Gaya	III	0.0 4
Gorakhpur	IV	0.0 5
Hyderabad	I	0.0 1
Imphal	V	0.0 8
Jaipur	II	0.0 2
Jamshedpur	II	0.0 2
Jhansi	I	0.0 1
Jodhpur	I	0.0 1
Jorhat	V	0.0 8
Jabalpur	III	0.0 4
Kanpur	III	0.0 4
Kathmandu	V	0.0 8
Kohima	V	0.0 8
Kurnool	I	0.0 1
Lucknow	III	0.0 4
Ludhiana	IV	0.0 5
Madras	II	0.0 2
Madurai	II	0.0 2
Mandi	V	0.0 8
Managalore	III	0.0 4
Monghyr	IV	0.0 5
Moradabad	IV	0.0 5
Mysore	I	0.0 1
Nagpur	II	0.0 2
Nainital	IV	0.0 5
Nasik	III	0.0 4
Nellore	II	0.0 2
Panjim	III	0.0 4
Patiala	III	0.0 4
Patna	IV	0.0 5
Pilibhit	IV	0.0 5
Pondicherry	II	0.0 2
Pune	III	0.0 4
Rajpur	I	0.0 1
Rajkot	III	0.0 4
Ranchi	II	0.0 2
Roorkee	IV	0.0 5
Raurkela	I	0.0 1
Sadiya	V	0.0 8
Simla	IV	0.0 5
Sironj	I	0.0 1
Srinagar	V	0.0 8
Surat	III	0.0 4
Tezpur	V	0.0 8
Thanjavur	II	0.0 2
Tiruchchirappalli	II	0.0 2
Trivandrum	III	0.0 4
Udaipur	II	0.0 2
Varanasi	III	0.0 4
Vijayawada	III	0.0 4
Vishakhapatna	II	0.0 2

Note : The coefficients given are according to 5.2.1 and should be suitably modified for important structures according to 5.2.2 and 5.4

Table A.4.4.2 LIST OF EARTHQUAKES OF MORE THAN 5 MAGNITUDE ON RICHTER SCALE, OCCURRED WITHIN THE NEPAL REGION

Y	MD	EPCL AREA	LAT DEG NDEG	LONG E	DEPT KM	INT MM	MAG	REF
1966	12 18	WEST NEPAL	29.600	81.000			5.0	USC
1966	12 21		29.650	80.790			5.2	ISC
1967	01 05		30.000	86.000			5.2	LAO
1967	08 14		28.000	80.000			5.0	LAO
1967	12 18		29.460	81.710			5.0	ISC
1968	05 27	NEPAL	29.700	80.400			5.1	USV
1969	02 04		28.300	81.400			5.1	LAO
1969	02 11		28.100	82.700			6.2	LAO
1969	02 13		27.900	85.400			5.0	LAO
1969	02 13		28.000	81.800			5.3	LAO
1969	02 24		27.900	85.600			5.2	LAO
1969	03 03		30.040	79.840			5.0	ISC
1969	03 05		29.200	81.100			5.2	HARI
1970	02 12		29.240	81.570			5.3	ISC
1970	02 26		27.620	85.700			5.0	ISC
1971	05 03	TIBET	30.790	84.330	27		5.3	ISC
1971	12 04	NEPAL	27.930	87.950	29		5.2	ISC
1972	02 04	TIBET	30.340	84.470	18		5.1	ISC
1972	03 15	TIBET	30.425	84.502	33		5.3	NEIS
1972	04 28	TIBET	31.340	84.920	32		5.0	ISC
1973	01 02	TIBET	61.170	88.080	43		5.1	ISC
1973	04 22	TIBET	28.135	86.993	33		5.2	NEIS
1973	10 16	NEPAL	28.219	82.945	33		5.2	NEIS
1974	03 03	TIBET	30.740	86.320			5.5	ISC
1974	03 24	NEPAL	27.660	86.000			5.4	ISC
1974	09 27	NEPAL	28.590	85.510	20		5.5	ISC
1974	12 23	NEPAL	29.320	81.380	45		5.2	ISC
1975	01 31	NEPAL	28.100	84.729	33		5.4	NEIS
1975	06 19		26.740	87.500			5.1	NEIS
1975	09 06	NEPAL	29.210	81.950	33		5.1	ISC
1975	11 26	TIBET	28.150	87.800	33		5.0	ISC
1976	05 10	NEPAL	29.284	81.460	33		5.2	NEIS
1976	09 14	TIBET	29.795	89.559	82		5.5	NEIS
1976	09 29	NEPAL	29.817	81.390	33		5.0	NEIS
1976	10 23	TIBET	28.676	86.228	63		5.1	NEIS
1977	01 06	TIBET	31.048	88.058	33		5.2	NEIS
1977	03 16	TIBET	31.300	89.380	33		5.0	ISC
1977	11 18	TIBET	32.693	88.388	33		6.5	NEIS
1978	02 10	NEPAL	28.030	84.700			5.3	ISC
1978	08 08	TIBET	32.270	83.100			5.1	ISC
1978	10 04	NEPAL	27.834	85.963	33		5.2	NEIS
1979	05 20	NEPAL INDIA BORDER	30.029	80.310	33		5.9	NEIS
1979	06 19	NEPAL INDIA BORDER	26.740	87.480			5.2	ISC
1980	02 22	TIBET	30.550	88.860	14		5.7	ISC
1980	06 25	TIBET	30.130	81.760	28		5.1	ISC
1980	07 29	NEPAL	29.340	81.210	3		5.7	ISC
1980	07 29	NEPAL	29.598	81.092	18		6.1	NEIS
1980	10 08	TIBET	31.354	87.666	33		5.0	NEIS
1980	10 10	NEPAL	29.170	81.208	33		5.0	NEIS
1980	11 18	TIBET	29.550	85.180	24		5.0	ISC
1980	11 19	SIKKIM	27.400	88.800			6.0	ISC
1981	05 15		29.504	81.942			5.1	
1982	04 05		27.496	88.984			5.1	NEIS
1983	02 02	INDIA CHINA BORDER	27.032	91.870	33		5.2	NEIS
1983	03 01	INDIA CHINA BORDER	28.610	95.982	33		5.0	NEIS
1984	02 19	NEPAL INDIA BORDER	29.659	80.550	58		5.0	NEIS
1984	04 15	TIBET	31.586	82.262	33		5.0	NEIS
1984	05 18	NEPAL	29.606	81.884	33		5.6	NEIS
1984	05 21	INDIA BANGLADESH	23.663	91.519	33		5.3	NEIS
1984	12 30	INDIA BANGLADESH	24.598	92.839	33		5.6	NEIS
1985	06 15		34.630	82.990	20		5.4	ISC
1986	01 10		28.650	86.560	63		5.5	ISC
1986	02 12		34.670	82.930	33		5.0	ISC
1986	03 01		34.680	82.960	33		5.0	NEIS
1986	04 26		32.150	76.400	33		5.5	ISC
1986	06 20		31.220	86.820	33		5.9	ISC
1986	07 06		34.450	80.200	9		5.7	ISC
1986	07 16		31.050	78.000	4		5.6	ISC
1986	07 19		31.180	86.860	17		5.1	ISC
1986	09 09		31.450	85.050	7		5.4	ISC
1987	01 19		28.200	83.600	33		5.2	ISC
1987	08 09		29.470	83.740	74		5.5	ISC
1988	04 20		27.020	86.720	55		5.4	ISC
1988	08 20		26.770	86.610	71		6.4	PDE
1989	02 09		30.040	89.760	33		5.4	PDE
1989	04 03		29.120	90.020	10		5.2	PDE
1989	05 22		27.550	87.770	33		5.0	PDE
1990	02 22		29.070	89.940	33		5.0	PDE

Abbreviation

Y = year
M = month
D = day
EPCL = epicentre location
LAT = latitude
LONG = longitude
Dept = depth of hypocentre
Mag = Magnitude
REF = Reference Agency
ISC = International Seismological Centre, UK
NEIS = National Earthquake Informations Service, USA
PDE = Preliminary Determination of epicentre

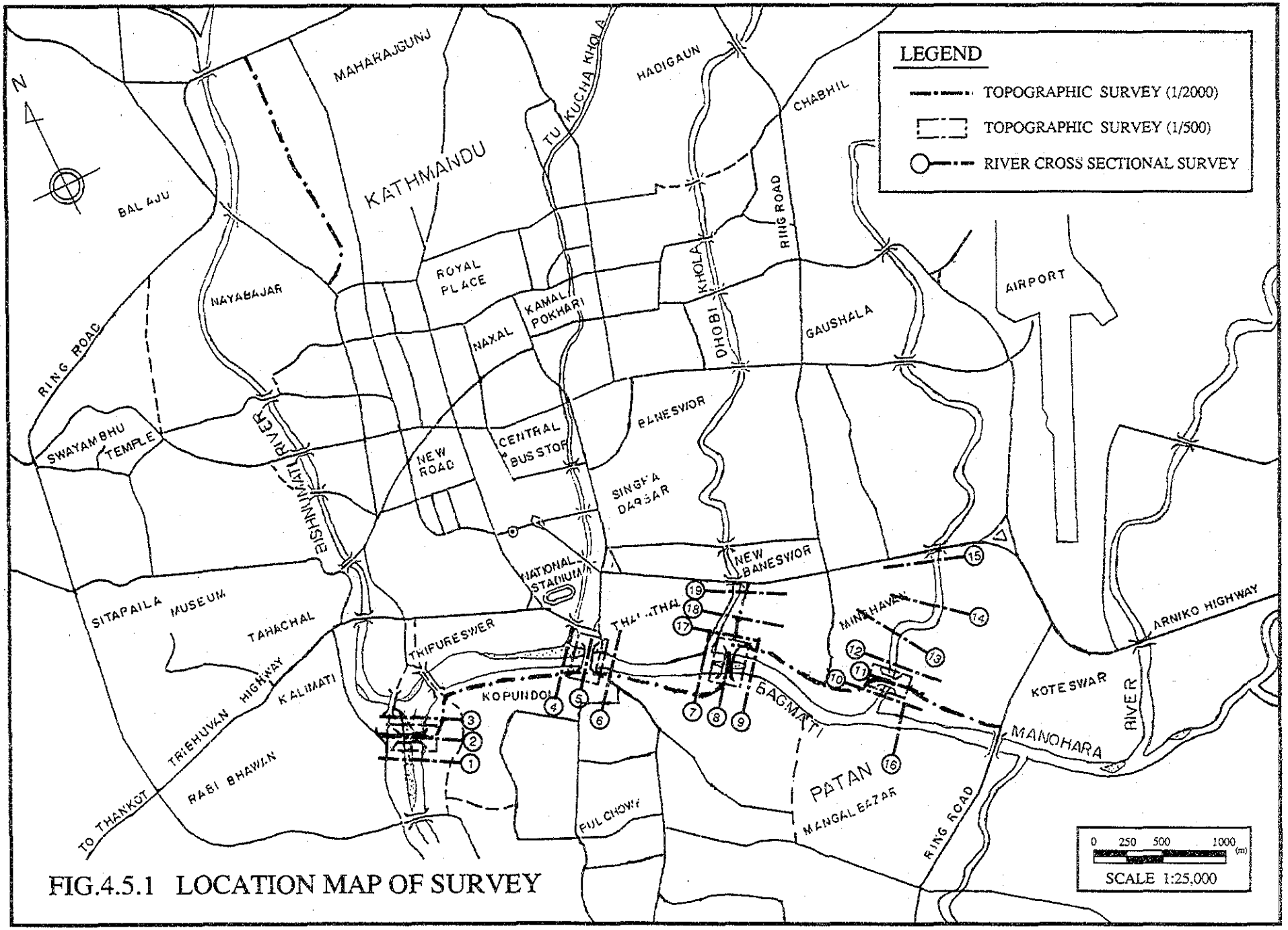
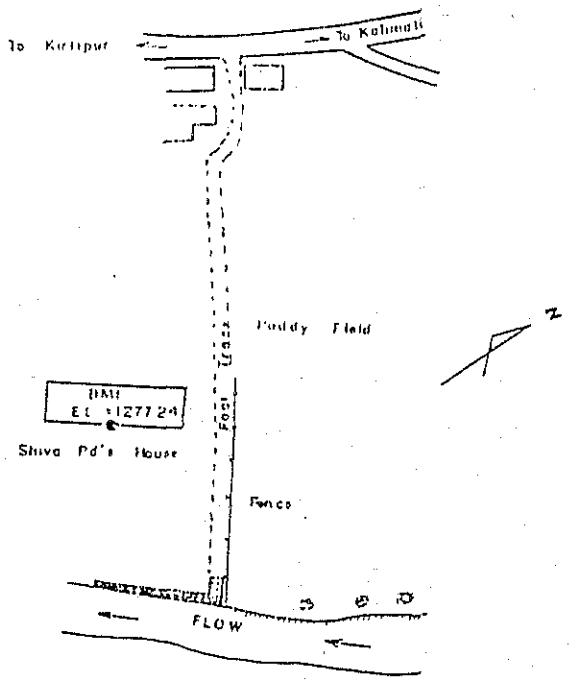


