

CHAPTER 9

ECONOMIC EVALUATION

Chapter 9 Economic Evaluation

9-1 General

9-1-1 Subject for Economic Study

The economic evaluation was carried out to assess the possibility of the new road to be constructed from Melgar to Buga, considering the traffic demand through to the year 2010.

A lowest cost alternative program was examined through the benefit-cost analysis, since almost the same benefits are forecasted against the alternatives. (Chaparral Route is selected for economic assessment.)

9-1-2 Unquantified Benefits and Costs

Some elements are difficult to measure in terms of monetary costs, whereas others are difficult to measure due to lack of supporting information.

Since records of slope failure of the past are not available and the studies on geological and soil features are only preliminary in nature, the benefits due to the suspension of existing road by slope failure are excluded.

Further, the benefits of the development by road construction are also excluded as the basic data to estimate the benefits, such as agricultural potential, its developing plans, migration plan and other, are scarce.

Time saving benefits are ignored due to the following reasons.

- Time saving benefit is difficult to measure in terms of monetary cost.
- Urban traffic congestion of Girardot, Espinal and Ibagu  will be on a detour course by constructing of bypasses till the completion of the new road.

Reduction of accident costs are also not considered due to lack of information.

9-1-3 Alternative Plans of the New Road

Three alternative plans of the new road route which are shown in Fig. 7-2 are here investigated.

The alignments of these alternatives are designed to follow the existing road alignment as lengthy as possible.

Details are shown in Table 7-4.

9-2 Benefits

9-2-1 Vehicle Operation Cost

The vehicle operating cost (VOC) has been calculated for the traffic level of the year 1990, 2000 and 2010. It is composed of the cost of; fuel, oil, tyres, maintenance, depreciation and overhead costs, including driver's wages converted to the cost basis of 1 Km.

The vehicle operating cost has been so calculated for the cases of the existing road, that is, with and without the Project, and the new road in due consideration of the traffic volume and related road gradients.

The results of the VOC analysis are summarized in Table 9-1. The details of this analysis are summarized in Annex 9 of this volume.

9-2-2 Estimate of the Traffic Cost

The traffic costs of each route are the total vehicle operating costs as based on the sub-sections (existing road 13, and new road 14 of sub-sections), calculated with their average gradient and road length. The result are shown in Annex Table 9-1, 9-2, and 9-3 of this volume.

9-2-3 Benefits

The benefits of the Project in this study are measured in the following categories.

- Traffic Diversion Benefit

The savings in the cost of traffic by the diversion of traffic resulting from the Project. The traffic cost of the existing road (with and without the Project), and the new road are calculated for the year of 1990, 2000 and 2010, shown in Table 9-2.

The difference between the cost of existing road without the Project and the costs of the existing road with the Project, and the new road offers benefits from the diversion of traffic.

- Road Length Reduction Benefit

The saving of traffic cost by road length reduction

Km 133-Castilla	52.8Km x 15 veh/day in 1980
Km 133-Guamo	26.7Km x 6 veh/day in 1980

Table 9-1 Economic Vehicle Operating Cost (\$/Km)

in 1980 prices of The Colombian Pesos

Year	Road Gr. (%)	Existing Road without Project				Existing Road with Project				New Road			
		Pass.Car	Bus	Truck	Trailer	Pass.Car	Bus	Truck	Trailer	Pass.Car	Bus	Truck	Trailer
1990	1.0	10.861	20.472	22.252	40.945	10.911	20.463	22.254	40.945	11.018	21.664	23.529	42.960
	3.0	12.283	24.330	26.372	48.446	12.129	24.165	26.276	48.609	12.050	23.990	26.036	48.173
	5.0	13.405	26.923	29.266	53.423	12.710	26.313	28.551	53.423	12.710	26.313	28.551	53.423
	7.0	14.095	29.560	31.512	59.898	13.245	28.124	31.146	59.043	13.245	28.124	31.146	59.043
	9.0	15.087	33.230	34.455	65.218	13.822	31.968	34.024	65.218	13.822	31.968	34.024	65.218
2000	1.0	10.815	19.880	21.943	39.114	10.821	19.880	21.943	39.114	10.911	21.054	23.272	42.960
	3.0	12.643	24.697	26.468	48.854	12.248	24.322	26.372	48.609	12.050	23.990	26.036	48.173
	5.0	13.771	27.555	29.508	53.423	13.423	26.923	28.551	53.423	12.710	26.313	28.551	53.423
	7.0	15.000	30.723	31.892	60.840	14.112	29.182	31.512	59.043	13.929	29.182	31.146	59.043
	9.0	16.039	34.751	34.904	66.417	15.087	33.284	34.455	65.218	14.615	32.939	34.024	65.218
2010	1.0	10.793	19.386	21.641	38.196	10.508	19.323	21.641	38.522	10.861	20.463	22.871	40.538
	3.0	12.961	24.889	26.487	48.854	12.651	24.712	26.468	48.854	12.215	24.322	26.036	48.499
	5.0	14.478	28.179	29.704	53.959	13.922	27.555	29.266	53.423	13.268	27.123	29.266	53.423
	7.0	15.787	31.565	32.257	60.840	14.808	30.388	31.892	59.043	14.625	30.331	31.512	59.043
	9.0	16.901	35.558	35.369	66.334	16.039	34.358	34.904	65.218	15.290	33.351	34.455	65.218

Table 9-2 Traffic Cost

Year	Traffic Cost			in million pesos/day	
	Existing Road		New Road	Traffic Cost Saving	Benefit by Road Length Reduction
	w/o Project	with Project			
1990	32.611	23.928	7.653	1.030	0.033
2000	53.326	38.940	12.397	1.989	0.052
2010	87.190	63.574	20.367	3.249	0.084

- Existing Traffic Benefit

The savings in the traffic costs by up-grading the road pavement from gravel to asphalt concrete.

Vehicle operating costs of gravel roads are assumed to be 20 per cent higher than that of asphalt concrete paved road.

Existing traffic benefits are shown in Table 9-3.

Table 9-3 Existing Traffic Benefits (Chaparral Route)

Road Section	in million pesos/year		
	1990	2000	2010
Castilla - Coyaima	11.830	19.184	30.394
Coyaima - Chaparral	16.158	25.844	42.150
Buga - Sta. Lucia	4.067	6.734	11.162

9-2-4 Residual Value of Project Road

The residual value of the Project Road is estimated to be the construction cost of the similar role road of which the Project Road will contribute to at the end of Project Life, that is, if supposing the up-grading of the Project Road or the new road construction will be completed.

The road capacity of the Project Road at the year 2010, the last year of Project Life, thus are only partly less than the estimated traffic demand forecasted from Castilla to Buga.

Therefore, it is not necessary to increase the road capacity immediately after the year 2010, but within five years after, the road capacity will be required to be increased.

Large parts of the new road will be difficult to widen because of the layout of the site conditions. The another route section is recommended from the engineering and economic point of view.

The geometric structure of the new road is considered to be a very critical one, and thus, it is concluded that the construction costs of a similar road is to be equally worth to the present cost of the Project road when construction of another new road starts from the year 2011.

9-3 Costs

The economic cost is studied in terms of the prices in June/July 1980. Costs of southern route. (Chaparral Route) are summarized in Table 9-4.

Details of the cost study are presented in Chapter 8.

The work schedule is developed by considering the total quantities.

A detailed engineering study is scheduled for 1984, and construction is scheduled to be commenced thereafter for completion by 1990. (referring Fig.8-1)

Table 9-4 Construction Cost (Chaparral Route)

million Pesos

Items	Foreign Currency	Local Currency	Tax	Total
Direct Cost	2,424.8	2,348.0	523.4	5,296.1
Overhead, Profit, Supervision, and Contingency	3,981.7	2,997.9	666.7	7,646.3
Detailed Eng.	276.7	69.2	18.2	364.1
Total	4,258.4	4,900.3	798.5	8,010.4
Land Acquisition		372.0		
Financial Cost = 8,382.4 million pesos				
Economic Cost = 7,325.5 million pesos				

9-4 Benefit/Cost Calculation

The Benefit/Cost calculation are conducted primarily to evaluate the viability of Chaparral route. The resultant figures are shown below.

P.W. Cost (i=12%)	\$4,697.2 million at 1984
P.W. Benefit (i=12%)	\$2,905.0 million
P.W. B-C (i=12%)	\$-1,792.2 million
B/C	0.62
IRR	7.9%

The results are considered to be drawn from the following reasons.

- (1) The traffic capacity of the existing road will be adequate for the level of forecasted traffic of 1991, the first year of the Project, and will be at its maximum capacity in the year 2000.
- (2) Development benefits are excluded. One of the characteristics of this Project is a pilot road construction into the undeveloped area, thus it is reasonable to evaluate the developing effects.
- (3) The benefits from the existing road closure by slope failures are excluded.

In the section of the existing road between Ibague and Calarca, the road closures have happened frequently due to the slope failures and sometimes there need several days to reopen the road for the traffic flow.
- (4) The construction cost seems to be estimated at higher level comparing the actual contract cost of MOPT, as described in the following paragraph of sensitivity analysis.

9-5 Sensitivity Analysis

9-5-1 Introduction

Forecasts are inherently subject to error, sometimes by wide margins in either direction. It is therefore useful to analyze what impact changes in various assumptions would have on the forecast results.

Fig. 9-1, to 9-2 provide the results of sensitivity analysis in both explicit and implicit forecast assumption.

9-5-2 Road User Benefits.

Fig.9-1 shows the sensitivity of changes in the variable affecting road user benefits. Traffic volume index represents the starting point of the projections. (1.00 at 1991) Projected traffic index is a composite of the projected growth rate of the traffic over 20 years. Road user saving index is a composite of the savings of road user, and is determined by the factors of traffic diversion rate or vehicle operating cost.

9-5-3 Construction Cost

Of the direct cost of the Project, more than 50 percent is the cost of earth work. (See Table 8-5) The unit cost or the volume of the excavation, therefore, has great affect on the construction cost.

Based on the MOPT past contract cost data, the construction cost per unit road length are those in Table 9-5.

Table 9-5 Construction Cost per Km by MOPT in 1980 prices

Area Condition	Gradient	Million Pesos/Km
Flat	0 - 2 %	14.3
Rolling	2 - 4	19.0
Mountain	4 - 7	24.5
Steep Mountain	7 -	30.0

Note; 1) Direct Cost with Overhead and Profit

2) Excludes the cost of bridges and tunnels.

Using above cost data, the construction cost of the Project is estimated in Annex Table 9-31 and is about 30% less than the cost shown in Table 8-5.

Although the construction cost based on MOPT data would not be considered to represent the real economic cost of the Project, it seems to have the possibility to reduce the estimated construction cost of the Project.

Fig.9-2 shows the sensitivity of changes in the construction cost on benefit-cost ratio.

9-5-4 Unquantified Benefits

The benefits of development of the influence area and the existing road closure by slope failure are excluded from the benefits as the unquantified because of the uncertainness of supporting information.

But, these benefits are very important upon the economic analysis considering the purposes or properties of this Project. Then, it is required to study the exact status of these aspects for the Project execution.

Fig.9-2 shows the sensitivity of changes in the benefits on benefit-cost ratio.

9-6 Conclusion

Economic evaluation indicates that the Project of the new road construction from Melgar to Buga has not adequate economic efficiency because of the exclusion of the benefits from such as development of influence area or road closure by slope failure of the existing road.

B/C (i=12%)	0.62
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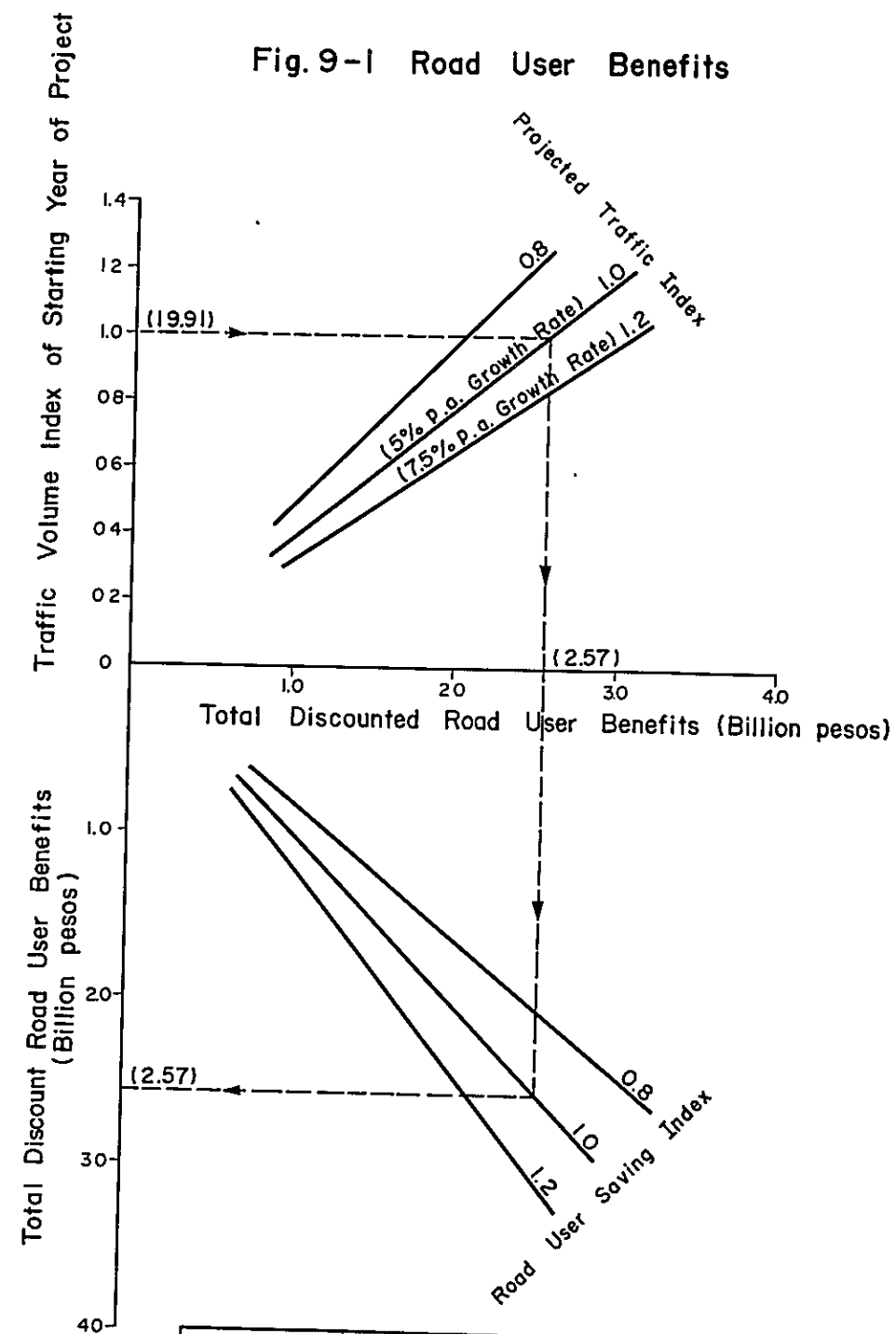
IRR	7.9%
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But, as described in the sensitivity analysis of paragraph 9-5, the construction cost would be less and the benefit higher with consideration of the benefits of development of influence area or existing road closure.

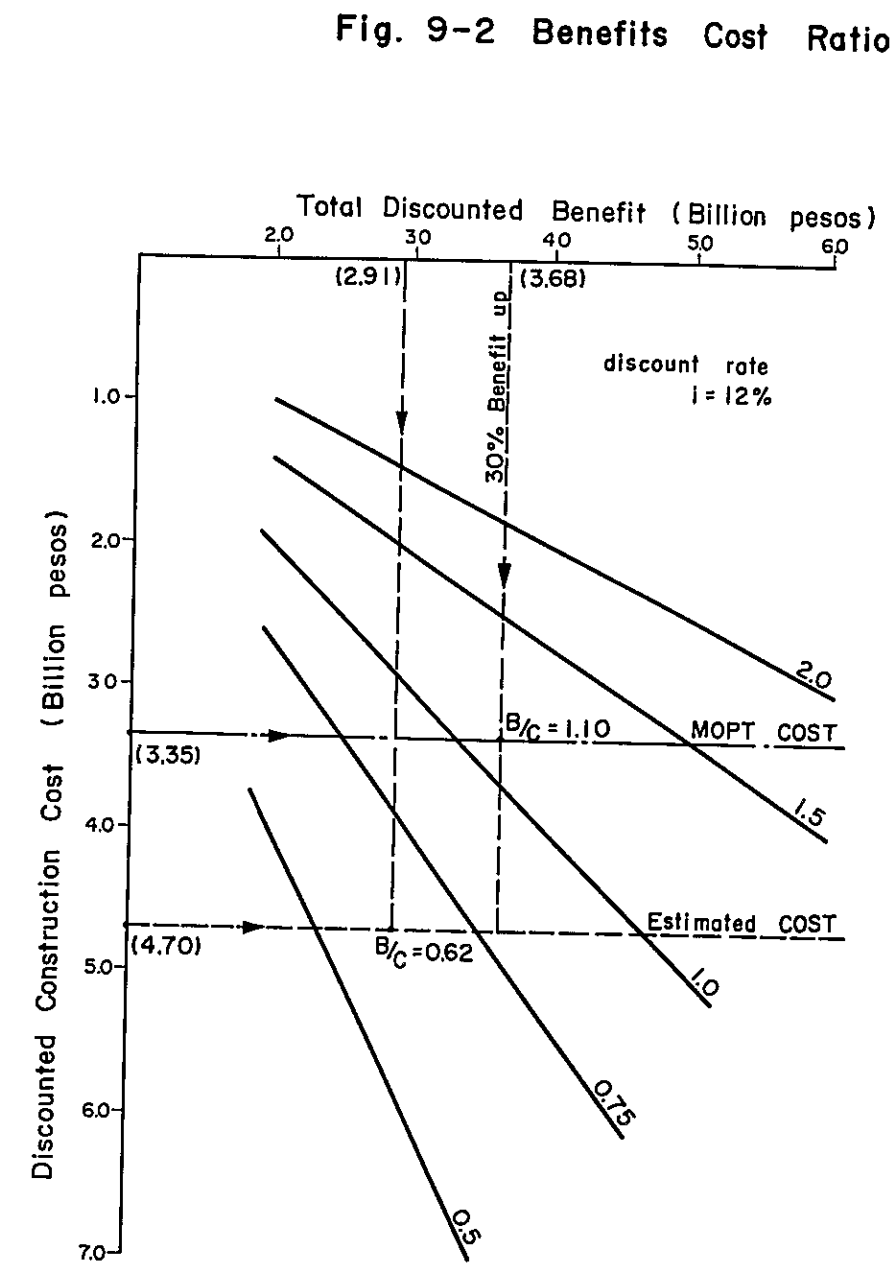
Therefore, resultant figures of economic evaluation are to be more large than those shown above.

Moreover, from such view points as the existing road supplement and national policy of rural area development, it is worthwhile to construct the new road.

