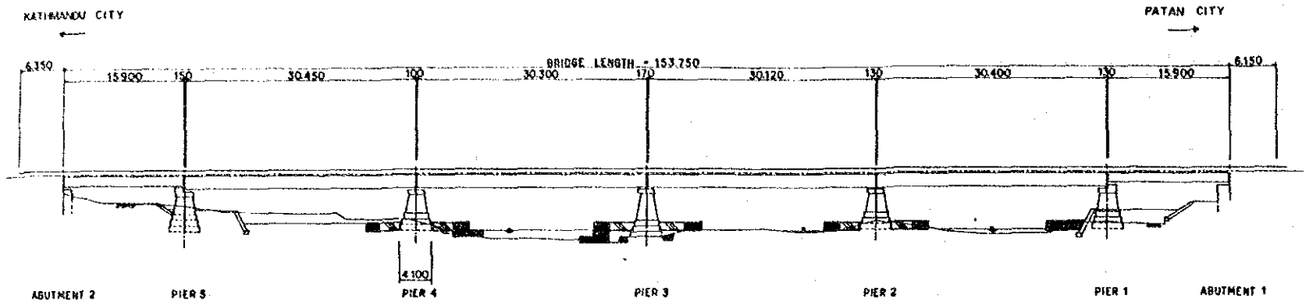
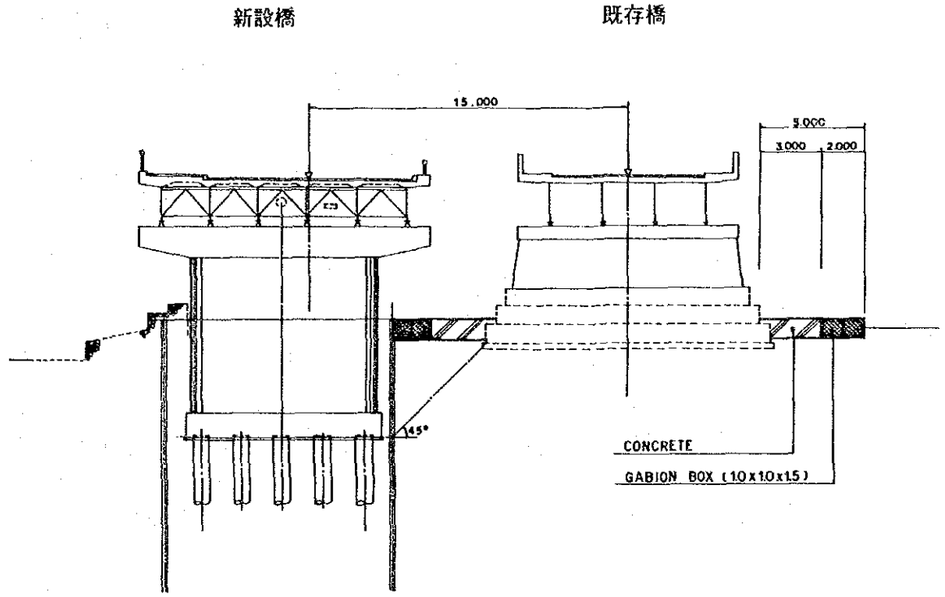
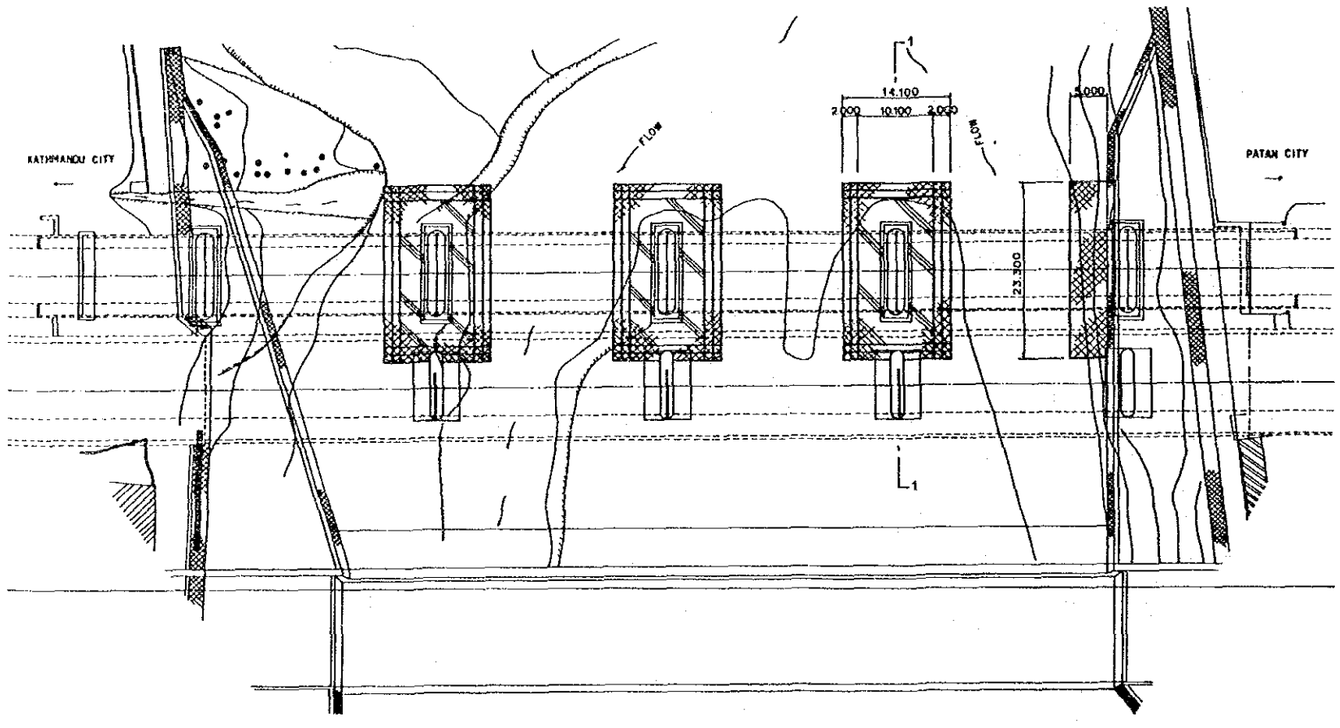
側面図 SCALE 1:400



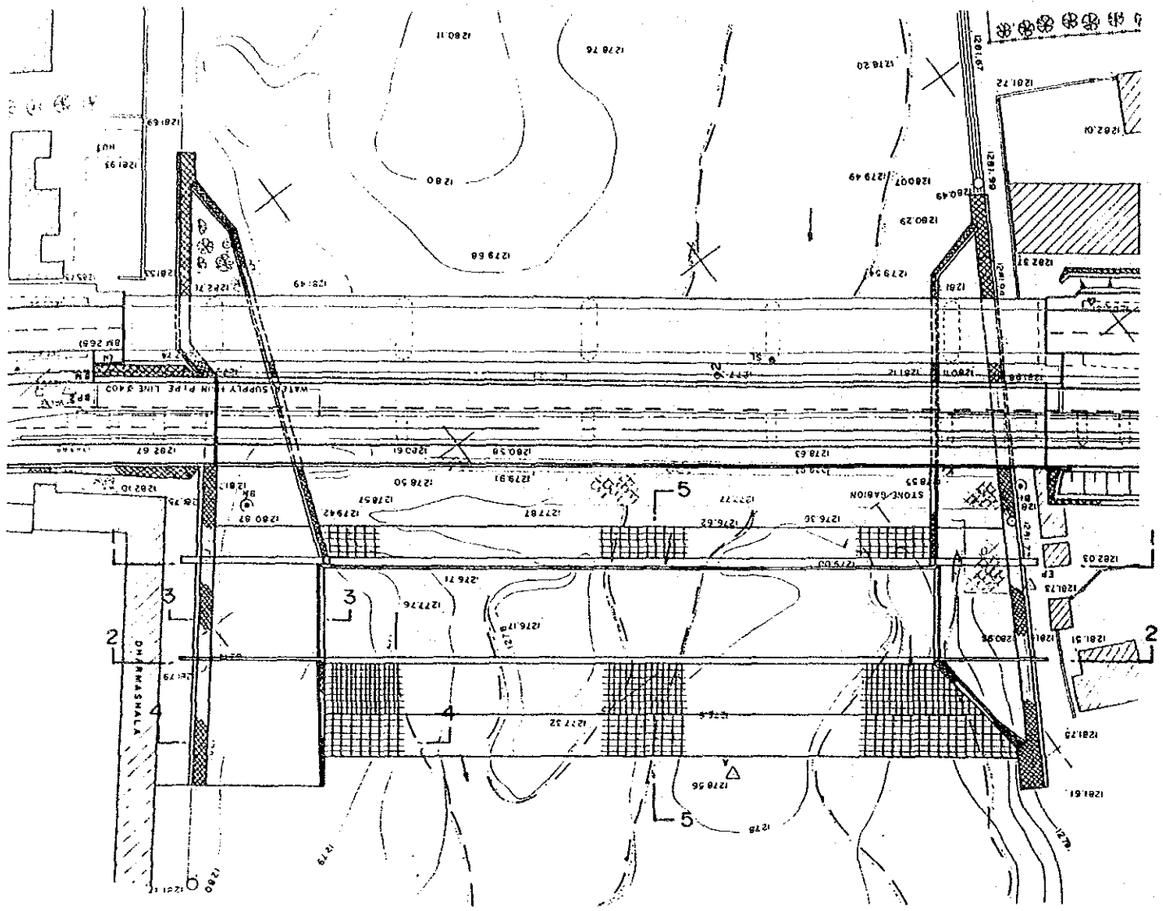
1－1 断面 SCALE 1:150



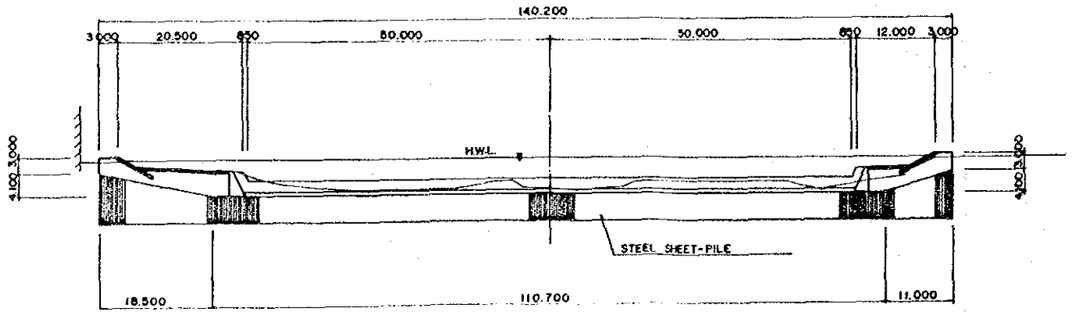
平面図 SCALE 1:400



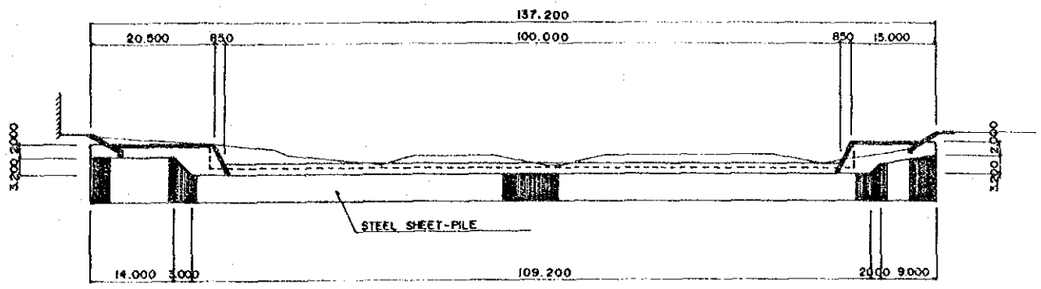
ネパール王国 公共運輸事業省 道路局	基本設計調査報告書 新バグマティ橋建設計画	国際協力事業団	図5.7 現バグマティ橋補修一般図	DATE OCTOBER 1993	SHEET NO.



