THE REPUBLIC OF COLOMBIA

THE BOGOTA-BUENAVENTURA ROAD PROJECT

FEASIBILITY SURVEY

VOLUME 2 (ANNEX)

FINAL REPORT

MARCH 1982

JAPAN INTERNATIONAL COOPERATION AGENCY

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Annex Table 2-1 Gross Domestic Product, 1970-1979

Year	In Current Prices					In 1970 Prices				
	GDP		National Income			GDP		National Income		
	Million peso	Annual Increase (%)	Million peso	Income per Capita	Personal Annual Increase (%)	Million peso	Annual Increase (%)	Million peso	Income per Capita	Personal Annual Increase (%)
1970	130,361.4	-	106,096.3	5,116	-	130,361.4	-	106,582.6	5,139	-
1971	152,262.8	16.8	124,948.0	5,864	14.6	137,889.0	5.8	112,358.5	5,273	2.2
1972	186,092.3	22.2	153,988.0	7,034	19.9	148,629.5	7.8	123,348.3	5,638	6.4
1973	243,235.9	30.7	204,468.2	9,091	29.2	159,194.7	7.1	134,348.3	5,973	5.5
1974	329,155.4	35.3	276,023.0	11,944	31.3	168,786.9	6.0	145,255.0	6,286	4.8
1975	412,828.7	25.4	341,578.2	14,386	20.4	175,225.9	3.8	146,187.0	6,157	-0.2
1976	534,015.3	29.4	437,950.1	17,953	24.7	183,296.1	4.6	157,640.3	6,462	4.5
1977	718,474.5	34.5	591,642.8	23,606	31.5	192,187.1	4.9	172,499.4	6,883	5.6
1978	895,766.5	24.7	732,824.9	28,458	20.5	209,235.8	8.9	183,532.0	7,127	3.5
1979	-	-	-	-	-	219,884.7[1)]	5.1	-	-	-

Source: Banco de la Republica, Division de Cuentas Nacionales, Cuentas Nacionales de Colombia 1970-1978.

Notes: 1) Provisional in July 1980.

Annex Table 2-2 Sectoral Contribution to GDP.

(In Percent)

Fiscal Year	Current Prices						1970 Prices					
	1970	1975	1976	1977	1978	70-78 Average Annual Growth Rate	1970	1975	1976	1977	1978	70-78 Average Annual Growth Rate
Agriculture	25.3	26.4	26.7	28.3	26.9	28.2	25.3	24.1	23.5	23.0	23.1	4.8
Fishery & Livestock Farming	0.6	0.7	0.8	0.9	1.0	35.8	0.6	0.6	0.7	0.7	0.6	6.1
Forestry	0.4	0.4	0.4	0.4	0.3	25.3	0.4	0.4	0.4	0.4	0.4	6.3
Mining	2.0	1.2	1.1	1.1	1.3	20.4	2.0	1.3	1.2	1.1	1.0	-2.0
Manufacturing	18.6	21.4	21.8	20.5	20.6	28.9	18.6	19.0	19.4	19.3	19.3	6.5
Construction	5.0	4.8	3.8	3.9	4.2	24.3	5.0	4.5	3.7	3.7	3.5	1.2
Commerce	17.2	17.5	18.2	18.4	18.6	28.4	17.2	16.7	17.0	17.1	17.3	6.1
Transportation	5.9	4.4	4.8	5.1	4.9	24.3	5.9	6.2	6.4	6.6	6.6	8.0
Communication	0.9	1.0	0.9	0.9	0.8	26.1	0.9	1.3	1.4	1.6	1.7	14.4
Utility	1.4	1.2	1.3	1.2	1.3	25.9	1.9	1.6	1.7	1.6	1.6	8.8
Finance	3.4	3.5	3.2	3.3	3.7	28.4	3.4	4.7	4.9	5.1	5.5	12.5
Real Estate	5.6	4.6	4.5	4.0	4.0	22.0	5.6	5.7	5.8	5.8	5.7	6.3
Personal Services	7.3	6.4	6.4	6.4	6.5	25.4	7.3	7.5	7.7	7.9	7.7	6.9
Public Services	6.4	6.5	6.1	5.6	5.9	25.9	6.4	6.4	6.2	6.1	6.0	5.4
Total GDP in Million Pesos	130,361.4	412,828.7	534,015.3	718,474.5	895,766.5	27.2	130,361.4	175,229.1	183,296.1	192,187.0	209,235.8	6.1
Total (%)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	

Source: Banco de la Republica, Ibid.

Note: Fiscal year is from January to December.

Annex Table 2-3 Composition of Gross Demand and Gross Supply - 1970 Prices

(In percent and In million pesos)

Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	70-78 Average Annual Growth Rate %
Total of Gross Supply	151,001.0	160,993.2	169,834.7	178,952.0	193,003.8	197,059.1	206,847.9	218,389.4	242,261.0	6.1
Total of GS %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	-
GDP	86.3	85.6	87.5	89.0	87.4	88.9	88.6	88.0	86.4	6.1
Import	13.7	14.4	12.5	11.0	12.6	11.1	11.4	12.0	13.6	6.1
Total of Gross Demand	151,001.0	160,993.2	169,834.7	178,952.0	193,003.8	197,059.1	206,847.9	218,389.4	242,261.0	6.1
Total of GD %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	-
Personal Consumption	62.2	61.9	64.0	66.9	65.5	66.1	64.7	64.5	64.5	6.6
Government Consumption	6.6	7.3	6.7	6.8	6.2	6.4	6.5	6.4	6.2	5.3
Fixed Capital Investment	17.5	17.4	16.4	16.3	16.5	16.2	15.9	15.8	15.6	4.6
Inventory Investment	1.4	1.7	1.4	-1.3	2.0	-1.2	2.0	3.4	2.0	10.1
Total of domestic Consumption	132,485.2	142,158.7	150,243.2	158,747.1	174,025.6	172,413.1	184,257.5	196,806.8	214,069.3	6.2
%	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	-
Export, %	12.3	11.7	11.5	11.3	9.8	12.5	10.9	9.9	11.6	5.4

Source: Banco de la Republica, Ibid.

Annex Table 2-4 Indices of Physical Production of Domestic Products

Sector \ Year	1970	1971	1972	1973	1974	1975	1976	1977	1978
1. Agriculture	100.0	102.1	108.9	115.4	122.5	131.0	134.1	139.2	152.9
2. Livestock	100.0	102.5	107.2	111.6	119.5	130.0	135.5	137.2	144.2
3. Fishing & hunting	100.0	71.6	199.9	168.0	128.6	137.7	153.3	158.3	161.8
4. Forestry	100.0	107.8	116.6	125.0	141.1	137.5	146.8	161.7	163.1
5. Mining	100.0	100.9	93.7	99.4	92.7	87.8	86.3	83.1	87.0
6. Construction	100.0	104.3	105.7	121.1	126.7	115.9	102.4	111.0	114.3
7. Manufacture	100.0	108.5	118.5	129.1	136.3	137.3	147.0	153.0	166.3
8. General services	100.0	107.1	115.7	124.9	133.3	140.0	149.5	159.0	174.1

Source: Banco de la Republica, Ibid.

Annex Table 2-5 Population for the Department Capitals in the Influence Area:

1973-1987

(in '000)

Year	1973	1974	1975	1976	1977	1978	1979	1980
Bogota, D.E.	2,855	3,050	3,239	3,410	3,619	3,831	4,056	4,294
Ibague	205	231	239	246	255	264	272	282
Armenia	146	163	166	168	172	174	177	180
Cali	923	1,038	1,081	1,142	1,197	1,255	1,316	1,380

Year	1981	1982	1983	1984	1985	1986	1987	80/73[1]	87/80[1]
Bogota, D.E.	4,546	4,813	5,096	5,394	5,711	6,046	6,400	(5.9) 1.50	(5.9) 1.49
Ibague	292	301	312	322	333	344	356	(4.7) 1.38	(3.4) 1.26
Armenia	183	187	190	193	196	199	203	(3.0) 1.23	(1.8) 1.13
Cali	1,447	1,517	1,591	1,663	1,749	1,834	1,923	(6.0) 1.50	(4.8) 1.39

Source: DANE. Banco de Datos. The estimates are based on the provisional result of the Census in 1973. The figures are slightly different from those in Table 2-1 and others. The final figures are not given by Banco de Datos.

Note: 1) The figures are shown as a ratio of increase in the period. The figures in ( ) are shown as the annual average growth rate in percentage.

Annex Table 2-6 Population for Urban and Other Areas in the Departments of the Influence Area: 1975-1990.

Section	Year	1975	1978	1980	1983	1985	1988	1990	'80/'75 1)	'85/'80 1)	'90/85 1)
Bogota	Urban	3,217,590	3,835,841	4,312,680	5,141.349	5,780,477	6,891,179	7,747,831	(6.0)	(6.0)	(6.0)
									1.34	1.34	1.34
	Others	16,481	13,450	11,746	9,586	8,372	6,832	5,967	(-7.1)	(-7.1)	(-7.1)
									0.71	0.71	0.71
	Total	3,234,071	3,849,291	4,324,426	5,150,935	5,788,849	6,898,011	7,753,798	(6.0)	(6.0)	(6.0)
									1.34	1.34	1.34
Cundina-marca.	Urban	445,662	485,220	513,523	559,109	591,717	644,238	681,818	(2.8)	(2.8)	(2.8)
									1.15	1.15	1.15
	Others	755,975	745,052	737,858	727,197	720,176	709,770	702,916	(-0.4)	(-0.4)	(-0.4)
									0.98	0.98	0.98
	Total	1,201,637	1,230,272	1,251,380	1,286,306	1,311,893	1,354,008	1,384,734	(0.8)	(0.9)	(1.2)
									1.04	1.05	1.06
Tolima	Urban	499,898	547,880	582,400	638,301	678,518	743,645	790,499	(3.1)	(3.1)	(3.1)
									1.17	1.17	1.17
	Others	485,478	485,017	484,710	484,250	483,944	483,485	483,179	(0.0)	(0.0)	(0.0)
									1.00	1.00	1.00
	Total	985,376	1,032,897	1,067,110	1,122,551	1,162,462	1,227,130	1,273,678	(0.6)	(0.6)	(0.6)
									1.08	1.09	1.10
Quindio	Urban	248,946	260,935	269,247	282,214	291,204	305,228	314,951	(1.6)	(1.6)	(1.6)
									1.08	1.08	1.08
	Others	95,511	95,158	94,883	94,472	94,200	93,792	93,521	(-0.2)	(-0.2)	(-0.2)
									0.99	0.99	0.99
	Total	344,457	356,093	364,130	376,686	385,404	399,020	408,472	(1.1)	(1.1)	(1.1)
									1.06	1.06	1.06
Valle	Urban	1,936,385	2,189,688	2,376,709	2,687,611	2,917,159	3,298,760	3,580,506	(4.2)	(4.2)	(4.2)
									1.23	1.23	1.23
	Others	582,137	601,982	615,587	636,573	650,959	673,151	688,364	(1.1)	(1.1)	(1.1)
									1.06	1.06	1.06
	Total	2,518,522	2,791,670	2,992,296	3,324,184	3,568,118	3,971,911	4,268,870	(3.5)	(3.5)	(3.5)
									1.19	1.19	1.20

Source: DANE, Banco de Datos. The estimates are based on the provisional result of the census in 1973.

Note : 1) The figures are shown as a ratio of increase in the period.
The figures in ( ) are shown as the annual average growth rate in percentages.

Annex Table 2-7 Gross Domestic Product by Sectors of Economic Activity (1965-1975)(Millions of pesos of 1970).

Sector \ Dept, Year	Colombia 1965	Colombia 1970	Colombia 1975	Tolima 1965	Tolima 1970	Tolima 1975	Quindio 1965	Quindio 1970	Quindio 1975	Valle 1965	Valle 1970	Valle 1975
Agriculture	27,814.8	34,306.0	44,360.8	2104.6	2805.6	3506.8	556.1	578.5	609.0	3022.9	3653.4	4498.8
Mining	2,298.4	2,546.2	2,208.8	22.3	15.8	18.4	.9	1.4	2.4	51.9	49.5	47.6
Manufacture	17,745.8	24,210.9	33,932.0	285.8	314.4	343.7	153.3	180.4	236.4	3289.6	4666.4	6120.5
Construction	3,308.9	6,566.1	7,912.0	66.2	122.1	112.1	27.3	52.8	59.1	305.0	681.2	616.6
Commerce	16,595.5	22,392.8	29,558.5	571.9	688.5	1079.9	241.6	258.1	268.5	2269.1	3040.3	3433.2
Transportation Services	5,724.2	7,699.4	10,812.9	170.1	222.2	281.0	70.1	65.1	105.7	773.7	1041.0	1567.5
Communication	756.7	1,184.2	2,311.5	19.0	24.6	42.1	6.4	14.7	25.7	110.9	132.8	222.0
Electricity, Gas and Water	1,206.1	1,830.8	2,783.1	19.6	25.6	74.9	11.9	11.5	13.9	242.4	215.8	283.9
Banks, Insurances and Others	2,993.6	4,482.8	8,195.6	79.6	123.4	223.7	39.8	72.2	142.6	366.0	459.1	904.7
Real Estates	5,554.7	7,335.0	10,056.3	122.9	149.3	189.5	120.8	134.1	172.6	520.5	958.3	842.1
Personal Services	7,372.3	9,523.3	13,161.2	248.0	268.9	320.5	103.9	121.8	155.3	814.2	1019.3	1386.4
Government Services.	6,524.8	8,283.5	11,184.9	320.5	650.0	910.4	52.8	73.9	89.9	599.0	666.1	884.3
TOTAL	96,967.9	130,361.4	176,477.6	4030.6	5410.4	7103.0	1384.9	1564.5	1880.1	12365.2	16303.2	20804.3
Sector	Percentage Participation											
Agriculture	28.39	26.32	25.13	52.1	51.8	49.3	40.1	36.9	32.3	24.4	22.4	21.6
Mining	2.35	1.95	1.25	.6	.3	.3	.1	.1	.1	.4	.3	.2
Manufacturing	18.11	18.57	19.23	7.1	5.8	4.8	11.1	11.5	12.6	26.5	28.5	29.5
Construction	3.45	5.04	4.48	1.6	2.3	1.6	2.0	3.4	3.1	2.5	4.2	2.9
Commerce	16.94	17.17	16.75	14.2	12.6	15.2	17.3	16.5	14.3	18.4	18.6	16.5
Transportation Services	5.84	5.91	6.13	4.2	4.1	4.0	5.1	4.2	5.6	6.3	6.4	7.5
Communication	.77	.91	1.31	.5	.5	.6	.5	.9	1.4	.9	.8	1.1
Electricity Gas and Water	1.23	1.40	1.58	.5	.5	1.1	.9	.7	.7	2.0	1.3	1.4
Banks, Insurances and Others	3.06	3.44	4.64	2.0	2.3	3.1	2.9	4.6	7.6	3.0	2.8	4.3
Real Estates	5.67	5.63	5.70	3.0	2.8	2.7	8.7	8.6	9.2	4.2	4.2	4.0
Personal Services	7.53	7.31	7.46	6.2	5.0	4.5	7.5	7.9	8.3	6.6	6.3	6.7
Government Services	6.66	6.35	6.34	8.0	12.0	12.8	3.8	4.7	4.8	4.8	4.1	4.3
Total in %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Banco de la Republica through El Desarrollo Economico Departamental, 1960-1975 (FONADE-INANDES, Bogota 1977).

Annex Table 2-8

Growth of the Production in the Sectors of Agriculture, Fishing and Forestry (1960-1974) (millions of pesos of 1970).

Sector \ Dept, Year	Colombia 1965	Colombia 1970	Colombia 1974	Tolima 1965	Tolima 1970	Tolima 1974	Quindio 1965	Quindio 1970	Quindio 1974	Valle 1965	Valle 1970	Valle 1974
1. Agriculture and Live Stock	27,007.4	33,002.8	39,923.1	2,090.9	2,788.6	3,206.6	549.7	573.0	571.1	2,893.4	3,500.0	4,631.8
1.1 Agriculture	15,365.6	17,059.3	20,602.2	1,404.2	1,743.5	1,950.4	435.5	447.7	437.2	1,908.5	2,175.1	2,768.6
1.2 Livestock	9,049.0	12,222.6	14,740.2	476.8	.627.3	724.5	72.0	81.4	93.1	628.8	910.7	1,352.2
1.3 Other Productions	2,662.8	3,720.9	4,580.7	209.9	417.8	531.7	42.2	43.9	40.8	356.1	414.2	511.0
2. Hunting and Fishing	356.4	792.8	1,018.5	4.8	5.7	10.7	-	-	-	53.1	65.8	75.1
3. Forestry	381.0	510.4	719.9	8.9	11.3	13.5	6.4	5.5	6.8	76.4	87.6	202.6
Total	27,814.8	34,306.0	41,661.5	2,104.6	2,805.6	3,230.8	556.1	578.5	577.9	3,022.9	3,653.4	4,909.5
Percentage Structure	Percentage Participation											
1. Agriculture and Livestock	97.3	96.1	95.9	99.4	99.4	99.3	98.8	99.1	98.8	95.7	95.8	94.3
1.1 Agriculture	55.2	49.7	49.5	66.7	62.1	60.4	78.3	77.4	75.6	63.1	59.6	56.4
1.2 Livestock	32.5	35.6	35.4	22.7	22.4	22.4	12.9	14.1	16.1	20.8	24.9	27.5
1.3 Other Productions	9.6	10.8	11.0	10.0	14.9	16.5	7.6	7.6	7.1	11.8	11.3	10.4
2. Hunting and Fishing	1.3	2.4	2.4	.2	.2	.3	-	-	-	1.8	1.8	1.5
3. Forestry	1.4	1.5	1.7	.4	.4	.4	1.2	.9	1.2	2.5	2.4	4.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Banco de la Republica, through El Desarrollo Economico Departamental 1960-1975 (FONADE-INANDES, Bogota 1977)

Annex Table 2-9 Cultivated Areas of Main Crops: 1965, 1970 and 1974

Crop	Quindio: Area in ha.				Valle : Area in ha.				Tolima: Area in ha.			
	1965	1970	1974	74/65	1965	1970	1974	74/65	1965	1970	1974	74/65
Cassava	1540	1640	1440	0.94	7270	6000	6500	0.89	11440	11220	11400	1.00
Potato	850	730	1200	1.41	1560	3015	3000	1.92	6280	4700	4200	0.67
Plantation	11900	13800	14200	1.19	17140	17200	17300	1.01	26100	32350	32200	1.23
Frijol	1130	550	400	0.35	21720	7500	9040	0.42	7430	4300	4900	0.66
Maize	3800	3300	2900	0.76	74280	60300	57390	0.77	54100	32700	28300	0.52
Coffee	48100	60100	62500	1.30	101950	125895	127050	1.25	133550	133600	135700	1.02
Flax	3250	3350	3400	1.05	81130	84200	86500	1.07	22380	22300	23600	1.05
Banana	350	300	160	0.46	3980	3800	1600	0.40	2300	3100	1300	0.57
Cacao	760	600	553	0.73	1250	2550	2979	2.38	2450	3700	4530	1.85
Soy Bean	-	-	-		30000	31860	54410	1.81				
Tabacco	-	-	-		685	300	400	0.58	1830	1470	1400	0.77
Millet	-	-	-		5100	14900	17826	3.50				
Cotton	-	-	-		9400	9200	26700	2.84	24750	36590	25500	1.03
Rice	-	-	-		12900	3500	7700	0.60	49880	51300	75800	1.52
Sorghum	-	-	-						21450	20970	38705	1.80
Animal Feed	-	-	-						200	40	-	0.00
Sesame	-	-	-						28100	14650	20130	0.72
Total	71680	84370	86753	1.21	368365	370220	418395	1.14	392240	372990	407665	1.04

Source: Ministerio de Agricultura, Oficina de Planeamiento del Sector Agropecuario, Grupo de Estudios Agricolas.

Annex Table 2-10 Cultivated Area and Production:

A. Tolima: 1960-1979 ('000)

year	Mechanized ha	Mechanized ton	Non-Mechanized ha	Non-Mechanized ton	Mixed ha	Mixed ton	Coffee ha	Coffee ton	Total ha	Total ton
1960	125.0	169.0	67.9	216.6	55.0	69.3	138.0	69.0	385.9	523.9
1965	109.0	219.0	80.0	244.6	56.0	58.6	133.0	66.5	378.0	588.7
1970	138.0	380.6	79.0	254.3	26.0	25.5	136.2	68.1	379.2	724.2
1973	169.0	532.7	86.0	355.1	18.0	33.6	137.1	75.4	410.1	964.6
1975	196.0	611.9	89.0	360.3	21.0	33.4	141.7	85.0	447.7	1090.6
1977	203.0	576.8	72.0	361.9	20.0	29.1	149.4	92.6	444.4	1060.4
1979	157.0	600.7	69.1	375.8	17.6	31.2	159.5	98.9	403.2	1106.6

Source: Caja Agraria - ICAO - Comite Regional de Produccion ADT, through Plan de Desarrollo Agroindustrial del Tolima (Asociacion para el Desarrollo Agroindustrial del Tolima, Ibague, Agosto de 1980).

B. Valle: 1970-1977 ('000)

year	Sugar cane ha	Sugar cane ton	Cultivation[1] ha	Cultivation[1] ton	Coffee ha	Coffee ton	Total ha	Total ton
1970	77.5	5062.1	216.1	748.7	126.0	76.9	419.6	5887.7
1973	96.4	6150.9	169.2	606.8	125.7	72.2	391.3	6829.9
1975	91.1	6794.3	209.0	723.5	126.9	81.4	427.0	7599.2
1977	99.8	6334.0	180.8	535.0	130.3	90.8	410.9	6959.8

Source: Banco de la Republica Cali, Comite de Cafeteros Cali, Oficina de Planeacion Departamental, Valle, y Universidad del Valle, through Cuentas Regionales del Valle del Cauca 1970-77 (Departmento Administrativo de Planeacion del Valle, Cali 1979)

Note: 1) Included are cotton, rice, banana, bean, maiz, plantation, potato, sorghum, soy bean, tabaco, cassava and tomato.

Annex Table 2-11 Cattle Slaughtered: 1970-78

Year	1 Total National		2 Quindio		3 Tolima		4 Valle		5 Total 2-4	
	Heads	Ratio[1]	Heads	Ratio[1]	Heads	Ratio[1]	Head	Ratio[1]	Heads	Ratio[1]
1970	2,385,939	1.00	49,446	1.00	134,800	1.00	280,602	1.00	464,848	1.00
1971	2,506,349	1.05	49,735	1.01	144,345	1.07	295,948	1.06	490,028	1.05
1972	2,250,365	0.94	43,749	0.88	129,568	0.96	248,873	0.89	422,190	0.91
1973	1,958,820	0.82	40,414	0.82	112,530	0.83	226,356	0.81	379,300	0.82
1974	2,077,017	0.87	41,083	0.83	120,598	0.90	244,783	0.87	406,464	0.87
1975	2,339,415	0.98	44,823	0.91	132,462	0.98	267,697	0.95	444,982	0.96
1976	2,433,384	1.02	48,025	0.97	132,652	0.98	275,971	0.98	456,648	0.98
1977	2,384,112	1.00	49,325	1.00	125,228	0.93	257,776	0.92	432,329	0.93
1978	2,480,421	1.04	52,176	1.06	120,442	0.89	279,581	1.00	452,199	0.97

Source: DANE, Boletin Mensual de Estadistica: Agropecuaria 1979.

Note: 1) The ratio is calculated for each year by dividing the yearly figure by the figure for 1970.

Annex Table 2-12 Regional Gross Product by Sector in Manufacturing in 1965-1970-1974 (Millions of Pesos of 1970)

Sector	Colombia 1965	Colombia 1970	Colombia 1974	Tolima 1965	Tolima 1970	Tolima 1974	Quindio 1965	Quindio 1970	Quindio 1974	Valle 1965	Valle 1970	Valle 1974
1. Food	3,910.4	5,831.0	7,380.3	98.90	151.70	167.70	54.1	75.80	114.30	964.0	1,337.20	1,771.90
2. Tobacco	534.3	726.0	866.9	.2	-	-	-	-	1	80.1	103.4	23.8
3. Textiles	2,739.5	3,727.9	4,988.0	17.50	2.60	2.60	2.60	4.0	6.8	227.2	304.10	300.40
4. Woods and Furnitures	293.1	339.5	426.3	2.0	2.50	4.4	.9	2.30	2.2	34.3	35.20	43.70
5. Paper and Printing	734.6	1,208.2	1,747.7	1.40	2.30	1.9	.5	-	.5	302.60	569.30	670.60
6. Leather	148.5	188.7	262.0	.2	.4	-	2.3	.7	.6	16.1	35.9	45.3
7. Rubber and Chemical Products	2,697.8	3,914.3	5,499.8	8.3	1.9	4.7	-	-	-	736.40	1,086.0	1,176.90
8. Metals, Machines and Appliances	2,801.3	3,651.6	5,836.5	18.30	14.60	23.40	3.9	4.7	11.60	434.50	653.60	1,102.10
9. Transportation Materials	442.8	575.5	968.6	1.4	-	-	3.9	.7	.3	64.1	60.0	68.3
10. Other Manufacturing	403.9	525.2	883.5	9.1	2.4	.2	-	.2	-	32.5	27.7	238.2
11. Sub-total	14,706.2	20,687.9	28,859.6	157.3	178.4	204.9	68.2	88.4	136.4	2891.8	4,212.4	5,441.2
12. Small and Cottage Industry	3,039.7	3,528.0	4,136.0	128.5	136.0	141.2	85.1	92.0	98.8	397.8	454.0	501.4
13. Total Manufacturing	17,745.9	24,215.9	32,995.6	285.8	314.4	346.1	153.3	180.4	235.2	3289.6	4,666.4	5,942.6

Source: Banco de la Republica and DANE, through El Desarrollo Economico Departamental 1960-75 (FONADE - INANDES, Bogota 1977)

Annex Table 2-13 Percentage Composition of the Product in the Sectors of Manufacturing in 1960 - 1974 (Millions of Pesos of 1970).

