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Mission to El Salvador Intermodal Transportation Study

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Final Report
TASK 3
HIGHWAY STUDIES
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San Salvador July 10, 1995

Mr. Ernesto Girón, CTO
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San Salvador, El Salvador

Ref.: Intermodal Transportation Study
Contract No. 519-0394-C-00-4112-00
Final Report, Task 3

Dear Mr. Girón:

In compliance with section C.3.6 of above referenced contract enclosed herewith are 10 (ten) copies, in English, of the Final Report of Task 3 **"Highway Studies"**

We are calling this "Final Report" rather than "Final In-Depth Report" because we are now incorporating in one single volume phases 1 (Assessment) and 2 (Analysis) of the Study.

We are sorry about the delay on the delivery of this report.

Sincerely yours,

José H. Cosío, P.E.
Team Leader

PN-ABX-448

TASK 3

HIGHWAY STUDIES

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Glossary of Terms

AID	=	International Development Agency
AME	=	Machinery and Equipment Administration
BCIE	=	Central American Bank of Economic Integration
BID	=	Inter American Development Bank
BIRF	=	World Bank
CBR	=	California Bearing Ratio
COV-VOC	=	Costo de Operación de Vehiculos (Spanish) Vehicle Operation Cost
CT	=	Total Cost
CV	=	Variable Cost
DGC	=	General Directorate of Roads
DUA	=	Architecture and Urban Directorate
GOES	=	Government of El Salvador
HDM III	=	Highway Design and Maintenance Model III
IIR	=	Rugosity International Index
INGECON	=	Model SIAMV Data Base
IVA	=	Added Value Tax
MEF	=	Special Financial Margin
MFS	=	Margin for Subsidy Financing
MOP	=	Ministry of Public Works
NEE	=	Number of Equivalent Axles
OECF	=	Overseas Economic Corporation Fund (Japan)

OPAMSS	=	San Salvador Metropolitan Area Planning Office
PBV	=	Vehicular Gross Weight
SIAMV	=	Integrated System of Road Maintenance Administration
TPD	=	Average Daily Traffic
TRANUS	=	Transport Model
TRRL	=	Transport Research Road Laboratory

3. Highway Studies

3.1 Institutional Assessment

At this stage an overall assessment is made of the operating efficiency of the Vice-ministry of Public Works, thru its General Directorate of Roads (DGC) and the Machinery and Equipment Administration (AME), in providing the Country with a network which guarantee the lowest possible transport costs, giving priority to investments in road maintenance.

3.1.1 Organization of the DGC and the AME

a. General Directorate of Roads

The General Directorate of Roads is made up of two sub-directorates and six advisory units. The Director and the two Sub-directors are the highest authorities of the agency responsible for carrying out Government policies.

As shown in Figure 3.1.1, the Directorate has an administrative support staff made up by the Legal Office, Secretary, Coordinating Office of Machinery and Equipment, Maintenance Plants, Auditing and Self Help.

The Sub-directorate of Ordinary Budget administers the resources coming from the National Budget. Most of these funds are used to cover the operating expenses and a small percentage is used for investments in equipment and materials. This Sub-directorate has three divisions: Operations, Administration and Project Planning. Figure 3.1.2 shows its organization chart. Given the characteristics and use of the resources handled by this Sub-directorate, its tasks cover routine road maintenance, road design, pre-investment, traffic engineering and transport studies. It also manages the weight control system for cargo vehicles.

The Sub-directorate of Extraordinary Budget was created to have the exclusive responsibility for obtaining and managing loans and external financing, implementing all related tasks. It has three divisions: International Loans, Special Project Financing and USAID Projects, as shown in Figure 3.1.3. In practice, this Sub-directorate also contracts for studies, road construction, reconstruction and rehabilitation.

b. Machinery and Equipment Administration

The Machinery and Equipment Administration, whose basic organization chart is shown in Figure 3.1.4, has two defined areas to carry out its functions: administrative and operational. The first is made up of the following units: Secretary, Legal, Auditing, Purchases, Data Processing and supporting units: Warehousing, Human Resources, Accounting, Organization and Methods and Plant Maintenance. The operational area is made up of the offices of Maintenance, Asphalt Mix Production, Administration and Finance.

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FIGURE 3.1.1
Organic and Administrative Structure of the DGC
Basic Organization Chart

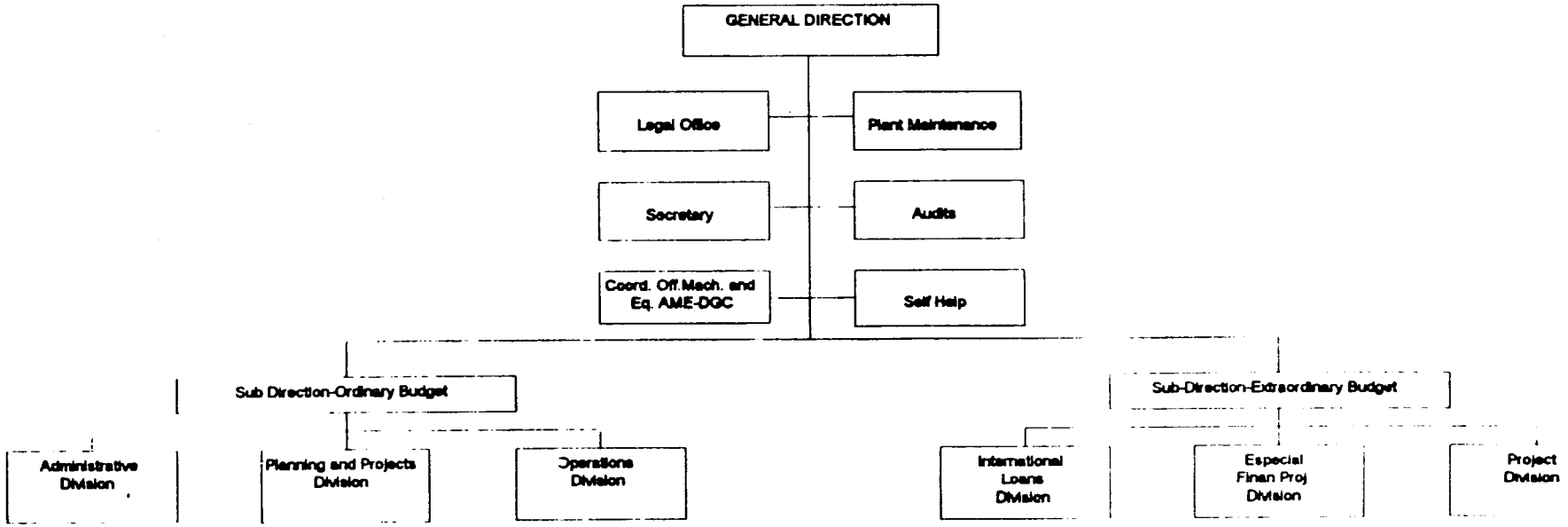

FIGURE 3.1.2
Organization Chart of the DGC-Administrative Division of the Sub-Directorate of Ordinary Budget

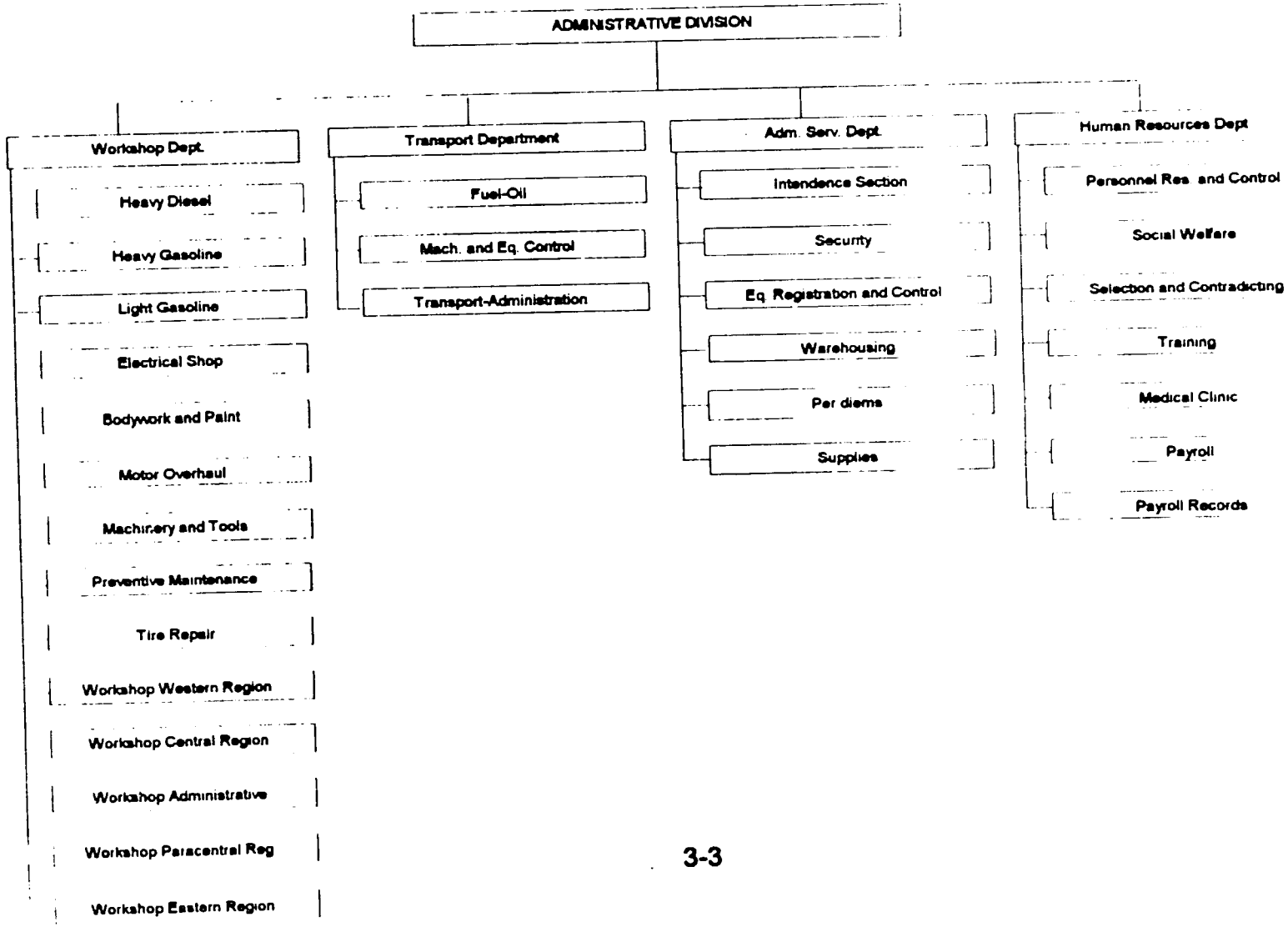

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FIGURE 3.1.2 (continue...)
Organization Chart of the DGC - Administrative Division
of the Sub-Directorate of Ordinary Budget

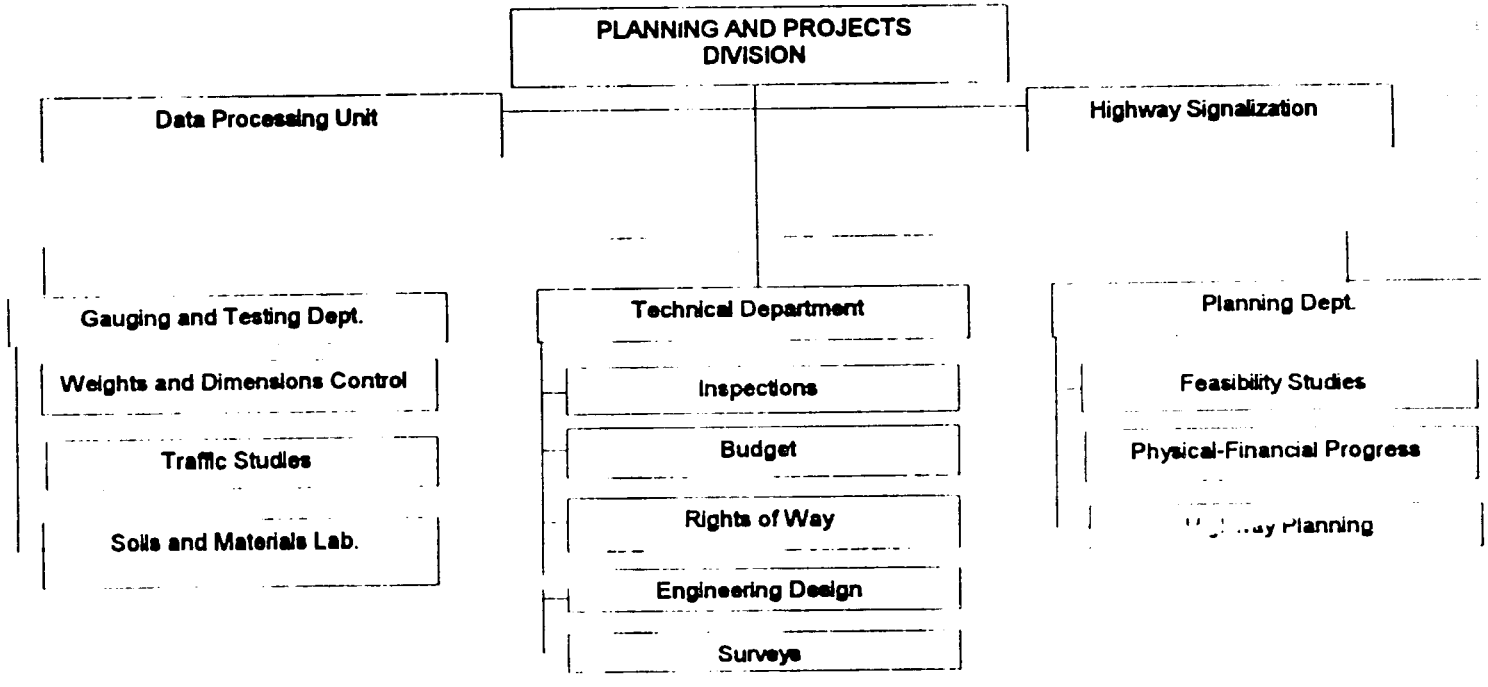


FIGURE 3.1.2 (continue...)
Organization of the DGC - Operational Division
Organization Chart of the Sub-Directorate of Ordinary Budget

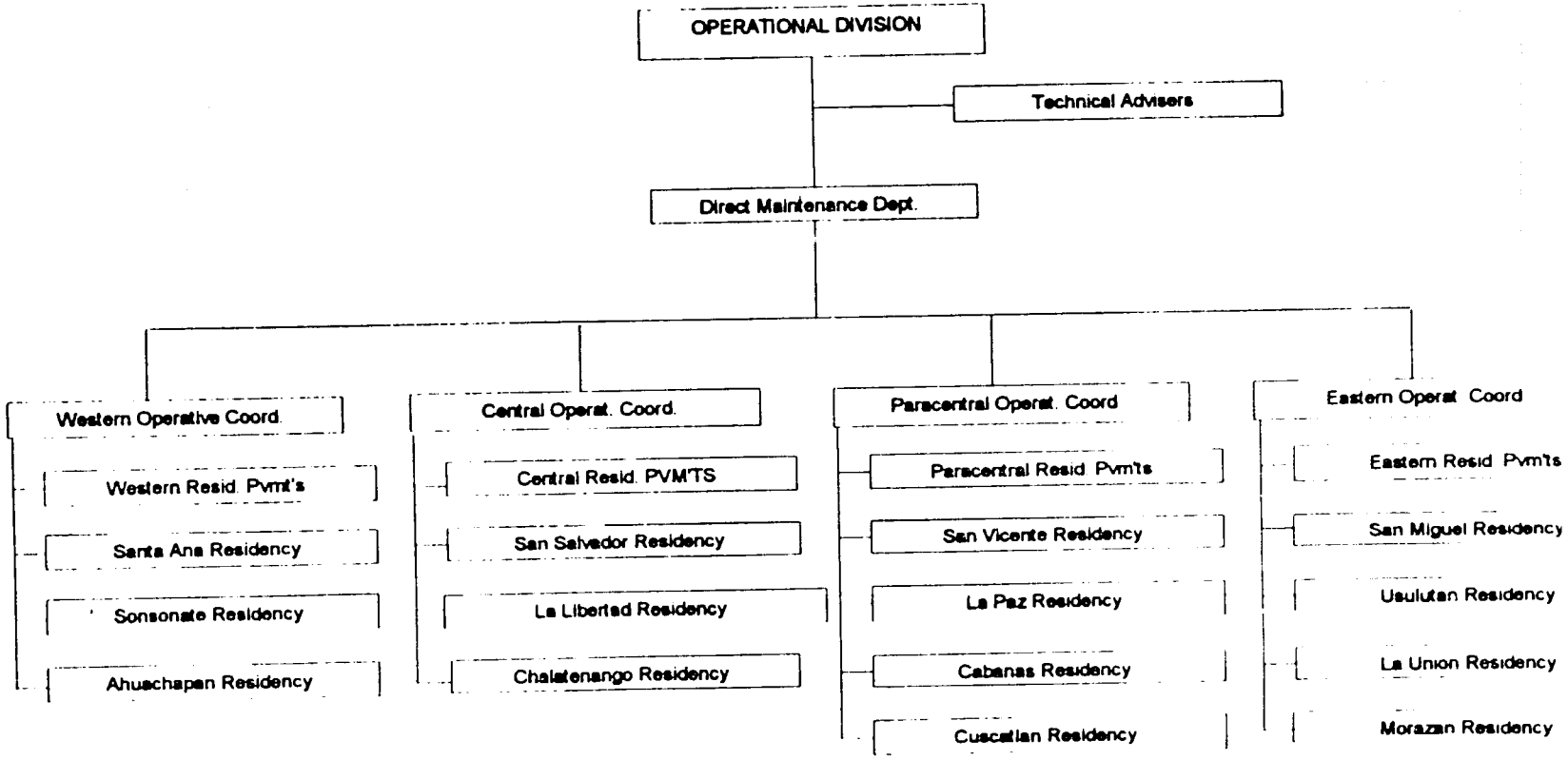


FIGURE 3.1.3
Organization of the DGC
Organization Chart of the Sub-Directorate of Extraordinary Budget