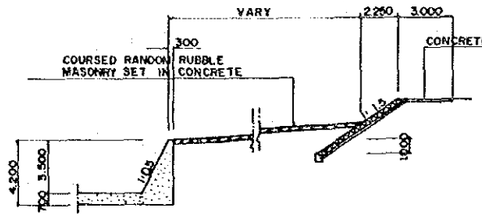
平面図　SCALE 1:500



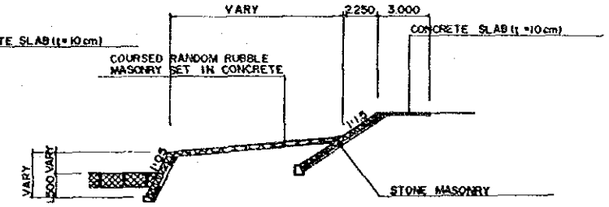
1-1　断面　SCALE 1:500



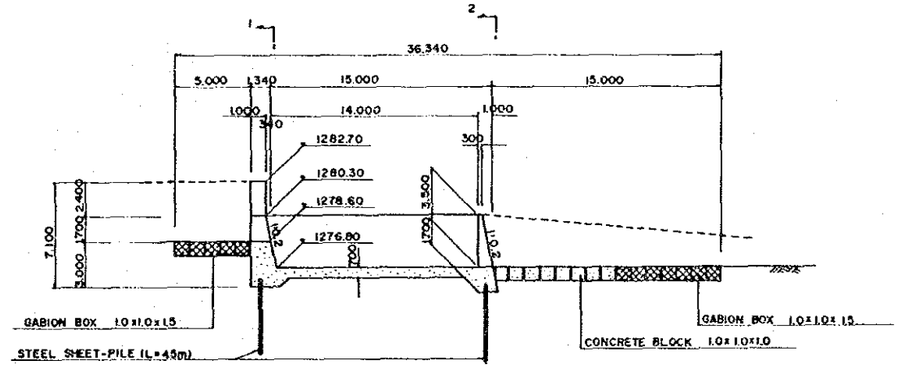
2-2　断面



3-3　断面

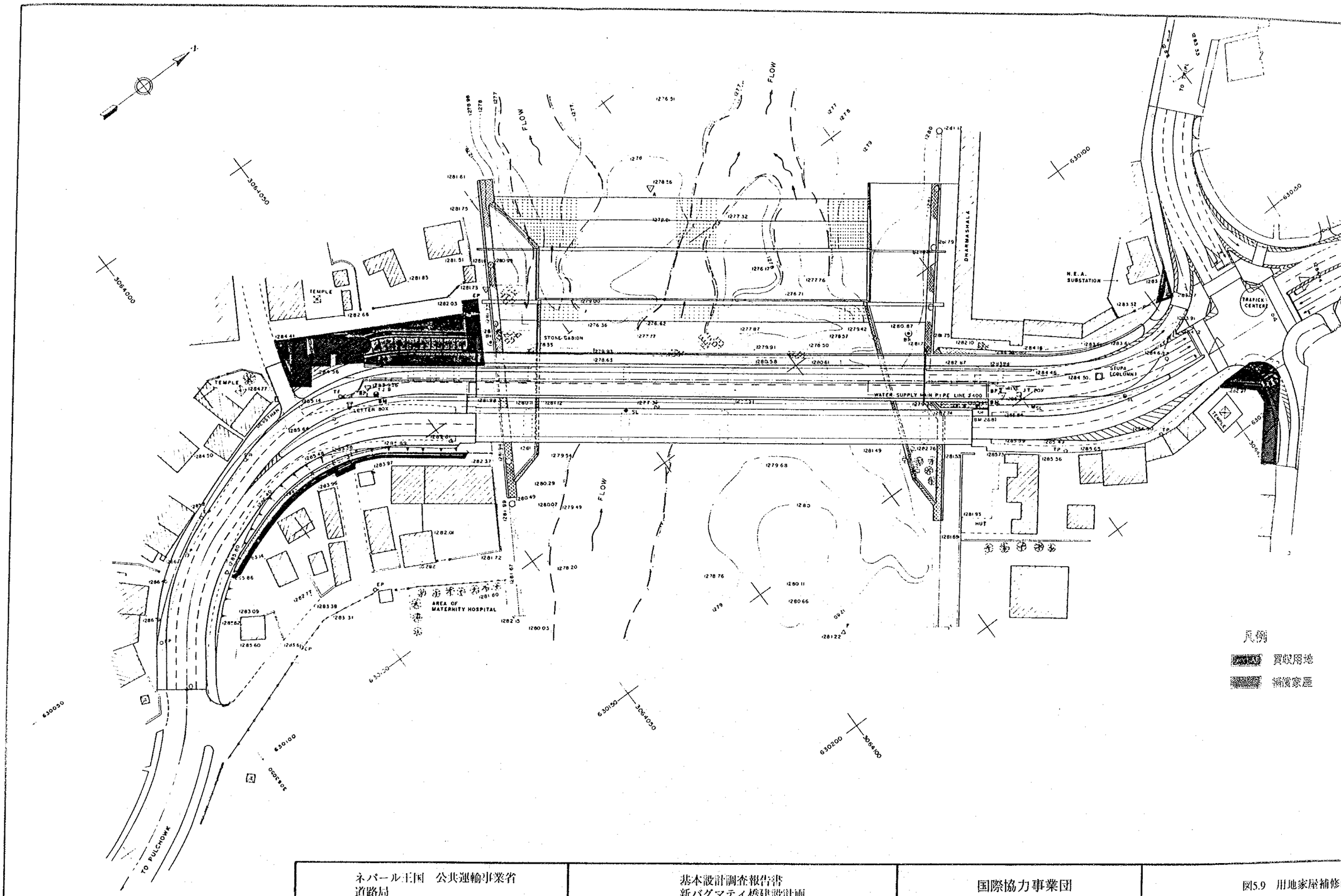


4-4　断面

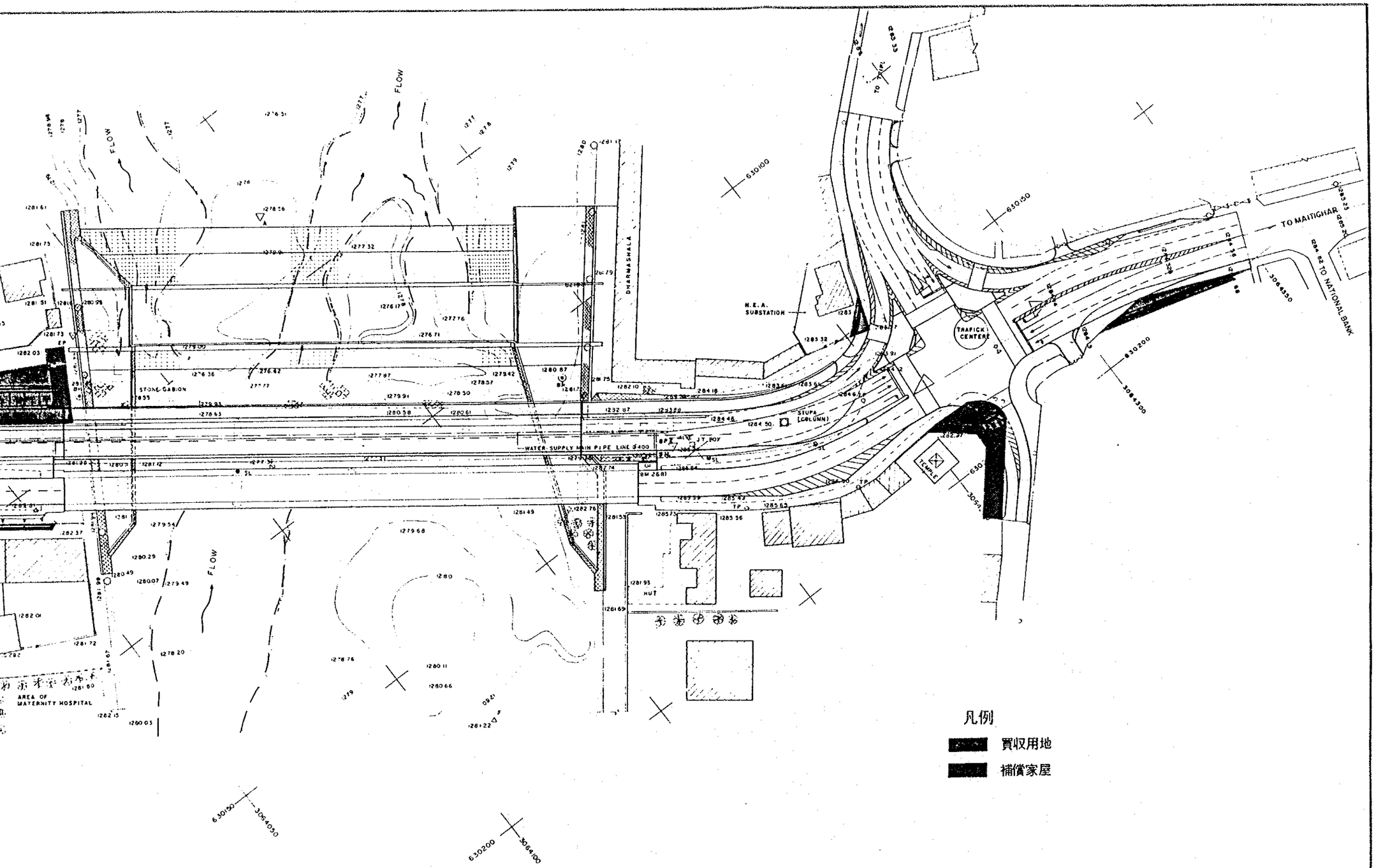


5-5　断面

ネパール王国　公共運輸事業省 道路局	基本設計調査報告書 新バグマティ橋建設計画	国際協力事業団	図5.8　河床低下防止工＆河川堤防保護	DATE OCTOBER 1993	SHEET NO.



ネパール王国　公共運輸航業省 道路局	基本設計調査報告書 新バグマティ橋建設計画	国際協力事業団	図5.9　用地家屋補修図



国　公共運輸事業省	基本設計調査報告書 新バグマティ橋建設計画	国際協力事業団	図5.9　用地家屋補修図	DATE OCTOBER 1993	SHEET NO.

5.6 施工計画

5.6.1 施工方針

計画の対象となっている新バグマティ橋は、カトマンドゥおよびラリトプール市を結ぶ最も重要な幹線道路であり、カトマンドゥ市内を流れる最大河川にかかる橋梁である。交通量はカトマンドゥ市内の幹線道路のうち、最も多い1日当たり48,000台の交通量があり、朝夕のラッシュ時の交通混雑は激しい。

本計画は、新橋の建設のみならず、隣接するタパタリ交差点の改良、現バグマティ橋の補修、バグマティ川の河床低下防止工などを含んでおり、これらに対する影響を十分考慮した施工計画が必要である。

(1) 新バグマティ橋建設

- 新バグマティ橋の建設中、一般の交通車両は従来通り現バグマティ橋を利用できるので、一般車輌に対する直接的な影響はないが、建設機械の搬入時には、ガードマンを配置するなどして、一般車や歩行者などに対する安全を確保する。
- タパタリ側橋台近くには寺院があり、建設物に対する振動、騒音による被害を与えないよう配慮する。
- 河川敷における下部工施工および上部工桁の仮組み時は、雨期における出水に対して充分配慮し、6月～9月の間は施工をひかえる。
- 現バグマティ橋は杭がない直接基礎であるため、近接施工の影響がでないよう新橋の下部工の施工には、既設橋への影響がないよう仮設計画には十分な配慮をする。
- 新橋建設に伴い撤去される予定のトラス橋には、水道本管など公共施設が添架されており、一時的に現バグマティ橋に移設する必要があるが、移設の際には関係官庁、住民の協力を得るよう十分な連絡を行なう。

(2) タパタリ交差点改良

- タパタリ交差点は一日当たりの交通量が48,000台と多いので、工事中の一般車両への影響をできるだけ少なくするため、施工規模を小さくし、交差点の工期設定にはゆとりのある計画とする。逆に最終の仕上げとなる舗装工事を行なう期間は、一般車両への影響を最小とするため、十分な照明施設を配置して夜間工事を行ない、短期間で完了するよう計画する。

- 交差点改良地域内には、位置の確定できない公共施設が多く埋設されている可能性があり、これらに対する影響を最小にするため、関係機関からの技術者派遣を要請するなど、緊密な連絡体制をとる。
- タバタリ交差点を利用する歩行者は極めて多く、これらの人に対する安全を確保するため、工事期間中ガードマンを配置する。
- タバタリ交差点を通過するトロリーバスは、電柱移設の工事期間中、一時的に運行を中止する必要があり、警察の協力を得るとともに、ラジオ、新聞などを通じてバス利用者への事前通告など行い、混乱を避ける。

(3) 現バグマティ橋の補修および河床低下防止工の設置

- 河川敷での下部工施工および上部工架設時には、雨期の出水に充分配慮し、6月～9月の間の施工はひかえる。

その他、全般的な方針として、なるべく現地労働力を利用するが、施工期間の短縮のため大型機械の使用も検討する。このため大型機械のオペレーターは機械の搬入と同時に日本人を配備し、その助手として現地技能者を使用する。

5.6.2 建設事情および施工上の留意事項

(1) 建設事情

a) 建設機械

ネパールの建設工事は、ほとんど国際機関からの援助によるもので、建設機械を所有した建設会社が存在しない。また、道路の維持、補修工事はほとんど道路局の直轄工事である。道路局には海外からの援助による建設機械（クレーン、トレーラー、クローラークレーン、ディーゼルハンマー等）があるが、道路局自体の使用計画があり、これを転用することは不可能である。市中から調達できるのはトラック、ピックアップであり、それ以外の大型建設機械は市中にて調達できない。

b) 調達可能な材料

セメント： 最近日本の援助で完成した民間のウダイプールのセメント工場があり、国営セメント会社へクウダセメントと合わせると、生産量は十分である。また品質や強度は多少劣っているが、本プロジェクトに

使用するには十分であり、市中から調達する。

鉄筋：　インゴットを輸入し、電炉を使用して生産しており、本プロジェクトの使用量は市中から調達可能である。但し、インゴットの輸入スケジュールによっては市中の製品が不足することもある。

ギャビオン：　インドからワイヤの形で輸入しており、市中から調達可能である。

粗骨材：　採石場としては、カトマンドゥの南東13kmの位置のゴダワリ、および西に10kmのタンコットがあり、量的にも、品質的にも本プロジェクトに利用可能である。

細骨材：　コンクリート用の細骨材は、これまで河川敷内の砂が利用されていたが、河川の河床低下の原因と判断され、建設用として採取するのは禁止となった。現在最も利用されているのは、バクタプールへの途中にあるティミの砂である。量的、品質的、経済的にも問題はなく利用可能である。

c) 労　務

労務者の一般的な作業時間は10:00～17:00であるが、限られた期間に施工する建設現場では8:00～17:00の労働時間を採用しており、このためには残業時間込みの労務費を重備する必要がある。また、数多くの労働力を集めるにはレーバーサプライヤーを通して行われており、交通費、宿舎、保健、道具類の供与などオーバーヘッドの費用を見込む必要がある。

d) 海外調達品の搬入

日本からの調達資機材は、日本からインドのカルカッタまで海上輸送され、カトマンドゥまで陸送輸送となる。カトマンドゥに入るまでの道路事情によりトレーラーでの輸送可能な部材の寸法は最大12mとされている。これは架橋現場まで搬入可能な寸法である。

(2) 施工上の留意点

上述した建設事情と計画地域の自然条件などを考慮して、次の述べる事項に留意して施工を行う。

a) 雨期の資機材搬入は、インドからカトマンドゥまでの道路事情（通行止めとなる場合もある）を配慮し、充分余裕のあるものとする。
b) 乾期に作業が集中するので材料、機械、労務の手配を計画的に行う。
c) 現地にて調達可能な建設機械が少ないので、工程に大きく影響する主要な建設機械は日本から調達する。
d) カトマンドゥ市内の橋梁架け替え工事は、日本のみならず世銀の援助でも行なわれてきており、現地の上級労務者や職工などはかなり育成されていると判断し、インドなどの外国からの調達を前提にせず、現地カトマンドゥでの調達を前提とする。

5.6.3 施工管理計画

(1) 実施設計、施工監理の基本方針

本計画の実施設計は、基本設計を行なったコンサルタントが行なうのが、設計期間の短縮、費用節減の観点から望ましい。また実施設計期間中、できるだけローカルコンサルタントを補助として雇用し技術移転を図る。

施工監理においても上述したごとく、実施設計を行なったコンサルタントが行なうことが、工事期間中に発生する問題点を的確にかつ敏速に処理する上で望ましい。また、実施設計と同様にローカルコンサルタントを補助として参加させ技術移転を図る。

(2) 実施設計体制

実施設計に係わるコンサルタント契約が完了した後、直ちに実施設計、入札図書の作成を開始する。これらの作業には日本人スタッフで構成される下記の専門家が必要である。

(a) 総括

(b) 橋梁上部工設計

(c) 橋梁下部工設計

(d) 道路／交差点／舗装設計

(e) 電気設備／交通信号設計

(f) 河川構造物設計

(g) 施工計画、積算

(h) 測量

(i) 入札図書作成

なお、実施設計の測量および附帯工事設計にはローカルスタッフを使用する。

(3) 施工監理体制

工事に対する入札が完了後、直ちに入札評価を行なう。工事開始後の施工監理体制として、コンサルタントから日本人の常駐監理技師と下記に示す主要工事の監督、指導要員が必要となる。なお、補助要員として現地コンサルタントを使用する。