Sector	Colombia			Tolima			Quindio			Valle		
	1965	1970	1974	1965	1970	1974	1965	1970	1974	1965	1970	1974
1. Food	22.02	24.08	22.37	34.61	48.25	48.43	35.30	42.02	48.60	29.31	28.65	29.82
2. Tobacco	3.01	3.00	2.63	.07	-	-	-		.04	2.43	2.22	.40
3. Textiles	15.43	15.4	15.12	6.13	.83	0.75	1.70	2.22	2.89	6.90	6.52	5.05
4. Woods and Furnitures	1.65	1.4	1.29	0.72	0.79	1.27	0.59	1.27	0.93	1.05	.76	0.73
5. Paper and Printing	4.14	4.99	5.29	0.49	0.74	.55	.32	-	.21	9.19	12.2	11.28
6. Leather	.84	.78	.79	.06	.13	-	1.50	.39	.26	.49	.77	.76
7. Rubber and Chemical Products	15.21	16.17	16.68	2.9	.60	1.36	-	-	-	22.41	23.27	19.81
8. Metals, Machines and Appliances	15.79	15.08	17.68	6.39	4.64	6.76	2.54	2.60	4.93	13.19	14.00	18.55
9. Transportation Materials.	2.50	2.38	2.93	.49	-	-	2.54	.39	.13	1.95	1.29	1.15
10. Other Manufacturing	2.28	2.17	2.68	3.18	.76	.08	-	.11	-	.99	.59	4.01
11. Sub-total	82.87	85.45	87.46	55.04	56.74	59.20	44.49	49.00	57.99	87.91	90.27	91.56
12. Small and Cottage Industry	17.13	14.55	12.54	44.96	43.26	40.80	55.51	51.00	42.01	12.09	9.73	8.44
13. Total Manufacturing	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Banco de la Republica and DANE, through El Desarrollo Economico Departamental 1960-75 (FONADE - INANDES. Bogota 1977)

Annex Table 2-14 Traffic Volumes in the Other Sectors of Transport in the Project Area: 1971-1979

	1971	1972	1973	1974	1975	1976	1977	1978	1979	79/71(p.a.) %	75/71(p.a.) %	79/75(p.a.) %
1. Civil Aviation (arrival and departure)												
1.1 Airports												
Bogota: International ('000 persons and '000 tons).												
Passengers	357.3	400.4	472.1	529.9	536.6	586.1	667.0	725.0	829.4	2.321(11.1)	1.577(12.1)	1.472(10.1)
Cargo	16.6	18.2	24.3	30.3	34.0	37.6	49.2	59.1	-	3.560(19.9)	2.048(19.6)	1.738(20.2)
Bogota: Domestic ('000 persons and '000 tons)'												
Passengers	1206.0	1666.7	1814.8	1924.5	2343.9	2786.9	3098.6	3144.1	3373.6	2.797(13.7)	1.944(18.1)	1.439(9.5)
Cargo	59.0	57.6	68.8	75.5	70.5	70.8	93.3	-	-	1.581(7.9)	1.195(4.6)	1.323(15.0)
Cali: International('000 persons and '000 tons)'												
Passengers	40.9	42.3	45.9	52.8	57.8	61.5	69.4	77.7	96.5	2.359(11.3)	1.413(9.0)	1.670(13.7)
Cargo	0.8	1.4	1.7	1.9	2.6	3.2	5.2	-	-	6.500(36.6)	3.250(34.3)	2.000(41.4)
Cali: Domestic('000 persons and '000 tons)'												
Passengers	447.8	608.0	635.8	575.6	698.1	846.1	896.6	993.9	1068.8	2.387(11.5)	1.559(11.7)	1.531(11.2)
Cargo	14.8	12.2	10.5	11.2	10.0	10.2	12.2	-	-	0.824(-3.3)	0.676(-10.3)	1.200(10.5)
Armenia: Domestic('000 persons)												
Passengers	-	-	-	5.3	7.4	9.9	16.0	32.2	26.4	-	-	3.568(37.4)
Cargo	-	-	-	-	-	-	-	-	-	-	-	-
1-2 Between Airports ('000 persons and '000 tons)												
Bogota-Armenia												
Passengers	11.3	4.2	0.1	6.2	7.2	8.9	13.7	20.7	15.7	1.389(4.8)	0.637(-11.9)	2.181(21.5)
Cargo	-	-	0.6	2.7	12.1	23.6	22.6	34.7	-	-	20.16(49.1)	2.754(40.2)
Bogota-Cali												
Passengers	331.5	337.3	360.8	308.6	420.3	486.0	524.9	571.9	622.2	1.877(8.2)	1.268(6.1)	1.480(10.3)
Cargo			7.2	6.0	6.5	6.5	7.7	6.7	-	0.931(-1.4)	0.903(-5.2)	1.031(1.0)

Annex Table 2-14 (Cont'd.)

	1971	1972	1973	1974	1975	1976	1977	1978	1979	79/71(p.a.) %	75/71(p.a.) %	79/75(p.a.) %
2. Marine ports												
Buenaventura('000 tons of international movement).												
Arrival	770.7	673.2	783.5	895.4	788.9	834.2	1302.9	1257.3	1614.1	2.09(9.7)	1.02(0.5)	2.05(20.0)
Departure	597.2	670.4	571.9	530.4	708.0	547.3	333.0	653.4	887.7	1.49(5.1)	1.19(3.5)	1.25(5.8)
Total	1290.5	1343.6	1355.4	1425.8	1496.9	1381.5	1635.9	1910.7	2501.1	1.94(8.6)	1.16(3.0)	1.67(13.7)
In percent of the total of the country (export and import)												
Arrival (%)	43	44	39	42	50	49	47	48	50	-	-	-
Departure(%)	65	60	55	52	55	56	48	55	59	-	-	-
Total (%)	48	51	44	46	52	51	48	50	53	-	-	-
3. Railways												
3.1 Passengers through the station('000 passengers, in the total of arrival and departure)												
Bogota	196.7	210.0	262.1	251.2	212.8	148.6	-	64.5	-	0.328(-17.3)	1.082(2.0)	0.303(-48.9)
Girardot	70.0	71.2	68.0	64.1	67.3	48.8	-	16.6	-	0.237(-22.8)	0.961(-1.0)	0.247(-59.4)
Ibague	-	-	-	-	-	-	-	-	-	-	-	-
Espinal	11.6	14.6	14.2	10.2	2.2	2.0	-	-	-		0.190(-51.5)	-
Cali	152.5	272.9	424.4	809.1	1149.7	1178.2	-	691.8	-	4.536(24.1)	7.539(65.7)	0.602(-18.4)
Palmira	64.2	98.8	161.4	351.6	477.5	364.3	-	217.6	-	3.389(19.1)	7.438(65.1)	0.456(-29.9)
Buga	38.0	72.3	135.8	213.1	290.8	389.4	-	217.0	-	5.711(28.3)	7.653(66.3)	0.746(-10.3)
Tulua	27.4	67.2	118.5	185.6	255.1	303.0	-	140.7	-	5.135(26.3)	9.310(74.7)	0.552(-21.9)
Armenia	40.4	44.2	27.7	57.8	139.6	178.2	-	131.6	-	3.257(18.4)	3.455(36.3)	0.943(-2.0)
Buenaventura	10.5	6.3	4.7	4.9	6.4	6.6	-	-	-		0.610(-13.2)	-
3.2 Cargo through the station ('000 tons in the total of arrival and departure).												
Bogota	291.7	290.4	334.3	426.4	289.1	328.7	-	320.2	-	1.098(1.3)	0.991(-0.2)	1.108(3.5)
Girardot	29.6	36.7	28.8	34.7	35.1	29.6	-	27.6	-	0.932(-1.0)	1.186(4.4)	0.786(-0.8)
Ibague	85.7	56.9	60.4	61.7	65.9	27.3	-	2.2	-	0.026(-68.4)	0.769(-6.8)	0.033(-)
Espinal	45.6	24.0	7.9	4.3	4.0	0.9	-	2.6		0.057(-50.6)	0.877(-14.0)	0.650(-15.4)
Cali	137.8	131.6	64.1	174.9	85.0	86.0	-	109.8	-	0.797(-3.3)	0.617(-12.8)	1.292(8.9)
Palmira	68.7	105.7	85.0	80.3	99.6	105.9	-	135.3		1.969(10.2)	1.450(9.7)	1.358(10.8)
Buga	58.3	65.1	78.4	62.1	37.8	23.0	-	48.1	-	0.825(-2.8)	0.648(-11.5)	1.272(8.4)
Tulua	14.8	12.3	22.5	18.1	16.1	12.4	-	15.6	-	1.054(0.8)	1.088(2.1)	0.969(-1.0)
Armenia	46.3	57.7	65.6	60.1	50.7	42.3	-	38.9		0.840(-2.5)	1.095(2.3)	0.767(-9.2)
Buenaventura	529.0	581.0	534.8	556.6	488.5	345.0	-	390.1	-	0.737(-4.5)	0.923(-2.0)	0.799(-7.8)

Annex Table 2-14 (Cont'd)

Source: 1. Departamento Administrativo de Aeronautica Civil, Grupo estadistica.
2. Colpuertos, Boletin Techico Estadistico No.13.
3. Ferrocarriles Nacionales Unidad de Planeacion y los Ferrocarriles en Cifras (1971-1978)

ANNEX 3

Annex Table 3-1 Zone Code

40-Zone		Aggregated Zone		40-Zone		Aggregated Zone	
No.	Name	No.	Name	No.	Name	No.	Name
1	Bogota	1	Bogota	22	Buga	7	Valle 2
2	Fusagasuga	2	Curdinamarca	23	St. Lucia		
3	Girardot			24	Cali		
4	Zipaquira			25	Buenaventura		
5	Facatativá			26	Pereira	8	Risaralda
6	Melgar	3	Tolima 1	27	Belende Umbria		
7	Espinal			28	Manizales	9	Caldas
8	Guamo			29	La Doroda		
9	Ibagué	4	Tolima 2	30	Medellin	10	Antioquia
10	Cajamarca			31	Pto. Berrio		
11	Rovira			32	Sonson		
12	Coyaima	3	Tolima 1	33	Boyoca	11	North-East of Bogota
13	Chaparral				Santander. Casanare. Arauca. Cesar N. de Santarder Magdalena Guajira VENEZUELA		
14	Armero	4	Tolima 2				
15	Calarca	5	Quindio				
16	Armenia						
17	Genova			34	Meta		
18	Cartago	6	Valle 1	35	Neiva	12	South of Bogota
19	Caicedonia			36	Caqueta		
20	Sevilla			37	Popayan	13	South of Valle
21	Bugalagrande			38	Pasto. EQUADOR		
				39	Choco. PANAMA	10	Antioquia
				40	Cordoba (Bolivar. Sucre Atlantico)		

Annex Table 3-2 Code of Products

1. Agricultural Products

   Cotton, Rice, Banana, Coffee, Animal feed,

   Maiz, Potato, Wheet, Sorghum, etc.

2. Livestocks

   Cattle, etc.

3. Forest Products

   Wood, etc.

4. Mineral Products

   Coal, Salt, Sand/Stone/Gravel,

   Crude Oil, etc.

5. Manufacturing Products

   Sugar, Milk, Other Foods, Beer, Soft Drink,

   Textiles, Paper, Chemical Fertilizer,

   Caustic Soda, Fertilizer, Glass, Cement,

   Steel, Metal Products, Machinery, Diesel Oil,

   Fuel Oil, Gasoline, Asphalt, etc.

6. Other Products

Annex Table 3-3 O-D Table for Total Vehicles (1980) veh/day

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	0	0	0	0	0	0	281	105	778	42	7	135	45	27	24	121
2	0	0	0	0	0	0	25	0	37	0	0	13	7	0	0	16
3	0	0	14	0	0	6	1649	225	641	6	88	313	8	7	5	18
4	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0
5	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0
6	0	0	0	0	0	0	14	12	49	0	0	20	0	0	0	0
7	0	0	0	0	0	0	184	0	22	41	0	0	0	14	0	5
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	421	0	0	0	0	13	89
10	0	0	0	0	0	0	0	0	0	0	3	2	1	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	2
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Annex Table 3-3 O-D Table for Total Vehicles (1980) veh/day (Cont'd)

	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	2	2	8	17	33	13	451	126	133	0	5	0	148	0	0
2	0	0	0	0	0	0	0	6	0	0	0	2	0	0	0	0
3	0	7	0	0	0	2	0	38	6	22	0	17	0	12	0	0
4	0	0	0	0	2	0	0	25	0	8	0	0	0	14	0	0
5	0	0	0	0	0	0	0	0	0	1	0	0	0	3	0	0
6	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	4	0	0	0	2	0	0	0	0
8	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0
9	0	6	0	2	0	19	0	83	10	39	2	10	0	10	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	2	0	4	0	0	0	5	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	3	0	1	0	2	0	0	0	3	0	0
15	0	0	0	0	0	0	0	6	0	0	0	0	6	0	0	0
16	0	0	0	0	0	46	0	238	31	0	0	0	5	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	22	0	249	23	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	59	0	0	0	0	0	0	0	0
20	0	0	0	0	0	31	0	122	6	0	0	0	2	0	0	0
21	0	0	0	0	12	158	0	393	17	6	0	0	0	0	0	0
22	0	0	0	0	0	4848	5	972	115	122	12	57	31	101	0	5
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	10	0	345	6	349	2	433	5	0
25	0	0	0	0	0	0	0	0	0	38	0	54	0	20	5	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Annex Table 3-3 O-D Table for Total Vehicles (1980) veh/day (Cont'd)

	33	34	35	36	37	38	39	40	Total
1	0	0	503	37	12	47	3	20	3133
2	0	0	0	12	0	0	0	0	118
3	0	7	69	7	0	2	0	0	3169
4	0	0	0	0	0	0	0	0	56
5	0	0	0	0	0	0	0	0	10
6	0	7	0	8	0	0	0	0	121
7	7	8	0	0	2	0	0	6	2264
8	6	0	0	0	0	0	0	0	354
9	0	6	0	0	2	2	0	0	2247
10	0	0	0	0	0	0	0	0	516
11	0	0	0	0	0	0	0	0	98
12	0	6	0	0	0	0	0	0	514
13	0	0	0	0	0	0	0	0	75
14	0	0	29	0	0	0	0	0	117
15	0	0	0	0	0	0	0	0	61
16	8	0	7	0	5	0	6	0	626
17	0	0	0	0	0	0	0	0	0
18	5	0	0	0	4	0	0	0	318
19	0	0	0	0	0	0	0	0	61
20	0	0	0	0	0	0	0	0	171
21	11	0	0	2	4	0	0	0	629
22	42	0	4	0	30	0	0	25	6689
23	0	0	0	0	0	0	0	0	18
24	23	6	9	0	0	6	8	71	3922
25	5	0	0	0	0	0	0	5	461
26	4	11	12	18	6	12	0	0	789
27	0	0	0	0	0	0	0	0	20
28	2	0	1	0	21	0	0	0	520
29	0	0	6	0	0	0	0	0	52
30	6	2	12	7	0	28	0	0	816
31	0	0	0	0	0	0	0	0	10
32	0	0	0	0	0	0	0	0	11
33	0	0	12	0	7	6	0	0	144
34	0	0	0	0	0	2	0	0	55
35	0	0	0	0	2	0	0	17	683
36	0	0	0	0	0	0	0	12	103
37	0	0	0	0	10	0	0	5	112
38	0	0	0	0	0	0	0	0	105
39	0	0	0	0	0	0	0	0	17
40	0	0	0	0	0	0	0	0	161
						Grand Total			29346

Note: Total number of vehicles of which origin or Destination are i zone is calculated as follows.

Zone	1 2 ..... i 40	Total
1		
2		
.		
.		
.		
i	→	[ ]
.		
.		
.		
40		

Annex Table 3-4 O-D Table for Cargo Flows (tons/day)

1) Agricultural Products

	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
1	0	0	1553	360	283	0	670	58	0	99	0	836	179	4038
2	0	0	979	133	67	0	60	40	0	78	0	0	0	1357
3	0	0	504	0	21	0	20	64	0	112	0	0	6	3259
4	0	0	0	42	160	0	325	152	0	56	0	0	38	1266
5	0	0	0	0	0	0	383	0	0	60	122	12	0	1108
6	0	0	0	0	0	0	676	0	0	0	0	0	40	716
7	0	0	0	0	0	0	1834	15	210	384	0	0	0	4577
8	0	0	0	0	0	0	0	0	0	0	0	158	0	487
9	0	0	0	0	0	0	0	0	0	0	0	0	156	366
10	0	0	0	0	0	0	0	0	0	0	34	158	48	1029
11	0	0	0	0	0	0	0	0	0	0	0	0	0	156
12	0	0	0	0	0	0	0	0	0	0	0	0	0	1164
13	0	0	0	0	0	0	0	0	0	0	0	0	100	567
												Grand Total		20090

2) Live Stocks

	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
1	0	0	0	0	0	0	6	0	0	0	0	0	0	6
2	0	0	70	0	0	0	0	0	0	0	0	0	0	70
3	0	0	0	0	0	15	0	0	0	0	0	0	0	85
4	0	0	0	8	0	0	0	0	0	0	0	0	0	8
5	0	0	0	0	0	0	0	0	10	0	0	8	0	18
6	0	0	0	0	0	0	53	0	0	0	0	0	0	68
7	0	0	0	0	0	0	120	0	0	215	0	0	28	422
8	0	0	0	0	0	0	0	0	0	0	0	9	0	9
9	0	0	0	0	0	0	0	0	0	0	0	0	0	10
10	0	0	0	0	0	0	0	0	0	0	0	0	0	215
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	17
13	0	0	0	0	0	0	0	0	0	0	0	0	0	28
												Grand Total		956

3) Forest Products

	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
1	0	0	30	0	0	0	148	0	0	0	0	40	0	218
2	0	0	15	0	0	0	0	0	0	0	0	0	0	15
3	0	0	0	0	0	0	0	0	0	0	0	0	0	45
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	172	0	0	0	0	0	0	172
6	0	0	0	0	0	0	107	0	0	0	0	0	0	107
7	0	0	0	0	0	0	564	92	0	160	60	0	0	1303
8	0	0	0	0	0	0	0	0	0	0	0	0	0	92
9	0	0	0	0	0	0	0	0	0	0	0	7	0	7
10	0	0	0	0	0	0	0	0	0	96	0	90	0	346
11	0	0	0	0	0	0	0	0	0	0	0	0	0	60
12	0	0	0	0	0	0	0	0	0	0	0	0	0	137
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0
													Grand Total	2502

4) Mineral Products

	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
1	0	0	330	191	0	24	314	14	0	181	0	406	0	1460
2	0	0	984	907	0	0	349	64	0	98	0	0	0	2402
3	0	0	0	0	0	0	0	0	0	0	0	0	0	1314
4	0	0	0	526	72	30	40	14	18	0	0	0	0	1798
5	0	0	0	0	0	0	0	0	0	0	0	0	0	72
6	0	0	0	0	0	0	0	0	0	0	0	0	0	54
7	0	0	0	0	0	0	154	0	36	440	14	0	0	1347
8	0	0	0	0	0	0	0	0	0	0	0	0	0	92
9	0	0	0	0	0	0	0	0	0	0	0	0	0	54
10	0	0	0	0	0	0	0	0	0	0	0	0	150	869
11	0	0	0	0	0	0	0	0	0	0	0	0	0	14
12	0	0	0	0	0	0	0	0	0	0	0	0	0	406
13	0	0	0	0	0	0	0	0	0	0	0	0	0	150
													Grand Total	10032

5) Manufacturing Products

	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
1	0	0	569	217	66	130	2778	159	0	750	0	257	150	5078
2	0	0	881	212	14	12	279	77	33	30	0	144	0	1682
3	0	0	0	42	0	0	0	0	0	0	0	32	0	1524
4	0	0	0	212	144	16	281	18	0	0	0	96	0	1238
5	0	0	0	0	0	0	355	0	0	0	0	9	15	605
6	0	0	0	0	0	0	1075	0	0	0	0	14	0	1247
7	0	0	0	0	0	0	3272	453	1108	2566	198	26	0	12391
8	0	0	0	0	0	0	0	0	0	0	40	20	119	886
9	0	0	0	0	0	0	0	0	0	0	0	12	15	1168
10	0	0	0	0	0	0	0	0	0	0	44	48	148	3586
11	0	0	0	0	0	0	0	0	0	0	0	0	14	296
12	0	0	0	0	0	0	0	0	0	0	0	0	0	658
13	0	0	0	0	0	0	0	0	0	0	0	0	0	461
												Grand Total		30820

6) Others

	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
1	0	0	0	52	6	0	504	89	20	290	0	59	18	1038
2	0	0	127	0	0	0	14	0	0	49	0	0	0	190
3	0	0	0	6	0	0	0	0	0	0	0	0	0	133
4	0	0	0	392	0	10	38	10	0	0	0	0	0	508
5	0	0	0	0	80	0	79	0	0	0	0	0	0	165
6	0	0	0	0	0	0	168	0	0	0	5	0	24	207
7	0	0	0	0	0	0	348	309	74	928	0	11	0	2473
8	0	0	0	0	0	0	0	0	0	0	0	0	0	408
9	0	0	0	0	0	0	0	0	0	0	0	0	0	94
10	0	0	0	0	0	0	0	0	0	0	32	20	0	1319
11	0	0	0	0	0	0	0	0	0	0	0	0	10	47
12	0	0	0	0	0	0	0	0	0	0	0	0	2	92
13	0	0	0	0	0	0	0	0	0	0	0	0	0	54
												Grand Total		6728

7) Total Products

	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
1	0	0	2482	820	357	154	4420	320	20	1320	0	1598	347	11838
2	0	0	3056	1252	81	12	702	181	33	255	0	144	0	5716
3	0	0	504	48	21	15	20	64	0	112	0	32	6	6360
4	0	0	0	1180	376	56	684	194	18	56	0	96	38	4818
5	0	0	0	0	80	0	989	0	10	60	122	29	15	2140
6	0	0	0	0	0	0	2079	0	0	0	5	14	64	2399
7	0	0	0	0	0	0	6292	869	1428	4693	272	37	28	22513
8	0	0	0	0	0	0	0	0	0	0	40	187	119	1974
9	0	0	0	0	0	0	0	0	0	0	0	19	171	1699
10	0	0	0	0	0	0	0	0	0	96	110	316	346	7364
11	0	0	0	0	0	0	0	0	0	0	0	0	24	573
12	0	0	0	0	0	0	0	0	0	0	0	0	2	2474
13	0	0	0	0	0	0	0	0	0	0	0	0	100	1260
												Grand Total		71128

Annex Table 3-5 Average Loading Volume

Trucks with 2 axles

Loading Volume (tons)	Station									Total		
	No.1			No.2			No.3					
	tons	Nos of veh	t/veh	tons	Nos of veh	t/veh	tons	Nos of veh	t/veh	tons	Nos of veh	t/veh
- 2	42	28	1.50	34	24	1.42	11	7	1.57	87	59	1.47
2 - 5	381	100	3.81	432	110	3.93	144	37	3.89	957	247	3.87
5 - 10	1643	208	6.89	1551	200	7.75	1346	173	7.78	4540	581	7.81
10 - 15	97	8	12.13	58	5	11.60	22	2	11.00	177	15	11.80
15 - 20	82	5	16.40	107	6	17.83	0	0	0.0	189	11	17.18
20 - 30	30	1	30.00	0	0	0.0	0	0	0.0	30	1	30.00
30 -	0	0	0.0	50	1	50.00	0	0	0.0	50	1	50.00
Vacant	0	84	0.0	0	96	0.0	0	84	0.0	0	264	0.0
Unknown	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0
Total	2275	434	5.24	2232	442	5.05	1523	302	5.04	6030	1178	5.12