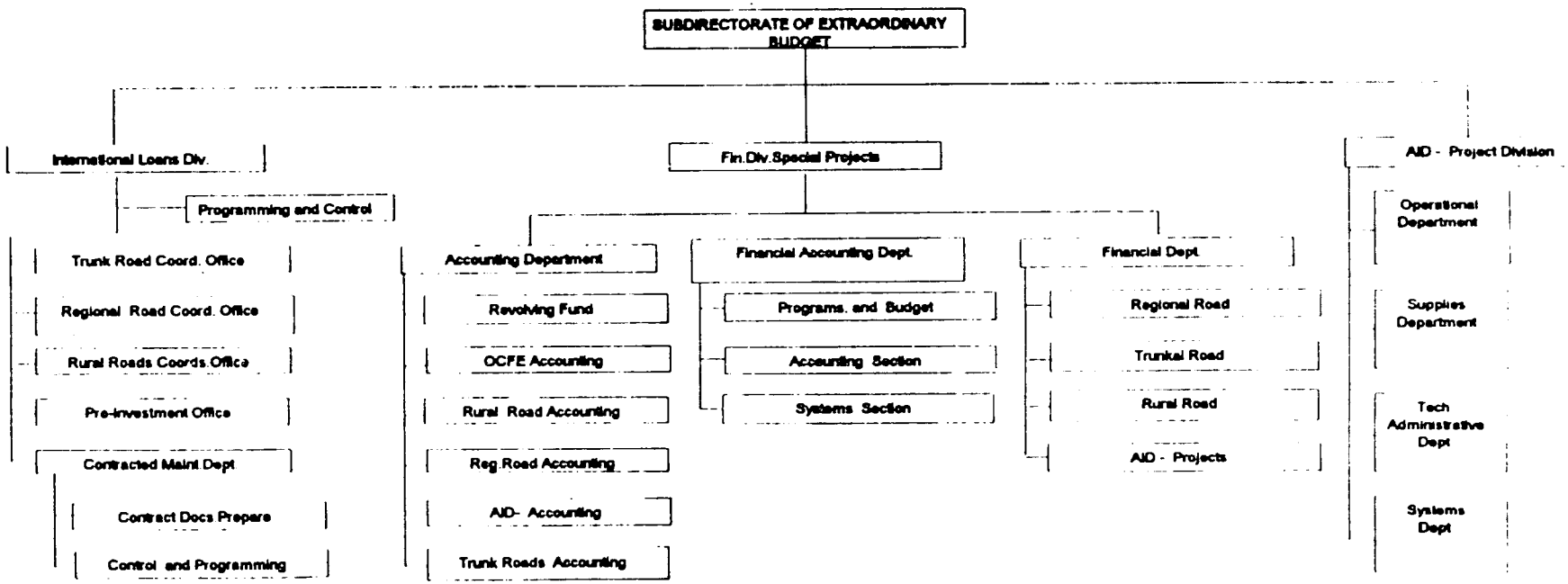
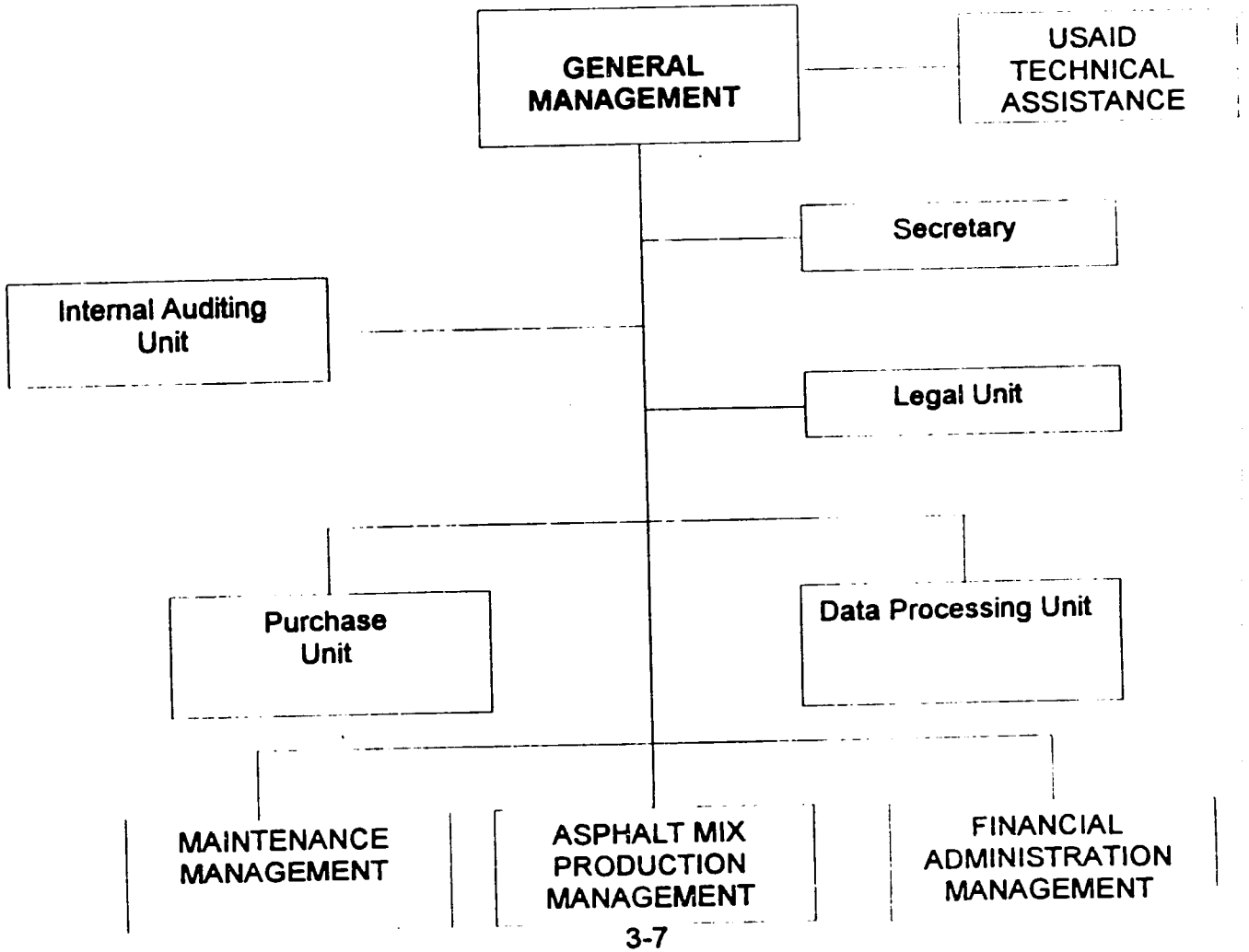


FIGURE 3.1.4
Machinery and Equipment Administration - AME
Organization Chart



3.1.2 Basic Functions of the Agencies

The basic functions of the Vice-Ministry of Public Works are centered on the planning and implementation of Government policies related to the road infrastructure. To carry out these functions, for interurban works, it has the DGC and the AME.

a. General Directorate of Roads

The DGC builds, rehabilitates and maintains the interurban road network. To this end, it carries out the following tasks:

- Plan, design and build roads, bridges and complementary works.
- Rehabilitate and maintain about 9,800 Kilometers of highways and roads, as per 1991 Road Inventory.
- Improve tertiary and rural roads.
- Reconstruct road structures - bridges, vaults, boxes and tunnels.

Complementary tasks in the exercise of these functions are:

- Make sure that road designs and their construction are according to specified norms.
- Establish and operate a weight and measurement control system for cargo vehicles.
- Plan, install and maintain adequate horizontal and vertical signs and signals.

DGC responsibilities are based on the concept that, under normal road management, roads should be rehabilitated a reasonable time after their construction. This idea, together with financial factors, in most cases, lead third world countries to let their roads deteriorate to unacceptable levels. Subsequent rehabilitation or reconstruction is highly expensive; and until is done, user costs on fair or bad roads becomes very expensive.

b. Machinery and Equipment Administration

The Machinery and Equipment Administration is specifically responsible for the following tasks:

- Manage construction machinery and equipment of the Ministry of Public Works, to carry out works implemented by the DGC or DUA.
- Provide preventive and corrective maintenance to construction machinery and equipment.
- Prepare asphalt mix and distribute it to the DGC departmental offices tc maintain the road network.

3.1.3 Analysis of Functions

a. Planning

In general, the DGC planning process is subject to the needs of the moment. It lacks medium or long-term planning. In general, its planning work concentrates in preparing pre-investment studies to be submitted for consideration of the Ministry of Planning. It also carries out economic and multicriteria evaluations for projects that could be financed with foreign resources.

At present there is limited capability for long-term investment planning to provide the Country with the road infrastructure it needs to strengthen its process of modernization and development.

There is a lack of tools to implement systematic analysis towards this end.

b. Design

Two years ago, the DGC created the Preinvestment Studies Unit, in charge to contract with private consulting firms the feasibility studies and final designs of those projects to be financed with external resources.

c. Construction

Road construction, reconstruction and rehabilitation is contracted with private contractors. This system should be a guarantee of efficiency and quality. However this is not always true; some projects last and cost more than planned. This is not always due to the private contractors. DGC and Finance Ministry delays in processing payments result in the contractors' need to lower their efficiency.

Other factors affecting some delays and cost overruns are:

- Design deficiencies or need to improve them to optimize original alignments.
- The constraints felt by professionals contracted by the DGC in performing their duties, due to lack of logistic support and physical resources to carry out their work.
- There is no an unified and obligatory system to be followed by supervisors, to allow the agency to evaluate the progress of work, its cost and contractor performance. If this system was available, the pre-qualification method presently used by the DGC could be improved.

d. Road Conservation and Maintenance

When talking about road maintenance, one must differentiate between routine, preventiv and emergency maintenance. The DGC carries out , thru the Sub-directorate of Ordinar Budget, routine and emergency maintenance. The Preventive Maintenance is not carrie out because of a total lack of resources and also due to lack of proper technical an economic arguments to sustain the need for these funds. However, soon it will b established a new road administrative system (SIAMV) that should overcome thes problems.

The maintenance task implemented regularly and with some success is the patching c potholes, which is very frequent because of the advanced stage of road deterioration. Thi type of work is more like emergency than routine maintenance, takes up most of th personnel, materials and equipment and does not allow these resources to be used fc other proper routine maintenance operations. Certainly, if deterioration was not allowe to advance as much as on El Salvador roads, the patching operations would decrease an the other types of maintenance could improve.

Some documents state that the reasons DGC does not carry out satisfactorily maintenanc tasks are:

- Low worker productivity.
- Inability of the equipment to work efficiently because of age.
- Machinery and equipment awaiting repairs because of lack of funding.
- The difficult process for removing inefficient workers.
- Lack of incentives due to low salaries.

These arguments can be seen as lacking proper judgement elements. While the describe problems are critical and must be solved, proper maintenance is essential and a priorit The roads have to be care for before premature deterioration takes place. Even if formula could be found to privatize all maintenance operations right away, practical result would not be best because of insufficient resources and lack of a proper monitoring an quality control.

- Road Maintenance Financing

The principal reason why road maintenance is a second priority operation in the DGC is the chronic lack of financing. For almost all international loans, financing is directed towards rehabilitation, reconstruction or construction of roads and does not include maintenance financing, even though maintenance brings a better rate of return and is less costly. Normally, lending agencies require road maintenance with counterpart funds, with formal commitments for the disbursement of the funds. This last condition, which can not be verified in the short run, becomes only a formality without tangible effects. If they are implemented at such a slow pace, they have minimal effects.

Counterpart funds, from the general budget, are subject to the country's economic circumstances and decisions of the Finance and Planning Ministries, who do not know enough of the effects of poor maintenance; they figure this can always be postponed without causing major problems. A clear example is the assignment of funds for the General Directorate of Urbanism and Architecture in 1994: Since the agency knows that the Finance Ministry defines the budgets for the following year based on the previous year budget plus an arbitrary percent near the growth of inflation, the agency manages its budget within this limit to avoid problems. On this basis, DUA decided to slice its budget for direct maintenance, and increase its budget for contracting that service, and submit this decision for Ministry approval. The results are shown in Table 3.1.1.

TABLE 3.1.1
Budget Allocated to DUA for Years 1993 and 1994
(Millions Colones)

	1993	1994 REQUEST	1994 APPROVED
MAINTENANCE	20	10	10
CONTRACTS	6.5	16.5	6.5

This table indicates that only 62% of the DUA budget was assigned to maintenance in 1994 as compared to 1993; and there is the additional problem of recuperating maintenance costs in the years to come. These figures show that while funds assigned for maintenance will depend on decisions taken in this Directorate, it will not be possible to finance road maintenance.

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- Road Maintenance Planning

The electronic tools created by the World Bank to provide developing countries with the technical basis for the development of good road management, and budgets are available, practically free of cost, to any government willing to use them. To use these tools, it is necessary to have as required by models, broad and detailed data base on the road network.

Because El salvador neither had this data base nor the measurement equipment for the parameters used by the HDM III Model, the GOES, through the DGC, decided to adapt a specific system to the situation. To this purpose, it has contracted with a consulting firm, the development of a road maintenance administrative system, which was named SIAMV. Its principal objectives is to build a qualitative and quantitative data base of road network, to develop a model that will simulate the pavement deteriorating processes, starting from the identification and original condition, to finally give a road maintenance planning.

In a first stage, the hired consultants defined the evaluation procedure of damages in pavements and completed a road inventory. Later on, with this information they built the data base and estimated the rehabilitation needs and strengthening of the road network for design periods of 5 and 10 years.

SIAMV is an evaluation and analysis tool of the road network, with functions similar to World Bank's HDM III Model. It constitutes an important effort to modernize the management of the road network in El salvador. However, since the contract is still under implementation, presently is not possible as yet to define and budget a maintenance program with the SIAMV Model.

Once this system is operating, DGC will be in position to protect the national assets of the road network, by means of identifying and quantifying the maintenance works necessary to avoid, in a medium term, new rehabilitation and reconstruction programs for roads recently attended with international loans. Of course, this will be possible only if adequate maintenance financing is provided.

Under these circumstances, consideration must be given to restate the financing system for road maintenance and the roll that the MOP, through the DGC, must play in this matter.

- Reassignment of Responsibilities for the Maintenance Implementation

With the State as administrator of road network maintenance, consideration must be given to using the private sector to assume this responsibility. This can be done by means of contractual schemes. These will be analyzed during the second phase of this Study. Contractors would guarantee adequate road maintenance under their contracts, with proper supervision by the government. Contractors would be liable to administrative and financial sanctions to cover deficiencies in their work.

The government role, therefore, would be concentrated on the permanent assessment of the network, the identification of when the roads need intervention to protect their pavements and to prevent basic structure damage. Also to control the good and timely execution of the works.

e. Administration of Construction Equipment and Vehicles

The administration of the machinery, construction equipment and vehicles belonging to the MOP is under the AME. This task, formerly financed almost totally by AID, presently has less external financing and probably none by the end of the current year. To counteract this situation, the MOP has increased local financing so the transition will be less traumatic.

The main difficulties for the proper functioning of the AME can be described as follows:

- Labor Problems

Labor efficiency is low. It is estimated that productivity is only about 60%.

- Poor Utilization of the Equipment

Equipment is used for work which it is not designed for, so it is quickly damaged. Although AME is decentralized, mobilization of the equipment to the work places is inefficient. The equipment is not available according to work needs but as per its location. It is common occurrence to find it located not where it is needed. The amount of equipment is sufficient but there is a shortage of platform vehicles for their transportation.

- Corrective Maintenance

In April 1994, of a total of 1,050 inventoried pieces of machinery, 399 were out of service, that is 38 percent of the total. In Table 3.2.1 detail is given of the quantities the out-of-service equipment and their causes.

TABLE 3.1.2
Out-Of-Service Equipment-April 1994

REASON	NUMBER	% OF	% OUT OF
Corrective Maintenance	225	21	56
Preventive - Corrective	85	8	21
Preventive Maintenance	24	2	6
Crashed	16	2	4
Burned	12	1	3
Stolen	3	0.3	1
Useless	34	3	9

This table shows that the relation between equipment under preventive and corrective maintenance is 1 to 12. This is a clear proof of poor administration. Equipment is repaired when stops functioning and not to prevent this happening.

- Diversity of Equipment

The manner in which the road sector has been financed generates the problem of a large number of equipment of different makes and models from the countries which have given the financing. This does not allow mechanics and operators to specialize nor to have a good stock of spare parts to avoid stopping equipment for minor problems.

- Slow, Bureaucratic Process to Acquire Spare Parts

For equipment and vehicles not acquired with USAID funding, AME must obtain the spare parts thru the MOP Purchasing Office. The work overload in this office, together with delays and errors in the submission of purchase orders, badly delay the supply of spare parts for this equipment. For the equipment provided by USAID, there is a special Purchasing Department which is effective because it is well organized and has a lesser of a work load.

3.2 Operational Assessment

Vehicle operating conditions, including the magnitude of the loads commercial vehicles transmit to the pavement and the frequency of their repetition, are essential to define construction and maintenance investment needs. Based on this fact, GOES has decided to modernize its weight control system in order to have an efficient tool to delay the pavement deterioration process and minimize the resources needed to maintain the road network in good operational conditions.

Therefore, the DGC is carrying out a project to build and equip 18 control stations, as part of the road program financed by BID under loans No 653/OC and 870/SF-ES. It has already contracted, in a first stage, for the design of six stations, the analysis of the required weighing equipment to carry out effective control, and the preparation of tender documents.

3.2.1 Existing Weight Control System

The Weight and Measurement Section of the DGC manages the operation of the seven existing weighing stations. They are located as shown below and, except for the Metapán and Los Chorros stations, they control all truck traffic on their respective roads.

1.	El Amatillo	CA 1	Km 210 + 000
2.	Cojutepeque	CA 1	Km 21 + 400
3.	Los Chorros	CA 1	Km 92 + 000
4.	Metapán	CA 12	Km 100 + 000
5.	Chalchuapa	Santa Ana-Chalchuapa	Km 77 + 000
6.	Acajutla	CA 12	Km 88 + 000
7.	La Libertad	CA 4	Km 33 + 000

The control operation at these stations are carried out by a working group made up of 4 operators and one guard. They work seven days a week from 6 am to 6 pm.

The existing weighing equipment, Toledo and Howe Richardson, have a 30-ton capacity and a precision of 50 kilos. The physical installations have an approximate area of 50 m^2. They have a work area, a rest area and sanitary services. The location of the existing stations are also shown in Figure 3.2.1

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FIGURE 3.2.1
Existing Weight Control Station

3.2.2 Current Weight and Size Standards for Cargo Vehicles

Decree No. 86 of December 6, 1973 contains weight and size regulations for cargo vehicles in El Salvador. However, this regulation is not applied, because in January 1992 the DGC decided to follow the REMITRAN Resolution of October 11, 1992, which approved Uniform Central American Standards to Control Maximum Loads and Dimensions for International Cargo Vehicles. These limits are higher than those of the Salvadorean legislation. To legalize this situation, proposed new regulations have been prepared derogating Decree 86 and adopting the norms set up in the Central American Resolution. These new regulations have not yet been approved.

The axle and gross weight limits set up by the two mentioned regulations are shown in Tables 3.2.1 and 3.2.2.