It is recommended, therefore, for the economic feasibility of the new road construction to establish the developing plans of the Project Area, or to assess the probability of slope failure and its extents.



Item	% of User Benefits
Traffic Existing	9.7
Diverted	90.3
	<hr/> 100.0



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Annex Table 4-1 Average Vehicle Speed with Project on Existing Road
(0% Diversion)

Road Section	1990				2000				2010			
	Pass.Car	Bus	L.Truck	H.Truck	Pass.Car	Bus	L.Truck	H.Truck	Pass.Car	Bus	L.Truck	H.Truck
Bypass-Mirolindo	56	54	51	43	52	52	50	41	50	50	49	39
Mirolindo-Ibague	52	49	44	36	52	49	44	36	49	47	42	34
Ibague-Coello	34	32	26	22	29	27	25	21	25	25	24	21
Coello-K73	34	32	26	22	29	27	25	21	25	25	24	21
K73-Cajamarca	35	33	27	22	30	28	26	22	26	26	25	21
Cajamarca-Kl04.3	36	34	28	23	33	31	27	23	28	28	26	22
Kl04.3-La Línea	27	25	22	16	23	22	21	15	20	20	20	15
La Línea-Kl24.5	25	24	20	14	21	20	19	13	18	18	18	13
Kl24.5-Calarca	29	26	23	17	24	23	22	16	21	21	21	16
Calarca-LaEspañola	58	27	55	46	55	53	53	46	51	51	51	44
La-Española-Sevilla	45	41	36	31	39	37	35	29	36	35	34	29
Sevilla-Urbe	40	39	32	28	37	35	31	28	33	32	30	27
Urbe-Buga	63	63	61	51	61	61	60	48	59	59	59	46

Annex Table 4-2 Average Vehicle Speed on New Road (km/h) (0% Diversion)

Road Section	1990				2000				2010			
	Pass.Car	Bur	L.Truck	H.Truck	Pass.Car	Bus	L.Truck	H.Truck	Pass.Car	Bus	L.Truck	H.Truck
Bypass-Espinal	65	65	63	51	63	63	61	51	61	61	60	51
Espinal-Guamo	68	67	65	54	65	65	64	54	63	63	63	50
Guamo-Castilla	68	68	66	54	65	65	65	54	63	63	63	50
Castilla-Coyaima	74	74	69	59	74	74	69	59	74	74	69	59
Cayaima-Chaparral	59	54	51	41	59	54	51	41	59	54	51	41
Chaparral-Km 66.75	45	42	35	29	45	42	35	29	45	42	35	29
Km 66.75-Hermozas	43	41	34	28	43	41	34	28	43	41	34	28
Hermozas-Km 105.75	37	34	27	21	37	34	27	21	37	34	27	21
Km 105.75-Km 120.25	36	33	26	20	36	33	26	20	36	33	26	20
Km 120.25-Sta.Lucia	38	35	28	22	38	35	28	22	38	35	28	22
Sta.Lucia-Km 149	34	31	24	17	34	31	24	17	34	31	24	17
Km 149-Nogales	36	33	26	20	36	33	26	20	36	33	26	20
Nogales-D.Diluvio	38	35	29	22	38	35	29	22	38	35	29	22
D.Diluvio-Buga	38	35	29	22	38	35	29	22	38	35	29	22

Annex Table 4-3 Average Vehicle Speed with Project on Existing Road (50% Diversion)

Road Section	1990				2000				2010			
	Pass.Car	Bus	L.Truck	H.Truck	Pass.Car	Bus	L.Truck	H.Truck	Pass.Car	Bus	L.Truck	H.Truck
Bypass-Mirolindo	56	54	51	43	52	52	50	41	50	50	49	39
Mirolindo-Ibague	52	49	44	36	52	49	44	36	49	47	42	34
Ibague-Coello	35	32	26	22	32	29	25	22	27	26	24	21
Coello-K 73	35	32	26	22	32	29	25	22	27	26	24	21
K 73-Cajamarea	35	33	27	22	30	28	26	22	26	26	25	22
Cajamarca-K 104.3	37	34	29	23	34	31	28	23	29	28	27	23
K 104.3-La Línea	27	25	22	16	23	22	21	16	20	20	20	15
La Línea-K 124.5	25	24	20	14	21	21	19	14	18	18	18	13
K 124.5-Calarca	29	27	23	17	25	24	22	17	22	22	22	16
Colarca-La Espanola	59	57	55	46	56	55	53	46	52	52	52	46
La Espanola-Sevilla	45	41	36	31	41	38	35	31	36	35	34	29
Sevilla-Urbe	41	39	32	28	39	36	31	28	34	33	30	27
Uribe-Buga	65	63	61	51	62	61	60	48	59	59	59	46

Annex Table 4-4 Average Vehicle Speed on New Road (km/h) (50% Diversion)

Road Section	1990			2000			2010			
	Pass.Car	Bus	L.Truck H.Truck	Pass Car	Bus	L.Truck H.Truck	Pass.Car	Bus	L.Truck H.Truck	
Bypass-Espinal	66	65	63	51	63	62	62	61	61	48
Espinal-Guamo	68	67	65	54	64	64	64	62	62	50
Guamo-Castilla	68	68	66	54	65	65	65	63	63	51
Castilla-Coyaima	74	74	69	59	74	74	69	74	74	59
Coyaima-Chaparral	59	54	51	41	59	54	51	59	54	41
Chaparral-Km 66.75	45	42	35	29	45	42	35	45	42	29
Km 66.75-Hermozas	43	41	34	28	43	41	34	43	41	28
Hermozas-Km 105.75	37	34	27	21	37	34	27	37	34	21
Km 105.75-Km 120.25	36	33	26	20	36	33	26	36	33	20
Km 120.25-Sta.Lucia	38	35	28	22	38	35	28	38	35	22
Sta.Lucia-Km 149	34	31	24	17	34	31	24	34	31	17
Km 149-Nogales	36	33	26	20	36	33	26	36	33	20
Nogales-D.Diluvio	38	35	29	22	38	35	29	38	35	22
D.Diluvio-Buga	38	35	29	22	38	35	29	38	35	22

Annex 7-1 The Determination of Typical Cross Section

To minimize the construction cost of the new Melgar-Buga Road, more economical road width is discussed by the Report¹⁾.

(1) Assumptions

a. Road conditions

1. 2 lane road with two direction traffic
2. Mixed traffic and Located at altitude 3,000 meter with vertical gradient 7.5%.

b. Traffic volume

1. 893 VPD in 1980
2. 1,370 VPD in 1991
3. 3,820 VPD in 2010

c. Peak Traffic

1. Peak hour ratio 7%
2. Peak traffic volume in 2010 (Traffic demand) 270/hr

d. Design service level in the Final year = C

(2) Analysis

From Fig. 4 and 16 of the above report

$$C_c = 440 \text{ vehicles/hr}$$

The following equation is established:

$$C_c \times \underline{W} = \text{Traffic Demand}$$

$$\text{where, required modification factor } \underline{W} = \frac{\text{Traffic Demand}}{C_c} = \frac{270}{440} = 0.61$$

From Table-III of the above Report, the following alternatives are considered for service level C and obstructions on both sides.

$$2 \text{ lane} \times 3.60\text{m} + 0.00\text{m shoulder} = 7.20\text{m (a)}$$

$$\underline{W} = 0.76$$

$$2 \text{ lane} \times 3.30\text{m} + 0.00\text{m shoulder} = 6.60\text{m (b)}$$

$$\underline{W} = 0.67$$

$$2 \text{ lane} \times 3.00\text{m} + 0.00\text{m shoulder} = 6.00\text{m (c)}$$

$$\underline{W} = 0.62$$

1) Luis Holguin: Conceptos de Diseño y de Nivel de Servicio y Evaluación de la Capacidad en Carreteras de Montana.

As far as the traffic capacity is concerned, (c) is good. However, from the view point of much more heavy traffic on the new road, 3.00 meter width for one lane is too narrow. Consequently 3.30m lane width of (b) is selected as an appropriate plan. Other elements composed of road width are decided from the experience as follows.

Paved lane	$3.30 \times 2 = 6.60\text{m}$
Shoulder	0m
Side ditch or Gutter	
at mountain side	1.00m
at Valley side	0.60m
Shoulder (extra)	0.60m
<hr/>	
Total	8.80m

Annex 7-2 Pavement Design Procedure

7-2-1 Pavement Design for New Construction

The design criteria to be followed are those described in the Asphalt Institute Manual Series (MS-1)
Given Initial Daily Traffic (IDT) is 893 vehicles per day in 1980.

Assume annual growth rate = 5%

IDT = 1,370 in 1990

$$\text{Number of Heavy Trucks} = 1,370 \times \frac{50}{100} \times \frac{50}{100} = 340$$

Average Gross weight = 26,000 lbs.

Single Axle Equivalent = 18,000 lbs.

a) CBR = 6%

b) ITN = 135 (Initial Traffic Number)

c) DTN = 135 x 1.67 = 226 (Design Traffic Number)

(By Interpolation from Table III-3)¹⁾

d) TA = 9.0 inches Thickness of asphalt concrete (from Fig. V-1)²⁾

e) Minimum thickness of asphalt concrete is considered to be 3 inches.

$$9.0 - 3.0 = 6.0 \text{ inches}$$

f) 6.0 inches is substituted by granular base

$$3.0 \text{ inches} \times 2.0^* = 6.0 \text{ inches say 15cm Base}$$

$$3.0 \text{ inches} \times 2.7^* = 8.0 \text{ inches say 20cm Subbase}$$

* Substitution Factor from Design Manual (MS-1)

g) Stage Construction

At the first stage, 2 inches (5cm) thickness of asphalt concrete is paved.

$$TA_1 = 8.0 \text{ inches}$$

$$DTN = 60 \text{ (from Fig. V-1)}^{2)}$$

$$\text{Adjustment Factor} = \frac{60}{135} = 0.45$$

Adjustment Factor 0.45 indicates 9 years of Design Period from Table III-3.¹⁾

At the second stage additional 1.0 inch (2.5cm) thickness of asphalt concrete should be added after 9 years.

The advantages of stage construction include more accurate analysis of traffic, and probably, more effective use of funds.

Note: 1) Table III-3 of Asphalt Institute Manual Series (MS-1)

2) Fig. V-1 of Asphalt Institute Manual Series (MS-1)

7-2-2 Pavement Design for Gravel Road Improvement

Traffic condition is the same as above.

- a) CBR = 6%
- b) ITN = 135 (Initial Traffic Number)
- c) DTN = 226 (Design Traffic Number)
- d) TA = 9.0 inches Thickness of asphalt concrete
- e) Assume the minimum thickness of asphalt concrete is 2.0 inches, which is suggested for new road construction.

$$9.0 - 2.0 = 7.0 \text{ inches}$$

- f) 7.0 inches is substituted by granular base.

$$4.0 \text{ inches} \times 2.0^* = 8.0 \text{ inches} \quad \text{say 20cm Base}$$

$$3.0 \text{ inches} \times 2.7^* = 8.0 \text{ inches} \quad \text{say 20cm Subbase}$$

Where, existing gravel thickness can be substituted for Subbase course.

* Substitution Factor for Design Manual.

Annex 7-3 Structure Type Determination Procedure

Discharge at river-crossing or stream crossing sites along the alternatives is calculated by the following Rational Formula.

$$Q = \frac{1}{3.6} \times C \times i \times A \text{ (m}^3\text{/S)}$$

where Q : Discharge (m³/S)

C : Runoff coefficient (0.85)

i : Rainfall intensity (75 mm/hr) for 50 years return period

A : Catchment Area (km²)

Five types of Bridges and two types of Culvert Boxes are selected to deal with estimated discharge as shown in Annex Table 7-1.

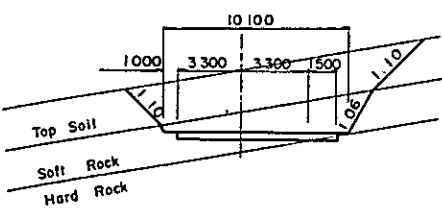
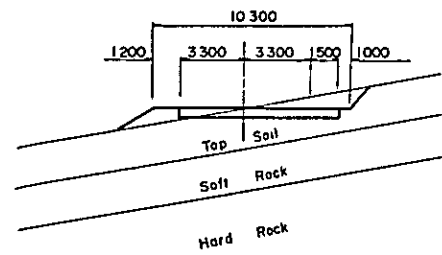
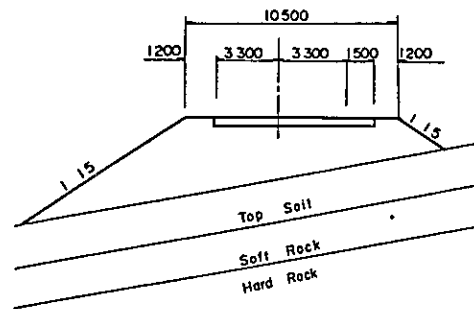
Forty meter span bridge is regarded as the longest one in the project area from the reasons described in Paragraph 5-2-3.

The relation between the structure type, permissible discharge and catchment area is given in Annex Table 7-1.

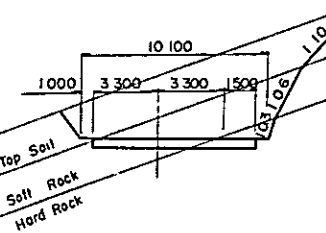
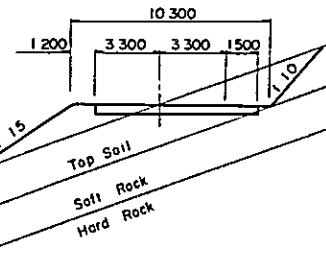
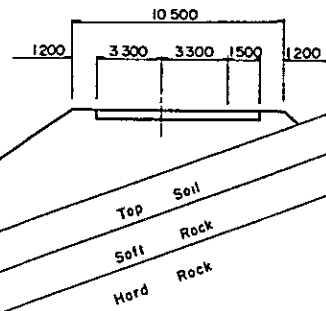
The structure type depends on the catchment area measured by the topographical map with a scale of 1:25,000.

It is natural that this finding should be reviewed at the further stage study.

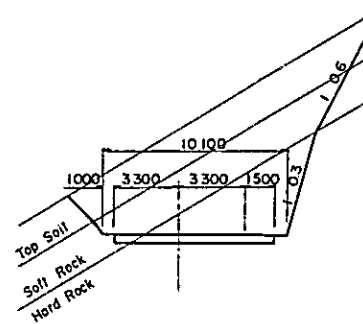
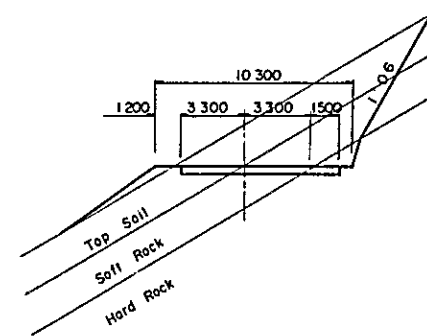
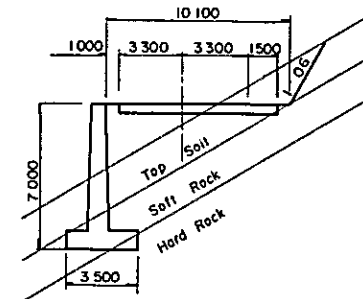
Natural Ground Slope 0°-15°



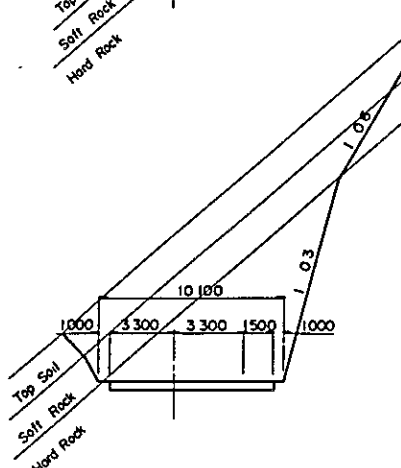
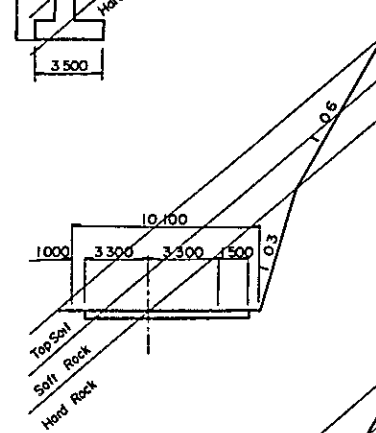
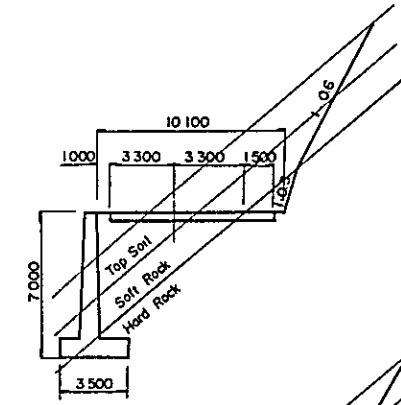
Natural Ground Slope 15°-25°