FIG.4.5.1 LOCATION MAP OF SURVEY

Fig. A 4.5.1 (1) LOCATION DETAIL OF BM

BRIDGE # 1



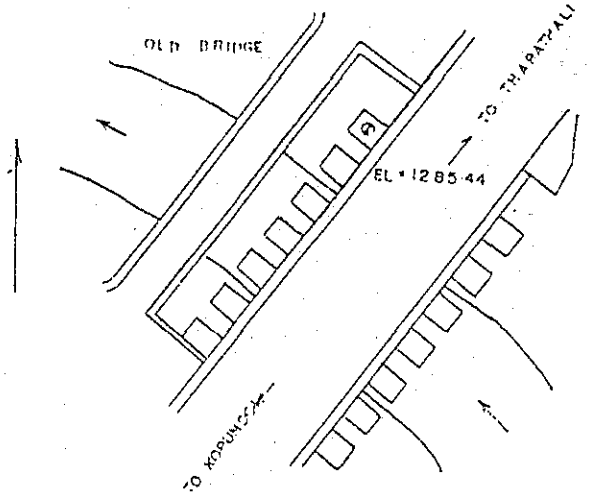
NOTES :—

From Kuleshwor (at Between Kalimati & Balkhu joint) Follow the Pd 45 m m Towards Balkhu & Turn left and Follow Foot track Towards the River Bagmati As shown in the sketch the B.M (1) is fixed at the Plinth level of Shiv Pd's House

Fig. A 4.5.1 (2) LOCATION DETAIL OF BM

BRIDGE NO.2

(258 NO. OF GEODETIC SURVEY)

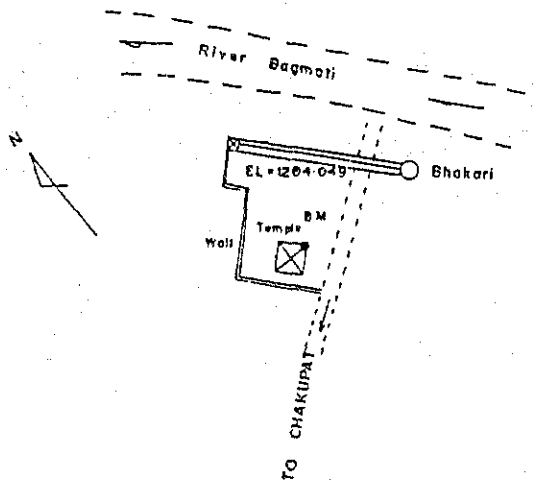


NOTES :—

This BM is fixed by Geodetic Branch of department of survey at the D/S edge of Right Abutment of Thapathali Bridge on Deck Level.

Fig. A 4.5.1 (3) LOCATION DETAIL OF BM

BRIDGE # 3

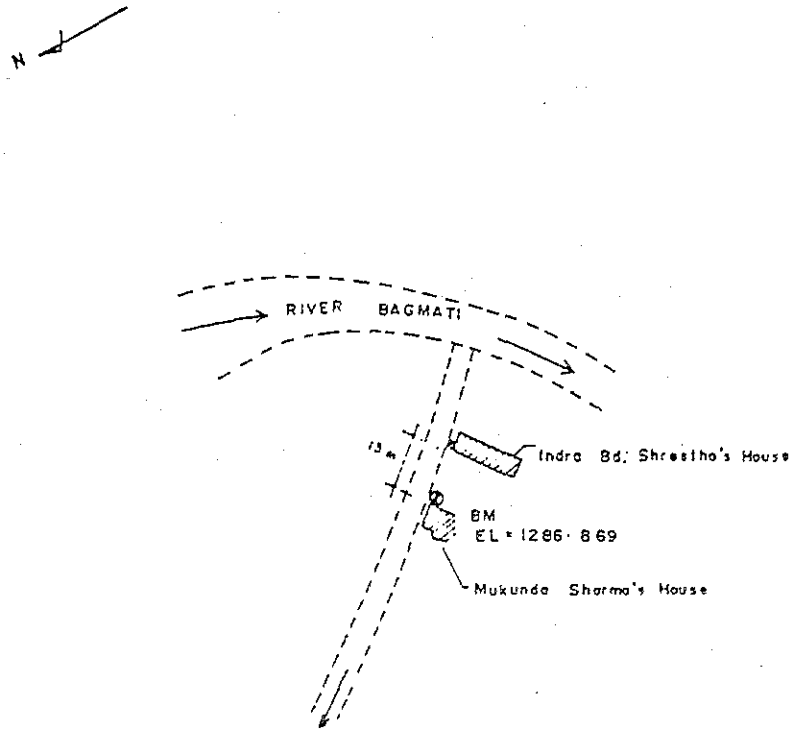


NOTES.

This BM is Fixed at North East Corner of the Temple (South East of the Bridge Pt.# No) on Wooden Beam at the Plinth Level.

Fig. A 4.5.1 (4) LOCATION DETAIL OF BM

BRIDGE # 4



NOTES:—

This BM is Fixed at the North West Corner of Mr Mukunda Sharma's House (120 m West of Bridge Pt # BP2) on the Plinth Level (White Mark)

Table A.4.5.1 (1) COORDINATES OF TRAVERSE POINT (1/2)

ATIONS		BEARING (W. C. B.)	DISTANCE (m.)	EASTING (m.)	NORTHING (m.)
TP 11974	- I 1	225.34740	077.018	631,644.22	3,062,951.62
	- T 1	031.80710	137.323	631,771.39	3,063,122.45
T 1	- T 2	091.92876	116.533	631,887.86	3,063,118.53
	- T 3	303.05766	219.454	631,587.46	3,063,242.16
T 3	- T 4	297.34821	119.401	631,481.40	3,063,297.01
T 4	- T 5	328.80210	245.358	631,354.30	3,063,506.88
T 6	- T 7R	329.00377	223.358	631,202.57	3,063,777.72
T 5	- T 6	335.20266	087.491	631,317.60	3,063,586.31
T 7R	- T 8a	165.55988	031.985	631,210.55	3,063,746.80
	- T 8R	321.28710	111.825	631,132.64	3,063,865.03
	- T 11a	244.06905	267.714	630,961.81	3,063,660.70
T 11a	- T 8	277.16849	313.406	630,650.86	3,063,699.81
T 8a	- T 9	303.06016	163.760	630,513.61	3,063,789.14
T 9	- T 10	291.86249	117.806	630,404.28	3,063,833.01
	- T 11	306.32599	600.221	630,030.04	3,064,144.70
T 11	- B P1	181.49349	103.637	630,027.34	3,064,041.10
	- TP 5476	013.06470	103.564	630,053.45	3,064,245.58
T 11	- T 11#	311.52043	456.803	629,688.02	3,064,447.51
T 11#	- T 12	260.02793	238.446	629,453.55	3,064,407.92
T 12	- T 12	197.60738	073.556	629,431.30	3,064,337.81
	- T 13	290.05905	268.616	629,201.98	3,064,400.05
T 12/1	- T 12/2	282.14182	172.915	629,262.26	3,064,374.18
T 12/2	- T 14	267.31349	247.910	629,014.61	3,064,362.56
T 14	- T 15	202.43932	075.795	628,985.68	3,064,173.33
T 15	- T 16	319.591.55	062.420	628,945.22	3,064,292.51
T 16	- T 17	210.69321	193.865	628,846.26	3,064,173.33
T 17	- T 18	217.31932	115.135	628,776.46	3,064,081.77
T 18	- T 19	254.44460	103.589	628,676.66	3,064,053.99
T 19	- T 20	235.83405	042.631	628,641.39	3,064,030.04
T 20	- BP 2	237.23294	035.010	628,611.95	3,064,011.10
T 2	- T 1	271.92877			
	- BP 2 (T 21)	119.44460	137.889	632,007.94	3,063,050.74
BP 2	- BP 1 (T22)	128.45238	066.252	632,059.82	3,063,009.54
T 22	- T 23	135.33738	260.088	632,242.64	3,062,824.55
T 23	- T 24	159.84627	040.337	632,256.54	3,062,786.68
T 24	- T 25	142.18880	072.451	632,300.96	3,062,729.44
	- T 26	141.37960	144.239	632,346.51	3,062,673.99
T 26	- T 27	124.51849	395.078	632,672.07	3,062,450.14
T 28	- T 29	015.74266	122.683	628,539.12	3,063,696.16
T 29	- T 30	013.40432	243.625	628,595.60	3,063,933.14
T 30	- BP 2	011.84118	079.645	628,611.95	3,064,011.10
BP 2	- BH	335.78516	021.400	628,603.17	3,064,030.61
	T 31	348.82738	043.357	628,603.54	3,064,053.63
	T20 (BP1)	057.23294	035.010	628,641.39	3,064,030.04
T 31	- E	273.89960	086.261	628,517.48	3,064,059.50
E	- D	297.18849	069.711	628,455.47	3,064,091.35
D	- T 32	316.01349	094.240	628,390.02	3,064,159.15
T 32	- T 33	342.36405	194.810	628,330.97	3,064,344.91
	- A	149.44127	009.560	628,394.88	3,064,150.92
8 (R)	- 34	246.61543	034.230	631,101.22	3,063,851.44
	- 35	047.38960	060.520	631,177.18	3,063,906.00
	- 36	024.55960	242.440	631,233.41	3,064,085.84
	- 37	016.67850	386.641	631,243.61	3,064,235.41
T 37	- T 38	182.61322	084.721	631,239.75	3,064,150.78
	- T 38A	119.10072	062.282	631,298.03	3,064,205.12

Table A.4.5.1 (2) COORDINATES OF TRAVERSE POINT (2/2)

