

5. LIST OF COLLECTED DATA

1. SOCIO - ECONOMIC

- 1) Annual Budget of Ministry of Works & Transport and Department of Roads. 84/85 ~ 88/89 :
- 2) List of Land aquisition and Demolishing cost, 1988 : Department of Roads. (D.O.R)
- 3) Unit cost of Materials in Nepal, 1989 : Department of Housing and Financial Planning, District Secretary
- 4) Labor cost in Nepal, 1989 : ditto
- 5) Lubricant rate in Nepal, 1989 : Department of Roads. (D.O.R)
- 6) Population Distribution in KATHMANDU, 1987 :
- 7) Wardwise Distribution of Houses in KATHMANDU, 1987 :
- 8) List of Planned Utility services at Bridge sites, 1989 : Department of Roads. (D.O.R)
- 9) Organization of Department of Roads, 1989 : Department of Roads. (D.O.R)
- 10) Equipment - wise list of Heavy Equipment in Department of Roads, Aug. 1988 : Department of roads. (D.O.R)
- 11) Equipment - wise list of Heavy Equipment in Bagmati Zone office, 1989 : D.O.R.
- 12) Kathmandu Valley Physical Development Concept (PLANS) vol.2, 1984 : KATHMANDU VALLEY TOWN PLANNING TEAM.
- 13) Main Economic Indicators, Monthly Report Sep. Oct. Nov. 1988 : Nepal RASTRA BANK Research Department.

2. TRANSPORT / TRAFFIC

- 1) Traffic volume records in Kathmandu, 1988, 1989 : D.O.R.

3. METEOROLOGICAL

- 1) Climatological Records of Nepal 1971 ~ 1975 vol. I, June 1977 :
Ministry of Water Resources, Department of Hydrology and Meteorology.
- 2) - ditto - 1976 ~ 1980 Vol. I, Dec. 1982
- 3) - ditto - 1981 ~ 1982 Vol. I, Jul. 1984
- 4) - ditto - 1983 ~ 1984 Vol. I, Sep. 1986
- 5) - ditto - 1985 ~ 1986 Feb. 1988
- 6) - ditto - 1971 ~ 1976 Special Supplement
Kathmandu Valley, Vol. II, June 1977
- 7) - ditto - 1976 ~ 1984 Supplemental Data,
Vol. II, Nov. 1986

4. GEOLOGY

- 1) Study on the Crustal Movements in the Nepal Himalayas II, 1984 :
Nepal Geological Society
- 2) Engineering Geology of Kathmandu, Nepal, April 1987 : UMESH
SHAKA, Asian Institute of Technology Bangkok, Thailand
- 3) Report on Soil Investigation of SANKHAMUL Bridge Site : D.O.R.,
SILT CONSULTANTS (P.) LTD.

5. HYDROLOGY

- 1) Flood Records on Bagmati River, ~ 1980 :
- 2) Flood Records on Bishnumati River, ~ 1985 :
- 3) Report on Hydrological Study of Bagmati River at SANKHAMUL
Bridge Site. March, 1982 : D.O.R., SILT CONSULTANTS (P.) LTD.

6. SPECIFICATIONS & STANDARDS

- 1) Nepal Road Standards (2027) (First Revision - 2045) : H.M.G. Ministry of Works and Transport, D.O.R.
- 2) Standard Designs, January 1978 : H.M.G. Ministry of Works and Transport, D.O.R.
- 3) Specification for Road and Bridge Works. Fifth impression 1985 : Department of Transport, Scottish Development Department, Welsh Office.
- 4) National Building Code of INDIA 1970, Group 2, Part VI, Structural Design : Indian Standards Institution.

7. MAP

- 1) Nepal Central Development Region, S=1:500,000 : H.M.G. Survey Department, Topographical Survey Branch, 1985
- 2) Kathmandu Metropolitan Area, S=1:2,000, Sheet No. 11, 13, 17, 24, 31 : UNDP Kathmandu Water Supply & Sewerage Project
- 3) Base Map Derived from LANDSAT Imagery, MAP II, Eastern sheet and Western sheet, S=1:500,000 : H.M.G. National Remote Sensing Centre, Nepal, 1984
- 4) Land Utilization Map, Central Development Region, S=1:50,000 : H.M.G. Survey Department, Topographical Survey Branch, 1984
- 5) Geological Map No.72 E - A, Central Development Region, S=1:125,000 : H.M.G. Survey Department, Topographical Survey Branch, 1984
- 6) Nepal Administrative, S=1:2,000,000 : H.M.G. Survey Department, Topographical Survey Branch, 1987
- 7) NEPAL S=1:1,000,000, H.M.G. Survey Department, Topographical Survey Branch, 1986
- 8) NEPAL S=1:1,500,000, EAST NEPAL S=1:50,000 : APA PRESS, Singapore
- 9) Kathmandu Valley S=1:50,000 : Nepal - Kartenwerk der Arbeitsgemeinschaft für vergleichende Hochgebirgsforschung Nr. 1, 1977.

- 10) Kathmandu City S=1:10,000 : Nepal - Kartenwerk der Arbeitsgemeinschaft für vergleichende Hochgebirgsforschung Nr. 21, 1979.
- 11) City Map No.1 Kathmandu S=1:10,000 : H.M.G. Survey Department, Topographical Survey Branch, 1986.
- 12) KATHMANDU CITY / KATHMANDU VALLEY 1988/89 EDITION : Tiwari's Pilgrims Book House, Thawal, Kathmandu, Nepal.
- 13) Kathmandu Patan / KATHMANDU VALLEY 1989 EDITION : Jore Garesh Press Pvt. Ltd. Kathmandu.
- 14) Kathmandu Valley S=1:50,000 : MANDALA TREKKING MAPS
- 15) KATHMANDU VALLEY, EAST No. 1 CHISAPANI GAPHI No.72 E/6, S=1:50,000 : Brigadier Gambhir Singh M.I.S. Surveyer General of India, 1957
- 16) INDIAN SUBCONTINENT S=1:4,000,000 : NELLES VERLAG.

6. TECHNICAL DATA

(1) ROAD LENGTH, INFLUENCED POPULATION
AND INFLUENCED AREA

Plan Year	Description	Total Length (km)	Influenced Population (person)	Influenced Area (km ²)
- 1951		376	21,250	378
1956	First Five Year Plan	624	13,600	228
1962	Second Five Year Plan	1,193	7,970	119
1965	Third Five Year Plan	2,049	5,130	69
1970	Fourth Five Year Plan	2,504	4,600	57
1974/75	Fifth Five Year Plan	3,173	3,800	45
1975/76	First Year of Fifth Five Year Plan	3,444	3,594	42
1976/77	Second Year of Fifth Five Year Plan	4,136	3,132	35
1977/78	Third Year of Fifth Five Year Plan	4,594	2,921	32
1978/79	Fourth Year of Fifth Five Year Plan	4,691	2,925	31
1979/80	Fifth (Final) Year of Fifth five Year Plan	4,940	2,844	28
1980/81	First Year of the Sixth Five Year Plan	5,021	2,869	28
1981/82	Second Year of the Sixth Five Year Plan	5,270	2,854	28
1982/83	Third Year of the Sixth Five Year Plan	5,546	2,894	27
1983/84	Fourth Year of the Sixth Five Year Plan	5,717	2,882	25
1984/85	Final Year of Seventh Five Year Plan	5,925	2,840	25
The Seventh Plan				
1985/86	First Year of the Seventh Five Year Plan	6,039	2,841	24
1986/87	Second Year of Current Plan	6,306	2,775	23

Source: Department of Road

(2) ROAD DEVELOPMENT IN NEPAL

Name of Road	Total Length km	Date of Start	Date of Completion	Foreign Assistance
1. Thankot-Naubise	17	1953	1956	India
(Reconstruction)	17	1978	1982	World Bank
2. Naubise-Mugling	84	1967	1974	China
3. Naubise-Bhainse	97	1953	1956	India
4. Bhainse-Hetauda	10	1958	1967	U.S.A.
5. Hetauda-Narayangarh	78	1973	1983	A.D.B.
6. Narayangarh-Butwal	116	1969	1975	U.K.
7. Narayangarh-Mugling	36	1978	1982	China
8. Khairani-Gorkha	25	1978	1982	China
9. Mugling-Pokhara	90	1967	1974	China
10. Dhangadi-Dadeldhura	140	1967	-	U.S.A.
11. Pokhara-Sunauli	184	1964	1972	India
12. Kohalpur-Banbasa	204	1973	-	Nepal-India
13. Hetauda-Raxaul	57	1958	1967	U.S.A.
14. Kohalpur-Surkhet	92	1975	-	Nepal
15. Kathmandu-Kodari	114	1963	1967	China
16. Kathmandu-Trishuli	68	1957	1963	Nepal-India-U.S.A
17. Butwal-Kohalpur	251	1973	-	India
A. Butwal-Chandrauta	-	-	-	-
B. Chandrauta-Krishna-nagar	-	-	-	-
C. Chandrauta-Shivapur	-	-	-	-
18. Bhairahawa-Lumbini	22	1973	1978	Nepal
19. Pathalaya-Dhalkebar	109	1967	1972	U.S.S.R.
20. Dhalkebar-Rajbiraj	95	1967	1974	India
21. Rajbiraj-Itahari	69	1967	1974	India
22. Itahari-Kakarbhitta	92	1967	1974	India
23. Charali-Ilam	78	-	-	Nepal
24. Jogbani-Dharan	50	-	-	U.K.
25. Lamosangu-Jiri	110	1975	-	Switzerland
26. Dharan-Dhankuta	50	1976	1985	U.K.