Natural Ground Slope 25°-35°



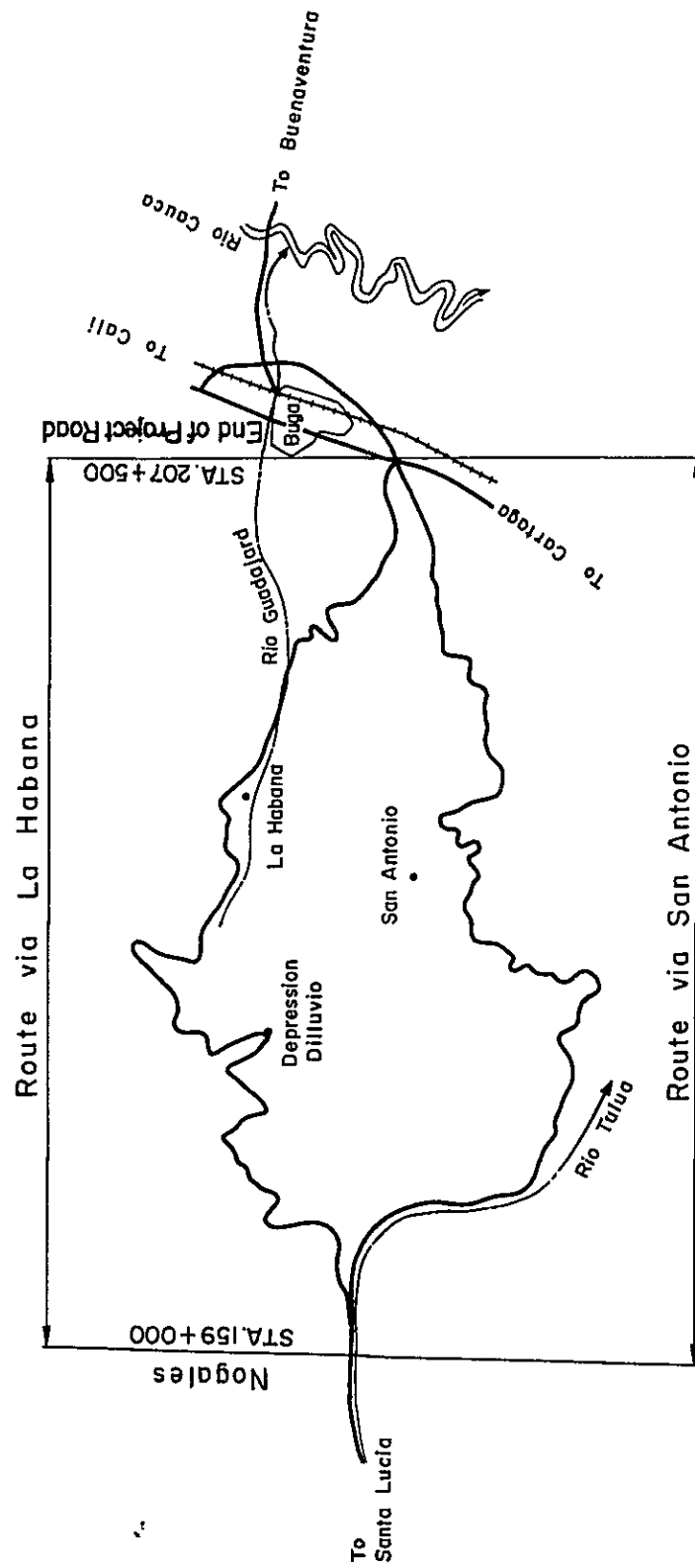
Natural Ground Slope 35°-



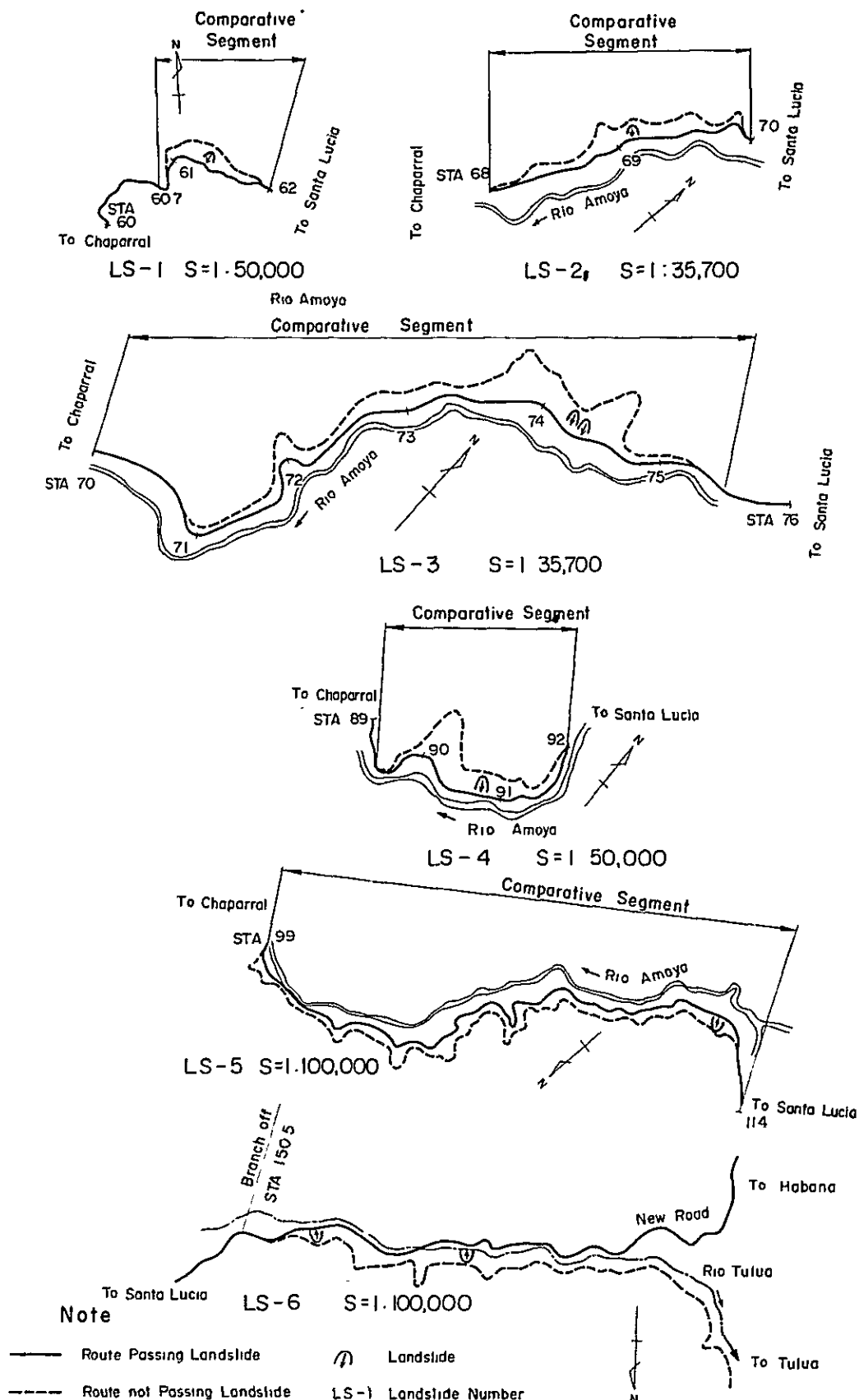
Note - Example of Rock Type "A" Top Soil - 2m thick, Soft Rock - 2m thick, Hard Rock - Not resistant to weathering

Annex Fig.7-1 Typical Cross Sections for Cost Estimate of New Road Construction

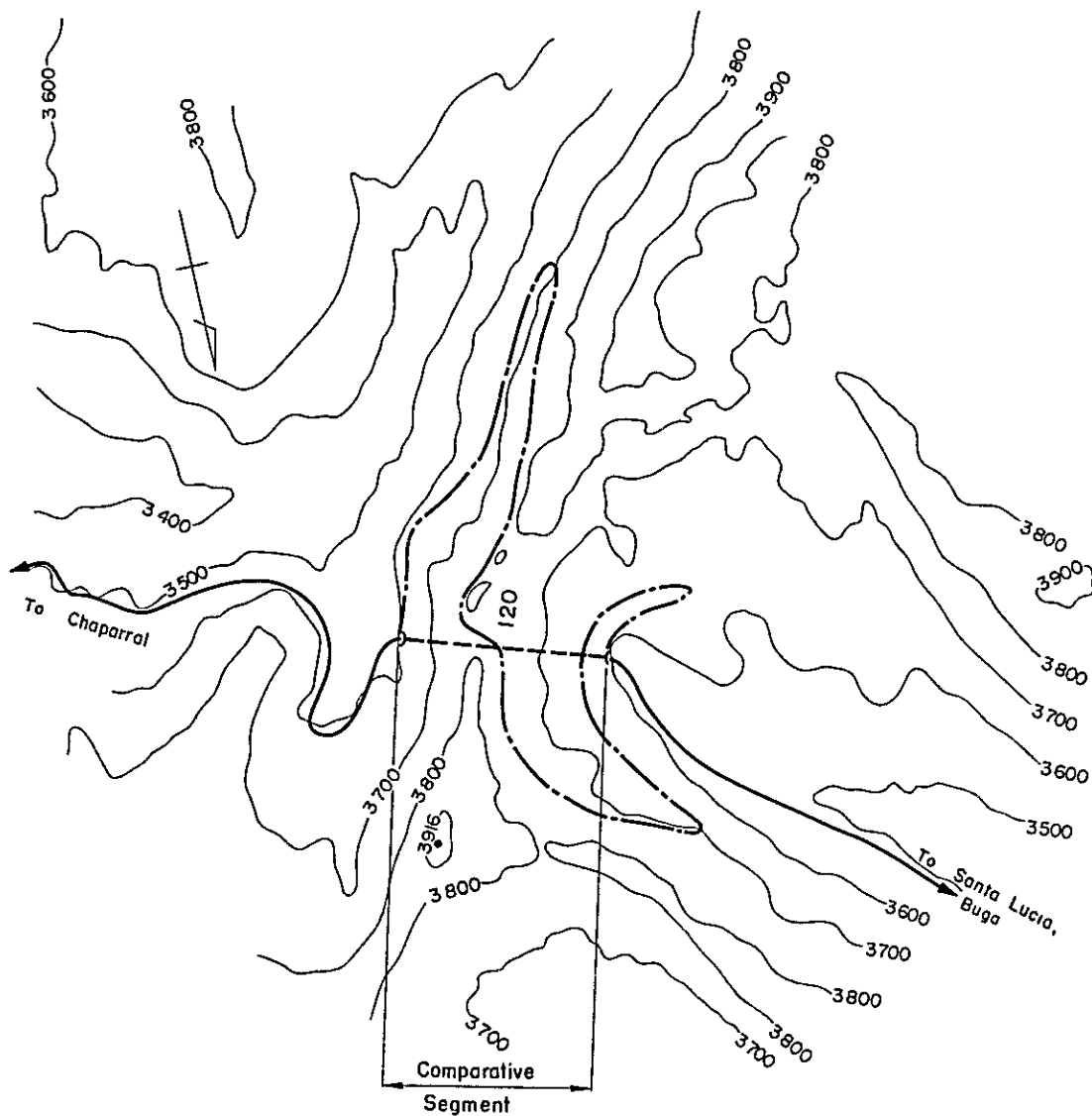
Scale 1:250



Annex. Fig. 7-2 Alternative Route Between Nogales And Buga



Annex Fig.7-3 Passing method of Landslide Areas



$S = 1 : 25,000$

Note

--- Tunnel Plan

— Road Plan

Annex Fig. 7-4 Passing Depression Los Andes

Annex Table 7-1

Permissible Discharge by Structure Type

Structure Type		(1) Catchment Area for(2)	(2) Permissible discharge	(3) Section Area for flow
Culvert Box	3.00x3.00	1.5 km ²	21.6 m ³	7.2 km ²
Culvert Box	4.50x4.00	3.0	43.2	14.4
Bridge	L=5m	4.2	61.5	20.5
	L=10m	8.0	117	39
	L=20m	13.6	198	66
	L=30m	36.4	531	177
	L=40m	49.8	726	242

Annex Table 7-2 Bridge Inventory along the Chaparral Route (Page 1)

Section (Chaparral - Sta. Lucia)

STA.	Structure type	Catchment Area (km ²)	Remarks
53 250	Br L=10	6.0	Q. El Piojo
69 800	Br L=20	8.0	Q. El Cedral
71 950	Br L=40	21.0	Q. San Jorge
78 300	Br L=30	19.4	Q.
79 450	Br L=10	4.1	Q.
87 500	Br L=20	7.0	Q. El Quebrador
90 050	Br L=20	7.0	Q. El Horizonte
92 450	Br L=30	23.0	Q. San Jose
96 000	Br L=30	18.0	Q. Alomania
99 500	Br L=40	40.0	Q.
102 400	Br L=10	3.4	Q.
104 200	Br L=30	12.0	Q.
107 400	Br L=20	9.0	Q.
116 900	Br L=5	2.6	Q.
124 800	Br L=20	9.0	Q.
140 500	Br L=10	5.5	Q. Sta. Lucia
143 250	Br L=30	12.0	Q. Yeguas
144 050	Br L=20	9.0	Q. San Fernando
150 700	Br L=10	5.5	Q.
150 850	Br L=5	2.4	Q.
155 750	Br L=40	29.0	Q. San Antonio
155 950	Br L=40	37.4	Rio Tuluá
157 150	Br L=30	16.8	Q. La Venla
161 150	Br L=5	2.3	Q. Delgaditos
165 200	Br L=40	28.2	Q. Nogales

Annex Table 7-2

Bridge Inventory along the Chaparral Route (Page 2)

STA.	Structure type	Catchment Area (km ²)	Remarks
168 400	Br L=20	9.5	Q. Nogales
179 450	Br L=10	5.0	Q. El Diluvio
183 000	Br L=10	4.0	Q. La Italia
183 250	Br L=5	3.5	Q. Los Alpes
192 950	Br L=30	23.0	Q. Magdalena
207 100	Br L=10	3.3	Q.
207 200	Br L=40	27.0	Q.
207 450	Br L=10	3.4	Q.

Annex Table 7-3 List of Specific Landslide and Countermeasures

Landslide No.	Location	Horizontal boreholes for groundwater drainage	H-beam Pile	Intercepting drain	Drainage pipe	Retaining wall
LS-1	Km 61.300	66mm ϕ Borehole 50m longx12		200m	150m	Gravity type H=4m 100m
LS-2	Km 69.100	66mm ϕ Borehole 40m longx16		300m	230m	Gravity type H=4m 150m
LS-3	Km 74.300			600m	300m	Crib type H=10m 120m
LS-4	Km 90.800	66mm ϕ Borehole 50m longx12 30m longx12		750m	300m	Gravity type H=4m 200m
LS-5	Km 112.700		H-200x200 30 pcs. 600m	500m	300m	Crib type H=10m 120m
LS-6	Km 152.200		H-200x200 40 pcs. 800m	800m	380m	Crib type H=10m 150m

Annex Table 8-1-1

Construction Quantities and Cost of Chaparral Route

<u>Castilla-Chaparral</u>				(Unit: \$'000)		
<u>Item</u>	<u>Quantity</u>	<u>Unit</u>	<u>Fc</u>	<u>LC</u>	<u>TAX</u>	<u>TOTAL</u>
Clearing, Grubbing	49,500	m ²	61	27	11	99
Stripping	49,500	m ²	126	48	23	197
Excavation Common M	4,884	m ³	86	385	14	485
Excavation Common B	9,768	m ³	735	281	135	1,151
Excavation Hard Rock	6,187	m ³	1,884	1,257	500	3,641
Excavation Soft Rock	5,643	m ³	687	426	164	1,277
Embankment	28,796	m ³	1,658	985	361	3,004
(Sub total)			(5,237)	(3,409)	(1,208)	(9,854)
Carriageway Pavement	24,300	m ²	6,345	4,390	1,257	11,992
Pavement on E.R.	357,000	m ²	79,700	52,454	14,027	146,181
(Sub total)			(86,045)	(56,844)	(15,284)	(158,173)
R. C. Bridge L=10 ^m	1	Span	581	930	91	1,602
Box Culvert 4.5m x 4.0m	12	m	418	616	62	1,096
Setting Pipe 600mm	1,800	m	1,896	2,280	214	4,390
Setting Pipe 900mm	135	m	211	255	25	491
Side Ditch	6,000	m	2,806	4,405	524	7,735
Catch Basin	60	u	119	375	17	511
(Sub-total)			(6,031)	(8,861)	(933)	(15,825)
Concrete Spraying	1,080	m ²	59	58	16	133
Seed Spraying	11,599	m ²	186	271	50	507
Guard Rail	900	m	893	1,317	114	2,324
(Sub-total)			(1,138)	(1,646)	(180)	(2,964)
Total			98,451	70,760	17,605	186,816
w/Overhead and Profit			131,728	81,852	19,940	233,520
Supervision			8,874	2,218	584	11,676
Contingency			14,060	8,407	2,053	24,520
Detailed Eng. w/Cont.			9,762	2,440	642	12,844
Total			164,424	94,917	23,219	282,560
Economic Cost			164,424	94,917	-	259,341

Annex Table 8-1-2

Chaparral-Sta. Lucia

(Unit: \$'000)

<u>Item</u>	<u>Quantity</u>	<u>Unit</u>	<u>FC</u>	<u>LC</u>	<u>TAX</u>	<u>TOTAL</u>
Clearing, Grubbing	1,219,350	m ²	1,488	671	268	2,427
Stripping	1,219,350	m ²	3,109	1,183	561	4,853
Excavation Common M	346,736	m ³	6,110	27,319	1,009	34,438
Excavation Common B	693,473	m ³	52,177	19,924	9,618	81,719
Excavation Hard Rock	1,535,871	m ³	467,750	311,966	124,098	903,814
Excavation Soft Rock	732,663	m ³	89,172	55,265	21,321	165,758
Embankment	299,676	m ³	17,258	10,249	3,752	31,259
Excavation Disposal	1,053,000	m	43,784	35,581	13,299	92,664
(Sub-total)			(680,848)	(462,158)	(173,926)	(1,316,932)
Carriageway Pavement	598,590	m ²	156,310	108,129	30,965	295,404
Pavement on E.R.	86,100	m ²	19,222	12,650	3,383	35,255
(Sub-total)			(175,532)	(120,779)	(34,348)	(330,659)
R.C. Bridge L=5m	1	Span	293	460	43	796
R.C. Bridge L=10m	3	Span	1,741	2,791	274	4,806
P.C.T. Bridge L=20m	5	Span	11,968	14,703	2,865	29,536
P.C.T. Bridge L=30m	4	Span	15,451	17,868	3,747	37,066
P.C.T. Bridge L=40m	2	Span	10,417	11,514	2,535	24,466
Box Culvert 4.5 m x 4.0 m	240	m	8,362	12,322	1,234	21,918
Box Culvert 3.0 m x 3.0 m	144	m	2,560	3,794	366	6,720
Setting Pipe 600mm	44,340	m	46,702	56,162	5,272	108,136
Setting Pipe 900mm	3,325	m	5,198	6,285	620	12,103
Side Ditch	147,800	m	69,129	108,509	12,907	190,545
Catch Basin	1,478	u	2,939	9,227	422	12,588
(Sub-total)			(174,760)	(243,635)	(30,285)	(448,680)
Retaining Wall H=7m	12,180	m	233,390	382,241	36,335	651,966
Concrete Spraying	408,478	m ²	22,139	21,964	5,931	50,034
Seed Spraying	645,088	m ²	10,367	15,063	2,767	28,197
Guard Rail	17,320	m	17,191	25,344	2,188	44,723
(Sub-total)			(283,087)	(444,612)	(47,221)	(774,920)
Tunnel	800	m	92,001	96,551	26,932	215,484
Total			1,406,228	1,367,735	312,712	3,086,675
w/Overhead Profit			1,956,042	1,551,006	351,296	3,858,344
Supervision			146,617	36,654	9,646	192,917
Contingency			210,266	158,766	36,094	405,126
Detailed Eng. w/Cont.			161,279	40,319	10,611	212,209
Total			2,474,204	1,786,745	407,647	4,668,596
Economic Cost			2,474,204	1,786,745	-	4,260,949

Annex Table 8-1-3

Sta. Lucia-Nogales

(Unit: \$'000)