ATIONS		BEARING (W. C. B.)	DISTANCE (m.)	EASTING (m.)	NORTHING (m.)
T 39	- T 40	180.75794	414.706	629,493.53	3,068,710.04
T 40	- T 41	185.97182	249.697	629,467.55	3,068,461.69
T 40	- T 42	349.24294	057.774	629,482.75	3,068,766.80
T 41	- T 43	193.39682	185.028	629,424.68	3,068,281.70
T 43	- T 44	109.55738	065.885	629,486.73	3,068,259.53
T 44	- T 45	175.48682	223.188	629,503.87	3,068,037.00
T 45	- T 46	129.22294	015.390	629,515.77	3,068,027.24
T 45	- T 47	175.41627	095.934	629,511.36	3,067,941.36
T 47	- T 48	071.27821	024.920	629,534.97	3,067,949.34
T 47	- T 49	157.89182	199.769	629,586.20	3,067,756.14
T 49	- T 50	174.78766	117.147	629,596.63	3,067,639.46
T 50	- T 51	280.06349	009.810	629,586.98	3,067,641.19
T 50	- T 52	188.07321	068.273	629,586.92	3,067,571.88
T 52	- T 53	193.58483	080.276	629,568.07	3,067,493.85
T 53	- T 54	194.28066	059.162	629,553.48	3,067,436.51
T 54	- T 55	217.00150	074.725	629,508.51	3,067,376.84
T 55	- T 56	220.80872	056.783	629,530.52	3,067,429.18
T 55	- T 57	260.72566	099.511	629,410.30	3,067,360.80
T 57	- T 58	046.05400	035.000	629,435.50	3,067,385.09
T 57	- T 59	258.57566	054.832	629,356.55	3,067,349.94
T 59	- T 60	15.61066	027.763	629,363.75	3,067,375.72

Appendix 5.3.1 Alternative Study on Protection Works of Existing *Bagmati Bridge*

The existing 2-lane Bagmati Bridge at Thapathali was constructed in 1968, about 25 years back. During the flood in September 1991, one of its pear suffered settlement and rotation. It was demolished and a new pier was constructed with a gabion check-dam against the lowering of river bed to open the traffic in early 1992. These protection works however are

The existing bridge is supposed to be utilized for another 10 years from now on, so that appropriate protection work should be provided on the piers of existing bridge.

The following four (4) alternative plans are studied as shown in Fig. A 5.1 on the protection work of existing bridge.

A - Plan : Construction of a new 2-lane bridge on d/s side and protection of the existing piers

B - Plan : This plan is same as A-Plan. The only difference is that instead of permanent ground sill, gabion ground sill will be provided.

C - Plan : Construction of a new 2-lane bridge on d/s side and reconstruction of the existing piers.

D - Plan : Construction of a new 4-lane bridge.

The detail of each alternatives are explained below:

A - Plan and B- Plan: Construction of a new 2-lane bridge on d/s side and protection of the existing piers

A check-dam (ground sill) should be provided on downstream to raise the river bed level and prevent it's further erosion. The materials of check-dam should be either reinforced concrete or gabion. The check-dam made of reinforced concrete is used as the permanent structure while gabion check-dam temporary stricture. Selection of materials depends on availability of funds.

In addition to the check-dam, the scour protection around the existing piers should also be constructed. The elevation of this protection will be the same as that for the ground sill. From hydrological considerations, the top of ground sill should be 1.5 m below the top of existing pier footing.

C - Plan : Construction of a new 2-lane bridge on d/s side and reconstruction of the existing piers.

After the construction of the new bridge, the traffic is diverted to the new bridge and the superstructure of the existing bridge is dismantled temporarily for the foundation works and sheet pile works. The existing piers are then demolished and new piers with pile foundations are constructed. After this, the superstructure is again placed on the new piers. In this plan there is no necessity of constructing the ground sill and scour protection. The difficult works associated with this plan are that the superstructure should be repaired and adjusted for new type of rivet connections, camber, etc. For this it has to be carried to a factory. In this way the cost for rehabilitation is sometime more than the cost for new construction. The construction period required for this plan will be longer, and temporary gabion has to be provided for the protection of existing bridge during new bridge construction.

D - Plan : Construction of a new dual 2-lane bridge.

This plan is total replacement of the existing 2 lane bridge to the new bridge with dual 2 lane. A first, a new 2-lane bridge is constructed on d/s side and the traffic is diverted through this new bridge. Then the existing bridge is completely demolished. The next is the construction of another new 2-lane bridge on the u/s side and their connection with each other. This plan has three disadvantages. One is its very high construction cost, second is the longer construction period and the third is the need for providing temporary gabion structure for the protection of the existing bridge during the construction of the first 2-lane bridge on d/s side.

On comparison of the above 4 plans, A-plan seems to be the most favorable and recommended to be implemented.

Appendix 5.3.2 Inspection of Existing Bridges and Topo. Conditions

For the planning and design of the bridges the existing bridges across Bagmati, Bishnumati, Dhobi Khola and Manohara rivers have been visually inspected. Also, some planned bridges and bridges under construction have been referred to. These bridges have been indicated in Fig. A 5.2 (1) and sketches of these bridges are shown in Fig. A 5.2 (2). These data have been used to fix the bridge length, the minimum span, span arrangement, the lowering of river bed, the girder bottom elevation, etc.

In addition to this, the aerial photo of 1987 and survey map of around 1974 has been referred to for estimation of the natural course change. The enlarged bridge site plans which resulted form the combination of the aerial photo and survey map are shown in the Fig. A 5.2 (3) and Fig. A 5.2 (4). The indicated new river line in the plans has been scaled up from the aerial photos.

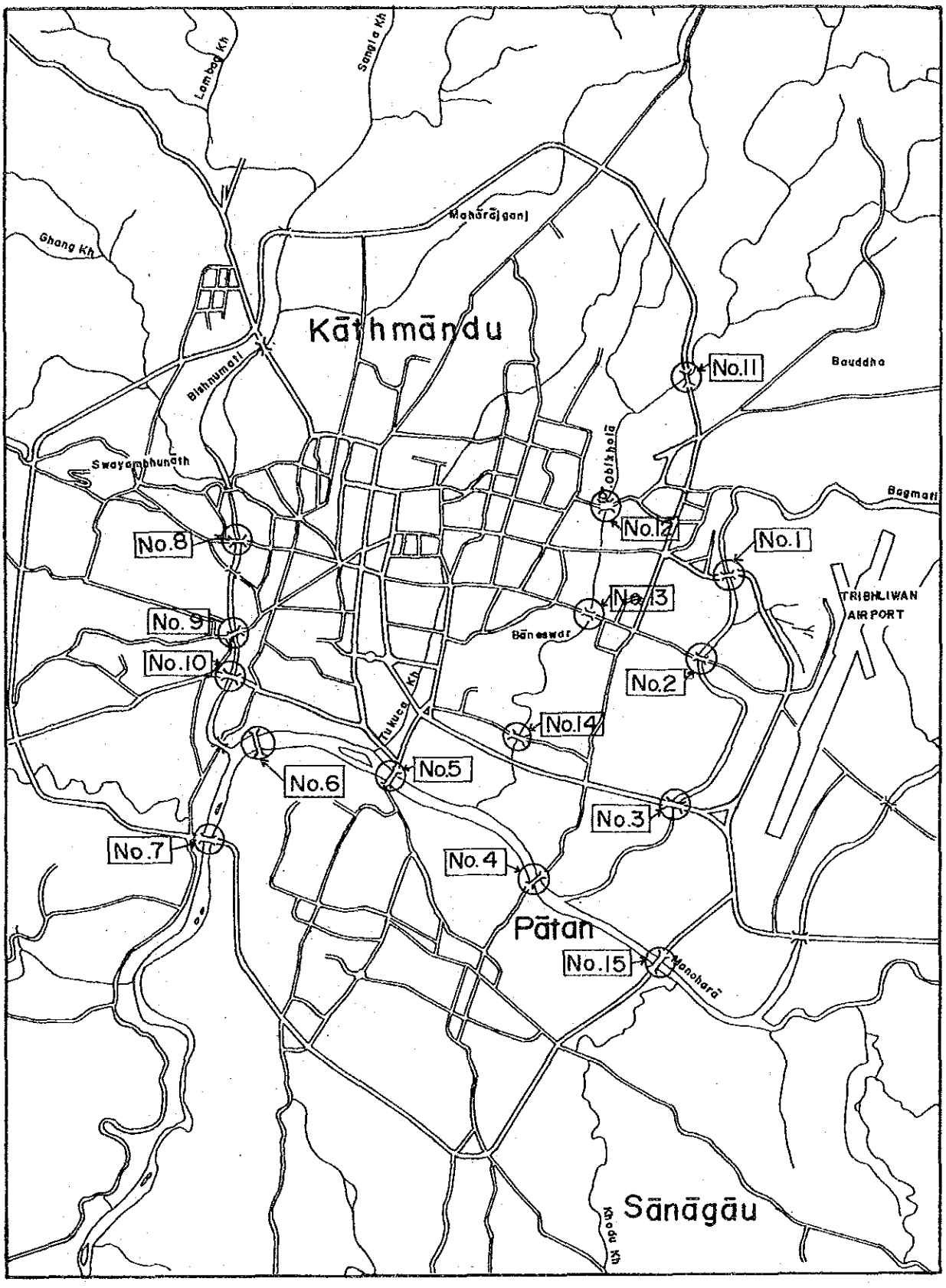


Figure A 5.2.1 LOCATION MAP OF EXISTING AND PLANNING BRIDGE

Figure A 5.2.2 SKETCHES OF EXISTING AND PLANNING BRIDGE 1/4

NO	BRIDGE NAME	ELEVATION	CROSS-SECTION	REMARKS
1	BAGMATI BRIDGE LOCATION: PASHUPATI (RING ROAD)	3X15 = 45m 5.6 SUPER: RC-T-BEAMS SUB: RC COLUMNS FOUNDATION: RC BORE PILES (DEPTH NOT KNOWN)	2.75 10 2.75	BUILT IN 1974 BORE PILES EXPOSED UPTO 3m DUE TO LOWERING OF BED LEVEL
2	BAGMATI BRIDGE ON OLD ROAD TO AIRPORT	63 m 7.1 SUPER: RC-T-BEAMS CANTILEVER TYPE SUB: RC PIERS AND ABUTMENTS FOUND: RC CAISSON (DEPTH NOT KNOWN)	10 1.7 6.6 1.7	BUILT IN 1967 CAISSON EXPOSED 3m DUE TO LOWERING OF BED LEVEL
3	BAGMETI BRIDGE KOTESWAR	5X17 = 85m 7.6 SUPER: RC-T-BEAMS SUB: RC COLUMNS FOUND: RC BORE PILE (DEPTH NOT KNOWN) YEAR BUILT: 1970 REMARK: BORE PILES EXPOSED MORE THAN 3m DUE TO LOWERING OF BED LEVEL	20 3 14 3	
7	BAGMATI BRIDGE BALKHU (RING ROAD)	8X15 = 120 5.0 SUPER: RC-T-BEAMS SUB: RC COLUMNS FOUND: RC BORE PILES CROSS-SECTION: SAME AS NO 11 REMARKS: BORE PILES EXPOSED FOR ≈30cm YEAR BUILT 1974		