Source: Department of Road

(3) FINANCIAL TARGETS FOR THE ROAD AND
BRIDGE DURING THE SEVENTH PLAN

Programme	In Million rupees Expenditure
A. Roads Development:	
A.1 Central Level	2,987.0
i. Highway Construction	(1,780.0)
ii. Feeder Roads Construction	(600.0)
iii. Major Urban Roads	(69.0)
iv. Roads under the IRDPs and Maintenance	(105.0)
v. Highway Reconstruction and Maintenance	(300.0)
vi. Equipment for Roads Construction and Maintenance Establishment of Workshop and Training	(73.0)
vii. Feasibility Study, Surveys and Designs	(25.0)
viii. Miscellaneous	(35.0)
A.2 District Level	394.5
i. Current Road Projects	
ii. Roads to be constructed on the basis of Feasibility Studies	
iii. Miscellaneous	
Total	3,381.5
B. Bridges	149.4
i. New Bridge Construction	
ii. Reconstruction of Bridges	
iii. Feasibility Study and Survey Design.	
iv. Backlog Projects from the Sixth Plan.	
C. Suspension Bridges	199.1
C.1 Central Level	(5.0)
i. Training Programme	
ii. National Highway Development Masterplan	
iii. Suspension Bridge Masterplan	
iv. Study and Research on Cable Crossing	
v. Directory of Suspension Bridge Construction and Maintenance	
C.2 District Level	(194.1)
i. Current Suspension Bridges	
ii. Suspension Bridges to be Undertaken after Feasibility Studies	
iii. Miscellaneous	
Grand Total (A+B+C)	3,730.0

(4) RAINFALL DATA IN KATHMANDU

Rainfall in mm
Kathmandu

Year	Jan.	Feb.	Mar.	Apr.	May.	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Max in 24 hrs. and date
1965	1.7	4.8	16.5	37.5	47.5	349.5	315.5	312.0	82.7	62.6	12.9	Nil	1333.2	72.0 18 June
1966	37.4	40.4	0.6	8.1	82.9	163.8	396.7	437.0	43.9	9.4	1.2	3.4	1224.8	115.2 24 Aug.
1967	Nil	1.3	51.2	60.8	11.6	245.0	476.4	353.5	142.9	Nil	5.9	Nil	1348.6	134.0 10 July
1968	30.5	9.0	44.8	28.9	130.2	331.8	442.0	279.2	83.3	139.5	0.0	0.0	1519.2	62.4 18 May
1969	9.7	2.2	44.6	31.3	60.5	114.8	315.9	340.9	123.0	65.0	2.3	0.0	1110.2	59.1 19 Aug.
1970	24.2	23.1	24.9	41.9	85.6	235.5	458.1	310.8	197.4	34.5	3.8	0.0	1139.8	68.0 16 July
1971	4.3	7.0	21.9	176.1	145.2	697.5	230.6	256.5	59.7	80.3	1.9	0.0	1681.0	109.0 12 June
1972	2.6	25.3	82.6	35.8	82.6	226.8	529.0	204.7	203.2	93.9	23.0	0.0	1509.5	107.4 28 July
1973	23.6	41.8	43.6	23.6	91.6	400.3	416.0	416.4	373.9	126.7	7.0	0.0	1969.2	96.9 11 Aug.
1974	15.0	4.9	15.1	38.4	119.3	80.8	324.6	285.0	212.4	30.3	0.0	9.7	1135.5	53.4 11 Sept.

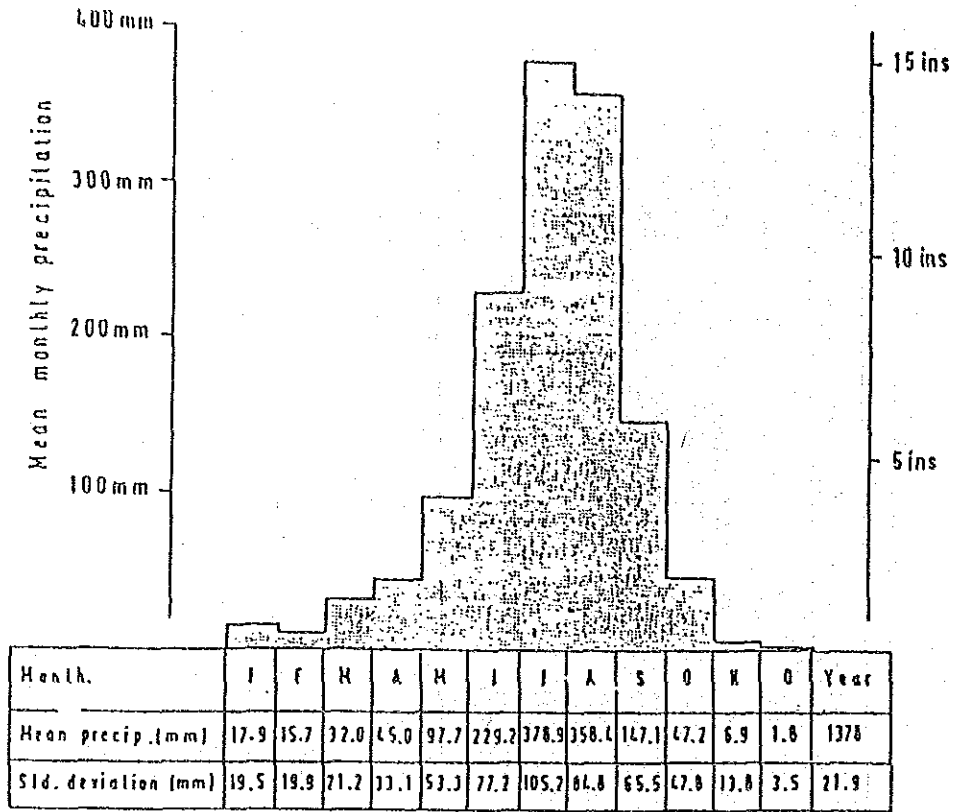
Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Max Date	Min Date	Year
Mean	2.076	1.465	3.338	0.518	1.581	19.11	19.21	55.48	62.15	39.19	9.276	3.752	335	0.16	20.73
Max daily	5.56	14.5	17.2	3.09	4.02	66.2	245	160	217	127	15.2	24.6	25 July	4 June	245
Min daily	1.15	0.39	0.38	0.23	0.36	0.18	7.82	22.5	25.8	15.8	5.56	0.52	73	173	0.18
Mean	1.604	0.721	0.714	1.142	4.263	2.282	17.29	79.82	61.56	15.09	7.180	4.912	350	0.15	10.04
Max Daily	8.72	2.10	2.88	3.15	18.0	17.5	177	200	171	36.2	9.70	6.43	30 Aug.	20	200
Min daily	0.82	0.33	0.16	0.24	0.20	0.29	2.10	22.2	15.0	10.2	5.86	3.40	174	March 174	0.16

Location - Latitude 27° 39' 40" N, Longitude 85° 17' 50" E

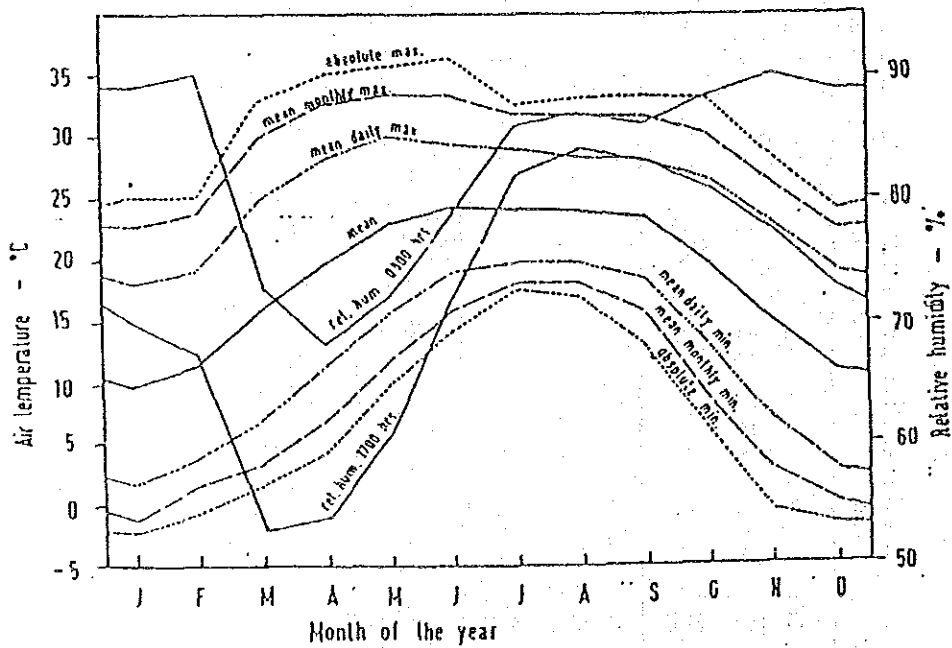
Drainage area - 585 sq. km.

Note: The nearest gauging station from the bridge site in the Chobhar gauging station (Station No. 550) at Chobhar gorge.

(5) PRECIPITATION, AIR TEMPERATURE AND HUMIDITY IN KATHMANDU



Monthly precipitation based on 1948-1970 data



Average monthly air temperature and humidity variation

(6) DISCHARGE AND GAUGE HEIGHT
(BAGMATI RIV., CHOBAR)

Date: 23 July 1989

Station name: Chovar
River: Bagmati River
Station no.: 550

EXTREME DISCHARGES

MAXIMUM INSTANTANEOUS			MINIMUM INSTANTANEOUS		
Discharge (cumec)	Gauge height (meters)	Date	Discharge (cumec)	Gauge height (meters)	Date
206	6.29	1 Sep. 1963	0.15	1.55	14 June 1963
251	6.76	3 Sep. 1964	0.020	1.40	9 June 1964
395	8.10	9 July 1965	0.040	1.40	13 June 1965
634	11.55	24 Aug. 1966	0.18	1.57	21 Apr. 1966
680	12.25	10 July 1967	0.57	1.56	4 June 1967
497	9.60	4 Oct. 1968	0.24	1.65	28 May 1968
431	8.70	19 Aug. 1969	0.44	1.64	14 June 1969
582	10.22	16 July 1970	0.24	1.40	1 Mar. 1970
617	10.57	12 June 1971	0.36	1.58	21 Mar. 1971
876	13.16	28 July 1972	0.046	1.30	8 June 1972
335	7.66	25 July 1973	0.16	1.42	4 June 1973
350	7.82	30 Aug. 1974	0.15	1.41	20 Mar. 1974
591	10.31	3 Aug. 1975	0.20	1.10	6 June 1975
245	6.66	30 June 1976	0.49	1.27	20 Mar. 1976
299	7.26	20 June 1977	0.28	1.27	26 Mar. 1977
407	8.45	16 July 1978	0.84	1.48	9 Mar. 1978
416	8.55	21 Aug. 1979	0.29	1.28	7 June 1979
254	6.75	31 July 1980	0.31	1.36	18 Apr. 1980

