

GEOE Consultants (P) Ltd.
TEST PIT LOG OF GRID SAMPLING

Hydrological Study For Basic Design Study on The Project For Construction of Sindhuil Road Construction, Section III

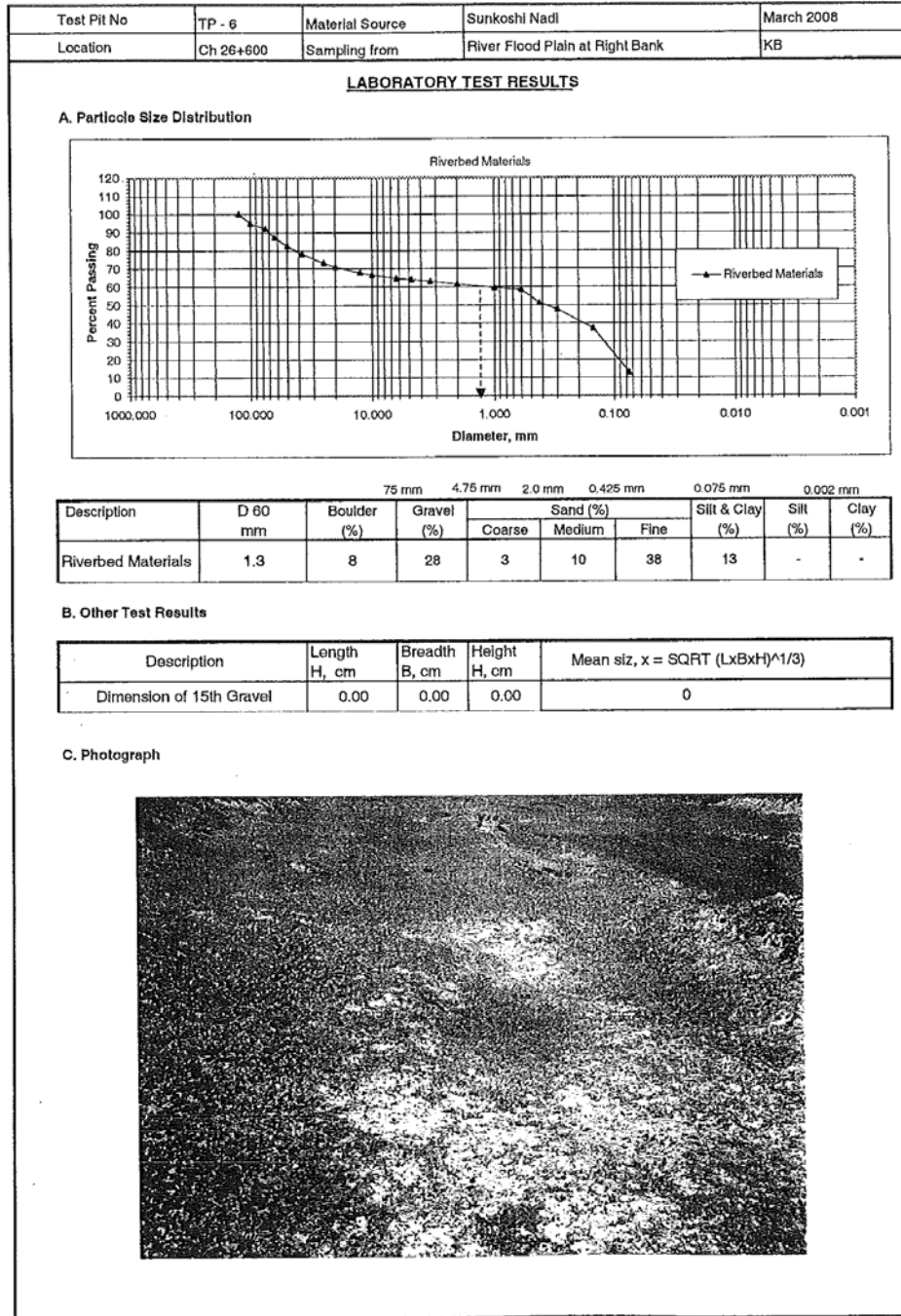
Chainage: Ch 26+600
 Location: Sunkosi Naafi Flood Plain
 Ground Elevation: 515.117 m
 Coordinates: N 3035127.630 and E 395570.512
 Test Pit No: 6
 Aprox. Dimension of TP: 0.90 x 0.90 x 0.90 m
 Date: March 2008
 Logged By: KB

Classification Group Symbol	Depth (m)	Type and Depth of Sample Taken	Dimension of 15th Gravel at Riverbed			Mean size, $x = \sqrt{\frac{L \times B \times H}{1/3}}$
			Length L, cm	Breadth B, cm	Height H, cm	
SM	0.05	CLASSIFICATION AND DESCRIPTION OF MATERIAL (Typical name, colour, in wet condition, odour, if any degree of plasticity, grain size range and description, moisture conditions, degree of compactness and other pertinent information) 0 to 40 cm, Silty SAND, greyish, fined grained sand, grass roots extended upto 10 cm from ground level	0	0	0	0
	0.10					
	0.15					
	0.20					
	0.25					
	0.30					
	0.35					
	0.40					
	0.45					
	0.50					
SP	0.55	Bulk for GSA 40 to 60 cm, Gravelly SAND, greyish/brownish, fine grained sand, little micaceous, mixed with little slightly plastic fines, sub rounded and sub angular Boulder and falky gravel fractions, hard & strong, maximum size of boulder fraction of 18 x 12 x 4 cm				
	0.50					
	0.45					