Trucks with 3 or more axles

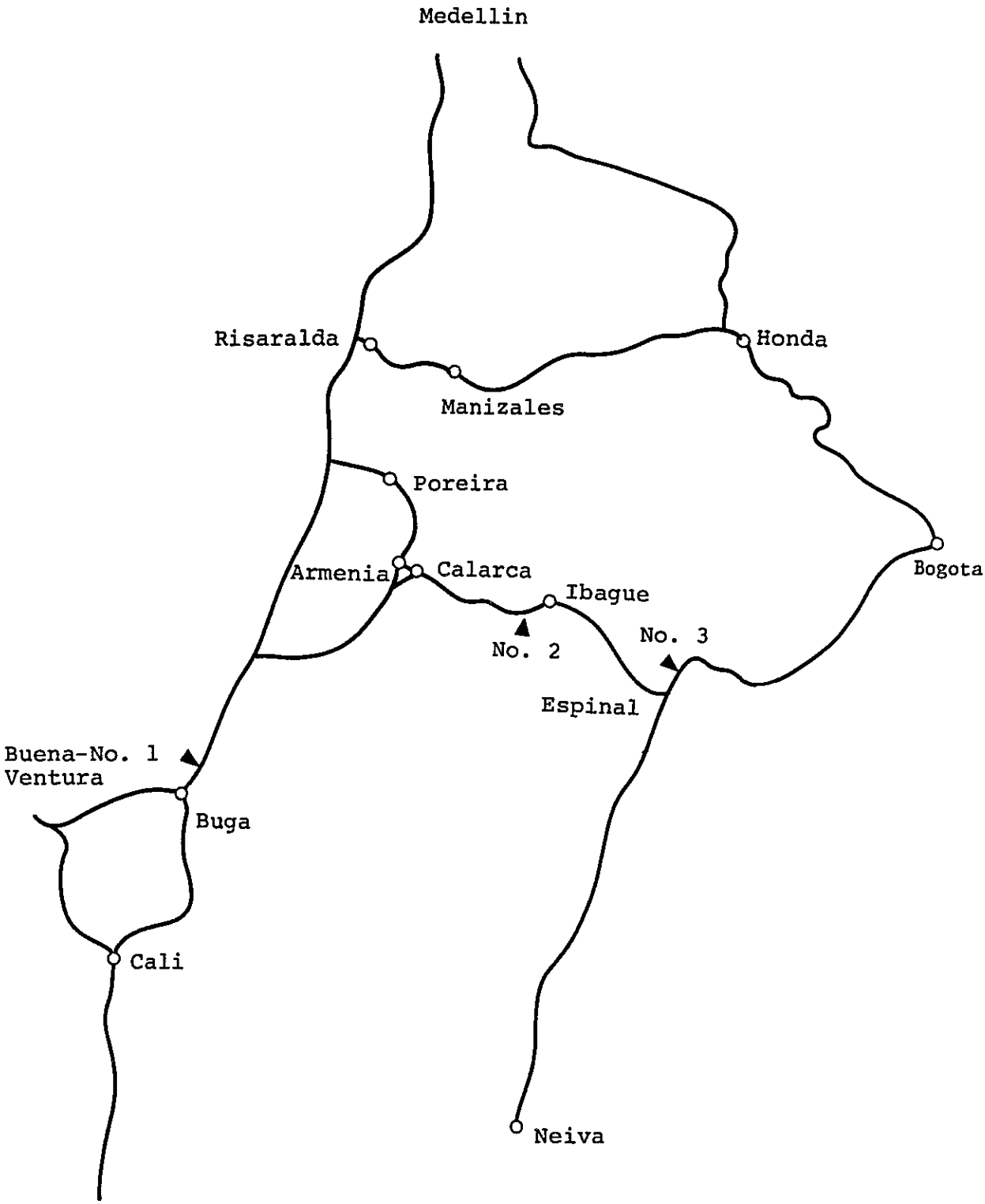
(tons)	tons	Nos of veh	t/veh	tons	Nos of veh	t/veh	tons	Nos of veh	t/veh	tons	Nos of veh	t/veh
- 2	1	1	1.00	4	3	1.33	1	1	1.00	6	5	1.20
2 - 5	16	4	4.00	12	3	4.00	6	2	3.00	34	9	3.78
5 - 10	72	8	9.00	137	17	8.06	112	13	8.62	321	38	8.45
10 - 15	230	16	14.38	518	37	14.00	194	14	13.86	942	67	14.06
15 - 20	399	23	17.35	835	48	17.40	421	24	17.54	1655	95	17.42
20 - 30	554	20	27.70	1103	40	27.57	427	15	28.47	2084	75	27.79
30 -	0	0	0.0	0	0	0.0	33	1	33.00	33	1	33.00
Vacant	0	17	0.0	0	15	0.0	0	26	0.0	0	58	0.0
Unknown	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0
Total	1272	89	14.29	2609	163	16.01	1194	97	12.31	5075	349	14.54

Annex Table 3-6 Average Number of Passengers

Type of Vehicle	Station №1			Station №2			Station №3			Total		
	Nos. of Vehicles	Nos. of Passengers	Ave. Passengers	Nos. of Vehicles	Nos. of Passengers	Ave. Passengers	Nos. of Vehicles	Nos. of Passengers	Ave. Passengers	Nos. of Vehicles	Nos. of Passengers	Ave. Passengers
1.	620	1,396	2.25	282	797	2.83	394	702	1.78	296	2,895	2.23
2.	106	2,057	19.41	74	1,406	19.00	123	2,285	18.58	303	5,748	18.97
3.	434	790	1.82	442	761	1.72	301	528	1.75	1,177	2,079	1.77
4.	42	64	1.52	92	150	1.63	61	102	1.67	195	316	1.62
5.	4	7	1.75	8	13	1.63	4	4	1.00	16	24	1.50
6.	5	9	1.80	3	4	1.33	1	2	2.00	9	15	1.67
7.	5	7	1.40	0	0	0.0	0	0	0.0	5	7	1.40
8.	32	48	1.50	60	101	1.68	30	47	1.57	122	196	1.61

Annex Table 3-7 Type of Fuel

Type of Vehicle	Station №1			Station №2			Station №3			Total		
	Gasolin	Diesel	Total	Gasolin	Diesel	Total	Gasolin	Diesel	Total	Gasolin	Diesel	Total
1.	0 (—%)	0 (—%)	618	137 (100%)	0 (0.0%)	282	0 (—%)	0 (—%)	394	137 (100%)	0 (0.0%)	1,294
2.	0 (—%)	0 (—%)	106	31 (81.6%)	7 (18.4%)	74	0 (—%)	0 (—%)	123	31 (81.6%)	7 (18.4%)	303
3.	349 (81.9%)	77 (18.1%)	430	349 (79.5%)	90 (20.5%)	440	237 (79.5%)	61 (20.5%)	299	935 (80.4%)	228 (19.6%)	1,169
4.	9 (22.0%)	32 (78.0%)	43	9 (9.8%)	83 (90.2%)	92	23 (37.7%)	38 (62.3%)	61	41 (21.1%)	153 (78.9%)	196
5.	1 (25.0%)	3 (75.0%)	4	2 (25.0%)	6 (75.0%)	8	3 (75.0%)	1 (25.0%)	4	6 (37.5%)	10 (62.5%)	16
6.	1 (20.0%)	4 (80.0%)	5	1 (33.3%)	2 (66.7%)	3	0 (0.0%)	1 (100%)	1	2 (22.2%)	7 (79.8%)	9
7.	2 (40.0%)	3 (60.0%)	5	0 (—%)	0 (—%)	0	0 (—%)	0 (—%)	0	2 (40.0%)	3 (60.0%)	5
8.	0 (0.0%)	31 (100%)	31	6 (10.0%)	54 (90.0%)	60	2 (6.7%)	28 (93.3%)	30	8 (6.6%)	113 (93.4%)	121



Annex Fig.3-1 LOCATION MAP FOR COUNTING STATIONS

Annex Fig. 3-2(1) Sample Survey Sheet

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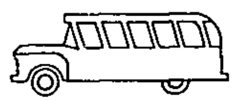
MINISTERIO DE OBRAS PUBLICAS OFICINA DE PLANEACION	ESTUDIO ORIGEN Y DESTINO		
Estudio (1 2)	Dia (3 4)	Hora (5 6)	Sentido (7)

Nº ORDEN	TIPO VEHICULO	MARCA	AÑO	ORIGEN	DESTINO	Pasajeros	Tripulantes	OBSERVACIONES
	8	9 10	11 12	14 15 16 17 18 19 20	21 22 23 24 25 26 27	32 33	34	

Forma A

①

TIPOS DE VEHICULOS



②

Annex Fig.3-2(2) Sample Survey Sheet (Page 2)

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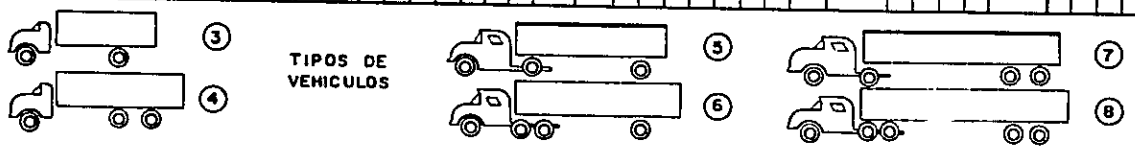
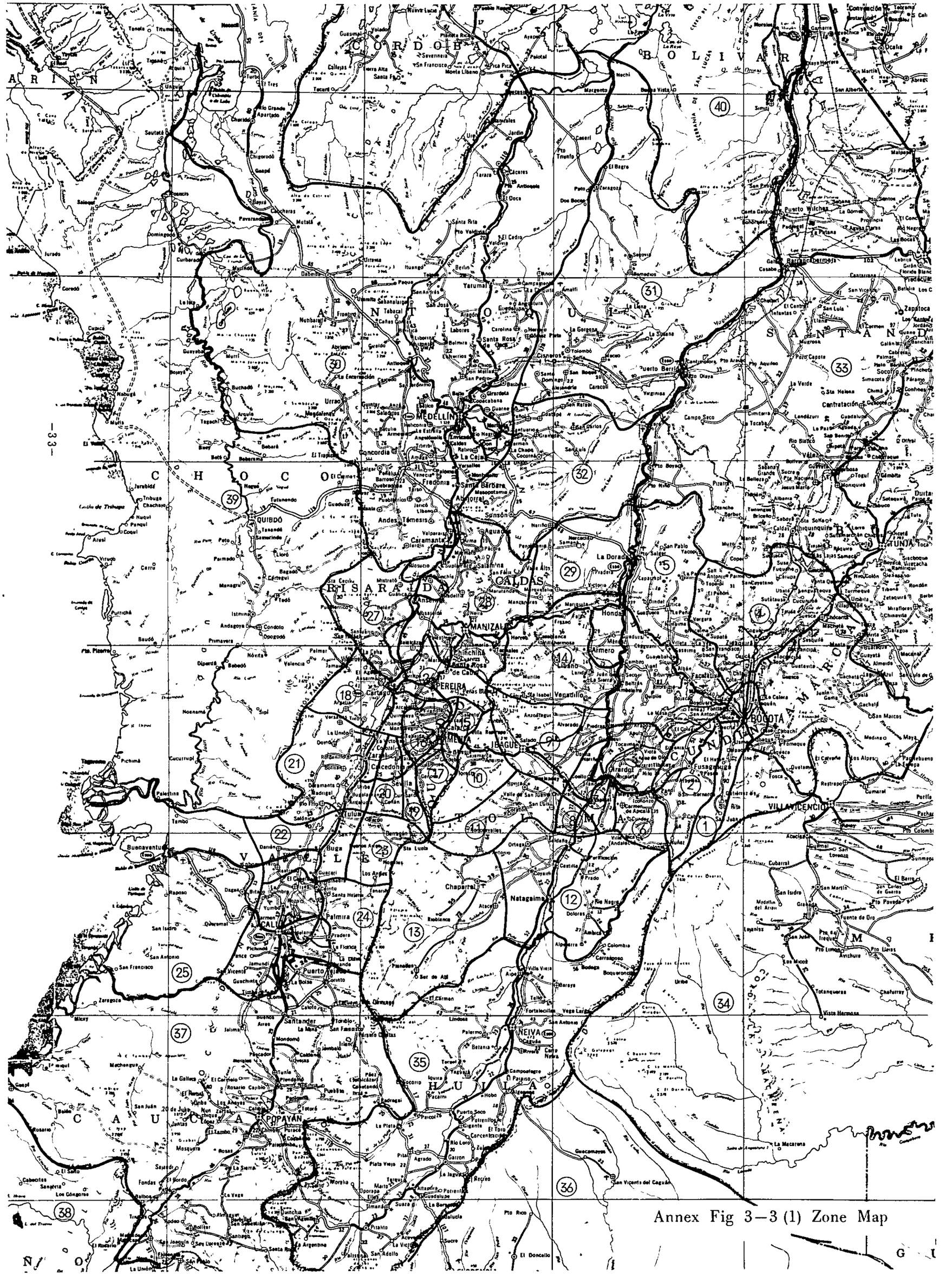
MINISTERIO DE OBRAS PUBLICAS Oficina de Planeación	ESTUDIO ORIGEN Y DESTINO

Estudio ☐☐ (1 2) Dia ☐☐ (3 4) Hora ☐☐ (5 6) Sentido ☐ (7)

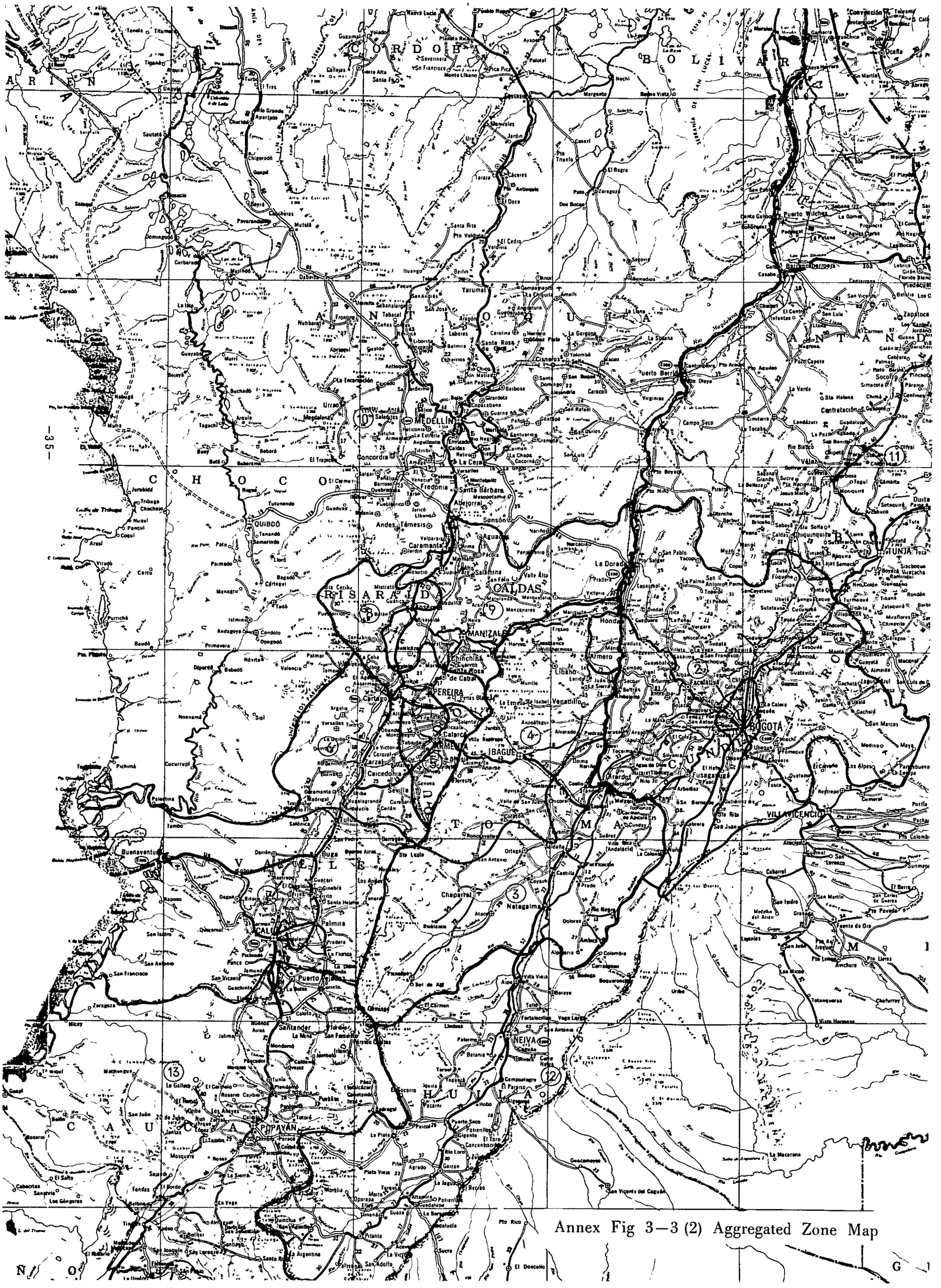
Nº ORDEN	TIPO VEHICULO	MARCA	AÑO	Combustible	ORIGEN	DESTINO	CLASE CARGA	Toneladas	Tripulantes	OBSERVACIONES
	8	9 10	11 12	13	14 15 16 17 18 19 20	21 22 23 24 25 26 27	28 29 30 31	32 33	34	

Forma B





Annex Fig 3−3 (1) Zone Map



Annex Fig 3—3 (2) Aggregated Zone Map

ANNEX 4

Annex Table 4-1 Traffic in ADT for Major Sections, 1971-1979

		1971	1972	1973	1974	1975	1976	1977	1978	1979
Melgar-Espinal	Sm	1563	1803	1776	2128	2083	2333	2251	2156	2359
	Bu	569	633	686	651	615	684	710	737	717
	T2	1268	1359	1485	1620	1636	1448	1531	1734	1675
	TM	157	168	203	221	244	318	314	407	393
	T	1425	1527	1688	1841	1880	1766	1845	2141	2068
	Tot.	3557	3963	4150	4620	4578	4782	4807	5165	5144
Espinal-Ibague	Sm	1560	1762	1927	2103	2139	2052	2217	2344	2237
	Bu	507	532	685	729	806	712	749	733	718
	T2	1316	1513	1567	1584	1465	1262	1528	1496	1448
	TM	114	132	200	176	367	335	406	422	432
	T	1430	1645	1761	1760	1832	1597	1934	1918	1880
	Tot.	3497	3940	4373	4592	4777	4361	4900	4995	4835
Ibague-Uribe	Sm	577	475	701	595	686	660	764	861	831
	Bu	200	230	277	245	267	245	264	261	257
	T2	742	639	699	696	772	735	793	739	743
	TM	111	96	114	143	193	220	250	317	366
	T	853	735	813	839	965	955	1043	1056	1109
	Tot.	1630	1439	1791	1679	1918	1860	2072	2177	2197
Uribe-Buga	Sm	1510	1594	1705	1890	2097	2011	2456	2618	2733
	Bu	549	651	677	705	690	682	865	899	833
	T2	1673	1602	1615	1976	1851	1751	1852	1970	2084
	TM	165	158	179	220	277	262	327	403	457
	T	1838	1760	1794	2196	2128	2013	2179	2373	2541
	Tot.	3897	4005	4176	4791	4915	4706	5500	5890	6107
Melgar-Buga	Sm	1033	1061	1224	1276	1357	1348	1490	1594	1587
	Bu	360	405	468	459	476	457	506	509	492
	T2	1061	1043	1104	1180	1181	1084	1190	1201	1204
	TM	126	122	151	171	245	261	308	362	395
	T	1187	1165	1255	1351	1426	1345	1489	1563	1599
	Tot.	2580	2631	2947	3086	3259	3150	3485	3666	3678

Source: MOPT, La Oficina de Planeacion.
Notes: The figures are obtained by calculating (the sum of veh-km)/(Km).T2 and TM for 1971 and 1972 are estimated by the figures after 1973.

Legend - (Sm=Small, Bu=Bus, T2=Truck with 2 axles, TM=Truck with 3 or more axles, T=Total trucks, Tot=Total of all vehicles).

Annex Table 4-2 Annual Changes of ADT for Major Sections, 1971-79 (in percent)

		1971	1972	1973	1974	1975	1976	1977	1978	1979	1971-9 1)	1971-5 1)	1976-9 1)
											(percent per annum)		
Melgar-Espinal	Sm	-	115.36	98.50	119.82	97.89	112.00	96.49	95.78	109.42	5.3	7.4	3.2
	Bu	-	111.25	108.37	94.90	94.47	111.22	103.80	103.80	97.29	2.9	2.0	3.9
	T2	-	107.18	109.27	109.09	100.99	88.51	105.73	113.26	96.90	3.5	6.6	0.6
	TM	-	107.01	120.83	108.87	110.41	130.33	98.74	129.62	96.56	12.2	11.7	12.7
	T	-	107.16	110.54	109.06	102.12	93.94	104.47	116.04	96.59	4.8	7.2	2.4
	Tot.	-	111.41	104.72	111.33	99.09	104.46	100.52	107.45	99.59	4.7	6.5	3.0
Espinal-Ibague 2)	Sm	-	112.95	109.36	109.13	101.71	95.93	108.04	105.73	95.44	4.6	8.2	1.1
	Bu	-	104.93	128.76	106.42	110.56	88.34	105.20	97.86	97.95	4.4	12.3	-2.9
	T2	-	114.97	103.57	101.08	92.49	86.14	121.08	97.91	96.97	1.2	2.7	-0.3
	TM	-	115.79	152.52	88.00	208.52	91.28	121.19	103.94	102.37	18.1	33.9	4.2
	T	-	115.03	107.05	99.94	104.09	87.17	121.10	99.17	98.02	3.5	6.3	0.6
	Tot.	-	112.67	110.99	105.01	104.03	91.29	112.36	101.94	96.80	4.1	8.1	0.3
Ibague-Uribe	Sm	-	82.32	147.58	84.88	115.29	96.21	115.76	112.70	96.52	4.6	4.4	4.9
	Bu	-	115.00	120.43	88.45	108.98	91.76	107.76	98.86	98.47	2.8	7.5	-1.0
	T2	-	86.12	109.39	99.57	110.92	95.21	107.89	93.19	100.54	0.0	1.0	-1.0
	TM	-	86.49	118.75	125.44	134.97	113.99	113.64	126.80	115.46	16.1	14.8	17.3
	T	-	86.17	110.61	103.20	115.02	98.96	109.21	101.25	105.02	3.6	3.1	3.5
	Tot.	-	88.28	124.46	93.75	114.23	96.98	111.40	105.07	100.92	3.9	4.2	3.5
Uribe-Buga	Sm	-	105.56	106.96	110.85	110.95	95.90	122.13	106.60	104.39	7.7	8.6	6.9
	Bu	-	118.58	103.99	104.14	97.87	98.84	128.63	103.93	92.66	5.3	5.9	4.8
	T2	-	95.76	100.81	122.35	93.67	94.60	105.77	106.37	105.79	2.8	2.6	3.0
	TM	-	95.76	113.29	122.91	125.91	94.58	124.81	123.24	113.40	13.6	13.7	13.3
	T	-	95.76	101.93	122.41	96.90	94.60	108.25	108.90	107.08	4.1	3.7	4.5
	Tot.	-	102.77	104.27	114.73	102.95	95.75	116.87	107.09	103.68	5.8	6.0	5.6
Melgar-Buga	Sm	-	102.71	115.36	104.25	106.35	99.34	107.66	106.98	99.56	5.5	7.1	4.0
	Bu	-	112.50	115.56	98.08	103.70	96.01	110.72	100.59	96.66	4.0	7.2	0.8
	T2	-	98.30	105.85	106.88	100.08	91.79	109.78	100.92	100.25	1.6	2.7	0.5
	TM	-	96.83	123.77	113.25	143.27	106.53	118.01	117.53	109.12	15.4	18.1	12.7
	T	-	98.15	107.73	107.65	105.55	94.32	110.71	104.97	102.30	4.0	4.7	2.9
	Tot.	-	101.98	112.01	104.11	105.61	96.66	110.63	105.19	100.33	4.5	6.0	3.1

Source: Based on the figures in Annex Table 4-1.
Notes: 1) The formula of $F = (1+i)^n$ is used to obtain i. The "i" is shown in percent

For legend, see Annex Table 4-1.

Annes Table 4-3 Percent Composition of the Type of Trucks, 1971-1979 and 1980-2000.

Year	1971 1)	1972 1)	1973 1)	1974	1975	1976	1977	1978	1979	1980 2)	1985 2)	1990 2)	1995 2)	2000 2)
Distrito 8, No.30. Melgar-Girardot.														
Trucks 2 axles	(89)	(89)	(88)	88	87	82	83	81	81	80	78	77	76	76
Trucks 3 axles more	(11)	(11)	(12)	12	13	18	17	19	19	20	22	23	24	25
Truck in total	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Distrito No.17, No.228 Buenos Aires-Mirolindo.														
Trucks 2 axles	(92)	(92)	(89)	90	90	79	79	78	77	77	75	74	73	72
Trucks 3 axles more	(8)	(8)	(11)	10	10	21	21	22	23	23	25	26	27	28
Trucks in total	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Distrito 23, No.244 Cajamarca-Calarca														
Trucks 2 axles	(87)	(87)	(86)	83	80	77	76	70	67	67	65	64	63	62
Trucks 3 axles more	(13)	(13)	(14)	17	20	23	24	30	33	33	35	36	37	38
Trucks in total	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Distrito 18, No.253 Tulua-Buga.														
Trucks 2 axles	(91)	(91)	(90)	90	87	87	85	83	82	81	79	78	77	76
Trucks 3 axles more	(91)	(91)	(10)	10	13	13	15	17	18	19	21	22	23	24
Trucks in total	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: MOPT, Oficina de Planeacion

Notes: 1) percent figures in ( ) are by extrapolation from the figures in the years from 1974 to 1979.
2) These are determined by assuming a more gradual changes than in the previous years.

Annes Table 4-4 Average Annual Growth Rate: 1971-2000 (% p.a.)

		1971 -79	1971 -75	1975 -79	1979 -2000
Melgar-Espinal	Sm	5.3	7.4	3.2	5.5
	Bu	2.9	2.0	3.9	3.4
	T2	3.5	6.6	0.6	4.6
	TM	12.2	11.7	12.7	5.9
	Tr	4.8	7.2	2.4	5.1
	Tot	4.7	6.5	3.0	5.0
Espinal-Ibague	Sm	4.6	8.2	1.1	5.5
	Bu	4.4	12.3	- 2.9	3.4
	T2	1.2	2.7	- 0.3	4.6
	TM	18.1	33.9	4.2	5.9
	Tr	3.5	6.3	0.6	5.1
	Tot	4.1	8.1	0.3	5.0
Ibague-Uribe	Sm	4.6	4.4	4.9	5.5
	Bu	2.8	7.5	- 1.0	3.4
	T2	0.0	1.0	- 1.0	4.6
	TM	16.1	14.8	17.3	5.9
	Tr	3.6	3.1	3.5	5.1
	Tot	3.9	4.2	3.5	5.0
Uribe-Buga	Sm	7.7	8.6	6.9	5.5
	Bu	5.3	5.9	4.8	3.4
	T2	2.8	2.6	3.0	4.6
	TM	13.6	13.8	13.3	5.9
	Tr	4.1	3.7	4.5	5.1
	Tot	5.8	6.0	5.6	5.0
Melgar-Buga	Sm	5.5	7.1	4.0	5.5
	Bu	4.0	7.2	0.8	3.4
	T2	1.6	2.7	0.5	4.6
	TM	15.4	18.1	12.7	5.9
	Tr	4.0	4.7	2.9	5.1
	Tot	4.5	6.0	3.1	5.0

For legend, see Annex Table 4-1.

