1.2 Minutes (Explanation of Basic Design Draft Report)

MINUTES OF DISCUSSION
OF
THE BASIC DESIGN STUDY
ON
THE PROJECT FOR CONSTRUCTING THE BUS TERMINAL IN KATHMANDU, THE KINGDOM OF NEPAL

In response to the request of His Majesty's Government of Nepal for Grant Aid for the Project for Constructing the Bus Terminal in Kathmandu (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 the Basic Design Study Team headed by Mr. Hiroomi MOTOZAKI, Special Assistant to the Director of the Division, Transport Promotion Division, Regional Transport Bureau, Ministry of Transport, to the Kingdom of Nepal from 30 January to 23 February, 1989.

As a result of the study, JICA prepared a draft final report and dispatched a draft final report explanation team headed by Mr. Satoshi MACHIDA, Deputy Director, Second Basic Design Study Division, Grant Aid Planning and Survey Department, JICA to explain and discuss it from July 16 to July 23, 1989.

Both parties had a series of discussions on the report and have agreed to recommend to their respective Governments that the major points of understandings reached between them, attached herewith, should be examined towards the realization of the Project.

Kathmandu, July 21, 1989

Mr. Satoshi MACHIDA
Leader,
Basic Design Study Team
JICA

R. K. TIWARI
Joint Secretary
Ministry of Panchayat
and Local Development

A T T A C H M E N T

1. The Nepal side has principally agreed to the basic design proposed in the Draft Final Report.

2. The Nepal side has understood Japanese grant aid system and confirmed that the necessary measures will be taken by the Nepal side as shown in Annex- I, which is in line with the Annex- III of THE MINUTES OF DISCUSSIONS on the Project signed on 13 February 1989, on condition that the grant aid by the Government of Japan would be extended to the Project.

3 The Nepal side stated that necessary budget will be provided for the Project to ensure the effective operation and maintenance of the Project constructed under the grant aid.

4. Ten copies of the Final Report in English will be submitted to the Nepal side through JICA by the end of August 1989.

5. In connection with the Annex- I, item 1, the Nepal side stated that there would be difficulty for the Nepal side to conduct reclamation of the proposed site and requested the team to include the reclamation in the scope of Japanese grant aid.

   The team understood the request and promised to convey it to the Japanese Government for further consultation.

6. The Nepal side explained that it was preparing legal measures directing long and middle distance buses to depart from and arrive to the proposed terminal only, as well as managing organization of the terminal for implementation of the Project.

   The Nepal side also stated the content of planned legal measures and managing body would be informed to the Japanese Government when those plans were formulated.

A N N E X - I

The necessary measures to be taken by His Majesty's Government of Nepal are as follows.

1. To clear, level and reclaim the site in accordance with basic specification provided by the Basic Design Study Team prior to commencement of the construction.

2. To provide facilities for distribution of electricity, water supply, drainage, telephone system and other incidental facilities to the site.

3. To provide data and information necessary for the Project.

4. To take any legal measures to direct long and middle distance buses to depart from and arrive to the proposed terminal only.

5. To clarify the type of management of the terminal and/or any part of the terminal.

   (Direct management, consignment, rental, etc.)

6. To secure the connection bus services from the new terminal to the existing terminal and also to the other final destination of the passenger.

7. 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.

8. To ensure prompt unloading, tax exemption and customs clearance at the port of disembarkation in the Kingdom of Nepal and prompt internal transportation therein of the products purchased under the Grant.

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

10. To exempt Japanese nationals engaged in the Project 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.

11. To provide and/or acquire necessary permissions, licenses and other authorizations necessary for carrying out the Project.

12. To bear all the expenses, other than those to be borne by the Grant, such as gardening, fencing, gates, exterior lighting etc..

1.3 Members of Basic Design Study Team

1) Basic Design Survey

Assignment	Name	Position
Team Leader	Hiroomi MOTOZAKI	Special Assistant to the Director of the Division, Transport Promotion Division, Regional Transport Bureau, MINISTRY OF TRANSPORT
Project Coordinator	Ryoji YAGINUMA	Planning Division, Grant Aid Planning and Survey Department, JAPAN INTERNATIONAL COOPERATION AGENCY
Architectural Planner	Kenjiro HIROSE	AZUSA SEKKEI CO., LTD.
Architectural Designer	Chuichi YAMAKAWA	AZUSA SEKKEI CO., LTD.
Civil Engineering Designer	Shiro MATSUNO	AZUSA SEKKEI CO., LTD.
Operation Planner	Akio MORIKAWA	AZUSA SEKKEI CO., LTD.
Equipment Planner	Kozo ISHIZAKA	AZUSA SEKKEI CO., LTD.
Facilities Designer	Wataru SHIROKAWA	AZUSA SEKKEI CO., LTD.

2) Explanation of Basic Design Draft Report

Assignment	Name	Position
Team Leader	Satoshi MACHIDA	Deputy Director Second Basic Design Study Division, Grant Aid Planning & Survey Department JAPAN INTERNATIONAL COOPERATION AGENCY
Architectural Planner	Kenjiro HIROSE	AZUSA SEKKEI CO., LTD.
Architectural Designer	Chuichi YAMAKAWA	AZUSA SEKKEI CO., LTD.
Operation Planner	Akio MORIKAWA	AZUSA SEKKEI CO., LTD.

1.4 Itineraries of Basic Design Study Team

1) Basic Design Survey

Date	Members	Activities	Place
Janunary 29, Sunday	Hirose Morikawa	. Leave Tokyo by TG 641	Bangkok
30, Monday	Hirose Morikawa	. Arrive in Nepal by TG 311 . Courtesy visit to JICA Office . Explanation of Survey Schedule and Contents	Kathmandu
31, Tuesday	Hirose Morikawa	(1) Visit Saja Yatayat Repair Shop (2) Courtesy visit to Japanese Embassy (3) Courtesy visit to MPLD Submit questionnaire (4) Tender call for Soil Investigation	
February 1, Wednesday	Hirose Morikawa	(1) Conference at MPLD (2) Conference at KNP (3) Contract for Soil Investigation	
2, Thursday	Hirose Morikawa	(1) Visit proposed sites (No.5, No.8, No.9) (2) Conference at KNP (3) Traffic Survey at Existing Bus Terminal	
3, Friday	Hirose Morikawa	(1) Traffic Survey at Existing Bus Terminal (2) Attend the commencement of soil investigation work (3) Schedule arrangement at JICA office (4) Conference at KNP Receive lay-out drawing of Existing Bus Terminal	

Date	Members	Activities	Place
February 4, Saturday (Local holiday)	Hirose Morikawa	(1) Check survey results	
5, Sunday	Hirose Morikawa	(1) Attend the commencement of topographical survey (2) Conference at KNP	
	Motozaki Yaginuma Yamakawa Shirokawa Matsuno	. Leave Tokyo by TG 641	Bangkok
6, Monday	Hirose Morikawa	(1) Meeting at KNP * Stop soil investigation work due to obstruction by land owners	
	Motozaki Yaginuma Yamakawa Shirokawa Matsuno	. Arrive in Nepal by TG 311	Kathmandu
7, Tuesday	Motozaki Yaginuma Yamakawa Shirokawa Matsuno Hirose Morikawa	(1) Courtesy visit to Japanese Embassy, JICA office and MPLD (2) Verbal interim report to JICA office (3) Visit proposed sites (No.5, No.8, No.9) (4) Complete the boring work at site No.8	
8, Wednesday	Motozaki Yaginuma Hirose Morikawa Matsuno	(1) Check the draft of Minutes of Discussion at JICA office (2) Site Survey (3) Prepare report on site selection	
	Yamakawa Shirokawa	(1) Prepare a list of facilities	
		(1) Team meeting Study appropriate size of the terminal based on traffic survey results	

Date	Members	Activities	Place
February 9, Thursday	Motozaki Yaginuma Hirose Morikawa Yamakawa Shirokawa Matsuno	(1) Conference at MPLD on draft of Minutes of Discussion (2) Courtesy visit to Ministry of Finance (1) Survey of No.8 Site	
10, Friday (National holiday)	Motozaki Yaginuma Hirose Morikawa Yamakawa Matsuno Ishizaka	(1) Reconnaissance survey on ring road (2) Survey on existing bus terminal . Leave Tokyo by TG-641	 Bangkok
11, Saturday (Local holiday)	Motozaki Yaginuma Hirose Morikawa Yamakawa Shirokawa Matsuno Ishizaka	(1) Reconnaissance survey on city road (2) Team meeting (3) Data arrangement . Arrive in Nepal by TG 331 (1) Join team meeting	 Kathmandu
12, Sunday	Motozaki Yaginuma Hirose Morikawa Yamakawa Shirokawa Matsuno Ishizaka	(1) Explanatory meeting with related organizations and discussion on draft of Minutes of Discussion at MLPD (2) Reconnaissance survey on proposed sites (3) Courtesy visit to Ministry of Housing and Physical Planning	

Date	Members	Activities	Place
February 13, Monday	Motozaki Yaginuma Hirose Morikawa Yamakawa Shirokawa Matsuno Ishizaka	(1) Discussion on the Minutes draft at JICA office (2) Sign on Minutes of Discussion * Two sites were proposed in the Minites	
	Matsuno	(1) Reconnaissance survey on the new site (2) Data arrangement	
14, Tuesday	Hirose Morikawa Ishizaka Yamakawa Shirokawa Matsuno	(1) Team meeting (2) Conference on the new site at KNP	
	Motozaki Yaginuma	(1) Courtesy visit to Japanese Embassy . Left Nepal by TG 312	Bangkok
15, Wednesday	Hirose Morikawa Ishizaka Yamakawa Shirokawa Matsuno	(1) Conference on Soil Investigation for the new site at KNP	
	Hirose Shirokawa Ishizaka Yamakawa	(1) Survey on private engine workshop (2) Visit to Shaja Yatayat	
	Hirose Shirokawa Matsuno	(1) Survey on the new site	
	Motozaki Yaginuma	. Arrive in Tokyo by TG 740	

Date	Members	Activities	Place
February 16, Thursday	Hirose Morikawa Ishizaka Yamakawa Shirokawa Matsuno	(1) Conference at NTEA * Confirmation of organization (2) Data arrangement (3) Cost survey	
	Hirose Shirokawa Ishizaka	(1) Visit to NEA, survey on power supply (2) Survey on private engine workshops and city bus terminals	
17, Friday	Hirose Morikawa Ishizaka Yamakawa Shirokawa Matsuno	(1) Survey on similar facilities * New Airport Passenger Terminal * National Tuberculosis Center (2) Team meeting (3) Conference at KNP * On area and shape of the site (4) Cost survey	
	Hirose Shirokawa Ishizaka	(1) Visit Water Supply and Sewerage Corporation Survey on water supply and sewerage (2) Survey on bus maintenance at TATA agent (3) Survey on private bus maintenance shop	
18, Saturday (Local holiday)	Hirose Morikawa Ishizaka Yamakawa Shirokawa Matsuno	(1) Team meeting (2) Data arrangement (3) Study on basic plan and conceptional drawing	