Test Pit Log of Grid Sampling at Location TP-6

GEOCE Consultants (P) Ltd.
TEST RESULTS OF RIVERBED MATERIALS

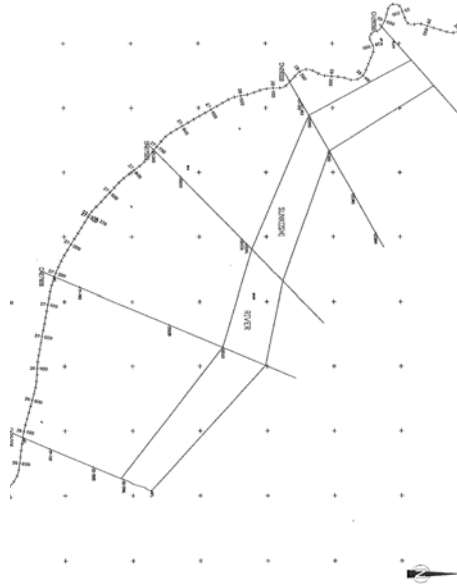
Hydrological Study For Basic Design Study on The Project For Construction of Sindhuli Road Construction, Section III



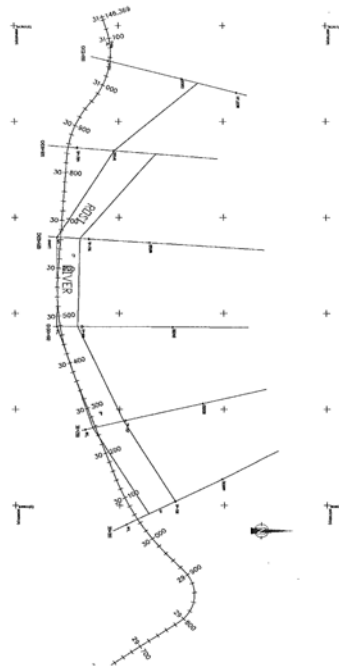
River bed condition and mean particle size at Location TP-6

2) River Cross Section Topo Survey Results

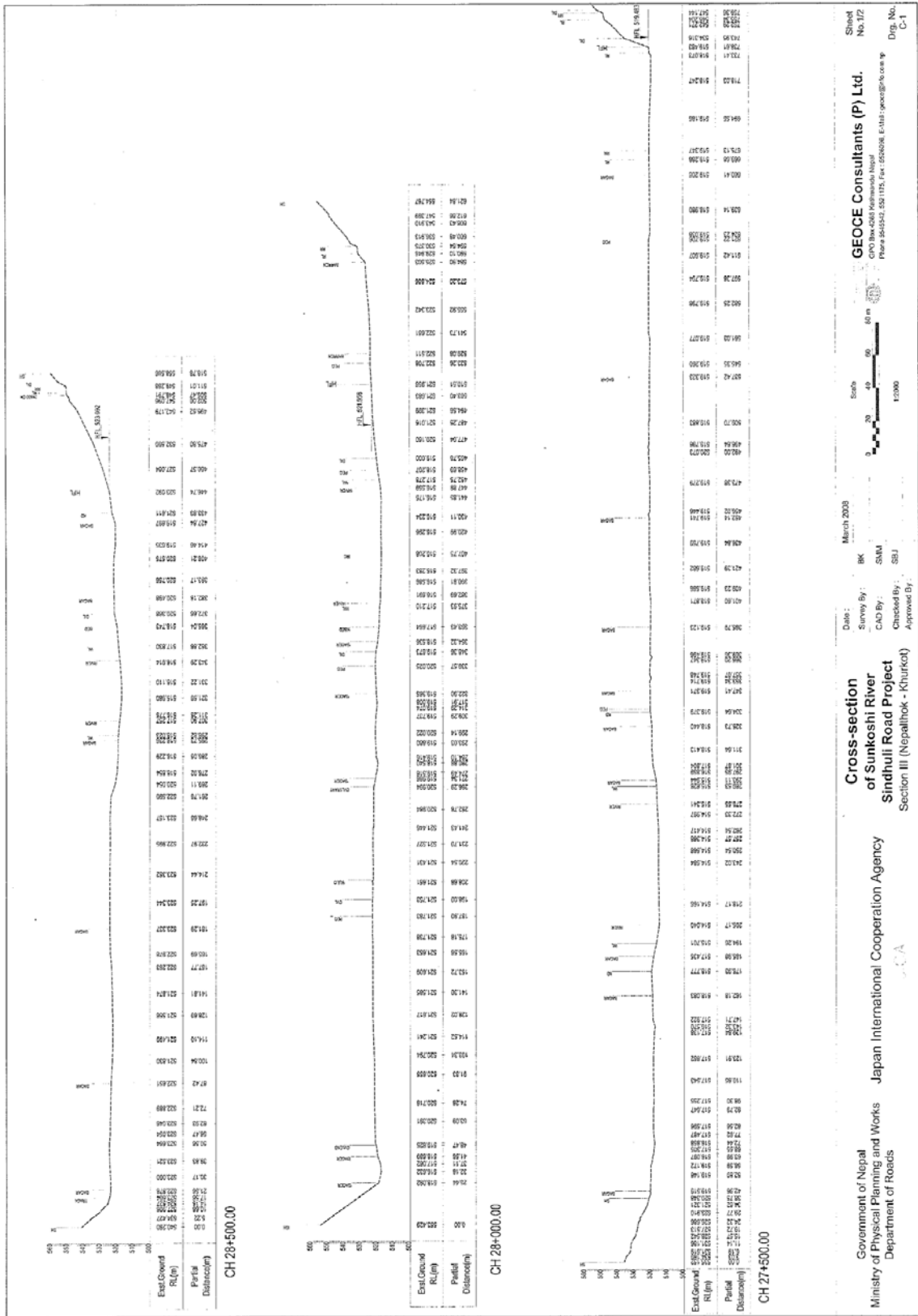
Survey locations, direction and sections are shown from page A6-4-13 to A6-4-17.