Annex Table 4-5 Traffic in ADT for Sub-sections, Selected Years 1971-2000. [1]

Year		1971	1975	1979	1980	1983	1985	1990	1995	2000
1. Melgar - Espinal [3]	Sm	1563	2083	2359	2488	2916	3252	4268	5586	7292
	Bu	569	615	717	737	799	855	1013	1198	1419
	T2	1268	1636	1675	1721	1866	2040	2549	3188	3983
	TM	157	244	393	430	433	486	649	866	1156
	Tr	1425	1880	2068	2151	2299	2526	3198	4054	5139
	Tot	3557	4578	5144	5376	6014	6633	8479	10838	13850
2. Espinal-Mirolindo [3]	Sm	1386	1856	1872	1972	2307	2575	3381	4427	5778
	Bu	493	627	624	641	693	742	878	1039	1230
	T2	1271	1595	1391	1441	1546	1690	2113	2642	3302
	TM	110	177	415	437	442	495	661	8882	1178
	Tr	1381	1772	1806	1878	1988	2185	2774	3524	4480
	Tot	3260	4256	4302	4491	4988	5502	7033	8990	11488
3. Mirolindo-Ibague [3]	Sm	2604	3796	4431	4656	5459	6080	7949	10370	13499
	Bu	589	1314	1277	1313	1437	1537	1820	2153	2549
	T2	1584	1994	1854	1922	2095	2291	2863	3579	4473
	TM	138	197	470	494	509	571	763	1018	1358
	Tr	1722	2191	2324	2416	2604	2862	3626	4597	5831
	Tot	4915	7301	8032	8385	9500	10479	13395	17120	21879
4. Ibague-Calarca-La Espanola [3]	Sm	466	495	645	682	781	870	1137	1488	1948
	Bu	188	256	248	255	266	285	336	399	473
	T2	786	878	767	794	806	882	1102	1381	1727
	TM	117	219	377	396	394	440	587	785	1049
	Tr	903	1097	1144	1190	1200	1322	1689	2166	2776
	Tot	1557	1848	2037	2127	2247	2477	3162	4053	5197
5. La Espanola-Uribe [2]	Sm	709	915	1055	1101	845	939	1220	1581	2043
	Bu	215	279	267	274	197	211	250	295	350
	T2	690	646	714	739	549	600	749	936	1169
	TM	103	161	352	370	286	321	428	571	762
	Tr	793	807	1066	1109	835	921	1177	1507	1931
	Tot	1717	2001	2388	2493	1877	2071	2647	3383	4324
6. Uribe-Buga	Sm	1510	2097	2733	2909	3434	3834	5037	6599	8623
	Bu	549	690	833	866	958	1025	1213	1436	1700
	T2	1673	1851	2084	2161	2470	2699	3372	4212	5262
	TM	165	277	457	507	603	677	903	1205	1608
	Tr	1838	2128	2541	2668	3073	3376	4275	5417	6870
	Tot	3897	4915	6107	6443	7465	8235	10525	13452	17193

Notes: 1) The figures in small vehicles are adjusted to be equal to the total when added for all vehicles

2) Section 5 (La Espanola-Uribe) is shown under an assumption that some traffic (35%) will divert to the new by-pass between Armenia and Zarzal after 1983. The 35% is estimated by the analysis of origin and destination survey which was conducted in February 1980. (See Chapter 3 for the detail of OD distribution.)

3) When the road between Medellin and Bogota is improved, the part of traffic is forecasted to divert to the new route from the existing road after 1983. The traffic which will divert is found 186 vehicles/day in 1980 according to the OD survey (Sm 17, Bus 14, Truck 89, and Tmula 66). They are deducted from the traffic on the sections from Melgar - Ibague - Calarca - La Espanola after 1983.

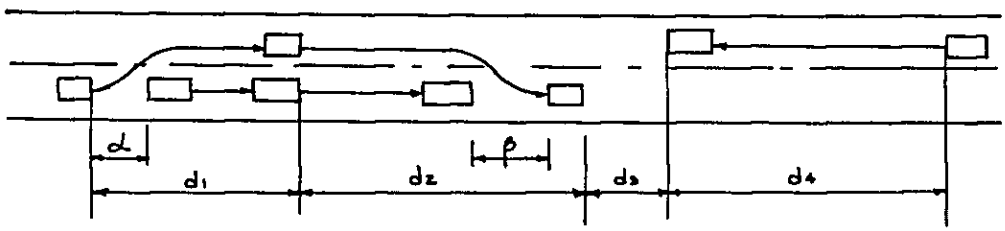
ANNEX 5

Annex 5-1 Methodology for the Estimating Capacity

1) Methodology

According to the H.C.M., level of service "C" is a zone of stable flow, and at such level of volume and density, overtaking is entirely possible whenever overpassing sight distance is provided. At level of service "D", the flow is partly unstable and the overtaking is also partially restricted. Operation at level of service "E" (when traffic volume expands) is unstable, with little independence in speed selection, i.e., overtaking becomes almost impossible.

For the project road which is a two-way road with two lanes, and without a passing lane, the concept of overtaking has been explored extensively as it is closely associated with the determination of the current level of service. The maximum density level, at which overtaking is possible, is considered to be the volume under level of service "C". As shown in Annex Fig 5-6, the total distance required for overtaking is represented by (d1 + d2 + d3 + d4.)



Annex Fig 5-6 Overtaking Distance

$$d_1 = V1 \times \frac{\alpha + a}{V_1 - Vo}$$

$$d_2 = V1 \cdot \frac{\beta + b}{V_1 - Vo}$$

$$d_4 = V \cdot \frac{\alpha + \beta + a + b}{V_1 - Vo}$$

Where: V_1 : Speed of the vehicle overtaking the slow moving vehicle.
Vo : Speed of slow moving vehicle.
a : Average length of the slow moving vehicle.
b : Average length of the fast moving vehicle.
V : Average speed of the fast and slow moving vehicles.
α, β. d_3 : Safety distances between the vehicles.

In general, the traffic volume is expressed by the following formula:

$C = V \cdot D$

Where C : Traffic volume
V : Average speed
D : Average density of vehicles.

Accordingly the volume at level of service "C" is:

$$Cc = 2.V \cdot 1 \Big/ \sum_{i=1}^{4} di \qquad \ldots\ldots\ldots\ldots\ldots \qquad (1)$$

Taking into account the adjustment factor for lane width, the actual capacity will be given by:

$C = Cc \times W$

Where W : Adjustment factor for lane width
(See Table 10.8 in H.C.M.)

2) Examples of Application

Assume a section with 7.5% grade at an altitude of 3,000m. The theoretical speeds for the fast and slow vehicles are determined by Fig 4 and Fig 5 in the document of MOPT, OP-3-21-021[1] as V_1 = 35Km/H and Vo = 10Km/H. Assuming $\alpha = \beta = d_3$ = 10m and a = 15m, b = 5m, the total of the distance in Annex Fig 5-6 will be $\sum_{i=1}^{4} di$ = 102m.

When formula (1) is applied, the following volume is arrived at by using 7% of the volume of the ADT as the peak hour ratio.

Cc = 440 Veh / H

Cc = 6286 Veh / Day

On the other hand, if the capacity is estimated directly through the methodology described by the document 1), the volume at level "C" using the same assumptions is found to be Cc = 440Veh/H and Cc = 6286Veh/Day. Although the approaches are slightly different, it is found that, in general, similar results will be obtained by both the MOPT and the study team methodologies.

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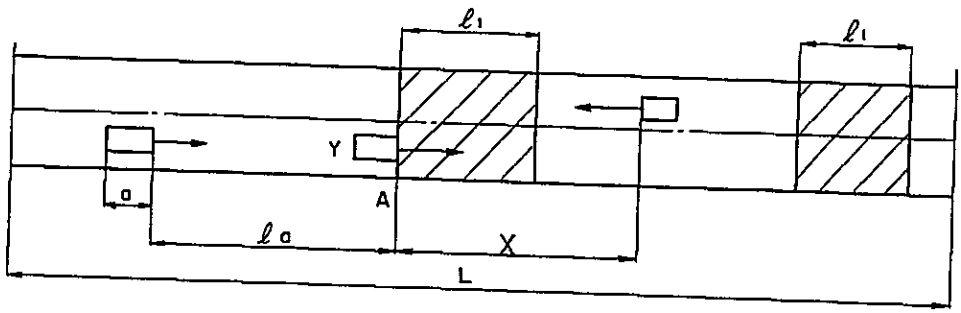
1) Louis Holguin Pardo. Conceptos de Diseno y de Nivel de Servicio y Evaluation de la Capacidad en carreteras de Montana, MOPT, OP-3-21-021, September 1980

Annex 5-2 Encounters at Sharp Curves

It is often found that where sharp curves exist, a vehicle would have to stop for several seconds to allow for the passing of another vehicle travelling in the opposite direction. This usually occurs at a curve where the road width is not adequate. Both methodologies for capacity analysis mentioned in 5-3 are based on a stable and undisturbed traffic flow, therefore these encounters are not taken into account.

When the traffic grows from year to year, the number of such encounters is certain to increase. Such encounters should be taken into account in the estimate of the capacity of the existing road.

Assume a section with several sharp curves where such encounters would occur. As illustrated in Annex Fig 5-7, it is assumed that the average headway is "1a", that the average length of a heavy vehicle is "a" and that the average speed is the same for both vehicles travelling in opposite directions. Using the figure, let us assume that a vehicle "Y" arrives at the point "A" which is the beginning of the curve "ℓ1". Whether or not this vehicle encounters another one travelling in the opposite direction depends on the length "X" which is the distance from the head of the vehicle in the opposite direction to point "A".



Annex Fig 5-7 Headway Spacing on a Curve

If $X < 2 \cdot \ell 1$ then vehicle "Y" will come into the curve and encounter the other. If $X > 2\ell 1$ the other vehicle will not be in the curve while vehicle "Y" is going through the curve section. When the average headway spacing "1a" is less than $2\ell 1$, the two vehicles will inevitably encounter each other in the curve section. The probability "P" that the vehicle "Y" will encounter the other is summarized as follows:

If $la < 2\ell i$. $\quad Pi = 1$

If $la \geq 2\ell i$ and $0 \leq X \leq 2\ell i$, $\quad Pi = \dfrac{2\ell i \cdot N}{L}$ $\qquad$ (1)

If $la > 2\ell i$ and $X > 2\ell i$, $\quad Pi = 0$

Where N is the total number of the vehicles in one direction in the section L. Pi is the probability of encounter at the curve i.

The waiting time required for the passing-by of the other vehicle is shown by the following formula.

$$ti = \frac{2a + b}{V}$$

Where V : passing speed at the curve
ti : the waiting time at the curve i
a : average vehicle length
b : additional distance required for safety

Taking into account the mutual concessions, the waiting time imposed on the said vehicle "Y" will be as follows:

$$To = \frac{1}{2} \sum_{i=1}^{n} ti.Pi \qquad \text{.....} \qquad (2)$$

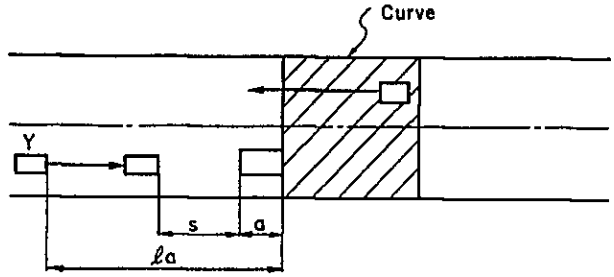
Where n : Number of curves in L
pi : Probability of encounter at the curve i
To : Waiting time of "Y" in L

In addition, the waiting time due to the encounter by the advancing vehicle ahead of vehicle "Y" will be:

$$tl = \frac{1}{2} \sum_{i=1}^{n} \left(ti.Pi - \frac{la - a - s}{Vc} Pi\right) \qquad \text{.....} \qquad (3)$$

Where s : Stopping distance of the vehicle "Y"
Vc : Speed of vehicle "Y"

The first term of equation (3) is the expected waiting time of the first vehicle ahead, and the second term indicates that the said vehicle "Y" can continue to drive for a distance (la-a-s). This is illustrated in Annex Fig 5-8.



Annex Fig 5-8 Encounters by advancing vehicles

Similarly the waiting time due to the encounter by the second and the k-th vehicles ahead fo the vehicle "Y" will be:

$$t_2 = \frac{1}{2} \sum_{i=1}^{n} \left[tiPi - 2 \frac{la - a - s}{Vc} \cdot Pi \right]$$

$$t_R = \frac{1}{2} \sum_{i=1}^{n} \left[tiPi - k \frac{la - a - s}{Vc} \cdot Pi \right]$$

If $t_R + 1 \leq 0$, there exists no disturbances by the (k + 1) the vehicle ahead of the vehicle "Y". Therefore, the total encounters of other vehicles ahead are given by the following equation:

$$Tl = \sum_{k=1}^{k} t_R = \frac{k}{2} \sum_{i=1}^{n} (ti.pi) - \frac{k\,(k+1)}{2} \cdot \frac{la - a - s}{Vc} \sum_{i=1}^{n} Pi \quad .... \quad (4)$$

The total wiating time expected for the vehicle "Y" can be given by:

$$T = To + Tl = \frac{(k+1)}{2} \sum_{i=1}^{n} (ti.pi) - \frac{k(k+1)}{2} \cdot \frac{la - a - s}{Vc} \sum_{i=1}^{n} Pi \quad .... \quad (5)$$

The reduced road capacity is given by the following formula (6):

$$C = D \cdot V = D \frac{L}{L/V_o + T} \qquad ..... \qquad (6)$$

Where D : Average density of vehicles
V : Average speed in the section L
Vo : Average speed without the curves in L

If the above formulas are applied to a road section 5Km in length involving five sharp curves, and if it is assumed that the section has the same characteristics as those in the Annex 5-1, i.e., a 7.5% grade and an altitude of 3,000m, and if the curve lengths are assumed to be 50m, 30m, 70m, 50m and 30m respectively; the volume at level C is calculated as 371 veh/H by formula (6), which indicates a reduction in capacity by 15%.

Annex Table 5-1

Fuel Consumption Survey

Test Vehicle: D-Dart Date: Sep. 15, 1980

Total Vehicle Weight: Road Section: Ibague - Espinal

Section No.	Direction	Distance (Km)	Fuel Consumption (cc)	Elapsed Time (sec)	Ave. Velocity (Km/hr)
5	2	2.53	172	116	78.5
4	2	1.0	37	72	50.1
2	2	0.9	128	49	65.9
1	2	4.83	436	221	79.0
1	1	4.83	586	217	80.0
2	1	0.81	59	42	77.1
3	1	0.9	119	64	50.6
4	1	0.95	270	87	41.4
5	1	2.53	434	137	66.5
2	2	0.9	134	50	64.5
3.	2	0.9	49	53	60.9
5	2	2.53	189	159	58.6
5	1	2.53	450	153	59.5
5	2	2.53	170	226	40.3
5	1	2.53	354	225	40.5
5	2	2.53	311	459	19.8
5	1	2.53	456	454	20.1

Fuel Consumption Survey

Test Vehicle: D-Dart Date: Sep. 16, 1980

Total Vehicle Weight: Road Section: Ibague - Cajamarca

Section No.	Direction	Distance (Km)	Fuel Consumption (cc)	Elapsed Time (sec)	Ave. Velocity (Km/hr)
1	1	2.23	570	178	45.1
2	1	3.67	295	258	51.3
3	1	1.75	494	140	44.9
4	1	1.15	276	92	44.9
5	1	1.17	253	88	47.8
6	1	1.37	211	89	55.5
7	1	0.96	274	84	40.8
8	1	1.01	184	84	42.9
8	2	1.01	158	54	67.0
7	2	0.96	95	67	51.5
6 .	2	1.37	217	75	66.0
5	2	1.17	97	76	55.4
4	2	1.15	70	73	56.2
3	2	1.75	88	126	50.0
2	2	3.67	914	287	46.1
1	2	2.23	135	155	51.6
3	1	1.75	464	216	29.2
3	2	1.75	106	209	30.1

Annex Table 5-1 (Cont'd)

Fuel Consumption Survey

Test Vehicle: D-Dart Date: Sep. 16, 1980

Total Vehicle Weight: Road Section: Ibague - Cajamarca

Section No.	Direction	Distance (Km)	Fuel Consumption (cc)	Elapsed Time (sec)	Ave. Velocity (Km/hr)
3	1	1.75	463	317	19.9
3	2	1.75	139	316	19.9
3	1	1.75	459	156	40.5
3	2	1.75	96	157	40.1
6	1	1.37	195	86	57.3
7	1	0.96	280	104	33.0
7	2	0.96	70	88	39.3
6	2	1.37	205	83	59.6
6	1	1.37	153	116	42.5
7	1	0.96	279	88	39.0
7	2	0.96	69	101	34.1
6	2	1.37	170	126	39.2
6	1	1.37	187	252	19.6
7	1	0.96	265	166	20.8
7	2	0.96	73	171	20.1
6	2	1.37	214	254	19.5

Fuel Consumption Survey

Test Vehicle: D-Dart Date: Sep. 17, 1980

Total Vehicle Weight: Road Section: Cajamarca - La Linea

Section No.	Direction	Distance (Km)	Fuel Consumption (cc)	Elapsed Time (sec)	Ave. Velocity (Km/hr)
1	1	1.42	514	119	42.7
3	1	1.75	746	157	40.2
4	1	3.26	1058	304	38.7
5	1	1.03	430	121	30.7
5	2	1.03	80	106	35.0
5	1	1.03	361	192	19.4
5	2	1.03	93	191	19.4
5	1	1.03	420	258	14.4
5	2	1.03	51	86	42.9
3	2	1.75	123	204	31.0
2	2	2.40	306	214	40.4
2	1	2.40	595	250	34.6
1	2	1.42	139	93	54.5

Annex Table 5-1 (Cont'd)

Fuel Consumption Survey

Test Vehicle: D-Dart

Date: Sep. 18, 1980

Total Vehicle Weight:

Road Section: La Linea - Calarca

Section No.	Direction	Distance (Km)	Fuel Consumption (cc)	Elapsed Time (sec)	Ave. Velocity (Km/hr)
10	2	4.93	1713	407	43.6
9	2	4.0	1533	406	35.4
8	2	1.67	602	207	29.0
7	2	4.41	1900	384	41.3
6	2	0.76	240	66	41.7
7	2	4.41	1620	775	20.5
7	2	4.41	1659	1039	15.3
6	1	0.76	139	57	47.9
7	1	4.41	389	312	51.0
8	1	1.67	117	168	35.8
9	1	4.0	354	342	42.1
10	1	4.93	376	443	40.0
7	1	4.41	241	524	30.3
7	1	4.41	304	788	20.1

Fuel Consumption Survey

Test Vehicle: D-600

Date: Sep. 23, 1980

Total Vehicle Weight: 12030 Kg.

Road Section: Ibague - Espinal

Section No.	Direction	Distance (Km)	Fuel Consumption (cc)	Elapsed Time (sec)	Ave. Velocity (Km/hr)
5	2	2.53	793	136	67.0
4	2	0.95	121	128	26.6
3	2	0.9	163	48	67.7
2	2	0.81	647	77	37.8
1	2	4.83	1935	269	64.5
1	1	4.83	2211	246	70.8
1	1	4.83	2510	247	70.3
2	1	0.81	110	59	49.1
5	1	2.53	1860	181	50.3
3	2	0.9	96	73	44.1
3	1	0.9	605	76	42.6
3	2	0.9	216	155	20.8
3	1	0.9	703	153	21.1

Annex Table 5-1 (Cont'd)

Fuel Consumption Survey

Test Vehicle: D-600 Date: Sep. 24, 1980

Total Vehicle Weight: 12030 Kg. Road Section: Ibague - Cajamarca

Section No.	Direction	Distance (Km)	Fuel Consumption (cc)	Elapsed Time (sec)	Ave. Velocity (Km/hr)
1	1	2.23	3,837	270	29.7
2	1	3.67	646	432	30.5
3	1	1.75	2,853	213	29.7
4	1	1.15	1,780	135	30.4
5	1	1.17	1,536	119	37.2
6	1	1.37	798	107	46.4
7	1	0.96	1,548	136	25.4
8	1	1.01	716	76	50.9
8	2	1.01	624	68	56.6
7	2	0.96	236	134	25.3
6	2	1.37	1,042	102	49.6
6	1	1.37	678	117	42.4
7	1	0.96	1,539	159	21.2
6	1	1.37	701	239	20.7
7	1	0.96	1,719	347	9.7
5	2	1.17	276	134	33.1
4	2	1.15	246	132	31.2
3	2	1.75	371	203	31.1
2	2	3.67	5,886	432	30.5
1	2	2.23	482	264	30.4

Annex Table 5-1 (Cont'd)

Fuel Consumption Survey

Test Vehicle: D-600 Date: Oct. 14, 1980

Total Vehicle Weight: 12030 Kg. Road Section: Ibague - Cajamarca

Section No.	Direction	Distance (Km)	Fuel Consumption (cm)	Elapsed Time (min. sec)	Ave. Velocity (Km/hr)
3	1	1.75	6.5	4:32	23
6	1	1.37	2.2	2:09	38
6	2	1.37	1.4	2:48	39

Note: Fuel consumption of 1 cm is corresponding to the consumption of 505 cc.

Fuel Consumption Survey

Test Vehicle: D-600 Date: Oct. 14, 1980

Total Vehicle Weight: 12030 kg. Road Section: Cajamarca - La Linea

Section No.	Direction	Distance (Km)	Fuel Consumption (cm)	Elapsed Time (min. sec)	Ave. Velocity (Km/hr)
1	1	1.42	6.2	3:30	24
4	1	0.83	4.2	2:55	17
4	2	0.83	0.9	2:57	17
4	2	0.83	0.9	4:05	12

Annex Table 5-1 (Cont'd)

Fuel Consumption Survey

Test Vehicle: D-600 Date: Oct. 15, 1980

Total Vehicle Weight: 12030 kg Road Section: La Linea - Calarca

Section No.	Direction	Distance (Km)	Fuel Consumption (cm)	Elapsed Time (min. sec)	Ave. Velocity (Km/hr)
6	1	0.78	2.5	1:47	26
7	1	4.36	2.2	14:57	17
8	1	0.84	0.5	2:17	22
B	1	0.88	0.8	2:46	19
9	1	3.93	1.4	11:20	21
A	1	1.18	1.5	3:03	23
A	2	1.18	3.1	2:36	27
A	2	1.18	3.3	3:10	22
10	1	1.12	2.9	12:35	5

Fuel Consumption Survey

Test Vehicle: D-600 without cargo Date: Oct. 16, 1980

Total Vehicle Weight: Road Section: Ibague - Cajamarca

Section No.	Direction	Distance (Km)	Fuel Consumption (cm)	Elapsed Time (min. sec)	Ave. Velocity (Km/hr)
1	1	2.23	3.7	3:58	33.7
1	1	2.23	3.5	2:46	48.3
2	1	3.67	1.1	5.06	43.2
2	1	3.67	0.9	4:37	47.7
3	1	1.75	3.4	2:21	44.7
3	1	1.75	2.7	2:18	45.7
3	2	1.75	0.7	4:20	24.2
3	2	1.75	1.4	4:23	24.0
3	2	1.75	2.8	3:53	27.0
3	1	1.75	1.9	4:34	23.0
4	1	1.15	3.1	1:49	37.8
4	1	1.15	3.0	1:33	44.4
5	1	1.17	2.2	1:34	44.7
5	1	1.17	1.4	1:23	50.6
6	1	1.37	1.3	1:40	49.4
6	2	1.37	1.4	1:35	52.0
6	2	1.37	1.9	1:39	49.9
6	1	1.37	1.2	2:03	40.2

Note: Fuel consumption of 1 cm is corresponding to the consumption of 505 cc.