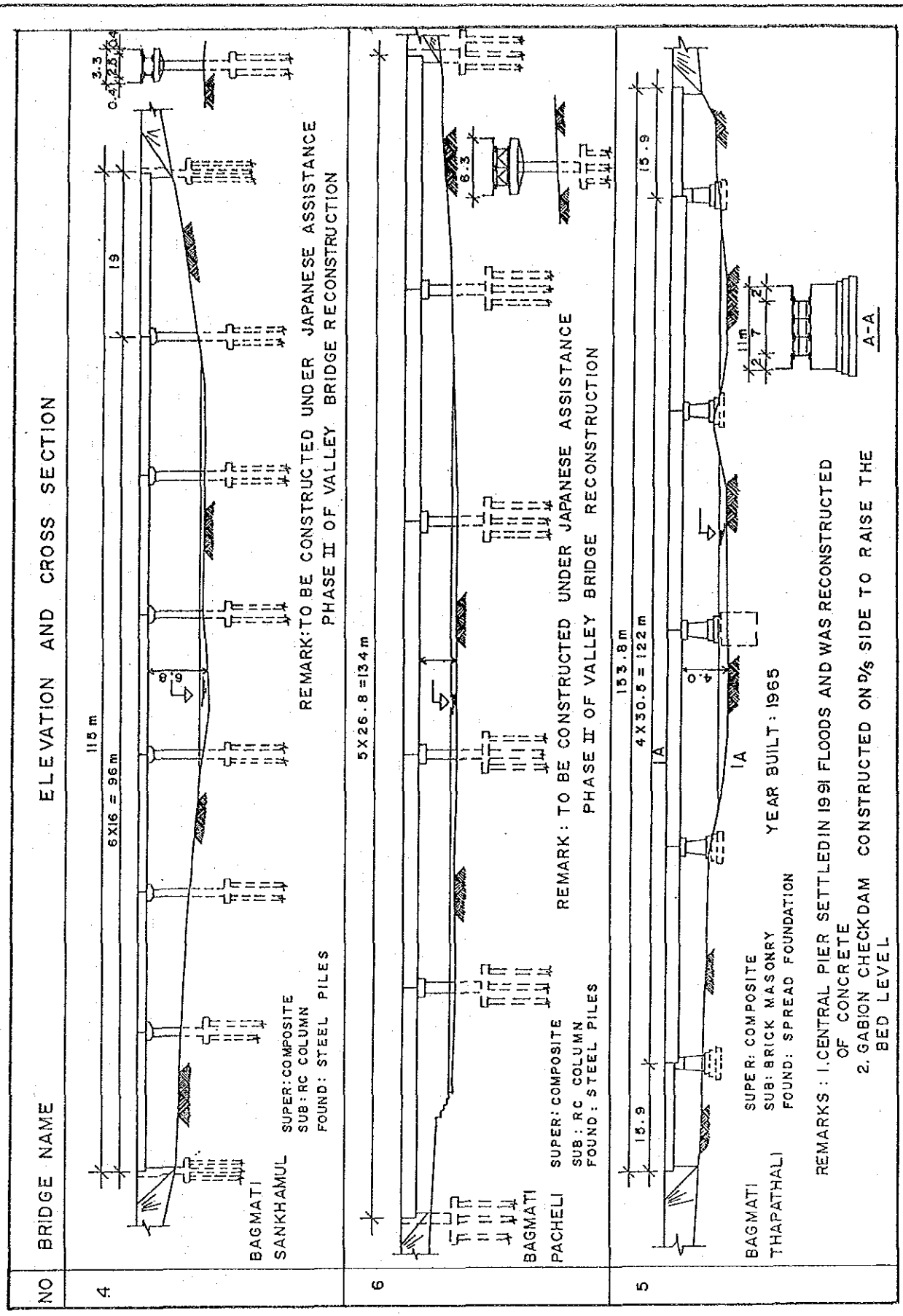


Figure A 5.2.2 SKETCHES OF EXISTING AND PLANNING BRIDGE 2/4

Figure A 5.2.2 SKETCHES OF EXISTING AND PLANNING BRIDGE 3/4

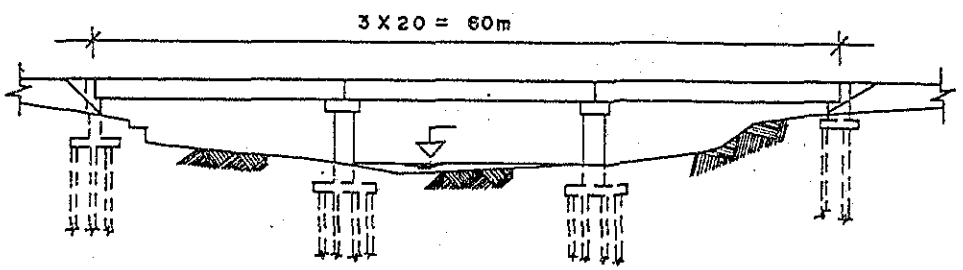
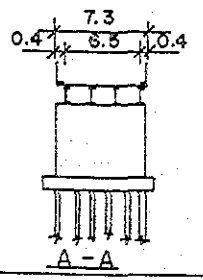
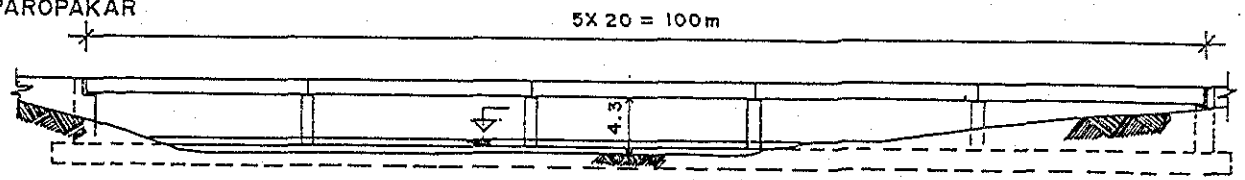
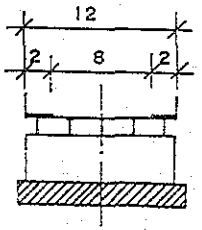
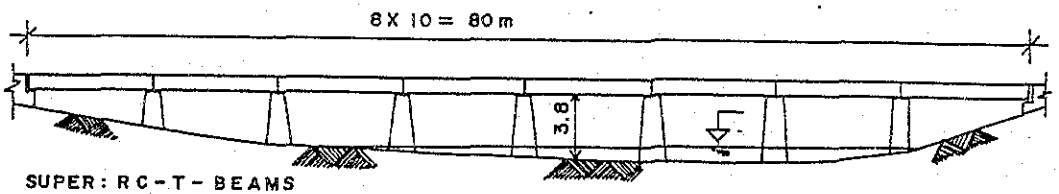
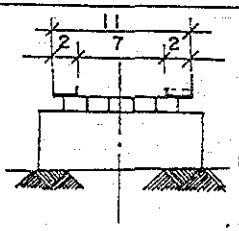
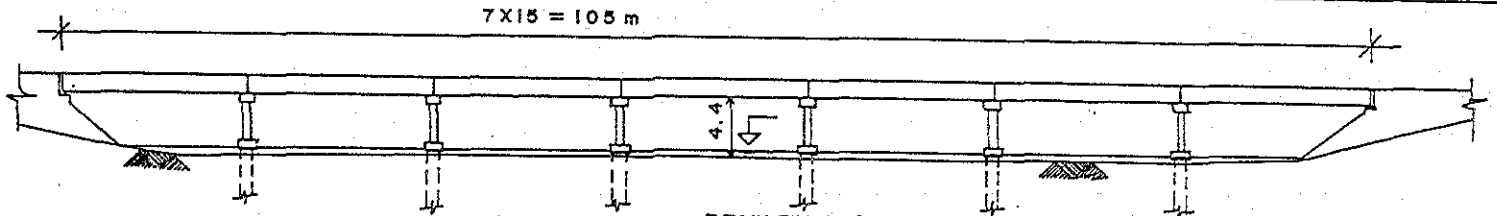
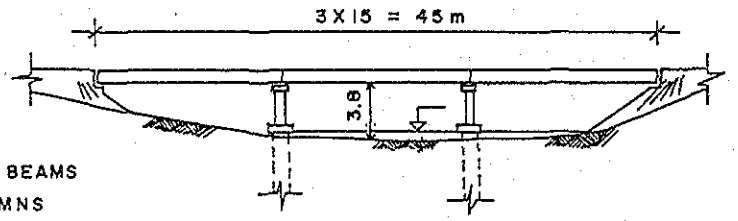
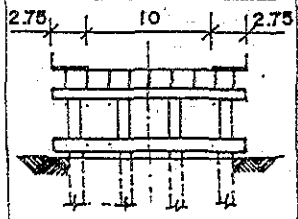
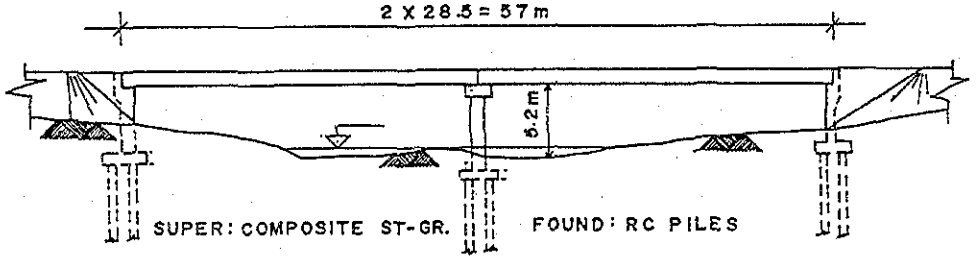
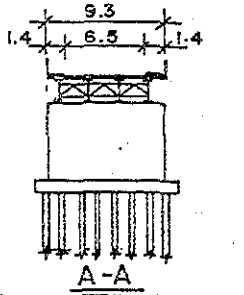
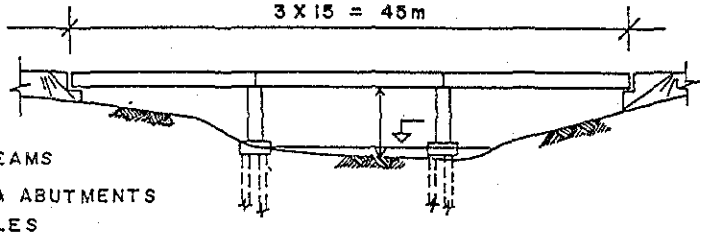
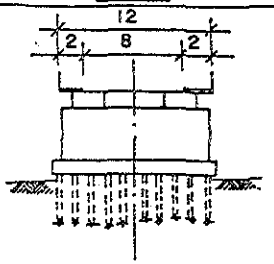
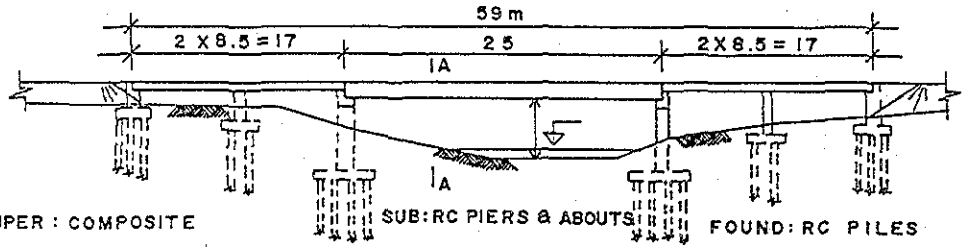
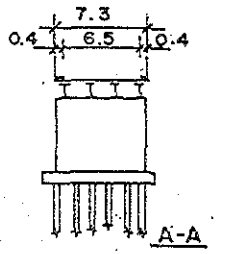
NO	BRIDGE NAME	ELEVATION	CROSS SECTION	REMARKS
8	BISHNUMATI DALLU			NEW BRIDGE CONSTRUCTED UNDER JAPANESE ASSISTAUCE
9	BISHNUMATI PAROPAKAR	SUPER : RC-T- BEAMS SUB : RC- PIERS & ABUTMENTS FOUND : RC-MAT FOUNDATION 		BUILT : 1984 GABION CHECK DAM BUILT RECENTLY TO PREVENT EROSION OF BED LEVEL
10	BISHNUMATI TEKU	 SUPER : RC-T- BEAMS SUB : BRICK MASONRY FOUND : SHALLOW FOUNDN OF BRICK MASONRY WITH CONCRETE FOOTING		BUILT : 1967 GABION CHECK DAM BUILT RECENTLY TO PREVENT EROSION OF BED LEVEL
15	MANOHARA RING ROAD BUILT : 1974	 CROSS-SECTION : SAME AS BRIDGE NO.1 REMARKS : GABION CHECKDAM BUILT RECENTLY TO PREVENT BED EROSION		