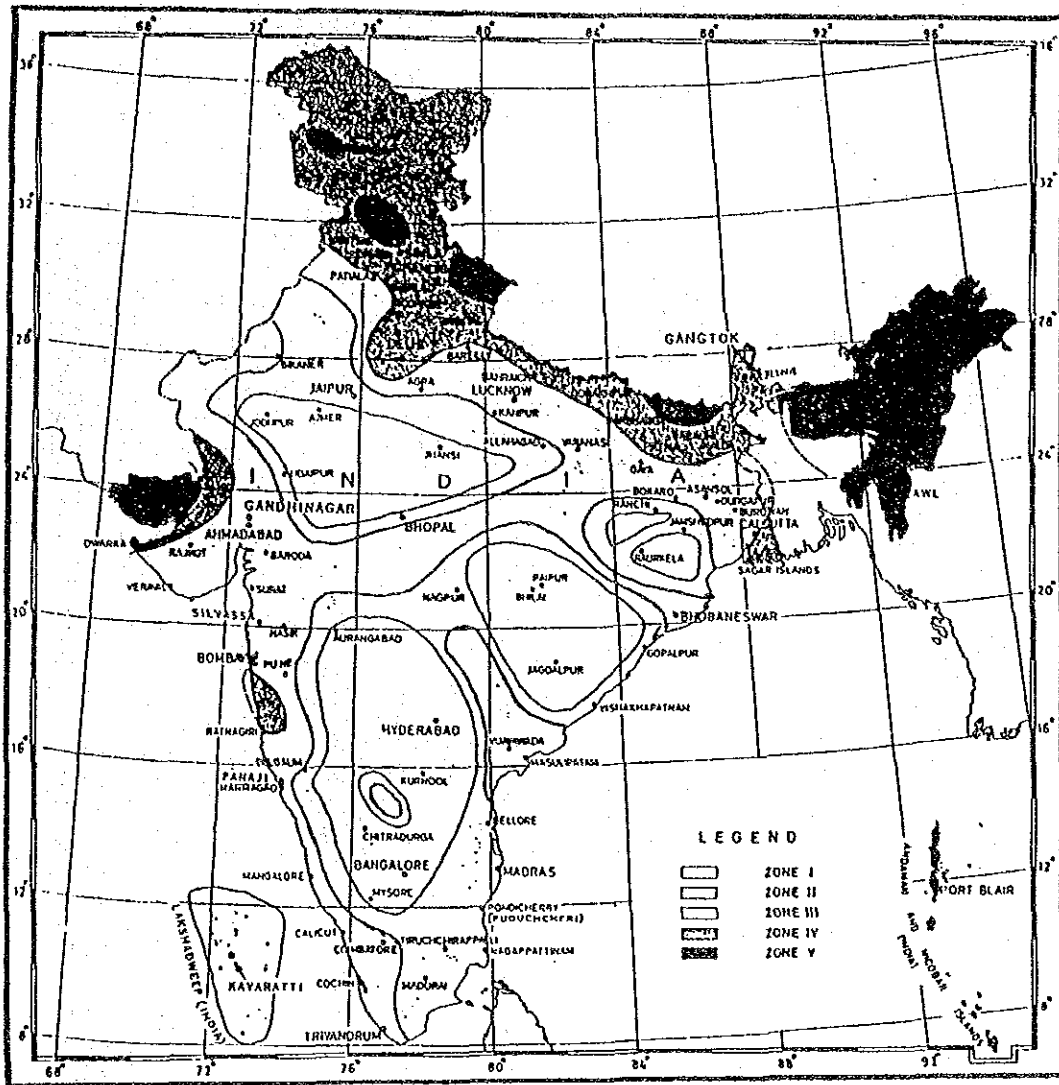
(7) SEISMIC COEFFICIENTS FOR SOME IMPORTANT TOWNS (NBCI)

SEISMIC COEFFICIENTS FOR SOME IMPORTANT TOWNS

TOWN	ZONE	HORIZONTAL SEISMIC COEFFICIENT α_h	TOWN	ZONE	HORIZONTAL SEISMIC COEFFICIENT α_h
Agra	III	0.04	Jabalpur	III	0.04
Ahmadabad	III	0.04	Kanpur	III	0.04
Ajmer	I	0.01	Katmandu	V	0.08
Allahabad	II	0.02	Kohima	V	0.08
Almora	IV	0.05	Kurnool	I	0.01
Ambala	IV	0.05	Lucknow	III	0.04
Amritsar	IV	0.05	Ludhiana	IV	0.05
Asansol	III	0.04	Madras	II	0.02
Aurangabad	I	0.01	Madurai	II	0.02
Bahraich	IV	0.05	Mandi	V	0.08
Bangalore	I	0.01	Mangalore	III	0.04
Barauni	IV	0.05	Monghyr	IV	0.05
Bareilly	III	0.04	Moradabad	IV	0.05
Baroda	III	0.04	Myosre	I	0.01
Bhatinda	III	0.04	Nagpur	II	0.02
Bhilai	I	0.01	Nainital	IV	0.05
Bhopal	II	0.02	Nasik	III	0.04
Bhubaneswar	III	0.04	Nellore	II	0.02
Bhuj	V	0.08	Panjim	III	0.04
Bikaner	III	0.04	Patiala	III	0.04
Bokaro	III	0.04	Patna	IV	0.05
Bombay	III	0.04	Pilibhit	IV	0.05
Burdwan	III	0.04	Pondicherry	II	0.02
Calcutta	III	0.04	Poona	III	0.04
Calicut	III	0.04	Raipur	I	0.01
Chandigarh	IV	0.05	Rajkot	III	0.04
Chitradurga	I	0.01	Ranchi	II	0.02
Coimbatore	III	0.04	Roorkee	IV	0.05
Cuttack	III	0.04	Raurkela	I	0.01
Darbhanga	V	0.08	Sadiya	V	0.08
Darjeeling	IV	0.05	Simla	IV	0.05
Dehra Dun	IV	0.05	Sironj	I	0.01
Delhi	IV	0.05	Srinagar	V	0.08
Durgapur	III	0.04	Surat	III	0.04
Gangtok	IV	0.05	Tezpur	V	0.08
Gadhahi	V	0.08	Thanjavur	II	0.02
Gaya	III	0.04	Tiruchchirappalli	II	0.02
Gorakhpur	IV	0.05	Trivandrum	III	0.04
Hyderabad	I	0.01	Udaipur	II	0.02
Imphal	V	0.08	Varanasi	III	0.04
Jaipur	II	0.02	Vijayawada	III	0.04
Jamshedpur	II	0.02	Vishakhapatnam	II	0.02
Jhansi	I	0.01			
Jodhpur	I	0.01			
Jorhat	V	0.08			

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.

(8) SEISMIC ZONES (NBCI)



The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line. Based upon Survey of India map with the permission of the Surveyor General of India. © Government of India copyright 1975

Fig. 13 Map of India Showing Seismic Zones

(9) LIST OF EARTHQUAKES OF MORE THAN
5 MAGNITUDE IN RICHTER SCALE,
OCCURRED WITHIN THE NEPAL REGION

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

Y	M	D	EPCL AREA	LAT . DEG N	LONG DEG E	DEPT KM	INT MM	MAG	REF
1966	12	18	WEST NEPAL	29.6	81.0			5.0	USC
1966	12	21		29.65	80.79			5.2	ISC
1967	01	05		30.0	86.0			5.2	LAO
1967	08	14		28.0	80.0			5.0	LAO
1967	12	18		29.46	81.71			5.0	ISC
1968	05	27	NEPAL	29.7	80.4			5.1	USV
1969	02	04		28.3	81.4			5.1	LAO
1969	02	11		28.1	82.7			6.2	LAO
1969	02	13		27.9	85.4			5.0	LAO
1969	02	13		28.0	81.8			5.3	LAO
1969	02	24		27.9	85.6			5.2	LAO
1969	03	03		30.04	79.84			5.0	ISC
1969	03	05		29.2	81.1			5.2	HARI
1970	02	12		29.24	81.57			5.3	ISC
1970	02	26		27.62	85.7			5.0	ISC
1971	05	03	TIBET	30.79	84.33	27		5.3	ISC
1971	12	04	NEPAL	27.93	87.95	29		5.2	ISC
1972	02	04	TIBET	30.34	84.47	18		5.1	ISC
1972	03	15	TIBET	30.425	84.502	33		5.3	NEIS
1972	04	28	TIBET	31.34	84.92	32		5.0	ISC
1973	01	02	TIBET	61.17	88.08	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	30.74	86.32			5.5	ISC
1974	03	24	NEPAL	27.66	86.0			5.4	ISC
1974	09	27	NEPAL	28.59	85.51	20		5.5	ISC
1974	12	23	NEPAL	29.32	81.38	45		5.2	ISC
1975	01	31	NEPAL	28.1	84.729	33		5.4	NEIS
1975	06	19		26.74	87.5			5.1	NEIS
1975	09	06	NEPAL	29.21	81.95	33		5.1	ISC
1975	11	26	TIBET	28.15	87.8	33		5.0	ISC
1976	05	10	NEPAL	29.284	81.46	33		5.2	NEIS
1976	09	14	TIBET	29.795	89.559	82		5.5	NEIS
1976	09	29	NEPAL	29.817	81.39	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	31.3	89.38	33		5.0	ISC
1977	11	18	TIBET	32.693	88.388	33		6.5	NEIS
1978	02	10	NEPAL	28.03	84.7			5.3	ISC
1978	08	08	TIBET	32.27	83.1			5.1	ISC
1978	10	04	NEPAL	27.834	85.963	33		5.2	NEIS
1979	05	20	NEPAL INDIA BORDER	30.029	80.31	33		5.9	NEIS

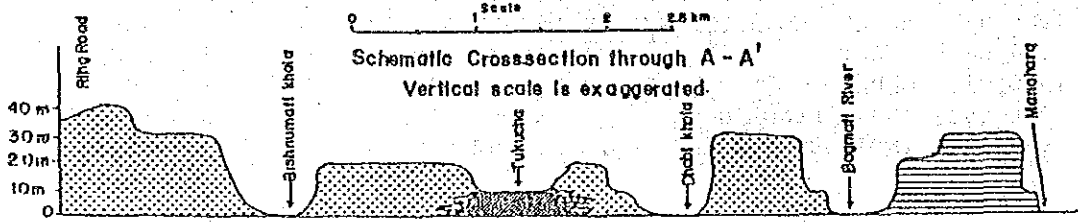
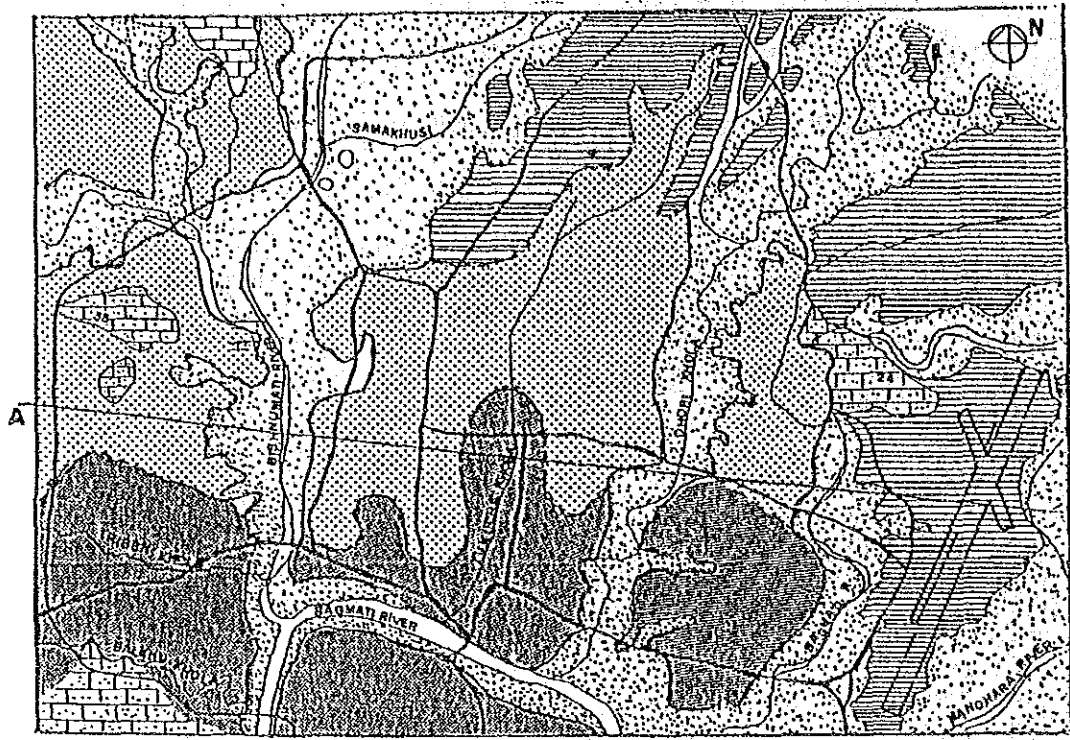
LIST OF EARTHQUAKES OF MORE THAN 5 MAGNITUDE
ON RICHTER SCALE, OCCURED WITHIN THE NEPAL REGION