<u>Item</u>	<u>Quantity</u>	<u>Unit</u>	<u>FC</u>	<u>LC</u>	<u>TAX</u>	<u>TOTAL</u>
Clearing, Grubbing	297,000	m ²	363	163	65	591
Stripping	297,000	m ²	757	288	137	1,182
Excavation Common M	145,451	m ³	2,563	11,460	423	14,446
Excavation Common B	290,902	m ³	21,887	8,358	4,035	34,280
Excavation Hard Rock	192,234	m ³	58,545	39,046	15,533	113,124
Excavation Soft Rock	263,755	m ³	32,102	19,895	7,675	59,672
Embankment	76,278	m ³	4,393	2,609	954	7,956
Excavation Disposal	285,000	m ³	1,850	9,630	3,600	25,080
(Sub-total)			(132,460)	(91,449)	(32,422)	(256,331)
Carriageway Pavement	145,800	m ²	38,073	26,337	7,542	71,952
(Sub-total)			(38,073)	(26,337)	(7,542)	(71,952)
R.C. Bridge L=5m	1	Span	293	460	43	796
R.C. Bridge L=10m	1	Span	581	930	91	1,602
P.C.T. Bridge L=20m	1	Span	2,394	2,940	573	5,907
P.C.T. Bridge L=30m	2	Span	7,725	8,934	1,874	18,533
P.C.T. Bridge L=40m	2	Span	10,417	11,514	2,535	24,466
Box Culvert 4.5m x 4.0m	60	m	2,091	3,080	308	5,479
Bos Culvert 3.0m x 3.0m	36	m	641	948	91	1,680
Setting Pipe 600mm	10,800	m	11,376	13,679	1,284	26,339
Setting Pipe 900mm	810	m	1,266	1,531	151	2,948
Side Ditch	36,000	m	16,838	26,430	3,144	46,412
Catch Basin	360	u	716	2,248	102	3,066
(Sub-total)			(54,338)	(72,694)	(10,196)	(137,228)
Retaining Wall H=7m	3,160	m	60,511	99,169	9,427	169,147
Concrete Spraying	68,214	m ²	3,697	3,668	991	8,356
Seed Spraying	222,207	m ²	3,571	5,189	953	9,713
Guard Rail	4,730	m	4,695	6,921	597	12,213
(Sub-total)			(72,514)	(114,947)	(11,968)	(199,429)
Total			297,385	305,427	62,128	664,940
w/Overhead and Profit			415,827	344,908	70,440	831,175
Supervision			31,585	7,896	2,078	41,559
Contingency			44,741	35,280	7,252	87,273
Detailed Eng. w/Cont.			34,744	8,686	2,285	45,715
Total			526,897	396,770	82,055	1,005,722
Economic Cost			526,897	396,770	-	923,667

Annex Table 8-1-4

Nogales-Buga

(Unit: \$'000)

<u>Item</u>	<u>Quantity</u>	<u>Unit</u>	<u>FC</u>	<u>LC</u>	<u>TAX</u>	<u>TOTAL</u>
Clearing, Grubbing	729,300	m ²	890	401	160	1,451
Stripping	729,300	m ²	1,860	707	336	2,903
Excavation Common M	137,282	m ³	2,419	10,817	399	13,635
Excavation Common B	274,565	m ³	20,659	7,888	3,808	32,355
Excavation Hard Rock	646,592	m ³	196,920	131,336	52,244	380,500
Excavation Soft Rock	291,978	m ³	35,537	22,024	8,496	66,057
Embankment	405,758	m ³	23,368	13,877	5,080	42,325
Excavation Disposal	330,000	m ³	13,721	11,151	4,168	29,040
(Sub-total)			(295,374)	(198,201)	(74,691)	(568,266)
Carriageway Pavement	258,020	m ²	93,490	64,673	18,520	176,683
Pavement on E.R.	30,100	m ²	6,720	4,423	1,182	12,325
(Sub-total)			(100,210)	(69,096)	(19,702)	(189,008)
R.C. Bridge L=5m	2	Span	586	920	87	1,593
R.C. Bridge L=10m	4	Span	2,322	3,722	365	6,409
P.C.T. Bridge L=20m	1	Span	2,394	2,940	573	5,907
P.C.T. Bridge L=30m	1	Span	3,863	4,467	936	9,266
P.C.T. Bridge L=40m	2	Span	10,417	11,514	2,535	24,466
Box Culvert 4.5m x 4.0m	84	m	2,927	4,313	431	7,671
Box Culvert 3.0m x 3.0m	60	m	1,067	1,581	152	2,800
Setting Pipe 600mm	26,520	m	27,933	33,590	3,154	64,677
Setting Pipe 900mm	1,989	m	3,110	3,759	371	7,240
Side Ditch	88,400	m	41,346	64,900	7,720	113,966
Catch Basin	884	u	1,758	5,519	252	7,529
(Sub-total)			(97,723)	(137,255)	(16,576)	(251,524)
Retaining Wall H=7m	4,200	m	80,479	131,807	12,530	224,816
Concrete Spraying	1,270	m ²	69	68	19	156
Seed Spraying	400,122	m ²	6,430	9,343	1,716	17,489
Guard Rail	20,150	m	20,000	29,485	2,545	52,030
(Sub-total)			(106,978)	(170,703)	(16,810)	(294,491)
Total			600,285	575,225	127,779	1,303,289
w/Overhead and Profit			832,433	652,608	144,070	1,629,111
Supervision			61,906	15,477	4,073	81,456
Contingency			89,434	66,809	14,814	171,057
Detailed Eng. w/Cont.			68,097	17,025	4,480	89,602
Total			1,051,870	751,919	167,437	1,971,226
Economic Cost			1,051,870	751,919	-	1,803,789

Annex Table 8-1-5

Nogales-Buga (Via San Antonio)

(Unit: \$,000)

<u>Item</u>	<u>Quantity</u>	<u>Unit</u>	<u>FC</u>	<u>LC</u>	<u>TAX</u>	<u>TOTAL</u>
Clearing, Grubbing	845,600	m ²	1,032	465	186	1,683
Stripping	845,600	m ²	2,156	820	389	3,365
Excavation Common M	153,322	m ³	2,702	12,080	446	15,228
Excavation Common B	306,644	m ³	23,072	8,810	4,253	36,135
Excavation Hard Rock	570,822	m ³	173,844	115,945	46,123	335,912
Excavation Soft Rock	316,007	m ³	38,461	23,836	9,196	71,493
Embankment	459,916	m ³	26,487	15,729	5,758	47,974
Excavation Disposal	310,000	m ³	12,890	10,475	3,915	27,280
(Sub-total)			(280,644)	(188,160)	(70,266)	(539,070)
Carriageway Pavement	415,125	m ²	108,402	74,988	21,474	204,864
(Sub-total)			(108,402)	(74,988)	(21,474)	(204,864)
R.C. Bridge L=5m	3	span	879	1,380	130	2,389
R.C. Bridge L=10m	1	span	581	930	91	1,602
P.C.T. Bridge L=30m	2	span	7,725	8,934	1,874	18,533
P.C.T. Bridge L=40m	2	span	10,417	11,514	2,535	24,466
Box Culvert 4.5m x 4.0m	84	m	2,927	4,313	432	7,672
Box Culvert 3.0m x 3.0m	120	m	2,134	3,161	305	5,600
Setting Pipe 600mm	30,750	m	32,388	38,948	3,657	74,993
Setting Pipe 900mm	2,300	m	3,596	4,347	429	8,372
Side Ditch	102,500	m	47,941	75,252	8,951	132,144
Catch Basin	1,025	u	2,038	6,399	293	8,730
(Sub-total)			(110,626)	(155,178)	(18,697)	(284,501)
Retaining Wall H=7m	7,100	m	136,048	222,817	21,180	380,045
Concrete Spraying	1,906	m ²	103	103	28	234
Seed Spraying	493,270	m ²	7,927	11,518	2,116	21,561
Guard Rail	20,000	m	19,851	29,266	2,526	51,643
(Sub-total)			(163,929)	(263,704)	(25,850)	(453,483)
Total			663,601	682,030	136,287	1,481,918
w/Overhead and Profit			927,568	770,019	154,811	1,852,398
Supervision			70,391	17,598	4,631	92,620
Contingency			99,796	78,762	15,944	194,502
Detailed Eng. w/Cont.			77,430	19,358	5,094	101,882
Total			1,175,185	885,737	180,480	2,241,402
Economic Cost			1,175,185	885,737	-	2,060,922

Annex Table 8-1-6

QUANTITIES AND COST: Preventive WorkChaparral - Sta. Lucia

(Unit; \$'000)

<u>Location</u>	<u>Item</u>	<u>Quantity</u>	<u>Unit</u>	<u>FC</u>	<u>LC</u>	<u>TAX</u>	<u>TOTAL</u>
No.1	Horizontal Drilling	600	m	279	708	50	1,037
	Drain Pipe ø50mm	630	m	10	20	2	32
	Slope End Block	30	m	19	27	2	48
	Collecting Drain	200	m	105	194	12	311
K61.300	Pipe Drainage ø0.6m	150	m	158	190	18	366
	Gravity Wall H=4m	100	m	823	1,098	117	2,038
	Common Labor	504	MH	0	26	0	26
	Misc. Work	1	Lump	0	53	0	53
	(Sub-total)			(1,394)	(2,316)	(201)	(3,911)
No.2	Horizontal Drilling	640	m	297	755	54	1,106
	Drain Pipe ø50mm	670	m	10	22	2	34
	Slope End Block	40	m	25	36	3	64
	Collecting Drain	300	m	157	291	18	466
K69.100	Pipe Drainage ø0.6m	230	m	242	292	27	561
	Gravity Wall H=4m	150	m	1,235	1,646	176	3,057
	Common Labor	536	MH	0	28	0	28
	Misc. Work	1	Lump	0	68	0	68
	(Sub-total)			(1,966)	(3,138)	(280)	(5,384)
No.3	Collecting Drain	600	m	314	583	35	932
	Pipe Drainage ø0.6m	300	m	316	380	36	732
	Slope End Block	50	m	31	45	4	80
	Retaining Wall H=10m	120	m	3,500	4,349	340	8,189
K74.300	Misc. Work	1	Lump	0	52	0	52
	(Sub-total)			(4,161)	(5,409)	(415)	(9,985)
No.4	Horizontal Drain	960	m	446	1,132	81	1,659
	Drain Pipe ø50mm	1,010	m	15	33	3	51
	Slope End Block	60	m	37	54	5	96
	Collecting Drain	750	m	392	729	44	1,165
K90.800	Pipe Draining ø0.6m	300	m	316	380	36	732
	Gravity Wall H=4m	200	m	1,646	2,196	234	4,076
	Common Labor	808	MH	0	42	0	42
	Misc. Work	1	Lump	0	112	0	112
	(Sub-total)			(2,852)	(4,678)	(403)	(7,933)
No.5	Collecting Drain	500	m	261	486	29	776
	Pipe Drainage ø0.6m	300	m	316	380	36	732
	Slope End Block	50	m	31	45	4	80
	Retaining Wall H=10m	120	m	3,500	4,349	340	8,189
K112.700	Steel Pile H=200 x 200	600	m	1,166	449	393	2,008
	Misc. Work	1	Lump	0	107	0	107
	(Sub-total)			(5,274)	(5,816)	(802)	(11,892)
	Total Direct Cost			15,647	21,357	2,101	39,105

Annex Table 8-1-7

QUANTITIES AND COST: Preventive WorkSta. Lucia - Nogales

(Unit: \$ '000)

<u>Location</u>	<u>Item</u>	<u>Quantity</u>	<u>Unit</u>		<u>FC</u>	<u>LC</u>	<u>TOTAL</u>
No.6	Collecting Drain	800	m	418	777	47	1,242
	Pipe Drainage ϕ 0.6m	380	m	400	482	45	927
	Slope End Block	60	m	38	54	5	97
K152.200	Retaining Wall H=10m	150	m	4,374	5,346	425	10,235
	Steel Pile H=200 x 200	800	m	1,555	599	524	2,678
	Misc. Work	1	Limp	0	148	0	148
	Total Direct Cost			6,785	7,496	1,046	15,327

Annex Table 8-1-8

Depression Los Andes1. Road Plan (L=6.5^{km})

(Unit: \$'000)

Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Grubbing	97,500	m ²	119	54	21	194
Stripping	97,500	m ²	249	94	45	388
Excavation Common M	31,380	m ³	553	2,472	92	3,117
Excavation Common B	62,760	m ³	4,722	1,803	871	7,396
Excavation Hard Rock	39,710	m ³	12,094	8,066	3,208	23,368
Excavation Soft Rock	74,680	m ³	9,089	5,633	2,173	16,895
Embankment	66,060	m ³	3,805	2,259	827	6,891
Excavation Disposal	49,860	m ³	2,073	1,685	630	4,388
Carriageway Pavement	52,650	m ²	13,748	9,511	2,724	25,983
Box Culvert 4.5m x 4.0	24	m	836	1,232	124	2,192
Box Culvert 3.0m x 3.0	24	m	427	632	61	1,120
Setting Pipe 600mm	3,900	m	4,108	4,940	463	9,511
Setting Pipe 900mm	293	m	458	554	55	1,067
Side Ditch	13,000	m	6,080	9,544	1,135	16,759
Catch Basin	130	u	258	812	37	1,107
Retaining Wall H=7m	910	m	17,437	28,558	2,715	48,710
Concrete Spraying	9,107	m ²	494	490	132	1,116
Seed Spraying	83,850	m ²	1,347	1,958	360	3,665
Guard Rail	6,500	m	6,452	9,511	821	16,784
Total Direct Cost			84,349	89,808	16,494	190,651

2. Tunnel Plan (L=0.8km)

Item	Quantity	Unit	FC	LC	TAX	TOTAL
Excavation Upper half	36,640	m ³	41,202	44,763	13,519	99,484
Excavation Lower half	22,560	m ³	10,194	13,550	3,486	27,230
Concrete Lining	15,120	m ²	40,605	38,238	9,927	88,770
Total Direct Cost			92,001	96,551	26,932	215,484

Annex Table 8-2

Quantities of Materials to be Procured

1.	Portland Cement	66,000 ^t
2.	Asphalt	10,000 ^t
3.	Asphalt Liquid	1,400 ^t
4.	Reinforcing Steel	8,600 ^t
5.	P.C. Steel Cable	130 ^t
6.	Structural Steel	92 ^t
7.	Diesel	5,173,000 ^{gal}
8.	Gasoline	346,000 ^{gal}
9.	Motor Oil	73,800 ^{gal}
10.	Transmission Oil	6,500 ^{gal}
11.	Hydraulic Oil	9,500 ^{gal}
12.	Grease	68,000 ^{kg}
13.	Plank	2,700 ^{m³}
14.	Explosive	820 ^t

Annex Table 8-3

Required Quantity of Principal Equipment

Equipment		Chaparral- Sta.Lucia	Sta.Lucia- Nogales	Nogales- Buga	Total
1. Bulldozer	D6D	1	1	1	3
2. Bulldozer	D7G	4	2	3	9
3. Bulldozer	D8K	1	1	1	3
4. Bulldozer	D8K w/R	5	2	3	10
5. Tractor Shovel	1.8 ^{m3}	2	0	0	2
6. Wheel Loader	1.8 ^{m3}	5	3	4	12
7. Excavator	0.6 ^{m3}	2	1	2	5
8. Motor Scraper	16 ^{m3}	3	2	2	7
9. Asphalt Plant	70 T/H	1	0	1	2
10. Asphalt Finisher	2.4 ^m -4.3 ^m	1	1	1	3
11. Concrete Batching Plant	90 ^{m3/H}	1	0	0	1
12. Concrete Mixer, portable	0.7 ^{m3}	5	2	3	10
13. Air Compressor	10.5 ^{m3/min.}	4	2	2	8
14. Air Compressor	17.0 ^{m3/min.}	16	2	6	24
15. Crushing Plant	60 T/H	1	0	1	2
16. Road Roller, Tire	20 ton	2	2	2	6
17. Road Roller, Macadam	10 ton	1	1	1	3
18. Dump Truck	7 ton	36	20	24	80

Note: Equipments for Castilla-Chaparral are included Chapareel-Sta.Lucia.

Annex 9-1 Benefit by Diverted Traffic

Benefits by diverted traffic are calculated as the difference of traffic cost of vehicles on two routes, namely the existing road and new road, without and with project.

Annex Table 9-34 to 9-35 show the calculation of these traffic cost. From these tables, the benefits of diverted traffic are given as belows.

1990 ;	$32.611 - 23.928 - 7.653$	$= 1.030$	million pesos/day
		$= 388$	million pesos/annum
2000 ;	$53.326 - 38.940 - 12.397$	$= 1.989$	"
		$= 745$	"
2010 ;	$87.190 - 63.574 - 20.367$	$= 3.249$	"
		$= 1,216$	"

Annex 9-2 Benefits by Existing Traffic

Existing traffic on the road section of Castilla-Chaparral of new road are forecasted as follows.

	1980	1990	2000	2010	
Castilla-Coyaima	290	470	770	1250	veh./day
Coyaima-Chaparral	171	280	450	740	

This road section is now gravel road and therefore it is expected to be in less traffic cost due to the asphalt concrete pavement.

The road condition is flat, less than 2% of road gradient, and Vehicle operating cost of this gravel road are assumed to be 20 percent higher than that of asphalt concrete paved road at same condition.

The vehicle composition are supposed as follows.

Passenger car	40 percent
Bus	10
Truck	40
Trailer	10

Benefit of existing traffic are calculated as follows.