Figure A 5.2.2 SKETCHES OF EXISTING AND PLANNING BRIDGE 4/4

NO	BRIDGE NAME	ELEVATION	CROSS - SECTION	REMARKS
11	DHOBI KHOLA CHABAHIL (RING ROAD)	 SUPER : RC - T - BEAMS SUB: RC - COLUMNS *FOUND : RC - BORE PILES*		BUILT 1974 BORE PILES EXPOSED ABOUT 30cm
12	DHOBI KHOLA SIPHAL (KALO PUL)	 SUPER: COMPOSITE ST-GR. FOUND : RC PILES SUB: RC PIERS AND ABUTMENTS		NEW BRIDGE CONSTRUCTED UNDER JAPAN ASSISTANCE BUILT : 1992
13	DHOBI KHOLA MAITI DEVI	 SUPER : RC - T - BEAMS SUB : RC - PIERS & ABUTMENTS FOUND : RC - PILES		BUILT : 1975 RC PILES EXPOSED ABOUT 50cm
14	DHOBI KHOLA BABAR MAHAL BACK LANE	 SUPER : COMPOSITE SUB: RC PIERS & ABOUTS FOUND: RC PILES		NEW BRIDGE CONSTRUCTED UNDER JAPANESE ASSISTANCE BUILT : 1992