TABLE 3.2.1
Axle Weight Limits for Cargo Vehicles

TYPE OF AXLE	TYPE OF VEHICLE	DECREE 86/73 (tons)	CENTRAL AMERICA
Directional	C2, T2	4.0	4.5
	Other	4.0	5
Simple	C2	8.0	9
	S1	8.0	9
	R2	8.0	6.5*
Double	C3, T3	14.9	16
	S2	14.9	16
	R3	14.9	10
Triple	C4, S3	NE	20

NE No Specified
* If Tire's is single 4 tons are authorized
Source: Decret 86/73 and Remitran Standard

TABLE 3.2.2
Gross Vehicle Weight Limits (In Tons)

TYPE OF AXLE	EL SALVADOR	CENTRAL	INCREASE (%)
C2	12.0	13.5	12.5
C3	18.9	21	11.1
C4	NE	25	
T2-S1	20.0	23	15
T2-S2	26.9	30	11.5
T2-S3	NE	34	
T3-S1	26.9	30	11.5
T3-S2	33.8	37	9.5
T3-S3	NE	41	
C2-R2	NE	21.5 a 26.5	
C3-R2	NE	29 a 34	
C4-R2	NE	35 a 37	

NE No Specified
Source: Decret 86/73 and Remitran standard

3.2.3 Comments on Current Regulations

Comparing Tables 3.2.1 and 3.2.2, the adoption of the Central American regulations has brought about the following:

- A 12.5 percent increase in authorized directional and motor axle weight for C2 trucks and the single axles of trailers.
- A 25 percent increase in directional axles and 7.4 percent in the double motor axles for all other vehicles.
- Regulations on traffic with triple axles, not clearly defined in Decree 86/73.
- Increase in the gross vehicular weights which vary from 10 to 15 percent.
- A 19 percent decrease for single-axle trailers.

- A decrease in the authorized weight for trailer trucks, because Salvadorean regulations do not differentiate between load limits per axle, per type of vehicle. The Central American regulations do.

Therefore, given that the larger load increments have been authorized for vehicles of less load capacity, these have become more competitive with trailers. This is because there is a better ratio between the carrying load and the net vehicle weight; this increases efficiency and reduces operating costs per ton transported.

It is important to notice that the differentiation made by the Central American norms between simple axles with double tires and limitations for their use in trailers, is a factor which works against the use of more efficient vehicles with lesser cost per ton transported. The basis for this specification is not clear, since there is not much difference in the deterioration of pavements due to motor axles with double tires and single tires.

The Central American standards have not been adopted by Nicaragua because it has made adoption conditional to securing financing to rebuild their road network. Panama, although it has approved these norms, has restricted the entry of foreign trucks.

Table 3.2.3 shows the authorized axle load limits in the six Central American countries as well as the Central American norm.

TABLE 3.2.3
Axle Weight Limits in the Central American Countries (In Tons)

TYPE OF AXLE	EL SALVADOR	GUATEMALA	HONDURAS	NICARAGUA	COSTA RICA	PANAMA	CENTRAL AMERICA
DIRECTIONAL C2	4	5	4	4	4	4	4.5
DIRECTIONAL OTHERS	4	5	5.5	4	5.5	5.5	5
SIMPLE	8	9	8	8	8	10	9
SIMPLE TRAILER	8	7.25 a 7.75	6.5	8	8	8	6.5
DOUBLE	14.9	15.5	14.5	14.5	14.5	16.4	16
DOUBLE TRAILER	14.9	NA	NA	14.5	NA	14.5	10
TRIPLE	NA	NA	NA	15	NA	22	20

Source: Legislation of each country

NE: Not Authorize

In this table one can observe that in the Panamanian case, Central American regulations are more restrictive. For the other countries, it limits the authorized load for trailers and for Honduras, Guatemala and Costa Rica the loads on directional axles.

3.2.4 Cargo Levels

In this section we present official statistics and the results of samples taken by the consultants.

a. Official Statistics

According to 1993 statistics processed by the DGC, 98 percent of the 240,000 controlled trucks (that is 658 trucks per day) in that year were found to be within the allowable weight limits. This could be interpreted as indicating that due to the effectiveness of the controls, changes in the system need not be introduced.

Nevertheless, a review of the statistics prior to re-establishing the fine system in 1992 shows that, at that time, that percentage of overloaded vehicles exceeded 50 percent, as shown in Table 3.2.4 and Figures 3.2.2 and 3.2.3.

TABLE 3.2.4
Annual Weight Control Statistics on El Salvador Highway

	1986	1987	1988	1989	1990	1991	1992	1993
Cargo –Tons								
Total Overload	3145942 160785	3347065 191004	3758873 225944	3374089 220995	4737938 352678	4537401 319114	4113752 2422	4729741 3194
Vehicles								
Totals Overloaded	178941 94468	181182 102302	196886 107938	177917 98049	245925 140783	233314 134356	203582 4594	240061 4159
Overload %								
GrossWt. # Vehicles	5.1 52.8	5.7 56.5	6.0 54.8	6.5 55.1	7.4 57.2	7.0 57.6	0.1 2.3	0.1 1.7

Source: Estadistics DGC 1992 Y 1993

FIGURE 3.2.2
Percentage of Overloaded Vehicles per Year

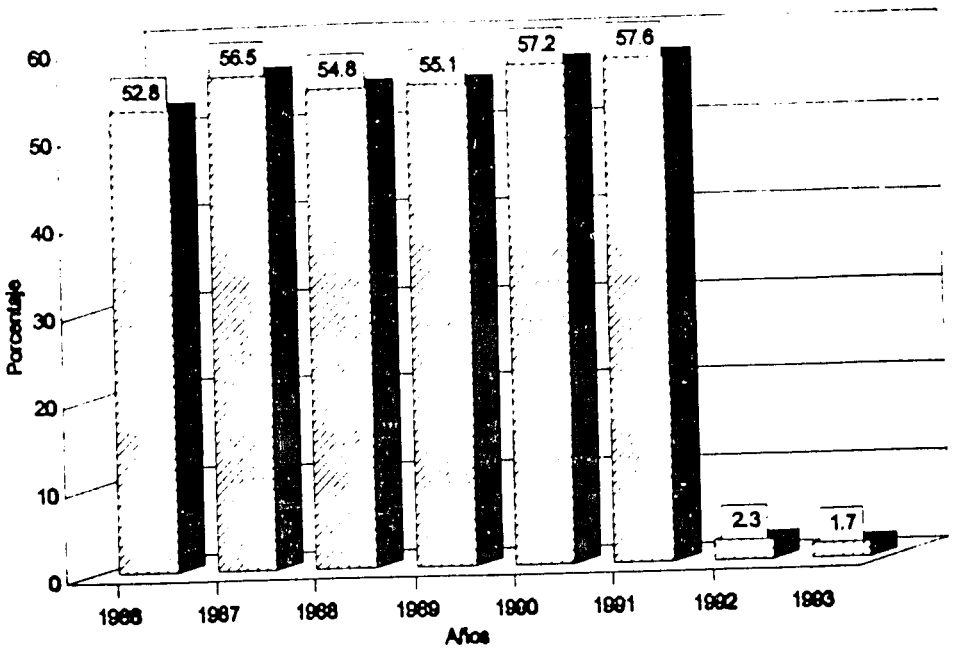
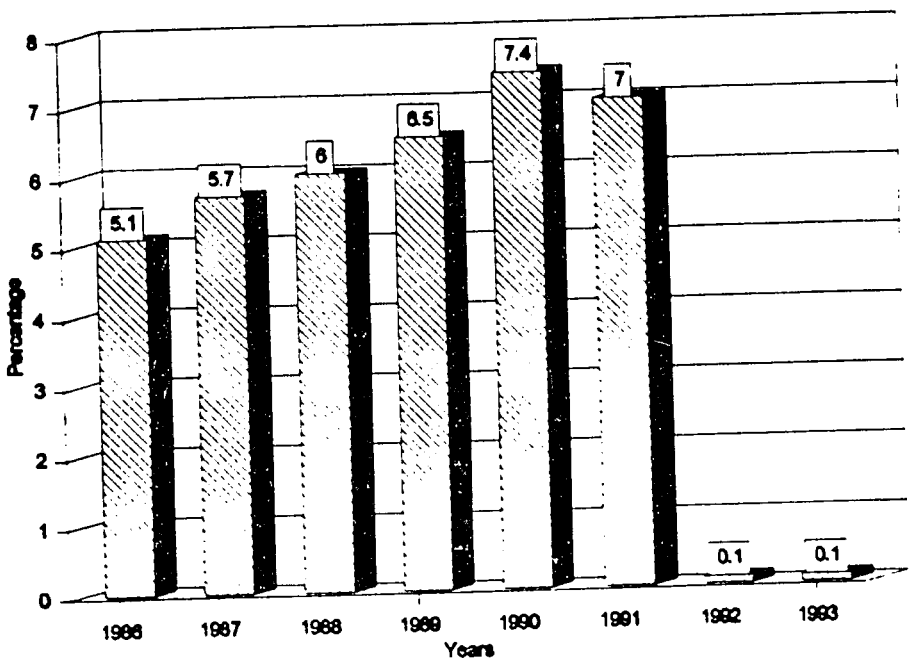


FIGURE 3.2.3
Percentage of Overloads in Gross Vehicle Weight, per Year



Source: Estadistics DGTA, 1992 Y 1993

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This information would indicate that, because of the coercive measures taken in 1992, the percentage of transgressor vehicles was reduced immediately from 60 to 2 percent and the tendency towards increase overload in relation to the total controlled weight, which went from 5 to 7.5 percent between 1986 and 1990, practically disappeared, reaching only 0.1 percent in 1992.

b. Processing of the Collected Sample

Because of the apparent elimination of overloaded trucks during the past two years, the consultants, during their field visits, took samples of weight controls at the weighing station, to verify the validity of the official statistics.

This work showed that information on the overloaded vehicles is under-recorded and that foreign vehicles often do not even stop at the control stations.

In the first case, it is obvious that operators manipulate the data in order not to show the overloads in their reports or do not complete the weighing process once they realize the vehicles are overloaded.

In the second case, the operators of foreign trucks do not comply with the controls, knowing that it is impossible for weight control operators to impose fines or stop their movements.

The described procedures prevent considering the reliability of the information produced by the DGC from January 1st, 1992, nor can they be used to estimate the magnitude of the problem to be controlled.

Annex 3.2.1 shows all the data taken by the consultants at the visited weighing stations.

Tables 3.2.5 to 3.2.7 and Figures 3.2.4 to 3.2.6 summarize the processed results of the information given in that Annex.

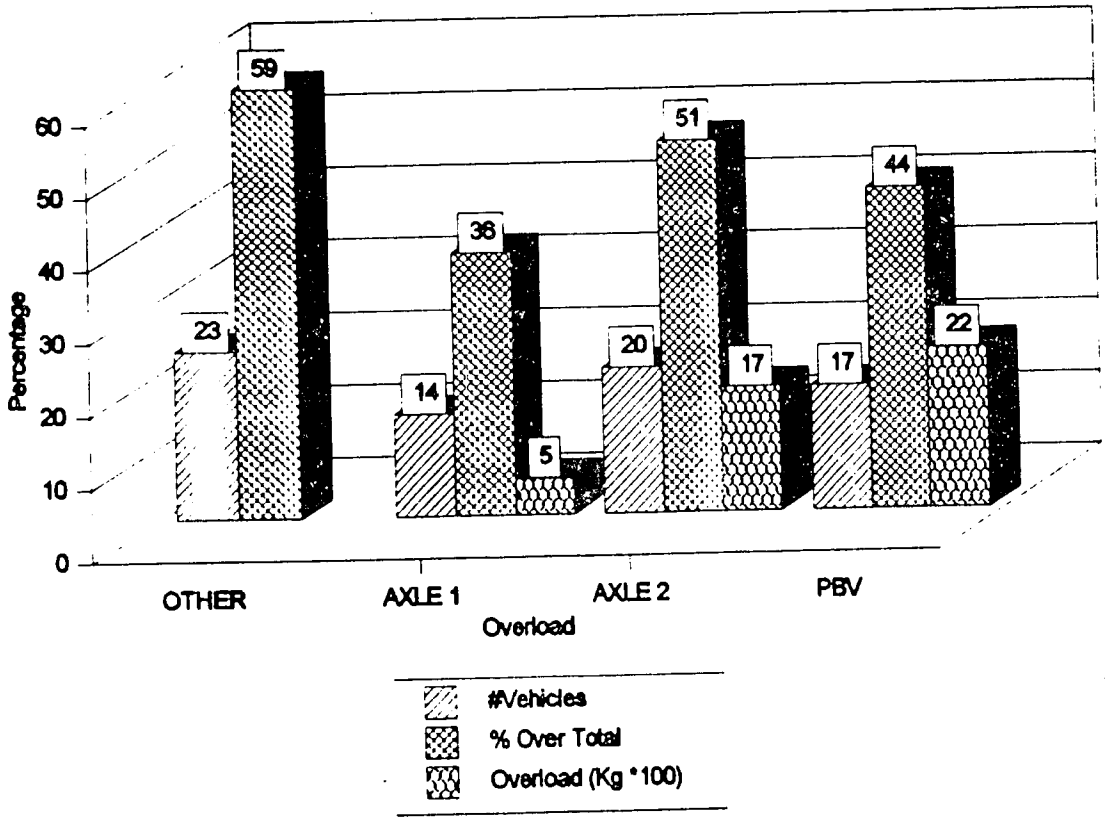
The data shown indicate that there are important discrepancies between official information and reality.

TABLE 3.2.5
Weighing Sample of C2 Type Trucks

VEHICLES C2						
Controlled Transgressors			#	%	WEIGHT IN KILOGRAMS	
			39	100%		
			23	59%		
SUM	AXLE 1	AXLE 2	TOTAL	AXLE 1	AXLE 2	TOTAL
	160,750	345,000	505,750	7,200	33,700	36,550
% Overload				4.5%	9.8%	7.2%
Transgressors Vehicles				14	20	17
% Transgressors				36%	51%	44%
Average Excess (kilos)				514	1,685	2,150

Source: Consultants sample

FIGURE 3.2.4
Infractions for Overloads C2 Vehicles (Sample)



Source: Consultants sample

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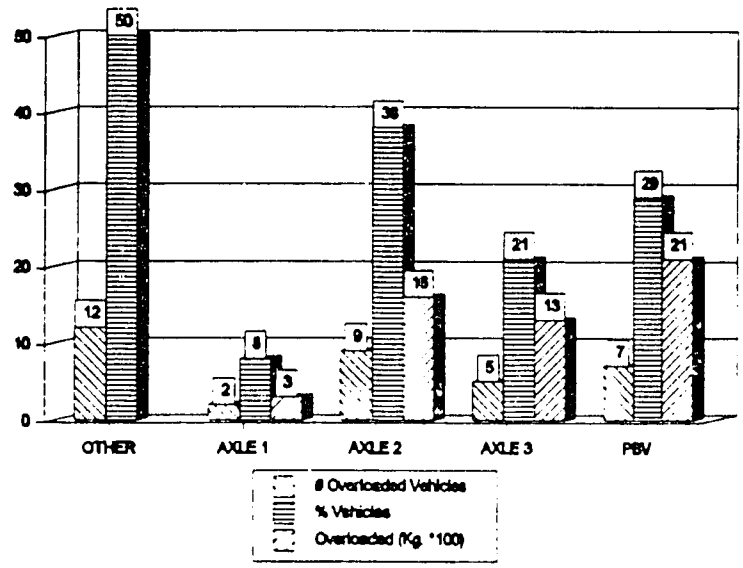
TABLE 3.2.6
Weighing Sample of C3 and T3-S2 Type Trucks

VEHICLES C3 y T3-S2								
Controlled Transgressors				#	%	Weighing Kilograms		
				24	100%			
				12	50%			
LOAD					OVERLOAD			
S U M	AXLE 1	AXLE 2	AXLE 3	TOTAL	AXLE 1	AXLE 2	AXLE 3	TOTAL
	103,05	360,40	265,05	728,50	600	14,400	6,400	14,750
% Overload					0.6 %	4.0 %	2.4 %	2.0 %
Transgressor Vehicles					2	9	5	7
% Transgressors					8 %	38 %	21%	29%
Average Excess (kilos)					300	1600	1,280	2,107

Source: Consultants Sample

FIGURE 3.2.5
Sampling of C3 and T3-S2 Vehicles with Overloads



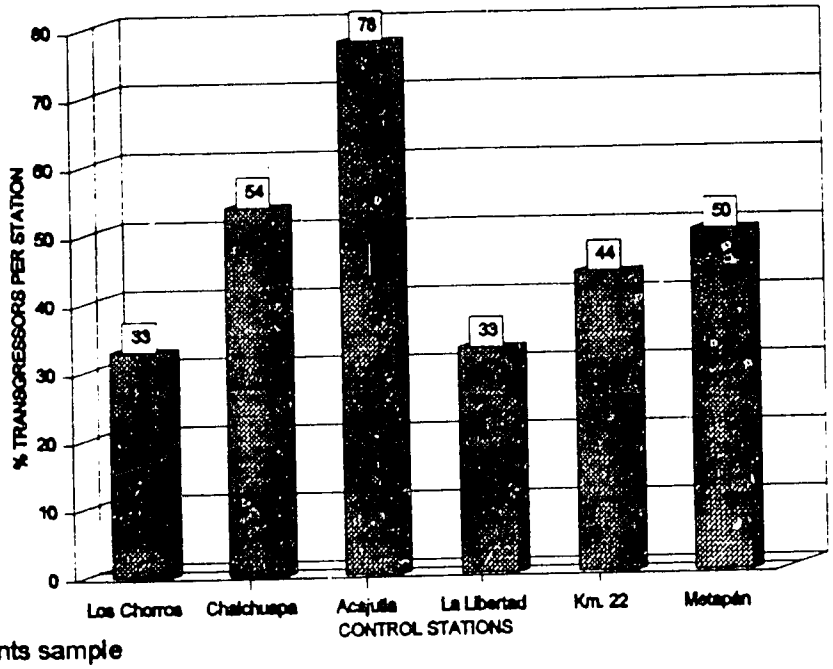
Source: Consultants sample

TABLE 3.2.7
Controlled and Transgressor Vehicles by Station (sample)

STATION	VEHICLES				
	CONTROLLED			TRANSGRESSORS	
	C2	>C2	Total	Total	%
Los Chorros	3	0	3	1	0.33
Chalchuapa	11	2	13	7	0.54
Acajutla	8	10	18	14	0.78
La Libertad	2	1	3	1	0.33
Km. 22	13	3	16	7	0.44
Metapán	2	8	10	5	0.50
TOTAL	39	24	63	35	0.56

Source: Consultants Sample

FIGURE 3.2.6
Percentage of Transgressor Vehicles by Station



Source: Consultants sample

From the information contained in these tables and figures, and considering the limitations of the samples taken, it can be stated that:

- Of all controlled trucks, there was excess weight on 4.5 percent of the directional axles and 9.8 percent on tractor axles.

- 59 percent of the C2 vehicles had overloads on one or more axles.

- The average overload and the percentage of transgressor C2 vehicles were:
  514 kilos on the directional axle for 36 percent of the trucks.
  1,685 kilos on the tractor axle for 51 percent of the trucks.
  2,150 kilos overload in gross weight for 44 percent of the cases.

- 50 percent of the three-axle vehicles violated standards, although overload levels are less than for two-axle trucks.