1990 ;	$20.281 \times 0.2 \times 17.0 \times 470 \times 365$	27.988 million pesos /annum
	$+ 21.366 \times 0.2 \times 37.0 \times 280 \times 365$	
2000 ;	$20.075 \times 0.2 \times 17.0 \times 770 \times 365$	45.028 "
	$+ 21.263 \times 0.2 \times 37.0 \times 450 \times 365$	
2010 ;	$19.593 \times 0.2 \times 17.0 \times 1250 \times 365$	72.544 "
	$+ 21.088 \times 0.2 \times 37.0 \times 740 \times 365$	

Annex Table 9-1 Economic Vehicle Operating Cost (Pesos/km)

Existing Route without Project

Year	Gradient (%)	Vehicle Type			
		Pass.Car	Bus	Truck	Trailer
1990	1.0	10.861	20.472	22.252	40.945
	3.0	12.283	24.330	26.372	48.446
	5.0	13.405	26.923	29.266	53.423
	7.0	14.095	29.560	31.512	59.898
	9.0	15.087	33.230	34.455	65.218
2000	1.0	10.815	19.880	21.943	39.114
	3.0	12.643	24.697	26.468	48.854
	5.0	13.771	27.555	29.508	53.423
	7.0	15.000	30.723	31.892	60.840
	9.0	16.039	34.751	34.904	66.417
2010	1.0	10.793	19.386	21.641	38.196
	3.0	12.889	24.889	26.487	48.854
	5.0	14.478	28.179	29.704	53.959
	7.0	15.787	31.565	32.257	60.840
	9.0	16.901	35.558	35.369	66.334

Annex Table 9-2 Economic Vehicle Operating Cost (Pesos/km)

Existing Route with Project

Year	Gradient (%)	Vehicle Type			
		Pass.Car	Bus	Truck	Trailer
1990	1.0	10.911	20.463	22.252	40.945
	3.0	12.129	24.165	26.276	48.609
	5.0	12.710	26.313	28.551	53.423
	7.0	13.245	28.124	31.146	59.043
	9.0	13.822	31.968	34.024	65.218
2000	1.0	10.821	19.880	21.943	39.114
	3.0	12.248	24.322	26.372	48.609
	5.0	13.268	26.923	28.551	53.423
	7.0	14.112	29.182	31.512	59.043
	9.0	15.087	33.284	34.455	65.218
2010	1.0	10.508	19.323	21.641	38.522
	3.0	12.651	24.712	26.468	48.854
	5.0	13.922	27.555	29.266	53.423
	7.0	14.808	30.388	31.892	59.043
	9.0	16.039	34.358	34.904	65.218

Annex Table 9-3 Economic Vehicle Operating Cost (Pesos/km)

New Route

Year	Gradient (%)	Vehicle Type			
		Pass.Car	Bus	Truck	Trailer
1990	1.0	11.018	21.664	23.529	42.960
	3.0	12.050	23.990	26.036	48.173
	5.0	12.710	26.313	28.551	53.423
	7.0	13.245	28.124	31.146	59.043
	9.0	13.822	31.968	34.024	65.218
2000	1.0	10.911	21.054	23.272	42.960
	3.0	12.050	23.990	26.036	48.173
	5.0	12.710	26.313	28.551	53.423
	7.0	13.929	29.182	31.146	59.043
	9.0	14.615	32.939	34.024	65.218
2010	1.0	10.861	20.463	27.871	40.538
	3.0	12.215	24.322	26.036	48.499
	5.0	13.268	27.123	29.266	53.423
	7.0	14.625	30.331	21.512	59.043
	9.0	15.290	33.351	34.455	65.218

Annex Table 9-4 Average Running Speed

Existing Route without Project

Year	Gradient (%)	Vehicle Type			
		Pass.Car	Bus	Truck	Trailer
1980	1.0	70	69	66	54
	3.0	48	44	38	32
	5.0	40	36	29	23
	7.0	35	31	25	18
	9.0	31	28	21	14
1990	1.0	63	63	61	51
	3.0	45	41	36	31
	5.0	36	34	28	23
	7.0	30	27	24	17
	9.0	25	24	20	14
2000	1.0	61	61	60	48
	3.0	39	37	35	29
	5.0	33	31	27	23
	7.0	25	24	23	16
	9.0	21	20	19	13
2010	1.0	59	59	59	46
	3.0	36	35	34	29
	5.0	28	28	26	22
	7.0	22	22	22	16
	9.0	18	18	18	13

Annex Table 9-5 Average Annual Running Mileage (1000 km/year)

1990	1%	3%	5%	7%	9%
Pass.Car	19.0	16.4	14.6	13.9	13.0
Bus	95.0	78.1	72.2	67.4	65.4
Truck	60.8	48.3	43.4	43.2	41.3
Trailer	84.3	65.9	60.0	54.2	52.2
2000					
Pass.Car	18.7	15.5	14.1	12.9	12.1
Bus	93.6	75.0	69.7	64.0	60.3
Truck	60.4	47.8	42.8	42.3	40.3
Trailerf	81.7	63.9	60.0	52.6	50.3
2010					
Pass.Car	18.4	15.0	13.3	12.2	11.4
Bus	92.1	73.5	67.1	61.6	57.7
Truck	59.9	47.3	42.3	41.5	39.3
Trailer	80.0	63.9	58.7	52.6	50.3

Existing Route without Project

Annex Table 9-6 Fuel Consumption (Existing Route without Project)
1/1000 Km

1990	1%	3%	5%	7%	9%
Pass.Car	133.62	153.3	162.88	175.15	190.36
Bus	507.30	649.66	746.12	847.53	1,003.99
Truck	576.05	736.06	840.98	959.37	1,086.55
Trailer	1,190.36	1,575.79	1,834.9	2,134.73	2,413.60
2000					
Pass. Car	127.46	152.10	165.49	182.50	198.40
Bus	481.26	657.34	764.30	880.61	1,035.87
Truck	561.48	738.24	847.86	968.14	1,095.60
Trailer	1,097.69	1,585.21	1,834.90	2,159.05	2,436.13
2010					
Pass.Car	121.30	154.16	172.52	190.93	206.13
Bus	455.62	661.18	782.48	902.67	1,051.81
Truck	546.91	740.42	854.74	976.91	1,104.65
Trailer	1,049.37	1,585.21	1,850.05	2,159.05	2,436.13

Annex Table 9-7

Depreciation and Interest Cost

Existing Route without Project

Year	Vehicle Type	Gradient (%)	Annual Km	Econ.Dep. Cost/Year	Econ.Dep. Cost/Km	Remarks
1990	Pass.Car	1	19,000	76,895	4.047	Dep. Econ. Cost Pesos 493,863 n=13 i=12%
		3	16,400		4.689	
		5	14,600		5.267	
		7	13,900		5.532	
		9	13,000		5.915	
	Bus	1	95,000	155,066	1.632	Pesos 876,177 n=10 i=12%
		3	78,100		1.985	
		5	72,200		2.148	
		7	67,400		2.301	
		9	65,400		2.371	
	Truck	1	60,800	108,432	1.783	Pesos 786,082 n=18 i=12%
		3	48,300		2.245	
		5	43,400		2.498	
		7	43,200		2.510	
		9	41,300		2.625	
	Trailer	1	84,300		5.454	Pesos 2,953,458 n=13 i=12%
		3	65,900		6.977	
		5	60,000		7.663	
		7	54,200		8.483	
		9	52,000		8,808	
2000	Pass.Car	1	18,700	76,895	4.112	
		3	15,500		4.961	
		5	14,100		5.454	
		7	12,900		5.961	
		9	12,100		6.355	
	Bus	1	93,600	155,066	1.657	
		3	75,000		2.068	
		5	69,700		2.225	
		7	64,000		2.423	
		9	60,300		2.572	
	Truck	1	60,400	108,432	1.795	
		3	47,800		2.268	
		5	42,800		2.533	
		7	42,300		2.563	
		9	40,300		2.691	
	Trailer	1	81,700	459,794	5.628	
		3	63,900		7.196	
		5	60,000		7.663	
		7	52,600		8.741	
		9	50,300		9.141	

Annex Table 9-7 Depreciation and Interest Cost (Cont'd)

Existing Route without Project

Year	Vehicle Type	Gradient (%)	Annual Km	Econ.Dep. Cost/Year	Econ.Dep. Cost/Km	Remarks
2010	Pass.Car	1	18,400	76,895	4.179	
		3	15,000		5.126	
		5	13,300		5.782	
		7	12,200		6.303	
		9	11,400		6.745	
	Bus	1	92,100	155,066	1.684	
		3	73,500		2.110	
		5	67,100		2.311	
		7	61,600		2.517	
		9	57,700		2.687	
	Truck	1	59,900	108,432	1.810	
		3	47,300		2.292	
		5	42,800		2.533	
		7	41,500		2.613	
		9	39,300		2.759	
	Trailer	1	80,000	459,794	5.757	
		3	63,900		7.196	
		5	58,700		7.833	
		7	52,600		8.741	
		9	50,300		9.141	

Annex Table 9 -8 Fixed Cost

Existing Route without Project

Year	Vehicle Type	Gradient (%)	Econ.Fixed Cost Per Year	Annual Km	Economic Fixed Cost/Km
1990	Pass.Car	1	62,813	19,900	3.306
		3		16,400	3.830
		5		14,600	4.302
		7		13,900	4.519
		9		13,000	4.832
	Bus	1	499,178	95,000	5.255
		3		78,000	6.400
		5		72,200	6.914
		7		67,400	7.406
		9		65,400	7.633
	Truck	1	379,346	60,800	6.239
		3		48,300	7.854
		5		43,400	8.741
		7		43,200	8.781
		9		41,300	9.185
	Trailer	1	657,246	84,300	7.797
		3		65,900	9.973
		5		60,000	10.954
		7		54,200	12.126
		9		52,200	12.591
2000	Pass.Car	1	62,813	18,700	3.359
		3		15,500	4.052
		5		14,100	4.455
		7		12,900	4.869
		9		12,100	5.191
	Bus	1	499,178	93,600	5.333
		3		15,500	6.656
		5		69,700	7.162
		7		64,000	7.800
		9		60,300	8.278
	Truck	1	379,346	60,400	6.281
		3		47,800	7.936
		5		42,800	8.863
		7		42,300	8.968
		9		40,300	9.413
	Trailer	1	657,246	81,700	8.045
		3		63,900	10.286
		5		60,000	10.954
		7		52,600	12.495
		9		50,300	13.067

Annex Table 9-8 Fixed Cost (Cont'd)

Year	Vehicle Type	Gradient (%)	Econ.Fixed Cost Per Year	Annual Km	Economic Fixed Cost/Km
2010	Pass.Car	1	62,813	18,400	3.414
		3		15,000	4.188
		5		13,300	4.723
		7		12,200	5.149
		9		11,400	5.510
	Bus	1	499,178	92,100	5.420
		3		73,500	6.792
		5		67,100	7.440
		7		61,600	8.104
		9		57,700	8.651
	Truck	1	379,346	59,900	6.333
		3		47,300	8.020
		5		42,300	8.968
		7		41,500	9.141
		9		39,300	9.653
	Trailer	1	657,246	80,000	8.216
		3		63,900	10.286
		5		58,700	11.197
		7		52,600	12.495
		9		50,300	13.067

Annex Table 9-9 Tyre Cost

Existing Route without Project

Year	Vehicle Type	Gradient (%)	Life in Km	Cost of a Set	Cost/Km
1990	Pass.Car	1	23,400	9,040	0.386
		3	35,000		0.258
		5	46,400		0.195
		7	56,800		0.159
		9	65,500		0.138
	Bus	1	24,100	32,400	1.344
		3	39,800		0.814
		5	49,600		0.653
		7	69,000		0.470
		9	79,500		0.408
	Truck	1	25,800	44,400	1.721
		3	46,300		0.959
		5	61,000		0.728
		7	73,000		0.608
		9	85,000		0.522
	Trailer	1	32,700	167,400	5.119
		3	54,900		3.049
		5	76,000		2.203
		7	98,800		1.694
		9	113,000		1.481
2000	Pass.Car	1	24,600	9,040	0.367
		3	42,700		0.212
		5	51,500		0.176
		7	65,500		0.138
		9	72,500		0.125
	Bus	1	25,400	32,400	1.276
		3	44,800		0.723
		5	55,000		0.589
		7	79,500		0.408
		9	93,500		0.347
	Truck	1	26,500	44,400	1.675
		3	48,000		0.925
		5	64,000		0.694
		7	76,000		0.584
		9	88,000		0.505
	Trailer	1	36,000	167,400	4.650
		3	58,900		2.842
		5	76,000		2.203
		7	103,500		1.617
		9	113,000		1.481

Annex Table 9-9 Tyre Cost (Cont'd)

Year	Vehicle Type	Gradient (%)	Life in Km	Cost of a set	Cost/Km
2010	Pass.Car	1	25,700	9,040	0.352
		3	46,400		0.195
		5	60,300		0.150
		7	70,800		0.128
		9	77,800		0.116
	Bus	1	26,600	32,400	1.218
		3	47,800		0.678
		5	65,500		0.495
		7	86,500		0.375
		9	100,500		0.322
	Truck	1	27,300	44,400	1.626
		3	53,000		0.838
		5	67,000		0.663
		7	79,000		0.562
		9	91,000		0.488
	Trailer	1	38,200	167,400	4.382
		3	58,900		2.842
		5	79,600		2.103
		7	103,500		1.617
		9	117,800		1.421

Annex Table 9-10

Vehicle Maintenance Cost

Existing Route without Project Year 1990

Vehicle Type	Gradient (%)	Fuel Cost Pesos/Km	Lubricant Pesos/Km	Tyres Pesos/Km	Total Pesos/Km	Fina. Cost Pesos/Km	Econ. Cost Pesos/km
Pass. Car	1	1,200	(0.20)	0.386	1.826	(0.668)	(0.90)
	3	1,377	0.240	0.258	1.910	1.220	1.098
	5	1,463	0.275	0.195	1.951	1.314	1.183
	7	1,573	0.293	0.159	2.047	1.303	1.173
	9	1,710	0.315	0.138	2.190	1.367	1.231
Bus			0.342			1.463	1.317
	1	4,557	(0.25)	1.344	7.040	(0.668)	(0.90)
	3	5,836	1.139	0.814	8.109	4.703	4.232
	5	6,702	1.459	0.653	9.031	5.417	4.875
	7	7,613	1.676	0.470	9.986	6.033	5.429
Truck	9	9,019	1.903	0.408	11.682	6.671	6.004
			2.255			7.804	7.023
	1	5,175	(0.15)	1.721	7.672	(0.600)	(0.90)
	3	6,612	0.776	0.959	8.563	4.603	4.143
	5	7,555	0.992	0.728	9.416	5.138	4.624
Trailer	7	8,618	1.133	0.608	10.519	5.650	5.085
	9	9,760	1.293	0.522	11.746	6.311	5.680
			1.464			7.048	6.343
	1	10,693	(0.075)	5.119	16.614	(0.429)	(0.90)
	3	14,155	0.802	3.049	18.266	7.127	6.415
Trailer	5	16,483	1.062	2.203	19.922	7.836	7.053
	7	19,176	1.236	1.694	22.308	8.547	7.692
	9	21,681	1.438	1.481	24.788	9.570	8.613
			1.626			10.634	9.511

Fuel Price 8.983 pesos/l

Annex Table 9-10 Vehicle Maintenance Cost
(Cont'd)

Existing Route without Project Year 2000

Vehicle Type	Gradient (%)	Fuel Cost Pesos/Km	Lubricant Pesos/Km	Tyres Pesos/Km	Total Pesos/Km	Fina. Cost Pesos/Km	Econ. Cost Pesos/Km
Pass. Car	1	1.145	(0.20)	0.367	1.741	(0.668)	(0.90)
	3	1.366	0.229	0.212	1.851	1.163	1.047
	5	1.487	0.273	0.176	1.960	1.236	1.113
	7	1.639	0.297	0.138	2.105	1.309	1.178
Bus	9	1.782	0.328	0.125	2.263	1.406	1.266
			0.356			1.512	1.361
	1	4.323	(0.25)	1.276	6.680	(0.668)	(0.90)
	3	5.905	1.081	0.723	8.104	4.462	4.016
Truck	5	6.866	1.476	0.589	9.172	5.413	4.872
	7	7.911	1.717	0.408	10.297	6.127	5.514
	9	9.305	1.978	0.347	11.978	6.878	6.191
			2.326			8.001	7.201
Trailer	1	5.044	(0.15)	1.675	7.476	(0.600)	(0.90)
	3	6.632	0.757	0.925	8.552	4.486	4.037
	5	7.616	0.995	0.694	9.452	5.131	4.618
	7	8.697	1.142	0.584	10.586	5.671	5.104
Trailer	9	9.842	1.305	0.505	11.823	6.352	5.716
			1.476			7.094	6.384
	1	9.861	(0.075)	4.650	15.251	(0.429)	(0.90)
	3	14.240	0.740	2.842	18.150	6.543	5.888
Trailer	5	16.483	1.068	2.203	19.922	7.786	7.008
	7	19.395	1.236	1.617	22.467	8.547	7.692
	9	21.884	1.455	1.481	25.006	9.638	8.675
			1.641			10.728	9.655

Fuel Price 8.983 pesos/l

Annex Table 9-10 Vehicle Maintenance Cost
(Cont'd)

Existing Route without Project Year 2010

Vehicle Type	Gradient (%)	Fuel Cost Pesos/Km	Lubricant Pesos/Km	Tyres Pesos/Km	Total Pesos/Km	Fina. Cost Pesos/Km	Econ. Cost Pesos/Km
Pass. Car	1	1.106	(0.20)	0.352	1.679	(0.668)	(0.90)
	3	1.385	0.277	0.195	1.857	1.122	1.010
	5	1.550	0.310	0.150	2.010	1.240	1.116
	7	1.715	0.343	0.128	2.186	1.343	1.208
	9	1.852	0.370	0.116	2.338	1.460	1.314
Bus	1	4.093	(0.25)	1.218	6.334	(0.668)	(0.90)
	3	5.939	1.023	0.678	8.102	4.231	3.808
	5	7.029	1.485	0.495	9.281	5.412	4.871
	7	8.109	1.757	0.375	10.511	6.200	5.580
	9	9.448	2.027	0.322	12.132	7.021	6.319
Truck	1	4.913	(0.15)	1.626	7.276	(0.600)	(0.90)
	3	6.651	0.737	0.838	8.487	4.366	3.929
	5	7.678	0.998	0.663	9.493	5.092	4.583
	7	8.776	1.152	0.562	10.654	5.696	5.126
	9	9.923	1.316	0.488	11.899	6.392	5.753
Trailer	1	9.426	(0.075)	4.382	14.515	(0.429)	(0.90)
	3	14.240	0.707	2.842	18.150	6.227	5.604
	5	16,619	1.068	2.103	19.968	7.786	7.008
	7	19.395	1.246	1.617	22.467	8.566	7.710
	9	21.884	1.455	1.421	24.946	9.638	8.675
			1.641		10.702		9.632

Fuel Price 8.983 pesos/l

Annex Table 9-11 Economic Cost of Vehicle Operation (Pesos/Km)

Existing Route without Project Year 1990

	Vehicle Type			
	Pass.Car	Bus	Truck	Trailer
Gr=1%				
Fuel	1.687	6.407	7.275	15.033
Lubricant	0.337	1.602	1.091	1.127
Tyres	0.386	1.344	1.721	5.119
Maintenance	1.098	4.232	4.143	6.415
Dep. & Int.	4.047	1.632	1.783	5.454
Overhead	3.306	5.255	6.239	7.797
Total	10.861	20.472	22.252	40.945
Gr=3%				
Fuel	1.936	8.205	9.296	19.901
Lubricant	0.387	2.051	1.394	1.493
Tyres	1.183	0.815	0.959	3.049
Maintenance	1.183	4.875	4.624	7.053
Dep. & Int.	4.689	1.985	2.245	6.977
Overhead	3.830	6.400	7.854	9.973
Total	12.283	24.330	26.372	48.446
Gr=5%				
Fuel	2.057	9.423	10.621	23.173
Lubricant	0.411	2.356	1.593	1.738
Tyres	0.195	0.653	0.728	2.203
Maintenance	1.173	5.429	5.085	7.692
Dep. & Int.	5.267	2.148	2.498	7.663
Overhead	4.302	6.914	8.741	10.954
Total	13.405	26.923	29.266	53.423
Gr=7%				
Fuel	2.212	10.703	12.116	26.960
Lubricant	0.442	2.676	1.817	2.022
Tyres	0.159	0.470	0.608	1.694
Maintenance	1.231	6.004	5.680	8.613
Dep. & Int.	5.532	2.301	2.510	8.483
Overhead	4.519	7.406	8.781	12.126
Total	14.095	20.560	31.512	59.898
Gr=9%				
Fuel	2.404	12.679	13.722	30.481
Lubricant	0.481	3.170	2.058	2.286
Tyres	0.138	0.408	0.522	1.481
Maintenance	1.317	7.023	6.343	9.571
Dep. & Int.	5.915	2.371	2.625	8.808
Overhead	4.832	7.633	9.185	12.591
Total	15.087	33.230	34.455	65.218