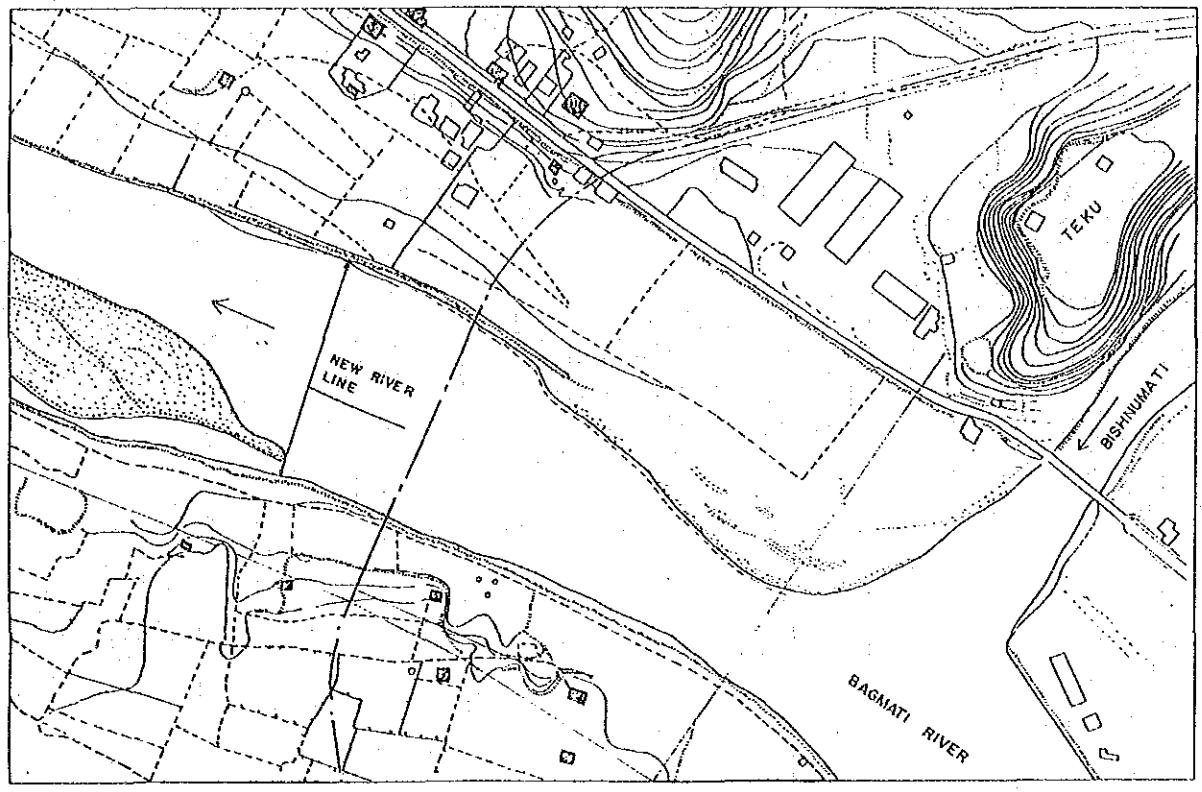


Figure A 5.2.3 (1) BAGMATI BRIDGE No.1 MAP

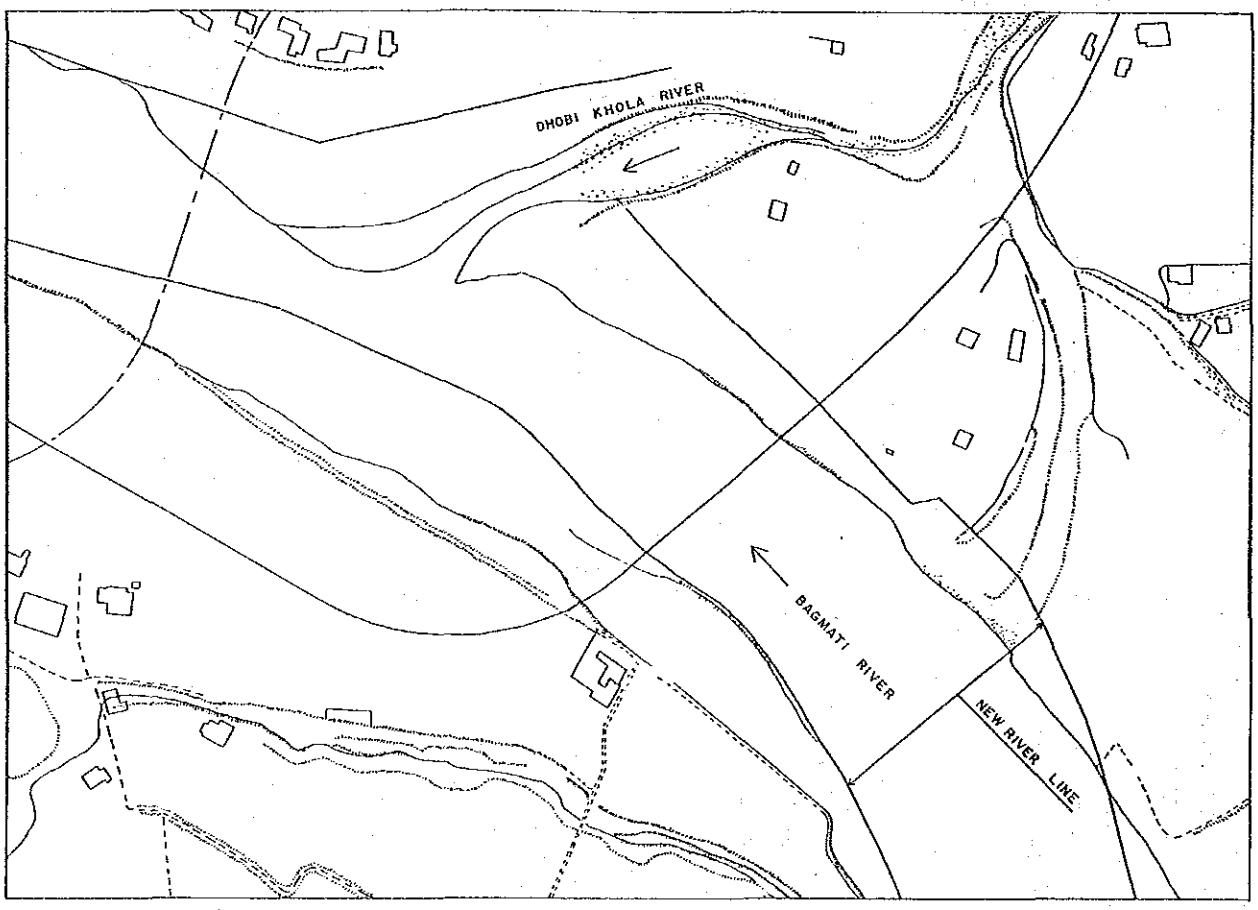


Figure A 5.2.3 (2) BAGMATI BRIDGE No.3 MAP

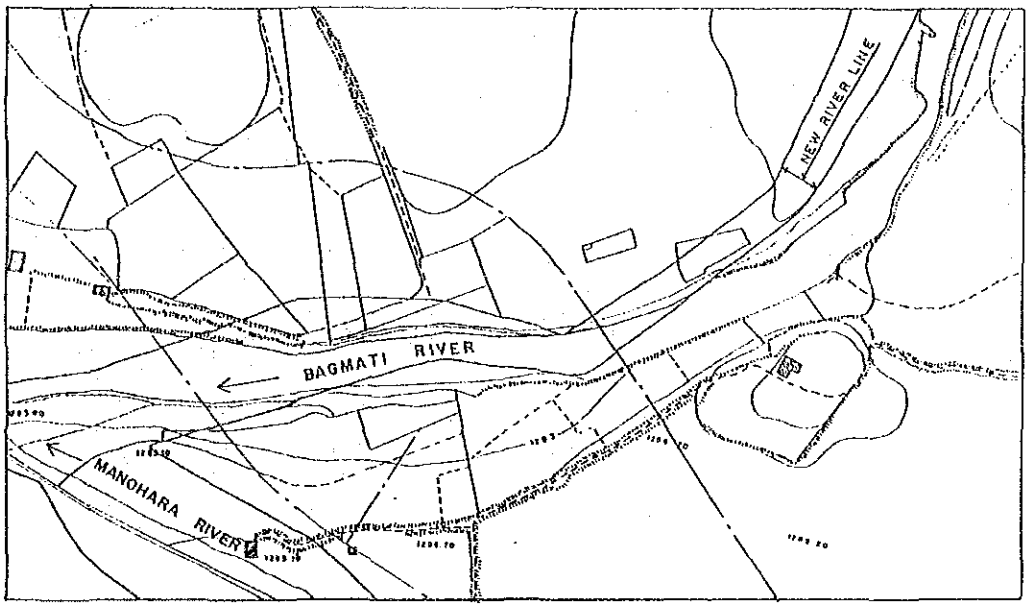


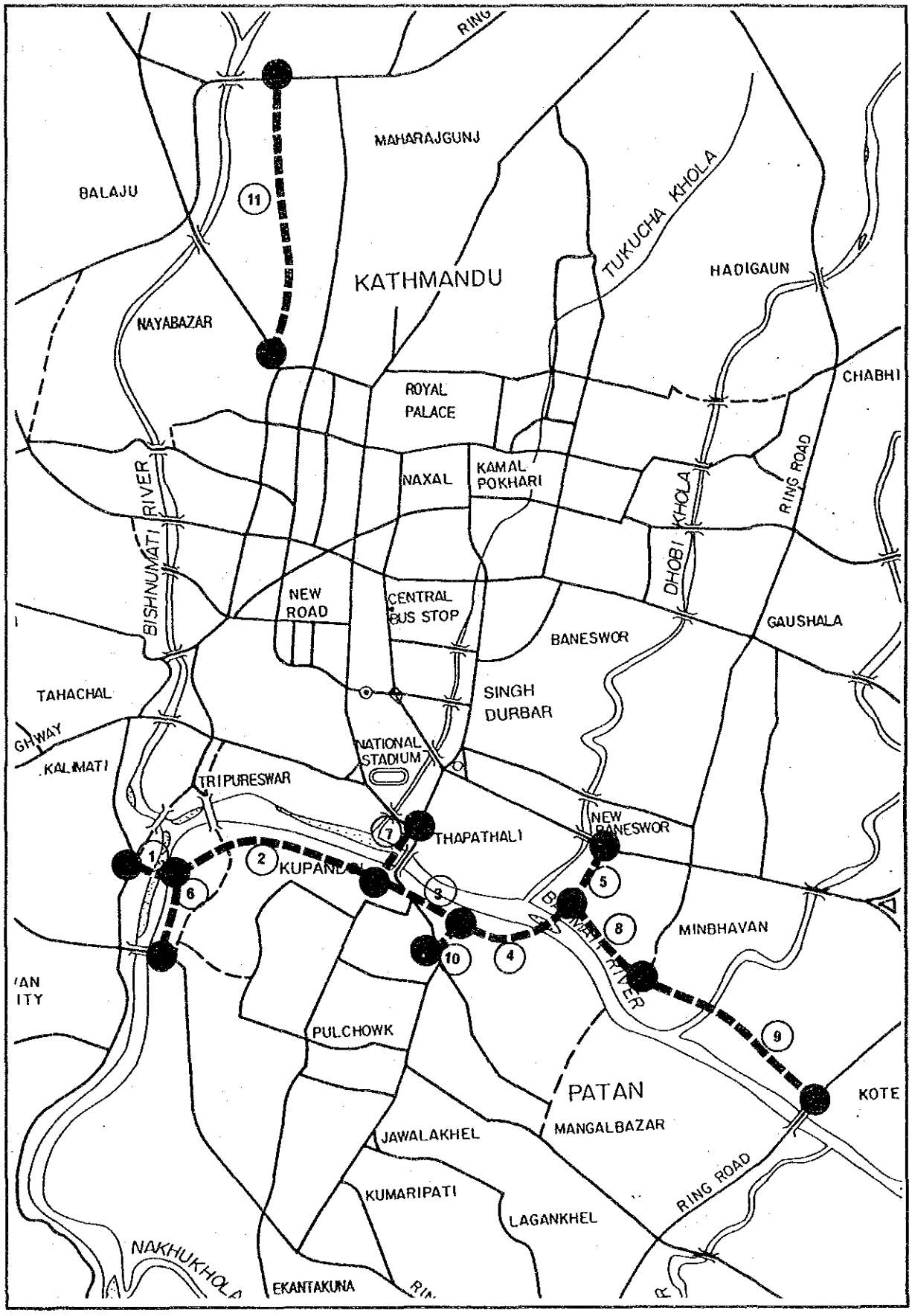
Figure A 5.2.3 (3) BAGMATI BRIDGE No.4 MAP

Appendix 5.5.2 Traffic Volume on the Project Roads

TRAFFIC VOLUME ON THE SECTIONS OF THE PROJECT ROADS

Section	Traffic Volume - 1997 (100Vehicles/day)						
	M/C	Taxi	Bus	P/C	Truck	Total	HV*
1	17	19	3	13	5	57	8
2	38	35	7	29	11	120	18
3	19	9	3	13	8	52	11
4	46	23	8	32	11	120	19
5	38	17	6	29	5	95	11
6	28	26	7	21	8	90	15
7	135	100	20	87	19	361	39
8	39	15	6	28	8	96	14
9	34	8	4	20	7	73	11
10	28	14	5	18	3	68	8
11	20	56	8	20	3	107	11

Section	Traffic Volume - 2002 (100Vehicles/day)						
	M/C	Taxi	Bus	P/C	Truck	Total	HV*
1	20	19	3	17	7	67	10
2	46	35	8	39	15	143	23
3	23	9	3	17	11	64	15
4	55	23	9	43	15	146	24
5	46	17	7	39	7	116	14
6	34	26	8	28	11	107	19
7	163	100	23	117	26	429	49
8	47	15	7	38	11	118	18
9	41	8	5	27	10	90	14
10	34	14	6	24	4	82	10
11	24	56	9	27	4	120	13
Growth Rate (% per annum)	3.8	0.0	2.6	6.1	6.8		
Expansion Factor (2002/1997)	1.20	1.00	1.14	1.34	1.39		



Location Map

Appendix 6.5.1 Detailed Work Quantities

Description	Unit	South link of inner ring road	Sanepa access	Patan access	Koteswor access	Central bus terminal access	New bagnmati bridge Thaphatali side intersection with signal	New bagnmati bridge Patan side intersection
Clear site and stripping	m2	76,464	8,830	3,556	45,000	38,012		
Removal of existing pavement material	m3						100	100
Removal of existing bridge at Thaphatali	L.S							
Removal of existing structures	m3						100	100
Fill in soft material	m3	120,713	9,582	2,511	68,173	41,384	1,300	862
Spoil in soft material	m3	5,162	1,373	275	11,004	196	130	493
Sodding	m2	25,648	2,414	1,086	15,599	10,856		
Plant selected trees	no.	744						
Gabion	m3						50	500
Stone Masonry	m2	4,880		490			250	
Excavation in soft material for structures	m3					120		
Backfilling with selectedmaterials for structures	m3					40		
Side block	m	2,840						
Kerb stone (A)	m	2,521	990	400	4,064	3,730		
Kerb stone (B)	m	1,345			150		400	450
Kerb stone for bridge	m							
Pipe culvert D300	m	1,155	188	80	1,600	750		
Pipe culvert D600	m	1,720	240	200	1,060	760	100	50
Pipe culvert D1000	m	205	74		81	133	80	
U shaped drain ditch (0.3 x 0.3m)	m		940	365				
U shaped drain ditch (0.5 x 0.5m)	m	3,167			3,615	3,572		
U shaped drain ditch (1.0 x 1.0m)	m	300				132		
Side drain with stone pitching	m	1,934						
Catch pit	no.	135	47	20	206	187	20	23
Manhole	no.	96	102	4	114	90	4	
Subbase course	m3	12,831	638	423	2,894	4,875	290	197
Base course	m3	11,134	552	368	2,504	4,219	310	164
Prime coat, 1.0 litre/m2	m2	34,400	4,880	1,600	22,140	18,650	4,185	2,408
Tack coat, 0.4litre/m2	m2	68,880	4,880	1,600	22,140	18,650	4,185	2,408
Asphalt concrete binder course t=6cm	m2		4,880	1,600	22,140	18,650	2,910	1,750
Asphalt concrete binder course t=10cm	m2	34,440					1,280	660
Asphalt concrete surfase course t=4cm	m2		4,880	1,600	22,140	18,650	2,910	1,750
Asphalt concrete surfase course t=5cm	m2	34,440					1,280	660
Side walk t=13cm	m2	17,220	2,440	1,600	11,070	9,325	1,076	750
Road lighting	no.	32					18	10
Traffic signal	portion	4	1	1	1	2	1	
Lane marking 15cm	m	11,721	1,575	690	6,681	5,775	1,120	700
Information sign	no.	19	3	3	3	6	4	
Steel pile D800	m							
Steel pile D500								
Concrete class-A, 240kg	m3					73		
Concrete class-C, 180kg	m3					8		
Formwork for superstructures	m2							
Formwork for all structures other than superstructur	m2					245		
Reinforcement	ton					8		
Prate girder (material,assemble,transportation,electi	ton							
Bridge railing	m							
Excavation for diversion of the river	m3							
Construction and removal of temporary road	m3							
Temporary bridge	m							
Steel sheet pile	m							

Bagmati bridge No.1	Bagmati bridge No.2	Bagmati bridge No.3	Bagmati bridge No.4	Pedestrian bridge at Thaphatali	Pedestrian bridge at Patan with signal	Check dam at Bagmati bridge No.2	Demolishing of existing old truss bridge	TOTAL
								171,862
								200
							1	1
								200
								244,525
								18,633
								55,603
								744
950	1,060	2,010	620			2,100		7,290
66		190	250			1,000		7,126
5,480	4,980	3,110	2,630	630	800	9,000		26,750
4,290	3,300	2,410	2,020	160	200	7,000		19,420
								2,840
								11,705
								2,345
306	276	240	120					942
								3,773
								4,130
								573
								1,305
								10,354
								432
								1,934
								638
								410
								22,148
								19,251
1,200	1,380	960	480					92,283
								122,743
								51,930
								36,380
1,200	1,380	960	480	410	570			56,930
								36,380
765	414	600	300					45,560
	4							64
					1			11
153	138	120	60					28,733
								38
3,060	1,680	1,414	1,530					7,684
				1,640	1,840			3,480
2,050	1,840	1,470	970	330	450			7,183
55	850	35	30	23	30	2,263		3,294
2,280	2,170	1,820	910					7,180
1,580	1,940	1,300	880	300	410	6,466		13,121
250	230	195	112	20	27			842
292	268	234	117	137	152			1,200
306	276	240	120					942
2,680								2,680
3,750		4,540	1,670					9,960
12	70							82
	3,960					4,300		8,260

Appendix 6.6.1

(1) Cost of Inner Ring Road including Checkdam

Unit : NRs.