- The percent violations and average overloads for three-or-more-axle trucks are:
  8 percent and 300 kilos on the directional axle.
  38 percent and 1,600 kilos on the tractor axle.
  21 percent and 1,280 kilos on the trailer axle.
  29 percent and 2,107 kilos in gross weight.

- Of the 63 controlled vehicles, 35 were overloaded, or 56 percent of the sample taken.

This shows that the loads on El Salvador roads have not varied with those prior to 1992, even if in theory overloading is sanctioned.

3.2.5 Operational Procedures

The weighing procedures and overload controls carried out at the weighing stations do not follow precise rules to guarantee effective control. The operators are free to register or not the overloads and to impose fines, at their criteria and convenience. On the other hand the control objective is completely impaired, because control is directed towards gross weight and not to axle weights, and because the operators are instructed to sanction overloads when gross vehicle weights exceed authorized gross weights by 200 kg.

Even so, in some cases, claiming national interest, permits are issued which contradict with the purposes of weight control; some trucks are authorized to travel, for a period of 30 days or more, without being subjected to weight controls.

3.2.6 Fines and Sanctions

Article 28 of Decree 86 of 1973 establishes the amount of the fines for overweight, either in gross weight or axle weight as follows:

From 201 to 300 kilos	¢ 100.00
From 301 to 500 kilos	¢ 200.00
From 501 to 1,000 kilos	¢ 500.00
From 1,001 over	¢ 500.00 plus ¢ 50 for each 50 kilos over 1,001 kilos.

Besides, it authorizes the DGC to detain transgressor trucks and requires the overload to be removed.

Contrary to these fines, its article 34 states that any vehicle that evades weight control be sanctioned ¢ 200, although only ¢50 is charged. This allows vehicles with overloads over 500 kilos to receive minimum fines, making weight control meaningless.

The decree does not define fines or sanctions for excessive size, neither are they controlled on the highways.

3.2.7 System Effectiveness

As a result of how weight control is carried out, without supervision nor control of the weight reports, Salvadorean highway weight control can be considered non-existent. The national truck operators, in contrast to the foreign ones, normally go thru the weighing process to avoid evasion fines.

3.2.8 Information from the Control Stations and How it is Handled

At the control stations, information is collected on special cargo transport forms, per vehicle type, as follows:

Vehicle registration plate
Trip route
Axles weight and gross weight
Trip origin/destination
Cargo type

This information is coded and delivered, by day of the week, to the Weights and Measurements Section of the DGC.

Although there is a large data base resulting from this information, the DGC only extracts truck weight statistics which, as we have seen, are not reliable and do not reflect actual highway conditions. Nevertheless, the origin/destination and cargo type data are reliable and should be important in sector planning. However, the data has neither been processed nor utilized.

3.2.9 The Modernization Program of the Weighing Control System and BID Requirements

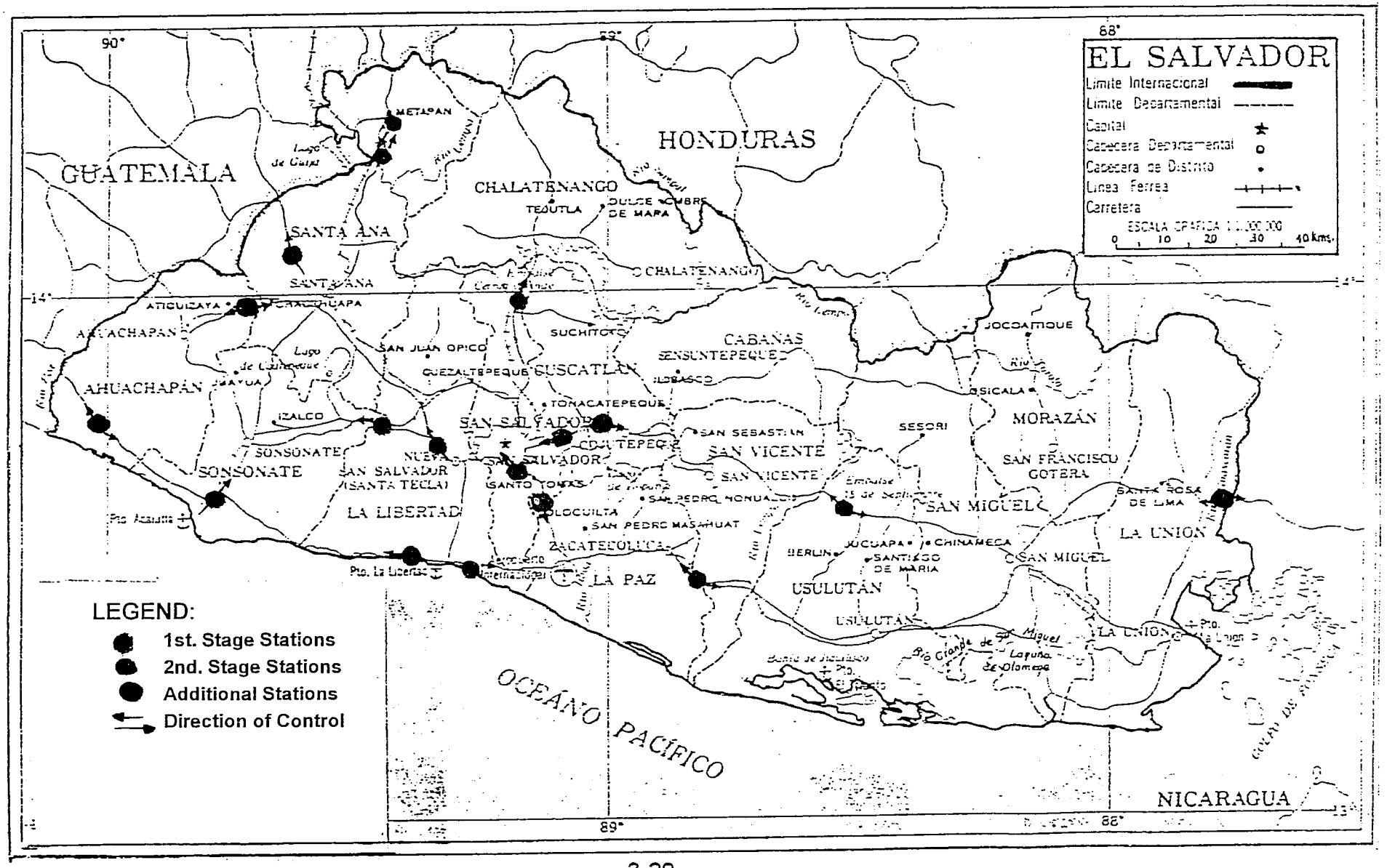
The process to build and equip 18 new weighing stations to replace the existing ones, is a commitment made by the GOES to IDB as part of the negotiations for the road rehabilitation and improvement loan. The Bank considers this commitment indispensable to guarantee adequate maintenance of the road network. Figure 3.2.7 shows the location and traffic direction for each of the new stations. The program is divided in two stages, based on resources availability. In the first stage, nine stations will be built in the western part of the Country. These stations, identified in Figure 3.2.7, are:

No.	UBICATION	ROAD	DIRECTION TO BE CONTROLED
1.	Km 100	CA 12	Metapán-Santa Ana
2.	Km 96	CA 12	Santa Ana-Metapán
3.	Km 79	CA 1	El Portezuelo-San Cristobal
4.	Km 17	CA 1	Santa Tecla-La Cuchilla
5.	Km 46	CA 8	La Cuchilla-Sonsonate
6.	Km 78	CA 12	Acajutla-Sonsonate
7.	Km 46	CA 2	La Libertad-Comalapa
8.	Km 18		Comalapa-San Salvador
9.	Aguilares		Apopa-Interconexión CA3-CA4

In the second stage, the following stations will be built:

No.	ROAD	DIRECTION TO BE CONTROLED
10.	Santa Ana-Ahuachapán	Both
11.	San Salvador-Comalapa	San Salvador-Comalapa
12.	Zacatecoluca-Usulután	Both
13.	Desvío San Vicente-San Miguel	Both
14.	Honduras-Desvío Ruta Militar	Both
15.	La Libertad-Kilómetro 5	La Libertad-Kilometer 5
16.	San Martín-Cojutepeque	San Martín-Cojutepeque
17.	San Martín-Cojutepeque	Cojutepeque-San Martín
18.	Pte. Manuel Arce-Desvío CA 12	Both

FIGURE 3.2.7
Planned Weight Control Stations



From the above one can see that the first group of stations are designed to control traffic in only one direction, while in the second group there are five stations that will control both directions.

According to available designs and costs estimates, one station costs ¢1,681,373 - about $200,000. The IDB loan provides $1.29 million to finance these stations, or for about six of them. The other three require additional financing.

Although the construction and equipment supply process is far advanced, no decision has been made as yet if these stations will remain under the DGC, under a different working scheme, or if it will be preferable to contract them out to the private sector to guarantee their efficiency.

Concerning the equipment, the design contract includes their pre-selection. It will be better to have a varied choice of equipment, from manufacturer representatives in the Country in order to guarantee the purchase of the best available equipment. Considering the traffic volume to be handled by the stations, only fixed good precision scales are needed, with computerized equipment to allow information to be obtained and memorized with minimum human participation.

3.2.10 Coverage

One matter that has not been considered in defining the number and location of the weighing stations is the truck traffic covered by each station individually and in the aggregate, by group of stations. Considering the low daily vehicle volumes presently controlled by the 7 existing stations, and the overlapping traffic they cover, the need for 18 stations is questionable. To try to solve this question, information related to vehicle registration plates, routes, weights per axle and origin and destination is been processed. After these data are processed, it will be possible to better determine program needs.

3.3 Road Assessment

3.3.1 Collection, Summary and Evaluation of the Roads and Bridges Inventories

The basic information was obtained from the DGC. The inventories show the relationships between roads and the major and minor drainage structures, with data providing for full identification, location and condition, following rules set before the inventories were taken.

a. Road Network

The road network inventory taken in 1991, and partially updated in 1993, gives detailed information by department and road category as follows:

Name of the road and cities connected.

Length in kilometers.

Identification code.

Average surface condition: Very good, good, fair, poor and very poor.

Roads not transitable because of lack of drainage works or general bad condition.

Length of roads without total or partial inventory due to being located within the war areas.

b. Drainage Structures

The inventory of these structures (bridges, boxes, vaults and tunnels) taken in 1991, is also very detailed and includes the following:

Name of the structure (when available)

Location: road and stationing

Length in meters

Type by construction materials: Masonry (MAM), reinforced concrete (CON), metallic structure (MET) and combinations.

Visual condition: good (B), fair (R) and poor (M).

There is no structural assessment.

A summary of the structure inventory is shown in Table 3.3.1. In this table, among other matters, one can see that the main road network, made up of the special, primary and secondary road categories, represent about 20 percent of the total network; that the departments of Cabañas and Cuscatlán do not have roads above the secondary category; and that only five departments have special category roads.

TABLE 3.3.1
El Salvador's Road Network by Department and Road Category

TYPES OF HIGHWAY							
Region	Special	Primary	Secondary	Third	Rural A	Rural B	Network total
Ahuachapán		40.5	40.8	144.1	143.3	358.2	726.9
Cabañas			41.9	123.8	61.2.0	325.2	552.1
Chalatenango		34	62.8	169.4	193.1	384.8	844
Cuscatlán			50.2	91	91.5	372	604.6
La Libertad	69	106.8	47.5	176.5	109.9	173.3	683
La Paz	43	39	114.2	96.4	126.3	435.4	854.3
La Unión		92	42.3	159.7	72.3	355.3	721.6
Morazán		14.6	57.5	129.7	25.9	257.4	485.1
San Miguel		61.5	127.4	128.5	323.1	288.3	928.8
San Salvador	50.2		162.5	57.2	80.3	268.9	619.2
San Vicente	33	29.8	52	151.3	82.3	241.6	590
Santa Ana	50.3	57	114.4	50.24	173.7	336.2	781.8
Sonsonate		88.7	86.9	86.9	85.8	168.4	516.7
Usulután		45.1	103	164.5	226	389.4	928
TOTALS	245.5	609	1103.4	1729.1	1794.6	4354.4	9836
% of network	2.5	6.2	11.2	17.6	18.2	44.3	100

According to their surface condition, the inventoried roads are classified in five groups: verygood, good, fair, poor and very poor. Table 3.3.2 shows a summary of the road conditions as per 1993 inventory.

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TABLE 3.3.2
Routes Classification per Condition of Pave Highway

STATE	LENGTH									
	SPECIAL		PRIMARY		SECONDARY		THIRD		NETWORK TOTAL	
	Kms	%	Kms	%	Kms	%	Kms	%	Kms	%
VG	33	13.4	41.3	6.8	17.7	1.7			92	2.6
G	197	80.4	93.3	15.3	239.8	22.5	295.3	19	825.4	23.7
R	15.2	6.2	215	35.3	574.5	53.9	790.7	50.1	1595.4	46
B			233.3	30.3	232.3	21.8	338.7	21.8	804.3	23.2
MM			26	4.3	0.8	0.1	127.9	8.2	154.7	4.5
TOTAL	245		608.9		1065.1		1552.6		3471.8	100

This summary shows that more than 26 percent of the Salvadorean roads were in satisfactory condition in 1993.

In the year 1990, an assessment was made of road network condition within the Infrastructure Sector Assessment Study. According to figures shown in Table II.A.7 of Volume II of that study, 23.7 percent of the roads were in good condition. Comparing these percentages with these for 1993, and taking into account that the length of the road network has practically not changed since then, one finds that road conditions also have not changed substantially. That means that the maintenance programs developed since then have not had a noticeable effect on the average quality of the network.

Table 3.3.3 shows a list of the road structures, by department, type an condition.

Table 3.3.4 summarizes the percent distribution of road structures by condition.

TABLE 3.3.3
Roads Structures in the El Salvador Road Network

REGION	LENGTH (meters)											
	MASONRY ARCH			BRIDGE			BOX			TUNNEL		
	Good	Regular	Bad	Good	Regular	Bad	Good	Regular	Bad	Good	Regular	Bad
Ahuachapán	185.3			311.2	227.6							
Cabañas	337.1	84.0		44.7		50.0						
Chalatenango	543	32.9	11.3	702.2	85.1	37.0	87.0					
Cuscatlán	336.3	47.0		64.3			7.1					
La Libertad	541.9	75.4		1400.1	311.1	81.7	350.3	49.0	56.9		805.0	576.0
La Paz	527.9	6.0		868.2	377.0	91.8	352.1					
La Unión	9.1			203.3			42.1	1.3				
Morazán	29.7			85.5	65.4		67.6	2.5				
San Miguel	10.5	5.5		73.2	55.7		26.9					
San Salvador	742.2	14.5	16.7	596.2	73.4		71.5	65.0				
San Vicente	705.5	43.9	44.3	253.7	48.6	481.8	79.1					
Santa Ana	147.7	11.7		364.6	220.7		119.2	40.4				
Sonsonate	193.9	28.1		629.7	38.5	101.7	4.2					
Usulután	44.4	52.8		250.1		27.2	24					
SUB TOTAL	4354.5	408.8	72.3	5847.4	1503.2	871.81	1	4.0				
TOTAL STRUCTURES							1231.1	162.2	71.95		805.0	576.0
TOTAL METERS	4825.5			8221.9			1465.3			1381		

TABLE 3.3.4
Distribution of the Road Structures by Type and Condition

CONDITION	PERCENTAGE OF ROAD STRUCTURES ACCORDING TO CONDITION			
	MASONRY ARCH	BRIDGE	BOX	TUNNEL
Good	90.1	72.0	84.0	0.0
Regular	8.4	17.3	11.1	58.3
Bad	1.5	10.7	4.9	41.7

It is important to note that most of the road structures in bad condition were built with masonry or masonry plus reinforced concrete. This shows that this type of structures have deficiencies. In general, the condition of the structures is much better than the condition of the roads.

3.3.2 Inp' 'ts for the HDM III Model

The Consultant proposes to apply the World Bank HDM III Model to formulate and assess an adequate road maintenance program, to fit the transport needs and the national economy. This is an interactive model that forecasts road conditions as a function of relevant characteristics such as initial conditions, traffic and time:

Variation D(t)= f(Condition/Characteristics, traffic, time, type of maintenance)

where D(t) is a deterioration or road condition parameter. In this model, the effects of earlier maintenance activities are taken into account by means of individual functions for each type or category of maintenance or construction activity. Minor maintenance activities such as routine tasks, crack sealing and patching are incorporated in the functions.

These type of functions, which reflect the causal process, deterioration factors and the effects of road maintenance, give a realistic and versatile basis for selecting among maintenance alternatives those which are technical and economically apropiate.

The model allows the user:

- To simulate the road deterioration process under operational traffic and load conditions, according to maintenance strategies defined by the user.
- To compute economic and financial vehicle operating cost as a function of road conditions.
- To obtain road maintenance costs broken down by type of activity.

- To compare the economic and financial results of different maintenance strategies and give economic indicators for each.

Among the questions that can be solved with the use of the model are:

- Which are the technical specifications of maintenance strategies which produce the best economic results?
- What are the implications for the economy and road user costs to defer preventive maintenance activities?
- What maintenance strategy or policy produces the least total transportation costs, understood as the sum of the construction, routine and preventive maintenance and vehicle operating costs?.

The use of the model requires detailed information of:

- Structural characteristics of the existing pavements.
- Types of surface and quantitative measurements of pavement condition, including: percentages of cracked, pot-holed and patched areas, Benkelman deflections, roughness indexes and sub-grade bearing capacity.
- Traffic levels and composition; growth projections.
- Load distribution by axle of commercial vehicles.
- Geometric road conditions such as: slope, curvature, roadway and shoulders width.
- Rain.
- Embankment height.
- Unit input costs by type of vehicle.
- Unit costs of road maintenance activities.

During the assessment stage of this Study, the existing information available for the El Salvador road network required by the model was determined, as well as the possibility of generating the remaining from existing data. Based on these data, a maintenance strategy will be formulated which closely reflects current road conditions.

It was found that, except for traffic data, most of the information required by the model is not available, but can be generated from:

- Correlations between the quantitative assessment of damages to pavements used to prepare the SIAMV data base and the deterioration parameters that the HDM III model uses.
- The 1976 geometric inventory.
- Rehabilitation and reconstruction project final designs and the structural characteristics of rehabilitated and reconstructed pavements.

With the road network data base generated form the above information, traffic projections and the formulation of maintenance strategies by type of road, a maintenance program of the paved road network may be evaluated based on the HDM III model. With the economic evaluation results, a maintenance program can be formulated which will guarantee the road network being permanently maintained in good condition, eliminating the need for new rehabilitation and reconstruction programs.

3.3.3 Review of the Technical Specifications Defined in the Infrastructure Sector Assessment Study

a. Typical Sections by Type of Road

Regarding the typical sections and some of the design specifications of the special and primary highways defined in the above study, some matters merit comments because of the effects they have on road capacity, construction and maintenance costs.