(a) 駐在技術者

(b) 橋梁上部工・下部工専門家

(c) 道路・舗装専門家

5.6.4 資機材調達計画

(1) 資材調達

a) 現地調達資材

ネパールにて調達可能な以下の建設資材は、原則として現地調達とする。

- コンクリート及びアスファルト用粗骨材
- コンクリート及びアスファルト用細骨材
- セメント
- コンクリート製品
- 鉄筋
- ギャビオン
- 型枠
- 舗装用アスファルト

b) 日本調達資材

- 橋梁上部鋼桁及び関連資材

  鋼桁はネパールでは入手不可能である耐候性鋼材を使用するので、日本で材料を調達し、加工してネパールに搬入する。

- 道路照明、信号機器及び関連資材

  照明および信号機器については現地調達が不可能であるので、日本からの調達を前提とするが、その仕様についてはネパール側と事前に了解を得る必要がある。

c) 第三国調達

主要材料は現地および日本調達となり基本的に第三国調達はない。

(2) 建設用機械調達

カトマンドゥ市内にはトラック以外の建設用機械のリース会社がないので、主要機械はすべて日本から持ち込み、持ち帰るものとする。隣国のインドからの調達も考えられるが、道路局からの情報ではその機械類は古く、故障しやすく、作業能率の確保が困難であるとのことである。

5.6.5 実施工程

Exchange Note(E/N)を締結後、建設工事が完成までの工程を表5.7に示す。

実施設計には3ヶ月、入札を含む工事期間は21ヶ月を想定する。それぞれの主な仕事の内容を以下に示す。

(1) 実施設計

実施設計に係わるExchange Note(E/N)を締結後、ネパール政府との間で直ちにコンサルタント契約を行ない、工事着手に必要な設計図書、入札関係書類の作成を行なう。

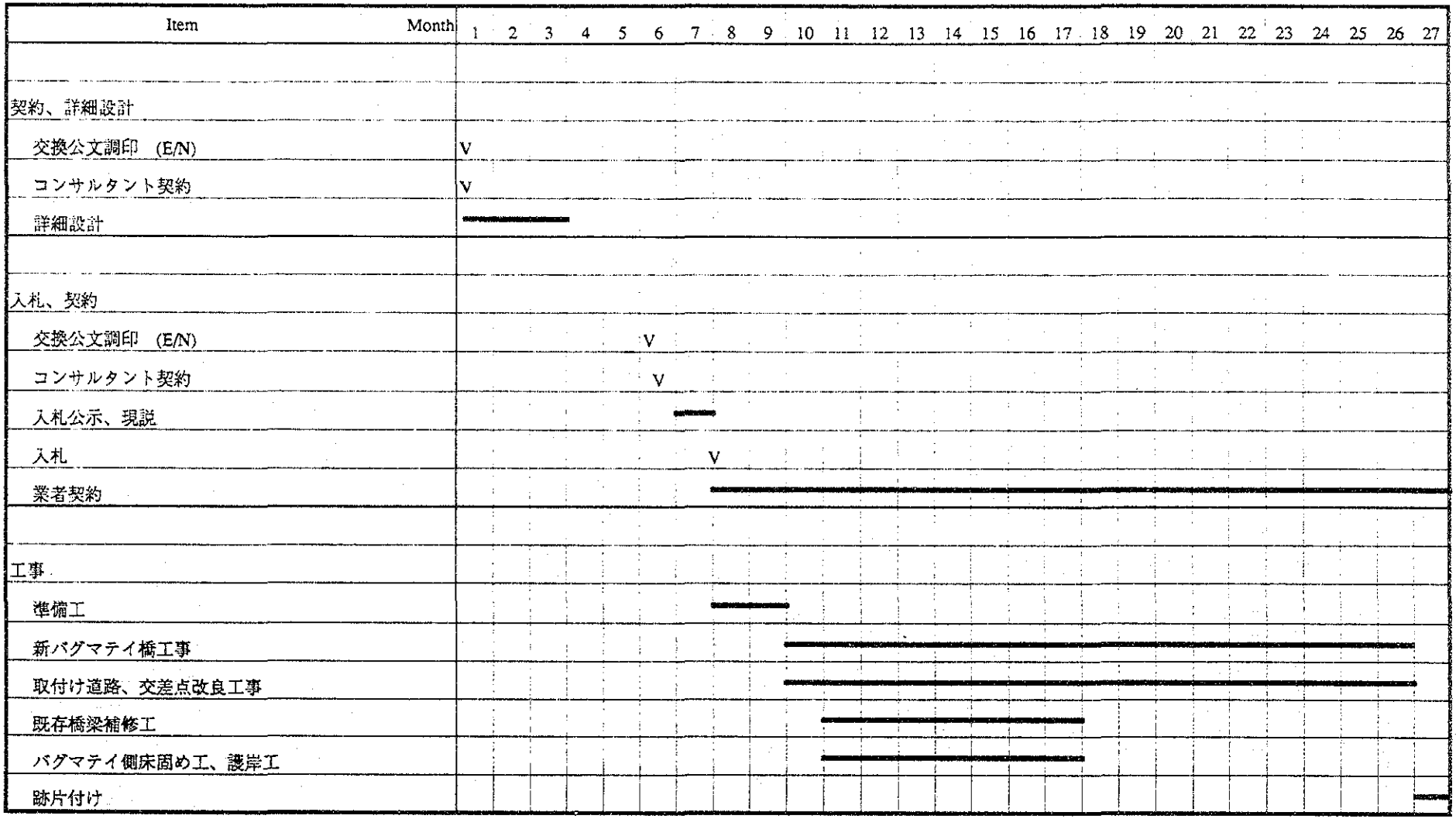
(2) 入札・契約

工事に係わるExchange Note(E/N)を締結後、ネパール政府の実施機関に代ってコンサルタントが資格審査、入札・契約業務を行なう。

(3) 建設工事

ネパール政府と建設業者の契約が締結された後、コンサルタントの監督のもとに、建設業者は仕様書に従って、品質管理、資金管理、工程管理を行ないながら、本工事に係わる契約図書で定められた工事を遂行する。

表 5.7　実 施 行 程 表


Item
Month
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
契約、詳細設計
交換公文調印 (E/N)
コンサルタント契約
詳細設計
入札、契約
交換公文調印 (E/N)
コンサルタント契約
入札公示、現説
入札
業者契約
工事
準備工
新バグマテイ橋工事
取付け道路、交差点改良工事
既存橋梁補修工
バグマテイ側床固め工、護岸工
跡片付け

5.6.6 両国政府の負担すべき工事内容

日本側負担工事

- 新バグマティ橋の建設（既存トラス橋の撤去、橋梁基礎、橋脚、橋台、上部工、橋面排水、橋面舗装の建設、取付け道路部の建設、水道本管の設置およびレーンマーク、照明の設置）
- タパタリ交差点の改良（道路舗装、歩道の移設、導流路の建設、レーンマークの設置、信号機、照明、非常電源装置などの設置）
- 現バグマティ橋の補修（既存橋梁の河川内３本の橋脚に対する床固め工、河川敷内の２本の橋脚に対する保護工の建設）
- 河床低下防止工（コンクリートチェックダム、河川堤防の保護工）
- 工事に必要な仮設道路、仮設橋、工事中の安全対策、仮設工事に係わる水、電気、電話などの費用、事務所、など一切の費用）
- 工事実施に必要なコンサルタント業務など

ネパール側の負担工事範囲

- 撤去するトラス橋から水道本管、水道管、電話線、電線の現バグマティ橋への移設
- 取付け道路およびタパタリ交差点改良に必要な用地の取得と家屋への補償
- 工事期間中の一般車両への警察による交通規制とラジオ、新聞などによる交通規制の広報およびトローリーバス運行の規制
- 撤去するトラス橋の保管場所の確保
- 完成後の適切な維持管理
- その他、建設に使用される建設資機材の免税処置、通関および内陸輸送路の確保と、業務に関連した日本人に対する関税、税金、その他財政課徴金の免除

5.6.6 概算事業費

(1) 積算の条件

a) 主要積算項目

積算は以下の項目別に算出する。

直接工事費、直接仮設費、共通仮設費、輸送梱包費、技術者派遣費、現場経費、一般管理費、設計監理業務費

b) 積算時点と使用した外国為替交換率

本計画の事業費の積算は、「カトマンズ都市交通計画調査」における積算結果（1992年10月時点）をベースとするが、現地調達資機材については、当社が実施した類似道路案件において収集した1993年3月の価格を基にレビューし、日本国にて調達する資機材については、最新の1993年9月の単価を用いて見直しを行なった。

ネパールルピー、日本円および米国ドル間の換算レートは下記の通りである。

US$ 1.00＝　¥110.78＝　NRs. 49.72、又は NRs. 1.00＝　¥2.228

(2) 本計画の総事業費

- 日本側負担分事業費　13.07 億円
- ネパール政府負担事業費　0.75 億円

(3) 事業費内訳　（単位：億円）

	日本側負担	ネパール側負担	合計
建設費	11.73	-	11.73
設計・監理費	1.34	-	1.34
用地・補償費	-	0.22	0.22
水道本管の移設、他	-	0.53	0.53
合計	13.07	0.75	13.82

5.6.7 維持管理計画

(1) 橋梁維持管理の現状

河川の河床低下による橋梁への影響を重視した道路局は、カトマンドゥ盆地内の全橋梁に対して現況をチェックし、その対応について現在検討中である。しかしながら、現時点ではこれらの橋梁についての維持管理は、予算的な制約もあり充分行なわれていない。近い将来幾つかの橋梁で転倒の危険性があり、早急な対策が必要である。

(2) 維持管理体制の設備

本計画の橋梁は道路局内のカトマンドゥ地方建設事務所（Kathmandu Regionel Office）が担当することになっているが、予算の制約から十分な管理は期待できない。工事を通して維持管理の重要性の認識を深め、予算配分の確保を行なうとともに、維持管理マニュアルの整備を図るよう提案する。

(3) 維持管理の主要点

工事完成後に行なうべき維持管理の主要な項目は次の通りである。

a) 車輌の衝突等による高欄、舗装の損傷
b) 水、塵埃による沓および主桁フランジ部の腐食
c) 洪水、河床低下による下部工の基礎周辺の局所洗掘
d) 橋梁アプローチ道路の損傷

第６章　事業の効果と結論

ネパールの首都カトマンドゥは、近年の著しい人口の増加により、首都圏の人口は100万人達し、都市の社会基盤整備が遅れ、都市地域のスプロール化、スラム化、交通混雑、公共交通施設の不足など深刻な都市問題が発生している。特に、本事業の対象となっているバグマティ橋の建設地点は、カトマンドゥ首都圏のなかで最も交通量が多く、カトマンドゥ市内の交通のボトルネックとなっている。

本事業を実施することにより、カトマンドゥ市内の交通上のボトルネックが解消され、カトマンドゥ市内の社会・経済のみならず、市民生活にも大きな事業効果を生むものと期待される。本計画の実施から、期待される直接・間接効果は以下の通りである。

(1)　本事業の実施による直接的効果

－　既存バグマティ橋は２車線の幅員であるが、同地点を通過する交通量はADT48,000台に達しており、朝夕著しい交通渋滞が慢性的に発生している。この既存橋梁に新しく２車線の橋梁を併設する事により、バグマティ川の渡河交通容量を増大し、慢性的な交通混雑の解消が図れる。

－　バグマティ橋に隣接するタパタリ交差点は、ロータリー方式の交差点であり交差点容量が小さく、橋梁部と同様に交通渋滞の原因となり、また交通事故の多発地点ともなっている。タパタリ交差点の改良は、交差点内の交通の流れをスムーズにし、交通容量を増大させ、且つ交通事故を防止する。

－　現バグマティ橋は、河床低下により橋脚転倒の危険性がある。現バグマティ橋の橋脚周辺の補修を行なうことにより、既存橋の転倒の危険性を少なくし、橋の耐用年数の延長を図る。万一現バグマティ橋が転倒した場合でも、新橋が代替橋として機能し、両地域の交通遮断によるパニックを防ぐことが出来る。

(2) 間接的効果

- 交通混雑の激しいバグマティ橋の交通渋滞が解消されることにより、急激に都市化が進むラリトプール市と、政治、経済活動の中心地であるカトマンドゥ市の両地域間に安定した幹線道路網が構築され、両地域のバランスの良い都市の発展に寄与する。

- カトマンドゥ市およびラリトプール市の都市人口約530,000人の少なくとも50%に当たる市民の通勤・通学を含む日常生活の安定に寄与する。

- 交通混雑解消によるガソリン消費の節減、時間短縮による効果により、カトマンドゥ市内の社会・経済の活性化に寄与する。

- 交通ボトルネック地点の改善により、関連する市内道路を走行する車の走行速度が上昇し、排気ガス減少による大気汚染の環境改善が期待できる。

以上のような効果を観察すれば、本計画を日本の無償資金協力により実施する事は有意義であり、本計画の早期実施が望まれる。

添付資料リスト

Appendix 1 Organization of Basic Design Team

Assignment	Name	Position
Team Leader	Katsutoshi OHTA	Professor Department of Urban Engineering Faculty of Engineering Tokyo University
Project Coordinator	Yasujiro SUZUKI	Japan International Corporation Agency
Chief Consultant	Hiroki SHINKAI	Nippon Koei Co., Ltd.