Annex Table 9-11 Economic Cost of Vehicle Operation (Pesos/Km)

(Cont'd) Existing Route without Project Year 2000

	Vehicle Type			
	Pass.Car	Bus	Truck	Trailer
Gr=1%				
Fuel	1.610	6.078	7.091	13.863
Lubricant	0.320	1.520	1.064	1.040
Tyres	0.367	1.276	1.675	4.650
Maintenance	1.047	4.016	4.037	5.888
Dep. & Int.	4.112	1.657	1.795	5.628
Overhead	3.359	5.333	6.281	8.045
Total	10.815	19.880	21.943	39.114
Gr=3%				
Fuel	1.921	8.302	9.323	20.020
Lubricant	0.384	2.076	1.398	1.502
Tyres	0.212	0.723	0.925	2.842
Maintenance	1.113	4.872	4.618	7.008
Dep. & Int.	4.961	2.068	2.268	7.196
Overhead	4.052	6.656	7.936	10.286
Total	12.643	24.697	26.468	48.854
Gr=5%				
Fuel	2.090	9.652	10.708	23.173
Lubricant	0.418	2.413	1.606	1.738
Tyres	0.176	0.589	0.694	2.203
Maintenance	1.178	5.514	5.104	7.692
Dep. & Int.	5.454	2.225	2.533	7.663
Overhead	4.455	7.162	8.863	10.954
Total	13.771	27.555	29.508	53.423
Gr=7%				
Fuel	2.305	11.121	12.227	27.267
Lubricant	0.461	2.780	1.834	2.045
Tyres	0.138	0.408	0.584	1.617
Maintenance	1.266	6.191	5.716	8.741
Dep. & Int.	5.961	2.423	2.563	8.741
Overhead	4.869	7.800	8.968	12.495
Total	15.000	30.723	31.892	60.840
Gr=9%				
Fuel	2.506	13.082	13.836	30.766
Lubricant	0.501	3.271	2.075	2.307
Tyres	0.125	0.347	0.505	1.481
Maintenance	1.361	7.201	6.384	9.655
De. & Int.	6.355	2.572	2.691	9.141
Overhead	5.191	8.278	9.413	13.067
Total	16.039	34.751	34.904	66.417

Annex Table 9-11 Economic Cost of Vehicle Operation (Pesos/Km)

(Cont'd) Existing Route without Project Year 2010

	Vehicle Type			
	Pass.Car	Bus	Truck	Trailer
Gr=1%				
Fuel	1.532	5.754	6.907	13.253
Lubricant	0.306	1.439	1.036	0.994
Tyres	0.352	1.281	1.626	4.382
Maintenance	1.010	3.808	3.929	5.604
Dep. & Int.	4.179	1.684	1.810	5.747
Overhead	3.414	5.420	6.333	8.216
Total	10.793	19.386	21.641	38.196
Gr=3%				
Fuel	1.947	8.350	9.351	20.020
Lubricant	0.389	2.088	1.403	1.502
Tyres	0.195	0.678	0.838	2.842
Maintenance	1.116	4.871	4.583	7.008
Dep. & Int.	5.126	2.110	2.292	7.196
Overhead	4.188	6.792	8.020	10.286
Total	12.961	24.889	26.487	48.854
Gr=5%				
Fuel	2.179	9.882	10.795	23.364
Lubricant	0.436	2.471	1.619	1.752
Tyres	0.150	0.495	0.663	2.103
Maintenance	1.208	5.580	5.126	7.710
Dep. & Int.	5.782	2.311	2.533	7.833
Overhead	4.723	7.440	8.968	11.197
Total	14.478	28.179	29.704	53.959
Gr=7%				
Fuel	2.411	11.400	12.337	27.267
Lubricant	0.482	2.850	1.851	2.045
Tyres	0.128	0.375	0.562	1.617
Maintenance	1.314	6.319	5.753	8.675
Dep. & Int.	6.303	2.517	2.613	8.741
Overhead	5.149	8.104	9.141	12.495
Total	15.787	31.565	32.257	60.840
Gr=9%				
Fuel	2.603	13.283	13.951	30.766
Lubricant	0.521	3.321	2.093	2.307
Tyres	0.116	0.322	0.488	1.421
Maintenance	1.406	7.294	6.425	9.632
Dep. & Int.	6.745	2.687	2.759	9.141
Overhead	5.510	8.651	9.653	13.067
Total	16.901	35.558	35.369	66.334

Annex Table 9-12

Average Running Speed

Existing Route with Project
100% diversion

Year 1990				
Gradient	Pass. Car	Bus	Truck	Trailer
1%	65	63	61	51
3	47	43	37	31
5	40	36	29	23
7	35	31	25	18
9	31	28	21	14
Year 2000				
1%	62	61	60	48
3	45	41	36	31
5	37	34	29	23
7	30	28	24	18
9	25	24	20	14
Year 2010				
1%	59	59	59	47
3	39	37	35	29
5	32	31	28	23
7	26	25	23	18
9	21	21	19	14

Annex Table 9-13 Average Annual Running Mileage (1000 Km/Year)

	Gradient				
Year 1990	1%	3%	5%	7%	9%
Pass.Car	19.3	16.7	15.7	15.0	14.4
Bus	95.0	79.6	75.7	72.1	70.6
Truck	60.8	48.8	46.0	44.1	42.3
Trailer	84.3	65.9	60.0	55.7	52.2
Year 2000					
Pass.Car	18.9	16.4	14.8	13.9	13.0
Bus	93.6	78.1	72.2	68.6	15.4
Truck	60.4	48.3	46.0	43.2	41.3
Trailer	81.7	65.9	60.0	55.7	52.2
Year 2010					
Pass.Car	18.4	15.5	13.9	13.1	12.1
Bus	92.1	75.0	69.7	65.1	61.6
Truck	59.9	47.8	43.4	42.3	40.3
Trailer	80.9	63.9	60.0	55.7	52.2

Existing route with Project
100% diversion

Annex Table 9-14 Fuel Consumption (Existing Route with Project)

1/1000 Km

Year 1990	1%	3%	5%	7%	9%
Pass.Car	139.78	153.7	159.4	167.8	178.3
Bus	506.9	645.82	734.0	803.41	972.11
Truck	576.05	733.88	834.1	950.6	1,077.50
Trailer	1,190.36	1,585.21	1,834.9	2,110.4	2,413.6
Year 2000					
Pass.Car	130.54	153.3	162.01	175.15	190.36
Bus	481.26	649.66	746.12	836.5	1,003.99
Truck	561.48	736.06	834.1	959.37	1,086.55
Trailer	1,097.69	1,585.21	1,834.9	2,110.4	2,413.6
Year 2010					
Pass.Car	121.3	152.1	166.36	181.03	198.4
Bus	455.62	657.34	764.3	869.59	1,027.9
Truck	546.91	738.24	840.98	968.14	1,095.6
Trailer	1,066.8	1,585.21	1,834.9	2,110.4	2,413.6

Annex Table 9-15 Depreciation and Interest Cost (Cont'd.)
Existing Route with Project

Year	Vehicle Type	Gradient (%)	Annual Km	Econ.Dep. Cost/Year	Econ.Dep. Cost/Km	Remarks
1990	Pass. Car	1	19,300		3.984	Dep. Econ. Cost pesos 493,863 n=13 i=12%
		3	16,700		4.604	
		5	15,700	76,895	4.898	
		7	15,000		5.126	
		9	14,400		5.340	
	Bus	1	95,000		1.632	Pesos 876,177 n=10 i=12%
		3	79,600	155,066	1.948	
		5	75,700		2.048	
		7	72,100		2.151	
		9	70,600		2.196	
	Truck	1	60,800		1.783	Pesos 786,082 n=18 i=12%
		3	48,800	108,432	2.222	
		5	46,000		2.357	
		7	44,100		2.459	
		9	42,300		2.563	
	Trailer	1	84,300		5.454	Pesos 2,953,458 n=13 i=12%
		3	65,900	459,794	6.977	
		5	60,000		7.663	
		7	55,700		8.255	
		9	52,200		8.808	
2000	Pass. Car	1	18,900		4.069	
		3	16,400		4.689	
		5	14,800	76,895	5.196	
		7	13,900		5.532	
		9	13,000		5.915	
	Bus	1	93,600		1.657	
		3	78,100	155,066	1.985	
		5	72,200		2.148	
		7	68,600		2.260	
		9	65,400		2.371	
	Truck	1	60,400		1.795	
		3	48,300	108,432	2.245	
		5	46,000		2.357	
		7	43,200		2.510	
		9	41,300		2.625	
	Trailer	1	81,700		5.628	
		3	65,900	459,794	6.977	
		5	60,000		7.663	
		7	55,700		8.255	
		9	52,200		8.808	

Annex Table 9-15 Depreciation and Interest Cost (Cont'd.)
Existing Route with Project

Year	Vehicle Type	Gradient (%)	Annual Km	Econ.Dep. Cost/Year	Econ.Dep. Cost/Km	Remarks
2010	Pass. Car	1	18,400		4.179	
		3	15,500		4.961	
		5	13,900	76,895	5.532	
		7	13,100		5.870	
		9	12,100		6.355	
	Bus	1	92,100		1.684	
		3	75,000		2.068	
		5	69,700	155,066	2.225	
		7	65,100		2.382	
		9	61,600		2.517	
	Truck	1	59,900		1.810	
		3	47,800		2.268	
		5	43,400	108,432	2.498	
		7	42,300		2.563	
		9	40,300		2.691	
	Trailer	1	80,900		5.683	
		3	63,900		7.196	
		5	60,000	459,794	7.663	
		7	55,700		8.255	
		9	52,200		8.808	

Annex Table 9-16 Fixed Cost

Existing Route with Project

Year	Vehicle	Gradient (%)	Econ.Fixed Cost Per Year	Annual	Econ.Fixed Cost/Km
1990	Pass.Car	1	62,813	19,300	3.255
		3		16,700	3.761
		5		15,700	4.001
		7		15,000	4.188
		9		14,400	4.362
	Bus	1	499,178	95,000	5.255
		3		79,600	6.271
		5		75,700	6.594
		7		72,100	6.923
		9		70,600	7.071
	Truck	1	379,346	60,800	6.239
		3		48,800	7.773
		5		46,000	8.247
		7		44,100	8.602
		9		42,300	8.968
	Trailer	1	657,246	84,300	7.797
		3		65,900	9.973
		5		60,000	10.954
		7		55,700	11.800
		9		52,200	12.591
2000	Pass.Car	1	62,813	18,900	3.323
		3		16,400	3.830
		5		14,800	4.244
		7		13,900	4.519
		9		13,000	4.832
	Bus	1	499,178	93,600	5.333
		3		78,100	6.392
		5		72,200	6.914
		7		68,600	7.277
		9		65,400	7.633
	Truck	1	379,346	60,400	6.281
		3		48,300	7.854
		5		46,000	8.247
		7		43,200	8.781
		9		41,300	9.185
	Trailer	1	657,246	81,700	8.045
		3		65,900	9.973
		5		60,000	10.954
		7		55,700	11.800
		9		52,200	12.591

Annex Table '9-16

Fixed Cost (Cont'd.)

Existing Route with Project

Year	Vehicle Type	Gradient (%)	Econ.Fixed Cost Per Year	Annual Km	Econ.Fixed Cost/Km
2010	Pass.Car	1	62,813	18,400	3.414
		3		15,500	4.052
		5		13,900	4.519
		7		13,100	4.795
		9		12,100	5.191
	Bus	1	499,178	92,100	5.420
		3		75,000	6.656
		5		69,700	7.162
		7		65,100	7.668
		9		61,600	8.104
	Truck	1	379,346	59,900	6.333
		3		47,800	7.936
		5		43,400	8.741
		7		42,300	8.968
		9		40,300	9.413
	Trailer	1	657,246	80,900	8.124
		3		63,900	10.286
		5		60,000	10.954
		7		55,700	11.800
		9		52,200	12.591

Annex Table 9-17 Tyre Cost

Existing Route with Project

Year	Vehicle Type	Gradient (%)	Life in Km	Cost of a Set	Cost/Km
1990	Pass. Car	1	22,300	9,040	0.405
		3	33,000		0.274
		5	40,000		0.226
		7	48,000		0.188
		9	55,000		0.164
	Bus	1	24,100	32,400	1.344
		3	37,300		0.869
		5	46,000		0.704
		7	55,000		0.589
		9	65,500		0.495
	Truck	1	25,800	44,400	1.721
		3	44,700		0.993
		5	58,000		0.766
		7	70,000		0.634
		9	82,000		0.541
	Trailer	1	32,700	167,400	5.119
		3	54,900		3.049
		5	76,000		2.203
		7	94,000		1.781
		9	113,000		1.481
2000	Pass. Car	1	24,000	9,040	0.377
		3	35,000		0.258
		5	44,800		0.202
		7	53,300		0.170
		9	65,500		0.138
	Bus	1	25,400	32,400	1.276
		3	39,800		0.814
		5	49,600		0.653
		7	65,500		0.495
		9	79,500		0.408
	Truck	1	26,500	44,400	1.675
		3	46,300		0.959
		5	58,000		0.766
		7	73,000		0.608
		9	85,000		0.522
	Trailer	1	36,000	167,400	4.650
		3	54,900		3.049
		5	76,000		2.203
		7	94,000		1.781
		9	113,000		1.481

Annex Table 9-17 Tyre Cost (Cont'd.)

Existing Route with Project

Year	Vehicle Type	Gradient (%)	Life in Km	Cost of a Set	Cost/Km
2010	Pass.Car	1	25,700	9,040	0.352
		3	41,600		0.217
		5	53,300		0.170
		7	63,800		0.142
		9	72,500		0.125
	Bus	1	26,600	32,400	1.218
		3	44,800		0.732
		5	55,000		0.589
		7	76,000		0.462
		9	90,000		0.360
	Truck	1	27,300	44,400	1.626
		3	48,000		0.925
		5	61,000		0.728
		7	76,000		0.584
		9	88,000		0.505
	Trailer	1	37,100	167,400	4.512
		3	58,900		2.842
		5	76,000		2.203
		7	94,000		1.781
		9	113,000		1.481

Annex Table 9-18 Vehicle Maintenance Cost

Existing Route with Project

Year 1990

Vehicle Type	Gradient (%)	Fuel Cost Pesos/Km	Lubricant Pesos/Km	Tyres Pesos/Km	Total Pesos/Km	Fina. Cost Pesos/Km	Econ. Cost Pesos/Km
Pass. Car	1	1.256	(0.20)	0.405	1.912	(0.668)	(0.90)
	3	1.381	0.276	0.274	1.931	1.277	1.149
	5	1.432	0.286	0.226	1.944	1.290	1.161
	7	1.507	0.301	0.188	1.996	1.299	1.169
	9	1.602	0.320	0.164	2.086	1.333	1.200
Bus						1.393	1.254
	1	4.553	(0.25)	1.344	7.035	(0.668)	(0.90)
	3	5.801	1.138	0.869	8.120	4.699	4.229
	5	6.594	1.450	0.704	8.947	5.424	4.882
	7	7.217	1.649	0.589	9.610	5.977	5.379
	9	8.732	1.804	0.495	11.410	6.419	5.778
Truck						7.622	6.860
	1	5.175	(0.15)	1.721	7.672	(0.600)	(0.90)
	3	6.592	0.776	0.993	8.574	4.603	4.143
	5	7.493	0.989	0.766	9.383	5.144	4.630
	7	8.539	1.124	0.634	10.454	5.630	5.067
	9	9.679	1.281	0.541	11.672	6.272	5.645
Trailer						7.003	6.303
	1	10.693	(0.075)	5.119	16.614	(0.429)	(0.90)
	3	14.240	0.802	3.049	18.357	7.127	6.415
	5	16.483	1.068	2.203	19.922	7.875	7.088
	7	18.958	1.236	1.781	22.161	8.547	7.692
	9	21.681	1.422	1.481	24.788	9.507	8.556
			1.626			10.634	9.571

Fuel Price 8.983 Pesos/l

Annex Table 9-18 Vehicle Maintenance Cost

(Cont'd) Existing Route with Project Year 2000

Vehicle Type	Gradient (%)	Fuel Cost Pesos/Km	Lubricant Pesos/Km	Tyres Pesos/Km	Total Pesos/Km	Fina. Cost Pesos/Km	Econ. Cost Pesos/Km
Pass. Car			(0.20)			(0.668)	(0.90)
	1	1.173	0.235	0.377	1.785	1.192	1.073
	3	1.377	0.275	0.258	1.910	1.276	1.148
	5	1.455	0.291	0.202	1.948	1.301	1.171
	7	1.573	0.315	0.170	2.058	1.375	1.237
	9	1.710	0.342	0.138	2.190	1.463	1.317
Bus			(0.25)			(0.668)	(0.90)
	1	4.323	1.081	1.276	6.680	4.462	4.016
	3	5.836	1.459	0.814	8.109	5.417	4.875
	5	6.702	1.676	0.653	9.031	6.033	5.429
	7	7.514	1.879	0.495	9.888	6.605	5.945
	9	9.019	2.255	0.408	11.682	7.804	7.023
Truck			(0.15)			(0.600)	(0.90)
	1	5.044	0.757	1.675	7.476	4.486	4.037
	3	6.612	0.992	0.959	8.563	5.138	4.624
	5	7.493	1.124	0.766	9.383	5.630	5.067
	7	8.618	1.293	0.608	10.519	6.311	5.680
	9	9.760	1.464	0.522	11.746	7.048	6.343
Trailer			(0.075)			(0.429)	(0.90)
	1	9.861	0.740	4.650	15.251	6.543	5.888
	3	14.240	1.068	3.049	18.357	7.875	7.088
	5	16.483	1.236	2.203	19.922	8.547	7.692
	7	18.958	1.422	1.781	22.161	9.507	8.556
	9	21.681	1.626	1.481	24.788	10.634	9.571

Fuel Price 8.983 Pesos/l

Annex Table 9-18 Vehicle Maintenance Cost
(Cont'd) Existing Route with Project Year 2010