Y	M D	EPCL AREA	LAT DEG N	LONG DEG E	DEPT KM	INT MM	MAG	REF
1979	0619	NEPAL INDIA BORDER	26.74	87.48			5.2	ISC
1980	0222	TIBET	30.55	88.86	14		5.7	ISC
1980	0625	TIBET	30.13	81.76	28		5.1	ISC
1980	0729	NEPAL	29.34	81.21	3		5.7	ISC
1980	0729	NEPAL	29.598	81.092	18		6.1	NEIS
1980	1008	TIBET	31.354	87.666	33		5.0	NEIS
1980	1010	NEPAL	29.17	81.208	33		5.0	NEIS
1980	1118	TIBET	29.55	85.18	24		5.0	ISC
1980	1119	SIKKIM	27.4	88.8			6.0	ISC
1981	0515		29.504	81.942			5.1	
1982	0405		27.496	88.894			5.1	NEIS
1983	0202	INDIA CHINA BORDER	27.032	92.87	33		5.2	NEIS
1983	0301	INDIA CHINA BORDER	28.61	95.982	33		5.0	NEIS
1984	0219	NEPAL INDIA BORDER	29.659	80.55	58		5.0	NEIS
1984	0415	TIBET	31.586	82.262	33		5.0	NEIS
1984	0518	NEPAL	29.606	81.884	33		5.6	NEIS
1984	0521	INDIA BANGLADESH	23.663	91.519	33		5.3	NEIS
1984	1230	INDIA BANGLADESH	24.598	92.839	33		5.6	NEIS







Abbreviation

Y = year M = month
D = day EPCL = epicentre location
LAT = latitude LONG = longitude
DEPT = depth of hypocentre

(10) GEOLOGICAL MAP OF KATHMANDU CITY

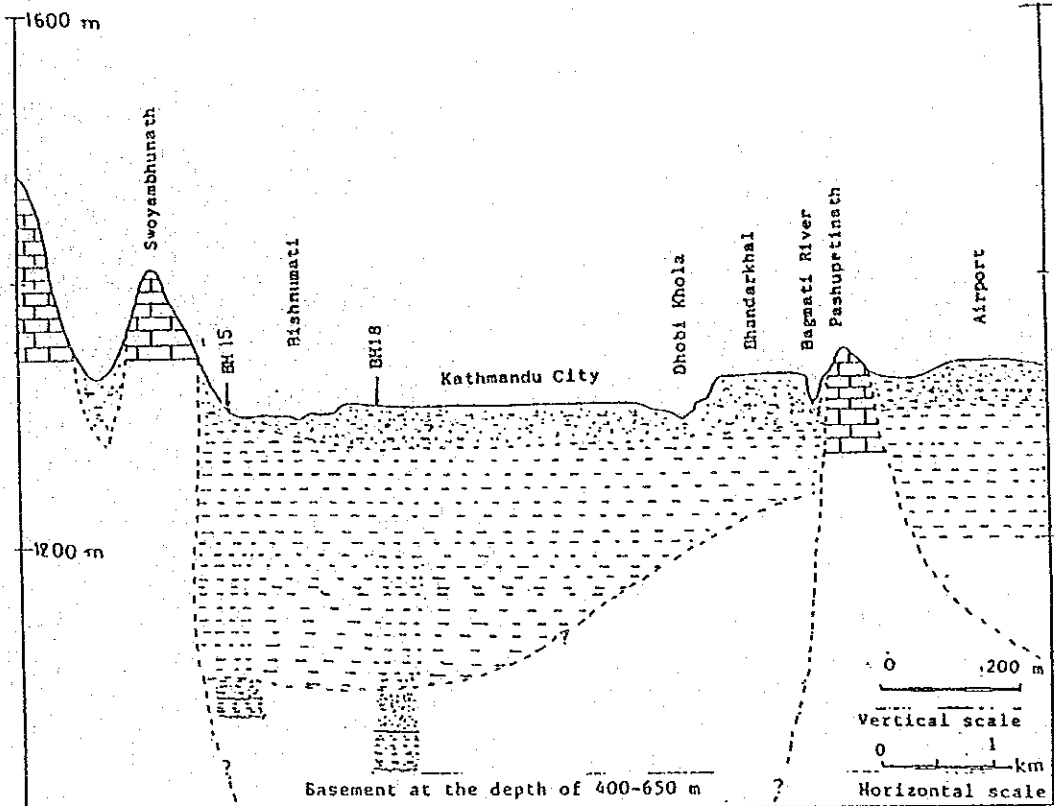


LEGEND

-  Limestone
-  Arenaceous Limestone
-  Lake Delta Facies: Coarse and Fine Sand Interlayered with Thin Clay
-  Proximal Lake Facies: Lamination of Fine Sand and Clay
-  Distal Lake Facies: Black Carbonaceous Clay
-  Flood Plain

Geological Map of Kathmandu City

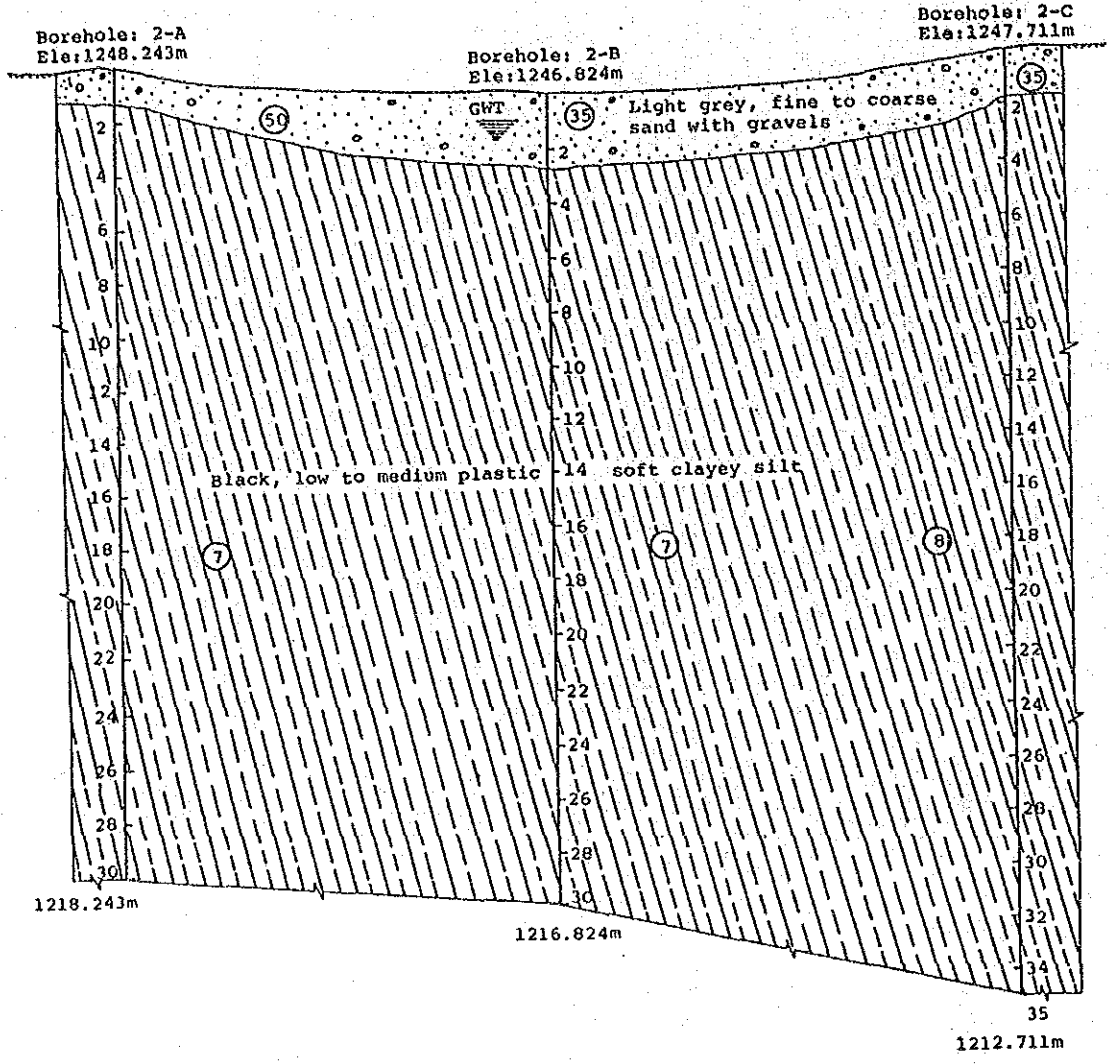
(11) GEOLOGICAL CROSS SECTION IN THE KATHMANDU VALLEY



- | | | | |
|--|-----------------|--|----------------------|
| | Silty Clay | | Sandy Clay |
| | Clay | | Sand |
| | Valley Basement | | Arenaceous Limestone |