Annex Table 5-1 (Cont'd)

Fuel Consumption Survey

Test Vehicle: D-699 without cargo Date: Oct. 16, 1980

Total Vehicle Weight: Road Section: Ibague - Cajamarca

Section No.	Direction	Distance (Km)	Fuel Consumption (cm)	Elapsed Time (min. sec)	Ave. Velocity (Km/hr)
6	2	1.37	1.6	2:26	33.9
6	2	1.37	1.4	2:29	33.2
7	1	0.96	1.4	1:30	38.2
7	1	0.96	2.8	1:22	41.9
7	1	0.96	2.1	1:24	40.9
7	2	0.96	1.6	1:59	28.9
7	1	0.96	2.1	2:10	26.4
7	2	0.96	1.5	1:56	29.6
8	1	1.01	1.1	1:08	53.2
8	2	1.01	1.2	1:03	57.4

Fuel Consumption Survey

Test Vehicle: D-600 without cargo Date: Oct. 16, 1980

Total Vehicle Weight: Road Section: Cajamarca - Calarca

Section No.	Direction	Distance (Km)	Fuel Consumption (cm)	Elapsed Time (min. sec)	Ave. Velocity (Km/hr)
1	1	1.42	3.4	2:07	40.1
1	1	1.42	3.1	2:02	41.8
4	1	0.83	0.9	1:54	26.2
4	2	0.83	1.1	2:01	24.7
4	2	0.83	1.9	2:17	21.8
4	2	0.83	1.3	1:33	32.1
5	1	1.03	3.2	2:14	27.7
5	1	1.03	2.4	2:11	28.3
5	2	1.03	1.7	3:01	20.5
5	2	1.03	2.0	2:17	27.1
6	2	0.78	0.8	1:18	36.0
7	2	4.36	2.2	10:35	24.7

Annex Table 5-1 (Cont'd)

Fuel Consumption Survey

Test Vehicle: CNT-900 Date: Oct. 23, 1980

Total Vehicle Weight: Road Section: Ibague - Cajamarca

Section No.	Direction	Distance (Km)	Fuel Consumption (cm)	Elapsed Time (min. sec)	Ave. Velocity (Km/hr)
1	1	2.23	5.5	3:30	38.1
2	1	3.67	0.5	6:10	42.7
3	1	1.75	4.0	3:45	28.0
4	1	1.15	2.2	2:45	25.0
5	1	1.17	2.0	2:05	33.6
6	1	1.37	1.0	2:15	36.6
7	1	0.96	5.5	2:25	23.7
8	1	1.01	0.7	1:35	38.1
8	2	1.01	0.3	2:10	27.8
7	2	0.96	1.0	2:30	22.9
6	2	1.37	1.2	2:25	34.1
5	2	1.17	0.7	2:30	28.0
4	2	1.15	0.2	2:05	33.0
3	2	1.75	0.8	3:20	31.5
2	2	3.67	7.2	7:45	28.4
1	2	2.23	0.8	3:50	34.8

Fuel Consumption Survey

Test Vehicle: CNT-900 Date: Oct. 24, 1980

Total Vehicle Weight: Road Section: Cajamarca - Calarca

Section No.	Direction	Distance (Km)	Fuel Consumption (cm)	Elapsed Time (min. sec)	Ave. Velocity (Km/hr)
1	1	1.42	3.0	3:30	24.3
4	1	0.83	2.5	4:25	11.3
5	1	1.03	3.5	5:10	12.0
6	1	0.78	1.0	2:25	19.4
7	1	4.36	1.5	13:55	18.8
8	1	0.84	0.5	2:40	18.9
B	1	0.88	1.0	2:10	24.4
9	1	3.93	2.0	13.20	17.7
A	1	1.18	0.9	2:15	31.5
10	1	1.12	1.5	2:35	26.0
10	2	1.12	1.0	3:15	20.7
A	2	1.18	2.1	2:30	28.4
9	2	3.93	11.5	11:20	20.8
B	2	0.88	4.2	2:40	19.8
8	2	0.84	1.3	2:30	20.2
7	2	4.36	12.7	11:0-	23.6
6	2	0.78	1.1	2:25	19.4
5	2	1.03	0.9	3:50	16.1
4	2	0.83	1.5	1.15	15.3
1	2	1.42	0.3	3.05	27.5

Annex Table 5-1 (Cont'd)

Fuel Consumption Survey

Test Vehicle: CNT-900 Date: Oct. 25, 1980

Total Vehicle Weight: Road Section: Ibague - Espinal

Section No.	Direction	Distance (Km)	Fuel Consumption (cm)	Elapsed Time (min. sec)	Ave. Velocity (Km/hr)
5	2	2.53	1.0	5:30	27.6
4	2	0.95	0.2	1:45	32.6
3	2	0.90	1.0	1:05	49.8
2	2	0.81	0.9	1:15	38.8
1	2	4.83	2.3	5:45	50.4
1	1	4.83	3.5	5:10	56.1
2	1	0.81	0.5	1:10	41.6
3	1	0.90	2.2	1:05	49.8
4	1	0.95	1.5	2:50	20.1
5	1	2.53	2.0	5:30	27.6

Fuel Consumption Survey

Test Vehicle: CNT-900 Date: Oct. 25, 1980

Total Vehicle Weight: Road Section: Ibague - Espinal

Section No.	Direction	Distance (Km)	Fuel Consumption (cm)	Elapsed Time (min. sec)	Ave. Velocity (Km/hr)
5	2	2.53	1.0	5:30	27.6
4	2	0.95	0.2	1:45	32.6
3	2	0.90	1.0	1:05	49.8
2	2	0.81	0.9	1:15	38.8
1	2	4.83	2.3	5:45	50.4
1	1	4.83	3.5	5:10	56.1
2	1	0.81	0.5	1:10	41.6
3	1	0.90	2.2	1:05	49.8
4	1	0.95	1.5	2:50	20.1
5	1	2.53	2.0	5:30	27.6

Annex Table 5-2 Average Observed Speeds

Road Section			Average Observed Speed in Km/hr.				
Section	Location	Ave. Grade	A	B	C2	C5	Average
Ibague - Espinal	K6.50 - K11.30	0.7 %	79.0	77.0	67.0	51.0	72
" "	K11.33 - K13.52	-0.8 %	79.5	70.0	72.0	69.0	73
" "	K13.52 - K15.89	0.8 %	45.0	39.0	35.0	34.0	39
" "	K15.89 - K17.10	3.7 %	33.0	29.0	26.0	30.0	29
" "	K11.33 - K 6.50	-0.7 %	71.0	64.0	58.0	52.0	65
" "	K13.52 - K11.33	0.8 %	77.0	74.0	70.0	73.0	74
" "	K15.89 - K13.52	-0.8 %	52.0	52.0	44.0	44.0	49
" "	K17.10 - K15.89	-3.7 %	55.0	57.0	49.0	50.0	53
" "	K17.10 - K24.20	1.7 %	72.0	65.0	61.0	52.0	63
" "	K24.20 - K25.15	6.7 %	39.0	35.0	28.0	21.0	32
" "	K25.15 - K38.17	1.8 %	63.0	61.0	46.0	35.0	53
" "	K38.17 - K40.70	2.3 %	55.0	45.0	36.0	35.0	43
" "	K24.20 - K17.10	-2.3 %	56.0	52.0	43.0	35.0	47
" "	K25.15 - K24.20	-1.8 %	60.0	61.0	48.0	46.0	55
" "	K38.17 - K25.15	-6.7 %	42.0	42.0	31.0	28.0	36
" "	K40.70 - K38.17	-1.7 %	73.0	71.0	52.0	51.0	63

A: Automobiles B: Buses C2: Trucks with 2 axles C5: Trucks with more than 3 axles

Annex Table 5-2 (Cont'd) Average Observed Speeds

Road Section			Average Observed Speed in Km/hr.				
Section	Location	Ave. Grade	A	B	C2	C5	Average
Ibague-Calarca	K58.055 - K60.280	6.5 %	30.0	24.0	26.0	25.0	27
" "	K60.280 - K61.000	3.2 %	40.0	40.0	33.0	24.0	35
" "	K61.000 - K64.800	-5.8 %	43.0	44.0	34.0	31.0	38
" "	K64.800 - K66.550	7.5 %	38.0	36.0	32.0	23.0	34
" "	K60.280 - K58.055	-6.5 %	37.0	35.0	22.0	19.0	26
" "	K61.000 - K60.280	-3.2 %	41.0	34.0	29.0	26.0	31
" "	K64.800 - K61.000	5.8 %	38.0	32.0	26.0	19.0	29
" "	K66.550 - K64.800	-7.5 %	39.0	36.0	26.0	22.0	29
" "	K66.550 - K69.714	5.3 %	50.0	47.0	41.0	35.0	43
" "	K69.714 - K70.860	5.8 %	37.0	37.0	31.0	28.0	33
" "	K70.860 - K72.418	0.3 %	42.0	46.0	38.0	35.0	39
" "	K72.418 - K73.585	4.6 %	42.0	38.0	37.0	32.0	38
" "	K69.714 - K66.550	-5.3 %	50.0	52.0	38.0	34.0	41
" "	K70.860 - K69.714	-5.8 %	45.0	46.0	31.0	26.0	34
" "	K72.418 - K70.860	-0.3 %	43.0	46.0	36.0	33.0	38
" "	K73.585 - K72.418	-4.6 %	45.0	44.0	33.0	30.0	36

A: Automobiles B: Buses C2: Trucks with 2 axles C5: Trucks with more than 3 axles

Annex Table 5-2 (Cont'd) Average Observed Speeds

Road Section			Average Observed Speed in Km/hr.				
Section	Location	Ave. Grade	A	B	C2	C5	Average
Ibague-Calarca	K81.406 - K82.779	-1.0 %	46.0	47.0	38.0	44.0	42
" "	K82.779 - K84.102	6.4 %	39.0	32.0	30.0	25.0	33
" "	K84.102 - K87.130	3.2 %	38.0	35.0	31.0	25.0	33
" "	K87.130 - K88.135	0.4 %	53.0	58.0	41.0	48.0	48
" "	K82.779 - K81.406	1.0 %	48.0	51.0	39.0	37.0	43
" "	K84.102 - K82.779	-6.4 %	41.0	42.0	28.0	28.0	34
" "	K87.130 - K84.102	-3.2 %	45.0	44.0	32.0	30.0	38
" "	K88.135 - K87.130	-0.4 %	48.0	52.0	41.0	41.0	45
" "	K110.861 - K112.370	8.1 %	26.0	20.0	18.0	12.0	20
" "	K112.370 - K113.400	8.4 %	33.0	25.0	21.0	12.0	25
" "	K113.400 - K114.180	-4.9 %	33.0	32.0	25.0	15.0	27
" "	K114.180 - K118.540	-8.9 %	35.0	25.0	24.0	15.0	27
" "	K112.370 - K110.861	-8.1 %	37.0	34.0	18.0	15.0	24
" "	K113.400 - K112.370	-8.4 %	35.0	33.0	19.0	14.0	24
" "	K114.180 - K113.400	4.9 %	30.0	23.0	18.0	16.0	21
" "	K118.540 - K114.180	8.9 %	36.0	23.0	22.0	13.0	24

A: Automobiles B: Buses C2: Trucks with 2 axles C5: Trucks with more than 3 axles

Annex Table 5-2 (Cont'd) Average Observed Speeds

Road Section			Average Observed Speed in Km/hr.				
Section	Location	Ave. Grade	A	B	C2	C5	Average
Ibague-Calarca	K118.540 - K120.260	-9.4 %	32.0	31.0	20.0	18.0	24
" "	K120.260 - K124.189	-8.8 %	32.0	29.0	19.0	19.0	24
" "	K124.189 - K125.371	-3.7 %	45.0	45.0	24.0	21.0	31
" "	K125.371 - K126.491	-6.2 %	38.0	25.0	28.0	24.0	30
" "	K120.260 - K118.540	9.4 %	25.0	25.0	16.0	14.0	18
" "	K124.189 - K120.260	8.8 %	26.0	20.0	18.0	16.0	19
" "	K125.371 - K124.189	3.7 %	33.0	35.0	21.0	18.0	22
" "	K126.491 - K125.371	6.2 %	25.0	23.0	22.0	20.0	22
" "	K112.370 - K113.400	8.4 %	30.0	18.0	18.0	12.0	18
" "	K113.400 - K114.180	4.9 %	32.0	31.0	27.0	20.0	26
" "	K114.180 - K118.540	-8.9 %	38.0	31.0	21.0	16.0	23
" "	K118.540 - K120.260	-9.4 %	36.0	25.0	22.0	16.0	23
" "	K113.400 - K112.370	-8.4 %	42.0	37.0	19.0	16.0	27
" "	K114.180 - K113.400	4.9 %	33.0	26.0	21.0	17.0	23
" "	K118.540 - K114.180	8.9 %	29.0	27.0	19.0	11.0	20
" "	K120.260 - K118.540	9.4 %	28.0	25.0	17.0	13.0	20

A: Automobiles B: Buses C2: Trucks with 2 axles C5: Trucks with more than 3 axles

Annex Table 5-3 Total Frequency of Encounters at Curve Sections

No	Location of Curve Sections	Existing Status				Status after P_1	
		Year 1983		Year 1995		Year 1983	Year 1995
		Truck & Bus	Tractomula	Truck & Bus	Tractomula	Tractomula	Tractomula
1	K61.292	19	26	76	109	7	33
2	K61.714	0	7	0	32	7	32
3	K63.046	3	5	11	21	2	10
4	K63.133	7	12	25	47	5	22
5	K65.793	70	26	231	103	7	32
6	K65.888	0	4	0	19	4	19
7	K66.016	3	4	9	17	1	8
8	K67.326	3	6	12	22	3	10
9	K67.411	10	13	35	51	3	16
10	K67.621	7	9	24	34	2	10
11	K67.807	0	3	0	10	3	10
12	K68.535	7	9	25	36	2	11
13	K68.671	25	9	82	36	3	11
14	K68.720	16	21	58	84	5	26
15	K68.806	6	8	23	33	2	10
16	K68.907	10	13	36	52	3	16
17	K69.361	9	12	33	48	3	15
18	K69.643	8	13	29	55	5	26
19	K70.284	7	9	25	36	2	11
20	K71.063	7	9	24	35	2	11
21	K74.242	0	4	0	14	4	14
22	K74.892	0	2	0	9	2	9
23	K75.502	5	9	18	34	4	16
24	K75.922	0	2	0	7	2	7
25	K77.130	4	6	13	24	2	11
26	K78.210	6	8	11	20	2	9

Annex Table 5-3 (Cont'd) Total Frequency of Encounters at Curve Sections

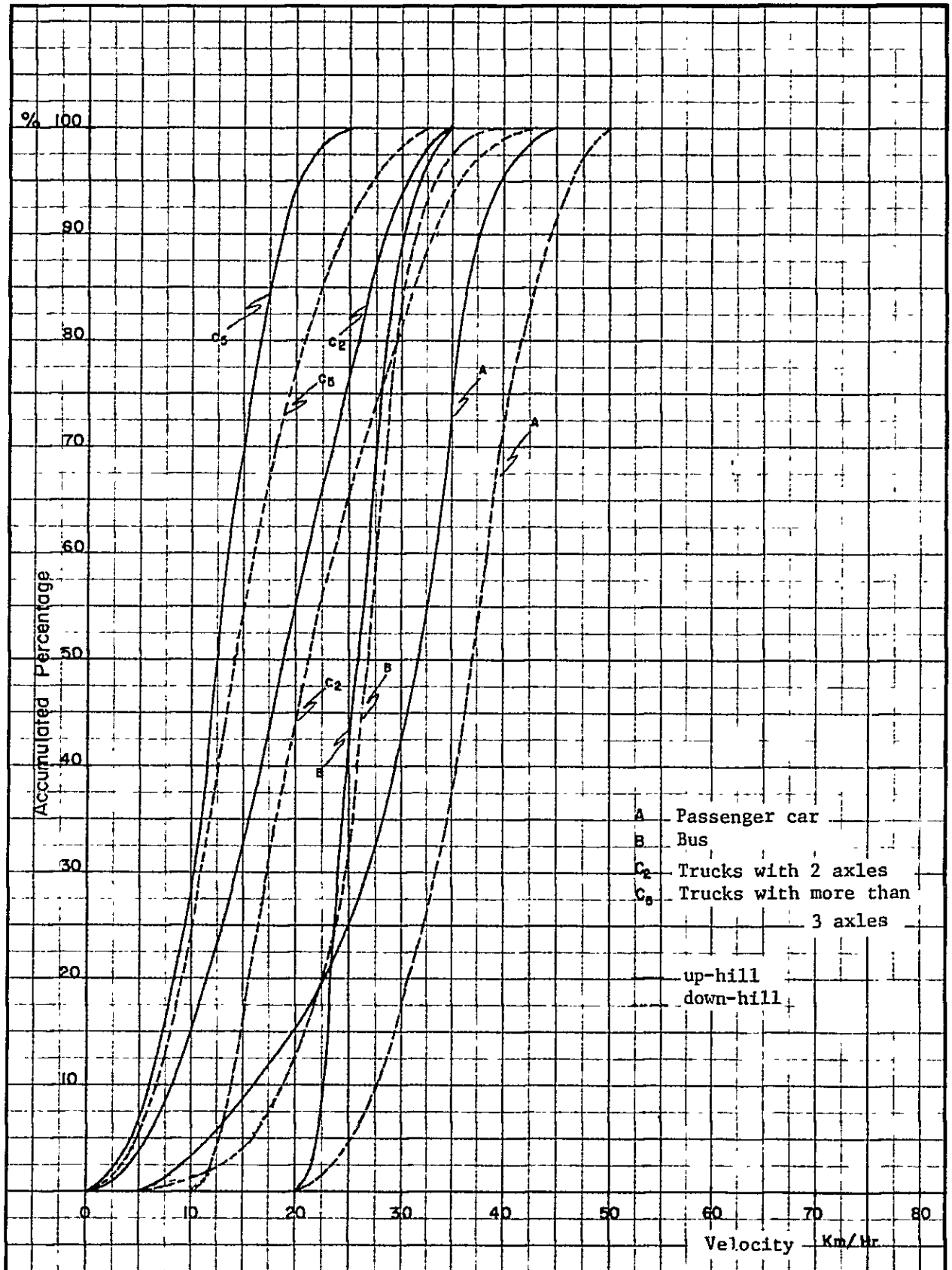
No	Location of Curve Sections	Existing Status				Status after P_1	
		Year 1983		Year 1995		Year 1983	Year 1995
		Truck & Bus	Tractomula	Truck & Bus	Tractomula	Tractomula	Tractomula
27	K78.251	0	6	0	12	6	12
28	K78.973	3	5	12	17	2	5
29	K79.047	0	3	0	8	3	8
30	K79.610	0	4	0	15	4	15
31	K81.379	7	9	23	33	2	10
32	K83.117	14	19	51	74	5	23
33	K83.608	0	5	0	23	5	23
34	K83.830	0	3	0	11	3	11
35	K84.449	0	2	0	9	2	9
36	K84.568	0	4	0	15	4	15
37	K86.353	6	7	19	28	1	9
38	K86.430	0	1	0	5	1	5
39	K86.525	0	2	0	9	2	9
40	K94.301	18	24	70	100	6	30
41	K95.344	23	31	90	130	8	40
42	K96.191	0	7	0	31	7	31
43	K96.466	0	4	0	19	4	19
44	K96.522	0	5	0	22	5	22
45	K97.888	0	7	0	32	7	32
46	K100.095	0	3	0	13	3	13
47	K101.237	0	4	0	15	4	15
48	K102.018	9	12	33	48	3	15
49	K102.083	0	2	0	10	2	10
50	K103.555	0	4	0	17	4	17
51	K104.946	7	9	25	36	2	11
52	K105.273	0	5	0	21	5	21

Annex Table 5-3 Total Frequency of Encounters at Curve Sections
(Cont'd)

No	Location of Curve Sections	Existing Status				Status after P_1	
		Year 1983		Year 1995		Year 1983	Year 1995
		Truck & Bus	Tractomula	Truck & Bus	Tractomula	Tractomula	Tractomula
53	K105.965	0	4	0	15	4	15
54	K106.577	6	9	20	48	3	18
55	K107.062	0	5	0	23	5	23
56	K108.107	8	11	29	42	3	13
57	K108.647	0	5	0	24	5	24
58	K110.209	12	16	50	72	4	22
59	K110.476	10	14	43	61	4	18
60	K110.770	37	13	134	59	4	18
61	K110.869	51	19	186	83	5	26
62	K111.476	0	4	0	21	4	21
63	K111.668	0	5	0	43	5	43
64	K112.406	0	8	0	42	8	42
65	K112.694	0	3	0	15	3	15
66	K115.634	55	20	200	88	6	27
67	K116.624	0	6	0	27	6	27
68	K116.985	38	14	138	61	4	19
69	K117.150	0	4	0	17	4	17
70	K117.373	8	11	33	47	3	14
71	K117.600	0	5	0	26	5	26
72	K117.865	0	3	0	13	3	13
73	K118.715	0	3	0	13	3	13
74	K118.748	0	3	0	15	3	15
75	K118.748	8	10	31	45	2	14
76	K119.140	0	5	0	26	5	26
77	K119.335	0	7	0	32	7	32
78	K119.882	0	9	0	47	9	47
79	K120.130	0	4	0	20	4	20

Annex Table 5-3 (Cont'd) Total Frequency of Encounters at Curve Sections

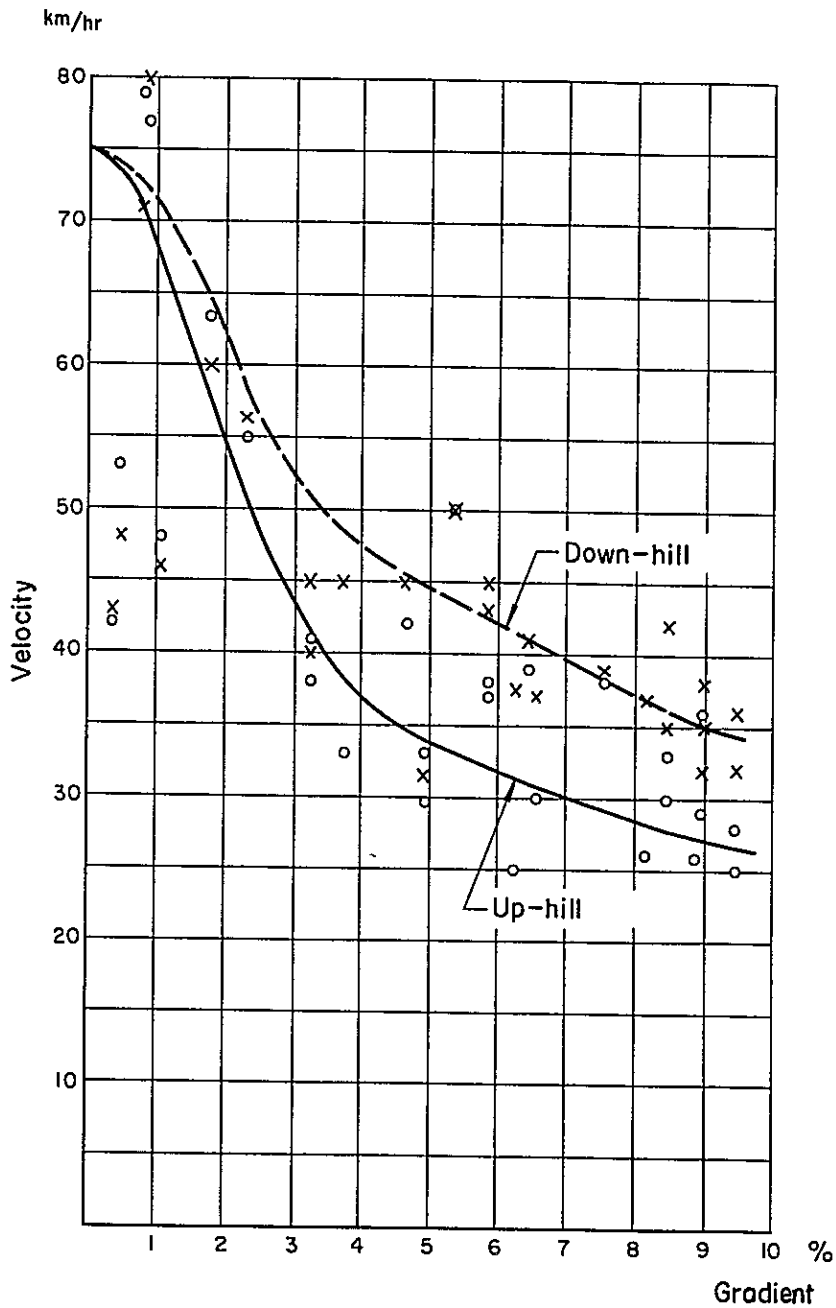
No	Location of Curve Sections	Existing Status				Status after P_1	
		Year 1983		Year 1995		Year 1983	Year 1995
		Truck & Bus	Tractomula	Truck & Bus	Tractomula	Tractomula	Tractomula
80	K120.461	0	4	0	18	4	18
81	K120.750	0	3	0	14	3	14
82	K120.958	0	5	0	22	5	22
83	K122.705	0	7	0	32	7	32
84	K123.857	0	5	0	24	5	24
85	K124.060	15	20	28	41	5	13
86	K124.370	0	2	0	5	2	5
87	K125.856	5	7	18	26	2	8
88	K125.950	0	3	0	11	3	11
89	K129.100	8	13	14	29	5	15
90	K129.920	0	4	0	17	4	17
91	K130.064	4	6	16	23	2	7
92	K130.109	8	10	31	45	2	14
93	K130.187	19	26	40	57	7	17
94	K130.580	0	4	0	20	4	20
95	K131.266	5	9	21	39	4	18
96	K131.502	9	12	37	54	3	17
97	K131.659	55	20	200	88	6	27
98	K132.097	2	3	10	14	1	4
99	K122.264	0	4	0	20	4	20
100	K133.194	11	15	46	66	4	20
101	K133.990	7	10	30	43	3	13
102	K134.515	0	6	0	13	6	13
103	K135.086	10	13	41	59	3	18



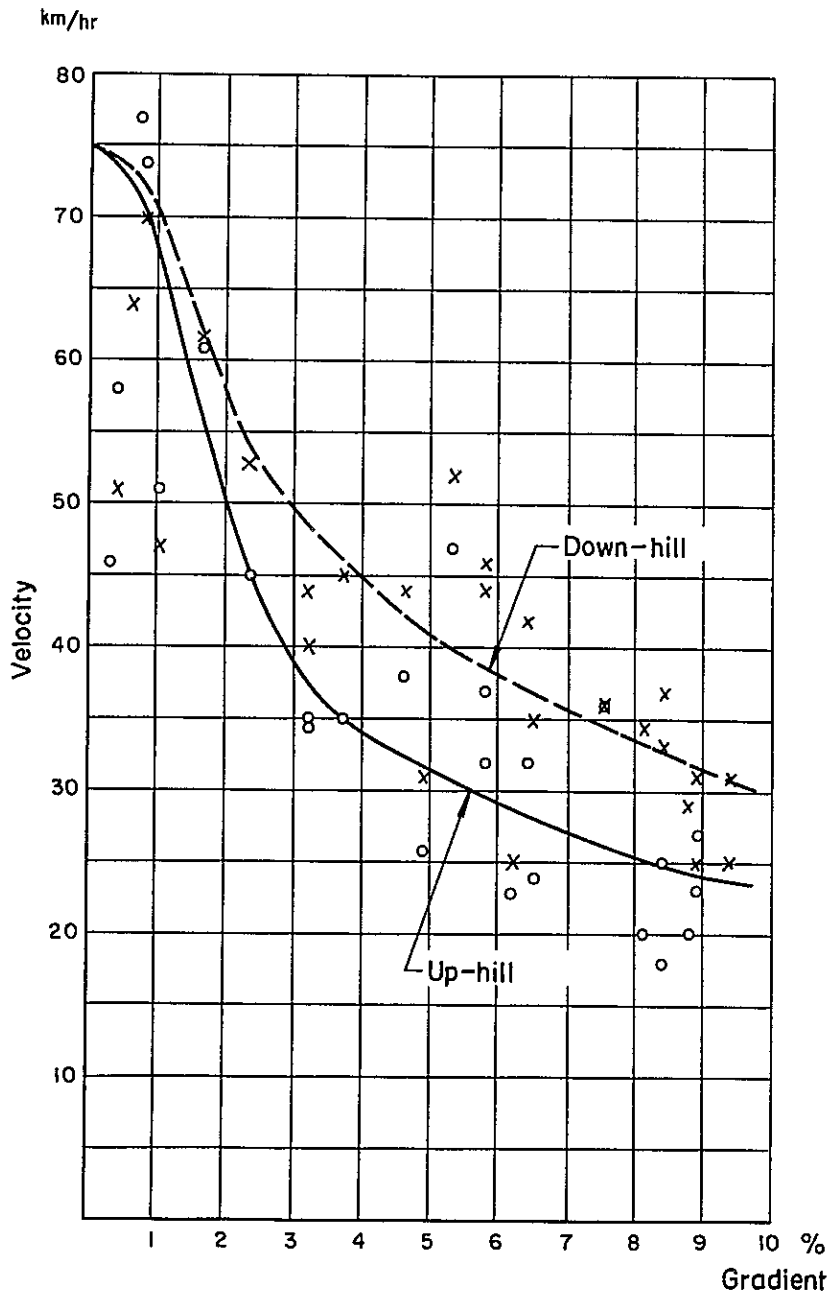
Annex Fig 5-1 ACCUMULATED DISTRIBUTION OF VELOCITY