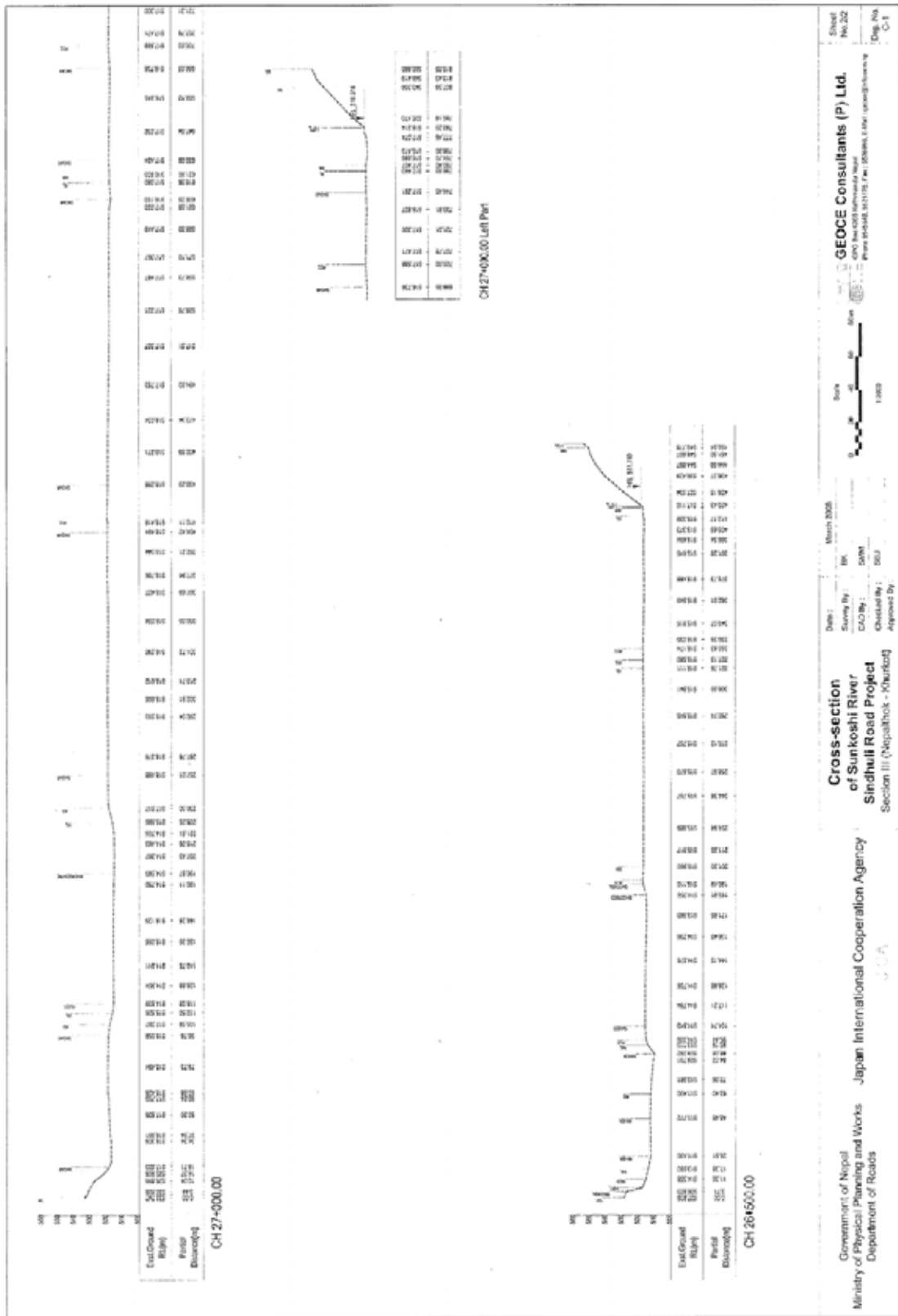
Cross section survey location at Sunkoshi River