Cross Section in E-W Direction
between Swayambhu and Pashupatinath

(12) SOIL PROFILES AT BRIDGE SITE

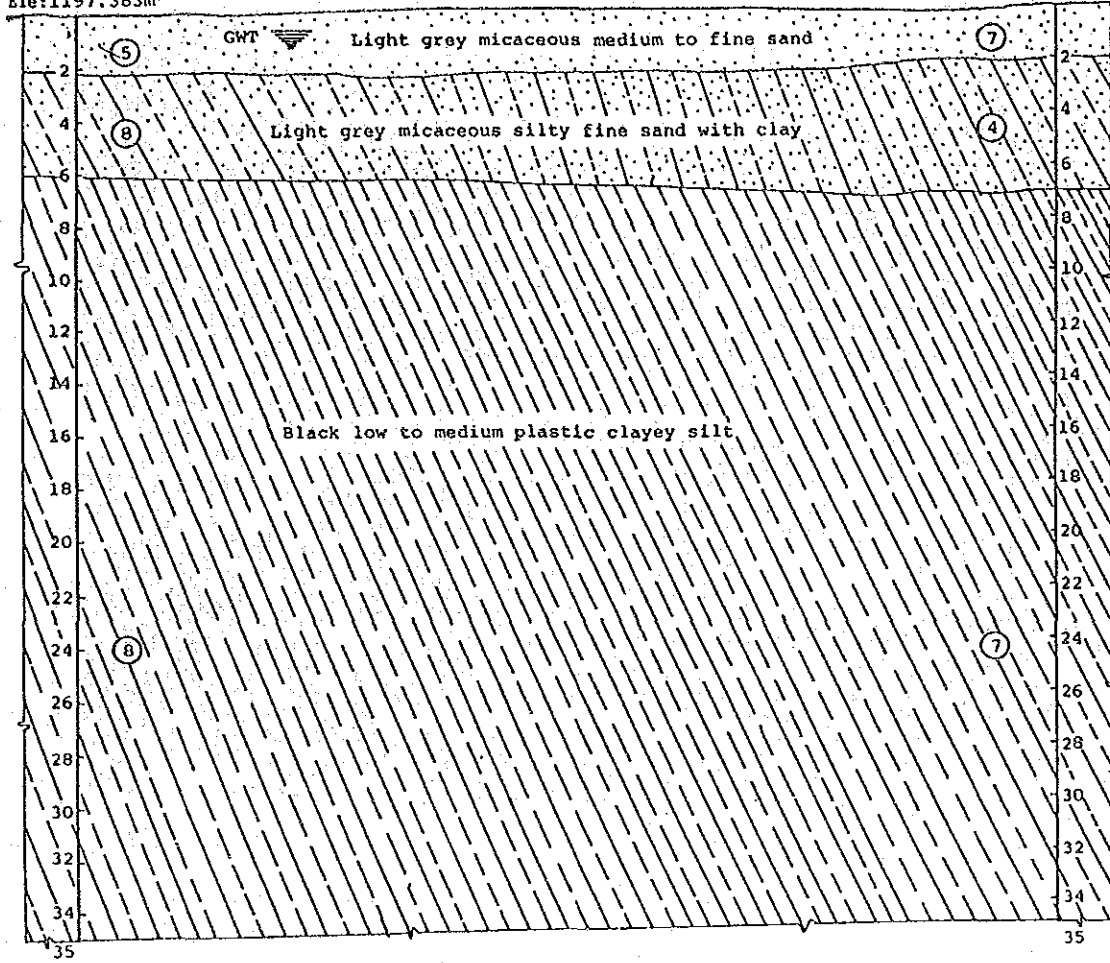


⊙ average SPT for the strata

Fig-8 Geological profile at bridge construction site of Bishnumati river (Dallu)

Borehole: 7-A
Ele: 1197.383m

Borehole: 7-B
Ele: 1247.200m

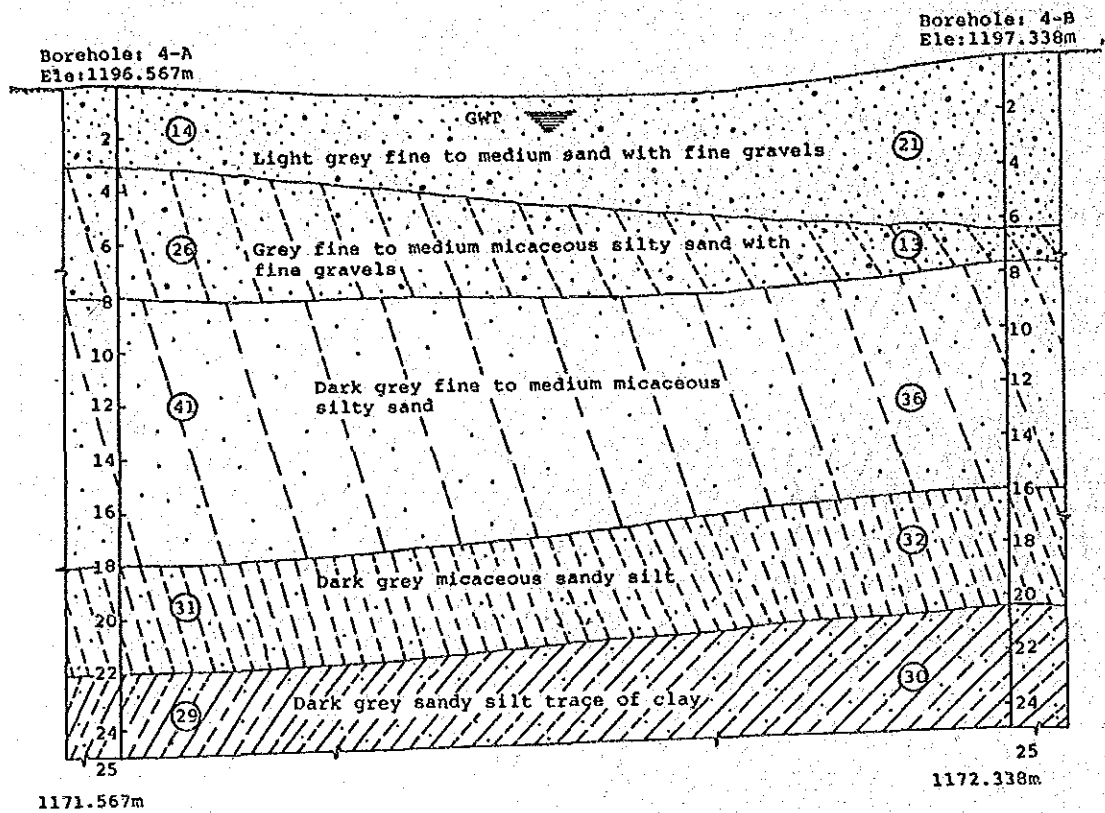


1162.383m

⑤ average SPT value of the strata

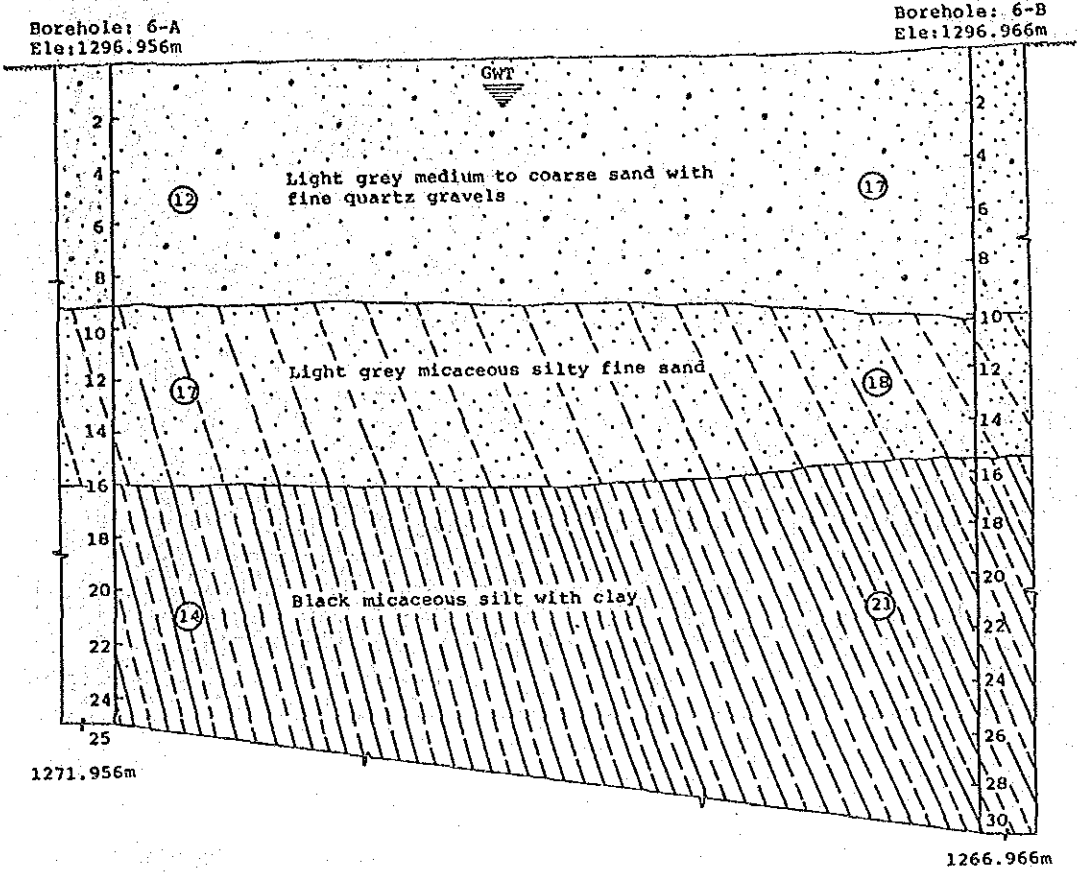
1212.200m

Fig- 11 Geological profile at the bridge construction site of Dhobikhola (Babarmahal)



⑭ average SPT of the strata

Fig- 9 Geological profile at the bridge construction site of Dhobikhola river \ (Kalopul)

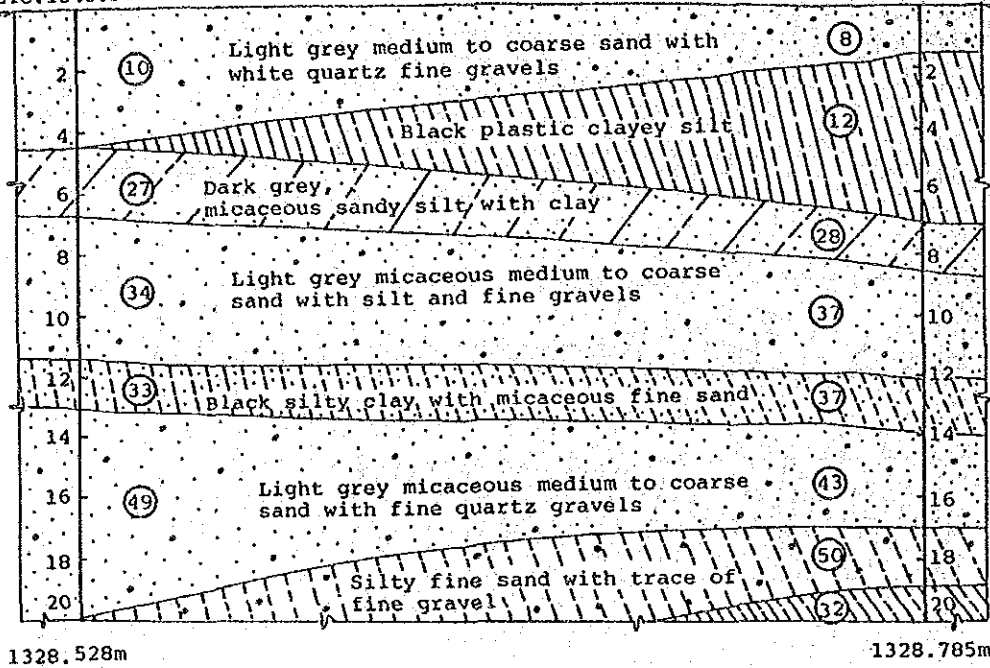


⑫ average SPT for the strata

Fig- 10 Geological profile at the bridge construction site of Dhobikhola river (Handigaon)