Description	Unit	Quantity	Unit Cost		Amount		
			Foreign Portion	Local Portion	Foreign Portion	Local Portion	Total
Clear site and stripping	m2	76,464	16	4	1,223,424	305,856	1529280
Removal of existing pavement material	m3		308	77	0	0	0
Removal of existing bridge at Thaphatali	L.S		4,802,398	1,200,600	0	0	0
Removal of existing structures	m3		1,566	392	0	0	0
Fill in soft material	m3	120,713	335	84	40,462,998	10,115,749	50578747
Spoil in soft material	m3	5,162	241	60	1,243,010	310,752	1553762
Sodding	m2	25,648	156	39	4,001,088	1,000,272	5001360
Plant selected trees	no.	744	1,292	0	961,248	0	961248
Gabion	m3		1,957	345	0	0	0
Stone Masonry	m2	4,880	4,885	1,221	23,837,824	5,959,456	29797280
Excavation in soft material for structures	m3		40	10	0	0	0
Backfilling with selectedmaterials for structures	m3		36	9	0	0	0
Side block	m	2,840	558	239	1,584,436	679,044	2263480
Kerb stone (A)	m	2,521	1,352	580	3,409,400	1,461,172	4870572
Kerb stone (B)	m	1,345	2,668	1,143	3,588,057	1,537,739	5125795
Kerb stone for bridge	m		570	244	0	0	0
Pipe culvert D300	m	1,155	2,110	904	2,436,819	1,044,351	3481170
Pipe culvert D600	m	1,720	3,720	1,594	6,398,056	2,742,024	9140080
Pipe culvert D1000	m	205	7,445	3,191	1,526,123	654,053	2180175
U shaped drain ditch (0.3 x 0.3m)	m		1,384	593	0	0	0
U shaped drain ditch (0.5 x 0.5m)	m	3,167	1,912	820	6,056,571	2,595,673	8652244
U shaped drain ditch (1.0 x 1.0m)	m	300	4,624	1,982	1,387,260	594,540	1981800
Side drain with stone pitching	m	1,934	1,373	343	2,654,995	663,749	3318744
Catch pit	no.	135	6,811	2,919	919,485	394,065	1313550
Manhole	no.	96	11,379	4,877	1,092,403	468,173	1560576
Subbase course	m3	12,831	648	162	8,314,488	2,078,622	10393110
Base course	m3	11,134	1,173	293	13,057,955	3,264,489	16322444
Prime coat, 1.0 litre/m2	m2	34,400	33	1	1,134,512	35,088	1169600
Tack coat, 0.4litre/m2	m2	68,880	11	0	734,950	22,730	757680
Asphalt concrete binder course t=6cm	m2		577	86	0	0	0
Asphalt concrete binder course t=10cm	m2	34,440	968	145	33,348,596	4,983,124	38331720
Asphalt concrete surfase course t=4cm	m2		415	62	0	0	0
Asphalt concrete surfase course t=5cm	m2	34,440	512	77	17,648,089	2,637,071	20285160
Side walk t=13cm	m2	17,220	402	60	6,921,407	1,034,233	7955640
Road lighting	no.	32	269,413	5,498	8,621,209	175,943	8797152
Traffic signal	portion	4	4,598,410	93,845	18,393,640	375,380	18769020
Lane marking 15cm	m	11,721	54	1	631,762	12,893	644655
Information sign	no.	19	222,546	4,542	4,228,379	86,293	4314672
Steel pile D800	m		22,121	451	0	0	0
Steel pile D500			11,060	226	0	0	0
Concrete class-A, 240kg	m3		4,598	94	0	0	0
Concrete class-C, 180kg	m3		3,627	74	0	0	0
Formwork for superstructures	m2		632	271	0	0	0
Formwork for all structures other than superstructur	m2		408	175	0	0	0
Reinforcement	ton		37,914	774	0	0	0
Prate girder (material,assemble,transportation,electi	ton		488,414	25,706	0	0	0
Bridge railing	m		21,742	1,144	0	0	0
Excavation for diversion of the river	m3		40	10	0	0	0
Construction and removal of temporary road	m3		335	84	0	0	0
Temporary bridge	m		52,156	2,745	0	0	0
Steel sheet pile	m		2,673	141	0	0	0
TOTAL					215,818,182	45,232,534	261,050,716

Construction Cost of Check Dam at No. 2 Bridge

Unit : NRs.

Description	Unit	Quantity	Unit Cost		Amount		
			Foreign Portion	Local Portion	Foreign Portion	Local Portion	Total
Clear site and stripping	m2		16	4	0	0	0
Removal of existing pavement material	m3		308	77	0	0	0
Removal of existing bridge at Thaphatali	L.S		4,802,398	1,200,600	0	0	0
Removal of existing structures	m3		1,566	392	0	0	0
Fill in soft material	m3		335	84	0	0	0
Spoil in soft material	m3		241	60	0	0	0
Sodding	m2		156	39	0	0	0
Plant selected trees	no.		1,292	0	0	0	0
Gabion	m3	2,100	1,957	345	4,109,070	725,130	4,834,200
Stone Masonry	m2	1,000	4,885	1,221	4,884,800	1,221,200	6,106,000
Excavation in soft material for structures	m3	9,000	40	10	360,000	90,000	450,000
Backfilling with selectedmaterials for structures	m3	7,000	36	9	252,000	63,000	315,000
Side block	m		558	239	0	0	0
Kerb stone (A)	m		1,352	580	0	0	0
Kerb stone (B)	m		2,668	1,143	0	0	0
Kerb stone for bridge	m		570	244	0	0	0
Pipe culvert D300	m		2,110	904	0	0	0
Pipe culvert D600	m		3,720	1,594	0	0	0
Pipe culvert D1000	m		7,445	3,191	0	0	0
U shaped drain ditch (0.3 x 0.3m)	m		1,384	593	0	0	0
U shaped drain ditch (0.5 x 0.5m)	m		1,912	820	0	0	0
U shaped drain ditch (1.0 x 1.0m)	m		4,624	1,982	0	0	0
Side drain with stone pitching	m		1,373	343	0	0	0
Catch pit	no.		6,811	2,919	0	0	0
Manhole	no.		11,379	4,877	0	0	0
Subbase course	m3		648	162	0	0	0
Base course	m3		1,173	293	0	0	0
Prime coat, 1.0 litre/m2	m2		33	1	0	0	0
Tack coat, 0.4litre/m2	m2		11	0	0	0	0
Asphalt concrete binder course t=6cm	m2		577	86	0	0	0
Asphalt concrete binder course t=10cm	m2		968	145	0	0	0
Asphalt concrete surfase course t=4cm	m2		415	62	0	0	0
Asphalt concrete surfase course t=5cm	m2		512	77	0	0	0
Side walk t=13cm	m2		402	60	0	0	0
Road lighting	no.		269,413	5,498	0	0	0
Traffic signal	portion		4,598,410	93,845	0	0	0
Lane marking 15cm	m		54	1	0	0	0
Information sign	no.		222,546	4,542	0	0	0
Steel pile D800	m		22,121	451	0	0	0
Steel pile D500			11,060	226	0	0	0
Concrete class-A, 240kg	m3		4,598	94	0	0	0
Concrete class-C, 180kg	m3	2,263	3,627	74	8,207,856	167,507	8,375,363
Formwork for superstructures	m2		632	271	0	0	0
Formwork for all structures other than superstructur	m2	6,466	408	175	2,638,775	1,130,903	3,769,678
Reinforcement	ton		37,914	774	0	0	0
Prate girder (material,assemble,transportation,electi	ton		488,414	25,706	0	0	0
Bridge railing	m		21,742	1,144	0	0	0
Excavation for diversion of the river	m3		40	10	0	0	0
Construction and removal of temporary road	m3		335	84	0	0	0
Temporary bridge	m		52,156	2,745	0	0	0
Steel sheet pile	m	4,300	2,673	141	11,495,190	605,010	12,100,200
TOTAL					31,947,690	4,002,751	35,950,441

Appendix 6.6.1 (2) Cost of Access (Sanepa, Koteswor, Patan Core and New Bus Terminal Access)

Construction Cost of Sanepa Access

Unit : NRs.

Description	Unit	Quantity	Unit Cost		Amount		
			Foreign Portion	Local Portion	Foreign Portion	Local Portion	Total
Clear site and stripping	m2	8,830	16	4	141,280	35,320	176600
Removal of existing pavement material	m3		308	77	0	0	0
Removal of existing bridge at Thaphatali	L.S		4,802,398	1,200,600	0	0	0
Removal of existing structures	m3		1,566	392	0	0	0
Fill in soft material	m3	9,582	335	84	3,211,886	802,972	4014858
Spoil in soft material	m3	1,373	241	60	330,618	82,655	413273
Sodding	m2	2,414	156	39	376,584	94,146	470730
Plant selected trees	no.		1,292	0	0	0	0
Gabion	m3		1,957	345	0	0	0
Stone Masonry	m2		4,885	1,221	0	0	0
Excavation in soft material for structures	m3		40	10	0	0	0
Backfilling with selectedmaterials for structures	m3		36	9	0	0	0
Side block	m		558	239	0	0	0
Kerb stone (A)	m	990	1,352	580	1,338,876	573,804	1912680
Kerb stone (B)	m		2,668	1,143	0	0	0
Kerb stone for bridge	m		570	244	0	0	0
Pipe culvert D300	m	188	2,110	904	396,642	169,990	566632
Pipe culvert D600	m	240	3,720	1,594	892,752	382,608	1275360
Pipe culvert D1000	m	74	7,445	3,191	550,893	236,097	786990
U shaped drain ditch (0.3 x 0.3m)	m	940	1,384	593	1,300,866	557,514	1858380
U shaped drain ditch (0.5 x 0.5m)	m		1,912	820	0	0	0
U shaped drain ditch (1.0 x 1.0m)	m		4,624	1,982	0	0	0
Side drain with stone pitching	m		1,373	343	0	0	0
Catch pit	no.	47	6,811	2,919	320,117	137,193	457310
Manhole	no.	102	11,379	4,877	1,160,678	497,434	1658112
Subbase course	m3	638	648	162	413,424	103,356	516780
Base course	m3	552	1,173	293	647,386	161,846	809232
Prime coat, 1.0 litre/m2	m2	4,880	33	1	160,942	4,978	165920
Tack coat, 0.4litre/m2	m2	4,880	11	0	52,070	1,610	53680
Asphalt concrete binder course t=6cm	m2	4,880	577	86	2,814,833	420,607	3235440
Asphalt concrete binder course t=10cm	m2		968	145	0	0	0
Asphalt concrete surfase course t=4cm	m2	4,880	415	62	2,025,151	302,609	2327760
Asphalt concrete surfase course t=5cm	m2		512	77	0	0	0
Side walk t=13cm	m2	2,440	402	60	980,734	146,546	1127280
Road lighting	no.		269,413	5,498	0	0	0
Traffic signal	portion	1	4,598,410	93,845	4,598,410	93,845	4692255
Lane marking 15cm	m	1,575	54	1	84,893	1,733	86625
Information sign	no.	3	222,546	4,542	667,639	13,625	681264
Steel pile D800	m		22,121	451	0	0	0
Steel pile D500			11,060	226	0	0	0
Concrete class-A, 240kg	m3		4,598	94	0	0	0
Concrete class-C, 180kg	m3		3,627	74	0	0	0
Formwork for superstructures	m2		632	271	0	0	0
Formwork for all structures other than superstructur	m2		408	175	0	0	0
Reinforcement	ton		37,914	774	0	0	0
Prate girder (material,assemble,transportation,electi	ton		488,414	25,706	0	0	0
Bridge railing	m		21,742	1,144	0	0	0
Excavation for diversion of the river	m3		40	10	0	0	0
Construction and removal of temporary road	m3		335	84	0	0	0
Temporary bridge	m		52,156	2,745	0	0	0
Steel sheet pile	m		2,673	141	0	0	0
TOTAL					22,466,674	4,820,487	27,287,161

Construction Cost of Koteswor Access

Unit : NRs.