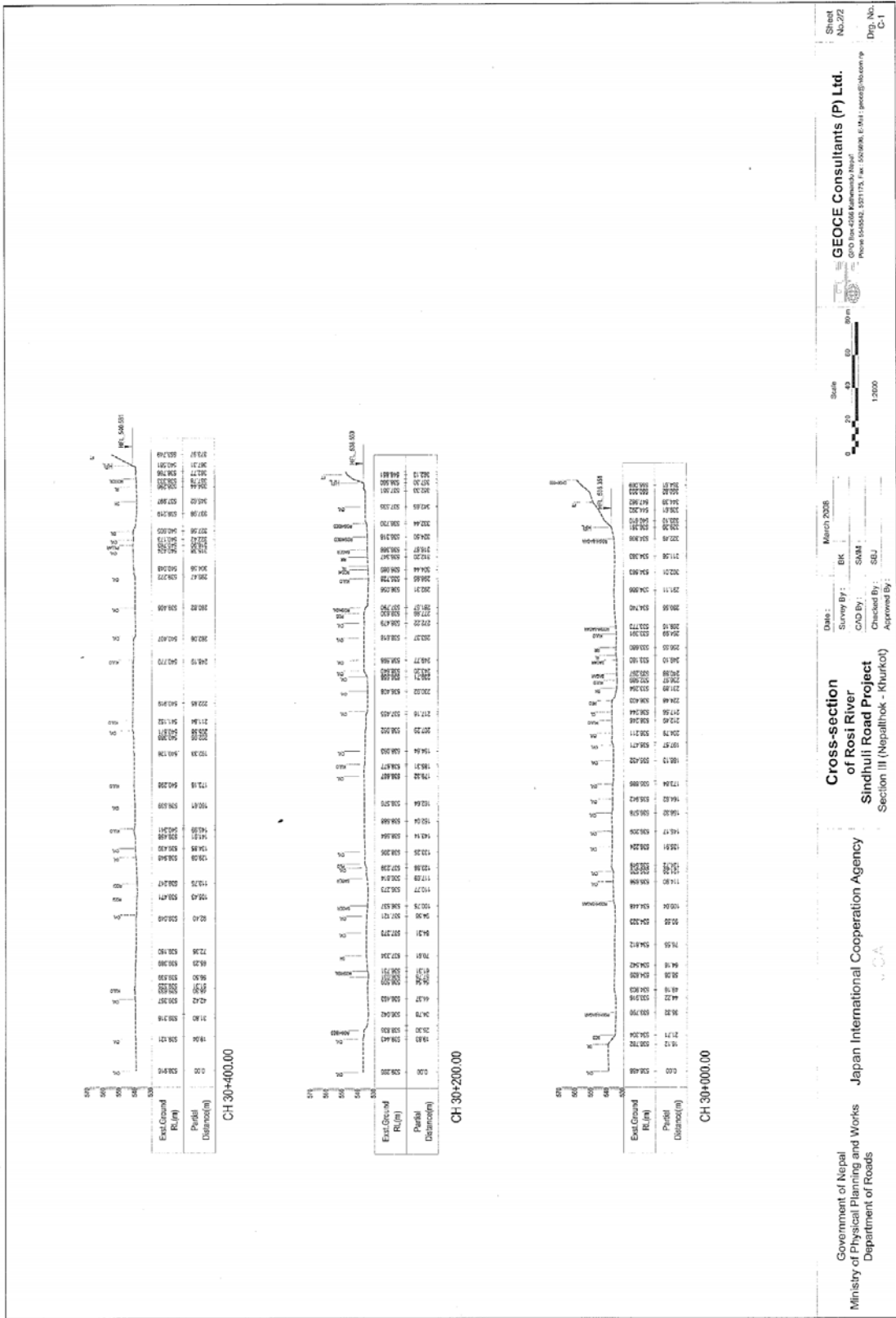
Cross section survey location at Rosi River



River bed cross section (1/4)



River bed cross section (2/4)



River bed cross section (4/4)

6-5 Traffic Survey

6-5 TRAFFIC SURVEY

Traffic survey was conducted at 6 different intersection locations. All turning movement counts on each leg of the intersection were recorded. Locations and durations of survey are as shown below and in Figure 1;

(1) Dhalkebar	24 hours/1 day (6am-6am)
(2) Bardibas	16 hours/2 days (4am- 8pm)
(3) Pathlaiya	24 hours/1 day (6am-6am)
(4) Narayanghat	24 hours/1 day (6am-6am)
(5) Naubise	24 hours/1 day (6am-6am)
(6) Dhulikhel	16 hours/2 days (4am-8pm)