Borehole: 8-A
Ele:1348.528m

Borehole: 8-B
Ele:1348.785m

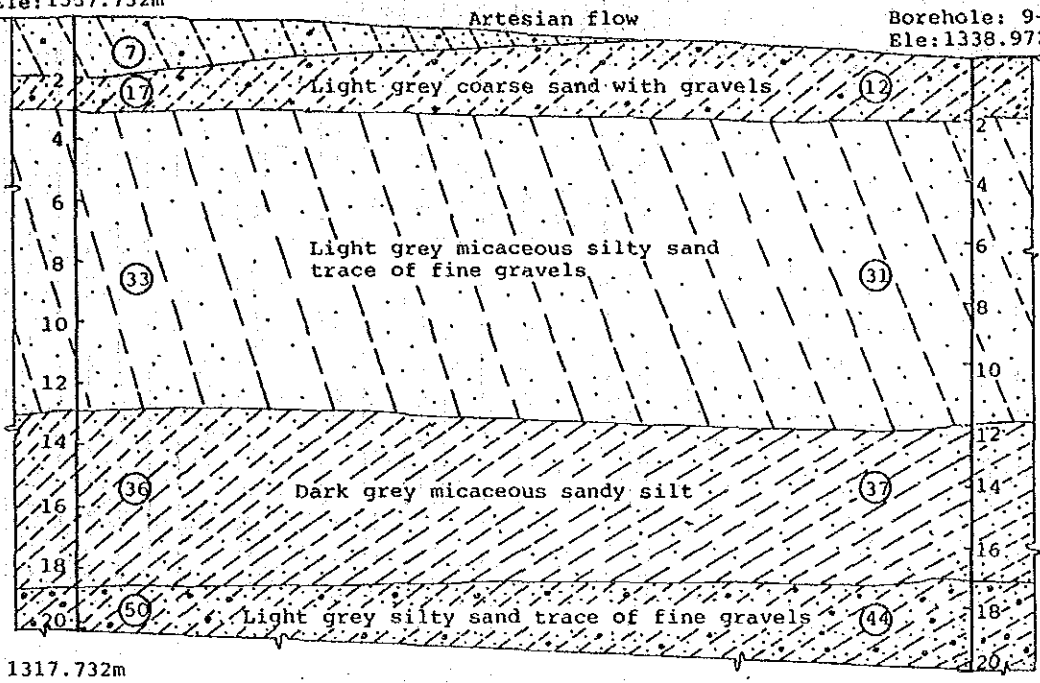


⑩ average SPT for the strata

Fig-12 Geological profile at the bridge construction site of Mahadeo khola

Borehole: 9-A
Ele: 1337.732m

Borehole: 9-B
Ele: 1338.972m



1317.732m

1318.972m

⑦ average SPT for the strata

Fig-13 Geological profile at the bridge construction site of Manmatta river
(Branch of Manohara river)

(13) SOIL BORING LOG

Borehole: 2-A

Project : Soil investigation and laboratory test for basic design study on reconstruction of Kathmandu valley bridges

Elevation: 1248.243

Location: Bishnumati

Total depth: 30.0m

Date: 20-25/10/89

Soil Description	Symbol	Depth, meter	Sample/type	No. of blows			N-Value	Water level	SPT value-N, No. of blows/30cm penetration													
				10cm	10cm	10cm			10	20	30	40	50									
Light grey fine to medium sand gravels with boulders (0.0-1.35m)		0		50			50															
Black moist to wet, medium plasticity clay with silt and trace of fine sand (1.35-30.0m)		3	Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	1	0	1	2	Ground water level encountered at 2.3m depth														
		1		1	1	3																
		1		1	1	3																
		1		1	1	3																
		1		1	2	4																
		1		1	1	3																
		1		1	1	3																
		2		1	2	5																
		2		2	1	5																
		1		2	3	6																
		2		2	3	7																
		1		2	3	6																
		3		3	3	9																
		3		3	3	9																
		3		4	3	10																
		2		3	3	8																
		2		3	3	8																
		2		3	3	8																
		3		3	3	9																
		33		2	4	9																
2	2	2	6																			
4	5	5	14																			
2	1	2	5																			
4	3	4	11																			
3	4	4	11																			
4	5	5	14																			
3	2	3	8																			
4	4	4	12																			
3	2	4	9																			

Borehole: 2-B

Project : Soil investigation and laboratory test for basic design study on reconstruction of Kathmandu valley bridges

Elevation: 1246.824

Location: Bishnumati

Total depth: 30.0m

Date: 20-25/10/89

Soil Description	Symbol	Depth, meter	Sample/type	No. of blows			N-Value	Water level	SPT value-N, No. of blows/30cm penetration						
				10cm	10cm	10cm			10	20	30	40	50		
Light grey medium to coarse, sand and gravels with boulder (0.0-2.8m)		0-3	Disturbed samples extracted at each 1.0m depth of the borehole to the entire depth	11	5	4	20								
				50			50								
				1	1	1	3								
				1	1	1	3								
				1	1	1	3								
				1	1	1	3								
				2	1	2	5								
				1	2	2	5								
				2	2	2	6								
				1	2	2	5								
				2	2	3	7								
Black moist to wet medium plasticity clay with silt (2.80-30.0m)		3-30	Disturbed samples extracted at each 1.0m depth of the borehole to the entire depth	2	1	2	5	Ground water level encountered at 1.0m depth							
				1	2	2	5								
				2	2	3	7								
				2	1	2	5								
				1	2	3	6								
				2	3	3	8								
				3	4	3	10								
				3	2	2	7								
				3	2	3	8								
				3	3	3	9								
				1	2	2	5								
				2	3	3	8								
				3	2	4	9								
				2	3	3	8								
				3	2	4	9								
				3	3	5	11								
				3	5	4	12								
				3	4	4	11								
				3	3	4	10								
3	3	3	9												
3	4	3	10												
3	2	2	8												

Borehole: 2-C

Project : Soil investigation and laboratory test for basic design study on reconstruction of Kathmandu valley bridges

Elevation: 1247.711

Location: Bishnumati

Total depth: 35.0m

Date: 1-4/11/89

Soil Description	Symbol	Depth, meter	Sample/type	No. of blows			N-Value	Water level	SPT value-N, No. of blows/30cm penetration					
				10cm	10cm	10cm			10	20	30	40	50	
Light grey fine to medium sand gravels with boulders (0.0m-1.9m)	[Symbol]	0		10	6	5	21	[Water level graph]						
				25	15	10	50							
				1	1	1	3							
				1	0	1	2							
				1	1	1	3							
				1	1	2	4							
				1	2	2	5							
				UD1	1	2	2		5					
				UD2	2	2	2		6					
				UD3	1	2	2		5					
				UD4	1	2	3		6					
				Black moist to wet medium plasticity clay with silt (1.9m-35.0m)	[Symbol]	1.9			2	3	4	9		
2	3	4	9											
4	4	4	12											
UD5	2	3	4					9						
UD6	2	4	4					10						
2	3	3	8											
2	3	3	8											
3	3	3	9											
3	3	4	10											
3	3	4	10											
3	3	4	10											
27	3	4	5					12						
3	3	4	11											
2	4	4	10											
30	3	3	4	11*										

* Average SPT from 30m to 35m

Borehole: 4-A

Project : Soil investigation and laboratory test for basic design study on reconstruction of Kathmandu valley bridges

Elevation: 1196.567

Location: Dhobikhola

Total depth: 25m

Date: 20-24/10/89

Soil Description	Symbol	Depth, meter	Sample/type	No. of blows			N-Value	Water level	SPT value-N, No. of blows/30cm penetration										
				10cm	10cm	10cm			10	20	30	40	50						
Light grey fine to medium sand with fine gravels (0-3.0m)	[Symbol]	0-3	Sample type	4	4	7	15	Ground water level encountered at 0.96m depth	10	20	30	40	50						
				3	5	6	14		10	20	30	40	50						
				5	5	7	17		10	20	30	40	50						
Grey fine to medium micaceous silty sand with fine gravels (8.0-8.0m)	[Symbol]	3-6	Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	6	7	9	22	Ground water level encountered at 0.96m depth	10	20	30	40	50						
				7	8	9	24		10	20	30	40	50						
				8	9	13	30		10	20	30	40	50						
				10	13	15	38		10	20	30	40	50						
				13	16	18	47		10	20	30	40	50						
				12	15	17	44		10	20	30	40	50						
Dark grey fine to medium micaceous silty sand (8.0-18.0m)	[Symbol]	6-12	Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	10	9	13	32	Ground water level encountered at 0.96m depth	10	20	30	40	50						
				13	14	20	47		10	20	30	40	50						
				14	15	16	45		10	20	30	40	50						
				14	16	17	47		10	20	30	40	50						
				10	16	19	45		10	20	30	40	50						
				5	9	14	28		10	20	30	40	50						
Dark grey micaceous sandy silt (18.0-22.0m)	[Symbol]	12-18	Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	10	11	14	35	Ground water level encountered at 0.96m depth	10	20	30	40	50						
				13	14	17	44		10	20	30	40	50						
				12	13	15	40		10	20	30	40	50						
Dark grey sandy silt trace of clay (22.0-25.0m)	[Symbol]	18-24	Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	7	12	14	33	Ground water level encountered at 0.96m depth	10	20	30	40	50						
				6	7	13	26		10	20	30	40	50						
				6	9	11	26		10	20	30	40	50						
	[Symbol]	24-27	Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	7	9	13	29	Ground water level encountered at 0.96m depth	10	20	30	40	50						
				5	9	11	25		10	20	30	40	50						
				8	8	16	32		10	20	30	40	50						
		27-30		10	10	12	32												

Borehole: 4-B

Project : Soil investigation and laboratory test for basic design study on reconstruction of Kathmandu valley bridges

Elevation: 1197.338

Location: Dhobikhola

Total depth: 25.00m

Date: 20-23/10/89

Soil Description	Symbol	Depth, meter	Sample/type	No. of blows			N-value	Water level	SPT value-N, No. of blows/30cm penetration
				10cm	10cm	10cm			
Light grey medium to coarse sand with fine quartz gravels (0-5.50m)	[Symbol]	3	Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	3	3	5	11	[Water level symbol]	[SPT graph]
				5	5	8	18		
				8	7	8	23		
Dark grey sandy silt trace of fine gravels (5.50-7.50m)	[Symbol]	6	Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	6	8	9	24	[Water level symbol]	[SPT graph]
				11	11	13	30		
				2	4	6	12		
Dark grey fine medium micaceous silty sand (7.50-16.00)	[Symbol]	9	Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	4	4	6	14	[Water level symbol]	[SPT graph]
				11	12	18	41		
				6	10	12	28		
Dark grey micaceous sandy silt (16.00-20.50m)	[Symbol]	12	Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	10	10	11	31	[Water level symbol]	[SPT graph]
				11	12	18	41		
				15	18	17	50		
Dark grey micaceous sandy silt (20.50-25.00m)	[Symbol]	15	Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	13	16	14	43	[Water level symbol]	[SPT graph]
				8	11	14	33		
				6	9	11	26		
Dark grey micaceous sandy silt trace of clay (20.50-25.00m)	[Symbol]	18	Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	6	10	12	28	[Water level symbol]	[SPT graph]
				7	18	22	47		
				4	9	13	26		
Dark grey micaceous sandy silt trace of clay (20.50-25.00m)	[Symbol]	21	Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	6	8	12	26	[Water level symbol]	[SPT graph]
				8	9	16	33		
				6	7	10	23		
Dark grey micaceous sandy silt trace of clay (20.50-25.00m)	[Symbol]	24	Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	5	6	8	19	[Water level symbol]	[SPT graph]
				6	13	14	33		
				13	14	17	44		
	[Symbol]	27	Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	7	9	15	31	[Water level symbol]	[SPT graph]
		30							