Date	Members	Activities	Place
February 19, Sunday	Hirose Morikawa Yamakawa Matsuno Shirokawa Ishizaka	(1) Visit to and study at Department of Road (2) Visit to and study at Bagmati Regional office (3) Data arrangement (1) Visit to and study at Nepal Telecommunication Corporation (2) Survey on tyre renewal shops	
20, Monday	Hirose Morikawa Ishizaka Yamakawa Shirokawa Matsuno	(1) Verbal interim report to JICA office (2) Conference at NTEA (3) Team meeting (4) Data arrangement (5) Traffic survey at the existing bus terminal	
21, Tuesday	Hirose Morikawa Ishizaka Yamakawa Shirokawa Matsuno	(1) Conference at KNP (2) Study on organization of the new bus terminal (3) Data arrangement (4) Prepare conceptional drawing	
22, Wednesday	Hirose Morikawa Ishizaka Yamakawa Shirokawa Matsuno	(1) Conference at MPLD (2) Team meeting (3) Data arrangement (4) Prepare conceptional drawing (5) Prepare draft of organization chart for the new bus terminal	
23, Thursday	Hirose Morikawa Ishizaka Yamakawa Shirokawa Matsuno	(1) Courtesy visit to Japanese Embassy and JICA office (2) Conference at MPLD * Submit a conceptional plan * Submit comments on Topography and Subsoil of New Plant Site * Submit a draft schedule * Receive a copy of the letter re: final decision on proposed site . Leave Nepal by TG 312	 Bangkok

Date	Members	Activities	Place
February 24, Friday	Hirose Morikawa Ishizaka Yamakawa Shirokawa Matsuno	. Arrive in Tokyo by TG 740	

2) Explanation of Basic Design Draft Report

Date	Activities	Place
July 16, Sunday	. Leave Tokyo by CX-509 Arrive in Bangkok by CX-2705	Bangkok
17, Monday	. Arrive in Nepal by TG-311 . Courtesy visit to MPLD Explanation of the report to Mr. Tiwari, Joint Secretary . Courtesy visit to Japanese Embassy . Courtesy visit to JICA Office	Kathmandu
18, Tuesday (National holiday)	. Explanation of the report to Mr. Dongol, KNP . Confirmation on site of the boundary of the land which is to be acquired by KNP	
19, Wednesday	. Courtesy visit to Mr. Thapa, Secretary, MPLD . Explanation of the Report at MPLD	
20, Thursday	. Reconnaissance survey on borrow pit sites . Explanation meeting with related organization	
21, Friday	. Sign Minutes of Discussion . Visit to JICA Office . Visit to Japanese Embassy	
22, Saturday (Local holiday)	. Leave Nepal by TG-312	Bangkok
23, Sunday	. Arrive in Tokyo by CX-700, CX-508	

1.5 List of Persons Met

Ministry of Panchayat and Local Development	Secretary Joint Secretary Under Secretary Section Secretary	Mr. D.B. Thapa Mr. R.K. Tiwari Mr. N. Ghimire Mr. A. Ghimire
Kathmandu Nagar Panchayat	Chairman Chief Officer Engineer	Mr. S.P. Bhattarai Mr. S. Adhikari Mr. D. Dongol
Ministry of Works and Transport Dept. of Transport Dept. of Road	Joint Secretary Engineer Chief of Design Section Mechanical Engineer	Mr. G.P. Ranjitkar Mr. R.R. Sthapit Dr. S.B.S. Tuladhar Mr. H.L. Rajbahak
Ministry of Finance	Under Secretary	Mr. T. Neopane
Kathmandu Town Development Committee	Member Secretary	Mr. S. Shrestha
Bagmati Zone Office	Engineer	Mr. S.P. Upodhya
Sajha Yatayat	General Manager	Mr. M.R Satyal
Nepal Transport Entrepreneurs Association	Chairman General Secretary	Mr. S.C. Giri Mr. H.P. Adhikari
Water Supply and Sewerage Corporation	Manager	Mr. P.L. Jashi
Nepal Electricity Agency	Manager	Mr. G.K. Shrescho
Nepal Telecommunication Corporation	Engineer	Mr. S.M. Singn

Embassy of Japan in Nepal	Ambassador Councilor Secretary	Mr. K. Arichi Mr. T. Nishina Mr. T. Muromoto
JICA, Nepal Office	Resident Representative Deputy Representative Assistant Resident Representative Assistant Resident Representative	Mr. S. Kumano Mr. Ayukawa Mr. M. Sugimoto Mr. M. Oyama

2. Survey Data of Existing Bus Terminal

2.1 Traffic Survey

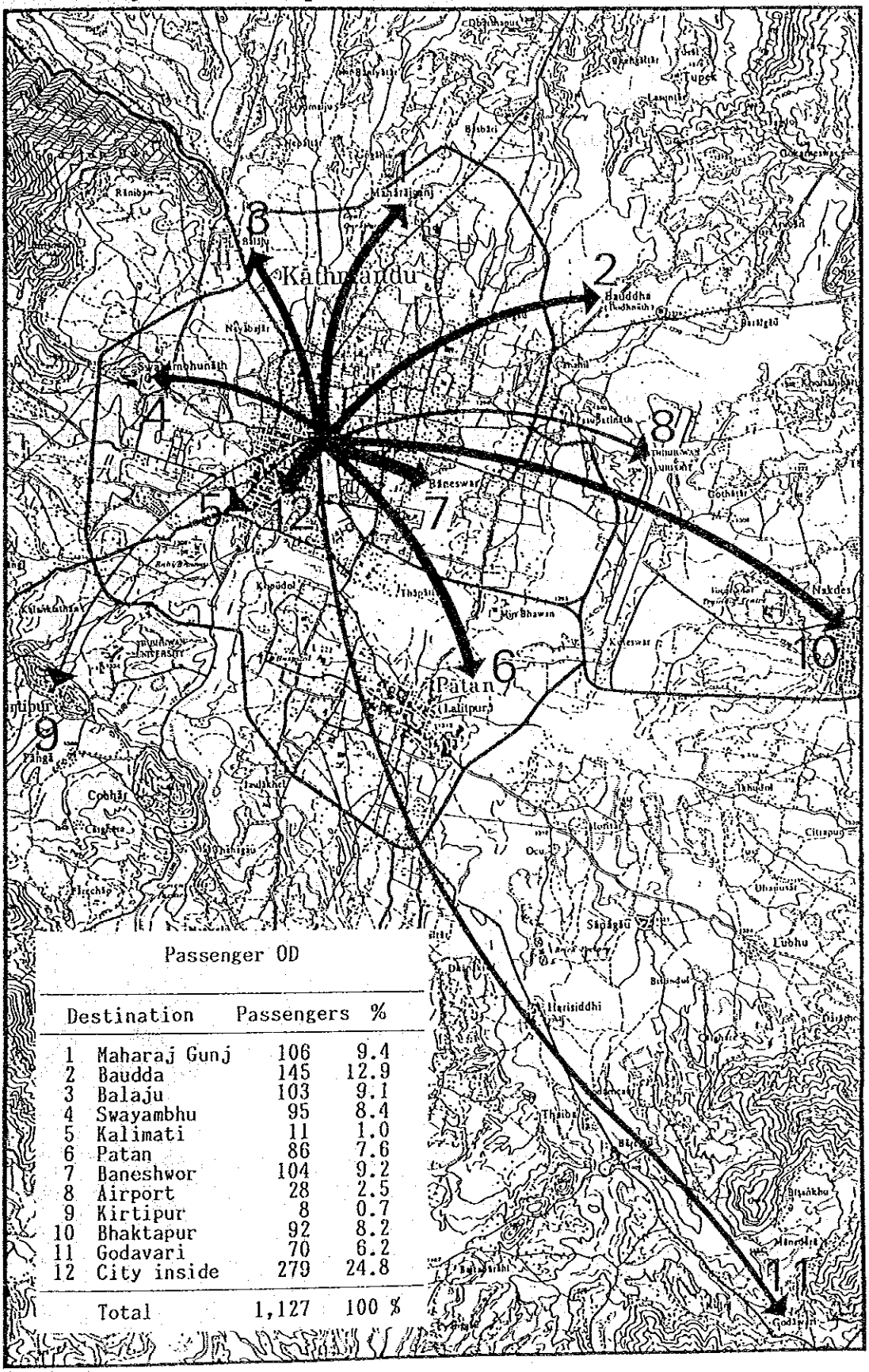
Bus Terminal Traffic Survey

(Unit: Vehicle/Hour)

Time	Incoming			Outgoing		
	Bus	Taxi	Tempo	Bus	Taxi	Tempo
0-1	0	0	0	0	0	0
1-2	0	0	0	0	0	0
2-3	0	0	0	0	0	0
3-4	0	0	0	0	0	0
4-5	3	4	5	2	1	5
5-6	14	13	16	7	155	23
6-7	20	28	33	7	25	26
7-8	18	46	27	14	25	24
8-9	12	35	23	4	47	45
9-10	11	34	22	11	30	25
10-11	4	27	17	11	18	12
11-12	10	38	36	12	19	19
12-13	9	36	27	9	23	27
13-14	7	32	25	9	34	26
14-15	14	52	29	12	21	16
15-16	10	70	34	18	32	18
16-17	15	111	82	34	39	26
17-18	10	85	82	31	32	33
18-19	8	69	39	18	29	14
19-20	5	45	29	14	23	11
20-21	1	18	8	7	6	5
21-22	0	13	7	0	0	0
22-23	0	0	0	0	0	0
23-24	0	0	0	0	0	0
TOTAL	171	756	541	220	419	355

Observation Date: Feb. 20, 1989

2.2 Passenger OD Survey



Passenger OD

	Destination	Passengers	%
1	Maharaj Gunj	106	9.4
2	Baudda	145	12.9
3	Balaju	103	9.1
4	Swayambhu	95	8.4
5	Kalimati	11	1.0
6	Patan	86	7.6
7	Baneshwor	104	9.2
8	Airport	28	2.5
9	Kirtipur	8	0.7
10	Bhaktapur	92	8.2
11	Godavari	70	6.2
12	City inside	279	24.8
	Total	1,127	100 %

3. Condition of Present Bus Maintenance Facility in Kathmandu

At present, in the Kathmandu Metropolitan district there is one public bus maintenance facility operated by Sajha Yatayat and about 40 small private repair shops. The capacity of these facilities are described below.

1) Sajha bus maintenance facility

This facility constructed in 1972 under grant aid from Japan is the only bus maintenance facility in the Kingdom of Nepal, and its main purpose is to provide maintenance for the 102 buses operated by Sajha Yatayat. Among the 102 buses, 82 buses are supplied from Japan under grant aid and an expert on bus maintenance is dispatched from JICA.

- Bus accommodation capacity:

  5 buses

- Repair equipment:

  forklift, brake tester, speedometer tester, headlight tester, tyre changer, fuel supply stand, luthe, car washing equipment, etc.

- Maintenance capacity:

  Maintenance capacity is quite difficult to estimate since the supply of spare parts is erratic, but on an average it may be estimated to be as follows:

monthly inspection and maintenance:	2-3 buses
repair:	2-3 buses

The capacity of this facility is even insufficient for maintaining buses operated by Sajha Yatayat and it is planned to be enlarged by the 1988 grant aid from Japan.