(LA LINEA - CALARCA ⑩ Gradient 3.4%)

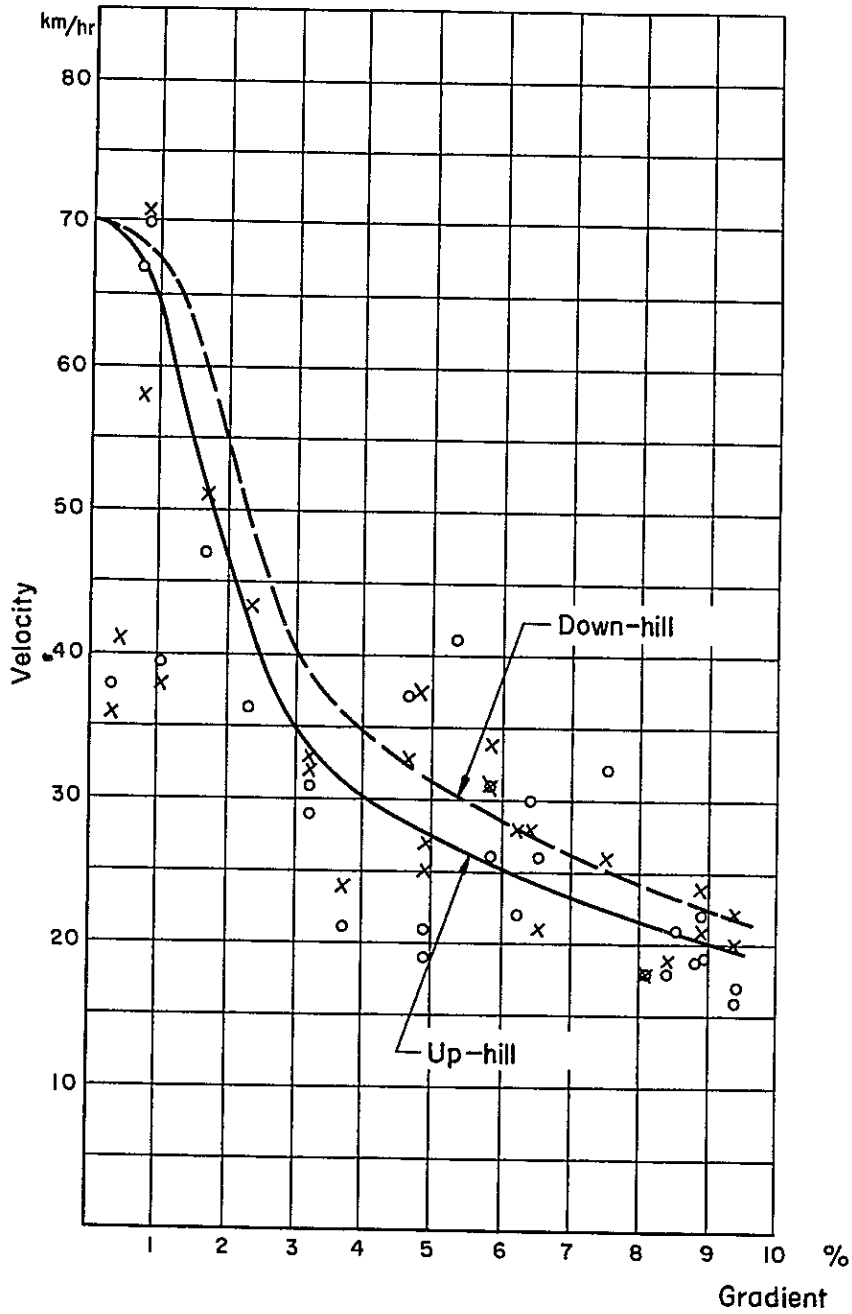
Annex Fig 5-2 Average Operation Velocity
(Automobile)



Annex Fig. 5-3 Average Operation Velocity
(Bus)

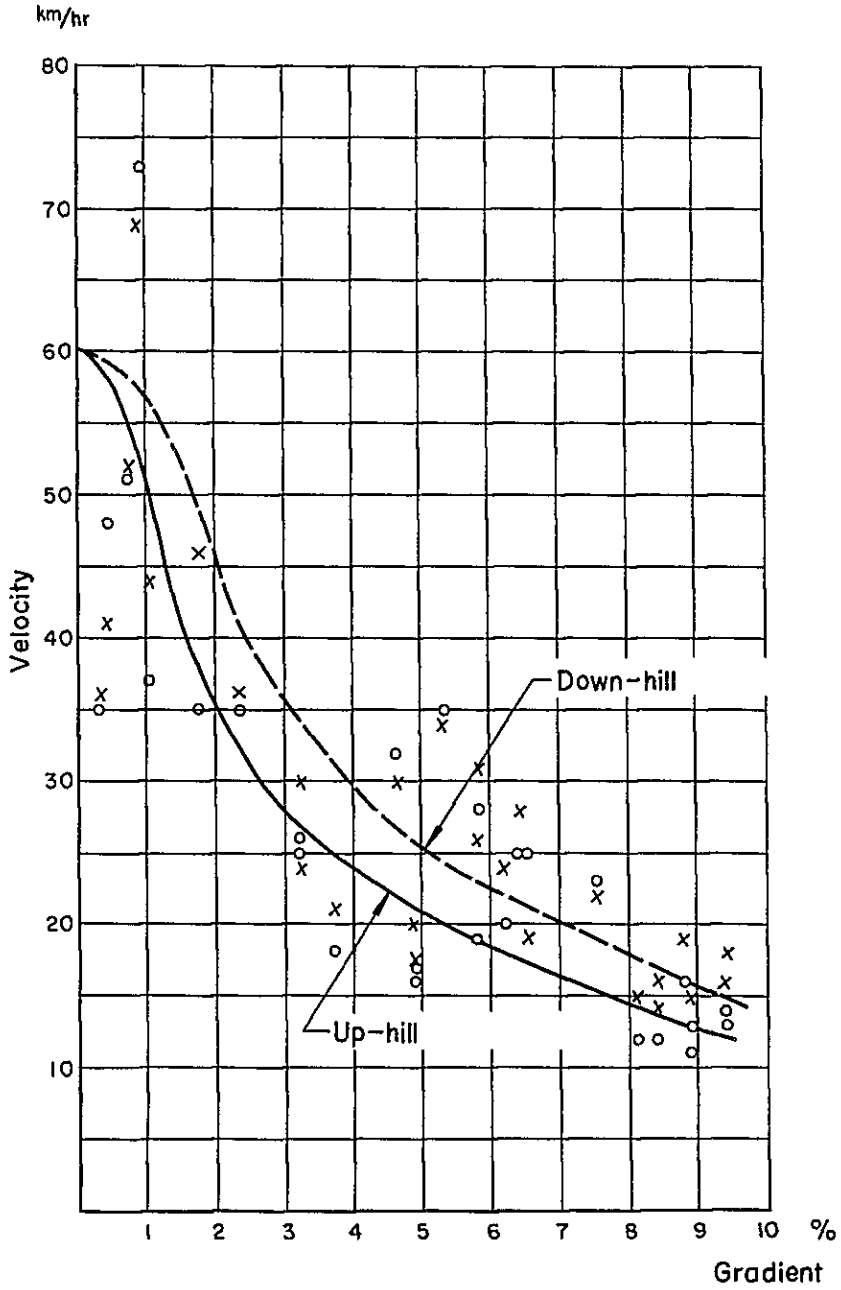


Annex Fig. 5-4 Average Operation Velocity
(Truck 2 axles)



Annex Fig. 5-5 Average Operation Velocity

(Truck 3 or more axles)



ANNEX 6

Annex Table 6-1 Existing Alignment of Ibague - Calarca section

Section Km - Km	Number of Horizontal Curves: Radius of Curvature (m) 10–15	15–20	20–25	25–30	30–45	45–100	100–150	Vertical Alignment (m): Length (m)	0–2%	2–4%	4–6%	6–8%	8–10%	10%	Total
56 - 57					1	2		160	170	166	456	208			1000
57 - 58									180	595			225		"
58 - 59											260	710	30		"
59 - 60						5		312			170	749	81		"
60 - 61				1	2	3	2	419	173	286	200	341			"
61 - 62			2	2	8	3	1	584			102	898			"
62 - 63				3	1	4	1	425				1000			"
63 - 64		3	1			6	4	397			157	843			"
64 - 65					1	7		250		160		840			"
65 - 66		2		1	6	5	4	567				1000			"
66 - 67			1		4	10	2	528	128	80		466	326		"
67 - 68			3	3	8	3		595	124	282	594				"
68 - 69		3	3	1	5	3		521	29		731	240			"
69 - 70		2		1	4	8		463			32	968			"
70 - 71		1		1	1	12		503			405	595			"
71 - 72					4	7	1	529	158		481	154	207		"
72 - 73				1	3	7		422	196	330		474			"
73 - 74					3	9		400		516		484			"
74 - 75			1	1	3	5	3	428		153	612	235			"
75 - 76		1	1	2	5	5	2	426	244	95	459	122		80	"
76 - 77					3	5	4	335		331		630		39	"
77 - 78			1	3	4	5	3	495	52	294	284	370			"
78 - 79			2	1	2	7	2	425	227	262		511			"
79 - 80		2		3	2	8	3	508	58	263	241	438			"
80 - 81					2	2	6	297		146	401	453			"
81 - 82	1	1				7	2	320	219	432	151	198			"
82 - 83				1	2	5	1	294	360	45	595				"
83 - 84 (84.639)		1	3	3	7	7	2	572		230	210		560		"
84 - 85			2		3	3	2	320					639		639
85 - 86				1	9	6	1	541				480	520		1000
Sub total	1	17	20	29	92				2318	4666	6541	13407	2588	119	29639

Note: 1. Km values between km 56 and km 114 are dependent on predetermined km post for construction.
2. Km values between km 114 and km 135.6 are dependent on insitu km post.
3. From km 56 to km 114 the alignments are based on the results of a survey done by MOPT and are therefore accurate.
4. From km 114 to km 135.6 the alignments are based on measurements taken from a 1/5000 scale map and are therefore not accurate.

Annex Table 6.1 Existing Alignment of Ibague - Calarca section

(Cont'd)

Section Km	Section Km	Number of Horizontal Curves: Radius of Curvature (m) 10–15	15–20	20–25	25–30	30–45	45–100	100–150	Length (m)	Vertical Alignment (m): 0–2%	2–4%	4–6%	6–8%	8–10%	10%	Total
86	87		1	2	1	2	4	2	436			110	650	240		1000
87	88					2	8	1	451	305	539	30	126			"
88	89					3	8	1	397	233	481	286				"
89	90									1000						"
90	91									125	435	280	160			"
91	92						3	1	120	160	236	110	48	311	135	"
92	93						3	1	152	350	459	191				"
93	94						5	1	417	413	72	215	156	144		"
94	95			1		2	6	2	532				390	469	141	"
95	96			2	1	1	4	4	508	468			532			"
96	97			3	3	1	5	1	488		175		825			"
97	98			2		3	3	1	297	194	191	124	162	329		"
98	99					5	4	1	425				283	717		"
99	100					4	9	2	519			290		710		"
100	101				1	1	8	2	433	51	300	126	473	50		"
101	102				1	3	4	1	324		200	800				"
102	103				3	6	5		488			1000				"
103	104				1	3	8	4	541		700	300				"
104	105			1		2	4	4	424		300			700		"
105	106			1		4	8		357					1000		"
106	107		2		1	4	3		410				400	600		"
107	108				1	5	5	2	564				1000			"
108	109			2	3	4	1		410				1000			"
109	110			1		2	4	1	333				900	100		"
110	111	1	1	2	3	2	6		534					1000		"
111	112		1	1	2	7	3	1	582					1000		"
112	113		1	1	2	1	6	2	478					1000		"
113	113.538 (114)				1	5	3		336		78		260	200		"
114	115				1	3					400			600		"
115	116		1			2								1000		"
Sub total		1	7	19	25	77				3299	4566	3862	7365	10170	276	29538

Annex Table 6.1 Existing Alignment of Ibague - Calarca section (Cont'd)

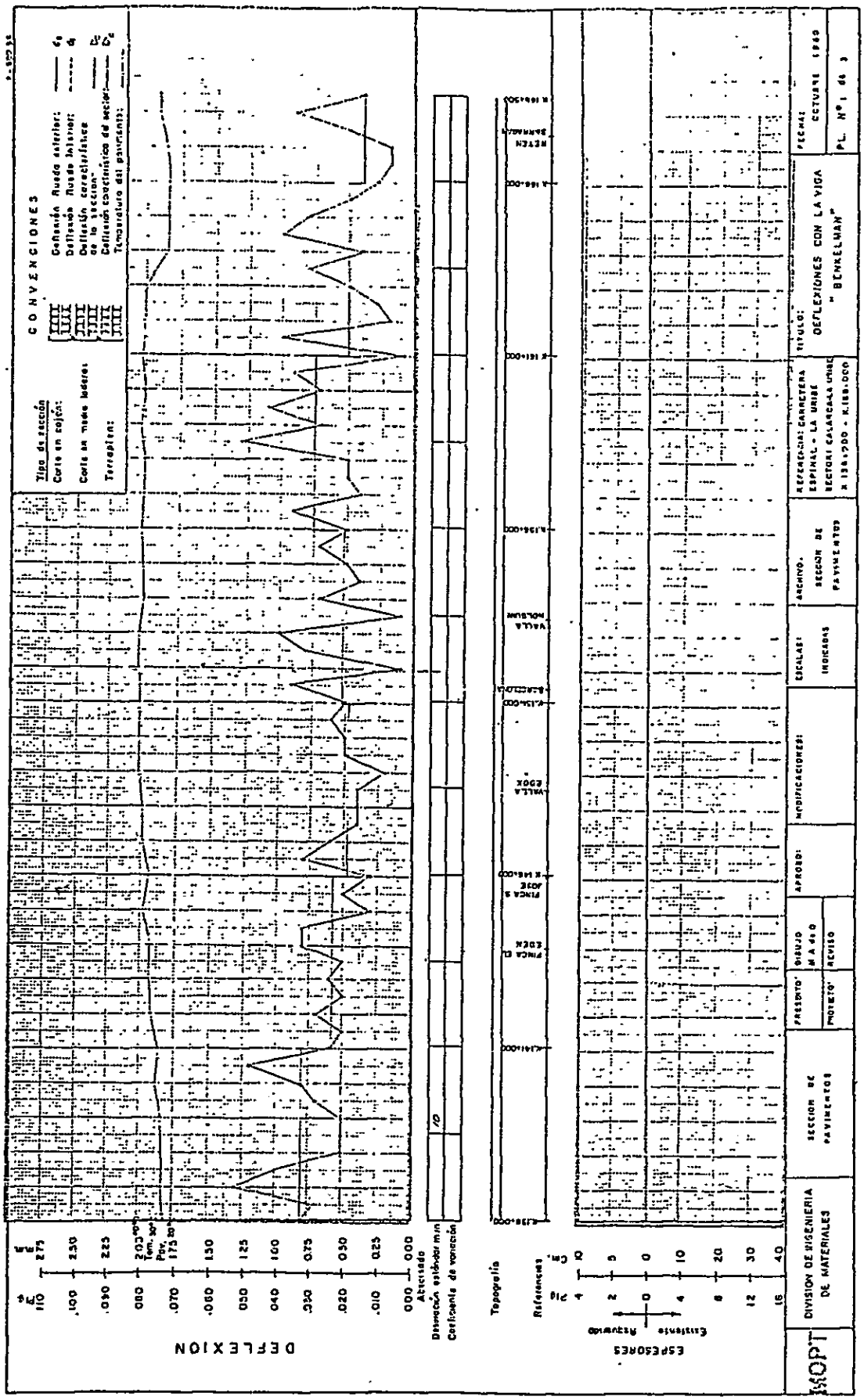
Section Km - Km	Number of Horizontal Curves: Radius of Curvature (m) 10 — 15	15 — 20	20 — 25	25 — 30	30 — 45	45 — 100	100 — 150	Length (m)	Vertical Alignment (m): 0 2%	2 4%	4 6%	6 8%	8 10%	10%	Total
116 - 117		1			2					300			700		1000
117 - 118	1	2	2	1	4								1000		"
118 - 119		2	1	2	1								1000		"
119 - 120		1	2		2								1000		"
120 - 121		2	2	2	4								1000		"
121 - 122					3							300	700		"
122 - 123		1		1	1						100		400	500	"
123 - 124		1			3									1000	"
124 - 125	1	1			4				400					600	"
125 - 126		1		2	1					500		500			"
126 - 127				1	4				200		300	100	400		"
127 - 128					1							800	200		"
128 - 129				1	6							1000			"
129 - 130		2		1	3							100	900		"
130 - 131		2	2		2						200		800		"
131 - 132		2	1		1					400	100	100	400		"
132 - 133		1	1		4	2						300	300	400	"
133 - 134			1		1							100	700	200	"
134 - 135		1		2	1								1000		"
135 - 135.6		1			1								600		600
Sub Total	2	21	12	13	49				600	1200	700	3300	11100	2700	19600
Total	4	47	54	67	218				6217	10432	11103	24072	23858	3095	78777

Note:
1. Km values between km 56 and km 114 are dependent on predetermined km post for construction.
2. Km values between km 114 and km 135.6 are dependent on insitu km post.
3. From km 56 to km 114 the alignments are based on the results of a survey done by MOPT and are therefore accurate.
4. From km 114 to km 135.6 the alignments are based on measurements taken from a 1/5000 scale map and are therefore not accurate.

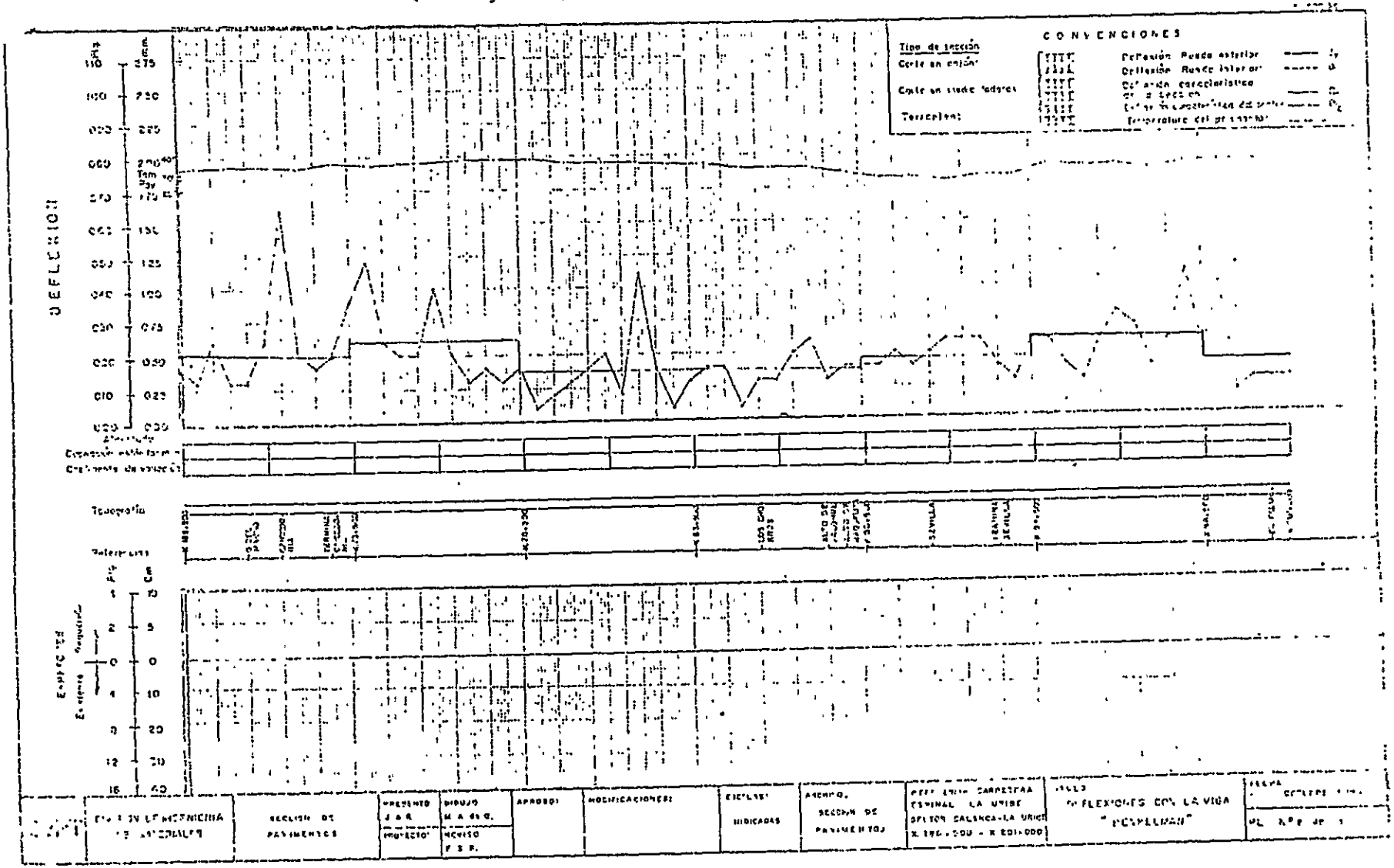
Annex Table- 6-2 Relationship between insitu Km Post and predetermined Km Post for construction in the Ibague - La Linea section of the existing road

Insitu Km Post	Predetermined Km Post for Construction Work	Insitu Km Post	Predetermined Km Post for Construction Work
Km 56	Km 56,000	Km 86	Km 86,057
60	59,973	87	87,038
62	61,956	88	88,027
63	62,944	89	89,011
64	63,939	92	91,940
65	64,930.30	94	93,920
67	66,905	95	94,893
68	67,895	97	96,863
70	69,870	97.786	97,640
74	73,811	99	98,932
75	74,802	100	99,806
76	75,791	101	100,803
78	77,772	102	101,772
79	78,761	104	103,751
80	79,750	105	104,725
81	80,737	106	105,711
83	82,702	110	109,627
84	83,710	112	111,590
85	84,639	114	113,538
	(=85,000)		(=114,000)

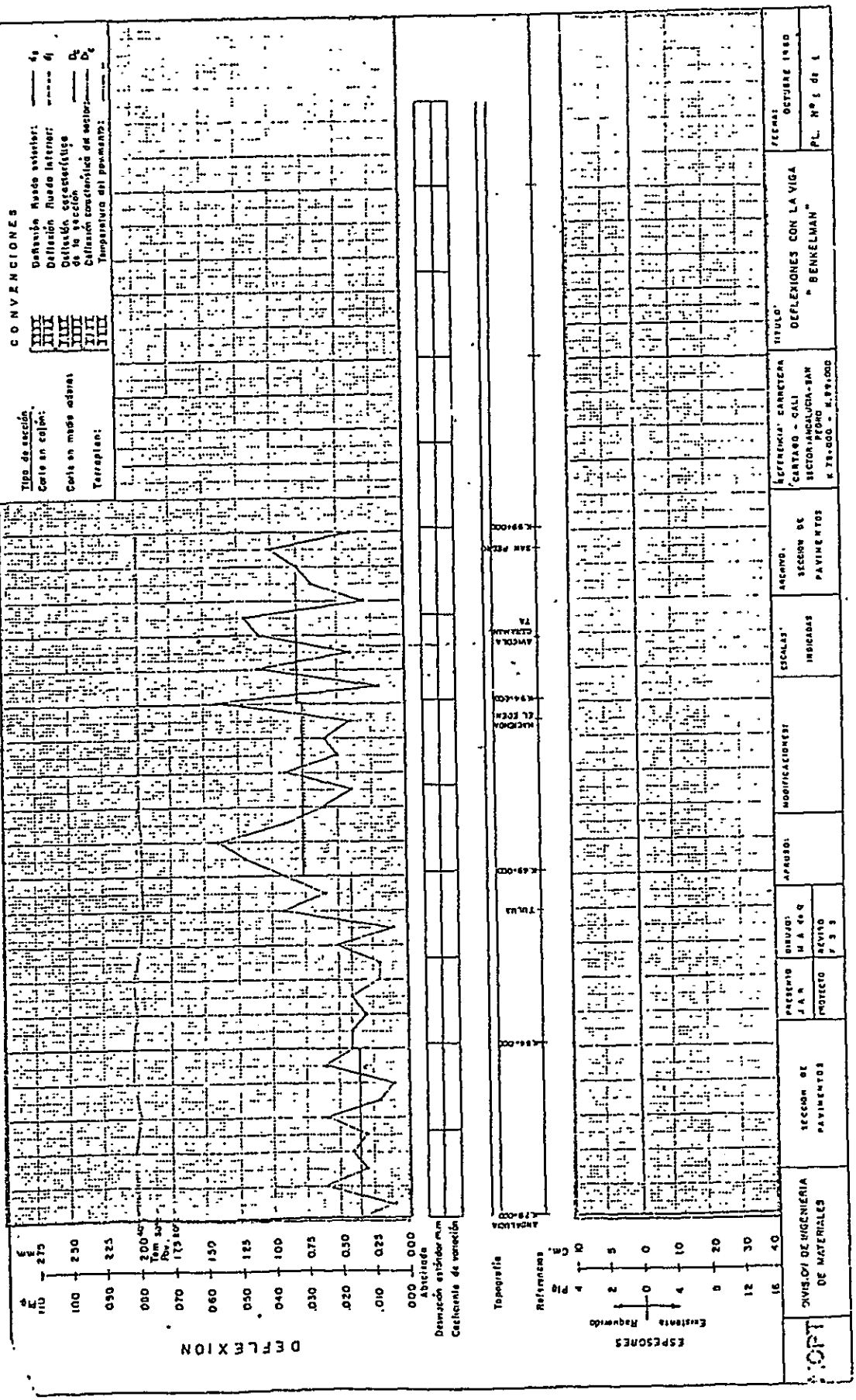
Annex Fig 6-1 Benkelman Beam Test Result
(Test by MOPT)