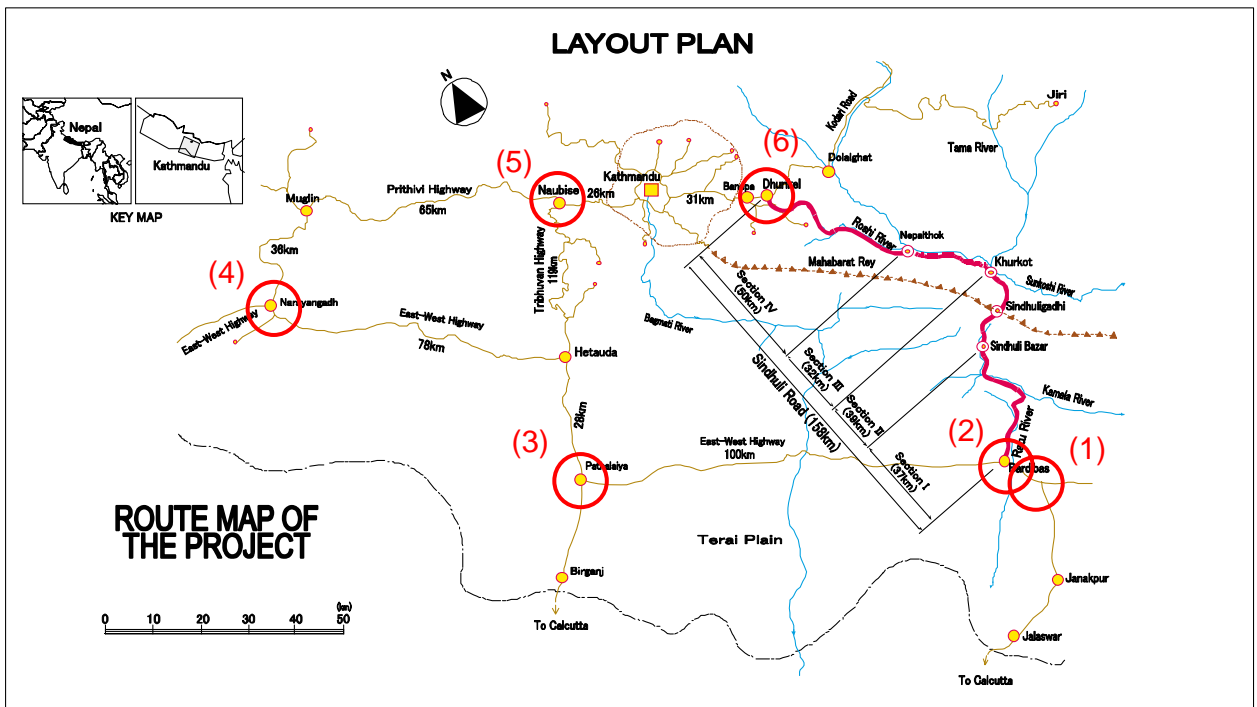


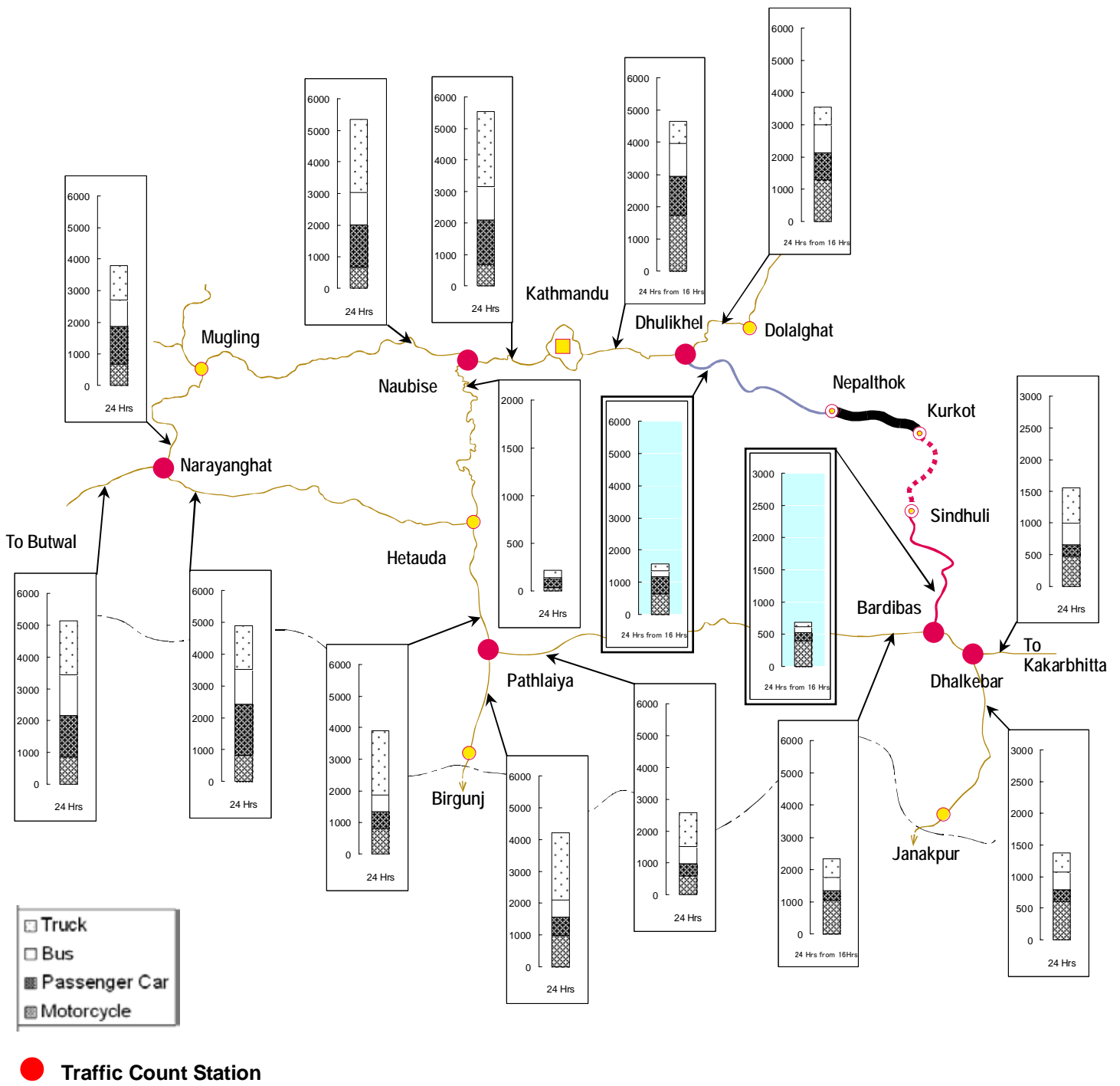
Figure 1 Traffic Count Stations

RESULTS

The results of the survey are shown in Table 1 and Figure 2. The results for Bardibas and Dhulikhel were converted to 24hours volume by applying factors calculated from Dhalkebar and Naubise respectively.

Table 1 Results of Traffic Volume Counts

Location	Survey Date and Time	Direction		Car Van Jeep	Bus		Truck		Tractor	Motor Cycle	Others Tempo etc	Total
		From	To		Mini Bus	Bus	Light	Medium/ Heavy				
Naubise	From March 19,'08 (Wed) 06:00 to March 20,'08 (Thu) 06:00	Kathmandu	Mugling	666	140	384	80	1037	3	362	2	2674
		Mugling	Kathmandu	671	158	344	57	1131	1	298	2	2662
		Kathmandu	Daman	38	2	4	3	41	1	14	0	103
		Daman	Kathmandu	43	0	8	4	26	1	14	0	96
		Mugling	Daman	3	0	0	0	1	0	4	0	8
		Daman	Mugling	4	0	0	1	1	0	6	0	12
	Total	Kathmandu	1418	300	740	144	2235	6	688	4	5535	
	Mugling	1344	298	728	138	2170	4	670	4	5356		
		Daman	88	2	12	8	69	2	38	0	219	
Narayanghat	From March 19,'08 (Wed) 06:00 to March 20,'08 (Thu) 06:00	Kathmandu	Butwal	249	65	177	33	309	21	171	32	1057
		Butwal	Kathmandu	193	56	206	32	336	20	192	30	1065
		Kathmandu	Hetauda	398	57	110	70	141	30	188	24	1018
		Hetauda	Kathmandu	349	49	115	43	122	34	134	40	886
		Hetauda	Butwal	448	158	253	98	459	77	232	70	1795
		Butwal	Hetauda	392	146	214	87	352	65	277	52	1585
	Total	Kathmandu	1189	227	608	178	908	105	685	126	4026	
	Hetauda	1282	425	850	250	1456	183	872	184	5502		
		Butwal	1587	410	692	298	1074	206	831	186	5284	
Pathlaiya	From March 25,'08 (Tue) 06:00 to March 26,'08 (Wed) 06:00	Kathmandu	Birgunj	173	65	69	26	629	33	306	73	1374
		Birgunj	Kathmandu	184	71	68	33	850	46	296	75	1623
		Kathmandu	Bardibas	98	18	111	9	176	7	99	66	584
		Bardibas	Kathmandu	67	12	126	9	299	3	117	50	683
		Bardibas	Birgunj	109	78	58	10	239	83	213	112	902