2) Private car repair shops

There is no large maintenance facility nor maintenance cooperations for maintaining private buses and each bus company must provide its own maintenance. However, since private bus companies are small companies operating 5 buses or less, they do not have their own maintenance facilities, with the exception of 2 or 3 companies. Therefore, scheduled maintenance and inspection are not performed. Broken down buses are sent to the private repair shops in Kathmandu Metropolitan where parts for engines and transmission are renewed, tyres repaired, metal work performed and other repair works are conducted. An outline of these shops are as described below.

a) Special repair shops

There are 3 repair shops in Kathmandu Municipality which specializes in repairing and renewing parts for engine, fuel pump, transmission, differential gears and other units. Although the equipment and machinery are old, they have various types of machine tools and the quality of their work is quite high. The employees number only 10 to 20 workers, and when compared with the workers at public maintenance facility, their level of skill is high and the turnover of workers is low.

- Equipment:

  crankshaft grinder, cylinder boring machine, plane grinder, lathe, milling machine, drill, fuel pump tester

- Maintenance capacity:

engine overhaul	2-3 units/week
fuel pump overhaul	15-20 units/week

b) Ordinary car repair shop

The ordinary car repair shops mostly do not have garages for large vehicles and repairs are performed outdoors. The number of employees are less than 10 and their skill level is quite low.

- Equipment:

  air compressor, welding machine, etc.

- Repair capacity:

  Replacing tyres, spare parts and consumable parts are the work performed mainly and so it is difficult to judge the repair capacity.

Judging from the above condition of maintenance facilities, the bus maintenance facility is insufficient to service and maintain the 1,920 buses registered in 1986. Especially, there is no facility to provide scheduled inspection and maintenance for private buses.

INDEX NO. : 1030 STATION : KATHMANDU AIRPORT YEAR : 1986

Month	AIR TEMPERATURE °C							RELATIVE HUMIDITY %		VAPOUR PRESSURE mb.		PRECIPITATION mm.							
	Mean			Absolute extreme		Number of days		Observed at		Observed at		Total	Maximum in 24 hrs. & date	Number of rainy days					
	Max.	Min.	Daily	Max. date	Min. date	Max. >=30	Min. <=0.	0840	1740	0840	1740			>= 1.0	1.0 - 9.9	10.0 - 24.9	25.0 - 49.9	50.0 - 99.9	>= 100.
JAN	18.3	2.7	10.5	21.2 7	0.1 23	0	0	97	65	8.3	9.5	0	0	0	0	0	0	0	0
FEB	20.1	3.5	11.8	23.4 24	0.0 1	0	1	96	58	9.2	9.9	23	20 / 11	2	1	1	0	0	0
MAR	24.6$_a$	7.2	15.9$_a$	30.6 30 a	3.0 2	2$_a$	0	79$_b$	43$_a$	11.2$_b$	9.3$_a$	16	7 / 13	5	5	0	0	0	0
APR	26.4	11.1	18.8	29.6 19	6.9 6	0	0	74	54	14.3	13.4	93	24 / 5	11	7	4	0	0	0
MAY	27.1	13.9	20.5	29.4 31	9.6 24	0	0	73	58	16.8	16.4	97	21 / 15	10	5	5	0	0	0
JUN	28.9	18.9	23.9	32.0 5	12.8 2	8	0	79	71	22.6	22.6	316	65 / 29	18	9	5	3	1	0
JUL	28.2$_b$	20.1$_a$	24.2$_b$	30.2 4 b	19.1 1 a	1$_b$	0$_a$	84$_a$	81$_c$	23.8$_a$	24.2$_c$	381	78 / 16	22	11	6	3	2	0
AUG	28.7$_a$	19.5$_a$	24.1$_a$	30.8 10 a	18.0 5 a	5$_a$	0$_a$	84	78$_a$	23.3	24.2$_a$	219	62 / 3	20	12	7	0	1	0
SEP	26.9	18.0	22.5	30.4 8	15.8 21	1	0	87	81$_a$	21.2	21.6$_a$	221	48 / 1	15	10	2	3	0	0
OCT	24.8	12.3$_a$	18.6$_a$	27.4 3	8.2 25 a	0	0$_a$	93	71	15.9	16.5	80	26 / 12	6	2	3	1	0	0
NOV	22.3	8.1	15.2	25.2 6	5.6 29	0	0	97	72	12.0	13.4	0	0	0	0	0	0	0	0
DEC	18.7	2.8	10.8	24.0 3	-0.2 31	0	1	98	68	8.3	10.0	49	32 / 19	4	2	1	1	0	0
YEAR	24.6	11.5	18.1	32.0 JUN	-0.2 DEC	17	2	87	67	15.6	15.9	1495	78 /JUL	113	64	34	11	4	0

Missing number of days :
a = 1; b = 2; c = 3;

2) Absolute Extreme Temperature, 1976-1984

(Unit: °C)

	January	February	March	April	May	June
Max	22.0	24.5	28.2	32.3	33.0	34.0
D/y	(17,81)	(26,81)	(29,77)	(25,80)	(18,79)	(3,79)
Min	-2.0	-2.2	0.5	3.7	8.9	11.1
D/y	(4,83)	(2,83)	(13,78)	(1,78)	(8.77)	(29,82)

	July	August	September	October	November	December
Max	31.3	31.0	31.2	29.8	26.4	23.7
D/y	(8,79)	(29,78)	(9,82)	(2,84)	(1,83)	(14,78)
Min	17.8	13.0	11.8	4.2	2.4	-2.0
D/y	(4,76)	(6,84)	(29,82)	(31,83)	(30,76)	(31,76)

Note: D/y indicates date followed by year.

Source: Climatological records of Nepal volume I, II & III.

3) Annual Rainfall, 1976-1984

(Unit: mm)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984
Precipitation	1489	1298	1556	1356	1341	1370	1168	1449	1313

Source: Climatological records of Nepal Volume I, II and III.