- Special Highways

For this type of road, the study calls for 3m wide outside shoulders, 1m wide inside shoulders and 8m wide median. The DGC stated that the width of the outside shoulder was established for safety reasons that is, to provide enough parking space for disable vehicles, totally clearing the traffic lanes. Although this is a valid argument, one should consider that the width of commercial vehicles varies between 2.30 and 2.60m, and shoulders more than 1.80m wide do not produce restrictive effects on road capacity. Therefore, without sacrificing safety nor changing overall highway width, the width of the outside shoulders can be reduced and the width of the median increased. A wider median allows for the possibility of adding an additional lane in the future in each direction. The present 8m-wide median allows two possibilities for later expansion: eliminate internal shoulders to maintain at least a 2m-wide median - the minimum recommended by the Highway Capacity Manual for safety and to avoid capacity restrictions - or to leave only a 70cm wide median. In both instances, the resulting specifications will not satisfy proper highway standards for neither the new road nor the existing one. Therefore, the Consultant recommends redefining the width of the outside shoulders and the median. This would result in lower maintenance costs and would allow for future expansion in compliance with design standards.

- Primary Highways

The above mentioned study specifies that shoulders of primary highways must be built with select compacted material. Considering the low possibility

of receiving adequate routine maintenance, keeping the double surface treatment throughout the road width would overcome the need for frequent maintenance.

- Secondary Highways

In this case it would again be better to build the entire width of the road with the same surface. This will allow use of the full width of the road on curves, improving safety and operating speed.

- Other Specifications

In general, the specified bridge widths were found to be smaller than the overall road width. Thus, bridges are critical road sections because they produce narrow passages which lower road standards.

b. Design Loads

The established bridge design loads for special and primary roads are different from those for secondary and tertiary roads, although there are no truck traffic restrictions for secondary and tertiary roads. This means that the bridge load capacity should not be a function of the road type but of the possible loads going over them. Therefore, it is reasonable to eliminate the existing differentiation.

On the other hand, the tendency to increase the loads for commercial vehicles should be evaluated. It may be preferable to increase design loads, considering future containerization.

c. Deterioration Curves

The deterioration curves defined in the Infrastructure Sector Assessment Study, correspond to simplified pavement deterioration models, where the age of the pavement is the only independent variable. These type of models have limited reliability when applied to a highway network.

Without a data base containing historical road conditions of Salvadorean highways to verify the applicability of the deterioration curves used in that study, no comments can be made on the validity of the estimates. However, given their mathematical characteristics, one can state that the these functions do not correctly extrapolate deterioration trends. While pavements have the tendency to deteriorate almost in a straight line in the beginning, as these functions forecast, this trend later follows a curve with a gradually ascending slope. The principal limitation of these curves is that they are defined as a function of pavement age. They do not consider very important factors for forecasting the

process of wear and pavement behavior, which is too complex to be simulated on the basis of so little information.

d. Relation Between Roughness and Pavement Condition

In the referred study, subjective relationships were established between roughness and pavement surface conditions, as shown in Table 3.3.5.

The equivalencies defined in the study do not correspond to the quality ranges at which pavements change their deterioration rate over time, while passing from good to fair to poor condition. Theoretical and empirical formulations made by World Bank experts, at the time the HDM III model work was done, indicate that pavements pass from good to fair condition when the roughness is higher than 3.5 m/Km and a pavement is in poor condition when its roughness exceeds 5.8 m/Km. Therefore, the study's classification does not appropriately represent road conditions.

TABLE 3.3.5
Roughness/Pavement Condition Relationships Defined in the Infrastructure Sector Assessment Study

TYPE OF ROAD	CORRUGATION m/km	CONDITION
Paved	2	Excellent
	4	Good
	6	Fair
	10	Bad
	14	Complete Deterioration
Not Paved	4	Excellent
	6	Good
	10	Fair
	14	Bad
	20	Complete Deterioration

The importance of a proper classification is that it is on this that the estimates of maintenance needs are based. Therefore, if optimistic classifications are used, the financial projections will be insufficient to cover actual maintenance needs and vehicle operating costs will far exceed reasonable estimates.

A classification, based on the results obtained by the World Bank, limits road conditions to only three ranges: good, fair and poor in accordance with the following values:

Roads in good condition:	$IIR \leq 3.5$
Roads in fair condition:	$3.5 < IIR \leq 5.8$
Roads in poor condition	$IRR > 5.8$

To clarify the meaning of this classification, which is solid and consistent, their characteristics are described as follows:

- Roads in Good Condition

Roads are considered in good condition when they are free of defects and require only routine maintenance and occasional surface treatments to preserve road surface quality. These roads are in their first stage of the road cycle and their deterioration process is slow. Even so, this process can be delayed if some low-cost routine and preventive maintenance are carried out. However, when these maintenance activities are not carried out, as happens in El Salvador and other countries, the deterioration process is shortened, the demand for maintenance funds increases and general road conditions deteriorate.

- Roads in Fair Condition

The passage of a road from good to fair condition is practically not noticeable. At the beginning of the deterioration process, the surface damages are very small. For the common observer, the road is in good condition. Although the pavement structure is good, in a short time, the surface damages increase and the basic pavement structure starts to deteriorate. The initial defects spread fairly quickly. If not taken care of, if will affect the totality of the road and its structural strength will be lost. At one stage of this process, the roads could be strengthened or renewed without major demolition of the existing structure.

- Roads in Poor Condition

If no care is [illegible]en of the road in the previous stage, and the deterioration process is a[illegible]ed to continue without control, the road passes to poor condition. At this stage, in order to repair the road, poor sections need to be demolished and replaced. The longer the road is left in poor condition, the damages and the demand for resources for its rehabilitation will be greater. In some instances, when the roads are already in bad condition and are left unattended, the only way to restore them to their original condition is to rebuild them at great expense.

Although the expenditure required to keep up the roads increases as their maintenance is more deficient, its amount is only a small fraction of global transport cost - construction, maintenance and vehicular operational cost - because vehicle operating cost (VOC) has the greatest share. It varies as an exponential function of road deterioration.

3 3.4. Users Charges

The most important road user charges identified are the following:

Purchase taxes (transfer and registration)
Vehicle property taxes
Taxes on transport companies and vehicle insurance firms
Import duties, including ad valorem taxes
Taxes on transport related items (fuel, oil and tires)
Custom duties on spare part imports
Driver license charges
Traffic and police fines

At the end of each fiscal year, the Finance Ministry, thru the General Direction of Government Accounting, prepares an annual Government financial report, which identifies Government sources of revenues.

However, even at the level of specific accounts, the revenues originated from road transport is not well defined. Table 3.3.6 shows the public sector income accounts for 1991 to 1993, which can be identified as derived from road use. During this period, income grew at an annual rate of 22.8 percent, higher than the 14.0 percent average annual inflation rate. Table 3.3.6 does not include those incomes which can not be directly identified with specific sources: taxes on the ownership and transfer of vehicles, on transportation firms, vehicle insurance companies, etc.

TABLE 3.3.6
Annual Government Income Identified as Originating from Road Use
(in millions of colones)

SPECIFIC ACCOUNTS				
No.	DESCRIPTION	1991	1992	1993
87	Taxes of importation on transport material	110	161.08	204.22
118	Taxes for the intervention of commercial procedures	96.8	96.8	113.83
133	Taxes on vehicles registration	30.1	31.62	42.01
257	Sale of vehicle license plates	2.73	2.41	2.46
339	Toll collections	5.37	8.11	2.72
341	Driver licenses	1.12	1.71	7.05
495	Transit fines by police	3.11	2.45	3.64
TOTAL		249.23	311.39	375.93

Source: Report Regarding the Liquidation of the General Budget and Situation of the Public Treasury and Fiscal Patrimonial. Fiscal exercises of 1991, 1992 and Report of the State Financial Management, Fiscal exercise of 1993, General Office of Governmental Accounting, Ministry of Finance.

As part of a highway questionnaire requested by the International Road Federation, the DGC estimated that for 1992, the income originating from road use, except fuel taxes (about 100 million colones), was 356.39 million colones as shown in Table 3.3.7. For the same year, transport and warehouse expenses totaled 370.1 million colones. (Table No. I-10, Report Regarding the liquidation of the General Budget and Situation of the Public Trasury and Fiscal Patrimonial, 1992, Ministry of Finance). This amount includes all transport and warehouse expenses, including non-highway transport expenses, but excludes public dept service expenses originated from highways expenses estimates, including highway related public dept service expenses. In Table 3.3.8, total highway expenses in 1992 amount to 375.3 million colones. Therefore, 1992 higway transport revenue (including fuel taxes) exceeded expenditures. In the next phase of this study, highway revenues and expenses will be forecasted considering the impacts of current economic policies regarding import duties and proposed highway maintenance and investment levels derived from the study.

TABLE 3.3.7

Annual Tax Income for the Use of Roads (in millions of colones)

ITEM	VALUE
ACQUISITION TAXES	
- Transfer of vehicles	33.64
- Registration of vehicles	35.6
FINES RELATED TO VEHICLE PROPERTY	3.72
PROPERTY TAXES	
- Passengers vehicles	14.91
– Other vehicles	21.15
DRIVER PERMITS	1.88
TAXES FOR USE	
Taxes on transport materials	162.86
Taxes on vehicle insurance companies and taxes an importation	70.87
Taxes on importation and customs registry	
TOLLS	8.11
TRAFFIC AND POLICE FINES AND TAXES FOR TOURISM	3.65
TOTAL	356.39

Source: Division of Assistance and Registry, General Office of Intern Taxes, Ministry of Finance.

TABLE 3.3.8
Highway Sector Expenses in 1992
(Thousand of colones in 1992 prices)

ITEM	VALUE
Operations (1)	
104 Highway studies and maintenance	
Management and Coordination	326
Administration	22764.1
Projects	4691
Highway Infrastructure maintenance	87452.1
Supervision, Evaluation and control	2624.3
Drainage maintenance	4526.9
Highway signals	1.660.1
Total operations	124044.5
DIRECT INVESTMENTS	
302 Construction and improvements of highways and roads	18429
303 Longitudinal highway and north zone development road	110.6
304 Regional highways	61960.6
305 Rural roads	2[illegible]3.3
307 Metropolitan highways	139.3
308 Tourist highways improvements	15805.8
309 Other highway infrastructure improvements	10436.3
311 Rehabilitation of the metropolitan area highway infrastructure	220.1
312 Acquisition of buildings and indenization payments DGC	3068.3
313 Rehabilitation and improvements of rural roads III phase	49557.7
TOTAL DIRECT INVESTMENTS	162671
PUBLIC DEBT SERVICE OF HIGHWAY PROJECTS (2)	
Maintenance and improvement of highway network 321-ES	4858
Financing urban ways San Salvador 427-ES	5398.7
Emergency rehabilitation program of the energy and highway sectors of San Salvador metropolitan area 453/OC-ES	2564.4
Rural roads program 472-ES	3911.8
Rural roads program II phase 665-ES	6496.3

TABLE 3.3.8 (...continued)
Highway Sector Expenses in 1992
(Thousand of colones in 1992 prices)

ITEM	VALUE
Rural roads rehabilitation and improvements program III phase 844-SF-ES	1786.6
Interamerican highway segments 2-0003-0-1-2-3-4	5078.6
San Francisco Gotera Perquin highway widening	721.2
Santa Ana-Metapan-Anguiatu highway	540.4
Interamerican highway San Salvador-San Miguel improvement/reconstruct 2-0112-0	6643.1
Interamerican highway San Salvador-San Miguel improvement phase II 2-0112-1	28880.4
Supervision and construction of the regional interconnection routes CA-12 and CA-1 Santa Ana 2-0136-0	1256.7
Littoral highway La Herradura, Playa Costa del Sol 2-0148-0	6335.8
To finalize construction of highway km. 52, Littoral La Herradura Playa Costa del Sol 2-0148-1	1969.3
Addition to regional highway interconnection project CA-1 and CA-2 Santa Ana 2-0136-1	248.1
La Hachadura highway rehabilitation CA-12 2-0213-0	1180.7
Santa Ana-Metapán Anguiatu CA-12 highway rehabilitation 2-0219-0	1089.8
San Salvador-San Miguel highway improvement and reconstruction phase II, segment No. 2 2-0225-0	6744.1
National highways program 31-ES	2835.2
TOTAL PUBLIC DEBT SERVICE OF HIGHWAY PROJECTS	88539.2
TOTAL HIGHWAY SECTOR EXPENSES	375254.7

(1) Includes DGC's operating expenses only.
(2) Includes amortization of principal, interests and commissions
Source: Tables No. III-3 and IV-6 , report regarding the liquidation of the general budget and situation of the public treasury and fiscal patrimonial, fiscal exercise of 1992, Ministry of Finance.

Taken all together, given actual levels of tariffs, duties, and expenses, the Government's highway transport revenues exceeds expenditures, including operating, maintenance, public debt service resulting from highway investments, and new highway investments.

During the second phase of this study, estimates will be made of the road user charges for each type of vehicle. Table 3.3.9 shows the of registered vehicles to November 1994 by type of registration plate.

TABLE 3.3.9

Vehicle Tax Registry to November 1994 Total Vehicles by License Letter

VEHICLE PLATE		QUANTITY
LETTER	DESCRIPTION	
P	Particular	249,477
M	Motorcycles	20,751
C	Trucks	22,579
RE	Trailer	3,044
V	Vehicle on sale	886
AB	Bus	7,513
A	Rental	5,489
N	Goverment Vehicle	8,062
R	Repair	.119
	TOTAL	317,920

Highway Analysis - Introduction

The detailed road analysis comprises an evaluation of investment needs in the paved network and the privatization options of road maintenance and weight control per axle.

Investment needs were estimated based on:

> Identification of the conditions of the existing road network, current traffic levels and growth rates of the same forecasted to 20 years.
>
> Evaluation of the use of the network capacity under the transit demand during the same term.

Based on the mentioned information, in first place was obtained the demand of financial resources originated from the establishment of a good road maintenance system, which will prevent in a medium term the execution of new rehabilitation and reconstruction programs of paved roads. In order to support the recommendation to introduce the system, we present the results of its economic evaluation.

Starting from the identification of the road sections which will present congestion problems and low service levels during the next 20 years, if their current geometric characteristics are kept and traffic demand behaves according to projections, several road construction and expansion programs were costed and evaluated to timely answer the unsatisfied demand.

Additionally, the analysis provides specific proposals to privatize routine maintenance tasks of the road network and transfer the responsibility of weight control per axle in highways to private enterprises.

Expositions around privatization of routine maintenance are focused in contracting these activities with small associative enterprises formed by personnel retired from the DGC and, or, individuals residents of the zones next to the roads purpose of the contracts.

In relation to periodic maintenance, different options are exposed to carry it out and an analysis of them showing which have better possibilities of being put into practice in El Salvador.

3.4 Road Maintenance in El Salvador

The life cycle of roadways, in most of the developing countries, is in general a repetitive process which may be described as follows:

- Initial construction or reconstruction
- Operation starting
- Prolonged lack of care of the roads
- Progressive and accelerated pavement deterioration as a consequence of the lack of care
- Excessive and costly carrying out of emergency maintenance tasks to maintain circulation, and finally
- Reconstruction of the roads at high costs

An important portion of the main road network of El Salvador is in the last of described stages or it has just been reconstructed. Nevertheless, the road network does not have a proper budgetary assignment for required minimal maintenance to assure a deterioration processes only in accordance to the levels traffic. Under this perspective, the reconstructed roads will fall again into the described cycle and the rest of the network will deteriorate faster than normally.

The highways deterioration process is characterized by four well defined stages, that set the difference among the various status in which important portions of the network can be found. They can be described as follows:

✓ The first stage corresponds to the beginning of operation of a new roadway, which even having construction or design failures, provides an excellent riding surface to vehicular traffic.

✓ Starting from the moment in which the roadway is opened to circulation, begins a slow deterioration process due in first place to the heavy vehicles, and factors such as weather-rains and temperature variations- and the level of routine maintenance provided. During this second stage, which can take 6 to 8 years, the pavement appearance is good and does not show surface damage signs.

✓ In the third stage, when surface damages appear, the roadways have started an accelerated deterioration process which if it is not stopped through the carrying out of reinforcement works, leads to strength loss by damages in the basic road structure and the appearance of even worst surface damages. This stage takes from 2 to 4 years.

✓ If the roadways lack of care continues, they get into a total deterioration stage. There is pavement loss, initial cracks turns into potholes that make circulation more difficult, vehicles are damaged and operation costs rise substantially.

Although this cycle has being accepted as normal, it is perfectly possible to have roads which never must be reconstructed or rehabilitated, if their maintenance is programmed so they will not suffer losses on their structural capacity and they are reinforced when they are still in good operating conditions. This is not well understood generally.

Proper maintenance program costs are not superior to those of rehabilitation and construction, but they do generate great economic benefits for the society as a group.

3.4.1 Road Network Condition

The general condition of the Salvadorean highways is not satisfactory from different points of view, among them are:

- Riding surface condition
- Pavement structural contribution
- Sub-base quality
- Shoulders and drainage works deterioration and misfunction
- Deficient technical specifications for roads of lesser type

According to the information provided by the road inventory carried out in 1991 and 1993, it was found that:

In terms of surface condition:

✓ 30% of the paved network was in fair condition and 38% in bad or very bad condition

✓ 39% of the primary roads and 47% of the secondary were in bad condition

✓ 30% of the non-paved roads were in fair condition and 37% in bad or very bad condition

✓ In non-paved roads, the percentages of roads in bad or very bad conditions were 76,44 and 41% for stone, gravel or earth surfaces respectively

✓ The lesser type roads show worse general conditions.

Regarding to structural characteristics of paved roads:

✓ 40% of deflection measures showed values between 100/100 mm and 180/100 mm and 18% between 80/100 mm and 100/100 mm. First values indicate inadequate behavior of the sub-base and second ones critical conditions of the same

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- ✓ 47% of strength values of sub-base deflection analysis, in terms of CBR, are inferior to the reference value of 4% indicating presence of weak sub-bases.

- ✓ The existing pavements' thicknesses calculated from the deflection curves analysis under load, in terms of hot asphaltic mixture (), show that 59% were in between 10 and 15 cm and a 10% under 10 cm. This indicate that structural contribution of existing pavements is minimal and they are underdesigned for the future traffic demand.

- ✓ 37% (2,275 km) of the inventoried non-paved roads have lesser width than the defined minimum DGC regulations for this type of roads, which makes traffic on them difficult and dangerous.

3.4.2 Causes of Network Maintenance Deficiencies

Resultant figures of the road inventory are a clear sign of a problem originated by several causes. Besides the armed conflict, which impeded to attend in a proper way the road infrastructure, among the most important are:

- The lack of road maintenance financing assigned in the budgetary laws, although there are enough potential resources

- The inefficiency in the investment programming

- The inefficiency in the works under state organizations responsibility, due to lack of proper goals set for the road maintenance.

- The little attention given to the effect that roads in bad condition have on the vehicle operation costs.