		Birgunj	Bardibas	102	93	48	13	307	73	175	136	947
	Total	Kathmandu	522	166	374	77	1954	89	818	264	4264	
	Birgunj	568	307	243	82	2025	235	990	396	4846		
		Bardibas	376	201	343	41	1021	166	604	364	3116	
Dhalkebar	From March 25,'08 (Tue) 06:00 to March 26,'08 (Wed) 06:00	Bardibas	Janakpur	64	14	86	5	101	17	206	66	559
		Janakpur	Bardibas	66	19	77	7	108	20	200	38	535
		Bardibas	Kakarbhitta	82	9	112	8	233	7	105	26	582
		Kakarbhitta	Bardibas	58	8	112	3	246	13	158	8	606
		Kakarbhitta	Janakpur	26	3	39	1	28	12	104	30	243
		Janakpur	Kakarbhitta	23	2	48	1	40	14	102	26	256
	Total	Bardibas	270	50	387	23	688	57	669	138	2282	
	Janakpur	179	38	250	14	277	63	612	160	1593		
		Kakarbhitta	189	22	311	13	547	46	469	90	1687	
Dhulikhel	Average of March 19,'08 (Wed) 04:00 to 20:00 and March 20,'08 (Thu) 04:00 to 20:00	Kathmandu	Dolalghat	398	193	251	99	186	39	628	40	1834
		Dolalghat	Kathmandu	350	153	258	99	141	23	567	50	1641
		Kathmandu	Sindhuli	237	17	63	32	61	15	280	17	722
		Sindhuli	Kathmandu	212	15	65	23	61	19	268	15	678
		Sindhuli	Dolalghat	43	6	7	6	9	4	50	15	140
		Dolalghat	Sindhuli	44	3	8	3	13	3	42	13	129
	Total	Kathmandu	1197	378	636	252	448	95	1742	121	4869	
	Dolalghat	834	354	524	206	348	69	1285	117	3737		
		Sindhuli	535	40	142	64	143	40	639	59	1662	
Bardibas	Average of March 25,'08 (Tue) 04:00 to 20:00 and March 26,'08 (Wed) 04:00 to 20:00	Kathmandu	Kakarbhitta	120	29	158	14	256	57	363	37	1034
		Kakarbhitta	Kathmandu	113	33	141	10	245	54	389	37	1022
		Kathmandu	Sindhuli	45	4	28	3	22	11	154	8	275
		Sindhuli	Kathmandu	37	6	22	3	13	9	118	10	218
		Sindhuli	Kakarbhitta	23	3	19	2	13	15	64	7	146
		Kakarbhitta	Sindhuli	20	1	13	2	9	11	65	10	131
	Total	Kathmandu	314	71	348	29	536	131	1023	91	2543	
	Sindhuli	124	14	80	9	56	46	401	34	764		
		Kakarbhitta	276	65	330	28	522	137	880	91	2329	