Appendix 2 Itinerary of the Study

Cumulative Days	Date	Place	Activities
1	Oct. 3 (Sun)	Tokyo ~ Bangkok	
2	4 (Mon)	Tokyo ~ Bangkok • Japanese Embassy, JICA	Courtesy call
3	5 (Tue)	Department of Roads (DOR)	Presentation and explanation of Draft Report, Discussion on Questionnaire and Reply
4	6 (Wed)	DOR	Site inspection with DOR
5	7 (Thu)	DOR	Meeting with Mayor, and other government agencies
6	8 (Fri)	DOR Japanese Embassy JICA	Signing of Minutes of Discussions Reporting the result of Minutes of Discussion
7	9 (Sat)	Kathmandu ~ Bangkok	Leaving for Tokyo
8	10 (Sun)	Bangkok ~ Tokyo	

Appendix 3 Members List of Person met during the Basic Design Study

(1) Department of Roads, Ministry of Works and Transport

(i)	Director General	: Mr. V.P. Shrestha
(ii)	Deputy Director General	: Mr. G.S. Pradhan
(iii)	Deputy Director General	: Mr. D.B. Banstola
(iv)	Deputy Director General	: Mr. M. B. Karkee
(v)	Deputy Director General	: Dr. S.B.S. Tuladhar
(vi)	Project Manager, Bridge Reconstruction Project (Phase 2)	: Mr. R.B. Dhakhar

(2) Ministry of Finance

(i)	Joint Secretary	: Mr. R.B. Bhattarai

(3) Ministry of Housing and Physical Planning

(i)	Regional Director	: Mr. B.P. Sharma

(4) National Planning Commission

(i)	Under Secretary	: Mr. S.L. Shrestha

(5) Lalitpur City

(i)	Mayor	: Mr. B.R. Shakya

(6) Embassy of Japan

(i)	Ambassador	: Mr. T. Itoh
(ii)	Councilor	: Mr. Ishikawa
(iii)	Second Secretary	: Mr. Ishiwatari

(7) JICA Kathmandu Office

(i)	Vice Representative	: Mr. Murakami
(ii)	Staff	: Mr. Masaki

MINUTES OF DISCUSSIONS ON THE BASIC DESIGN STUDY OF THE PROJECT FOR THE BRIDGE RECONSTRUCTION (PHASE 3) IN KATHMANDU VALLEY IN THE KINGDOM OF NEPAL

In response to the request of His Majesty's Government of Nepal (hereinafter referred to as HMG/N) for Grant Aid for the Project for the Bridge Reconstruction in Kathmandu (Phase 3) (hereinafter referred to as "the Project"), the Government of Japan decided to conduct a basic design study on the Project and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to the Kingdom of Nepal the study team headed by Mr. Katsutoshi OHTA, Professor, Tokyo University, from October 3 to October 10, 1993.

The team had a series of discussions on the Project with the officials concerned of HMG/N and, as a result of the discussions, both parties agreed to recommend to their respective governments that the major points of understanding reached between them, attached herewith, should be examined towards the realization of the project.

Kathmandu, October 8, 1993

Mr. Katsutoshi OHTA
Team Leader
Basic Design Study Team
JICA

Mr. V.P. SHRESTHA
Director General
Department of Roads
Ministry of Works and Transport

ATTACHMENT

1. Title of the Project

The title of the Project to be used for further implementation is "The Project for Construction of New Bagmati Bridge at Thapathali in Kathmandu".

2. Objectives of the Project

The objective of the Project is to construct the New Bagmati Bridge across the Bagmati River at Thapathali in order to remove the bottleneck of the traffic in Kathmandu City.

3. Executing Organization

The executing agency for the implementation of the Project is Department of Roads, Ministry of Works and Transport.

4. Components of the Draft Report

The Government of Nepal has agreed and accepted in principle the components of the Draft Report proposed by the Team. Major items on the Project discussed and confirmed in the meeting were presented in Annex-I.

5. Japan's Grant Aid System

The Nepalese side has understood the Japan's grant aid system explained by the Team including the principle that a Japanese consultant firm and Japanese general contractor should be used for the implementation of the Project.

6. Necessary Measures taken by Nepal

HMG/N will take the necessary measures as shown in the Annex-II for smooth implementation of the Project on condition that the grant aid assistance by the Government of Japan is extended to the Project.

7. Further Schedule

The team will make the Final Report in accordance with the confirmed items and send it to His Majesty's Government of Nepal by the end of November 1993.

Annex-I

The briefing/discussion was held regarding the Project for New Bagmati (Thapathali) Bridge on 5th and 7th Octpber, 1993 with DOR officials, the Mayor of Lalitpur Municipality, Director General, Department of Housing and Urban Development, and Under Secretary, National Planning Commission.

The following points were acknowledged and clarified by the Team and the Nepalese side:

1. The five points have been acknowledged by Department of Roads as follows:

   (i) Department of Roads understood that the basic design for the grant aid project will not include the improvement of 3 intersections, namely, Maitighar, Tripureshwor, Koteshwor, as mentioned at the annual meeting between His Majesty's Government of Nepal and Government of Japan.

   (ii) The pedestrian bridges proposed in the original design of Thapathali Intersection will not be included in the basic design, to preserve vista and urgency of the additional bridge. Necessity of pedestrian bridge shall be studied again in future when the traffic volume exceeds the capacity of intersection taking into account the possibility of under path.

   (iii) The repair and protective works of existing bridge as mentioned in the feasibility study is solely to prevent collapsing of piers.

   (iv) While the intersection is under construction the trolley-bus service can be made available only from Maitighar on-wards for few weeks (if necessary). Trolley-buses are not generally in operation during night time.

   (v) Cooperation of traffic police is possible for traffic control during construction time.

2. The following points have been clarified by the Team and Department of Roads:

   (vi) Land acquisition of the project site has already been started (since Sept. 24, 1993) by Department of Roads according to the draft map of site received from JICA Kathmandu Office.

(vii) Department of Roads is ready to bear expenses to relocate existing power lines, telephone cables, water pipes etc., to ease the construction work. Materials of water main and high power cable will be supplied within the grant but relocation work shall be done by Nepalese side.

(viii) Department of Roads will make space available near the Ring Road for disposal of waste/storage place due to the removal of existing truss bridge.

(ix) Introduction of traffic lights manufactured in Japan can be placed at intersection. Department of Roads does not have such restriction by law, so far. Sufficient spare parts as well as operation and maintenance training shall be considered under the Project.

(x) Existing bus-stop being used for trolley-bus services at Thapathali shall be shifted to the outside of the Project area in order to obtain the smooth peredstrain flow near the intersection.

Annex-II

Necessary Measures to be taken by HMG/N

1. To secure land necessary for the execution of the Project and provide enough space for such construction as temporary site offices, working area, stockyard and so on;

2. To ensure that river area necessary for the construction of the facilities be freely accessible;

3. To clear, level and reclaim the project sites;

4. To ensure prompt customs clearance and internal transportation in the Kingdom of Nepal of the products purchased under the Grant;

5. To exempt Japanese nationals from custom duties, internal taxes and other fiscal levies which may be imposed in the Kingdom of Nepal with respect to the supply of the products and services under the verified Contracts;

6. To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contracts such facilities as may be necessary for their entry to the Kingdom of Nepal and stay therein for the performance of their work;

7. To ensure that facilities constructed and the products purchased under the Grant be maintained and used properly and effectively for the execution of the Project;

8. To provide necessary permissions, licenses and other authorizations for carrying out the Project;

9. To bear two kinds of commissions to the Japanese foreign exchange bank for the banking services, based upon the "Banking Arrangement", namely, the advising commission of the "Authorization to Pay" and payment commission; and

10. To bear all expenses, other than those to be borne by the grant aid, necessary for the Project.

Questionnaire to the Nepal Government on the project for Reconstruction of Bridge in Kathmandu (Phase 3).

1. We wish you would acknowledge following fine points to the Government of Nepal before the arrival of mission.

(1) The basic design for the grant aid project will not include the improvement of 3 intersections, namely, intersections at Naittighar, Tripreswar, and Koteswar,as mentioned at the Annual Meeting between Government of Nepal and Government of Japan.

(2) The basic design for the grant aid project will not include establishment of pedestrian bridges near the bridge to preserve vista and due to the lack of urgency.

(3) The repair of existing bridge is solely to prevent collapse of their piers as mentioned in the feasibility study (F/S).

On condition that Japan's Grant Aid is extended to the Project, the followings should be taken into account ;

(4) While the intersection is under construction, it is possible that the trolley-bus service will not be available for a few weeks and/or in the nighttime.

(5) Corporation of police authority is necessary for traffic control.

2.The following points should be clarified and reported to JICA office in Kathmandu before the department of the mission from Japan.

(6) Is the acquisition of the project site in progress?

Concrete explanation on this point (progress of site acquisition) is expected at the arrival the mission.

(The map of site necessary to be acquired will soon be sent to JICA office in Kathmandu directly from the consultant.)

(7) Are the Government of Nepal ready to bear the expense of temporary removal, removal, dispose and establishment of public facilities (namely, waterpipe, electric wire and telephone wire), which are buried in the existing bridge for pedestrian and bicycle?

What is the reason if the Government of Nepal will not be able to bear the expense?

(8) Has the space been secured for the disposal of waste due to the removal of existing truss bridge (for the pedestrian and bicycle)?

Place to stock the removed materials is necessary for recycle. The mission, however, suggests not to utilize them again.

(9) The mission plans to introduce traffic lights manufactured in Japan at the intersection.

What is the opinion of the Nepal Government on this plan?

Are there any law and/or regulation on traffic lights?

(10) Does the Government of Nepal have a plan to build the bus-terminal near the Tapatali intersection?

In other words, do they intend to acquire land for the bus stop?

ANNEX 6

His Majesty's Government
MINISTRY OF WORKS & TRANSPORT
Department of Roads

Telex: 2570 Roads NP
Fax: 977-1-225993
Phone: 2-11109, 2-11377, 2-13243, 2-13348, 2-15774

Babar Mahal, Kathmandu.

Ref. No. 050/51-209
Your Ref. No.

Date Oct. 1, 1993

Subject:- Project for Reconstruction of Bridge in Kathmandu Valley (Phase 3)

Mr. Toshikazu Masaki
Assistant Resident Representative
JICA Nepal Office
Tripureswar, Kathmandu.

Dear Mr. Masaki,

We are in receipt of your letter Ref. No. JICA 365 - 93, dated Sept. 21, 1993.

Enclosed please find the reply of the questionnaire from the Department of Roads on the Project for Reconstruction of Bridges in Kathmandu Valley (Phase 3).

We would like to apprecaite your cooperation in this regard.

Thanking you.

Sincerely yours,

(Varun Prasad Shrestha)
Director General

Reply to the Questionnaire on the Project for Reconstruction of Bridge in Kathmandu Valley (Phase 3)

1. **The five points raised have been acknowledged by Department of roads as follows:**

(1) Department of Roads understood that the basic design for the grant aid project will not include the improvement of 3 intersections, namely, Maitighar, Tripureshwor, Koteshwor, as mentioned at the annual meeting between Government of Nepal and Government of Japan.

(2) The pedestrian bridges near the bridge at Kupondol will not be included in the basic design, to preserve vista and due to the lack of urgency. But pedestrian bridges near Thapathali intersection are very necessary and urgent.

(3) The repair and protective works of existing bridge as mentioned in the feasibility study is solely to prevent collapse of their piers.

(4) While the intersection is under construction the trolley-bus service can be made available only from Maitighar on-wards for few weeks (if necessary). Trolley-buses are not generally in operation during night time.

(5) Cooperation of traffic police is possible for traffic control during construction time.

2. **The following points have been clarified by Department of Roads as the answers of questionnaire:**

(6) Land acquisition of the project site has already been started (since Sept. 24, 1993) by the Project for Reconstruction of Bridges in Kathmandu Valley (Phase 2) according to the draft map of site received from JICA Kathmandu office.

(7) As before, Department of Roads is ready to bear expenses to relocate existing power lines, telephone cables, water pipes etc., so that they may be kept out of the way (if not possible to included within the grant/contract).

(8) As before, Department of Roads can make available space for disposal of waste/storage place due to the removal of existing truss bridge.

(9) Introduction of traffic lights manufactured in Japan can be placed at intersection. Department of Roads does not have such restriction by law, so far. But these traffic lights should be viable for maintenance purpose in future.

(10) Department of Roads does not have a plan to build the bus-terminal near Thapathali intersection at present.

Materials Required for Shifting Utilities from/near the Bridge to be Demolished:

For Shifting 11 KV Electricity Transmission Line:

1. **Electric Cable (covered/insulated by suitable duct):**

   Type: ACSR Type, Aluminium/Steel Reinforced conductor)
   Length: 200m*6 = 1200m
   Size: 0.10 sq. inch
   Wire in X-Section=7 No.

2. **Electric Pole:**

   Type: Hollow Steel Electric Pole
   Height: 15m
   Number: 4
   Size: 300mm @ Bottom and Tapered towards Top.

For Shifting 400mm Water Main Lines:

1. **Water Pipes:**

   Type: Ductile Steel Pipe (Kobuta Pipe)
   A-1, British Standard
   Length: 250m
   Size: 16" (400mm)

2. **Sluice Vulve:**

   Number: 1
   Size: 400mm

3. **Wash Vulve:**

   Number: 1
   Size: 400mm

Note: Other materials of good quality meeting the above standard can be used.

10/08/1993

Appendix 8. Engineering Supporting Data

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.