Vehicle	Gradient (%)	Fuel Cost Pesos/Km	Lubricant Pesos/Km	Tyres Pesos/Km	Total Pesos/Km	Fina. Cost Pesos/Km	Econ. Cost Pesos/Km
Pass. Car			(0.20)			(0.668)	(0.90)
	1	1.090	0.218	0.352	1.660	1.109	0.998
	3	1.366	0.273	0.217	1.856	1.240	1.116
	5	1.494	0.299	0.170	1.963	1.311	1.180
	7	1.626	0.325	0.142	2.093	1.398	1.258
	9	1.782	0.356	0.125	2.263	1.512	1.361
Bus			(0.25)			(0.688)	(0.90)
	1	4.093	1.023	1.218	6.334]	4.231	3.808
	3	5.905	1.476	0.732	8.113	5.419	4.878
	5	6.866	1.717	0.589	9.172	6.127	5.514
	7	7.812	1.953	0.462	10.227	6.832	6.148
	9	9.234	2.301	0.360	11.895	7.946	7.151
Truck			(0.15)			(0.600)	(0.90)
	1	4.913	0.737	1.626	7.276	4.366	3.929
	3	6.632	0.995	0.925	8.552	5.131	4.618
	5	7.555	1.133	0.728	9.416	5.650	5.085
	7	8.697	1.305	0.584	10.586	6.352	5.716
	9	9.842	1.476	0.505	11.823	7.094	6.384
Trailer			(0.075)			(0.429)	(0.90)
	1	9.583	0.719	4.512	14.814	6.355	5.720
	3	14.240	1.068	2.842	18.150	7.786	7.008
	5	16.483	1.236	2.203	19.922	8.547	7.692
	7	18.958	1.422	1.781	22.161	9.507	8.556
	9	21.681	1.626	1.481	24.788	10.634	9.571

Fuel Price 8.983 Pesos/l

Annex Table 9-19 Economic Cost of Vehicle Operation (Pesos/Km)

Existing Route with Project

Year 1990

	Vehicle Type			
	Pass.Car	Bus	Truck	Trailer
Gr=1%				
Fuel	1.765	6.402	7.275	15.033
Lubricant	0.353	1.601	1.091	1.127
Tyres	0.405	1.344	1.721	5.119
Maintenance	1.149	4.229	4.143	6.415
Dep. & Int.	3.984	1.632	1.783	5.454
Overhead	3.255	5.255	6.239	7.797
Total	10.911	20.463	22.252	40.945
Gr=3%				
Fuel	1.941	8.156	9.268	20.020
Lubricant	0.388	2.039	1.390	1.502
Tyres	0.274	0.869	0.993	3.049
Maintenance	1.161	4.882	4.630	7.088
Dep. & Int.	4.604	1.948	2.222	6.977
Overhead	3.761	6.271	7.773	9.973
Total	12.129	24.165	26.276	48.609
Gr=5%				
Fuel	2.013	9.270	10.534	23.173
Lubricant	0.403	2.318	1.580	1.738
Tyres	0.226	0.704	0.766	2.203
Maintenance	1.169	5.379	5.067	7.692
Dep. & Int.	4.898	2.048	2.357	7.663
Overhead	4.001	6.594	8.247	10.954
Total	12.710	26.313	28.551	53.423
Gr=7%				
Fuel	2.119	10.146	12.005	26.652
Lubricant	0.424	2.537	1.801	1.999
Tyres	0.188	0.589	0.634	1.781
Maintenance	1.200	5.778	5.645	8.556
Dep. & Int.	5.126	2.151	2.459	8.255
Overhead	4.188	6.923	8.602	11.800
Total	13.245	28.124	31.146	59.043
Gr=9%				
Fuel	2.252	12.277	13.608	30.481
Lubricant	0.450	3.069	2.041	2.286
Tyres	0.164	0.495	0.541	1.481
Maintenance	1.254	6.860	6.303	9.571
Dep. & Int.	5.340	2.196	2.563	8.808
Overhead	4.362	7.071	8.968	12.591
Total	13.822	31.968	34.024	65.218

Annex Table 9-19 Economic Cost of Vehicle Operation (Pesos/Km)
 (Cont'd) Existing Route with Project Year 2000

	Vehicle Type			
	Pass. Car	Bus	Truck	Trailer
Gr=1%				
Fuel	1.649	6.078	7.091	13.863
Lubricant	0.330	1.520	1.064	1.040
Tyres	0.377	1.276	1.675	4.650
Maintenance	1.073	4.016	4.037	5.888
Dep. & Int.	4.069	1.657	1.795	5.628
Overhead	3.323	5.333	6.281	8.045
Total	10.821	19.880	21.943	39.114
Gr=3%				
Fuel	1.936	8.205	9.296	20.020
Lubricant	0.387	2.051	1.394	1.502
Tyres	0.258	0.814	0.959	3.049
Maintenance	1.148	4.875	4.624	7.088
Dep. & Int.	4.689	1.985	2.245	6.977
Overhead	3.830	6.392	7.854	9.973
Total	12.248	24.322	26.372	48.609
Gr=5%				
Fuel	2.046	9.423	10.534	23.173
Lubricant	0.409	2.356	1.580	1.738
Tyres	0.202	0.653	0.766	2.203
Maintenance	1.171	5.429	5.067	7.692
Dep. & Int.	5.196	2.148	2.357	7.663
Overhead	4.244	6.914	8.247	10.954
Total	13.268	26.923	28.551	53.423
Gr=7%				
Fuel	2.212	10.564	12.116	26.652
Lubricant	0.442	2.641	1.817	1.999
Tyres	0.170	0.495	0.608	1.781
Maintenance	1.237	5.945	5.680	8.556
Dep. & Int.	5.532	2.260	2.510	8.255
Overhead	4.519	7.277	8.781	11.800
Total	14.112	29.182	31.512	59.043
Gr=9%				
Fuel	2.404	12.679	13.722	30.481
Lubricant	0.481	3.170	2.058	2.286
Tyres	0.138	0.408	0.522	1.481
Maintenance	1.317	7.023	6.343	9.571
Dep. & Int.	5.915	2.371	2.625	8.808
Overhead	4.832	7.633	9.185	12.591
Total	15.087	33.284	34.455	65.218

Annex Table 9-19 Economic Cost of Vehicle Operation (Pesos/Km)
(Cont'd)
Existing Route with Project Year 2010

	Vehicle Type			
	Pass.Car	Bus	Truck	Trailer
Gr=1%				
Fuel	1.532	5.754	6.907	13.473
Lubricant	0.306	1.439	1.036	1.010
Tyres	0.352	1.218	1.626	4.512
Maintenance	0.998	3.808	3.929	5.720
Dep. & Int.	4.179	1.684	1.810	5.683
Overhead	3.414	5.420	6.333	8.124
Total	10.508	19.323	21.641	38.522
Gr=3%				
Fuel	1.921	8.302	9.323	20.020
Lubricant	0.384	2.076	1.398	1.502
Tyres	0.217	0.732	0.925	2.842
Maintenance	1.116	4.878	4.618	7.008
Dep. & Int.	4.961	2.068	2.268	7.196
Overhead	4.052	6.656	7.936	10.286
Total	12.651	24.712	26.468	48.854
Gr=5%				
Fuel	2.101	9.652	10.621	23.173
Lubricant	0.420	2.413	1.593	1.738
Tyres	0.170	0.589	0.728	2.203
Maintenance	1.180	5.514	5.085	7.692
Dep. & Int.	5.532	2.225	2.498	7.663
Overhead	4.519	7.162	8.741	10.954
Total	13.922	27.555	29.266	53.423
Gr=7%				
Fuel	2.286	10.982	12.227	26.652
Lubricant	0.457	2.746	1.834	1.999
Tyres	0.142	0.462	0.584	1.781
Maintenance	1.258	6.148	5.716	8.556
Dep. & Int.	5.870	2.382	2.563	8.255
Overhead	4.795	7.668	8.968	11.800
Total	14.808	30.388	31.892	59.043
Gr=9%				
Fuel	2.506	12.981	13.836	30.481
Lubricant	0.501	3.245	2.075	2.286
Tyres	0.125	0.360	0.505	1.481
Maintenance	1.361	7.151	6.384	9.571
Dep. & Int.	6.355	2.517	2.691	8.808
Overhead	5.191	8.104	9.413	12.591
Total	16.039	34.358	34.904	15.218

Annex Table. 9-20 Average Running Speed

New Route

Year 1990 Gradient	Pass. Car	Bus	Truck	Trailer
1%	68	67	65	54
3	48	44	38	32
5	40	36	29	23
7	35	31	25	18
9	31	28	21	14
Year 2000				
1	65	65	64	54
3	48	44	38	32
5	40	36	29	23
7	31	28	25	18
9	27	25	21	14
Year 2010				
1	63	63	63	50
3	46	41	38	32
5	37	33	28	23
7	27	25	24	18
9	24	23	20	14

Annex Table 9-21 Average Annual Running Mileage (1000 Km/Year)
(New Route)

Year 1990	1%	3	5	7	9
Pass.Car	19.7	16.9	15.7	15.0	14.4
Bus	97.9	81.4	75.7	72.1	70.6
Truck	62.7	50.1	46.0	44.1	42.3
Trailer	87.0	67.0	60.0	55.7	52.2
Year 2000					
Pass.Car	19.3	16.9	15.7	14.1	13.5
Bus	96.4	81.4	75.7	68.6	66.7
Truck	62.2	50.1	46.0	44.1	42.3
Trailer	87.0	67.0	60.0	55.7	52.2
Year 2010					
Pass.Car	19.0	16.5	14.8	13.3	12.8
Bus	95.0	78.1	71.4	65.1	64.2
Truck	61.8	50.1	43.4	43.2	41.3
Trailer	83.5	67.0	60.0	55.7	52.2

Annex Table 9-22 Fuel Consumption (New Route) 1/1000 Km

1990	1%	3%	5%	7%	9%
Pass.Car	149.02	153.9	159.4	167.8	178.3
Bus	558.18	643.9	734.0	803.41	972.11
Truck	634.33	731.7	834.1	950.6	1,077.5
Trailer	1,283.03	1,571.08	1,834.9	2,110.4	2,413.6
2000					
Pass.Car	139.78	153.9	159.4	173.68	186.34
Bus	532.54	643.9	734.0	836.5	996.02
Truck	619.76	731.7	834.1	950.6	1,077.5
Trailer	1,283.03	1,571.08	1,834.9	2,110.4	2,413.6
2010					
Pass.Car	133.62	153.5	162.01	179.56	192.37
Bus	506.9	649.66	752.18	869.59	1,011.96
Truck	605.19	731.7	840.98	959.37	1,086.55
Trailer	1,159.47	1,589.92	1,834.9	2,110.4	2,413.6

Annex Table 9-23 Depreciation and Interest Cost

New Route

Year	Vehicle Type	Gradient (%)	Annual Km	Econ.Dep. Cost/Year	Econ.Dep. Cost/Km	Remarks
1990	Pass. Car	1	19,700		3.903	Dep. Econ. Cost
		3	16,900		4.550	Pesos
		5	15,700	76,895	4.898	493,863
		7	15,000		5.126	n=13
		9	14,400		5.340	i=12%
	Bus	1	97,900		1.584	Pesos
		3	81,400		1.905	876,177
		5	75,700	155,066	2.048	n=10
		7	72,100		2.151	i=12%
		9	70,600		2.196	
	Truck	1	62,700		1.729	Pesos
		3	50,100		2.164	786,082
		5	46,000	108,432	2.357	n=18
		7	44,100		2.459	i=12%
		9	42,300		2.563	
	Trailer	1	87,000		5.285	Pesos
		3	67,000		6.863	2,953,458
		5	60,000	459,794	7.663	n=13
		7	55,700		8.255	i=12%
		9	52,200		8.808	
2000	Pass. Car	1	19,300		3.984	
		3	16,900		4.550	
		5	15,700	76,895	4.898	
		7	14,100		5.454	
		9	13,500		5.696	
	Bus	1	96,400		1.609	
		3	81,400		1.905	
		5	75,700	155,066	2.048	
		7	68,600		2.260	
		9	66,700		2.325	
	Truck	1	62,200		1.743	
		3	50,100		2.164	
		5	46,000	108,432	2.357	
		7	44,100		2.459	
		9	42,300		2.563	
	Trailer	1	87,000		5.285	
		3	67,000		6.863	
		5	60,000	459,794	7.663	
		7	55,700		8.255	
		9	52,200		8.808	

Annex Table 9-23 Depreciation and Interest Cost (Cont'd.)

Year	Vehicle Type	Gradient (%)	Annual km	Econ.Dep. Cost/Year	Econ.Dep. Cost/km	Remarks
2010	Pass.Car	1	19,000	76,895	4,047	
		3	16,500		4,660	
		5	14,800		5,196	
		7	13,300		5,782	
		9	12,800		6,007	
	Bus	1	95,000	155,066	1,632	
		3	78,100		1,985	
		5	71,400		2,172	
		7	65,100		2,382	
		9	64,200		2,145	
	Truck	1	61,800	108,432	1,755	
		3	50,100		2,164	
		5	43,400		2,498	
		7	43,200		2,510	
		9	41,300		2,625	
	Trailer	1	83,500	459,794	5,507	
		3	67,000		6,863	
		5	60,000		7,663	
		7	55,700		8,255	
		9	52,200		8,808	

Annex Table 9-24

Fixed Cost

New Route

Year	Vehicle Type	Gradient (%)	Econ.Fixed Cost Per Year	Annual km	Econ.Fixed Cost/km
1990	Pass.Car	1	62,813	19,700	3,188
		3		16,900	3,717
		5		15,700	4,001
		7		15,000	4,188
		9		14,400	4,362
	Bus	1	499,178	97,900	5,099
		3		81,400	6,132
		5		75,700	6,594
		7		72,100	6,923
		9		70,600	7,071
	Truck	1	379,346	62,700	6,050
		3		50,000	7,572
		5		46,000	8,247
		7		44,100	8,602
		9		42,300	8,968
	Trailer	1	657,246	87,000	7,555
		3		67,000	9,810
		5		60,000	10,954
		7		55,700	11,800
		9		52,200	12,591
2000	Pass.Car	1	62,813	19,300	3,255
		3		16,900	3,717
		5		15,700	4,001
		7		14,100	4,455
		9		13,500	4,653
	Bus	1	499,178	96,400	5,178
		3		81,400	6,132
		5		75,700	6,594
		7		68,600	7,277
		9		66,700	7,484
	Truck	1	379,346	62,200	6,099
		3		50,100	7,572
		5		46,000	8,247
		7		44,100	8,602
		9		42,300	8,968
	Trailer	1	657,246	87,000	7,555
		3		67,000	9,810
		5		60,000	10,954
		7		55,700	11,800
		9		52,200	12,591

Annex Table 9-24 Fixed Cost (cont'd.)

New Route

Year	Vehicle Type	Gradient (%)	Econ.Fixed Cost Per Year	Annual km	Econ.Fixed Cost/km
2010	Pass.Car	1	62,813	19,000	3.306
		3		16,500	3.807
		5		14,800	4.244
		7		13,300	4.723
		9		12,800	4.907
	Bus	1	499,178	95,000	5.255
		3		78,100	6.392
		5		71,400	6.991
		7		65,100	7.668
		9		64,200	7.775
	Truck	1	379,346	61,800	6.138
		3		50,100	7.572
		5		43,400	8.741
		7		43,200	8.781
		9		41,300	9.185
	Trailer	1	657,246	83,500	7.871
		3		67,000	9.810
		5		60,000	10.954
		7		55,700	11.800
		9		52,200	12.591

Annex Table 9-25 Tyre Cost

New Route

Year	Vehicle Type	Gradient (%)	Life in km	Cost of a set	Cost/km
1990	Pass.Car	1	20,600	9,040	0.439
		3	32,000		0.283
		5	40,000		0.226
		7	48,000		0.188
		9	55,000		0.164
	Bus	1	21,600	32,400	1.500
		3	36,000		0.900
		5	46,000		0.704
		7	55,000		0.589
		9	65,500		0.495
	Truck	1	22,800	44,400	1.947
		3	43,000		1.033
		5	58,000		0.766
		7	70,000		0.634
		9	82,000		0.541
	Trailer	1	29,300	167,400	5.713
		3	53,800		3.112
		5	76,000		2.203
		7	94,000		1.781
		9	113,000		1.481
2000	Pass.Car	1	22,300	9,040	0.405
		3	32,000		0.283
		5	40,000		0.226
		7	55,000		0.164
		9	62,000		0.146
	Bus	1	22,900	32,400	1.415
		3	36,000		0.900
		5	46,000		0.704
		7	65,500		0.495
		9	76,000		0.426
	Truck	1	23,500	44,400	1.930
		3	43,000		1.033
		5	58,000		0.766
		7	70,000		0.634
		9	82,000		0.541
	Trailer	1	29,300	167,400	5.713
		3	53,800		3.112
		5	76,000		2.203
		7	94,000		1.781
		9	113,000		1.481

Annex Table 9-25 (Cont'd.) Tyre Cost

New Route

Year	Vehicle Type	Gradient (%)	Life in km	Cost of a set	Cost/km
2010	Pass.Car	1	23,400	9,040	0.386
		3	34,000		0.266
		5	44,800		0.202
		7	62,000		0.146
		9	67,300		0.134
	Bus	1	24,100	32,400	1.344
		3	39,400		0.814
		5	51,400		0.630
		7	76,000		0.426
		9	83,000		0.390
	Truck	1	24,300	41,400	1.827
		3	43,000		1.033
		5	61,000		0.728
		7	73,000		0.608
		9	85,000		0.522
	Trailer	1	32,700	167,400	5.119
		3	53,800		3.112
		5	76,000		2.203
		7	94,000		1.781
		9	113,000		1.481

Annex Table 9-26 Vehicle Maintenance Cost

Year 1990

Rw Route

Vehicle Type	Gradient (%)	Fuel Cost pesos/km	Lubricant pesos/km	Tyres pesos/km	Total pesos/km	Fina. Cost pesos/km	Econ. Cost pesos/km
Pass. Car			(0.20)			(0.668)	(0.90)
	1	1.339	0.268	0.439	2.046	1.367	1.230
	3	1.382	0.276	0.283	1.941	1.297	1.167
	5	1.432	0.286	0.226	1.944	1.299	1.169
	7	1.507	0.301	0.188	1.996	1.333	1.200
	9	1.602	0.320	0.164	2.086	1.393	1.254
Bus			(0.25)			(0.668)	(0.90)
	1	5.014	1.254	1.500	7.768	5.189	4.670
	3	5.784	1.446	0.900	8.130	5.431	4.888
	5	6.594	1.649	0.704	8.947	5.977	5.379
	7	7.217	1.804	0.589	9.610	6.419	5.778
	9	8.732	2.183	0.495	11.410	7.622	6.860
Truck			(0.15)			(0.600)	(0.90)
	1	5.698	0.855	1.947	8.500	5.100	4.590
	3	6.573	0.986	1.033	8.592	5.155	4.640
	5	7.493	1.124	0.766	9.383	5.630	5.067
	7	8.539	1.281	0.634	10.454	6.272	5.645
	9	9.679	1.452	0.541	11.672	7.003	6.303
Trailer			(0.075)			(0.429)	(0.90)
	1	11.525	0.864	5.713	18.102	7.766	6.989
	3	14.113	1.058	3.112	18,283	7.843	7.059
	5	16.483	1.236	2.203	19.922	8.547	7.692
	7	18.958	1.422	1.781	22.161	9.507	8.556
	9	21.681	1.626	1.481	24.788	10.634	9.571

Annex Table 9-26 Vehicle Maintenance Cost

(Cont'd)