GROWTH RATE

Comparison of traffic survey results conducted during different stages of the project from the year 1986 to date is shown in Table 2 and Figure 3. Annual Growth Rates from the year 1986 to 2008 are also indicated in the table. Annual average growth rate of 7.6% has been estimated for all locations.

Table 2 Annual Average Growth Rate at Different Locations

Location	Total of Leg	1986 Vpd	1993 vpd	1995 vpd	1999 vpd	2008 vpd	% Growth 1986-2008
Banepa (Dhulikhel)	Dhulikhel-Kathmandu	695	1517			4653	9.0
Thankot (Naubise)	Naubise-Kathmandu	1401	2404	2979	3444	5525	6.4
Bharatpur (Narayanghat)	Narayanghat-Mugling	842	2081	2351	2772	3795	7.1
Hetauda	Hetauda-Pathlaiya	836	1852	1929	2314	3911	7.3
Pathlaiya	Pathlaiya-Bardibas	639	1007	1170	1569	2586	6.6
Bardibas	Bardibas-Sindhuli	79	50			684	10.3
Dhalkebar	Dhalkebar-Bardibas	493	784			2095	6.8
AVERAGE							7.6

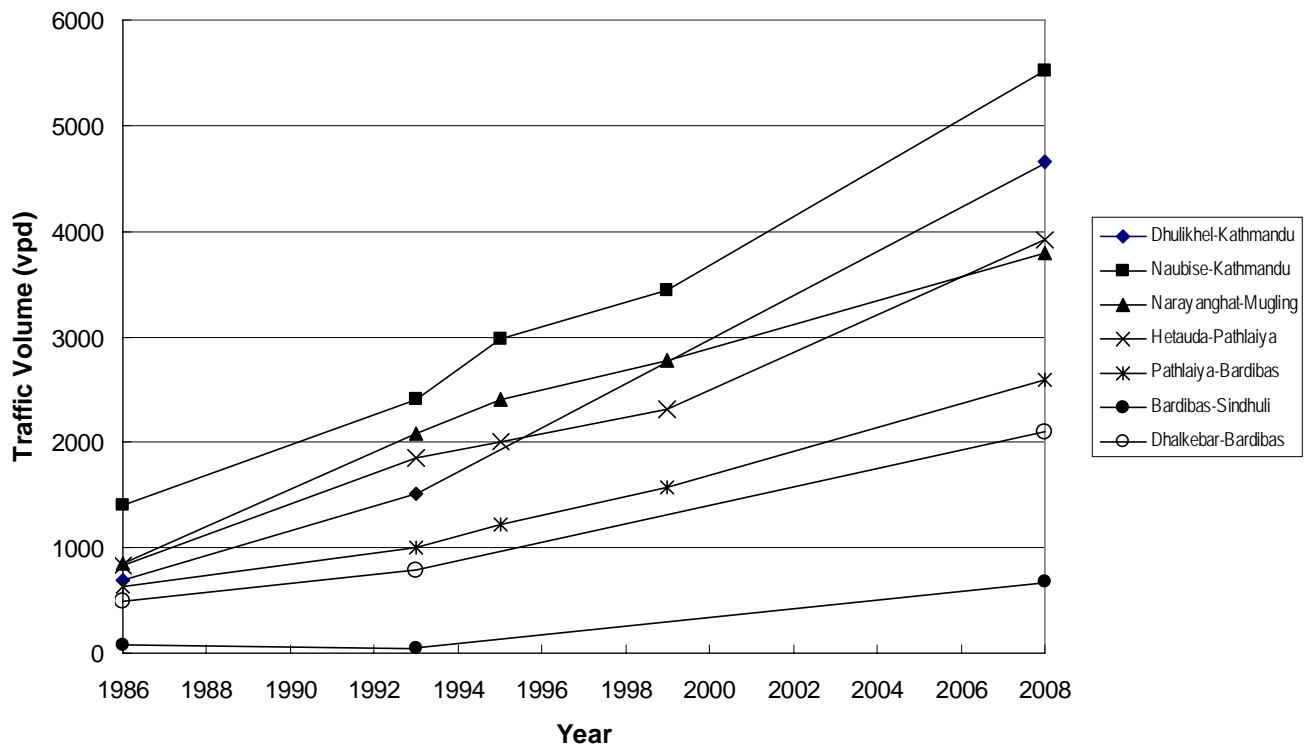


Figure 3 Traffic Growth at Different Locations

TRAFFIC FORECAST

Feasibility Study Report forecasted three types of traffic volume (1) normal traffic (2) developed/induced traffic, as a result of regional development (3) diverted traffic from Jaleswor border. Average percentage factors for developed/induced traffic and diverted traffic with respect to normal traffic were calculated for Bardibas side and Dhulikhel side, as given in Table 3.