4.2 Subsoil Investigation Data

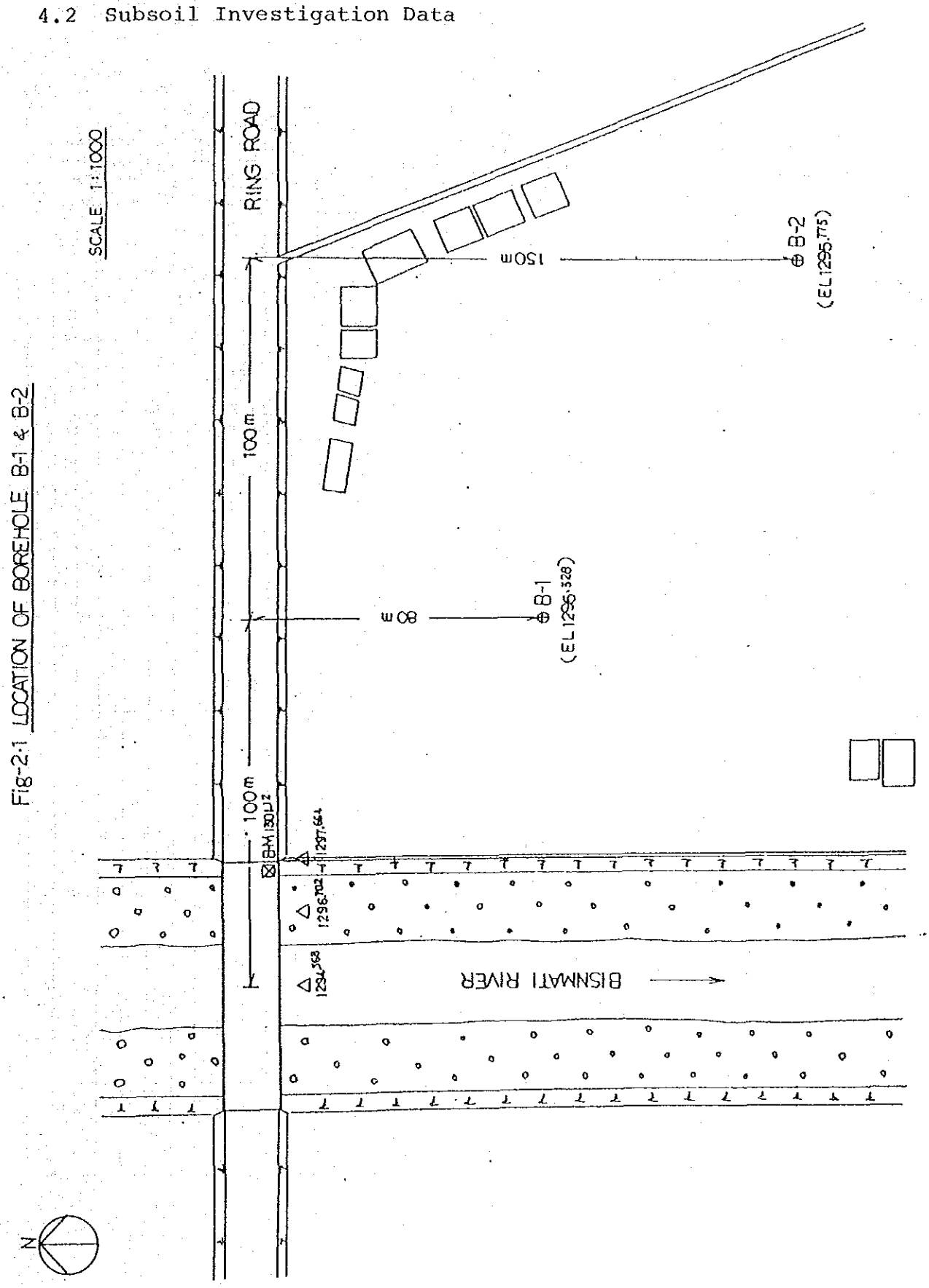


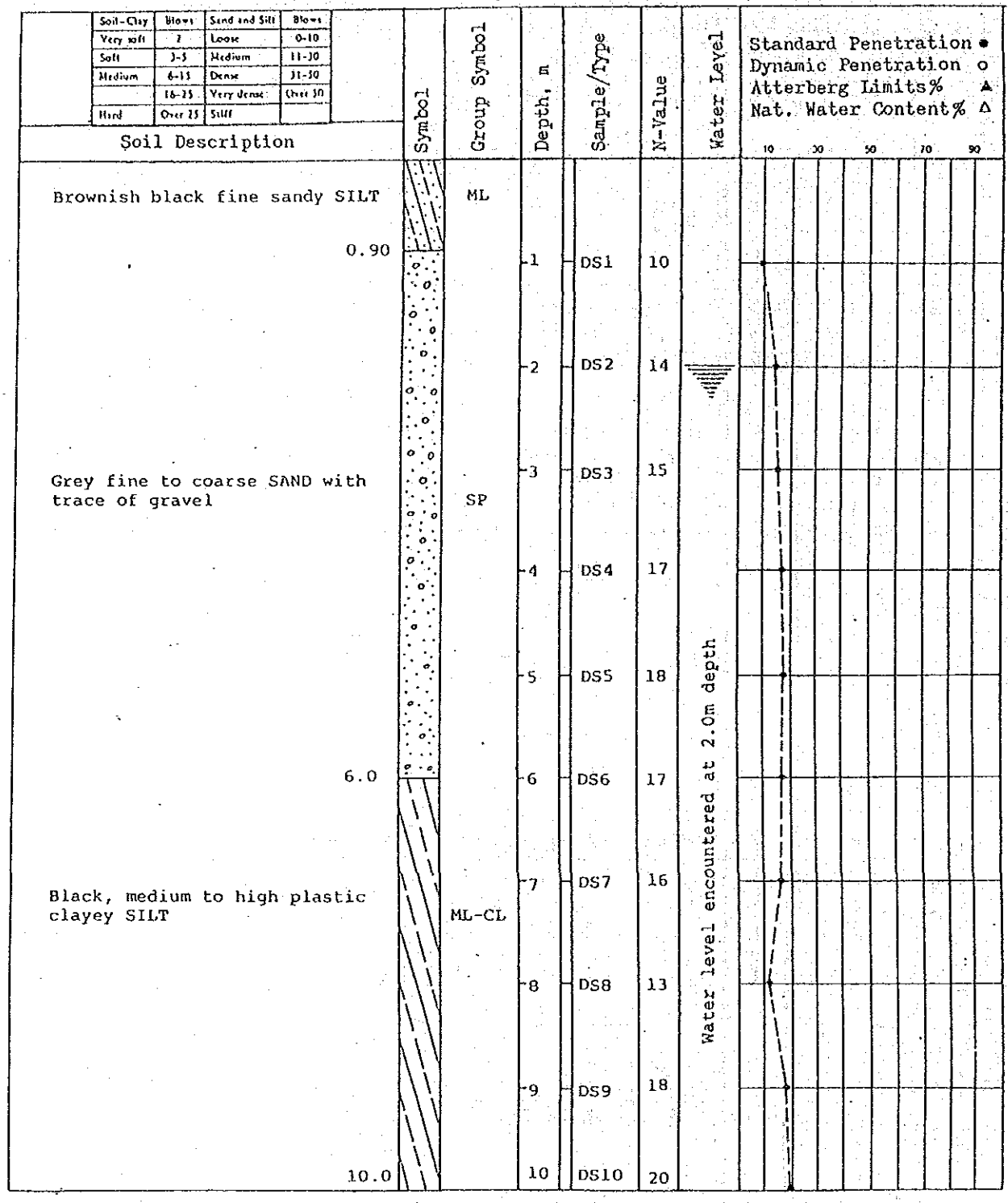
Fig-2.1 LOCATION OF BOREHOLE B-1 & B-2

LOG OF BORING B-1

(Dalaju)

Date: 15.2.1989

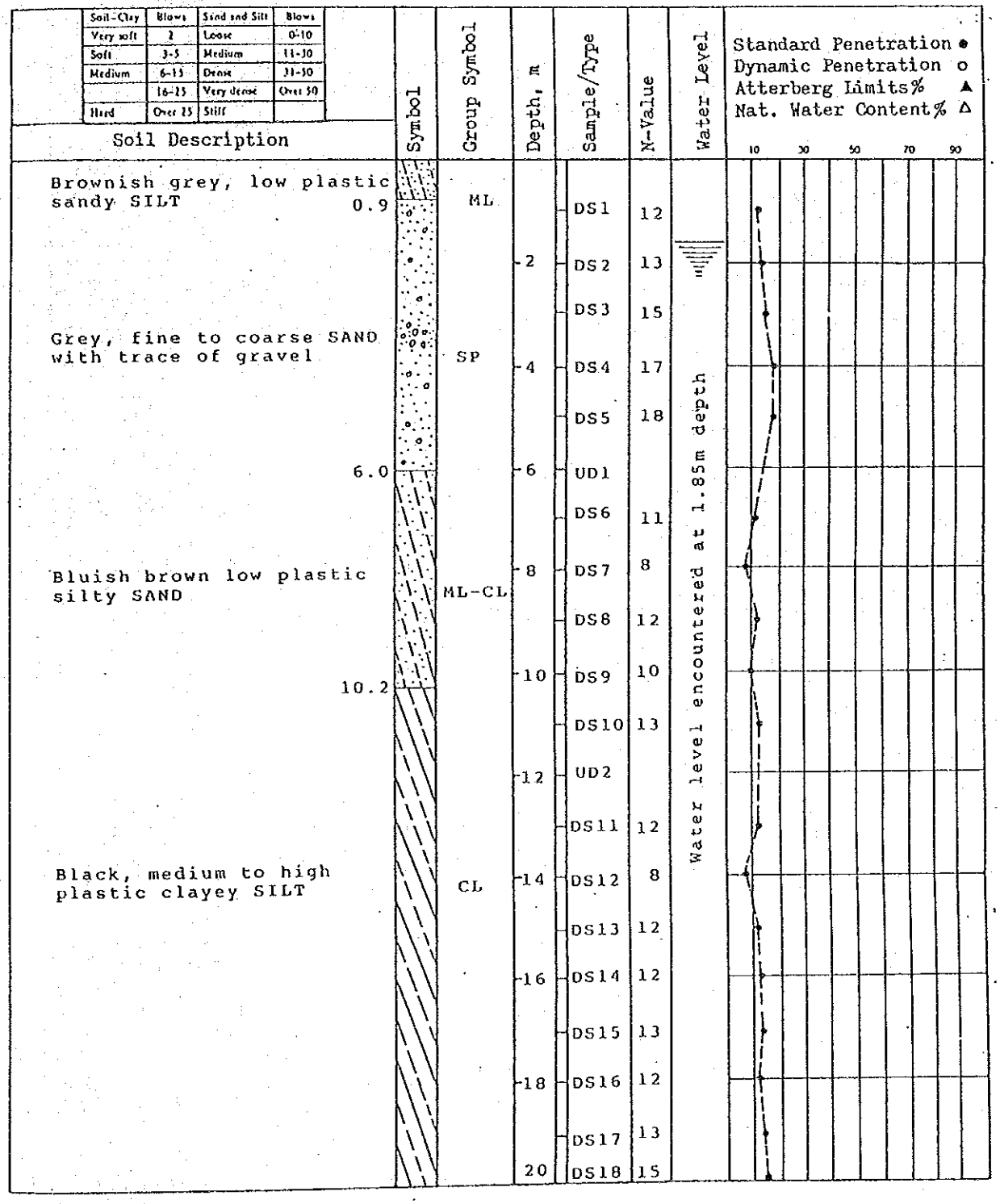
Soil-Clay	Blows	Sand and Silt	Blows
Very soft	2	Loose	0-10
Soft	3-5	Medium	11-30
Medium	6-15	Dense	31-50
	16-25	Very dense	Over 50
Hard	Over 25	Stiff	



LOG OF BORING B-2
(Balaju)

Date: 17.2.1989

Soil-Clay	Blows	Sand and Silt	Blows
Very soft	2	Loose	0-10
Soft	3-5	Medium	11-30
Medium	6-15	Dense	31-50
	16-25	Very dense	Over 50
Hard	Over 25	Stiff	



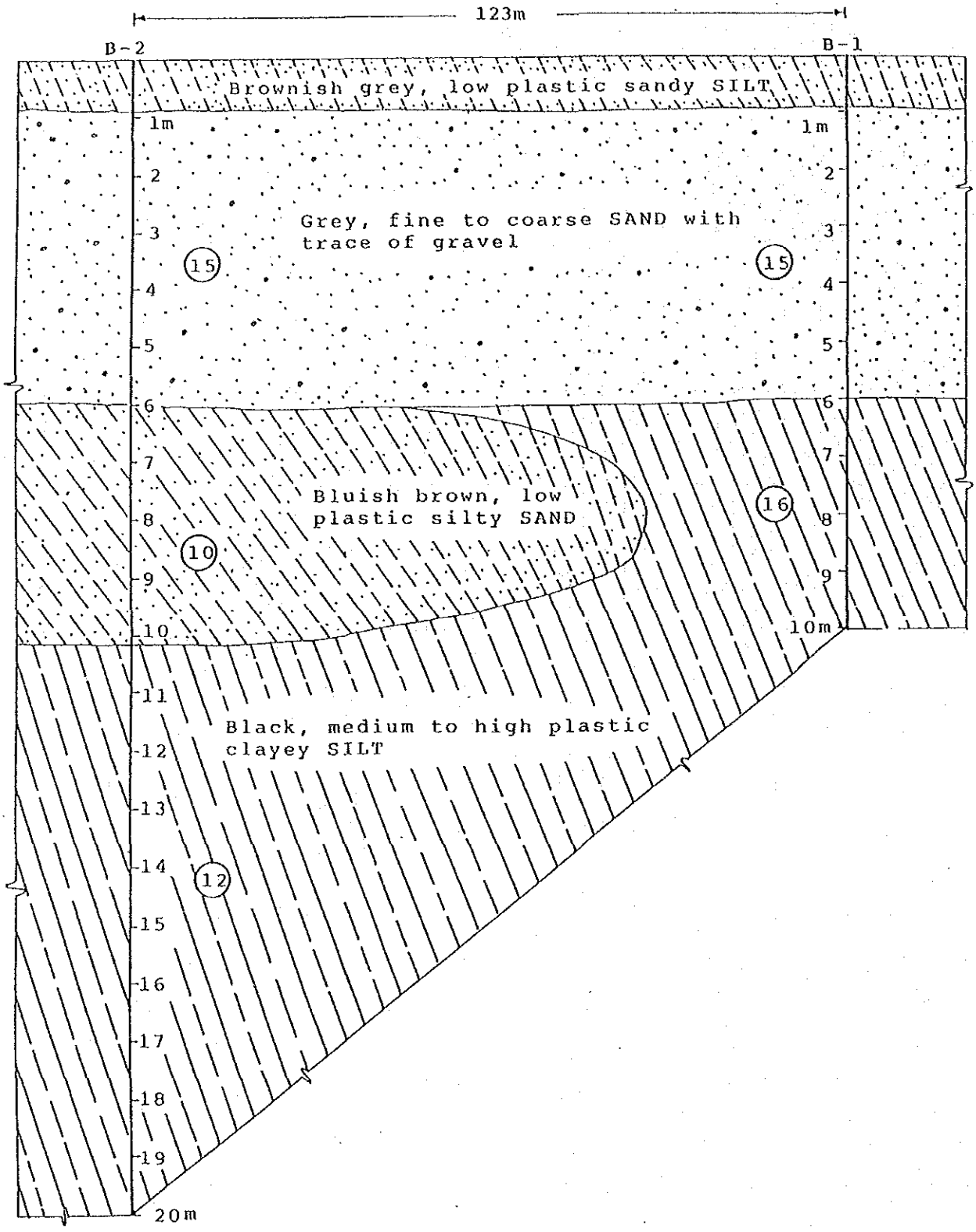
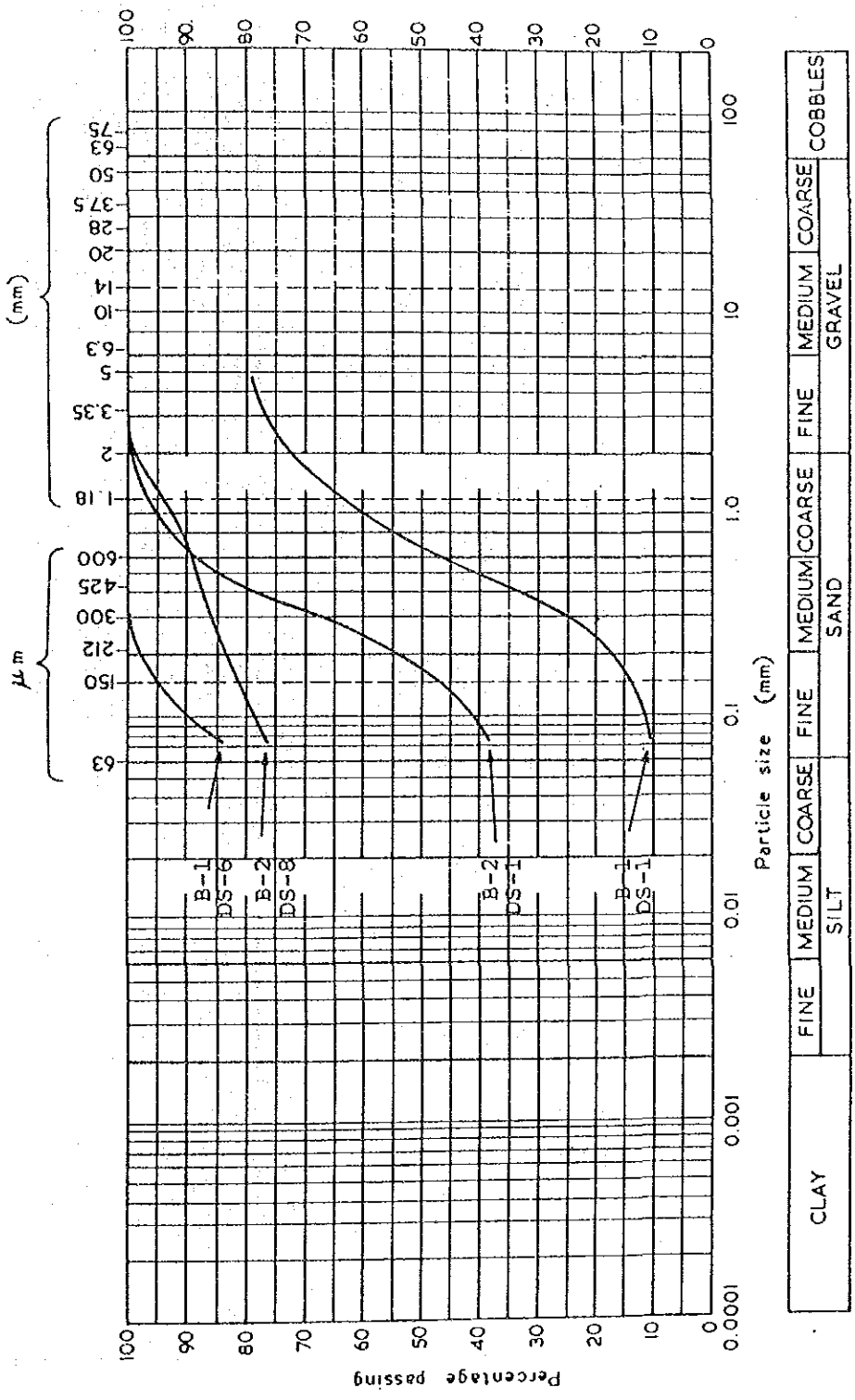