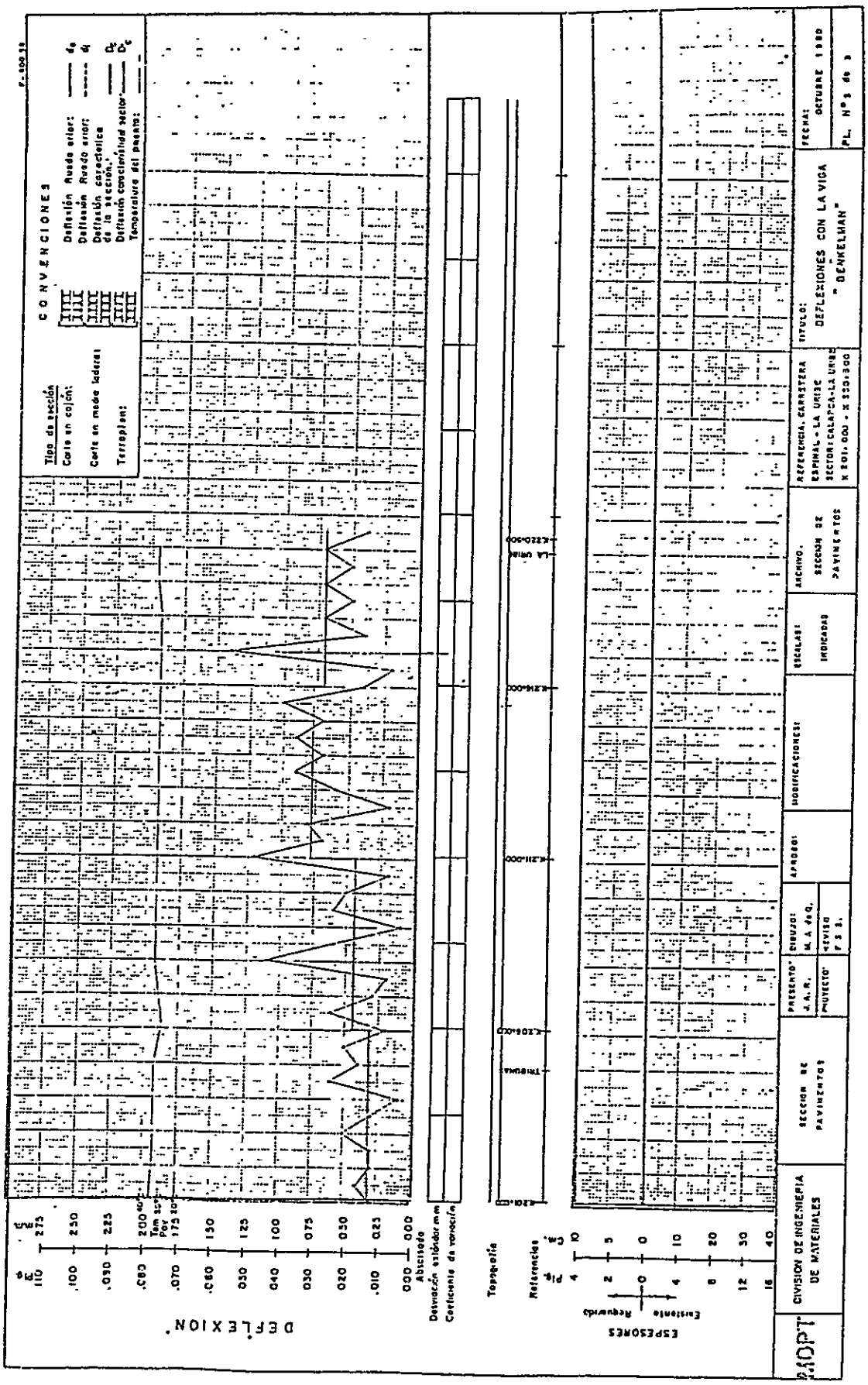
Annex Fig. 6-1 · Benkelman Beam Test Result (Cont'd)
(Test by MOPT)



Annex Fig 6-1 Benkelman Beam Test Result
(Test by MOPT)
(Cont'd)

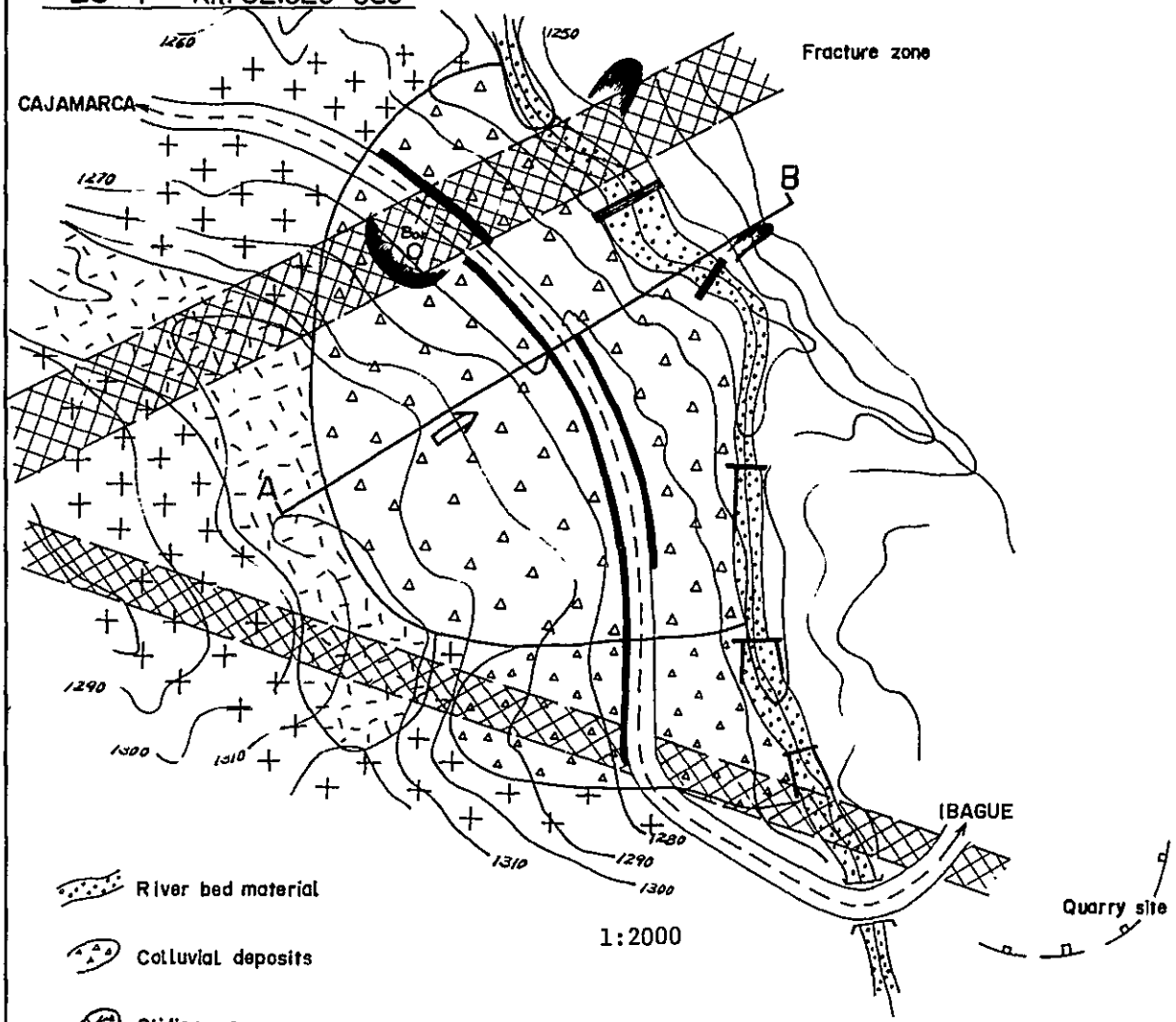


Annex Fig 6-1 Benkelman Beam Test Result (Cont'd)
(Test by MOPT)



Annex Fig. 6 – 2 Plan & Cross Section of Critical Landslide Area

LS-I Km 62.520~680



River bed material

Colluvial deposits

Sliding mass

Pumice flow deposits

Granodiorite

Collapse

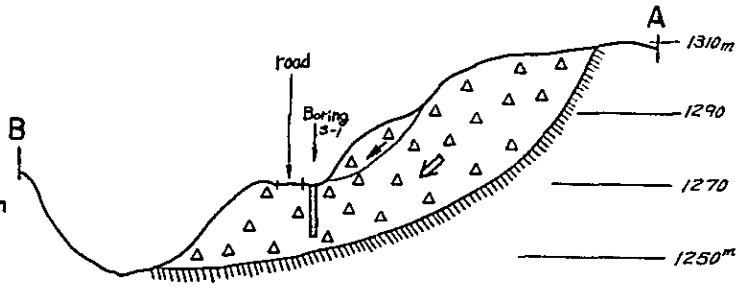
Sediment controldam

Retaining wall

Boring point

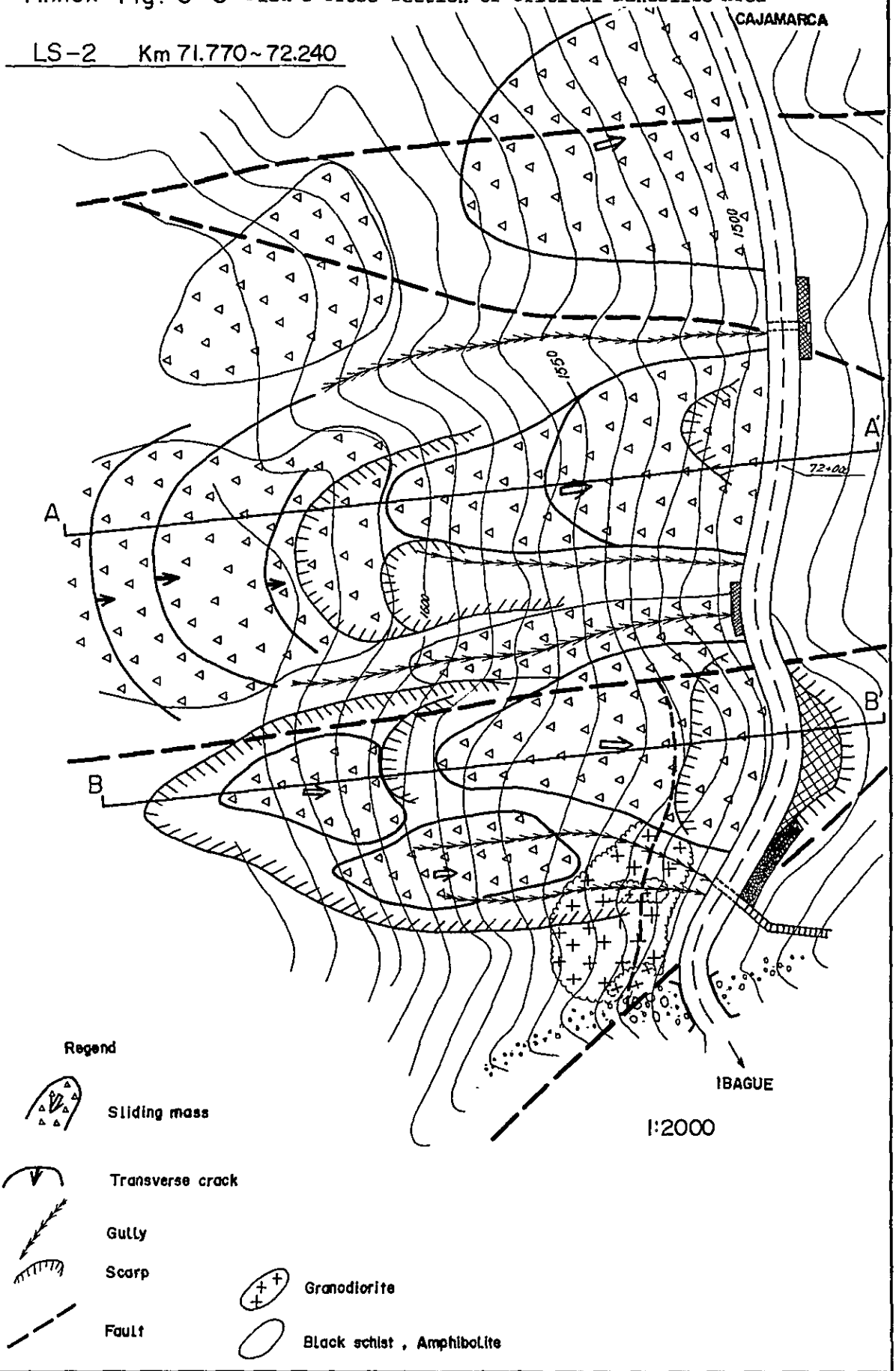
A B Cutting Line of Geological Section

Section A - B

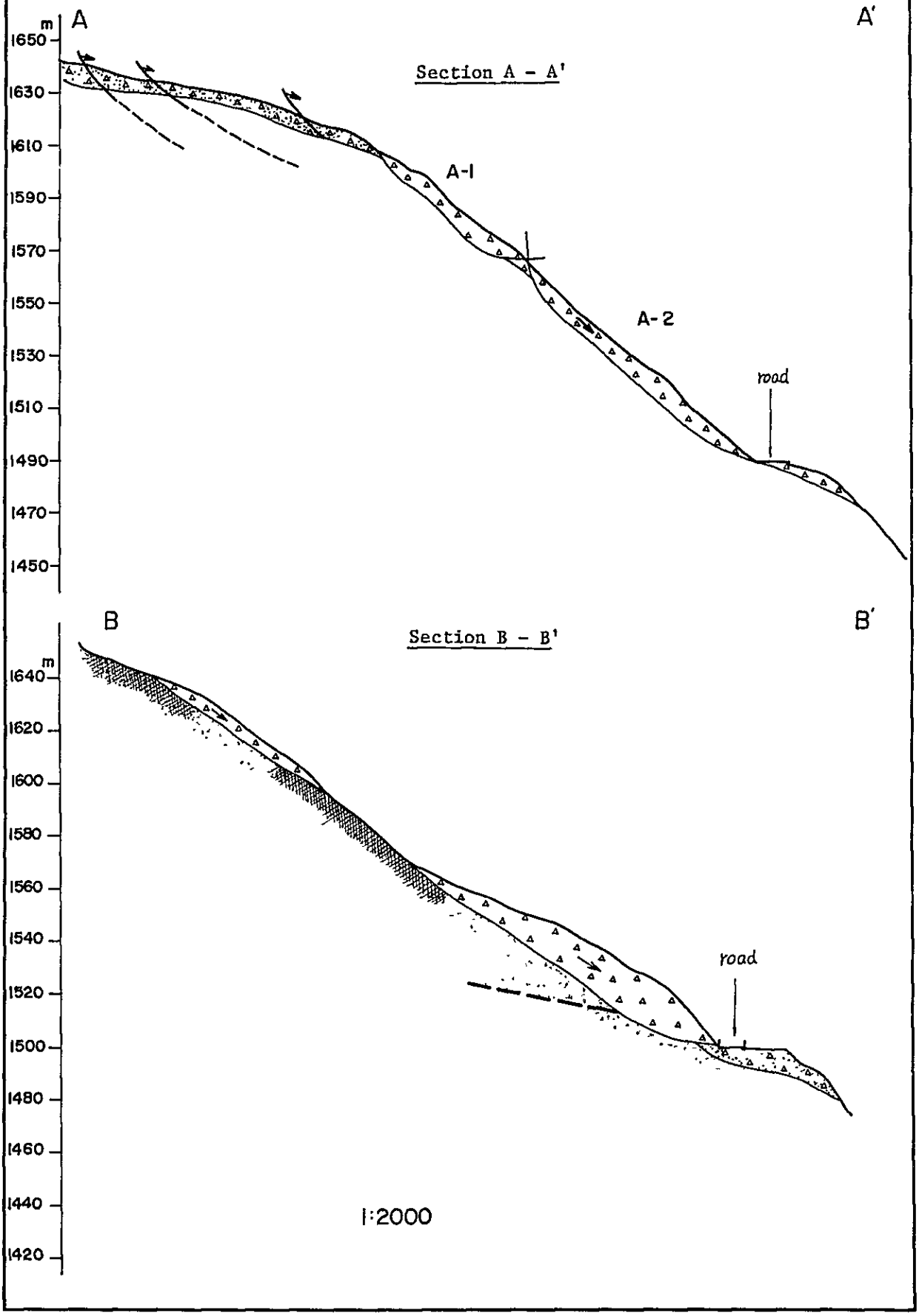


1:2000

Annex Fig. 6-3 Plan & Cross Section of Critical Landslide Area

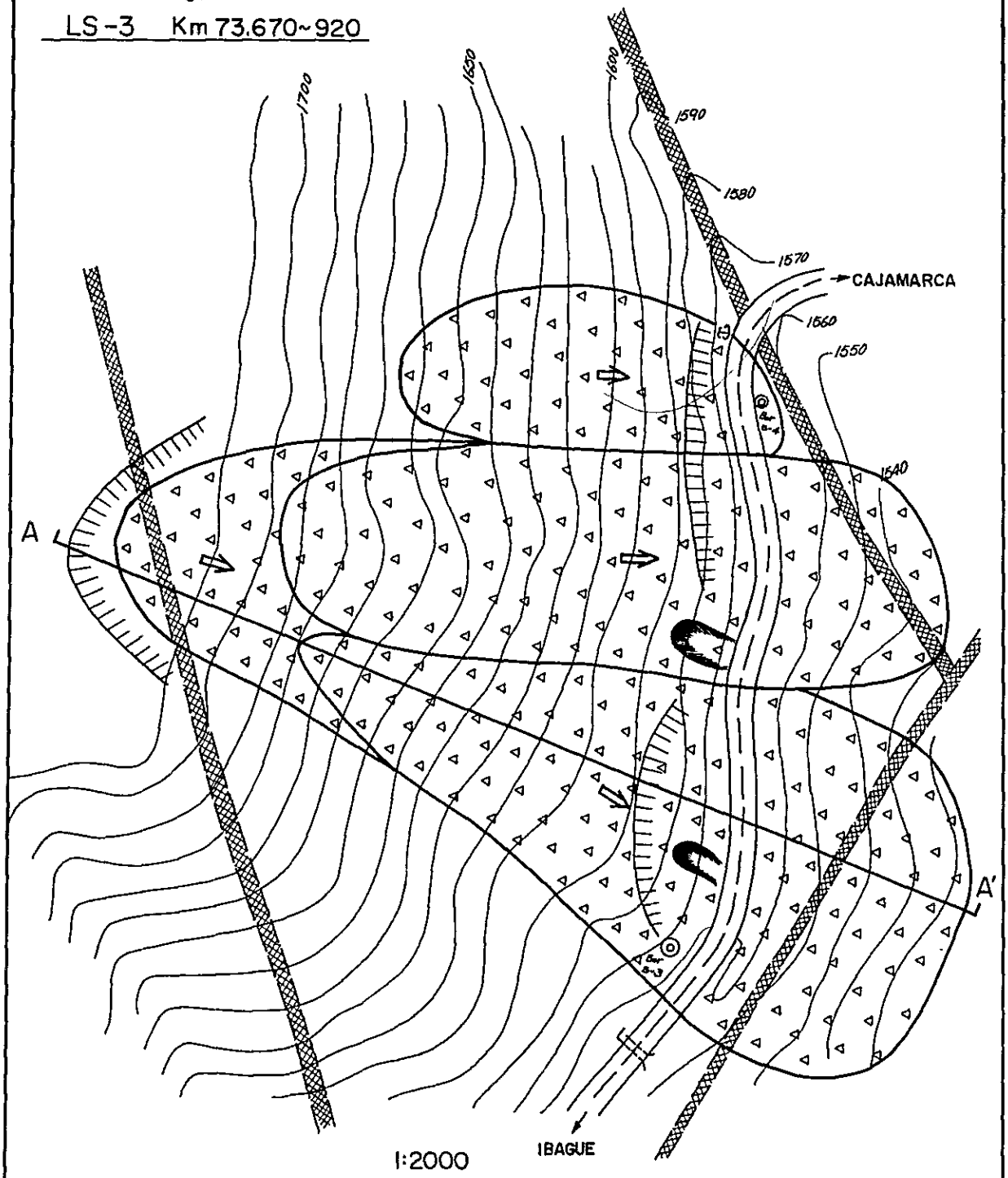


Annex Fig. 6 – 3 Plan & Cross Section of Critical Landslide Area
LS-2



Annex Fig. 6-4 Plan & Cross Section of Critical Landslide Area

LS-3 Km 73.670~920



Rocks : Black schist and Green schist

Fault, Fracture zone

Collapse

Sliding mass

Scarp

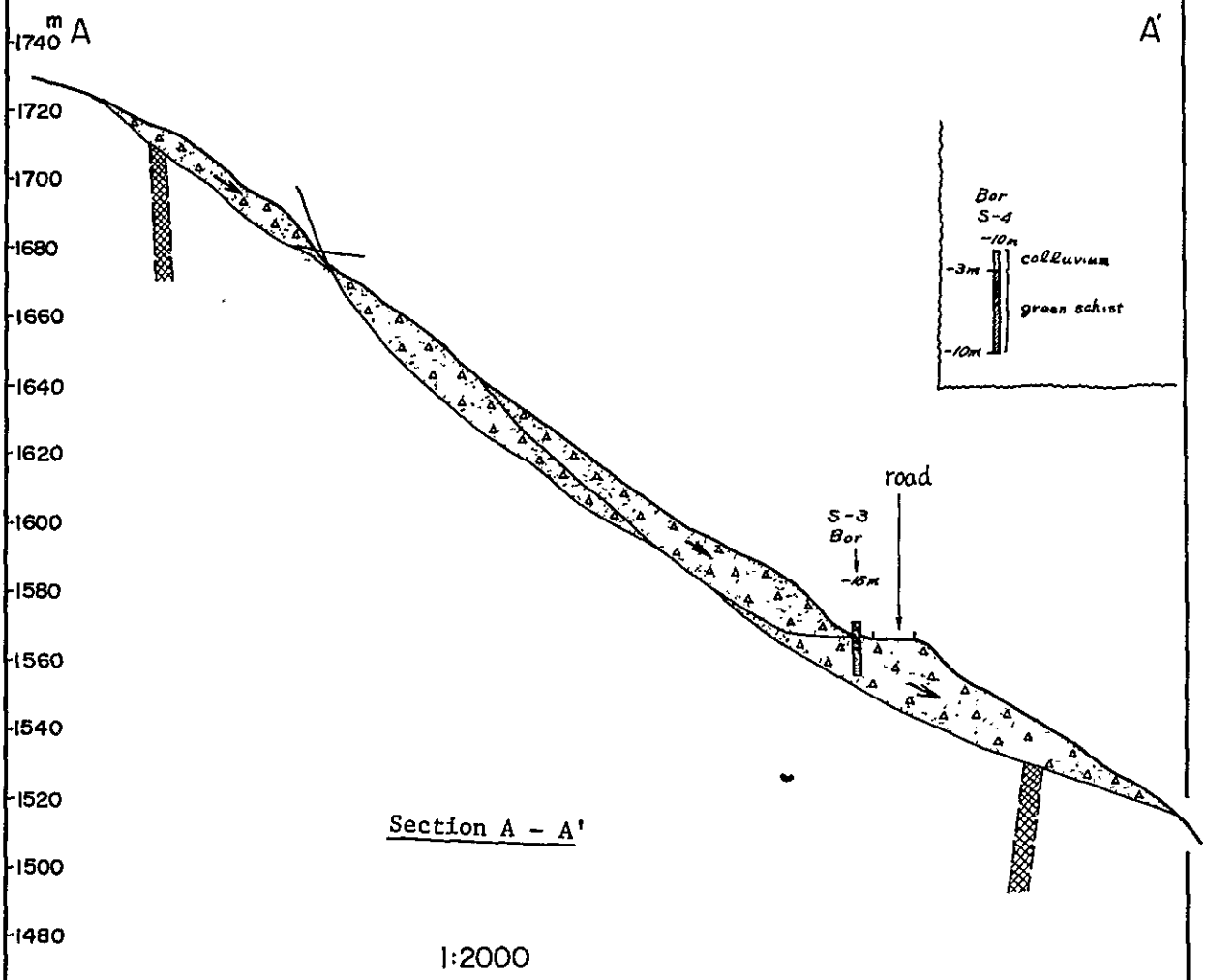
Spring

Boring point S-3

A A'