Description	Unit	Quantity	Unit Cost		Amount		
			Foreign Portion	Local Portion	Foreign Portion	Local Portion	Total
Clear site and stripping	m2	45,000	16	4	720,000	180,000	900000
Removal of existing pavement material	m3		308	77	0	0	0
Removal of existing bridge at Thaphatali	L.S		4,802,398	1,200,600	0	0	0
Removal of existing structures	m3		1,566	392	0	0	0
Fill in soft material	m3	68,173	335	84	22,851,590	5,712,897	28564487
Spoil in soft material	m3	11,004	241	60	2,649,763	662,441	3312204
Sodding	m2	15,599	156	39	2,433,444	608,361	3041805
Plant selected trees	no.		1,292	0	0	0	0
Gabion	m3		1,957	345	0	0	0
Stone Masonry	m2		4,885	1,221	0	0	0
Excavation in soft material for structures	m3		40	10	0	0	0
Backfilling with selectedmaterials for structures	m3		36	9	0	0	0
Side block	m		558	239	0	0	0
Kerb stone (A)	m	4,064	1,352	580	5,496,154	2,355,494	7851648
Kerb stone (B)	m	150	2,668	1,143	400,155	171,495	571650
Kerb stone for bridge	m		570	244	0	0	0
Pipe culvert D300	m	1,600	2,110	904	3,375,680	1,446,720	4822400
Pipe culvert D600	m	1,060	3,720	1,594	3,942,988	1,689,852	5632840
Pipe culvert D1000	m	81	7,445	3,191	603,005	258,431	861435
U shaped drain ditch (0.3 x 0.3m)	m		1,384	593	0	0	0
U shaped drain ditch (0.5 x 0.5m)	m	3,615	1,912	820	6,913,326	2,962,854	9876180
U shaped drain ditch (1.0 x 1.0m)	m		4,624	1,982	0	0	0
Side drain with stone pitching	m		1,373	343	0	0	0
Catch pit	no.	206	6,811	2,919	1,403,066	601,314	2004380
Manhole	no.	114	11,379	4,877	1,297,229	555,955	1853184
Subbase course	m3	2,894	648	162	1,875,312	468,828	2344140
Base course	m3	2,504	1,173	293	2,936,691	734,173	3670864
Prime coat, 1.0 litre/m2	m2	22,140	33	1	730,177	22,583	752760
Tack coat, 0.4litre/m2	m2	22,140	11	0	236,234	7,306	243540
Asphalt concrete binder course t=6cm	m2	22,140	577	86	12,770,573	1,908,247	14678820
Asphalt concrete binder course t=10cm	m2		968	145	0	0	0
Asphalt concrete surfase course t=4cm	m2	22,140	415	62	9,187,879	1,372,901	10560780
Asphalt concrete surfase course t=5cm	m2		512	77	0	0	0
Side walk t=13cm	m2	11,070	402	60	4,449,476	664,864	5114340
Road lighting	no.		269,413	5,498	0	0	0
Traffic signal	portion	1	4,598,410	93,845	4,598,410	93,845	4692255
Lane marking 15cm	m	6,681	54	1	360,106	7,349	367455
Information sign	no.	3	222,546	4,542	667,639	13,625	681264
Steel pile D800	m		22,121	451	0	0	0
Steel pile D500			11,060	226	0	0	0
Concrete class-A, 240kg	m3		4,598	94	0	0	0
Concrete class-C, 180kg	m3		3,627	74	0	0	0
Formwork for superstructures	m2		632	271	0	0	0
Formwork for all structures other than superstructur	m2		408	175	0	0	0
Reinforcement	ton		37,914	774	0	0	0
Prate girder (material,assemble,transportation,electi	ton		488,414	25,706	0	0	0
Bridge railing	m		21,742	1,144	0	0	0
Excavation for diversion of the river	m3		40	10	0	0	0
Construction and removal of temporary road	m3		335	84	0	0	0
Temporary bridge	m		52,156	2,745	0	0	0
Steel sheet pile	m		2,673	141	0	0	0
TOTAL					89,898,895	22,499,536	112,398,431

Construction Cost of Patan Access

Unit : NRs.

Description	Unit	Quantity	Unit Cost		Amount		
			Foreign Portion	Local Portion	Foreign Portion	Local Portion	Total
Clear site and stripping	m2	3,556	16	4	56,896	14,224	71120
Removal of existing pavement material	m3		308	77	0	0	0
Removal of existing bridge at Thaphatali	L.S		4,802,398	1,200,600	0	0	0
Removal of existing structures	m3		1,566	392	0	0	0
Fill in soft material	m3	2,511	335	84	841,687	210,422	1052109
Spoil in soft material	m3	275	241	60	66,220	16,555	82775
Sodding	m2	1,086	156	39	169,416	42,354	211770
Plant selected trees	no.		1,292	0	0	0	0
Gabion	m3		1,957	345	0	0	0
Stone Masonry	m2	490	4,885	1,221	2,393,552	598,388	2991940
Excavation in soft material for structures	m3		40	10	0	0	0
Backfilling with selectedmaterials for structures	m3		36	9	0	0	0
Side block	m		558	239	0	0	0
Kerb stone (A)	m	400	1,352	580	540,960	231,840	772800
Kerb stone (B)	m		2,668	1,143	0	0	0
Kerb stone for bridge	m		570	244	0	0	0
Pipe culvert D300	m	80	2,110	904	168,784	72,336	241120
Pipe culvert D600	m	200	3,720	1,594	743,960	318,840	1062800
Pipe culvert D1000	m		7,445	3,191	0	0	0
U shaped drain ditch (0.3 x 0.3m)	m	365	1,384	593	505,124	216,482	721605
U shaped drain ditch (0.5 x 0.5m)	m		1,912	820	0	0	0
U shaped drain ditch (1.0 x 1.0m)	m		4,624	1,982	0	0	0
Side drain with stone pitching	m		1,373	343	0	0	0
Catch pit	no.	20	6,811	2,919	136,220	58,380	194600
Manhole	no.	4	11,379	4,877	45,517	19,507	65024
Subbase course	m3	423	648	162	274,104	68,526	342630
Base course	m3	368	1,173	293	431,590	107,898	539488
Prime coat, 1.0 litre/m2	m2	1,600	33	1	52,768	1,632	54400
Tack coat, 0.4litre/m2	m2	1,600	11	0	17,072	528	17600
Asphalt concrete binder course t=6cm	m2	1,600	577	86	922,896	137,904	1060800
Asphalt concrete binder course t=10cm	m2		968	145	0	0	0
Asphalt concrete surfase course t=4cm	m2	1,600	415	62	663,984	99,216	763200
Asphalt concrete surfase course t=5cm	m2		512	77	0	0	0
Side walk t=13cm	m2	1,600	402	60	643,104	96,096	739200
Road lighting	no.		269,413	5,498	0	0	0
Traffic signal	portion	1	4,598,410	93,845	4,598,410	93,845	4692255
Lane marking 15cm	m	690	54	1	37,191	759	37950
Information sign	no.	3	222,546	4,542	667,639	13,625	681264
Steel pile D800	m		22,121	451	0	0	0
Steel pile D500			11,060	226	0	0	0
Concrete class-A, 240kg	m3		4,598	94	0	0	0
Concrete class-C, 180kg	m3		3,627	74	0	0	0
Formwork for superstructures	m2		632	271	0	0	0
Formwork for all structures other than superstructur	m2		408	175	0	0	0
Reinforcement	ton		37,914	774	0	0	0
Prate girder (material,assemble,transportation,electi	ton		488,414	25,706	0	0	0
Bridge railing	m		21,742	1,144	0	0	0
Excavation for diversion of the river	m3		40	10	0	0	0
Construction and removal of temporary road	m3		335	84	0	0	0
Temporary bridge	m		52,156	2,745	0	0	0
Steel sheet pile	m		2,673	141	0	0	0
TOTAL					13,977,094	2,419,356	16,396,450

Construction Cost of Central Bus Terminal Access

Unit : NRs.

Description	Unit	Quantity	Unit Cost		Amount		
			Foreign Portion	Local Portion	Foreign Portion	Local Portion	Total
Clear site and stripping	m2	38,012	16	4	608,192	152,048	760240
Removal of existing pavement material	m3		308	77	0	0	0
Removal of existing bridge at Thaphatali	L.S		4,802,398	1,200,600	0	0	0
Removal of existing structures	m3		1,566	392	0	0	0
Fill in soft material	m3	41,384	335	84	13,871,917	3,467,979	17339896
Spoil in soft material	m3	196	241	60	47,197	11,799	58996
Sodding	m2	10,856	156	39	1,693,536	423,384	2116920
Plant selected trees	no.		1,292	0	0	0	0
Gabion	m3		1,957	345	0	0	0
Stone Masonry	m2		4,885	1,221	0	0	0
Excavation in soft material for structures	m3	120	40	10	4,800	1,200	6000
Backfilling with selectedmaterials for structures	m3	40	36	9	1,440	360	1800
Side block	m		558	239	0	0	0
Kerb stone (A)	m	3,730	1,352	580	5,044,452	2,161,908	7206360
Kerb stone (B)	m		2,668	1,143	0	0	0
Kerb stone for bridge	m		570	244	0	0	0
Pipe culvert D300	m	750	2,110	904	1,582,350	678,150	2260500
Pipe culvert D600	m	760	3,720	1,594	2,827,048	1,211,592	4038640
Pipe culvert D1000	m	133	7,445	3,191	990,119	424,337	1414455
U shaped drain ditch (0.3 x 0.3m)	m		1,384	593	0	0	0
U shaped drain ditch (0.5 x 0.5m)	m	3,572	1,912	820	6,831,093	2,927,611	9758704
U shaped drain ditch (1.0 x 1.0m)	m	132	4,624	1,982	610,394	261,598	871992
Side drain with stone pitching	m		1,373	343	0	0	0
Catch pit	no.	187	6,811	2,919	1,273,657	545,853	1819510
Manhole	no.	90	11,379	4,877	1,024,128	438,912	1463040
Subbase course	m3	4,875	648	162	3,159,000	789,750	3948750
Base course	m3	4,219	1,173	293	4,948,043	1,237,011	6185054
Prime coat, 1.0 litre/m2	m2	18,650	33	1	615,077	19,023	634100
Tack coat, 0.4litre/m2	m2	18,650	11	0	198,996	6,155	205150
Asphalt concrete binder course t=6cm	m2	18,650	577	86	10,757,507	1,607,444	12364950
Asphalt concrete binder course t=10cm	m2		968	145	0	0	0
Asphalt concrete surfase course t=4cm	m2	18,650	415	62	7,739,564	1,156,487	8896050
Asphalt concrete surfase course t=5cm	m2		512	77	0	0	0
Side walk t=13cm	m2	9,325	402	60	3,748,091	560,060	4308150
Road lighting	no.		269,413	5,498	0	0	0
Traffic signal	portion	2	4,598,410	93,845	9,196,820	187,690	9384510
Lane marking 15cm	m	5,775	54	1	311,273	6,353	317625
Information sign	no.	6	222,546	4,542	1,335,277	27,251	1362528
Steel pile D800	m		22,121	451	0	0	0
Steel pile D500			11,060	226	0	0	0
Concrete class-A, 240kg	m3	73	4,598	94	335,666	6,850	342516
Concrete class-C, 180kg	m3	8	3,627	74	29,016	592	29608
Formwork for superstructures	m2		632	271	0	0	0
Formwork for all structures other than superstructur	m2	245	408	175	99,985	42,851	142835
Reinforcement	ton	8	37,914	774	303,314	6,190	309504
Prate girder (material,assemble,transportation,electi	ton		488,414	25,706	0	0	0
Bridge railing	m		21,742	1,144	0	0	0
Excavation for diversion of the river	m3		40	10	0	0	0
Construction and removal of temporary road	m3		335	84	0	0	0
Temporary bridge	m		52,156	2,745	0	0	0
Steel sheet pile	m		2,673	141	0	0	0
TOTAL					79,187,948	18,360,435	97,548,383