As a result of described conditions, the overall cost of ground transport, which includes infrastructure and vehicle operation costs, is more expensive than that produced by a road network in good maintenance. From the point of view of DGC, the resources demand to give proper maintenance is inferior to that from reconstruction and rehabilitation programs; from the users' point of view, their operation costs are higher when roads are in fair or bad condition. The economic analysis of maintenance alternatives studied for the paved road network of El Salvador (developed within this study and shown later on) confirms the aforementioned.

The World Bank considers that the lack of road maintenance programs causes losses of infrastructure in Latin-American and Caribbean countries valued between US$ 2,000 and 3,000 millions per year, and that highway users are obliged to spend a figure even higher in vehicle operation costs due to the bad conditions of roads on which they must travel. The Bank also states that accumulated figures in area countries for reinforcement works,

rehabilitation and reconstruction-due to delays in carrying out maintenance programs - have a cost of at least US$25,000 million. That, if they had been carried out on time, that value had been one third of the this value. It was also found that per every US$1 not invested in maintenance US$3 or 4 have been paid as operation costs.

The deficient road condition in El Salvador is also related to some pavement design concepts that, when misinterpreted, lead to wrong decisions for the country's economy. A second element for the road maintenance is the budgetary definition of maintenance costs as administrative expenses. A brief analysis is given below about these topics that tries to clarify concepts and proposes a new approach to avoid their negative effects with regard to roads quality.

a. Pavement Design Period.

In an large number of road agencies of the development countries, it was assumed for years that this term mean that normal process of highways is that which leads to their total deterioration due to exhaustion of the pavement useful life and therefore, reconstruction and rehabilitation of the roads is reasonably and unavoidable. Indeed, if the road network is administered in a proper way, rehabilitation and reconstruction programs can be eliminated in the future, as long as reinforcements are programmed on time to avoid structural damages on the highways.

b. Administration Expenses

Road maintenance costs have been considered traditionally as administration costs of the agency in charge of roads. When so included in official budgets, the possibilities of being increased in accordance to actual requirements are very low. On the other hand, when cuttings are needed in public expenditures, administration expenses are reduced, and since it is absolutely necessary to cover salary payments, budgetary cuttings affect mostly assignments to purchase materials. Such has been the case in the latest years at DGC; this leads to a situation where salaries are paid but there is no budgetary availability to provide what is required to carry out road maintenance works.[1]

Under a proper scheme of road maintenance, the preventive maintenance works of asphaltic carpets really correspond to investments activities. For practical purposes, a system of maintenance which considers the periodic reinforcement of asphaltic carpets is a staged paved construction process, that responds to traffic demand and optimize from the economic point of view, the investment programming.

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1 During years 1993 to 1995 near 90% of the DGC Ordinary Budget was assigned to salaries. During those years, only 14, 1.1 and 4 million Colones were available respectively for the purchase of stone, tools, asphalt, diesel and gasoline. For 1994 this represented ¢ 110 per Km per Year. This situation does not allow proper road maintenance and means subutilization of hand labor.

If the design period concept changes for one based on the road maintenance status and budgetary road maintenance is redefined as investment and not as administration, it is possible to overcome two important obstacles: to solve the financing problems of the road maintenance and to appreciate the real durability of pavements.

Other reasons to assign a minimal priority to road infrastructure maintenance into state budgets are:

- The DGC is not directly affected by the operation costs increase of vehicles because roads deterioration. In consequence, the transport costs reduction is not a basic objective involved in the decision making to distribute the sector resources.

- The investment, carried out only with external loans, is used primarily to reconstruct and rehabilitate highways that, for not having being properly maintained, require this type of investments.

3.4.3 Present Situation of Road Maintenance in El Salvador

As a consequence of not availability of resources for road maintenance, the functions of the Departmental Residences, have been reduced gradually to carry out maintenance works in concordance with municipalities of their district, which supply resources for materials and fuel purchasing. Given the nature and origin of this group work, of total local concern, the main road network gets little attention.

Regarding the Equipment Administration and Maintenance (AME) following is a summary of statements made about the functions, problems to carry them out appropriately and foresight about the future of the agency:

- The use of equipments by DGC frequently is unappropriated and causes unjustified damages of the same. It is common, that the equipment be overloaded with materials or that machinery is used to carry out works that must be made with other type of equipment.

- The machinery, is frequently transported by their own means, thus causing a fast deterioration.

- Machinery is moved from one place to another without reporting to AME.

- For the aforementioned reasons the reported damages by the residences are no reliable, since they are not objectives.

- The assigned budget to AME in 1994 was ¢47 millions, against ¢34 millions in 1995. That means a cut close to 30%. This indicates that when the agency requires more resources to attend equipments, is given a lesser amount.

- The budgetary cutting, which affects mostly funds for equipment spare parts and materials acquisition led to that the allocation of the budget for materials and parts in one hand, and salaries on the other one, passed from 50-50 to 30-70. This trend shows a similar trend to the ordinary budget of the DGC and if it is kept this way, it will lead to maintain a field staff to carry out a job which is not able to do so because the lack of materials and operating equipment.

- The asphaltic plant has not operated during 1995 because non-availability of asphalt, stone materials and diesel.

In accordance with recent modernization trends in the management of the road network, DGC has made an important logistic effort leading to modify the administration of its system. In first place it has stopped totally its construction activities. It is now contracting all of these works to private enterprises. Second, it is about to complete the assembling of the Road Administration and Maintenance System, SIAMV, which must become the tool for the analysis of the road deterioration process and the economic evaluation of road maintenance programs leading to maximize the benefits of having a road network in good operating conditions.

3.5 Proper Road Maintenance

The establishing of a maintenance program of the road network is a primary task to preserve the patrimony of the Nation invested in the past in highway construction and to assure the most efficiency in the utilization of resources to be used in the future in repairs, construction and maintenance of the new roads.

Road maintenance is associated to roads in good condition, rehabilitation with roads in fair and bad condition; and reconstruction with roads semi-destroyed.

The two basic actions in a maintenance program are:

- The definition of the best type of intervention, from the economic point of view, according to characteristics of the roads and the traffic volume they must stand.

- The identification of the most proper time to accomplish the interventions.

This last one is of special importance, because the magnitude of incurred overruns when the execution of the works is postponed regarding the time in which they must be carried out.

Within an adequate road maintenance program the knowledge of the roads condition is essential to estimate the proper time to carry out the works. This time estimate must be done with sufficient anticipation to secure necessary resources to be assigned to

accomplish the works on time. To carry out works ahead of the optimum time may, in some instances, be convenient; on the contrary, delaying them, is not a valid option, since it causes larger costs to those supposed savings resulting from postponing the works.

The technical characteristics of the interventions, once the time in which they must be carried out is defined, depend on the cost, the time to accomplish them and the durability of the works. In general, the most recommended interventions are those oriented towards mid and long term. Solution at short term are not quite good, though in certain circumstances are valid.

In order to establish clearly the exact meaning of the concepts more frequently used to refer to the interventions that highways must be submitted to, after their initial construction, and set the characteristics, quality, costs and opportunity of each one of them, definitions of the same are presented below as they are understood in this work:

3.5.1 Road Maintenance

This is the group of activities destined to assure the proper functioning in a long term basis of a road network, at the lesser possible cost. The main objective of road maintenance is to avoid the unnecessary loss of capital already invested, by a physical protection of the basic infrastructure and the roads surface. In a specific way, maintenance assumes to avoid the deterioration of the road structures that will afterwards impose the need of rehabilitation or reconstruction.

It includes both routine and periodic maintenance, and within this last, renewals and surface reinforcements.

a. Routine Maintenance

Consists of repairing small localized defects on the road and the pavement; shoulders and non paved surfaces leveling; regular drainage maintenance, lateral slopes, edges, traffic control devices and other accessory elements; cleaning of the right of way zone, plant control, cleaning of dust and sand and maintenance of safety devices. According to each road condition this must be carried out one or more times per year. It assures highway deterioration processes only according to traffic demand.

b. Periodic Maintenance

This is the expression that is mostly misunderstood, because all maintenance activities are periodic, since they must be repeated every so often. However, basically, periodic maintenance activities cover renewals of the road surfaces and pavement strengthening.

- Surface Renewal

In non-paved road, it means reapplication of gravel. In paved roads means adding one or several additional layers on the pavement, without modification of the existing basic structure. Pavement recycling is also classified as renewal of the surface.

The surface renewal has the purpose of preserving the quality of riding surface, assure the structural integrity of the road for an additional time period and avoid accelerated deterioration processes leading to the road destruction. This renewal must be carried out preferably in the stage in which the surface initially passes from good condition to fair. Under no circumstances it must be postponed until the stage in which the road reaches the bad condition. If the intervention is accomplished timely, it normally requires only the top surface renewal. However, since roads at that point do not show any obvious damage, there is the tendency to postpone the intervention and allow the speeding up of the deterioration.

Surface treatments are the typical activities of surfaces renewal. By its application some pavement characteristics are reestablished, without reinforcing its structure. Its objectives in the paved roads are to maintain the durability of the asphaltic mixture, to prevent the premature development of cracks and fissures that are commonly presented by solar radiation and improve the texture to assure the proper friction between vehicles and road. These treatments must be applied when pavements are still in good condition, not when fair conditions developed.

- Strengthening or Overlay

It is an activity of similar characteristics than those of surface renewal, but its specific objective is to increase the structural strength of the pavement. Within a well planned maintenance scheme the surface strengthening can be done instead of its renewal, and although more expensive, later it requires lesser resources for its maintenance. The decision about renewal or strengthening must obey to considerations about the maintenance system efficiency, traffic volumes, cargo levels and cargo growth rates. Strengthening is applicable to roads in good condition or in an early stage of fair condition.

3.5.2 Rehabilitation

The necessary intervention to get roads back into good service levels, when their deterioration is beyond the limit that allows them to be considered as roads in good condition. It implies the repair of structural damages and in consequence, the demolition and replacing of the damaged portions. This type of repairs together with structure strengthening are known as rehabilitation. Its purpose is to reestablish the structural strength and provide a good riding surface again. Its cost is considerably higher than that of a surface renewal. In most cases, rehabilitation is necessary when there was lack of an adequate maintenance.

Within a well planned road maintenance scheme, rehabilitation should be sporadic and only for cases of repairing defective sections of new works.

3.5.3 Defective Fraction

It is a small portion of a new road which does not satisfy the required quality parameters. Its occurrence may be attributed to the lack of homogeneity in the execution of the works or to localized terrain failures and its presence is common. This is the only case which justifies the carrying out of rehabilitation works.

3.5.4 Reconstruction

It means total replacement of the road structure, prior partial or total demolition of the existing structure. Generally it is made using the existing road embankment and alignment. Reconstruction is made when rehabilitation is not longer possible because prolonged lack of maintenance or severe construction defects.

3.5.5 Improvement

This cover all those works related to changes of width alignment, curves and gradients which increase the road capacity or circulation safety. The expression also includes surface renewal or rehabilitation works when they are carried out in roads in fair condition. Its objective is to increase the capacity of the highways as well as the speed of the vehicles and to provide circulation safety.

3.6 Analysis of Maintenance Strategies

Within the objectives of the Study is one of recommending a policy for the utilization and maintenance of the road infrastructure under the Ministry of Public Works responsibility and propose the actions to be followed to establish it. In order to define this policy the HDM III model was used, as an economic analysis tool, to evaluate road maintenance alternatives under different maintenance patterns during an analysis period of 20 years.

To use the model information was needed about:

1. Present operation conditions of the vehicle fleet on the road with regard to transmitted loads to the road structures and determination of the equivalent axle numbers per type of truck

2. The physical condition of the paved road network, such as: roughness indexes, percentages of damaged areas, road geometries, structures and types of pavement, bearing capacity of sub-grades and measured deflections with Benkelman beam.

3. Traffic levels and length of the roads associated to them.

4. Patterns or road maintenance regulations.

5. Financial and economic unit costs, of road maintenance and reconstruction.

6. Financial and economic costs of vehicle inputs.

Besides having this information it was necessary to group the different sections in which the road network is inventoried, in order to carry out the analysis which lead to set particular recommendations for group of roads with common characteristics or for particular projects. The information related to each subject was obtained as described bellow:

3.6.1 Present Situation of Weights per Axle

From the processing of trucks weigh samples carried out in the first stage of the Study, the average gross vehicle weight per type of truck were obtained, as well as the number of equivalent axles per vehicle configuration, starting from the weight per axle of each sample vehicle, according to the following formulas:

Directional axle: $NEE = (P/6.6)^4$

Single driving axle: $NEE = (P/8.2)^4$

Double driving axle: $NEE = (P/15.1)^4$

Where: P = Applied load in Tons per axle.

NEE= Number of equivalent axles
The denominator numbers are pattern or reference loads.

The computation of this parameters, essential for the vehicle operation costs submodels and road deterioration conforming the HDM III Model, are shown in Annex 3.6.1. In Table 3.6.1 results for every type of truck are shown.

TABLE 3.6.1
Average Gross Vehicular Weights (PBV) and
Number of Equivalent Axles (NEE) per Truck

TYPE OF VEHICLE	AVERAGE PBV (Tons)	NEE
C2	12.97	2.175
C2	21.63	2.165
T3-S2	34.22	2.359

Source: Processing of sample weighing on Nov. 1994. Frederic R. Harris, Inc.

3.6.2 Physical Condition of the Road Network

Based on the available information of the inventory carried out by the DGC in 1991 and 1993 and the designs of recent works or with assured design and financing, a data base of the paved road network of El Salvador was conformed in accordance with HDM III Model requirements:

Necessary parameters to typify the road network condition in operation and which will not be given attention within a short term, are the followings:

- ✓ Area of opened fissures
- ✓ Area of total fissures
- ✓ Area of landslides
- ✓ Area of potholes
- ✓ International Index of Roughness(IIR)
- ✓ Benkelman deflection
- ✓ Subgrade's CBR
- ✓ Ruttings depth
- ✓ Average deviation of the rutting depth

To obtain information about the first three parameters damages shown in the SIAMV's INGECON were used: D2, open fissures; D3, other fissures and D4, pealing, disintegration, exudation, weaving and sliding, were used, and the procedure described bellow was followed:

Information contained in the INGECON is presented by sections of 500 mt and indicates deterioration levels per type of damage on the road, in scales 1 to 5 defined in the road inventory handbooks. These indexes are related to percentages of damaged area, in the instance of quantitative measures, or according to the observers subjective appraisal, when it deals with the driving easiness on the road.

- To transform this information into data for the HDM III Model, weighted averages of the indexes for each of the sections which conform the analysis network were obtained.

- Weighted values were converted into damaged area percentages, taking as base the extreme values of the damaged level in which every value was found, to interpolate and find the corresponding percentages.

- Corresponding indexes to each quality level represent the following percentage ranges of damaged area:

Level 1	0%
Level 2	> 0% and < 5%
Level 3	> 5% and < 15%
Level 4	> 15% and < 25%
Level 5	> 25%

The D1 damage type, uncover potholes, was obtained directly from the initial calculation of the weighted values, since it corresponds to the actual value of potholed area of every section.

Quality parameter D5, defined as driving easiness, is the one which represents major difficulty to be transformed. At the beginning, it was thought to be used as a road roughness measure, but since it is not a quantitative value it was discarded. The driving easiness involves several factors not related to the longitudinal profile of the roads and the perception of the evaluators about what a comfortable driving means is very variable. That is why it was weighted similarly to other four parameters, but the resultant value was not taken directly. Roughness was assigned with a certain criteria, based on comfort indexes and percentages of uncover potholes and damaged areas.

Values of depth and average deviation of the ruttings, which INGECON lacks, were generated from the roughness values assigned to each section and took values from 4 to 32 for the first and 1.4 to 6 for the second.

Computation of damage area percentages, depth and average deviation of ruttings are presented in Table 1 of Annex 3.6.2

Benkelman deflection was taken from the survey carried out in 1200 km of the paved road network, for the sections included in it. For those sections which did not have this information, values were assigned so, the percentaged allocation per ranges established in the report of the road inventory was maintained.

To calculate the CBR value of the sub-grade, the defined formulas of the HDM III Model's theory were used, as follows:

$$SNC = 3.2 * (Deflection/100)^{-0.63}$$

$$SNC = 0.0394 * \sum_{i}^{n} a_i * H_i + SNSG$$

$$SNSG = 3.51 * \log CBR - 0.85 * (\log CBR)^2 - 1.43$$

Where:

SNC	=	Structural number
a_i	=	Structural coefficient of "*i*" pavement layer
H_i	=	Thickness of the "*i*" pavement layer
SNSG	=	Structural contribution of the sub-grade to the structural number
CBR	=	Sub-grade bearing capacity

The first of the formulas, with the known value of the Benkelman deflection, allowed to calculate the value of the structural number of the pavement (SNC). From the second formula, and pavement thicknesses, the contribution of the sub-grade to the structural number was obtained and from the last formula, it was found the CBR value.

For the road sections under implementation or already financed projects, structural characteristics of the new pavements were needed, to calculate the corresponding structural numbers (SNC) and the CBR of the sub-grades, since damages previous to the works are no longer of concern.

Tables 2 and 3 of Annex 3.6.2 shown the data base, per road section, used to run the HDM III Model.

3.6.3 Traffic

Starting from the 1992 traffic counts, demand projections for the study and the traffic assignations made with the model TRANUS, general growth rates per type of vehicle to apply to initial figures and obtain the traffic volumes of the analysis period were obtained. This generalization was necessary since historic series to allow making dependable projections are not available. The effects of the armed conflict on the traffic were very notorious and even nowadays, the growth rates have not been established; neither has the traffic volumes growth seems to be related to other economic indicators. When compared the traffic volumes measured for 1992 and 1993, in some cases, growth rates superior to the 80% are found, that if used, would certainly greatly distort any estimates.

In consequence, to project traffic the global figures of growth which provides the TRANUS Model were used. They are shown in Table 3.6.2

TABLE 3.6.2
Average Annual Growth Rate by Vehicle Type 1992-2015
Scenario A

VEHICLE TYPE	UNITS [1]-km * 1000		GROWTH RATE (%)
	1992	2015	
Automobile	3573.2	34729.1	10.4
Public Transport	15582.0	39110.5	4.1
Total passengers	19155.2	73839.6	6.0
Light Truck	8929.6	28804.3	5.2
Heavy Truck	2121.2	7954.1	5.9
Container Truck	461.0	4649.7	10.6
Total Trucks	11511.8	41408.1	5.7

Source: Frederic R. Harris, Inc.
1 Passengers or Truck Ton - Km
2 National, International urban buses and pick ups

Initial traffic figures were obtained by weighted averages according to the length of the sections which conforms the group of analyzed roads, as shown in Tables 2 and 3 of the Annex 3.6.3.

3.6.4 Road Maintenance Strategies

To the roads with initial traffic superior to 1500 vehicles per day, a group of seven maintenance strategies were defined, consisting of:

- Basic Alternative -NOR0-. It represents an option of providing only routine maintenance, refill every pothole appearing in the period and reconstruct the road when its deterioration has reached an advanced stage - IIR=8.5 -. It is the maintenance alternative most similar to how roads are attended in El Salvador and is the starting point of reference to calculate possible savings that may generate the application of the remaining maintenance alternatives which conforms the group of strategies.