New Route

Year 2000

Vehicle Type	Gradient (%)	Fuel Cost pesos/km	Lubricant pesos/km	Tyres pesos/km	Total pesos/km	Fina. Cost pesos/km	Econ. Cost pesos/km
Pass. Car	1	1.256	(0.20)	0.405	1.912	(0.668)	(0.90)
	3	1.382	0.251	0.277	1.912	1.277	1.149
	5	1.432	0.276	0.283	1.941	1.297	1.167
	7	1.560	0.286	0.226	1.944	1.299	1.169
	9	1.674	0.312	0.164	2.036	1.360	1.224
Bus			0.335	0.146	2.155	1.440	1.296
	1	4.784	(0.25)	1.415	7.395	(0.668)	(0.90)
	3	5.784	1.196	0.900	8.130	4.940	4.446
	5	6.594	1.446	0.704	8.947	5.431	4.888
	7	7.514	1.649	0.495	9.888	5.977	5.379
Truck	9	8.947	1.879	0.426	11.610	6.605	5.945
			2.237			7.755	6.980
	1	5.567	(0.15)	1.930	8.332	(0.600)	(0.90)
	3	6.573	0.835	1.033	8.592	4.999	4.499
	5	7.493	0.986	0.766	9.383	5.155	4.640
Trailer	7	8.539	1.124	0.634	10.454	5.630	5.067
	9	9.679	1.281	0.541	11.672	6.272	5.645
			1.452			7.003	6.303
	1	11.525	(0.075)	5.713	18.102	(0.429)	(0.90)
	3	14.113	0.864	3.112	18.283	7.766	6.989
Trailer	5	16,483	1.058	2.203	19.922	7,843	7,059
	7	18,958	1.236	1.781	22.161	8,547	7,692
	9	21,681	1.422	1.481	24,788	9,507	8,556
			1.626			10,634	9,571

Annex Table 9-26 Vehicle Maintenance Cost

(Cont'd) New Route Year 2010

Vehicle Type	Gradient (%)	Fuel Cost pesos/km	Lubricant pesos/km	Tyres pesos/km	Total pesos/km	Fina. Cost pesos/km	Econ. Cost pesos/km
Pass. Car	1	1.200	(0.20)	0.386	1.826	(0.668)	(0.90)
	3	1.379	0.276	0.266	1.921	1.220	1.098
	5	1.455	0.291	0.202	1.948	1.283	1.155
	7	1.613	0.323	0.146	2.082	1.301	1.171
	9	1.728	0.346	0.134	2.208	1.391	1.252
Bus						1.475	1.327
	1	4.553	(0.25)	1.344	7.035	(0.668)	(0.90)
	3	5.836	1.138	0.814	8.109	4.699	4.229
	5	6.787	1.459	0.630	9.076	5.417	4.875
	7	7.812	1.689	0.426	10.191	6.063	5.456
Truck	9	9.090	1.953	0.390	11.753	6.808	6.127
			2.273			7.851	7.066
	1	5.436	(0.15)	1.827	8.078	(0.600)	(0.90)
	3	6.573	0.815	1.033	8.592	4.847	4.362
	5	7.555	0.986	0.728	9.412	5.155	4.640
Trailer	7	8.618	1.33	0.608	10.519	5.650	5.085
	9	9.760	1.293	0.522	11.746	6.311	5.680
			1.464			7.048	6.343
	1	10.416	(0.075)	5.119	16.316	(0.429)	(0.90)
	3	14.282	0.781	3.112	18.465	7.000	6.300
Trailer	5	16.483	1.071	2.203	19.922	7.921	7.129
	7	18.958	1.236	1.781	22.161	8.547	7.692
	9	21.681	1.422	1.481	24.788	9.507	8.556
			1.626			10.634	9.571

Annex Table 9-27

Economic Cost of Vehicle Operation (pesos/km)

	New Route				Year 1990			
	Vehicle Type							
	Pass.Car	Bus	Truck	Trailer				
Gr=1%								
Fuel	1.882	7.049	8.011	16.203				
Lubricant	0.376	1.762	1.202	1.215				
Tyres	0.439	1.500	1.947	5.713				
Maintenance	1.230	4.670	4.590	6.989				
Dep. & Int.	3.903	1.584	1.729	5.285				
Overhead	3.188	5.099	6.050	7.555				
Total	11.018	21.664	23.529	42.960				
Gr=3%								
Fuel	1.944	8.132	9.241	19.841				
Lubricant	0.389	2.033	1.386	1.488				
Tyres	0.283	0.900	1.033	3.112				
Maintenance	1.167	4.888	4.640	7.059				
Dep. & Int.	4.550	1.905	2.164	6.863				
Overhead	3.717	6.132	7.572	9.810				
Total	12.050	23.990	26.036	48.173				
Gr=5%								
Fuel	2.013	9.270	10.534	23.173				
Lubricant	0.403	2.318	1.580	1.738				
Tyres	0.226	0.704	0.766	2.203				
Maintenance	1.169	5.379	5.067	7.692				
Dep. & Int.	4.898	2.048	2.357	7.663				
Overhead	4.001	6.594	8.247	10.954				
Total	12.710	26.313	28.551	53.423				
Gr=7%								
Fuel	2.119	10.146	12.005	26.652				
Lubricant	0.424	2.537	1.801	1.999				
Tyres	0.188	0.589	0.634	1.781				
Maintenance	1.200	5.778	5.645	8.556				
Dep. & Int.	5.126	2.151	2.459	8.255				
Overhead	4.188	6.923	8.602	11.800				
Total	13.245	28.124	31.146	59.043				
Gr=9%								
Fuel	2.252	12.277	13.608	30.481				
Lubricant	0.450	3.069	2.041	2.286				
Tyres	0.164	0.495	0.541	1.481				
Maintenance	1.254	6.860	6.303	9.571				
Dep. & Int.	5.340	2.196	2.563	8.808				
Overhead	4.362	7.071	8.968	12.591				
Total	13.822	31.968	34.024	65.218				

Annex Table 9-27 Economic Cost of Vehicle Operation (Pesos/Km)
(Cont'd)

	New Route		Year 2000	
	Vehicle		Type	
	Pass. Car	Bus	Truck	Trailer
Gr=1%				
Fuel	1.765	6.725	7.827	16.203
Lubricant	0.353	1.681	1.174	1.215
Tyres	0.405	1.415	1.930	5.713
Maintenance	1.149	4.446	4.499	6.989
Dep. & Int.	3.984	1.609	1.743	5.285
Overhead	3.255	5.178	6.099	7.555
Total	10.911	21.054	23.272	42.960
Gr=3%				
Fuel	1.944	8.132	9.241	19.841
Lubricant	0.389	2.033	1.386	1.488
Tyres	0.283	0.900	1.033	3.112
Maintenance	1.167	4.888	4.640	7.059
Dep. & Int.	4.550	1.905	2.164	6.863
Overhead	3.717	6.132	7.572	9.810
Total	12.050	23.990	26.036	48.173
Gr=5%				
Fuel	2.013	9.270	10.534	23.173
Lubricant	0.403	2.318	1.580	1.738
Tyres	0.226	0.704	0.766	2.203
Maintenance	1.169	5.379	5.067	7.692
Dep. & Int.	4.898	2.048	2.357	7.663
Overhead	4.001	6.594	8.247	10.954
Total	12.710	26.313	28.551	53.423
Gr=7%				
Fuel	2.193	10.564	12.005	26.652
Lubricant	0.439	2.641	1.801	1.999
Tyres	0.164	0.495	0.634	1.781
Maintenance	1.224	5.945	5.645	8.556
Dep. & Int.	5.454	2.260	2.459	8.255
Overhead	4.455	7.277	8.602	11.800
Total	13.929	29.182	31.146	59.043
Gr=9%				
Fuel	2.353	12.579	13.608	30.481
Lubricant	0.471	3.145	2.041	2.286
Tyres	0.146	0.426	0.541	1.481
Maintenance	1.296	6.980	6.303	9.571
Dep. & Int.	5.696	2.325	2.563	8.808
Overhead	4.653	7.484	8.968	12.591
Total	14.615	32.939	34.024	65.218

Annex Table 9-27 Economic Cost of Vehicle Operation (Pesos/Km)
(Cont'd)

	New Route		Year 2010	
	Pass. Car	Vehicle Type Bus	Truck	Trailer
Gr=1%				
Fuel	1.687	6.402	7.643	14.643
Lubricant	0.337	1.601	1.146	1.098
Tyres	0.386	1.344	1.827	5.119
Maintenance	1.098	4.229	4.362	6.300
Dep. & Int.	4.047	1.632	1.755	5.507
Overhead	3.306	5.255	6.138	7.871
Total	10.861	20.463	22.871	40.538
Gr=3%				
Fuel	1.939	8.205	9.241	20.079
Lubricant	0.388	2.051	1.386	1.506
Tyres	0.266	0.814	1.033	3.112
Maintenance	1.155	4.875	4.640	7.129
Dep. & Int.	4.660	1.985	2.164	6.863
Overhead	3.807	6.392	7.572	9.810
Total	12.215	24.322	26.036	48.499
Gr=5%				
Fuel	2.046	9.499	10.621	23.173
Lubricant	0.409	2.375	1.593	1.738
Tyres	0.202	0.630	0.728	2.203
Maintenance	1.171	5.456	5.085	7.692
Dep. & Int.	5.196	2.172	2.498	7.663
Overhead	4.244	6.991	8.741	10.954
Total	13.268	27.123	29.266	53.423
Gr=7%				
Fuel	2.268	10.982	12.116	26.652
Lubricant	0.454	2.746	1.817	1.999
Tyres	0.146	0.426	0.608	1.781
Maintenance	1.252	6.127	5.680	8.556
Dep. & Int.	5.782	2.382	2.510	8.255
Overhead	4.723	7.668	8.781	11.800
Total	14.625	30.331	31.512	59.043
Gr=9%				
Fuel	2.429	12.780	13.722	30.481
Lubricant	0.486	3.195	2.058	2.286
Tyres	0.134	0.390	0.522	1.481
Maintenance	1.327	7.066	6.343	9.571
Dep. & Int.	6.007	2.145	2.625	8.808
Overhead	4.907	7.775	9.185	12.591
Total	15.290	33.351	34.455	65.218

Annex Table 9-28 Traffic Cost (Existing Route without Project)

Road Section	Vehicle Composition (%)	Av. Gradient (%)	Av. V. O. C. (pesos/km)	Road Length (km)	V.O.C. (million Pesos/day)		
					1990	2000	2010
Bypass-Mirondo	50.11.29.10	2.0	19.770/19.734/19.705	51.8	8.019	13.033	21.190
Mirondo-Ibague	62.12.20.6	2.6	18.192/18.387/18.529	5.5	1.318	2.170	3.563
Ibague-Coello	38.9.33.20	5.8	28.874/29.344/29.839	9.1	0.935	1.546	2.561
Coello-K 73	"	5.7	28.747/29.193/29.689	8.2	0.839	1.386	2.296
K73-Cajamarca	"	5.5	28.493/28.891/29.386	16.7	1.694	2.794	4.628
Cajamarca-K104.3	"	5.0	27.859/28.135/28.632	14.3	1.231	2.024	3.353
K104.3-La Linea	"	8.2	32.041/32.877/33.398	9.2	0.911	1.521	2.516
La Linea-K124.5	"	8.8	32.863/33.737/34.270	10.5	1.066	1.782	2.947
K124.5-Calarca	"	7.4	30.944/31.731/32.235	11.1	1.061	1.772	2.930
Calarca-La Espanola	"	1.7	22.813/22.562/22.394	9.9	0.854	1.374	2.221
La Espanola-Sevilla	47.8.27.14	3.1	23.681/23.978/24.166	46.0	5.120	8.449	13.873
Sevilla-Urbe	"	3.8	24.525/24.819/25.133	29.2	2.442	4.029	6.642
Urbe-Buga	50.10.31.9	1.3	18.518/18.269/18.096	43.6	7.121	11.446	18.470
Total					32.611	53.326	87.190

Annex Table 9-28 Traffic Cost (Existing Route with Project)
(Cont'd)

Road Section	Vehicle Composition (%)	Av. Gradient (%)	Av. U. O. C. (pesos/km)	Road Length (km)	V.O.C. (million Pesos/day)		
					1990	2000	2010
Bypass/Mirolindo	50.11.29.10	2.0	19.729/19.590/19.556	51.8	6.622	10.716	17.413
Mirolindo-Ibague	62.12.20.6	2.6	18.099/18.119/18.322	5.5	1.177	1.920	3.163
Ibague-Coello	38.9.33.20	5.8	28.243/28.621/29.146	9.1	0.568	0.938	1.554
Coello-K73	"	5.7	28.126/28.490/29.016	8.2	0.510	0.841	1.394
K73-Cajamarca	"	5.5	27.891/28.228/28.758	16.7	1.029	1.697	2.814
Cajamarca-K104.3	"	5.0	27.304/27.571/28.113	14.3	0.679	1.120	1.857
K104.3-La Linea	"	8.2	31.301/31.964/32.527	9.2	0.501	0.835	1.383
La Linea-K124.5	"	8.8	32.126/32.848/33.444	10.5	0.587	0.980	1.622
K124.5-Calarca	"	7.4	30.201/30.786/31.306	11.1	0.583	0.970	1.605
Calarca-La Espanola	"	1.7	22.800/22.471/22.314	9.9	0.548	0.881	1.425
La Espanola-Sevilla	47.8.27.18	3.1	23.574/23.679/23.983	46.0	3.633	5.958	9.830
Sevilla-Urbe	"	3.8	24.248/24.429/24.824	29.2	1.459	2.404	3.972
Urbe-Buga	50.10.31.9	1.3	18.522/18.229/17.967	43.6	6.032	9.680	15.542
Total					23.928	38.940	63.574

Annex Table 9-28 Traffic Cost (Cont'd) (New Route) — Diverted Traffic

Road Section	Vehicle Composition (%)	Av. Gradient (%)	Av. U. O. C. (pesos/km)	Road Length (km)	V.O.C. (million Pesos/day)		
					1990	2000	2010
Bypass-Espinal	50.12.30.8	1.2	18.801/18.617/18.263	10.3	0.250	0.401	0.641
Espinal-Guamo	"	1.0	18.604/18.400/17.990	16.4	0.394	0.631	1.006
Guamo-Castilla	"	1.0	"	26.1	0.626	1.004	1.601
Castilla-Coyaima	40.10.40.10	0.5	20.281/20.075/19.593	17.0	0.445	0.713	1.136
Coyaima-Chaparral	"	2.0	21.366/21.263/21.088	37.0	1.020	1.644	2.661
Chaparral-Km66.75	40.10.40.10	3.6	23.059/23.059/23.328	12.75	0.379	0.614	1.014
Km66.75-Hermozas	"	3.8	23.262/23.262/23.577	25.75	0.773	1.252	2.070
Hermozas-Km105.75	"	5.9	25.376/25.547/26.114	13.25	0.434	0.707	1.180
Km105.75-Km120.25	"	6.6	26.074/26.378/26.927	14.5	0.488	0.799	1.331
Km120.25-Sta. Lucia	"	5.6	25.077/25.190/25.765	20.75	0.671	1.092	1.823
Sta. Lucia-Km150	"	7.5	27.069/27.457/27.983	9.0	0.314	0.516	0.859
Km150-Nozales	"	6.5	25.974/26.259/26.811	9.0	0.302	0.494	0.823
Nozales-D. Diluvio	"	5.4	24.877/24.953/25.533	16.2	0.520	0.845	1.410
D. Diluvio-Buga	"	5.4	"	32.3	1.037	1.685	2.812
Total					7.653	12.397	20.367

Annex Table 9-29

Economic Cost Stream (million pesos)

Year	Detailed Design	Construction	Maintenance	Total
'84	121.5			121.5
'85	121.5			121.5
'86	84.8	561.5		646.3
'87		1,463.1		1,463.1
'88		1,827.0		1,827.0
'89		1,772.9		1,772.9
'90		1,259.4		1,259.4
'99			21.75/annum	21.75/annum
2000			267.24	267.24
2001				
2010			21.75/annum	21.75/annum

i=	5%	10%	12%	15%
P.W	6,218.1	5,065.4	4,697.2	4,218.2

Annex Table 9-30 Benefits Stream (million pesos)

Year	Diverted Traffic	Existing Traffic	Total
1991	414.2	33.7	447.9
92	442.1	35.3	477.4
93	471.9	37.0	508.9
94	503.7	38.9	542.6
95	537.6	40.7	578.3
96	573.9	42.7	616.6
97	612.6	44.8	657.4
98	653.9	48.0	701.9
99	697.9	49.3	747.2
2000	745.0	51.7	796.7
01	782.4	54.3	836.7
02	821.8	57.0	878.8
03	863.1	59.8	922.9
04	906.4	62.7	969.1
05	952.0	65.9	1,017.9
06	999.9	69.0	1,068.9
07	1,050.1	72.5	1,122.6
08	1,102.9	76.0	1,178.9
09	1,158.3	79.8	1,238.1
2010	1,216.5	83.7	1,300.2
2011	Residual Value		7,211.8

i=	5%	10%	12%	15%	
PW=	8,995.9	3,910.2	2,905.0	1,926.1	
B/C=	1.447	0.772	0.618	0.457	IRR=7.9%

Annex Table 9-31 Construction Cost by MOPT Cost Data (cont'd)

	FC + LC	Tax	Total	Remarks
1. Direct Cost				
2. w/Overhead & Profit 1)x1.25	4,051,527	425,410	4,476,937	
3. Supervision	405,153	42,541	447,694	
4. Contingency	445,668	46,795	492,463	
5. Sub Total	4,902,348	514,746	5,417,094	
6. Detail Eng. w/Cont.	209,850	22,034	231,884	
7. Land Acquisition	372,060	-	372,060	
Total	5,484,258	536,780	6,021,038	
Economic Cost	5,484,258			

Annex Table 9-31 Construction Cost by MOPT Cost Data

	Length km	Cost /km	Total Cost \$,000	Remarks
1. Castilla-Chaparral				
0 - 2 %	2.25	14,300	32,125	
2 - 4 %	-	-	-	
4 - 7 %	0.75	24,500	18,375	
Existing Road	51.00	3,500	178,500	
Bridge (1)			1,889	
Sub Total			230,939	54km
2. Chaparral-Sta.Lucia				
0 - 2 %	11.95	14,300	170,885	
2 - 4 %	12.00	19,000	228,000	
4 - 7 %	36.75	24,500	900,375	
7 - %	13.20	30,000	396,000	
Existing Road	12.30	3,500	43,050	
Tunnel	0.80		234,768	
Bridge (15)			108,999	
Sub Total			2,082,077	87km
3. Sta.Lucia-Nogales				
0 - 2 %	1.50	14,300	21,450	
4 - 7 %	7.00	24,500	171,500	
7 - %	9.50	30,000	285,000	
Bridge (7)			57,730	
Sub Total			535,680	18km
4. Nogales-Buga				
2 - 4 %	6.40	19,000	121,600	
4 - 7 %	33.80	24,500	828,100	
7 - %	4.00	30,000	120,000	
Existing Road	4.30	3,500	15,050	
Bridge (10)			53,928	
Sub Total			1,138,678	48.5km
5. Preventive Work			64,153	
Total			4,051,527	

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