Borehole: 6-A

Project : Soil investigation and laboratory test for basic design study on reconstruction of Kathmandu valley bridges

Elevation: 1296.956

Location: Dhobikhola

Total depth: 25.0m

Date: 24-27/10/89

Soil Description	Symbol	Depth, meter	Sample/type	No. of blows			N-Value	Water level	SPT value-N, No. of blows/30cm penetration								
				10cm	10cm	10cm			10	20	30	40	50				
Light grey medium to coarse sand with fine quartz gravels (0-9.0m)	[Symbol: dots]	3	Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	3	3	5	11	Water level encountered at 1.0m depth	10	20	30	40	50				
				3	3	3	9		10	20	30	40	50				
				3	4	4	11		10	20	30	40	50				
				3	4	6	13		10	20	30	40	50				
				4	4	5	13		10	20	30	40	50				
				3	3	4	10		10	20	30	40	50				
				5	4	5	14		10	20	30	40	50				
				5	6	6	17		10	20	30	40	50				
				5	6	8	19		10	20	30	40	50				
				Light grey micaceous silty fine sand (9.0-16.0m)	[Symbol: dashed lines]	12	Disturbed samples extracted at each 1.0m depth of borehole to the entire depth		4	4	6	14	Water level encountered at 1.0m depth	10	20	30	40
3	4	8	15					10	20	30	40	50					
5	7	5	17					10	20	30	40	50					
7	8	9	24					10	20	30	40	50					
3	6	9	18					10	20	30	40	50					
4	6	8	18					10	20	30	40	50					
Black micaceous silt with clay (16.0-25.0m)	[Symbol: diagonal lines]	18	Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	4	6	8	18	Water level encountered at 1.0m depth	10	20	30	40	50				
				4	6	8	18		10	20	30	40	50				
				3	4	7	14		10	20	30	40	50				
				4	5	7	16		10	20	30	40	50				
				4	5	7	16		10	20	30	40	50				
				4	5	6	15		10	20	30	40	50				
				4	5	5	14		10	20	30	40	50				
				4	5	6	15		10	20	30	40	50				
	[Symbol: blank]	24	Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	4	4	5	13	Water level encountered at 1.0m depth	10	20	30	40	50				
				3	4	6	13		10	20	30	40	50				
				3	5	5	13		10	20	30	40	50				
		27															
		30															

Borehole: 6-B

Project : Soil investigation and laboratory test for basic design study on reconstruction of Kathmandu valley bridges

Elevation: 1296.966

Location: Dhobikhola

Total depth: 30.0m

Date: 24-28/10/89

Soil Description	Symbol	Depth, meter	Sample/type	No. of blows			N-Value	Water level	SPT value-N, No. of blows/30cm penetration *													
				10cm	10cm	10cm			10	20	30	40	50	60	70	80						
Light grey medium to coarse sand with fine quartz gravels (0-10.0m)		3		7	6	5	18															
				3	2	4	9															
				5	5	6	16															
				6	7	8	21															
				5	5	5	15															
				4	5	7	16															
				5	5	7	17															
				8	7	8	23															
				5	5	9	19															
				5	7	6	18															
Dark grey micaceous silty fine sand (10.0-15.5m)		12		4	7	9	20	Water level encountered at 1.6m depth														
				3	5	8	16															
				4	7	10	21															
				4	4	6	14															
				4	6	7	17															
				4	5	6	15															
				4	5	5	14															
				4	5	5	14															
				4	4	5	13															
				6	6	6	18															
Black micaceous silt with clay (15.5-30.0m)		21	UD3	4	5	6	15															
				5	6	7	18															
				6	6	8	20															
				5	7	8	20															
				10	12	13	35															
				10	12	13	35															
				10	12	13	35															
				7	8	9	24															
				8	9	9	26															
				7	8	10	25															

Borehole: 7-A

Project : Soil investigation and laboratory test for basic design study on reconstruction of Kathmandu valley bridges

Elevation: 1197.383

Location: Dhobikhola

Total depth: 35.0m

Date: 5-9/11/89

Soil Description	Symbol	Depth, meter	Sample/type	No. of blows			N-Value	Water level	SPT value-N, No. of blows/30cm penetration *													
				10cm	10cm	10cm			10	20	30	40	50	60								
Light grey micaceous medium to fine sand (0-2.2m)				2	2	1	5	4														
				3	1	3	7															
Light grey micaceous silty fine sand with clay (2.2-6.0m)		-3		2	3	3	8	Ground water level encountered at 1.3m depth														
				2	3	4	9															
				2	2	4	8															
				1	2	2	5															
				1	2	3	6															
				UD1	1	1	2		4													
				UD2	2	2	2		6													
				UD2	2	2	3		7													
				UD3	2	1	2		5													
				UD3	2	2	2		6													
				UD3	2	2	3		7													
				Black low to medium plastic clayey silt (6.0-35m)		-12			3	2	3	8										
UD4	2	2	2					6														
1	2	2	5																			
UD5	2	3	3					8														
2	2	3	7																			
1	2	3	6																			
2	3	4	9																			
2	3	4	9																			
2	3	4	9																			
3	3	4	10																			
	4	5	7	16																		
	4	5	5	14																		
	3	3	4	10																		
	2	3	4	9																		
	2	3	4	9																		
	3	3	4	10																		
	3	4	4	12*																		

* 12 average SPT from 30m to 35m

Borehole: 7-B

Project : Soil investigation and laboratory test for basic design study on reconstruction of Kathmandu valley bridges

Elevation: 1247.200

Location: Dhobikhola

Total depth: 35.0m

Date: 5-9/11/89

Soil Description	Symbol	Depth, meter	Sample/type	No. of blows			N-Value	Water level	SPT value-N, No. of blows/30cm penetration														
				10cm	10cm	10cm			10	20	30	40	50	60									
Light grey medium to fine sand (0-2.0m)		0-2		1	3	3	7																
Light grey micaceous silty sand clay (2.0-6.5m)		3-6	Disturbed samples extracted from each 1.0m depth of borehole to the entire depth	1	0	1	2	2	10														
				1	2	2	5																
				2	2	2	6																
				1	1	2	4																
				1	1	1	3																
				2	1	2	5																
				2	3	3	8																
				1	2	2	5																
				2	2	2	6																
				2	2	2	6																
				1	1	2	4																
				Black low to medium plastic clayey silt (6.5-35m)		6-30	Disturbed samples extracted from each 1.0m depth of borehole to the entire depth	1	2	3	6												
1	1	2	4																				
1	2	2	5																				
1	2	2	5																				
2	1	2	5																				
2	2	2	6																				
1	2	2	5																				
2	2	2	6																				
2	2	3	7																				
2	2	2	6																				
3	3	3	9																				
2	3	3	8																				
3	3	3	9																				
3	4	5	12																				
3	4	4	11																				
2	3	4	9																				
2	2	4	8																				
3	3	3	9																				
2	4	3	11*																				

* 11 average SPT from 30m to 35m

Borehole: 8-A

Project : Soil investigation and laboratory test for basic design study on reconstruction of Kathmandu valley bridges

Elevation: 1346.528

Location: Mahadeo khola

Total depth: 20.0m

Date: 26 Oct. - 1 Nov., 85

Soil Description	Symbol	Depth, meter	Sample/type	No. of blows			N-value	Water level	SPT value-N, No. of blows/30cm penetration
				10cm	10cm	10cm			
Light grey medium to coarse sand with white quartz fine gravels (0-4.5m) Dark grey micaceous sandy silt with clay (4.5-6.7m) Light grey micaceous medium to coarse sand with silt and fine gravels (6.7-11.35m) Black silty clay with micaceous fine sand (11.35-13.0m) Light grey micaceous medium to coarse sand with fine quartz gravels (13.0-20.0m)		3 6 9 12 15 18 21 24 27 30	Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	2	1	1	4	Ground water level encountered at 2.4m depth	
				2	2	5	9		
				3	4	5	12		
				8	6	3	17		
				4	4	6	14		
				9	14	17	40		
				25	25		50		
				9	10	12	31		
				19	18	13	50		
				12	13	10	35		
				8	13	13	34		
				6	9	18	33		
				18	23	9	50		
				19	24	7	50		
				11	16	19	46		
12	16	22	50						
25	25		50						
17	20	13	50						
16	22	12	50						
15	18	17	50						

Borehole: 8-B

Project : Soil investigation and laboratory test for basic design study on reconstruction of Kathmandu valley bridges

Elevation: 1348.785

Location: Mahadeo Khola

Total depth: 20.0m

Date: 28 Oct. - 2 Nov., 89

Soil Description	Symbol	Depth, meter	Sample/type	No. of blows			N-Value	Water level	SPT value-N, No. of blows/30cm penetration
				10cm	10cm	10cm			
Light grey micaceous fine to medium sand with gravels (0-1.9m)		0-1.9		3	2	3	8		
				2	2	4	8		
Black silty clay (1.9-7.0m)		1.9-7.0		2	4	5	11		
				3	4	6	13		
				4	4	6	14		
				3	5	6	14		
Light grey silty sand with clay (7.0-8.6m)		7.0-8.6		7	10	10	27		
				9	10	10	29		
Light grey medium to coarse sand with fine quartz gravels (8.6-12.0m)		8.6-12.0		10	13	11	34		
				50			50		
Light grey silty sand trace of fine gravels (12.0-14.0m)		12.0-14.0		6	10	13	29		
				5	9	11	25		
Light grey medium to fine sand with fine quartz gravels (14.0-17.0m)		14.0-17.0		12	18	20	50		
				12	14	15	41		
Light grey medium to fine sand with fine quartz gravels (17.0-20.0m)		17.0-20.0		9	14	16	39		
				14	18	18	50		
				20	20	10	50		
Light grey silty fine sand trace of fine gravels and black clayey silt after 19.5m		19.5-20.0		25	25		50		
				20	22	8	50		
Disturbed samples extracted at each 1.0m depth of borehole to the entire depth		20-30		8	11	13	32		