- Three alternatives of different technical specifications -10,7 and 5 cm of asphaltic layer thickness- and a maximum deterioration threshold associated with roads which start passing from good condition to fair - IIR=4 -, They are identified with codes NOR1, NOR2 and NOR3.

- Three alternatives of the same technical specifications than those aforementioned but with a degree of deterioration related to roads passing from fair to bad condition - IIR=5.4 -.

To the roads with traffic below than 1500 vehicles per day, a group of maintenance strategies was defined, that besides the basic alternative -NORO- have the following :

- Two alternatives of surface treatment -NOR1 and NOR2- applicable when the IIR reaches values 4 and 5.4 respectively.

- Two alternatives with 3 and 5 cm of asphaltic layer each - NOR3 and NOR4 - associate with the lesser acceptable deterioration level defined previously - IIR = 4-.

- Two alternatives with 3 and 5 cm of asphaltic layer each - NOR5 and NOR6 - to be applied when the highest acceptable deterioration level - IIR = 5.4 is reached.

In Table 3.6.3 summary descriptions of these maintenance models are presented.

TABLE 3.6.3
Maintenance Strategies Based Upon Traffic

STRATEGY	REFILL	SURFACE TREATMENT (1)	REINFORCEMENT (2)			RECONSTRUCTION (3)	ALTERNATIVE
			5 cm.	7 cm.	10 cm		
STANDARDS FOR TRAFFIC GREATER THAN 1600 VEHICLES PER DAY							
NOR0	100%					8.5	0
NOR1	100%				4.0	6.5	1
NOR2	100%			4.0		6.5	2
NOR3	100%		4.0			6.5	3
NOR4	100%				5.4	6.5	4
NOR5	100%			5.4		6.5	5
NOR6	100%		5.4			6.5	6

STRATEGY	REFILL	SURFACE TREATMENT (1)	REINFORCEMENT (2)		RECONSTRUCTION (3)	ALTERNATIVE
			3cm cm.	5 cm		
STANDARDS FOR TRAFFIC BELOW 1600 VEHICLES PER DAY						
NOR0	100%				8.5	0
NOR1	100%	4.0			6.5	1
NOR2	100%	5.4			6.5	2
NOR3	100%			4.0	6.5	3
NOR4	100%			5.4	6.5	4
NOR5	100%		4.0		6.5	5
NOR6	100%		5.4		6.5	6

Source: Frederic R. Harris, Inc.

Notes: All the strategies include routine maintenance.
1. Asphalt surface treatment required when pavement reaches the indicated IIR.
2. When the pavement reaches the IIR indicated.
3. If during the first year of analysis the IIR reaches 6.5, reconstruction followed by maintenance in accordance with the same strategy.

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3.6.5 Unit Costs of Maintenance and Reconstruction of Ways

To determine unit costs of maintenance and reconstruction of paved ways, which in the instance of the routine maintenance must be expressed as annual costs per km, and in any other activity in terms of cost per m2, the break down of the unit costs for all activities related to road maintenance as carried out by the DGC was analyzed.

In general terms the calculation procedure was the following:

- The work reports defined in the Implementation Norms Regulations elaborated by the departmental residents of DGC were taken.

- The hourly cost of the equipment was calculated as an average of the offered costs by enterprises bidding at the present for DGC contracts.

- The labor was recalculated from the value used by the DGC, adding the fringe benefits prescribed by law.

- For the materials and transport calculation market prices were used and IVA was deducted.

- Once obtained the breakdown of the unit costs to the sum of them, a 40% was added as indirect costs, and to the unit cost so obtained another 10% was added as IVA, to finally get the market cost of the analyzed activity.

The defined activities in the SIAMV as components of the routine maintenance that were analyzed are the following:

- Cutting and clearing of the right - of - way zone
- Manual clearance of ditches
- Mechanized clearance of ditches
- Cleaning of culverts
- Landslide removal
- Manual slope reshaping
- Patching of paved shoulders
- Patching of non-paved shoulders
- Crack sealing
- Localized seal coating
- Transit signals cleaning
- Kilometer markers painting
- Traffic strips

Quantities of work to determine the cost per km of routine maintenance were taken directly from those defined in the Integrated System of Road Maintenance Administration-SIAMV-.

Activities of patching surface or deep potholes, despite of being considered as proper of routine maintenance, were analyzed separately, because the model calculates as a whole the total of the area with potholes and the cost of their repair.

In relation to periodic maintenance activities, the following were analyzed:

- ✓ Overlays 7 cm thick
- ✓ Single surface treatment
- ✓ Seal coating

The calculation of the reconstruction costs was based on the information available at the DGC for projects just completed and those under construction. That is, actual statistical construction and supervision costs that DGC pays for this type of works was used.

Unit costs calculations related to construction and maintenance are shown in the Tables of the Annexes 3.6.5 A to 3.6.5 D.

To calculate economic costs of reconstruction, routine and periodic maintenance, shadow prices factors were used. Also, a discrimination was made of qualified and not qualified labor, local and foreign equipment and materials same as DGC uses in its economic evaluations.

Tables 3.6.4 and 3.6.5 show, all aforementioned structures and shadow pricing factors per cost component.

TABLE 3.6.4
Percentaged Structure of Construction Costs and Shadow Factors per Component

COMPONENT	COST PERCENTAGE	SHADOW FACTOR
Labor	16.5	
- Skilled	6.7	0.40
- Non Skilled	9.8	0.9744
Materials	63.9	
- National	48.9	0.8768
- Foreign	15.0	0.76
Equipment and tools	19.6	0.76

Source: Economic Evaluation, DGC

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TABLE 3.6.5
Percentaged Structure of Maintenance Costs
and Shadow Factors by Components

COMPONENT	COST PERCENTAGE	SHADOW FACTOR
Labor	51.70	
- Skilled	42.01	0.40
- Non Skilled	9.69	0.9744
Materials	34.46	
- National	4.12	0.8768
- Foreign	30.34	0.76
Equipment and tools	13.84	0.76

Source: Economic Evaluation, DGC.

Based on unit costs calculated as indicated, cost files were generated for every type of road, that is, for special, primary and secondary roads.

In the case of routine maintenance, values calculated for roads in good condition were taken. For primary and secondary road the total values were taken; for special roads half values were taken since these were analyzed as independent roads for each direction of traffic.

To calculate unit costs of periodic maintenance activities which assumes the placing of asphaltic overlays or surface treatments, must be considered that shoulders require also the application of additional overlays to keep a safe difference of levels with the travel roadway. Therefore, the cost of this activity in primary and special roads was calculated as follows: the travel road width was multiplied by the unit value of the 10 cm thick asphaltic layer; to this figure it was added the result of multiplying the shoulders width by the unit value of surface treatment; this added total was divided by the travel road width to obtain the unit cost of the activity. In secondary roads, the unit value of the overlay was multiplied by the total travel road width plus shoulders and it was divided by the travel road width, since the model assumes the application of the overlay to the road width and does not include the shoulders.

Table 3.6.6 shows costs used in the model to carry out the financial and economic evaluations.

TABLE 3.6.6
Unit Costs per Type of Road for Evaluation Maintenance Strategies
(in 1994 colones)

TYPE OF ROAD			
ACTIVITY	SPECIAL	PRIMARY	SECONDARY
FINANCIAL COSTS			
Routine Maintenance (¢/Km-year)	24308.00	25941.19	2546[illegible].42
10 cm. Carpets (¢/m²)	150.67	152.41	205.68
Reconstruction (¢/m²)	293.76	312.46	315.53
Refill (¢/m²)	93.83	93.83	93.83
Surface Treatment (¢/m²)	12.70	12.70	12.70
ECONOMIC COSTS			
Routine Maintenance(¢/Km-year)	19932.00	21271.72	20880.76
10 cm. Carpets (¢/m²)	119.96	121.35	163.76
Reconstruction (¢/m²)	233.90	248.78	251.22
Refill (¢/m²)	76.94	76.94	76.94
Surface Treatment (¢/m²)	10.41	10.41	10.41

Source: Frederic R. Harris, Inc.

3.6.6 Costs of Vehicle Inputs

The submodel of operation costs of the HDM III requires information of financial and economic costs of the vehicle inputs per type of vehicle involved in the analysis.

In order to establish the market prices a brief research was made about tire costs, lubricants, fuel, vehicles and driver and mechanic labor costs.

To determine economic prices of inputs, except those corresponding to vehicles, shadow factors used by the DGC in its economic studies were applied. In the instance of vehicles, average prices based on a estimated composition of the vehicle fleet were obtained; to those prices import duty taxes and IVA were deducted to get the corresponding economic prices.

Values used are shown in Table 3.6.7

TABLE 3.6.7
Financial and Economic Prices for Vehicle Inputs
(in 1994 colones)

ITEM	AUTO	PICKUP	BUS	C2L	C2P	C3	T3-S2
FINANCIAL PRICES							
Vehicle	139000	105000	500000	170000	265000	385000	550000
Fuel	3 43	3 43	2 22	3 43	2 22	2 22	2 22
Lubricant	25 15	25 15	25 15	25 15	25 15	25 15	25 15
Tires	494	455	2168	798	2168	2168	2168
Labor hand Gang	0	3.28	16 41	8 60	13 68	13.68	19 14
Labor hand Maintenance	19 14	19 14	21 88	19 14	21 88	21 88	21 88
Interest	21%	21%	21%	21%	21%	21%	21%
SHADOW PRICES							
Vehicle	0 625	0 845	0 845	0 845	0.845	0.845	0 845
Fuel	0.76	0.76	0.76	0 76	0.76	0.76	0 76
Lubricant	0 76	0 76	0.76	0.76	0.76	0.76	0 76
Tires	0 76	0.76	0.76	0 76	0.76	0.76	0 76
Labor hand Gang	0.70	0.70	0 70	0 70	0 70	0.70	0 70
Labor hand Maintenance	0 70	0.70	0.70	0.70	0 70	0 70	0 70
ECONOMIC PRICES							
Vehicle	86875	88725	422500	143650	223925	325325	464750
Fuel	2.61	2.61	1 69	2 61	1.69	1.69	1 69
Lubricant	19.11	19.11	19.11	19.11	19.11	19.11	19.11
Tires	375.44	345.80	1647.80	606.48	1647.68	1647.68	1647.68
Labor hand Gang	0	2.30	11.49	6.02	9.58	9.58	13.40
Labor hand Maintenance	13.40	13.40	15.31	13.40	15.31	15.31	15.31
Interest	12%	12%	12%	12%	12%	12%	12%

Source: Economic Studies, DGC

3.6.7 Conformation of Road Network Analyzed

The non-paved financed road network was separated, by type of road and traffic range, in 18 groups; the remaining network, made up by the financed highways, was divided by projects in 22 additional groups. In general, every analyzed group is made up of 10 or less sections of the network. Tables 1 and 2 of Annex 3.6.7 show the conformation of the 40 analyzed groups; in overall, about 2000 km of paved ways are covered. To each of the groups thus conformed, the HDM III Model was applied to obtain information about:

- ✓ Deterioration processes
- ✓ Financial costs
- ✓ Economic costs
- ✓ Economic comparison of maintenance alternatives at a 12% annual discount rate, and
- ✓ Annual traffic

3.7 Analysis of Road Network Maintenance Programs

In this section it is presented the analysis through the HDM III Model to determine the combination of road maintenance alternatives more convenient for the management of the road infrastructure. To include the total paved network, the expansion of the results according to kilometers associated with each of the groups indicated in Table 3.7.1 was carried out..

TABLE 3.7.1
Length of the Groups of the Paved Road Network Selected for the Analysis By Category and Traffic Level

GROUP	SAMPLE (km)	TYPE OF ROAD	NAME OF THE SEGMENT	TPD	TOTAL RED (km)
Z001	122.3	SPECIAL	SPECIAL 3000 - 4000	3636	122.3
Z002	125.6	SPECIAL	LA CUCHILLA - ACAJUTLA	5290	125.6
Z003	74.0	SPECIAL	SPECIAL 6000 - 8000	7419	74.0
Z004	18.6	SPECIAL	SAN SALVADOR - APOPA	12066	18.6
Z005	15.2	SPECIAL	SPECIAL > 15000	17876	15.2
Z006	32.5	PRIMARY	PRIMARY < 1000	541	77.0
Z007	76.0	PRIMARY	ACAJUTLA - LA LIBERTAD	588	86.0
Z008	58.8	PRIMARY	SANTA ANA - ANGUIATU	1037	66.8
Z009	44.2	PRIMARY	LA HACHADURA - CA 12	1064	50.8
Z010	27.7	PRIMARY	LA LIBERTAD - COMALAPA	1432	45.6
Z011	51.9	PRIMARY	ZACATECOLUCA - USULUTAN	2966	51.9
Z012	44.1	PRIMARY	EL PORTEZUELO - EL JOBO	3047	44.1
Z013	31.6	PRIMARY	USULUTAN - EL DELIRI	3175	31.6
Z014	31.6	PRIMARY	PRIMARY 200 - 4000	3284	31.6
Z015	26.0	PRIMARY	COMALAPA - ZACATECOLUCA	6216	26.0
Z016	48.2	SECONDARY	SECONDARY < 200	168	63.2
Z017	77.5	SECONDARY	SECONDARY 200 - 400	291	86.6
Z018	87.0	SECONDARY	SECONDARY 400 - 600	494	91.0
Z019	58.7	SECONDARY	SECONDARY 600 - 800	731	61.7
Z020	110.9	SECONDARY	SECONDARY 800 - 1000	854	111.9
Z021	27.6	SECONDARY	PORTEZUELO - SAN CRISTOBAL	1093	27.6
Z022	82.7	SECONDARY	SECONDARY 1000 - 1200	1137	82.7
Z023	80.6	SECONDARY	SECONDARY 1200 - 1500	1280	80.6
Z024	57.5	SECONDARY	SECONDARY 1500 - 2000	1684	57.5
Z025	42.5	SECONDARY	CA1 - SENSUNTEPEQUE	1941	42.5
Z026	32.4	SECONDARY	SECONDARY 2000 - 3000	2104	58.1
Z027	21.5	SECONDARY	SECONDARY 3000 - 5000	4126	21.5
Z028	1.5	SECONDARY	SECONDARY 5000 - 7000	6710	1.5
Z029	16.1	SECONDARY	SECONDARY 10000 - 20000	1219	16.1
Z030	4.0	SECONDARY	SECONDARY > 20000	2382	4.0
Z031	19.2	SPECIAL	SN MARTIN - SN RAFAEL CEDROS	6027	19.2
Z032	49.0	PRIMARY	QUITASOL - EL POY	655	49.0
Z033	15.3	PRIMARY	SAN MIGUEL - EL DELIRIO	2131	15.3
Z034	41.5	PRIMARY	KM 64- DESV. SANTIAGO DE MARIA	2252	41.5
Z035	33.5	PRIMARY	SAN MIGUEL - SIRAMA	2381	33.5
Z036	41.6	PRIMARY	SAN RAFAEL CEDROS - KM 64	3039	41.6
Z037	56.0	PRIMARY	SAN MIGUEL - GOASCORAN	3279	56.0
Z038	26.2	PRIMARY	DESV. STGO. MARIA- SAN MIGUEL	3358	26.2
Z039	35.9	PRIMARY	APOPA - QUITASOL	3583	35.9
Z040	24.2	PRIMARY	APOPA - SITIO DEL NIÑO	3973	24.2
TOTAL	1881.2				2016.05

Source: Frederic R. Harris, Inc.

3.7.1 Selection of Alternatives

Starting from the economic evaluations produced by the model, for each of the groups of studied roads the road maintenance alternatives which produce major benefits with lesser maintenance costs were chosen. In general, the chosen alternatives meet the following condition: between the two that produce the higher savings in net present value, the one (alternative) that has the lesser maintenance cost was selected, if the difference in costs did not justify the additional expense for the agency in charge of the road network.

Tables 3.7.2 and 3.7.3 show the economic costs of the basic alternatives and selected alternatives, expanded to the total of the paved road network.

TABLE 3.7.2

Economic Costs of the Base Maintenance Alternatives for the Total Paved Road Network (in million colones of 1994 - rate of return: 12%)

SEGMENT	LENGTH (Km)	ALT.	RECONSTRUCTION COST	ROUTINE COST	ROAD COST	OPERATION COST	TOTAL COST
Z001	122.30	ALT2	107.4	21.7	129.1	5,362.2	5,491.3
Z002	125.60	ALT2	70.7	22.0	92.7	7,386.8	7,479.6
Z003	74.00	ALT2	127.1	13.2	140.4	6653	6793.3
Z004	18.60	ALT2	16.7	3.4	20.0	2,504.2	2,524.3
Z005	15.20	ALT2	35.0	2.4	37.4	3,530.0	3,567.4
Z006	77.03	ALT6	25.8	14.1	40.0	423.8	463.8
Z007	66.00	ALT0	0.0	15.5	15.5	501.6	517.1
Z008	66.80	ALT4	5.6	12.3	17.9	935.8	953.6
Z009	50.80	ALT3	0.0	9.2	9.2	571.3	580.5
Z010	45.57	ALT3	0.0	8.3	8.3	629.9	638.1
Z011	51.90	ALT3	18.3	9.8	28.1	1,604.9	1,633
Z012	44.10	ALT3	18.0	8.3	26.3	1,476.3	1,502.5
Z013	31.80	ALT3	14.0	6.1	20.1	1,035.0	1,055.1
Z014	31.80	ALT3	26.0	6.2	32.1	1,139.3	1,171.4
Z015	28.00	ALT2	11.2	4.9	16.1	1,915.1	1,931.3
Z016	63.20	ALT0	2.2	11.5	13.7	113.0	126.8
Z017	66.80	ALT6	11.0	16.0	27.0	270.5	297.5
Z018	91.00	ALT6	28.6	16.9	45.6	483.1	529
Z019	61.70	ALT5	23.1	11.5	34.6	465.4	500.0
Z020	111.91	ALT4	40.0	21.1	61.1	935.3	996.4
Z021	27.60	ALT4	7.0	7.6	14.6	492.8	507.5
Z022	82.70	ALT4	38.8	15.5	54.3	823.7	878.0
Z023	80.60	ALT4	32.3	15.2	47.5	1,025.2	72.7
Z024	57.50	ALT3	57.8	10.6	68.4	1,008.2	1,076.6
Z025	42.50	ALT3	11.9	7.7	19.6	809.6	829.2
Z02	58.14	ALT3	47.8	10.9	58.7	1,236.2	1,294.9
Z027	21.50	ALT2	25.0	4.3	29.3	1,022.8	1,052.2
Z028	1.50	ALT2	2.7	0.3	2.9	121.9	124.9
Z029	16.10	ALT2	34.3	3.0	37.2	2,093.0	2,130.3
Z030	4.00	ALT2	5.6	0.6	6.2	1,028.8	1,034.9
Z031	19.20	ALT2	12.3	3.3	15.5	1,747.0	1,762.5
Z032	49.00	ALT4	0.0	8.8	8.8	435.3	444.2
Z033	15.30	ALT3	7.4	3.0	10.3	467.8	478.1
Z034	41.50	ALT3	11.9	7.6	19.4	1,441.4	1,460.8
Z035	33.50	ALT3	0.0	6.3	6.3	1,182.6	1,188.9
Z036	41.60	ALT3	20.9	7.5	28.4	1,980.2	2,008.6
Z037	56.00	ALT3	0.5	10.6	11.0	2,513.9	2,525.0
Z038	28.20	ALT2	0.0	4.8	4.8	1,292.5	1,297.3
Z039	35.90	ALT2	20.5	6.8	27.3	1,833.4	1,860.7
Z040	24.20	ALT2	13.1	4.5	17.5	1,384.5	1,402.1
TOTAL	2,018.10		930.3	373.3	1,303.6	61,877.5	63,18[illegible]

Source: Frederic R. Harris, Inc.