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		

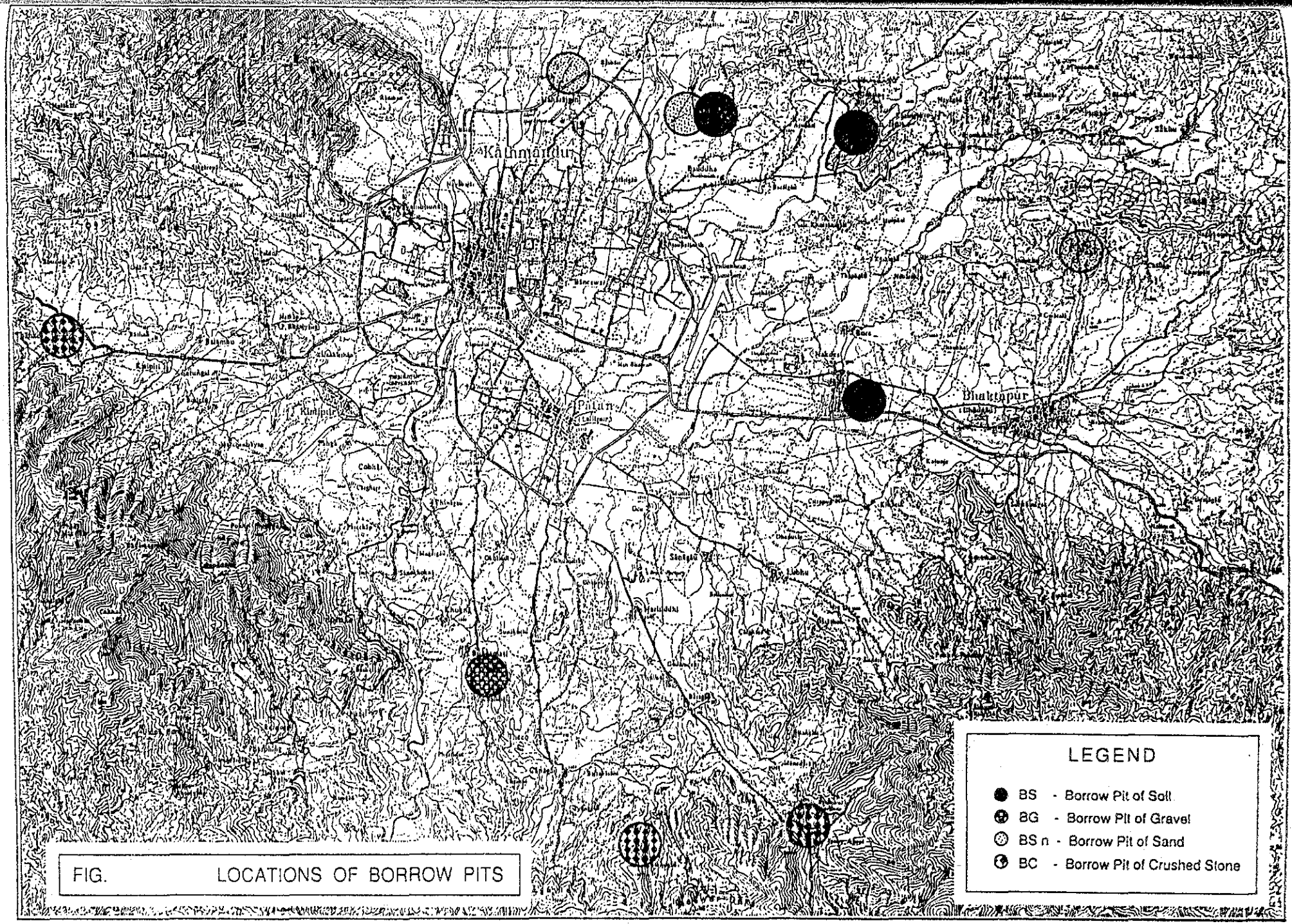


FIG. LOCATIONS OF BORROW PITS

Table Test Result Summary Sheet of Bridge Sites

Bridge No. 2 Location : Thapathali

Sam-ple' 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	

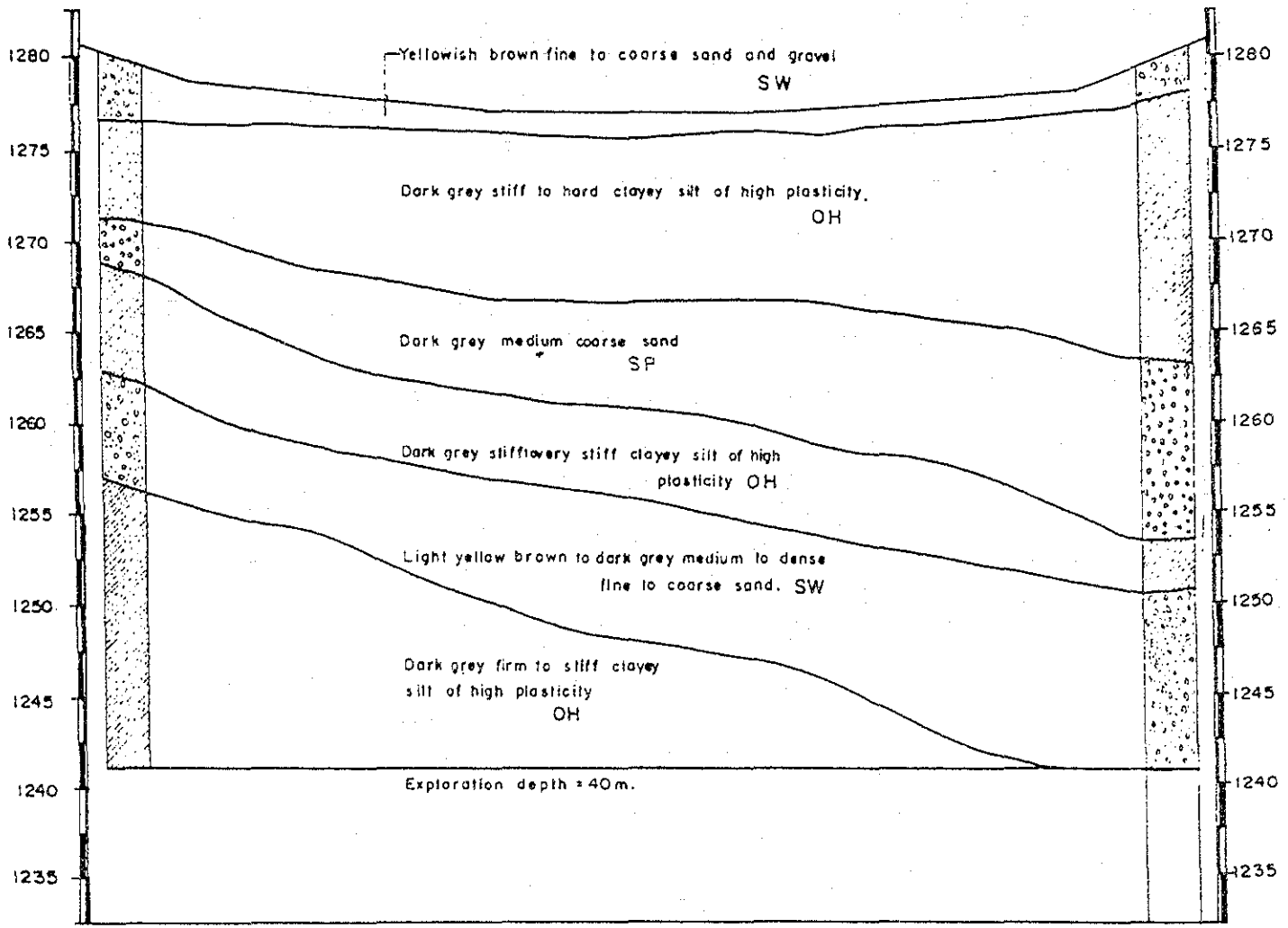


FIG. PROFILE ALONG BRIDGE AXIS
BRIDGE NO 2, THAPATHALI

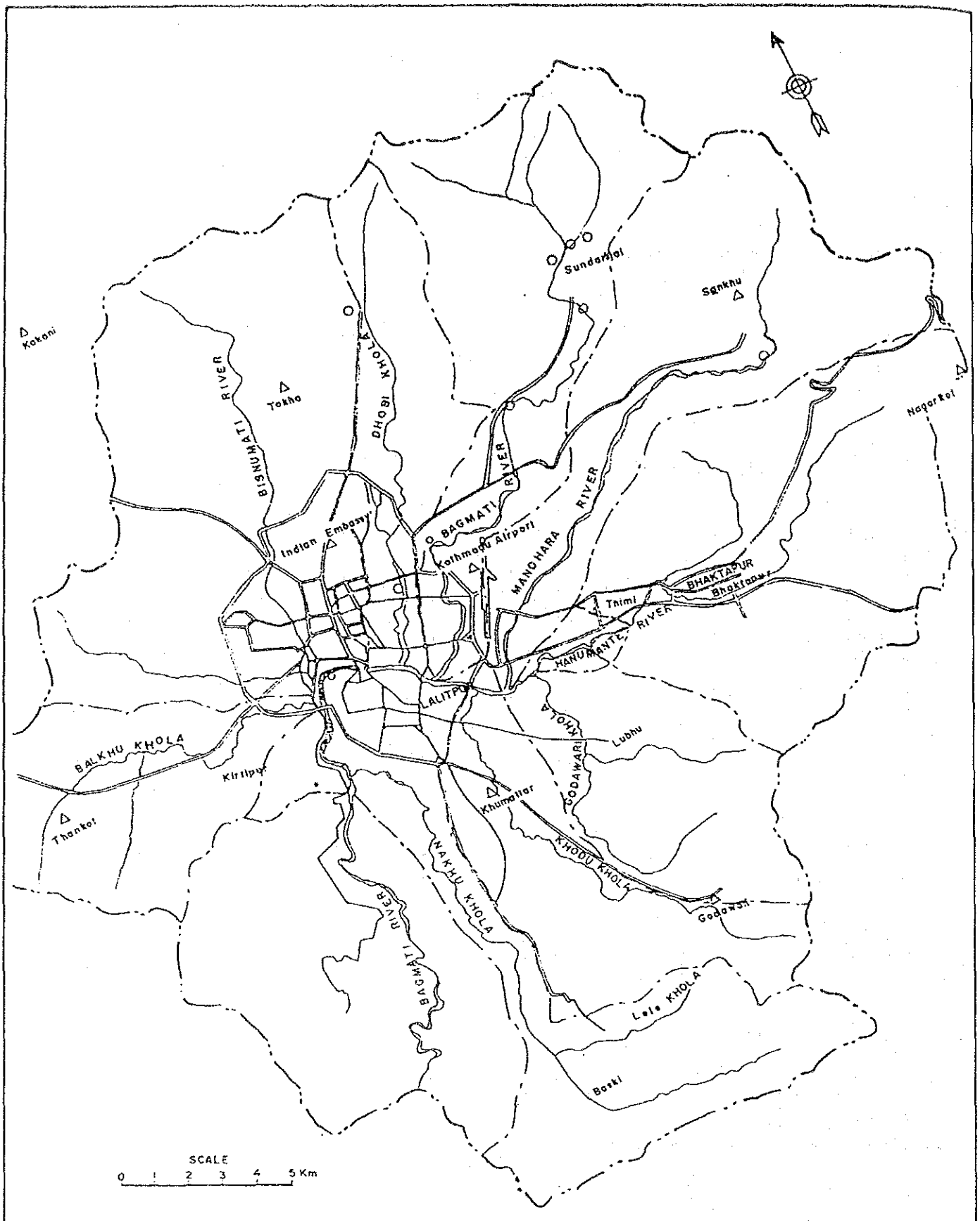


Figure LOCATION MAP OF RAINFALL STATION AND STREAM GAUGING STATION

Table 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 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	39.0	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 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	26.0	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 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 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 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 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		

Table 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 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

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 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 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