Borehole: 9-A

Project : Soil investigation and laboratory test for basic design study on reconstruction of Kathmandu valley bridges

Elevation: 1337.732

Location: Manmatta Khola

Total depth: 20.0m

Date: 3-5/11/89

Soil Description	Symbol	Depth, meter	Sample/type	No. of blows			N-Value	Water level	SPT value-N, No. of blows/30cm penetration							
				10cm	10cm	10cm			10	20	30	40	50			
Light grey medium silty sand with fine gravel (0-2.0m)	[Symbol]	0-2.0		1	2	4	7	[Water Level Symbol]	10	20	30	40	50	60	70	80
				6	6	5	17		10	20	30	40	50	60	70	80
Light grey coarse sand with gravels (2.0-3.0m)	[Symbol]	3-6		6	8	18	32	Ground water level encountered at 1.3m depth	10	20	30	40	50	60	70	80
				8	10	11	29		10	20	30	40	50	60	70	80
Light grey micaceous silty sand trace of fine gravels (3.0-13.0m)	[Symbol]	6-12		9	11	11	31	Ground water level encountered at 1.3m depth	10	20	30	40	50	60	70	80
				19	15	16	50		10	20	30	40	50	60	70	80
Light grey micaceous silty sand trace of fine gravels (3.0-13.0m)	[Symbol]	12-15		9	10	14	33	Ground water level encountered at 1.3m depth	10	20	30	40	50	60	70	80
				12	11	13	36		10	20	30	40	50	60	70	80
Dark grey micaceous sandy silt (13.0-19.0m)	[Symbol]	15-18		10	13	16	39	Ground water level encountered at 1.3m depth	10	20	30	40	50	60	70	80
				11	12	14	37		10	20	30	40	50	60	70	80
Dark grey micaceous sandy silt (13.0-19.0m)	[Symbol]	18-21		12	13	20	45	Ground water level encountered at 1.3m depth	10	20	30	40	50	60	70	80
				7	11	14	32		10	20	30	40	50	60	70	80
Light grey silty sand trace of fine gravels (19.0-20.0m)	[Symbol]	21-28		10	10	18	38	Ground water level encountered at 1.3m depth	10	20	30	40	50	60	70	80
				12	15	18	45		10	20	30	40	50	60	70	80
Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	[Symbol]	28-30		8	12	17	37	Ground water level encountered at 1.3m depth	10	20	30	40	50	60	70	80
				8	11	14	33		10	20	30	40	50	60	70	80
Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	[Symbol]	30-33		10	10	10	30	Ground water level encountered at 1.3m depth	10	20	30	40	50	60	70	80
				9	11	13	33		10	20	30	40	50	60	70	80
Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	[Symbol]	33-36		31	19		50	Ground water level encountered at 1.3m depth	10	20	30	40	50	60	70	80
				28	22		50		10	20	30	40	50	60	70	80
Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	[Symbol]	36-39		21				Ground water level encountered at 1.3m depth	10	20	30	40	50	60	70	80
				24					10	20	30	40	50	60	70	80
Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	[Symbol]	39-42		27				Ground water level encountered at 1.3m depth	10	20	30	40	50	60	70	80
				27					10	20	30	40	50	60	70	80
Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	[Symbol]	42-45		30				Ground water level encountered at 1.3m depth	10	20	30	40	50	60	70	80
				30					10	20	30	40	50	60	70	80

Borehole: 9-B

Project : Soil investigation and laboratory test for basic design study on reconstruction of Kathmandu valley bridges

Elevation: 1338.972

Location: Manmatta khola

Total depth: 20.0m

Date: 2-5/11/89

Soil Description	Symbol	Depth, meter	Sample/type	No. of blows			N-value	Water level	SPT value-N, No. of blows/30cm penetration									
				10cm	10cm	10cm			10	20	30	40	50					
Light grey medium to coarse sand with gravels (0-2.0m)		0-3	Sample type	2	4	6	12	Artesian flow occurred	10	20	30	40	50					
				5	9	9	23		10	20	30	40	50					
				7	8	10	25		10	20	30	40	50					
				6	7	8	21		10	20	30	40	50					
				7	9	12	28		10	20	30	40	50					
				6	9	10	25		10	20	30	40	50					
				9	11	12	32		10	20	30	40	50					
Light grey micaceous silty sand trace of fine gravels (2.0-12.0m)		3-6	Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	10	14	17	41	Artesian flow occurred	10	20	30	40	50					
				12	15	15	42		10	20	30	40	50					
				14	14	15	43		10	20	30	40	50					
				9	11	16	36		10	20	30	40	50					
				9	12	16	37		10	20	30	40	50					
Dark grey micaceous sandy silt (12.0-17.0m)		6-12	Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	9	13	13	35	Artesian flow occurred	10	20	30	40	50					
				9	12	14	35		10	20	30	40	50					
				6	12	12	30		10	20	30	40	50					
Light grey silty sand trace of fine gravels (17.0-20.0m)		12-18	Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	10	28	12	50	Artesian flow occurred	10	20	30	40	50					
				22	28		50		10	20	30	40	50					
				9	11	13	33		10	20	30	40	50					
		18-21	Disturbed samples extracted at each 1.0m depth of borehole to the entire depth	15	15	15	45	Artesian flow occurred	10	20	30	40	50					
				35	15		50		10	20	30	40	50					
		21-24																
		24-27																
		27-30																

(14) DESIGN LIVE LOADS (AASHTO, HS20-44)

3.7.7 -HS Loading

The HS loadings consist of a tractor truck with semi-trailer or the corresponding lane load as illustrated in Figures 3.7.7A and 3.7.6B. The HS loadings are designated by the letters HS followed by a number indicating the gross weight in tons of the tractor truck. The variable axle spacing has been introduced in order that the spacing of axles may approximate more closely the tractor trailers now in use. The variable spacing also provides a more satisfactory loading for continuous spans, in that heavy axle loads may be so placed on adjoining spans as to produce maximum negative moments.

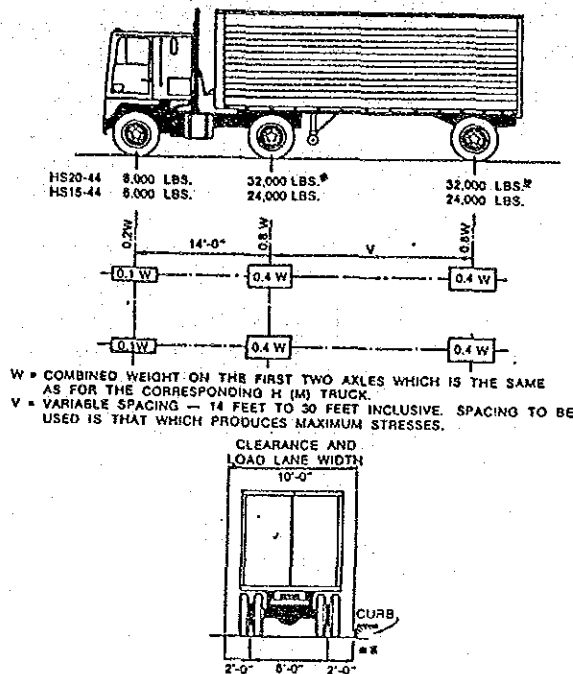
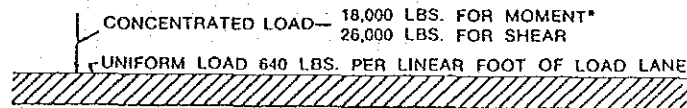


Figure 3.7.7A. Standard HS Trucks

*In the design of timber floors and orthotropic steel decks (excluding transverse beams) for HS 20 loading, one axle load of 24,000 pounds or two axle loads of 16,000 pounds each, spaced 4 feet apart may be used, whichever produces the greater stress, instead of the 32,000-pound axle shown.

**For slab design, the center line of wheels shall be assumed to be 1 foot from face of curb. (See Article 3.7.2.)



H20-44 LOADING
 HS20-44 LOADING

Fig. 3.7.6B

(15) DESIGN LIVE LOADS (JS, TL-20)

2.1.3 Live load loading on the 1st class and 2nd class bridges

The live load shall consist of the moving load of trucks (the T-loading and the L-loading), the sidewalk loading and the tramcar loading.

Table 2.1.2 T-loadings

Class of bridge	Loading	Gross weight W(ton)	Weight of a front wheel 0.1W(kg)	Weight of a rear wheel 0.4W(kg)	Width of a front wheel b_1 (cm)	Width of a rear wheel b_2 (cm)	Length of contact area of a wheel on the road-surface a (cm)
1st	T-20	20	2000	8000	12.5	50	20
2nd	T-14	14	1400	5600	12.5	50	20

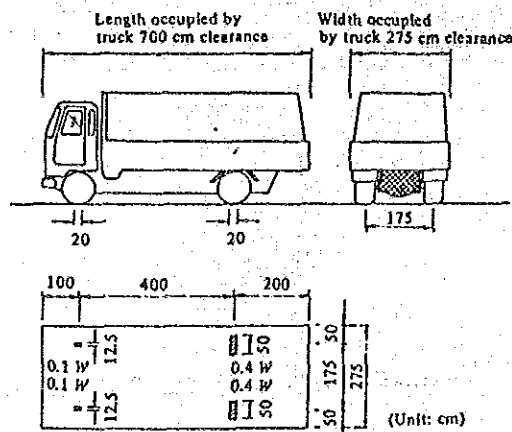


Fig. 2.1.1 T-loadings

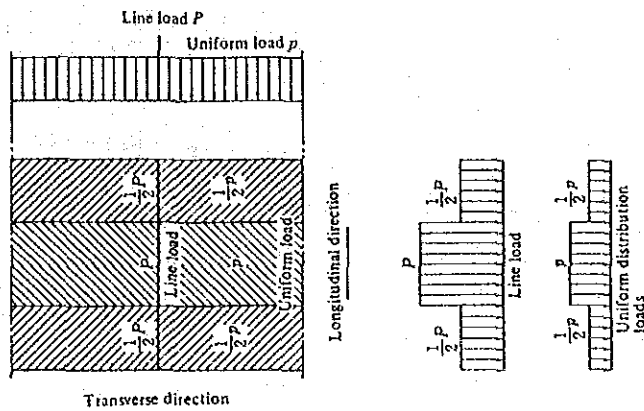


Fig. 2.1.3 L-loadings

Table 2.1.3 L-loadings

Class of bridge	Loading	Main loads (up to 5.5 meters in width)				Sub-loads
		Line load P (kg/m)	Uniform load, p (kg/m ²)			
			L < 80	80 < L < 130	L > 130	50% of main loads
1st	L-20	5,000	350	430-L	300	70% of those of 1st class
2nd	L-14					

where,

L = Span length in meters.

For the suspended span and the cantilever span in a cantilever bridge, those span lengths L and L, respectively, shall be taken as shown in Fig. 2.1.4.

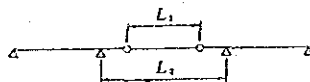


Fig. 2.1.4 How to take the span length in the suspended span

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