Fig-4 Geological soil profile along borehole B-1 and borehole B-2

Note: (15) Average SPT value for the strata



Sample	Depth, m	D_{10}	D_{15}	D_{30}	D_{60}	D_{85}

Fig - 6 Typical grain size curves from borehole B-1 & borehole B-2 (Balaju)

Table-5 Summary of geotechnical properties of foundation soils from laboratory test (Balaju)

Borehole	Depth, m	Samples		Natural moisture %	Atterberg limits			Modulus of elasticity from SPT-value kg/cm²	Direct shear test		Specific gravity
		DS	UD		LL	PL	PI		ø°	C, kg/cm²	
B-1	1.0 - 1.45	1		16.8							
	2.0 - 2.45	2						375	34	0	
	3.0 - 3.45	3		11.2							2.639
	4.0 - 4.45	4						450	32	0	
	5.0 - 5.45	5		12.8							2.642
	6.0 - 6.45	6		26.7				450			
	7.0 - 7.45	7									
	8.0 - 8.45	8		43.8	38	29	9				
	9.0 - 9.45	9						465			2.620
	9.55-10.0	10		53.2	42	30	12				
B-2	1.0 - 1.45	1									
	2.0 - 2.45	2		13.2				350			
	3.0 - 3.45	3		11.8							2.661
	4.0 - 4.45	4						450			
	5.0 - 5.45	5		17.2							2.652
	6.0 - 6.30		1					300	23	0.125	
	7.0 - 7.45	6			24	19	5				
	8.0 - 8.45	7		27.1					25	0	2.621
	9.0 - 9.45	8			28	21	7	320			
	10.0 -10.45	9									2.610
	11.0 -11.45	10		39.3	35	25	10				
	12.0 -12.30		2		36	27	9				
	13.0 -13.45	11			42	31	11				
	14.0 -14.45	12		47.2				240			
	15.0 -15.45	13			54	36	18				
	16.0 -16.45	14		43.8	49	33	16				
	17.0 -17.45	15						350			
	18.0 -18.45	16		52.7	56	37	19				
	19.0 -19.45	17			59	37	22	350			2.605
	19.55-20.0	18		48.7							2.613

NOTE:

DS = disturbed sample
UD = undisturbed sample
LL = liquid limit
PL = plastic limit
PI = plasticity index
ø° = angle of internal friction
C = cohesion of soil

Table-9 Allowable bearing capacity from standard penetration test (Balaju)

Depth, m	Borehole B-1		Borehole B-2	
	Corrected SPT value blows/30cm	Allowable bearing pressure tons/m²	Corrected SPT value blows/30cm	Allowable bearing pressure tons/m²
1.0- 1.45	10	9	12	10.5
2.0- 2.45	14	12.5	13	11.5
3.0- 3.45	15	13	15	13.0
4.0- 4.45	16	13.5	16	13.5
5.0- 5.45	16	13.5	16	13.5
6.0- 6.45	16	13.5		
7.0- 7.45	15	13	11	10.0
8.0- 8.45	13	11.5	8	7.0
9 0- 9.45	16	13.5	12	10.5
10.0-10.45	17	15	10	9.0
11.0-11.45			13	11.5
12.0-12.45				
13.0-13.45			12	10.5
14.0-14.45			8	7
15.0-15.45			12	10.5
16.0-16.45			12	10.5
17.0-17.45			13	11.5
18.0-18.45			12	10.5
19.0-19.45			13	11.5
20.0-20.45			15	13.0

CALIFORNIA BEARING RATIO TEST

Project: Kathmandu bus terminal Sample No: 1 Depth, m: 0-2m

Location: Near borehole B-1 Technician: K. Thapa Date: 21.2.1989

Soil Classification: Homogeneous mixture of sand and silt

Condition of Sample	Before Soaking	After Soaking
Weight of Wet Sample + Mould gm	12.130	12260
Weight of Mould gm	7.673	7673
Weight of Wet Sample gm		4587
Volume of Sample cc		2248
Wet Unit Weight (Unsoaked) gm/cc		2.04
Avg. Moisture Content %		20.41
Dry Unit Weight, gm/cc		1.69

No. of Layers: 3 Period of Soaking: 4 Days

No. of Blows Per Layer: 55 Swell: 1.77 mm & 1.390 %

Penetration mm	Standard Load kg/cm^2	Test Load		Corrected C.B.R.	
		kg	kg/cm^2	kg/cm^2	%
0.5		18.2	0.93		
1.0		34.8	1.77		
1.5		57.3	2.92		
2.0		76.1	3.88		
2.5	70.0	91.2	4.65	6.64	6.64
5.0	105.0	149.8	7.63	7.27	7.27
7.5		211.7	10.79		
10.0		259.5	13.23		
12.5		302.6	15.42		

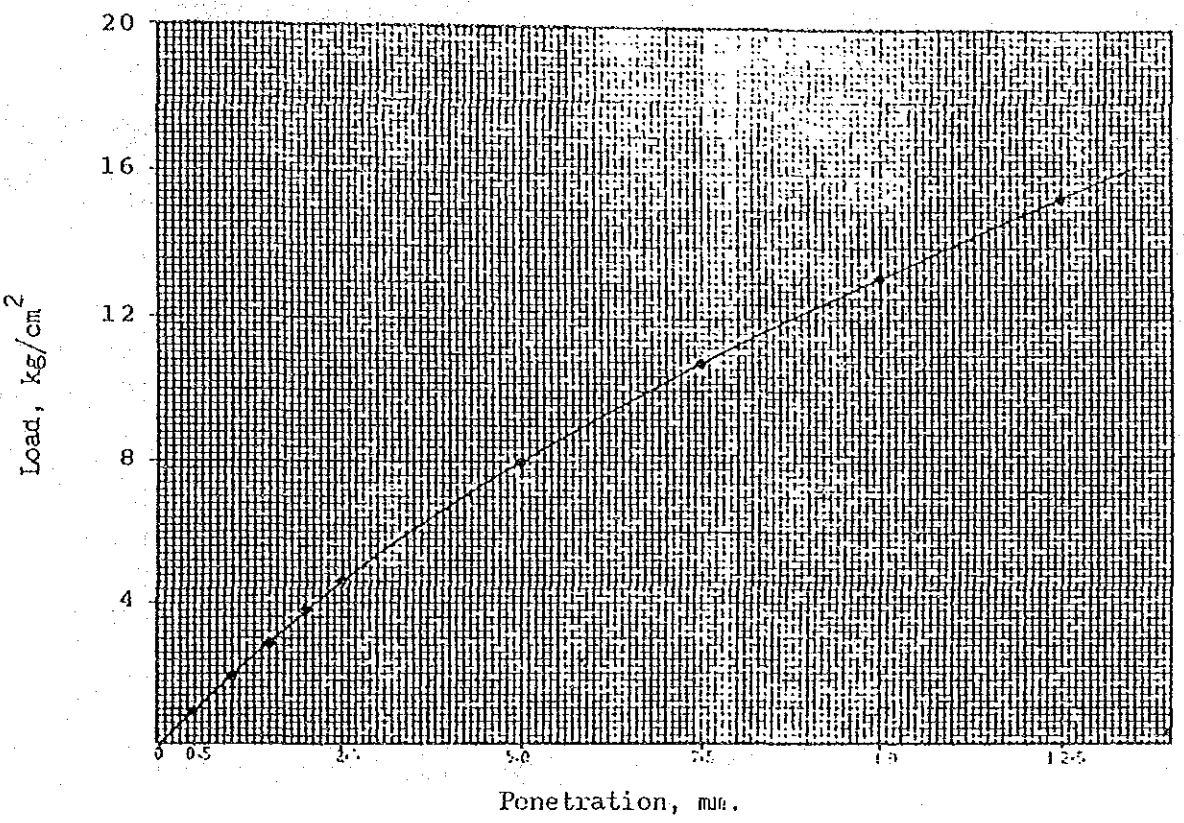


Fig - Load-Penetration Curve

Remarks:

CALIFORNIA BEARING RATIO TEST

Project: Kathmandu bus terminal Sample No: 2 Depth, m: 0-2m

Location: Near borehole B-2 Technician: K. Thapa Date: 21.2.1989

Soil Classification: Homogeneous mixture of sand and silt

Condition of Sample	Before Soaking	After Soaking
Weight of Wet Sample + Mould gm	12.030	12160
Weight of Mould gm	7.515	7515
Weight of Wet Sample gm		4645
Volume of Sample cc		2248
Wet Unit Weight (Unsoaked) gm/cc		2.07
Avg. Moisture Content %		19.44
Dry Unit Weight, gm/cc		1.73