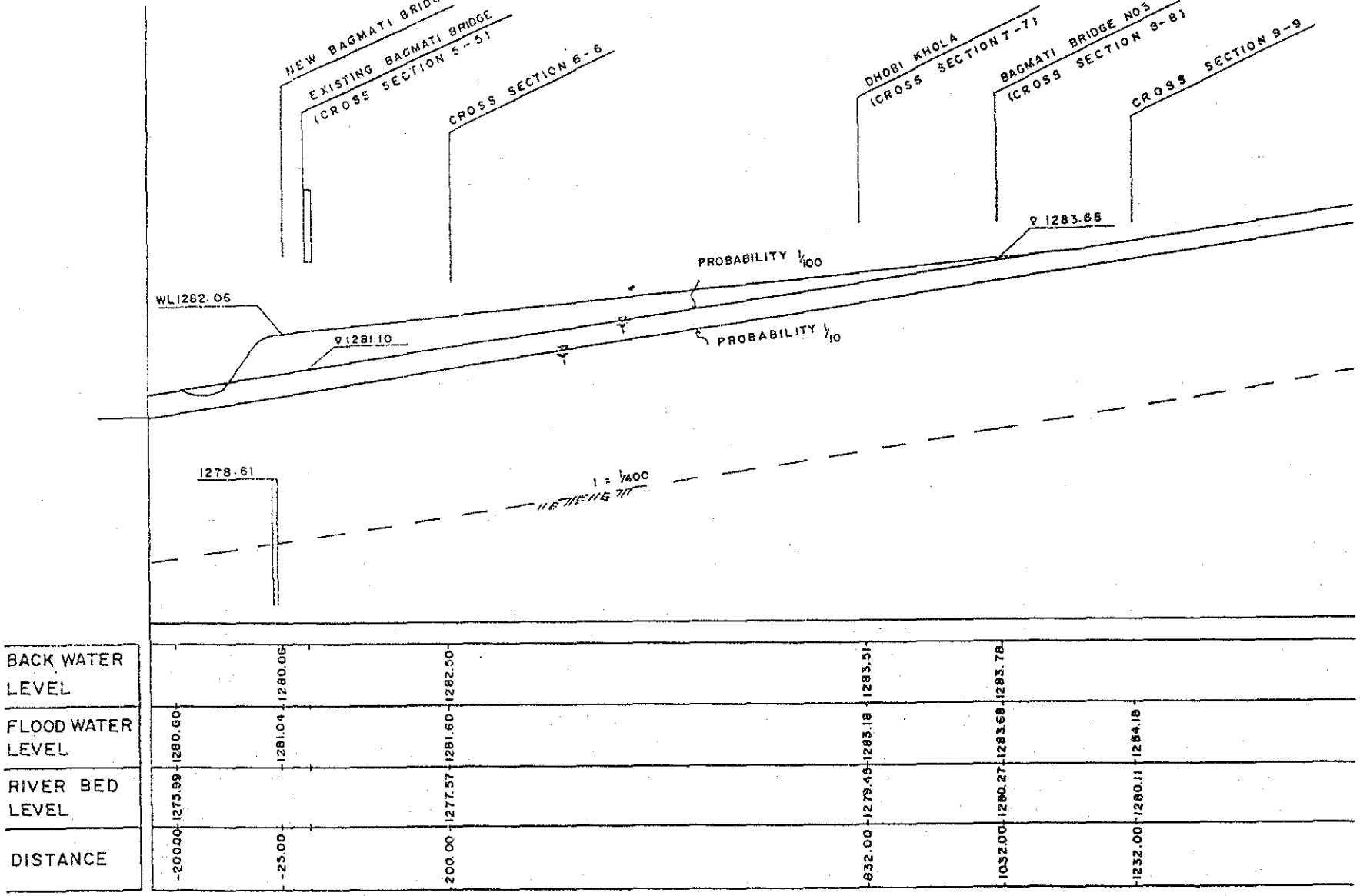


FIG. BACK WATER BY GROUND SILL AT DOWNSTREAM OF BAGMATI BRIDGE NO. 2

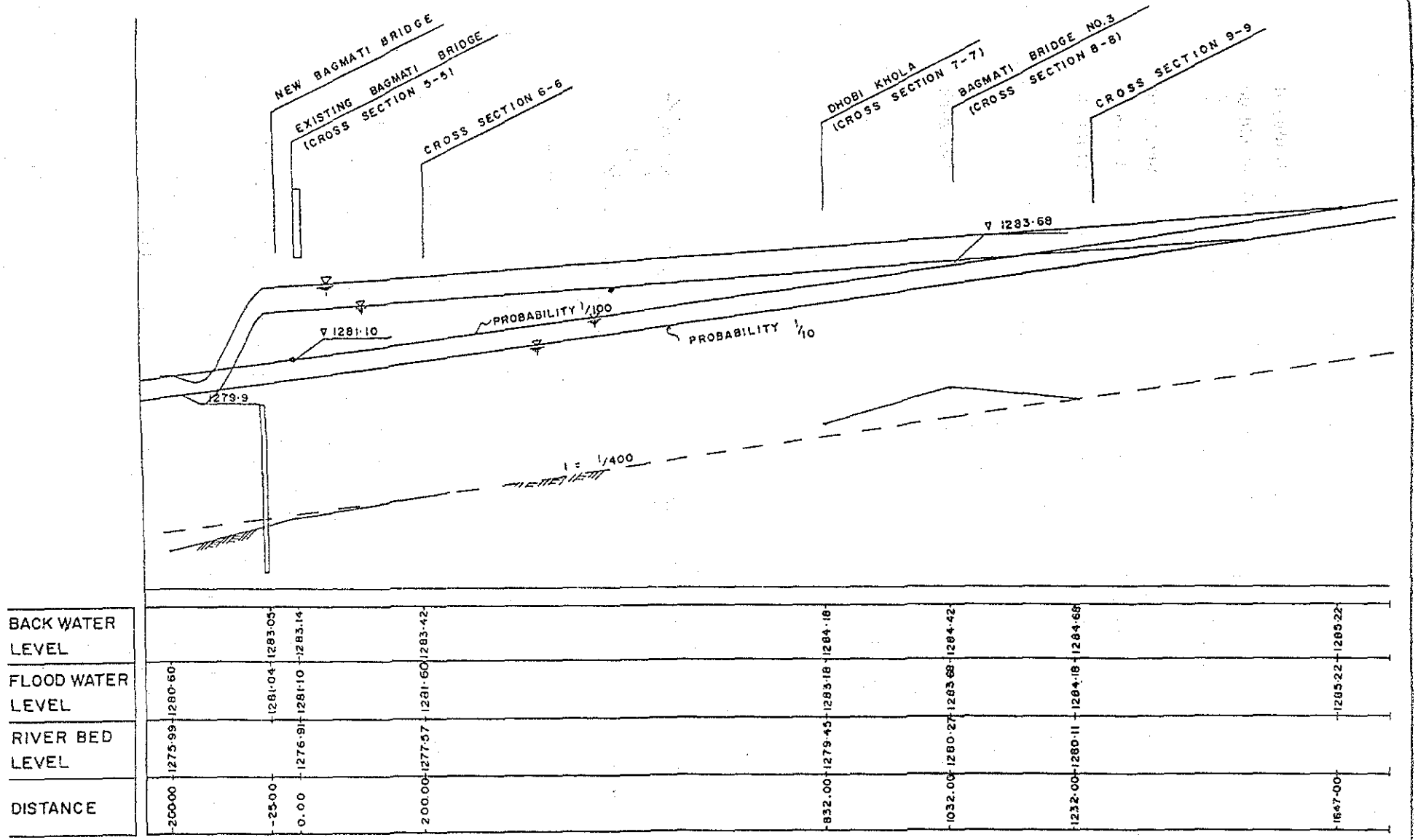


FIG. BACK WATER BY GROUND SILL AT DOWNSTREAM OF BAGMATI BRIDGE NO. 2

Proposed Gro··

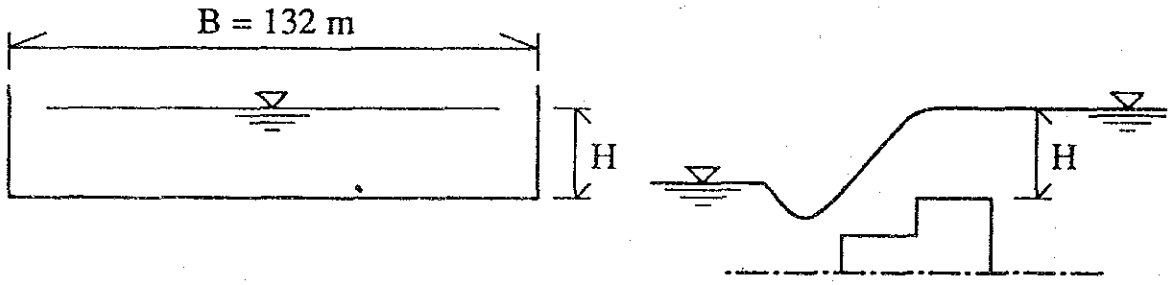
Existing ground sill is constructed to protect piers of Bagmati Bridge at Thapathali when New Bridge is constructed the ground sill should be reconstructed to maintain present condition.

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;

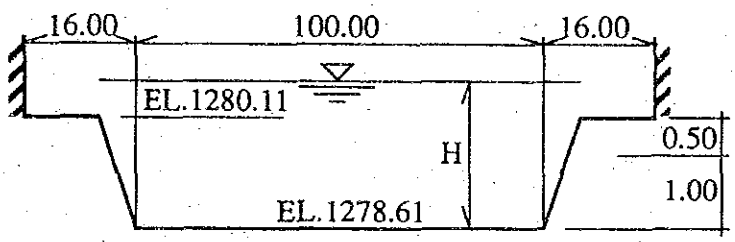
1279.9 + 3.15 = 1283.05

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.

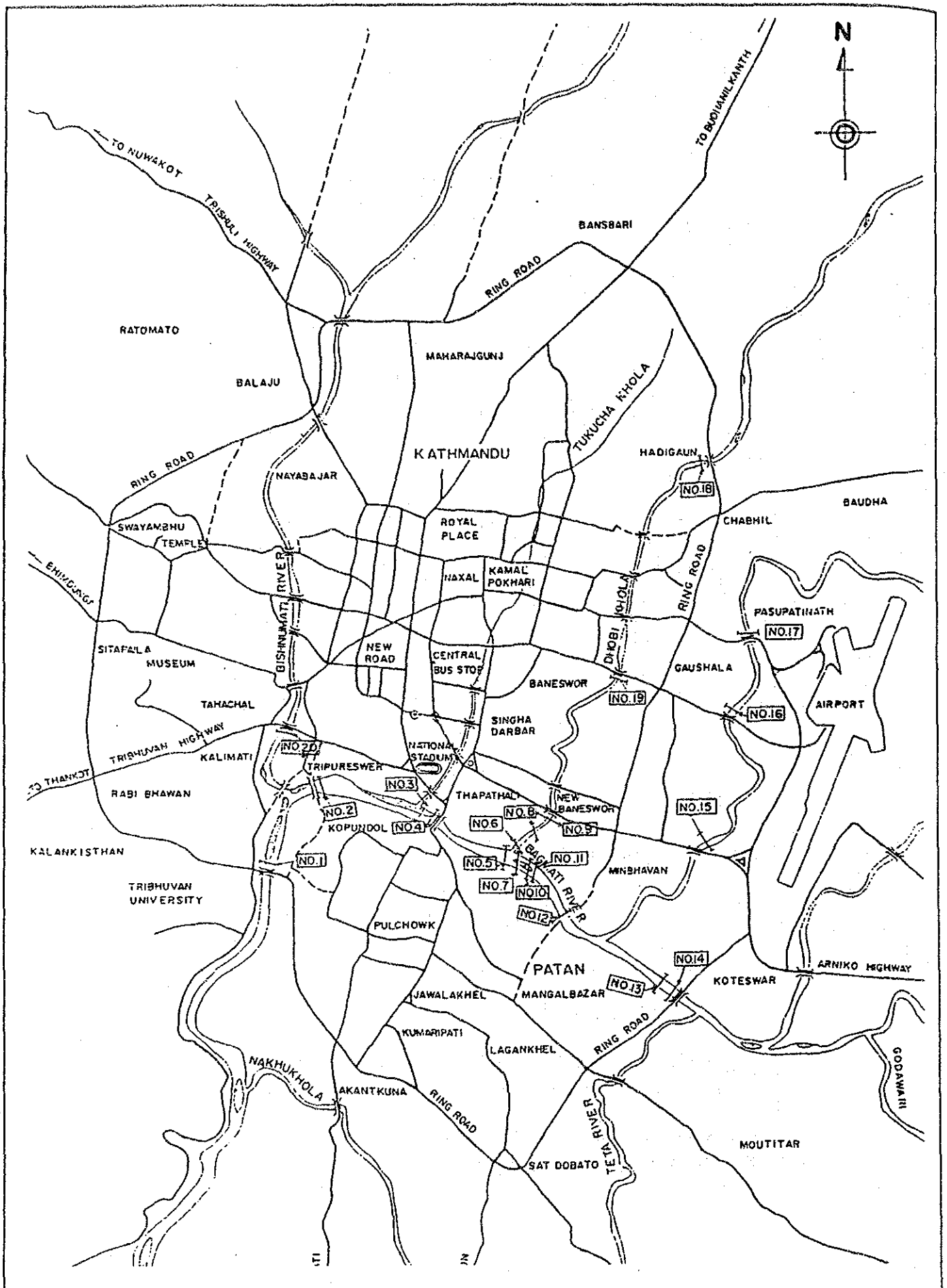
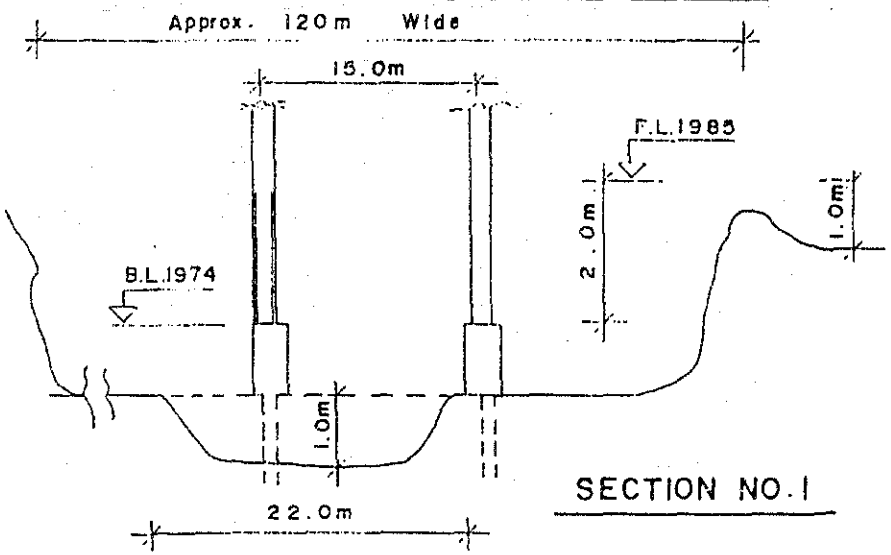


Figure **LOCATION OF REFERED FLOOD LEVEL ENQUIRY SECTION**

DATE : 6|9|92

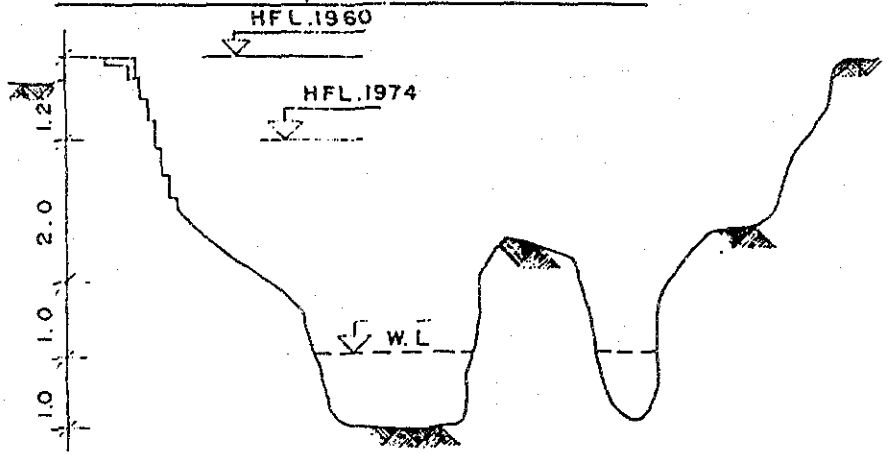
BAGMATI BRIDGE; BALKHU, RING ROAD (Br. No.7)



SECTION NO.1

DATE: 14|9|92

BAGMATI RIVER; BIRAUTA, KOPUNDOL

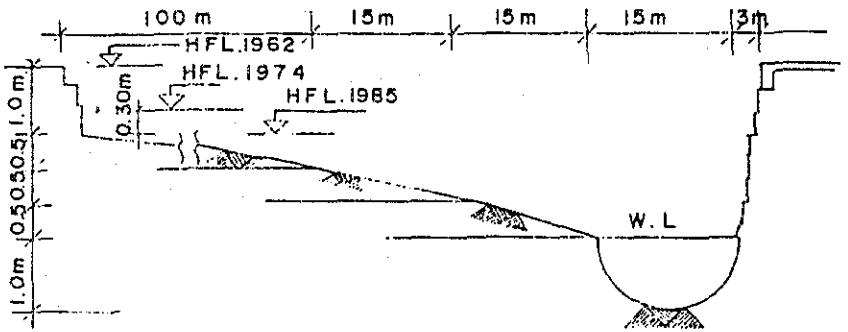


SECTION LOCATION: 200m D S OF BAGMATI BRIDGE

SECTION NO.3

DATE: 14|9|92

BAGMATI RIVER; RAJDAHA TIRTHA, SANEPA

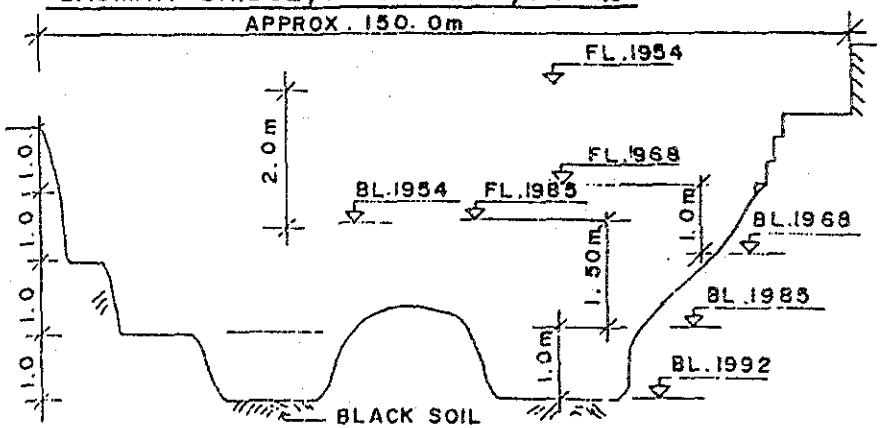


SECTION LOCATION: 100m U/S OF SUSPERISION BRIDGE, TEKU

SECTION NO.2

DATE: 7|9|92

BAGMATI BRIDGE; THAPATHALI, Br. No.5

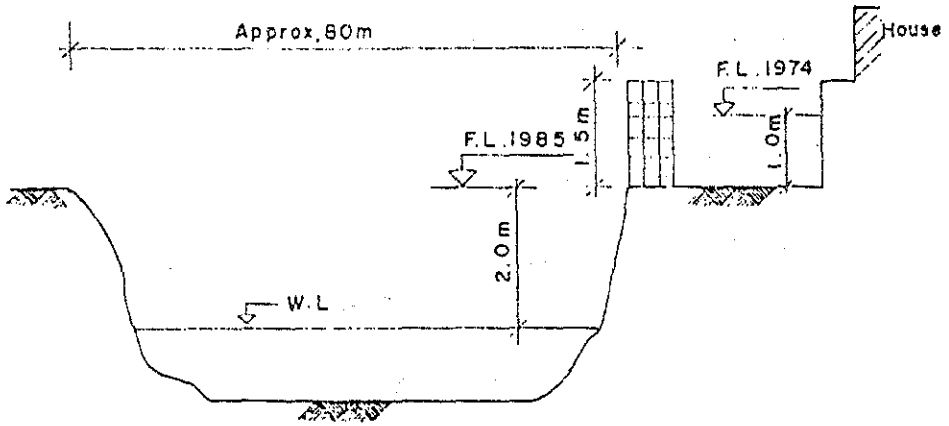


SECTION LOCATION; 40m D/S OF BRIDGE

SECTION NO.4

DATE: 8|9|92

BAGMATI RIVER; D/S OF DHOBIKHOLA

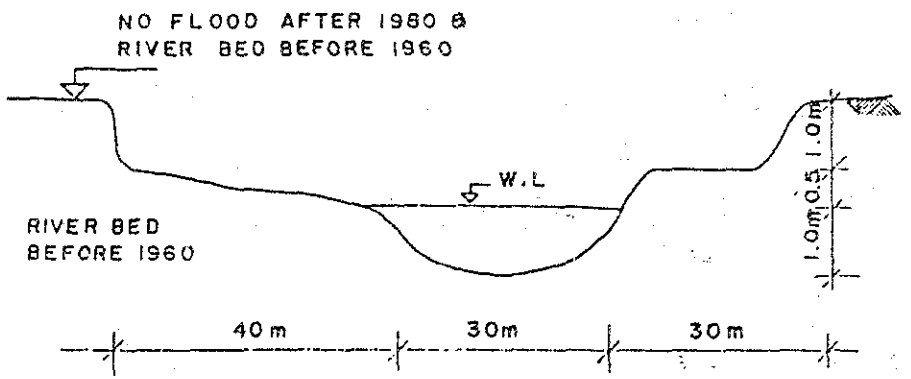


SECTION LOCATION: 20m D/S OF CONFLUENCE OF DHOBI KHOLA

SECTION NO. 5 (SURVEY SECTION NO 7)