Table 3 Developed/ Induced Traffic and Diverted Traffic as a Percentage of Normal Traffic

Bardibas side average	Developed / induced%	0.828	0.409	0.528	0.417
	Diverted Jaleswor%	0.131	0.159	0.173	0.208
Dhulikhel side average	Developed / induced%	0.424	0.378	0.442	0.417
	Diverted Jaleswor%	0.173	0.163	0.182	0.208

These factors were applied to the normal traffic (surveyed in 2008) to estimate the future traffic of Sindhuli Road, as given in Table 4, using annual growth rate of 7.6%.

Table 4 Forecasted Traffic Volume

	Year	Traffic Type	PC	Bus	Truck	Motorcycle	Total
Bardibas Side (Section I-II)	2008	Normal (Total)	124	94	65	401	684
	2013 Section III remains	Normal	173	131	91	558	953
		Developed & Induced	143	54	48	233	478
		Total	316	185	139	791	1431
	2014 If Section III Completed	Normal	185	140	97	596	1018
		Developed & Induced	153	57	51	249	510
		Diverted Jaleswor	24	22	17	124	187
		Total	362	219	165	969	1715
	2018 After completion of Section III	Normal	240	182	126	775	1323
		Developed & Induced	199	74	67	323	663
		Diverted Jaleswor	31	29	22	161	243
		Total	470	285	215	1259	2229
	Dhulikhel Side (Section III-IV)	2008	Normal	535	182	207	639
2013 Section III Remains		Normal	744	253	288	888	2173
		Developed & Induced	315	96	127	370	908
		Total	1059	349	415	1258	3081
2014 If Section III Completed		Normal	794	271	308	949	2322
		Developed & Induced	337	102	136	396	971
		Diverted Jaleswor	137	44	56	197	434
		Total	1268	417	500	1542	3727
2018 After completion of Section III		Normal	1033	352	400	1234	3019
		Developed & Induced	438	133	177	515	1263
		Diverted Jaleswor	179	57	73	257	566

		Total	1650	542	650	2006	4848
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CAPACITY ANALYSIS

Aftercare Study used PCU values of 1, 3, 3 and 1 for passenger car, bus, truck and motorcycles respectively. Similarly, Basic Design Study Report of Section IV (Section II-3) has estimated a capacity of 620 pcu/hr for the standard cross section of Sindhuli Road Project. These values were used to estimate Volume/Capacity (V/C) Ratio at different stages, as given in Table 5.

Table 5 Capacity Analysis for Sindhuli Road, Capacity = 620 pcu/hr
Case 1: PCU values for Passenger Car = 1, Bus = 3, Truck = 3, Motorcycle = 1

	Year	Construction status of Sindhuli Road	VPD	PCU/day	PCU/hr	V/C
Bardibas Side (Section I-II)	2008		684	1002	100	0.16
	2013	Section III not completed	1431	2079	208	0.34
	2014	Section III if completed	1715	2483	248	0.40
	2018	After completion of all sections	2229	3229	323	0.52
Dhulikhel Side (Section III-IV)	2008		1563	2341	234	0.38
	2013	Section III not completed	3081	4609	461	0.74
	2014	Section III if completed	3727	5561	556	0.90
	2018	After completion of all sections	4848	7232	723	1.17

V/C ratio at different stages was also checked with PCU value of 0.5 for motorcycle, which seems more practical, and with all other values same. The result is given in Table 6.

Table 6 Capacity Analysis for Sindhuli Road, Capacity = 620 pcu/hr
Case 2: PCU values for Passenger Car = 1, Bus = 3, Truck = 3, Motorcycle = 0.5

	Year	Construction status of Sindhuli Road	VPD	PCU/day	PCU/hr	V/C
Bardibas Side (Section I-II)	2008		684	802	80	0.13
	2013	Section III not completed	1431	1684	168	0.27
	2014	Section III if completed	1715	1999	200	0.32
	2018	After completion of all sections	2229	2600	260	0.42
Dhulikhel Side (Section III-IV)	2008		1563	2022	202	0.33
	2013	Section III not completed	3081	3980	398	0.64
	2014	Section III if completed	3727	4790	479	0.77
	2018	After completion of all sections	4848	6229	623	1.00

CONCLUSIONS

Based on the results of traffic survey and also the historic traffic data and analysis results from previous studies on Sindhuli Road, the future traffic volume was forecasted up to the year 2018, that is, 10 years from the study year 2008.

The results of capacity analysis show that the standard cross section width of Sindhuli Road will be able to cater traffic volume for the target year of 2018 in Bardibas side. The result also shows that the road section towards Dhulikhel side will reach near to its capacity by the target year 2018.