No. of Layers: 3 Period of Soaking: 4 Days

No. of Blows Per Layer: 56 Swell: 3.04 mm & 2.39 %

Penetration mm	Standard Load kg/cm^2	Test Load		Corrected C.B.R.	
		kg	kg/cm^2	kg/cm^2	%
0.5		16.6	0.85		
1.0		34.9	1.78		
1.5		56.4	2.88		
2.0		74.7	3.81		
2.5	70.0	89.6	4.57	6.52	6.52
5.0	105.0	156.0	7.95	7.57	7.57
7.5		214.1	10.91		
10.0		265.6	13.54		
12.5		307.1	15.65		

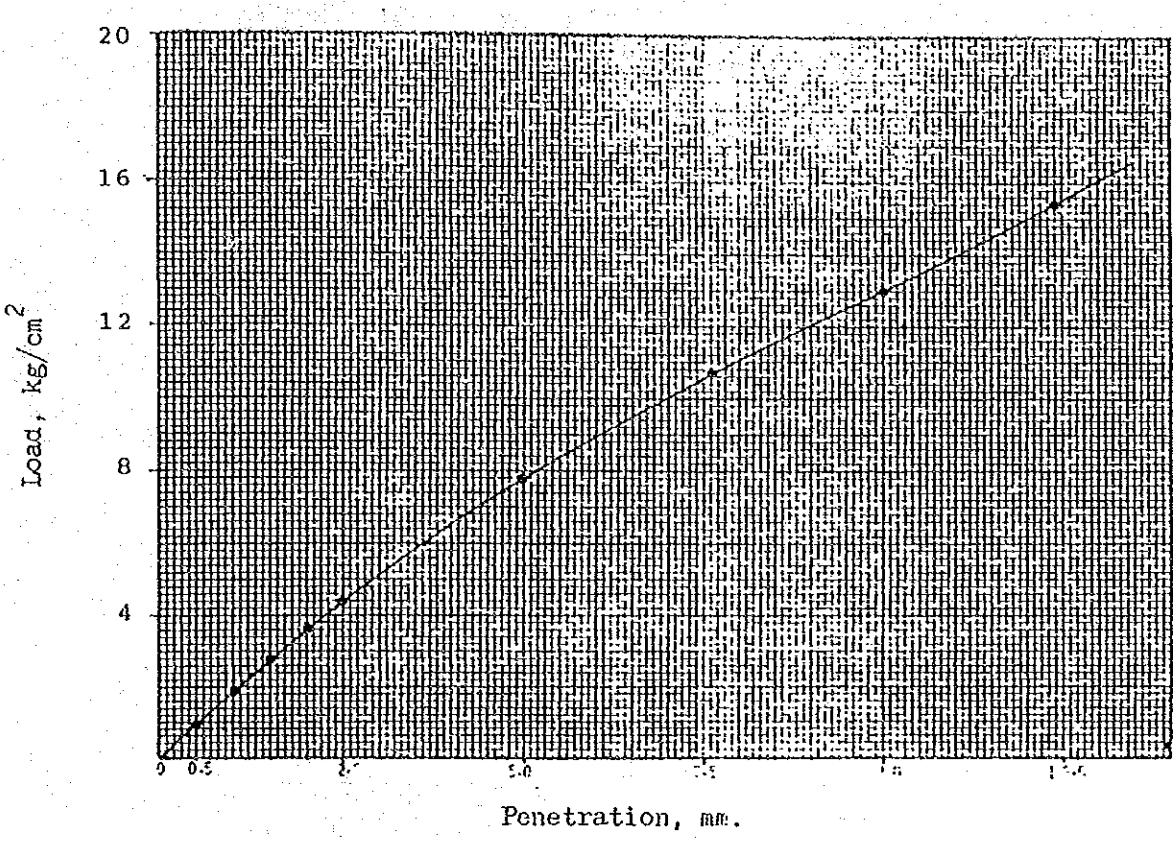


Fig - Load-Penetration Curve

Remarks:

4.3 Excerpts from Mannual for Asphalt/Cement Pavement

Asphalt Pavement

Road Classification by Traffic

Table 2-3 Road Classification by Traffic

Classification	One Way Daily Traffic of Heavy Vehicles
L	Less than 100
A	100 to 250
B	250 to 1,000
C	1,000 to 3,000
D	More than 3,000

Relations among Design CBR, T_A and H

Table 2-6 Target Values for T_A and for the Total Pavemement Thickness, H, cm.

Design CBR	Road Classification									
	L		A		B		C		D	
	T_A	H	T_A	H	T_A	H	T_A	H	T_A	H
2	17	52	21	61	29	74	39	90	51	105
3	15	41	19	48	26	58	35	70	45	83
4	14	35	18	41	24	49	32	59	41	70
6	12	27	16	32	21	38	28	47	37	55
8	11	23	14	27	19	32	26	39	34	46
12	—	—	13	21	17	26	23	31	30	36
20 or more	—	—	—	—	—	—	20	23	26	27

Pavement Structure

Table 2-7 Minimum Combined Thickness of Binder and Surface Courses (Unit: cm)

Road Classification	Minimum Combined Thickness of Binder and Surface Courses
L, A	5
B	10 (5)
C	15 (10)
D	20 (15)

Note: Figures in ( ) indicate the minimum thickness applicable to pavements with bitumen stabilized bases.

$$T_A = a_1 T_1 + a_2 T_2 + \cdots\cdots + a_n T_n \qquad (2.4)$$

where a_1, a_2, ……, a_n: Coefficients of relative strength given in Table 2-8.

T_1, T_2, ……, T_n: Thickness of individual layers of pavement, cm.

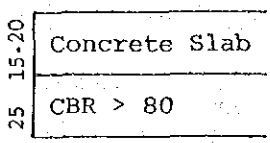
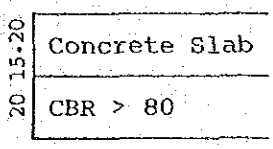
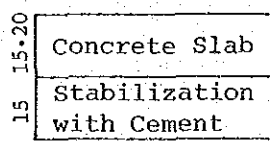
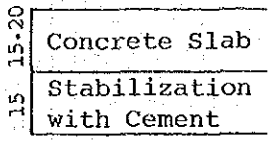
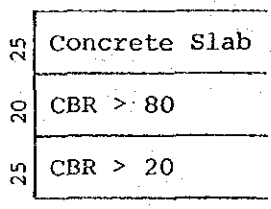
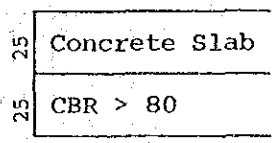
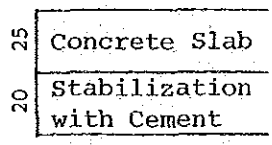
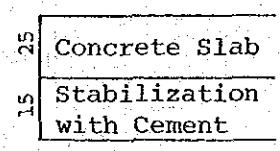
Table 2-8 Coefficients of Relative Strength for Calculating T_A

Pavement Course	Method and Material of Construction Used	Conditions	Coefficient
Binder and Surface Courses	Hot asphalt mix for binder and surface courses		1.00
Base	Bituminous stabilization	—Hot-mixed, Marshall stability: 350kg or more	0.80
		—Cold-mixed, Marshall stability: 250kg or more	0.55
	Cement Stabilization	—Unconfined compressive strength (7 days): 30kg/m²	0.55
	Lime Stabilization	—Unconfined compressive strength (10 days): 10kg/cm²	0.45
	Mechanically Stabilized Gravel and Slag	—Modified CBR: 80 or more	0.35
	Hydraulic Mechanically Stabilized Slag	—Modified CBR: 80 or more	0.55
	Penetration Macadam	—Unconfined compressive strength: (14 days): 12kg/cm²	0.55
Subbase	Crusher-run, Slag,	—Modified CBR: 30 or more,	0.25
	Sand, etc.	—Modified CBR: 20 or more, less than 30	0.20
	Cement Stabiliza-tion	—Unconfined compressive Strength, (7 days): 10kg/cm²	0.25
	Lime Stabilization	—Unconfined compressive Strength (10 days): 7kg/cm²	0.25

Note: Layer coefficient for any construction method or material other than those listed in Table 2-8 should only be adopted when based on established engineering experience.

Design Section of Concrete Pavement

(Unit: cm)

Traffic Classification	Sub-base \ Design CBR for Sub-grade	4	6
L.A	Granular Material		
	Stabilization with Cement (Granular Material)		
B	Granular Material		
	Stabilization with Cement (Granular Material)		

pressure on the roof may be assumed as:

—0·6 p on both slopes of the roof over a length from the gable end equal to the mean height of the roof from the surrounding ground-level, and

—0·4 p over the remaining length of the roof on both slopes.

4.6.2 LOCAL EFFECTS

4.6.2.1 The pressures and suctions specified in *4.6.1* are average values and may be exceeded locally. In designing individual components of roofs, such as sheeting, the values given in *4.6.1* shall be increased numerically by 0·3 p.

4.6.2.2 All fastenings for roof sheetings shall be capable of resisting the pressures on the sheeting as specified in *4.6.2.1*. Fastenings within a distance of 15 percent of the length of the roof from the gables shall be capable of resisting a suction of 2·0 p on the area of roof sheeting they support.

5. SEISMIC LOAD

5.1 General Principles

5.1.1 Earthquake shocks cause a movement of ground on which the structure is situated. This movement causes the structure to vibrate. The vibrations may be resolved in any three perpendicular directions and the design of structures, made safe for the components of vibrations in the three directions acting simultaneously, shall be considered safe unless otherwise specifically stated. The predominant direction of vibration is horizontal.

5.1.2 The vibration intensity of ground expected at any location depends upon the magnitude of earthquake, the depth of focus, the distance from the epicentre and the strata on which the structure stands. The important structures shall be designed for the maximum vibration intensity expected at the place.

5.1.3 The response of the structure to the ground vibration is a function of the nature of foundation soil; materials, form, size and mode of construction of the structure; and the duration and the intensity of ground motion. This section specifies design acceleration for structures standing on soils which will not considerably settle or slide appreciably due to vibration lasting for a few seconds.

5.1.4 In the case of structures designed for horizontal seismic force only it shall be considered to act in any one direction at a time. Where both horizontal and vertical seismic forces are taken into account, horizontal force in any one direction at a time may be considered simultaneously with the vertical force as specified in *5.3.4*.

5.1.5 The vertical seismic coefficient shall be considered only in the case of structures in which stability is a criterion of design or for overall stability except as otherwise stated in the relevant clauses.

5.2 Permissible Increase in Stresses

5.2.1 PERMISSIBLE INCREASE IN MATERIAL STRESSES — Whenever earthquake forces are considered along with other normal design forces, the permissible stresses in materials, in the elastic method of design, may be increased by one-third provided that for steels having a definite yield stress, the stress will be limited to the yield stress; for steels without a definite yield point, the stress will be limited to 80 percent of the ultimate strength.

5.2.2 PERMISSIBLE INCREASE IN ALLOWABLE BEARING PRESSURE OF SOILS — For permissible increase in allowable bearing pressure of soils, reference may be made to Part VI Structural design, Section 2 Foundations.

5.3 Seismic Coefficient for Different Zones

5.3.1 For the purpose of determining the seismic forces, the country is classified into five zones as shown in Fig. 13 (*see* P 22). Unless otherwise stated, horizontal seismic coefficients for static design in different zones shall be taken as follows (*see also 5.3.2 and 5.5*):

Zone No.	*Horizontal Seismic Coefficient* α_h
V	0·08
IV	0·05
III	0·04
II	0·02
I	0·01

5.3.1.1 For dynamic design, the acceleration spectra shown in Fig. 15 and multiplying factor F as given in Appendix A shall be used.