DATE: 11|9|92

BAGMATI RIVER U/S OF DHOBI KHOLA CONFLUENCE



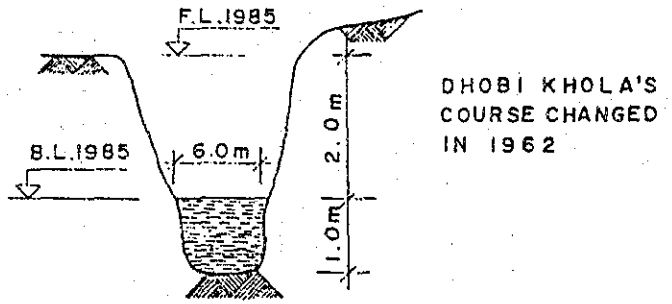
SECTION LOCATION: 150m D/S OF PHANTAL BARAHI AT L/S

SECTION NO.7

A-36

DATE: 8|9|92

DHOBI KHOLA; CONFLUENCE WITH BAGMATI

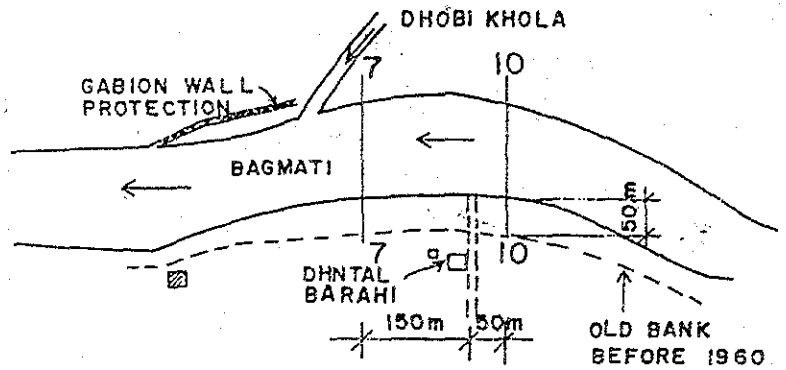


SECTION LOCATION: 15m U/S OF CONFLUENCE WITH BAGMATI

SECTION NO.6

DATE: 11|9|92

LOCATION PLAN OF SECTIONS AT DHNTAL BARAHI

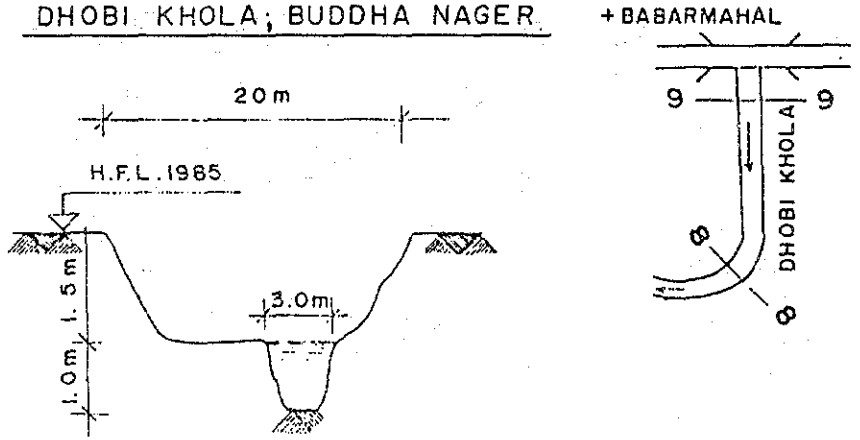


LOCATION: DHOBI KHOLA CONFLUENCE WITH BAGMATI

FOR SECTION NO.7 & 10

DATE: 8|9|92

DHOBI KHOLA; BUDDHA NAGER

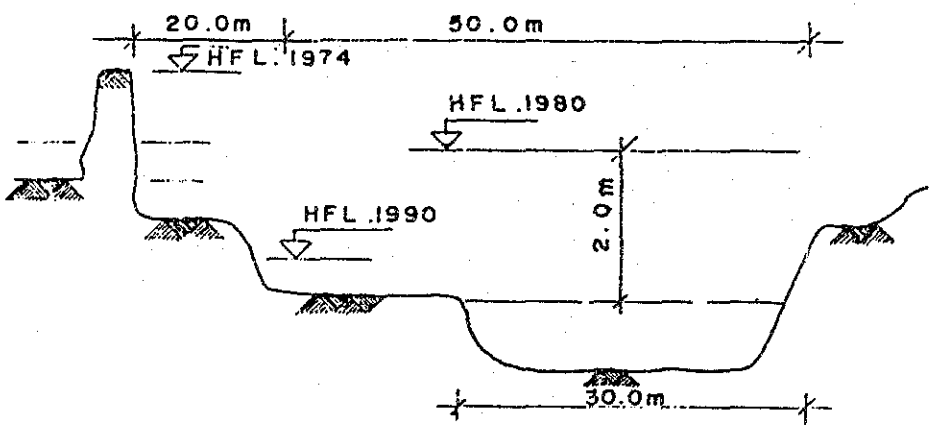


SECTION LOCATION: 500m D/S OF BRIDGE (BABARMAHAL)

SECTION NO. 8

DATE: 11|9|92

BAGMATI AT DHANTAL BARAHI

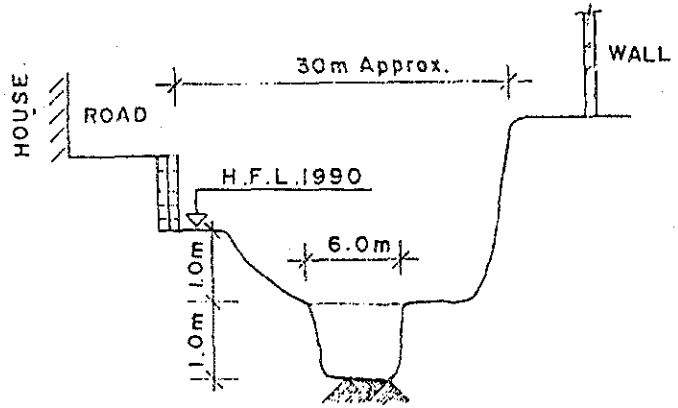


SECTION LOCATION: 50m U/S OF DHANTAL BARAHI AT L/B

SECTION NO. 10

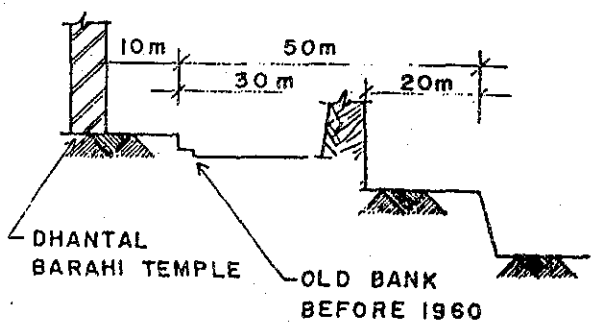
DATE: 8|9|92

DHOBI KHOLA BRIDGE BABAR MAHAL BR. NO



SECTION LOCATION: 15 m D/S OF DHOBIKHOLA BRIDGE

SECTION NO.9 (SURVEY SECTION NO.10)

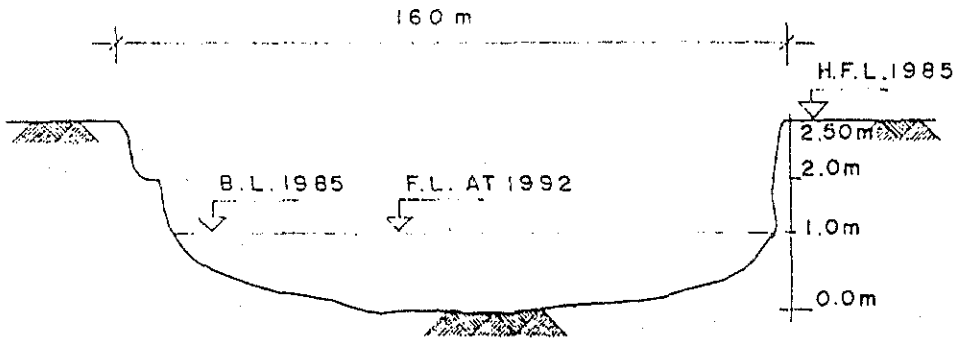


SECTION LOCATION: 50m U/S OF DHANTAL BARAHI AT L/B

SECTION: NO. 10 CONTINUED

DATE : 8|9|92

BAGMATI RIVER, BUDDHANAGAR

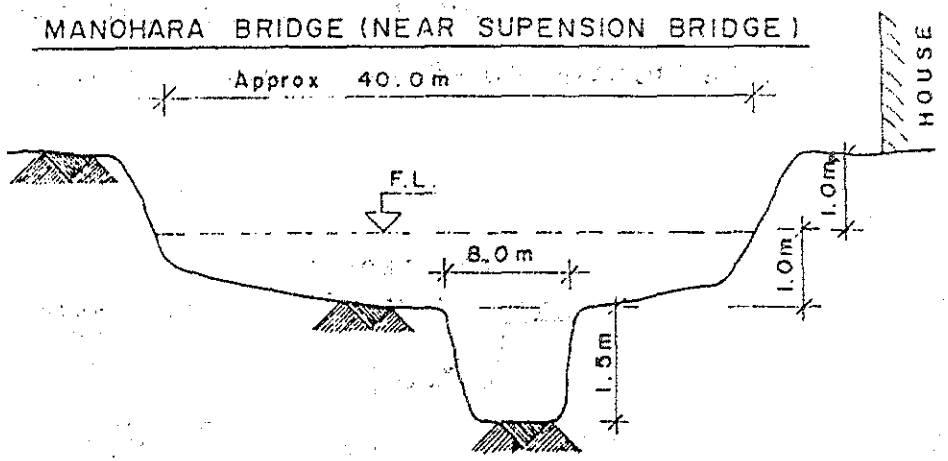


SECTION LOCATION : 400 m U/S OF DHOBIKHOLA CONFLUENCE

SECTION NO. 11

DATE : 8|9|92

MANOHARA BRIDGE (NEAR SUPENSION BRIDGE)



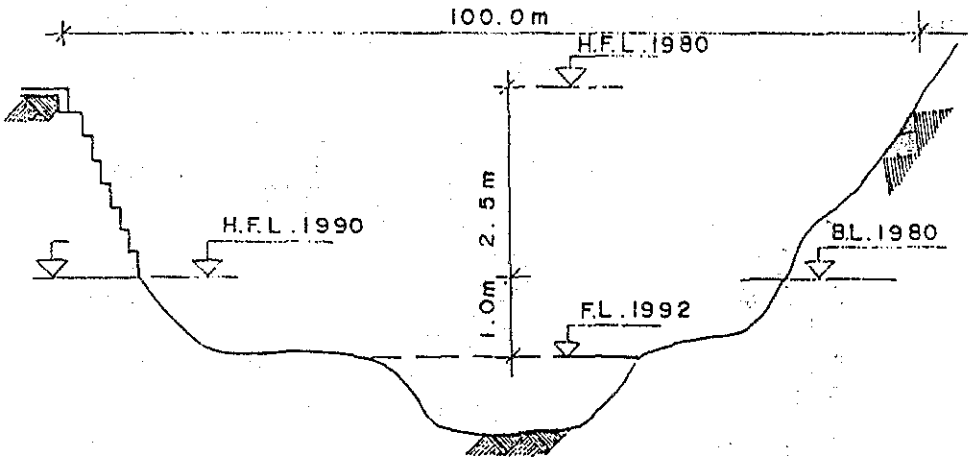
SECTION LOCATION : 100m U/S OF SUSPENSION BRIDGE