Annex Fig 6-4 Plan & Cross Section of Critical Landslide Area

LS-3

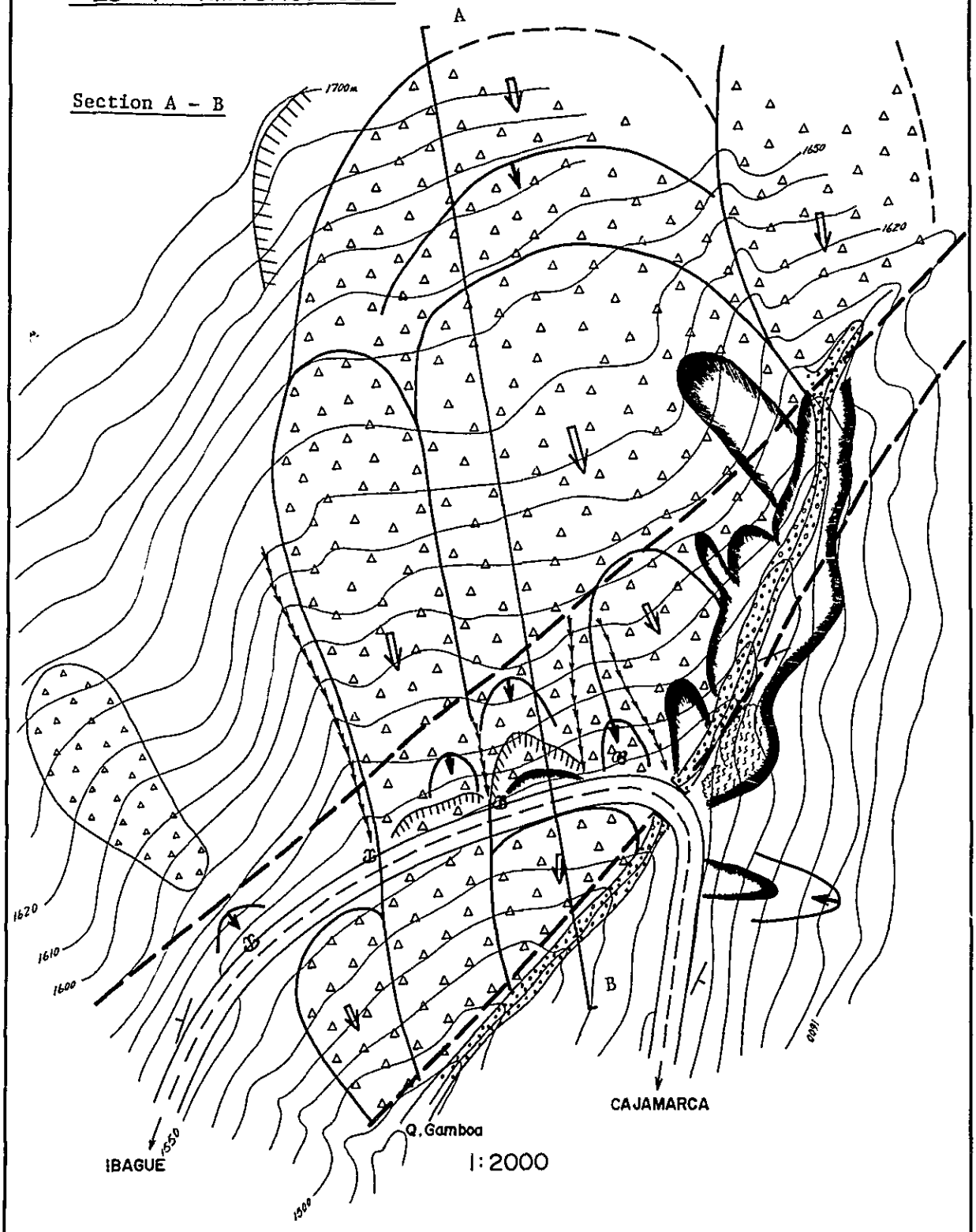


Section A - A'

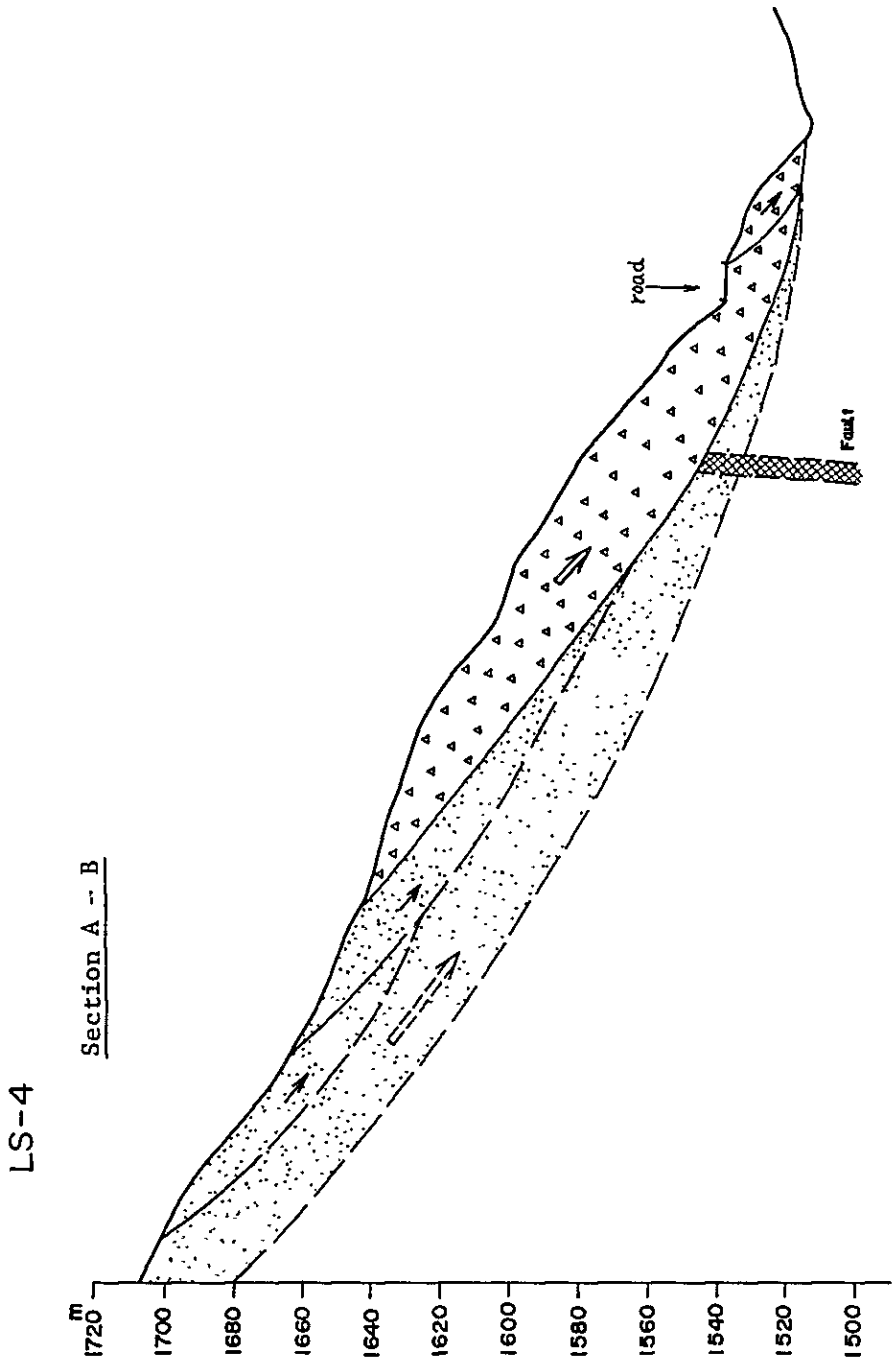
1:2000

Annex Fig. 6-5 Plan & Cross Section of Critical Landslide Area

LS-4 Km 75.400-505

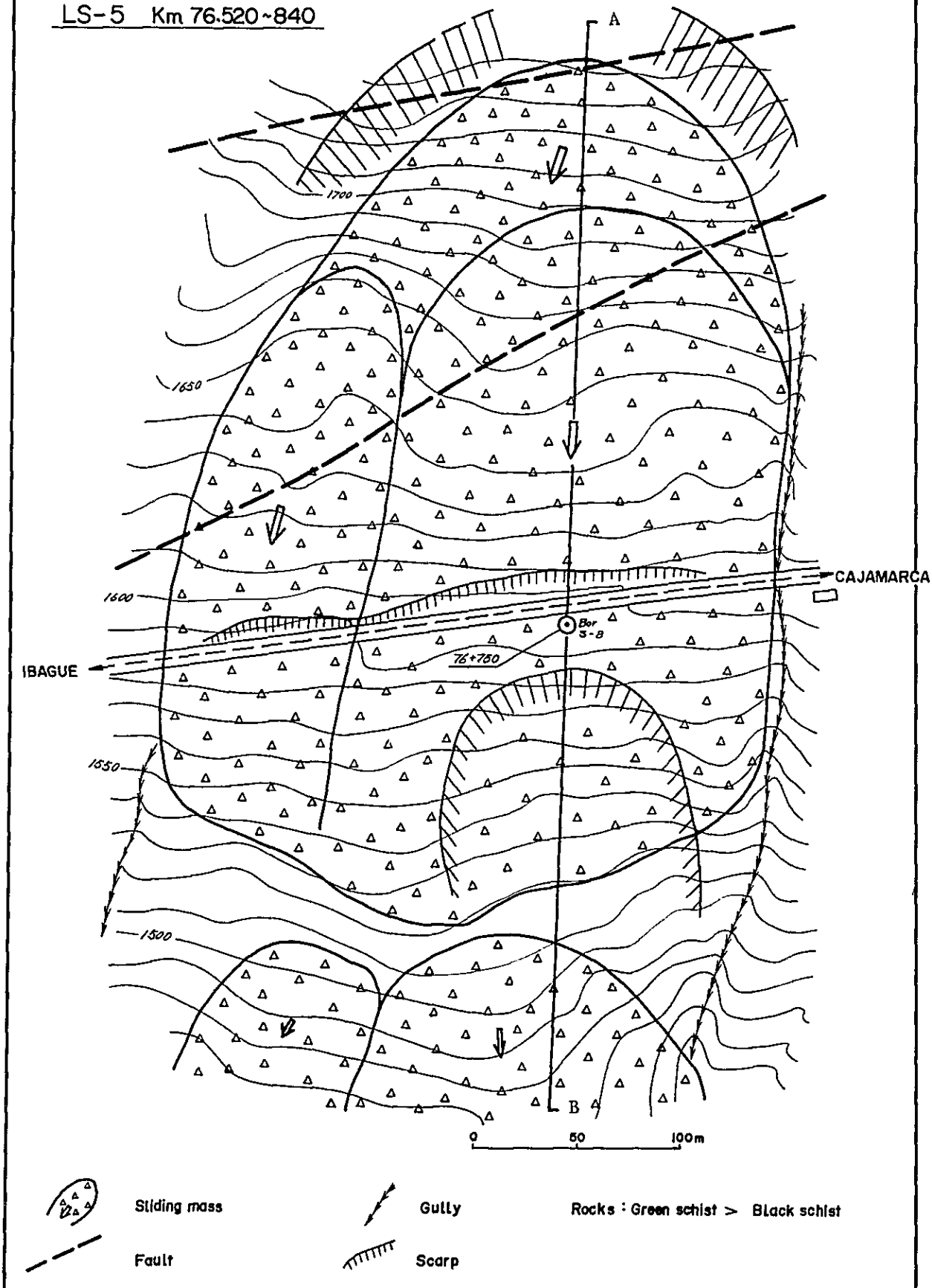


Annex Fig. 6 – 5 Plan & Cross Section of Critical Landslide Area

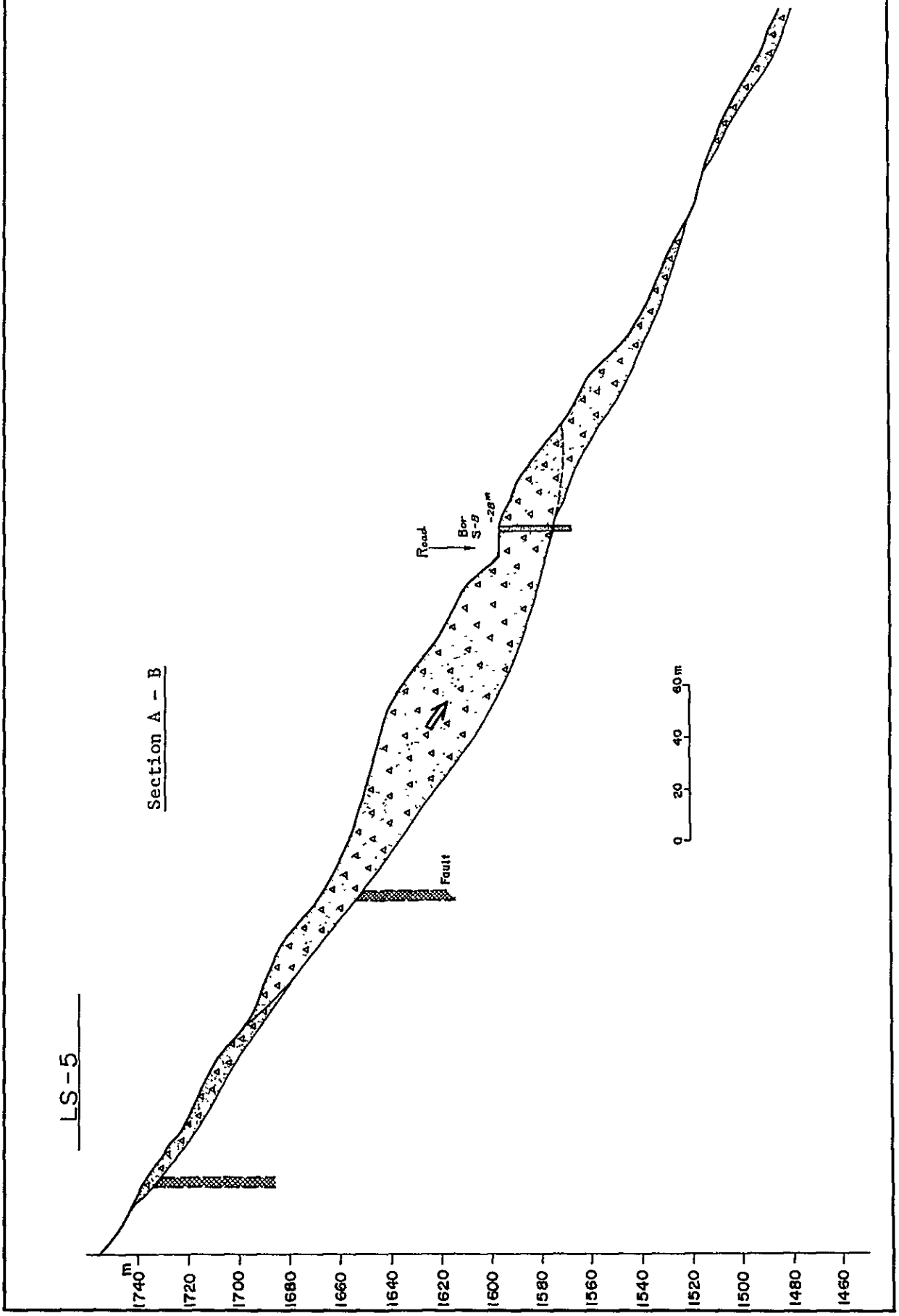


Annex Fig. 6-6 Plan & Cross Section of Critical Landslide Area

LS-5 Km 76.520~840

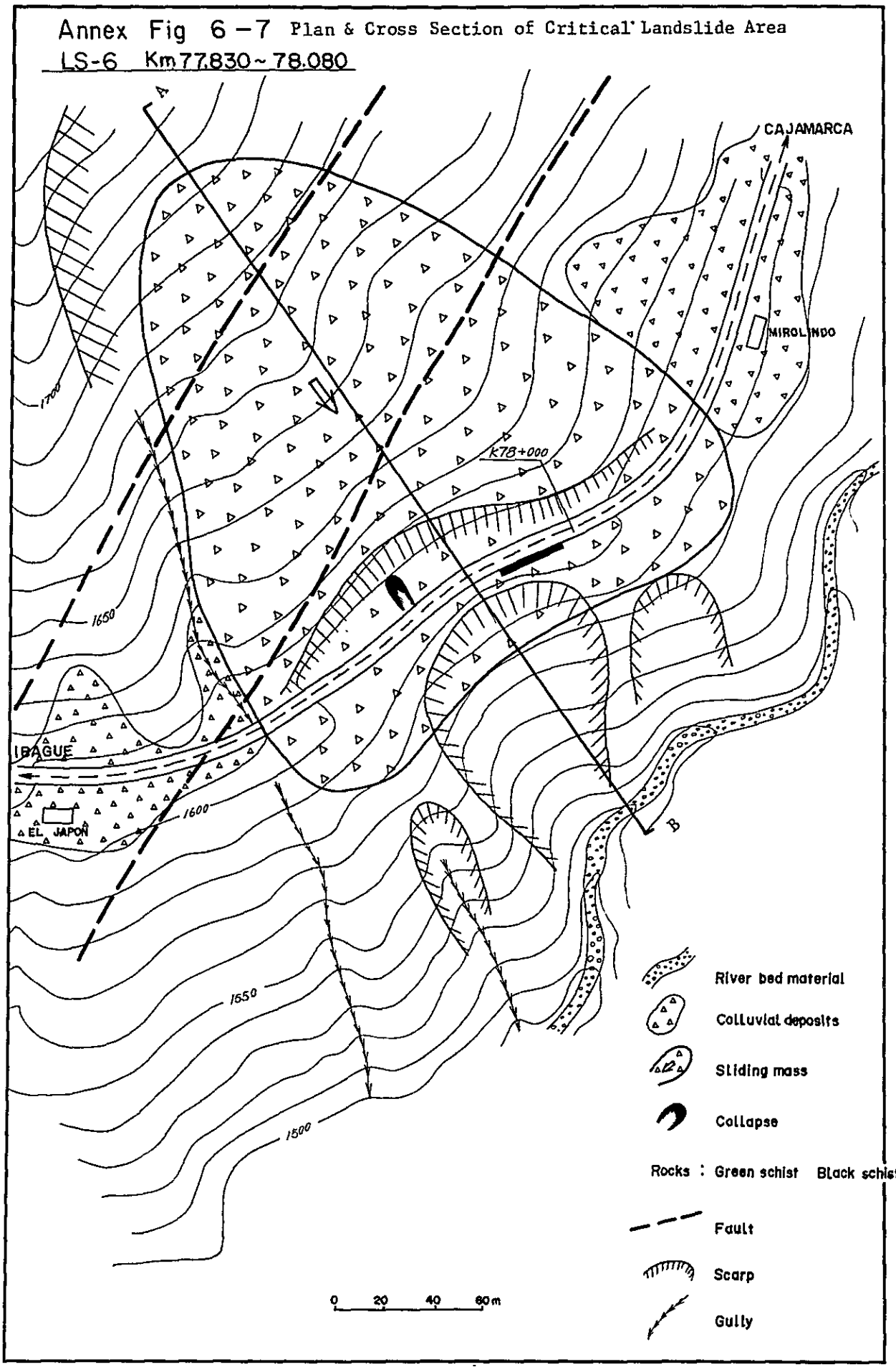


Annex Fig 6—6 Plan & Cross Section of Critical Landslide Area

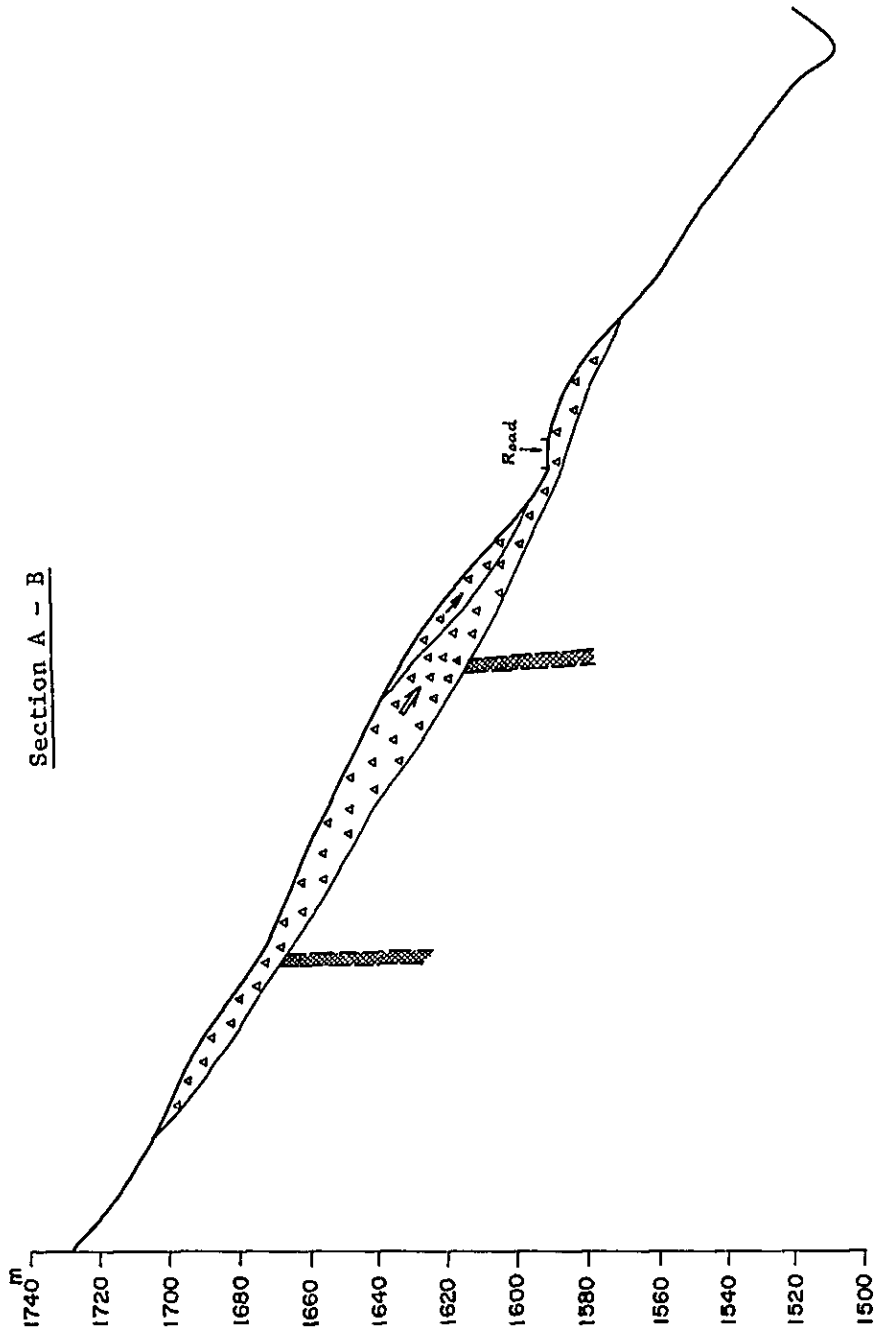


Annex Fig 6 – 7 Plan & Cross Section of Critical Landslide Area

LS-6 Km 77.830 ~ 78.080



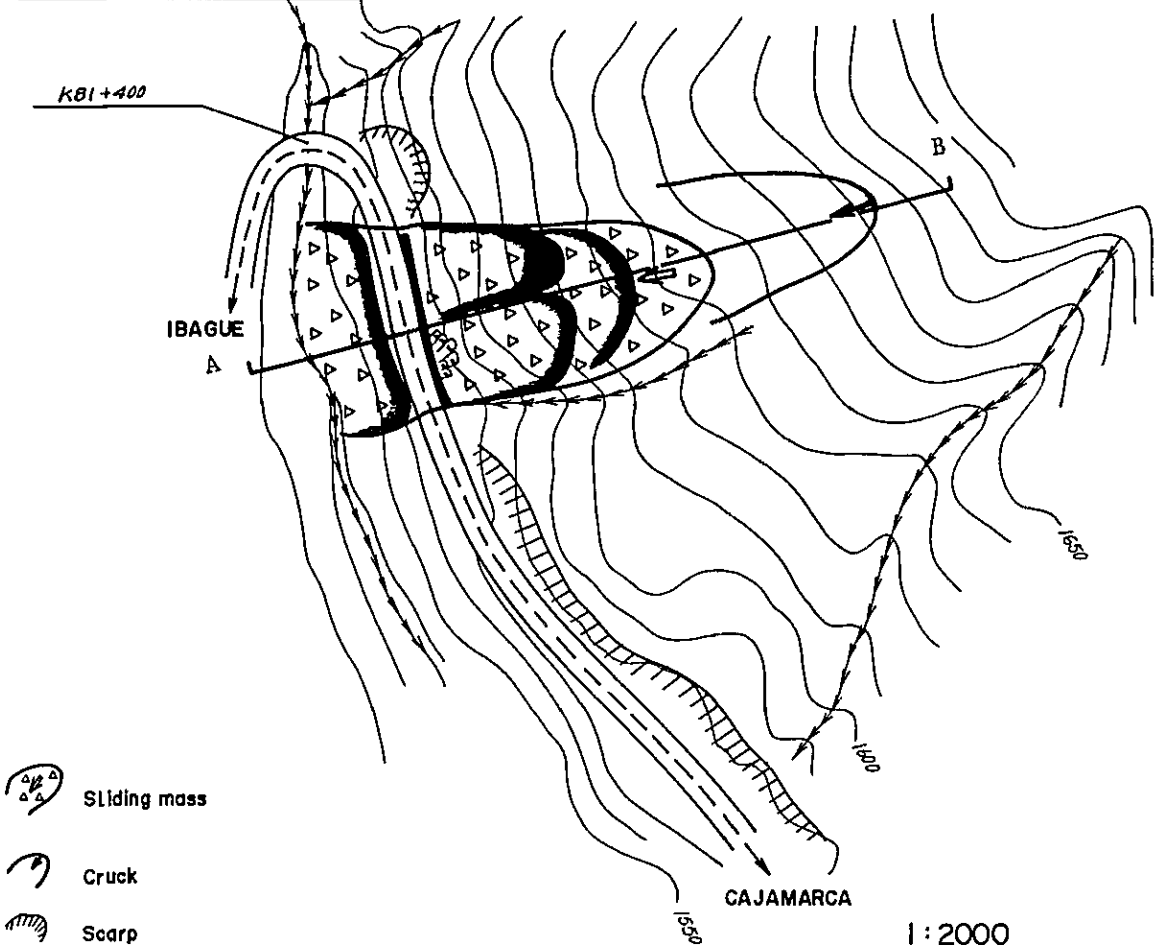
Annex Fig. 6-7 Plan & Cross Section of Critical Landslide Area



LS-6

Annex Fig. 6 – 8 Plan & Cross Section of Critical Landslide Area

LS-7 Km 81.430~500



Sliding mass

Cruck

Scarp

Collapse

Gully

Rocks : Green schist

Retaining wall