5.3.2 Depending upon the soil-foundation systems (*see* Part VI *Structural design*, Section 2 Foundations) on which the structure is founded, the horizontal seismic coefficient given in *5.3.1* and Factor F given in Appendix A, shall be multiplied by a factor β. The value of β for various cases shall be as given in Table 5.

5.3.3 The seismic coefficients for some important towns and cities are given in Appendix B.

TABLE 5 VALUE OF β FOR DIFFERENT SOIL-FOUNDATION SYSTEMS

(*Clause 5.3.2*)

Sl No.	Type of Foundations	Value of β for Soil Type		
		I Rock or Hard Soils	II Medium Soils	III Soft Soils
(1)	(2)	(3)	(4)	(5)
1)	Bearing piles resting on soil Type I or raft foundation	1·0	1·0	1·0
2)	Friction piles, combined or isolated RCC footing with tie beams	1·0	1·0	1·2
3)	Isolated footings without tie beam or unreinforced strip foundations	1·0	1·2	1·5
4)	Well foundation	1·0	1·2	1·5

5.3.4 The vertical seismic coefficient, where applicable (*see 5.1.5*) may be taken as half of the horizontal seismic coefficient given in *5.3.1*.

5.4 Design Live Loads

5.4.1 For various loading classes as specified in Table 1, the horizontal earthquake force shall be calculated for the full dead load and the percentage of live loads as given below:

Load Class	*Percentage of Design Live Load*
200, 250, 300, stairs and balconies	25
400, 500, 750 and 1 000, garage, light and heavy	50

NOTE 1 — The percentage of live load given above shall also be used for calculating stresses due to vertical loads for combining with those due to earthquake forces. Under the earthquake condition, the whole frame may be assumed as loaded with live load except the roof.

NOTE 2 — The proportions of the live load indicated above for calculating the horizontal seismic forces are applicable to average conditions. Where the probable loads at the time of an earthquake are more accurately assessed, the designer may alter the proportions indicated or even replace the entire live load proportions by the actual assessed load.

NOTE 3 — If the live load is assessed instead of taking the above proportions for calculating horizontal earthquake force, only that part of the live load shall be considered which possesses mass. Earthquake force shall not be applied on impact effects.

5.4.2 For calculating the earthquake force on roofs, the live load may not be considered.

5.5 Miscellaneous Buildings

5.5.1 Buildings provided for accommodating essential services which will be of post-earthquake importance, such as power stations, hospitals, emergency relief stores, foodgrain storage structures, water works and water towers shall be designed for one and a half times the seismic coefficient specified in *5.3.1* or one and a half times the *F* value specified in Appendix A.

5.5.2 Towers, tanks, parapets, smoke stacks, chimneys and other vertical cantilever projections attached to buildings and projecting above the roofs shall be designed for five times the horizontal seismic coefficient specified in *5.3.1*. However, compound walls need not be designed for increased seismic coefficient except where the environmental circumstances indicate that their collapse may lead to serious consequences.

5.5.3 All horizontal projections like cornices and balconies shall be designed to resist a vertical force equal to five times the vertical seismic coefficient specified in *5.3.4* multiplied by the weight of the projection.

NOTE — The increased seismic coefficient specified in *5.5.2* and *5.5.3* are for designing the projecting part and its connection with the main structure. For the design of the main structure such increase need not be considered.

5.6 Design of Buildings — For the application of seismic forces for the design of buildings, reference may be made to good practice [VI-1(3)].

6. SOIL AND HYDROSTATIC PRESSURES

6.1 In the design of structures or parts of structures below ground-level, such as basement floors and walls, the pressures exerted by the soil or water or both shall be duly accounted for on the basis of established theories. Due allowance shall be made for possible surcharge from stationary or moving loads.

6.2 While determining the lateral soil pressure on slender structural members, such as pillars which rest in sloping soils, the width of the member shall preferably be taken as twice its actual width. The relieving pressure of soil in front of the structural member concerned may generally not be taken into account (*see* Fig. 14).

6.3 Safeguarding of structures and structural

members against overturning and horizontal forward movement shall be verified. Live loads having favourable effect shall be disregarded for the purpose. Due consideration shall be given to the possibility of soil being permanently or temporarily removed.

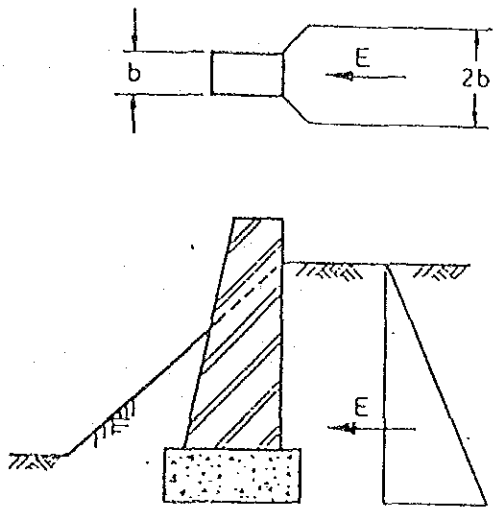


Fig. 14

7. ERECTION LOADS

7.1 All loads required to be carried by the structure or any part of it due to placing or storage of construction materials and erection equipment including all loads due to operation of such equipment, shall be considered as 'erection loads'. Proper provisions shall be made to take care of all stresses due to such loads.

8. OTHER FORCES

8.1 Impact, vibrations, temperature effects, shrinkage, creep and such other phenomena produce effects on structures some of which may be similar to those caused by external loads specified in *2* to *7*. Adequate provision should be made for the effects of one or more of these phenomena separately or in appropriate combination with the specified external loads in accordance with the recommendations of the appropriate design sections.

9. LOAD COMBINATIONS

9.1 A judicious combination of the working loads specified in *2* to *7* keeping in view the probability of their acting together and their disposition in relation to other loads and the severity of stresses or deformations caused by the combination of the various loads, is necessary to ensure the required safety and economy in the design of a structure.

9.2 The various loads specified in *2* to *7* should, therefore, be combined in accordance with the stipulations in the appropriate design sections. In the absence of such recommendations, however, the following load combinations, given for general guidance, may be adopted:

a) Dead load alone.

b) Dead load plus partial or full live load whichever causes the most critical condition in the structure.

c) Dead load plus wind or seismic loads.

d) Dead load plus such part of or whole of the specified live load whichever is most likely to occur in combination with the specified wind or seismic loads plus wind or seismic loads.

e) Dead loads plus such parts of the live load as would be imposed on the structure during the period of erection plus wind or seismic loads plus erection loads.

NOTE — For design purposes, wind load and seismic forces shall be assumed not to act simultaneously. Both forces shall, however, be investigated separately and adequately provided for.

9.2.1 While considering the load combinations recommended in *9.2*, the effects of other forces mentioned in *8* should also be taken into account.

APPENDIX A

(Clauses 5.3.1.1 and 5.5.1)

SPECTRA OF EARTHQUAKE

A-1. GENERAL

A-1.1 Spectrum of an earthquake is the representation of the maximum dynamic response of idealized structures during an earthquake. The idealized structure is a single degree of freedom system having a certain period of vibration and damping. The maximum response is plotted against the natural period of vibration and can be

expressed in terms of maximum absolute acceleration, maximum relative velocity or maximum relative displacement. For the purpose of design, acceleration spectra are very useful, as they give the seismic force on a structure directly by multiplying it with the generalized or modal mass of the structure.

A-2. AVERAGE SPECTRA

A-2.1 Prof G. W. Housner has proposed average spectra on the basis of studies on response spectra of four strongest earthquakes that have occurred in USA (*see* Fig. 15 which shows the average acceleration spectra).

A-2.2 To take into account the seismicity of the various zones, the ordinates of the average spectra are to be multiplied by a factor *F*. This factor *F* depends on the magnitude, duration and form of the expected earthquake, distance of the site from expected epicentre, soil conditions, resistance deformation characteristics of the structure, etc. For elastic design with permissible increase in stresses as given in *5.2*, the approximate values of this factor for the seismic zones of India are given below:

Zone	*F Value*
V	0·7
IV	0·4
III	0·3
II	0·2
I	0·1

NOTE 1 — It may be pointed out that during the expected maximum intensity of earthquakes in the various seismic zones, structures will be subjected to a bigger force. But the capacity of the structure in plastic range will be available for resisting such forces. If the energy absorption method of design is used, these values will have to be multiplied by 3 to 6 in order to obtain the appropriate design factors for the expected earthquake.

NOTE 2 — The values of *F* shall be multiplied by 1·5 for structures mentioned in *5.5.1* for elastic design. For inelastic design, the multiplier (3 to 6) takes the importance of the structure into account. For very important structures, however, it would be preferable to determine this factor more precisely.

A-3. DAMPING IN STRUCTURES

A-3.1 The variety of damping displayed in different types of structures has made the choice of a suitable damping coefficient for a given structure largely a matter of judgement. However, some values are given below to indicate the order of damping coefficient in various types of structures:

Type of Structure	*Damping Coefficient in Percent of Critical*
a) Steel structures	2 to 5
b) Concrete structures	5 to 10
c) Brick structures in cement mortar	5 to 10
d) Timber structures	2 to 5
e) Earthen structures	10 to 30

NOTE — It may be mentioned here that in the elastic range, damping displayed by structures is much lower than that given above. It may lie between 1 and 4 percent for the above type of structures at low stresses. The values given thus presume some inelastic deformations or fine cracking to take place when this order of damping will occur.

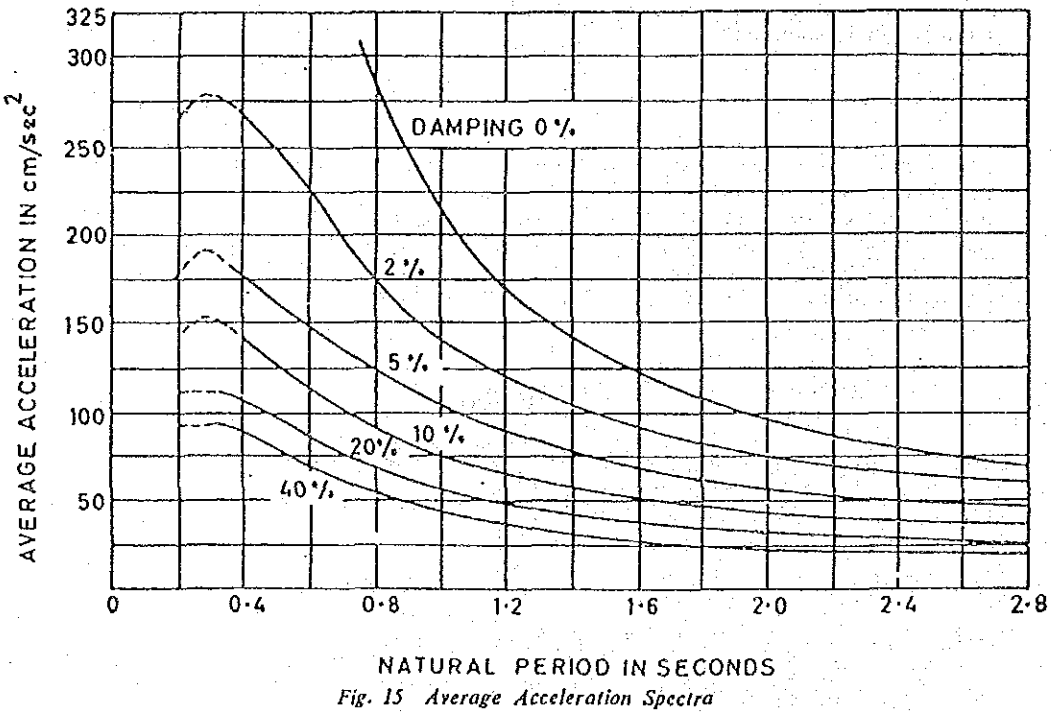


Fig. 15 Average Acceleration Spectra

A-4. METHOD OF USING THE SPECTRA

A-4.1 Let the period of a structure be 0·8 second and the damping 5 percent critical. Referring to Fig. 15, the spectral acceleration, S_a is 125 cm/sec^2. If the structure has mass $M = 12{\cdot}0$ kg/sec^2/cm and is to be located in zone V, the acceleration to be used for design would be $0{\cdot}7 \times 125 = 87{\cdot}5$ cm/sec^2, and the seismic force P would be given by $P = 87{\cdot}5 \times 12 = 1\,050$ kg.