SECTION NO. 13

A-38

DATE : 8|9|92

BAGMATI BRIDGE SANKHAMUL PEDESTRAN CROSSING

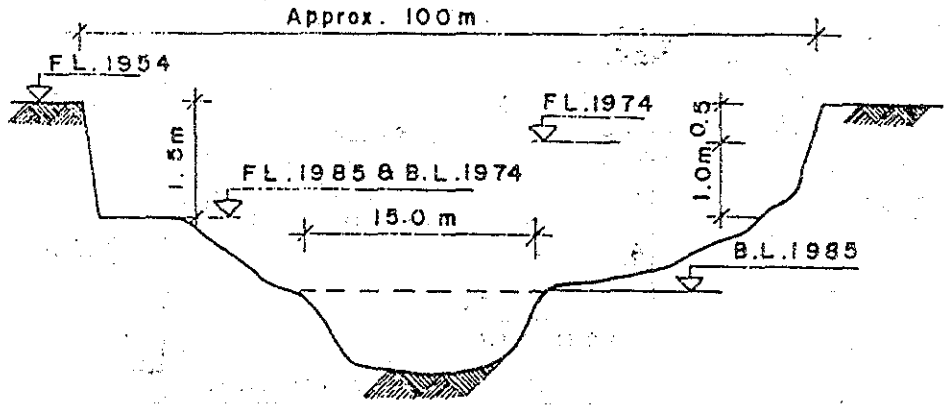


SECTION LOCATION : 10m D/S OF PEDESTRIAN CROSSING

SECTION NO.12

DATE : 7|9|92

MANOHARA BRIDGE ; RING ROAD, BALKUMARI

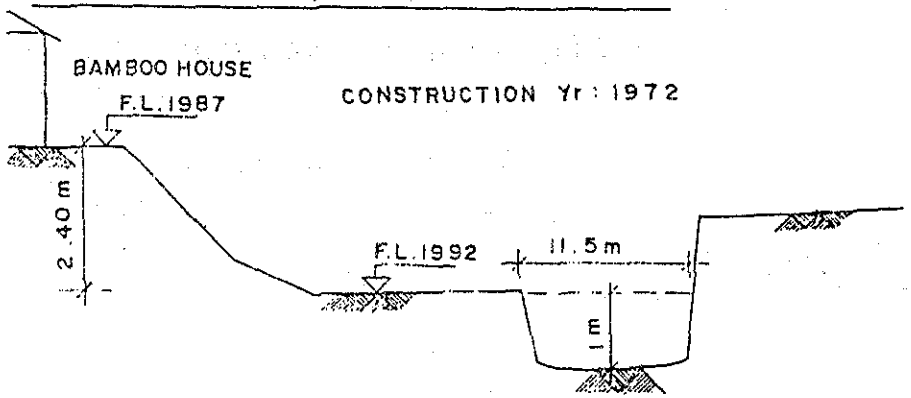


SECTION LOCATION : 15m D|S OF BRIDGE

SECTION NO. 14

DATE: 6|9|92

BAGMATI BRIDGE; MINBHAWAN (Br. No.3)

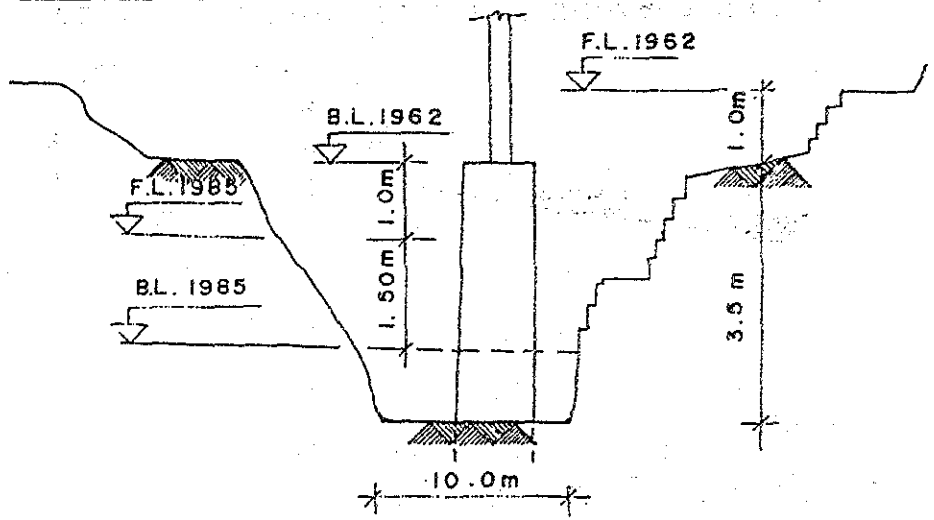


SECTION LOCATION: 30m U/S OF BRIDGE

SECTION NO. 15

DATE: 7|9|92

BAGMATI BRIDGE, PRAYAG GHAT (Br. No 2)



LOCATION: 20m U/S OF BRIDGE

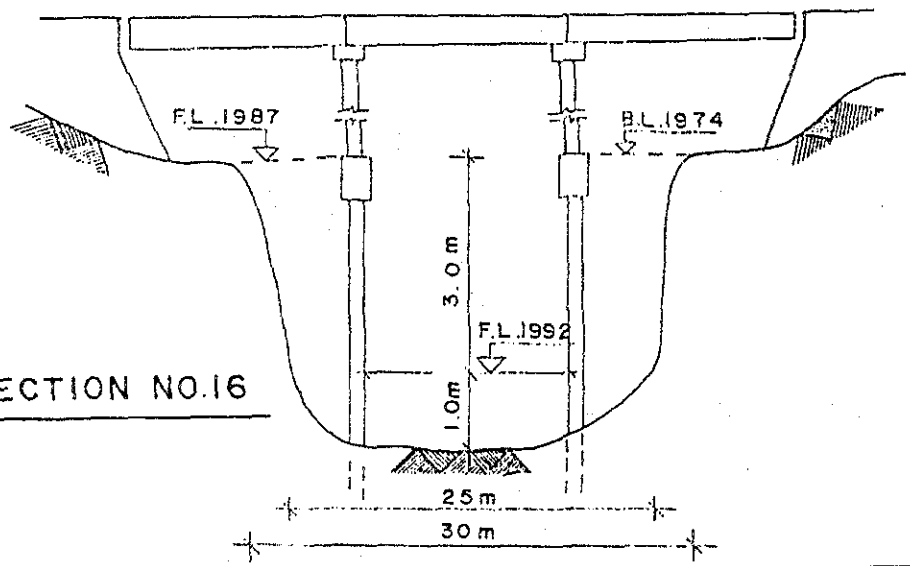
SECTION NO. 17

A-39

DATE: 6|9|92

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

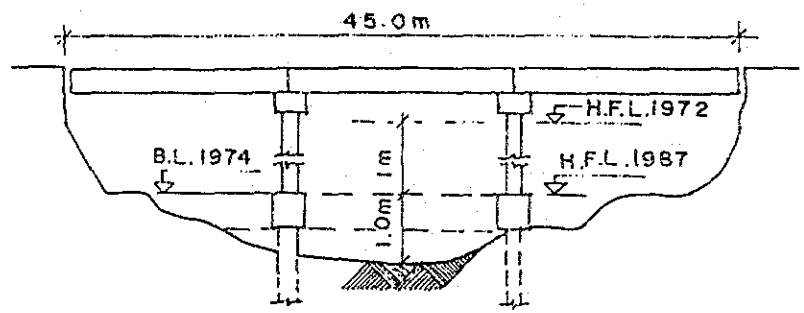
CONSTRUCTION 1974



SECTION NO.16

DATE: 6|9|92

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

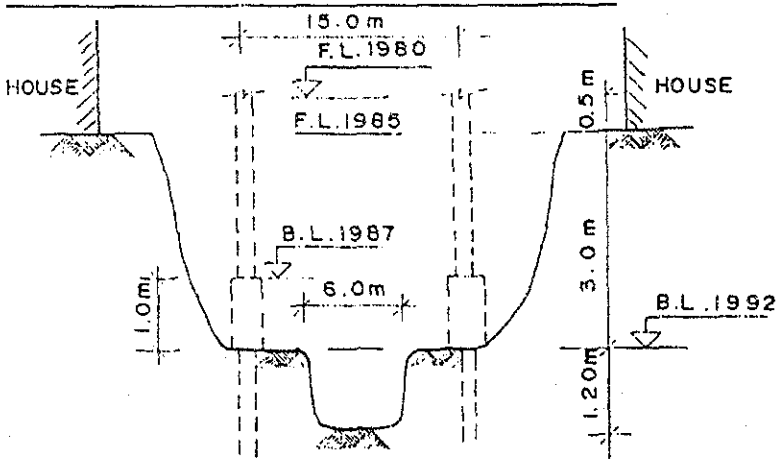


SECTION LOCATION: 15m D|S OF BRIDGE

SECTION NO.18

DATE: 7|9|92

DHOBI KHOLA; MAITI DEVI (Br. No13)

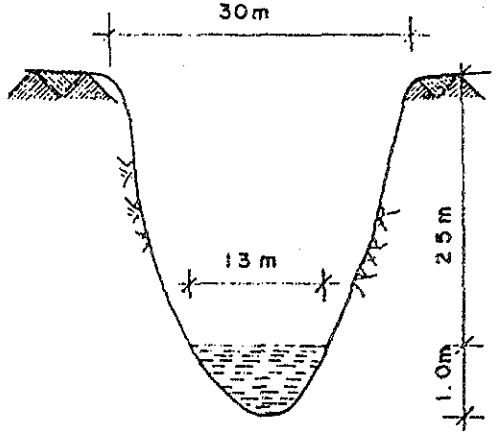


SECTION LOCATION: 10m D/S OF BRIDGE

SECTION NO.19

DATE: 24|9|92

BAGMATI RIVER, CHOVAR

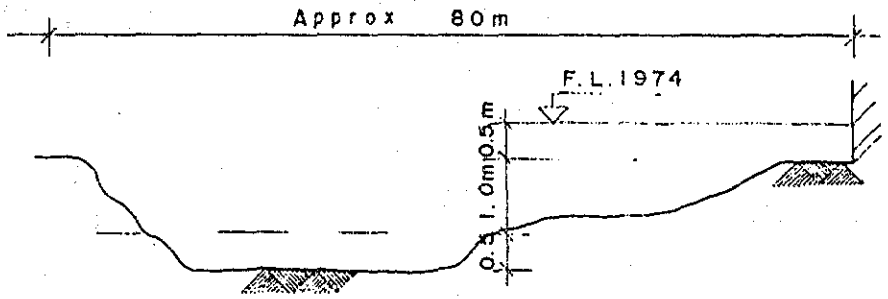


SECTION LOCATION: 15m U/S OF BRIDGE AT CHOVAR

SECTION NO.21

DATE: 6|9|92

BISHNUMATI BRIDGE; TEKU (Br. No.10)

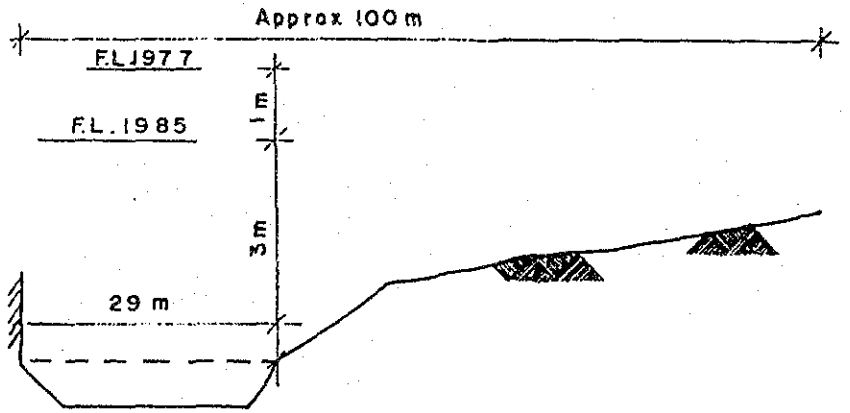


SECTION LOCATION: 15m D/S OF BRIDGE.

SECTION NO.20

DATE: 24|19|92

BAGMATI RIVER, KHOKANA VILLAGE, KHOKANA BRIDGE



SECTION LOCATION: 10m U/S OF KHOKANA BRIDGE

SECTION NO.22

Figure MAP OF INDIA SHOWING SEISMIC ZONES

Table 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

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

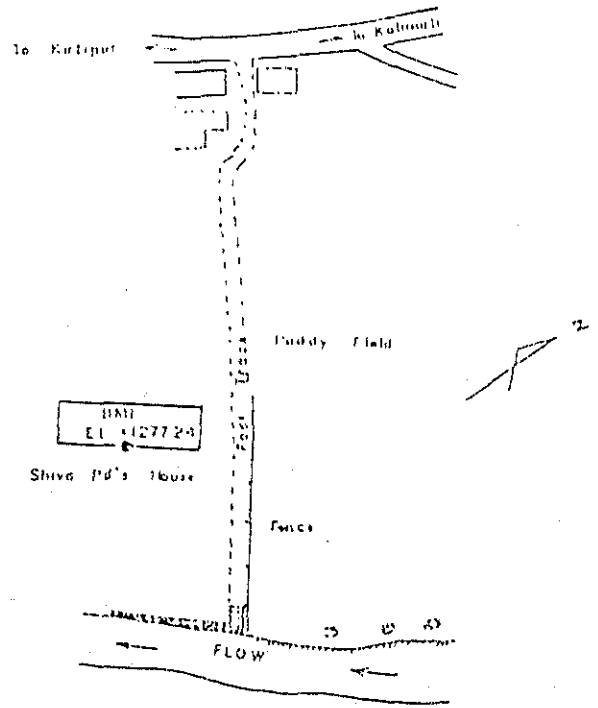
Y	MD	EPCL AREA	LAT DEG NDEG	LONG E	DEPT KM	INT MM	MAG	REF
1966	12 18	WEST NEPAL	29.600	81.000			5.0	USC
1966	12 21		29.650	80.790			5.2	ISC
1967	01 05		30.000	86.000			5.2	LAO
1967	08 14		28.000	80.000			5.0	LAO
1967	12 18		29.460	81.710			5.0	ISC
1968	05 27	NEPAL	29.700	80.400			5.1	USV
1969	02 04		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 03	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	27.460	88.800			6.0	ISC
1981	05 15		29.504	81.942			5.1	
1982	04 05		27.495	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	53		5.0	NEIS
1984	04 15	TIBET	31.586	82.262	33		5.0	NEIS
1984	05 13	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	89.750	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. (1) LOCATION DETAIL OF BM

BRIDGE # 1



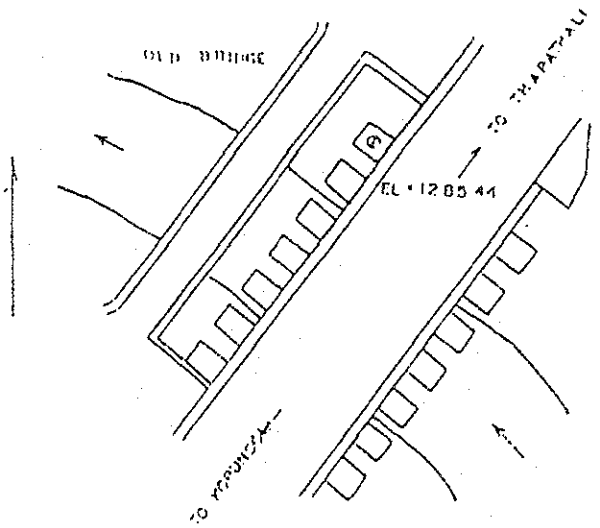
NOTES –

From Kuleshwor (in 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. (2) LOCATION DETAIL OF BM

BRIDGE NO.2

(266 NO. OF GEODETIC SURVEY)



NOTES –

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