APPENDIX B

(Clause 5.3.3)

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
Gauhati	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*.

4.5 Estimated Power Demand

Designed Power Capacity

Terminal building	2,025 m² x 0.035 kW/m² =	710 kW
Other buildings	1,034 m² x 0.02 kW/m² =	20.7 kW
Water Supply & drainage equipment (incl. bus washing equipment)		32.5 kW
Outside lighting		48.5 kW
Total		172.7 kW

Estimated monthly average power usage

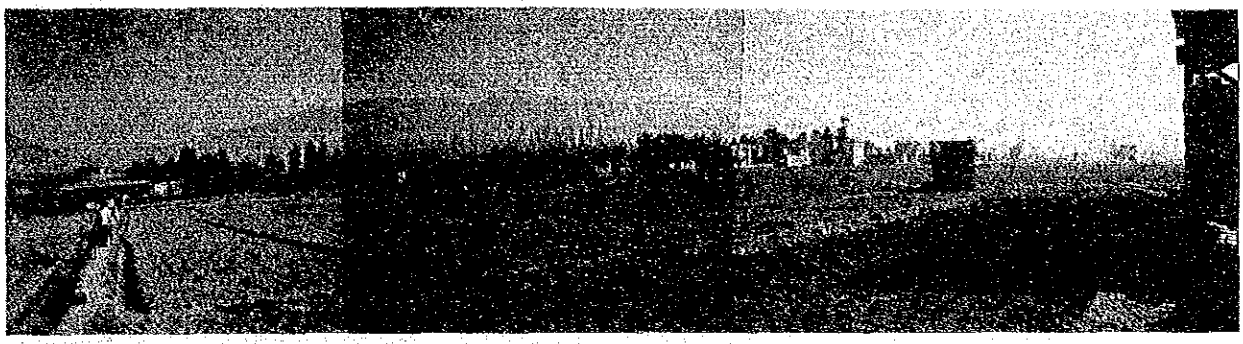
Terminal building	
71.0 kW x 0.45 x 18 H/D x 30 D =	17,250 kWH
Other buildings	
20.7 kW x 0.14 x 18 H/D x 30 D =	1,560 kWH
Water Supply & drainage equipment	
32.5 kW x 0.2 x 18 H/D x 30 D =	3,510 kWH
Outside lighting	
48.5 kW x 1.0 x 6 H/D x 30 D =	8,730 kWH
Total	31,050 kWH

4.6 List of Other Data

• The Seventh Plan 1985-1990 (A Summary) Part I	National Planning Commission
• Climatological Records of Nepal 1985-1986	Min. of Water Resources, Dep. of Hydrology and Meteorology
• Surface Water Records of Nepal Supplement No.11, 1976	Dep. of Irrigation, Hydrology and Meteorology
• Statistical Year Book of Nepal 1987	National Planning Commission, Central Bureau of Statistic
• Soil Investigation Report for Proposed Site (Samakhusi District)	KNP - Nissaku Co.
• Topographical Survey Map for Proposed Site (Samakhusi District)	KNP - Creative Designer, Co.
• Soil Investigation Report for No.8 Site	Nissaku Co.
• Topographical Survey Map for No.8 Site	Creative Designer, Co.
• Standard Drawings Urban Roads and Drains	Min. of Housing & Physical Planning Min. of Panchayat & Local Development
• Nepal Road Standards - 2045	Min. of Works and Transport Dep. of Roads
• Urban Roads Standards Management Support for Town Panchayat Project	

• Preliminary Drawings (Existing 1987)	Min. of Public Works & Transport Min. of Panchayat & Local Development
- Kathmandu-Lalitpur Road and Drain	DWG No. F-119
- Kathmandu-Lalitpur Water Supply Reticulation Network	DWG No. F-120
- Kathmandu-Lalitpur Service Public Transports Street Lighting & Markets	DWG No. F-121
- Kathmandu-Lalitpur Sewerage & Solid Waste Existing Network	DWG No. F-122

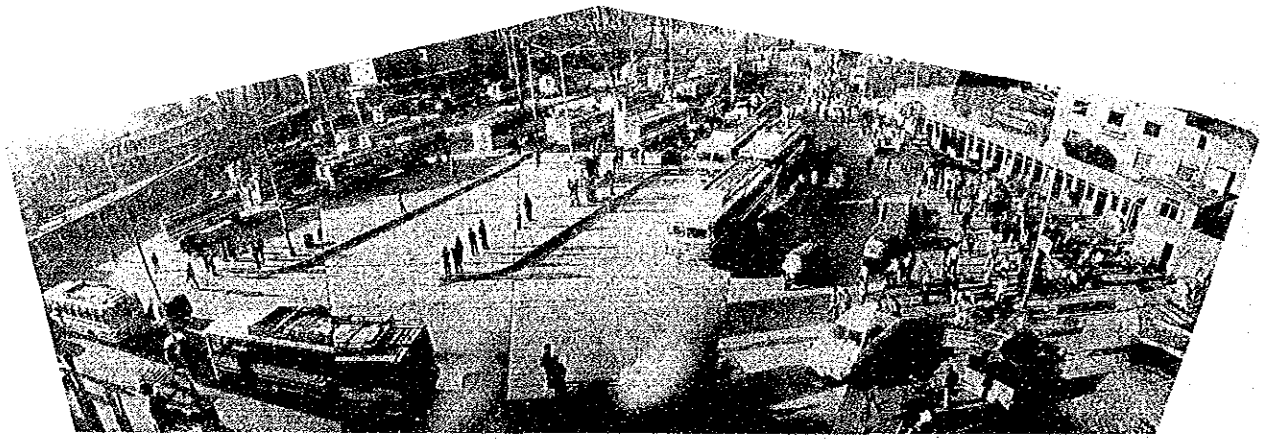
4.7 Photographs



Proposed Bus Terminal Site (Distant View of Ring Road)

Proposed Bus Terminal Site
(View from the Vishumati River/Ring Road Bridge)

Existing Bus Terminal PM 4:50

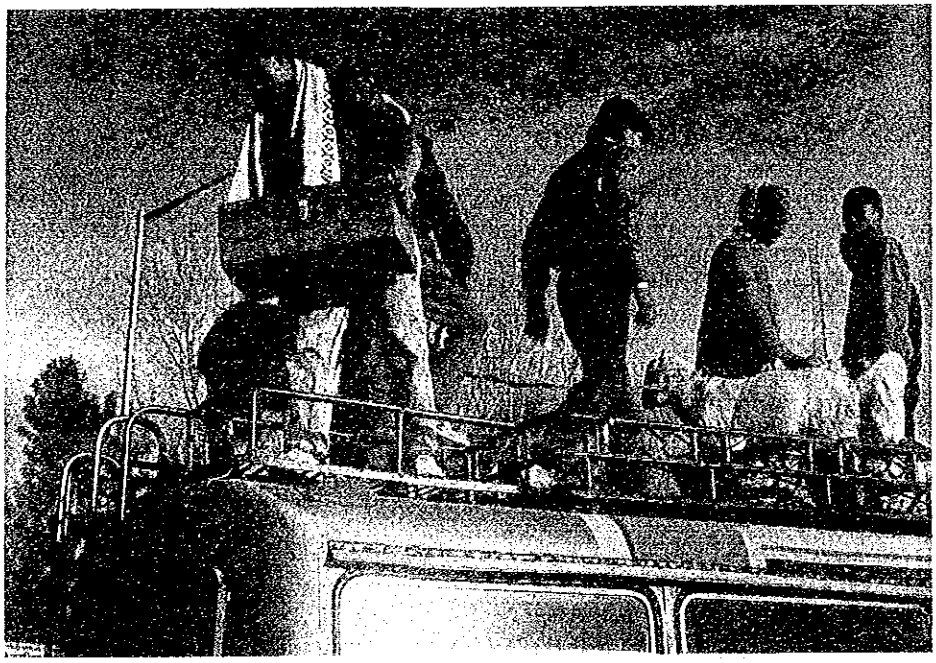


Existing Bus Terminal AM 8:00
(Holiday)

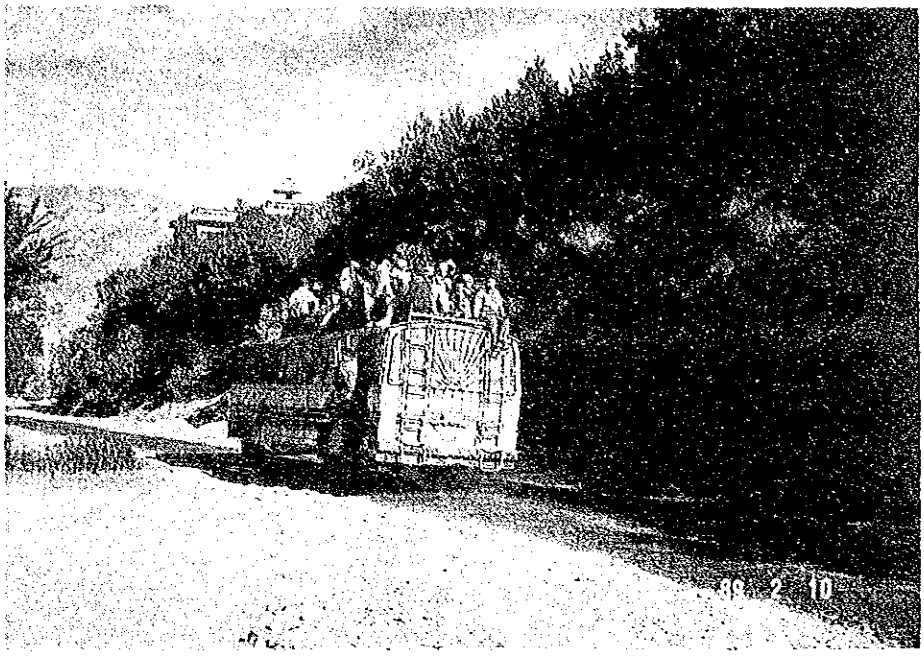
Existing Bus Terminal (Temporary Ticket Stand)

Existing Bus Terminal (Shop and Eating House)

Existing Bus Terminal (Baggage Loading/Unloading)



Existing Bus Terminal (Baggage Loading/Unloading)



Running Bus