TABLE 3.7.3

Economic Costs of the Base Maintenance Alternatives Selected for the Paved Road Network
(in million colones of 1994 - rate of return: 12%)

SEGMENT	LENGTH (Km)	ALT.	ROAD COST	OPERATION COST	TOTAL COST	COMPARISON	NPV SAVINGS	IRR (%)
Z001	122.30	ALT2	112.3	4,882.7	4995.0	ALT2VSALT0	496.3	79.7
Z002	125.60	ALT2	74.3	6,941.4	7015.7	ALT2VSALT0	463.9	158.2
Z003	74.00	ALT2	86.0	6,084.4	6170.4	ALT2VSALT0	622.9	161.7
Z004	18.60	ALT2	13.3	2,334.0	2347.3	ALT2VSALT0	177.0	293.9
Z005	15.20	ALT2	22.4	2,935.4	2957.7	ALT2VSALT0	609.7	361.1
Z006	77.03	ALT6	37.0	403.4	440.4	ALT6VSALT0	23.2	MULTIPLE RESULT
Z007	86.00	ALT0	15.5	501.6	517.1			
Z008	66.80	ALT4	22.4	886.3	908.7	ALT4VSALT0	44.8	63.8
Z009	50.80	ALT3	16.3	553.2	569.5	ALT3VSALT0	11.0	39.1
Z010	45.57	ALT3	15.1	608.4	623.5	ALT3VSALT0	14.6	44.5
Z011	51.90	ALT3	23.1	1,499.8	1523.0	ALT3VSALT0	110.0	99.6
Z012	44.10	ALT3	20.2	1,388.6	1408.8	ALT3VSALT0	93.7	102.5
Z013	31.60	ALT3	14.6	972.7	987.3	ALT3VSALT0	67.7	MULTIPLE RESULT
Z014	31.60	ALT3	22.5	1,054.0	1076.5	ALT3VSALT0	94.8	87.1
Z015	26.00	ALT2	14.6	1,790.7	1805.3	ALT2VSALT0	126.0	176.6
Z016	63.20	ALT0	13.7	113.0	126.8			
Z017	86.60	ALT6	33.3	258.8	292.1	ALT6VSALT0	5.4	19.6
Z018	91.00	ALT6	49.4	462.2	511.6	ALT6VSALT0	17.4	MULTIPLE RESULT
Z019	61.70	ALT5	30.9	443.1	474.0	ALT5VSALT0	26.1	MULTIPLE RESULT
Z020	111.91	ALT4	59.3	865.3	924.6	ALT4VSALT0	71.7	42.6
Z021	27.60	ALT4	14.6	468.8	483.4	ALT4VSALT0	24.1	MULTIPLE RESULT
Z022	82.70	ALT4	49.2	763.0	812.2	ALT4VSALT0	65.7	52.4
Z023	80.60	ALT4	41.2	959.5	1000.7	ALT4VSALT0	72.0	59.9
Z024	57.50	ALT3	62.7	930.0	992.6	ALT3VSALT0	84.0	69.0
Z025	42.50	ALT3	21.7	760.3	782.1	ALT3VSALT0	47.1	61.4
Z026	58.14	ALT3	48.5	1,144.9	1193.5	ALT3VSALT0	101.6	64.4
Z027	21.50	ALT2	24.1	946.4	970.5	ALT2VSALT0	81.7	93.1
Z028	1.50	ALT2	1.9	112.8	114.7	ALT2VSALT0	10.2	172.1
Z029	16.13	ALT2	22.8	1,962.0	1984.7	ALT2VSALT0	145.5	32.0
Z030	4.00	ALT2	5.2	834.9	840.1	ALT2VSALT0	194.8	401.2
Z031	19.20	ALT2	11.3	1,661.9	1673.2	ALT2VSALT0	89.4	236.2
Z032	49.00	ALT4	14.4	426.3	440.8	ALT4VSALT0	3.4	30.7
Z033	15.30	ALT3	7.1	442.7	449.7	ALT3VSALT0	28.4	28.4
Z034	41.50	ALT3	17.8	1,353.9	1371.7	ALT3VSALT0	89.1	102.6
Z035	33.50	ALT3	14.2	1,101.7	1115.9	ALT3VSALT0	73.0	112.4
Z036	41.60	ALT3	19.8	1,889.4	1909.2	ALT3VSALT0	99.3	140.0
Z037	56.00	ALT3	22.8	2,377.2	2400.0	ALT3VSALT0	125.0	122.3
Z038	26.20	ALT2	11.1	1,223.0	1234.1	ALT2VSALT0	63.3	114.5
Z039	35.90	ALT2	21.3	1,719.3	1740.6	ALT2VSALT0	120.2	190.1
Z040	24.20	ALT2	14.7	1,292.8	1307.5	ALT2VSALT0	94.6	145.2
TOTAL	2,016.1		1,142.5	57,349.9	58,492.6		4,688.6	

Source: Frederick R. Harris, Inc.

The analysis of these figures facilitates the identification of recommended actions for El Salvador to have permanently highways in good condition at reasonable costs, minimizing vehicle operating costs and overall ground transport costs through the prioritization of investment of available resources for those highways that can generate major benefits for the economy of the country.

3.7.2 Total Costs and Savings of the Group of Selected Alternatives

Based on the figures shown in Tables 3.7.2 and 3.7.3, Table 3.7.4 summarizes the subsequent economic evaluation.

TABLE 3.7.4
Summarized Evaluation of the Paved Road Network
(in million colones of 1994 - rate of return del 12%)

	VEHICLE OPERATION COSTS (VOC)	VOC/CT %	ROAD COSTS (CV)	CV/CT %	TOTAL COSTS (CT)
BASE ALTERNATIVES	61,877.50	97.90%	1,303.60	2.10%	63,181.20
BETTER ALTERNATIVES	57,349.90	98.00%	1,142.50	2.00%	58,492.60
SAVINGS (AH)	4,527.60		161.10		4,688.60
VARIATION	-7.30%		-12.40%		-7.40%
ROAD COST / AH. VOC	25.20%				

Source: Frederic R. Harris, Inc.

This summary indicates that the implementation of a road maintenance program that warranties the permanence of highways in good condition in the future - which implies the rehabilitation or reconstruction of the roads which so require at the present- in 20 years can produce savings in vehicle operating costs in the order of ¢4,500 millions US$520 millions approx. -. In addition, it shows that the resources demand for a proper road maintenance program would be lower with respect to rehabilitation plan by about 12%.

It can also be seen, that possible savings for vehicle operating costs would represent about 7.3% of the total transport costs that will be caused if attention to pavements stays as it is done at present.

If it is considered that the introduction of a road maintenance strategy allows savings in state investments and that the total cost of providing maintenance represents 25% of savings generated by users, the funding of road maintenance may be reached through direct collection from the road users.

If maintenance costs were fully collected from the users and these collected funds we invested in the roads, the users still would have at their disposal 75% of the generat savings as a retribution for payments made and would have roads in good condition.

These results are indicative to the definition of road maintenance patterns to be applied Salvadorean roads and will allow the formation of a clear idea in relation to the magnitu of resources required for its maintenance and of savings in road transport which may obtained when the program is established.

3.7.3 Costs and Total Saving of the other Groups of Alternatives

Tables of Annex 3.7.3 present economic costs for the groups of maintenance alternativ which according to the present net value of savings produced, are in the subseque positions to the selected alternatives. Starting from the same a summary was produc which is presented in Table 3.7.5.

TABLE 3.7.5
Costs of the Seven Groups of Maintenance Alternatives
(in million colones of 1994)

GROUP	COSTS			SAVINGS IN NPV		
	MAINTENANCE	OPERATION (VOC)	TOTALS	TOTALS	IN VOC	IN MAINTENANCE
THE BEST	1,142.50	57,349.90	58,492.60	4,688.60	4,527.60	161.10
2nd	1,424.00	56,946.20	58,370.40	4,810.80	4,931.30	-120.40
3rd	1,233.00	57,595.70	58,828.70	4,351.90	4,281.80	70.60
4th	1,137.20	58,682.50	59,819.60	3,361.30	3,195.00	166.40
5th	1,215.20	59,005.20	60,220.00	2,960.90	2,872.30	88.40
6th	1,099.00	59,576.60	60,675.80	2,505.60	2,300.90	204.60
BASE	1,303.60	61,877.50	63,181.20			

Source: Frederic R. Harris, Inc.
VOC = Vehicles Operation Costs
NPV = Net Present Value

As can be observed in the table above, except for the group of alternatives which produces major savings in the net present value, the base alternative is the one which presents greater maintenance costs. On the other side, the reason why these alternatives with greater savings were not selected but those which together with generating important savings have low maintenance costs, may be appreciated: the second group of alternatives supposes a maintenance overrun of 25% against the selected alternatives -281.5 million colones more- and only generates additional savings of 2.6% - 122.2 millions-, which does not justify the maintenance overrun which will infer its selection.

3.7.4 Description of Alternatives Selected per Analyzed Section

Starting from the results which appear in Annex 3.7.4, in which the road groups to be analyzed are related with their initial traffic volumes (1995), maintenance alternatives selected by section and the road category corresponding to each group, Table 3.7.6 was prepared to summarize such results and to describe the characteristics of the maintenance alternatives selected by type of road and traffic levels.

TABLE 3.7.6
Selected Maintenance Standards by Type of Road and Traffic Levels

TYPE OF ROAD	DAILY AVERAGE TRAFFIC	RECOMMENDED MAINTENANCE STANDARD [1]
ALL	>3300 [2]	7 cm. overlay. When IIR reaches 4m/km.
	<200	Only routine maintenance and reconstruction when IIR reaches 8.5 m/km
PRIMARY OR SECONDARY	200 -600	3 cm. overlay. When IIR reaches 5.4 m/km
	600-1300	5 cm. overlay. When IIR reaches 5.4 m/km
	1300-3300	5 cm. overlay. When IIR reaches 4 m/km

1 All maintenance standards assume: routine maintenance, 100% patching and reconstruction of roads if in their IIR is over 6.5m/km.

2 None special road has a one way initial traffic less than 3500 vehicles per day.

It may be appreciate in this table that as traffic volumes increase, independently of the roa category, the selected standards are more demanding, both in terms of technic specifications as for the admissible deterioration level.

Some results obtained for individual sections, as for the one identified with code Z007, whic corresponds to the road Acajutla-La Libertad, show differences with the gener recommendations presented in Table 3.7.6.

However, these are not contradictory neither impair the recommended. In this road i particular, the alternative of not carrying out periodic maintenance activities resulted in th most economic, even though the one recommended for primary roads with initial traffic les than 600 vehicles per day, consists in applying an overlay of 3 cm. when road deteriorati implies a rugosity higher than 5.4 m/km.

The explanation for this result is that, given the specifications of the road and the low traffi volume, maintenance costs are very similar to savings which may arise due to the executio of works.

3.7.5 Road Maintenance Priorization

Current lack of definition about funding sources and the availability of resources to attend th maintenance program evaluated, makes it necessary to foresee that in a beginning it will no be possible to cover all roads which requires maintenance.

Therefore, following we present several tables in which are shown the roads to be analyze in order as per amount of savings that the adoption of the proposed maintenance plan wi produce.

In Table 3.7.7 we show the ordering for a set of 30 groups of roads studied.

In Tables 3.7.8 and 3.7.9 appear the figures corresponding to the roads that are under repai at present or have recently been repaired and those of the 10 groups excluded from Tabl 3.7.7 because they have funding secured and will be repaired in the next years.

The ordering presented is based in the relation between savings and periodic maintenanc costs, which may optimize the expense when programming investments in those roads whos relations are higher, since they will produce greater benefit per colon invested.

TABLE 3.7.7
Economic Costs of Maintenance Alternatives Selected for the Analyzed Roads Ordered by Present Net Value

SEGMENT	LENGT H Km	ALT	PERIODIC MAINTENANCE COST	ROAD COST	OPERATION COST	TOTAL COST	COMPARISON	SAVING NPV	IRR %	SAVING NPV PERIODIC MAINTENANCE COST
Z030	4.00	ALT2	4 5	5.2	834.9	840 1	ALT2 VS ALT0	194 8	401 2	43 3
Z005	15 20	ALT2	19.8	22.4	2,935.4	2,957.7	ALT2 VS ALT0	609 7	361 1	30 7
Z004	18.60	ALT2	10.2	1.3	2,334.0	2.347.3	ALT2 VS ALT0	177 0	293 9	17 4
Z015	26.00	ALT2	9.9	14.6	1,790.7	1,805.3	ALT2 VS ALT0	126 0	176 6	12 7
Z002	125.60	ALT2	53.2	74.3	6,941.4	7,015 7	ALT2 VS ALT0	463 9	158 2	8 7
Z003	74 00	ALT2	73.6	86.0	6,084.4	6,170 4	ALT2 VS ALT0	622 9	161 7	8 5
Z011	51 90	ALT3	13.8	23.1	1,499.8	1,523.0	ALT3 VS ALT0	110 0	99 6	8 0
Z012	44 10	ALT3	12.3	20.2	1,388.6	1,408 8	ALT3 VS ALT0	93 7	102 5	7 6
Z013	31.60	ALT3	8.9	14.6	972.7	987.3	ALT3 VS ALT0	67 7	MULT	7 6
Z029	16.10	ALT2	20.0	22.8	1,962.0	1,884.7	ALT2 VS ALT0	145 5	232.0	7 3
Z028	1.50	ALT2	1.7	1.9	112.8	114.7	ALT2 VS ALTO	10 2	172 1	6 1
Z014	31.60	ALT3	16.8	22.5	1,054.0	1,076 5	ALT3 VS ALT0	94 8	87 1	5 6
Z001	122 30	ALT2	91.7	112.3	4,882.7	4,995.0	ALT2 VS ALT0	496 3	79 7	5 4
Z008	66.80	ALT4	10.5	22.4	886.3	908 7	ALT4 VS ALT0	44 8	63 8	4 3
2027	21.50	ALT2	20.3	24.1	946.4	970 5	ALT2 VS ALTO	81.7	93 1	4 0
2021	27.60	ALT4	7.0	14.6	468.8	483 4	ALT4 VS ALT0	24 1	MULT	3 5
2025	42.50	ALT3	14.3	21.7	760 3	782 1	ALT3 VS ALT0	47 1	61 4	3 3
2023	80 60	ALT4	26.7	41.2	959.5	1,000.7	ALT4 VS ALT0	72 0	59 9	2 7

TABLE 3.7.7 (...continued)
Economic Costs of Maintenance Alternatives Selected for the Analyzed Roads
Ordered by Present Net Value

SEGMENT	LENGTH Km	ALT	PERIODIC MAINTENANCE COST	ROAD COST	OPERATION COST	TOTAL COST	COMPARISON	SAVING NPV	IRR %	SAVING NPV PERIODIC MAINTENANCE COST
Z026	58.14	ALT3	38.3	48.5	11,449.9	1193.5	ALT3 VS ALT0	101.6	64.4	2.7
Z010	45.57	ALT3	7.0	15.1	6,084.4	623.5	ALT3 VS ALT0	14.6	44.5	2.1
Z022	82.70	ALT4	34.4	49.2	7,630.0	812.2	ALT4 VS ALT0	65.7	52.4	1.9
Z020	111.91	ALT4	39.1	59.3	865.3	924.6	ALT4 VS ALT0	71.7	42.6	1.8
Z024	57.50	ALT3	52.6	62.7	930.0	992.6	ALT3 VS ALT0	84.0	69.0	1.6
Z009	50.80	ALT3	7.2	16.3	553.2	569.5	ALT3 VS ALT0	11.0	39.1	1.5
Z019	61.70	ALT5	19.7	30.9	443.1	474.0	ALT5 VS ALT0	26.1	MULT	1.3
Z006	77.03	ALT6	23.2	37.0	403.4	440.4	ALT6 VS ALT0	23.2	MULT	1.0
Z018	91.00	ALT6	33.0	49.4	482.2	511.6	ALT6 VS ALT0	17.4	MULT	0.5
Z017	86.60	ALT6	17.6	33.3	258.8	292.1	ALT6 VS ALT0	5.4	19.6	0.3
Z016	63.20	ALT0	2.2	13.7	113.0	126.8				0.0
Z007	86.00	ALT0	0.0	15.5	501.6	517.1				0.0
TOTAL	1673.7		689.3	988.1	43,861.7	44,849.9				

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TABLE 3.7.8
Economic Costs of Maintenance Alternatives Selected for Repaired Roads
Ordered by Present Net Value

PROYECTS 1995										
SEGMENT	DESCRIPTION	LENGTH (Km)	ALT	MAINTENANCE COSTS PERIOD	RECONSTRUCTION AND MAINTENANCE COSTS	VEHICLE OPERATION COSTS	TOTAL COSTS	SAVINGS NET PRESENT VALUE	INTERNAL RATE OF RETURN (%)	SAVINGS NPV MAINTENANCE COSTS PERIOD
Z004	San Salvador -Apopa	18.60	ALT2	10.2	13.3	2,331.0	2,347.3	177.0	293.9	17.40
Z015	Comalapa-Zacatecoluca	26.00	ALT2	9.9	14.6	1,790.7	1,805.3	126.0	178.6	12.70
Z002	La Cuchilla-Acajutla	125.60	ALT2	53.2	74.3	6,941.4	7,015.7	463.9	158.2	8.72
Z011	Zacatecoluca Usulután	51.90	ALT3	13.8	23.1	1,499.8	1,523.0	110.0	99.6	7.95
Z012	Portezuelo-El Jobo	44.10	ALT3	12.3	20.2	1,388.6	1,408.8	93.7	102.5	7.64
Z013	Usulután-El Delirio	[illegible]	ALT3	8.9	14.6	972.7	987.3	67.7	MULT	7.61
Z008	Santa Ana-Anguiatu	58.80	ALT4	9.3	19.8	780.2	799.9	39.4	63.8	4.25
Z021	Portezuelo-San Cristobal	27.60	ALT4	7.0	14.6	468.8	483.4	24.1	MULT	3.45
Z025	CA-1-Sensuntepeque	42.50	ALT3	14.3	21.7	760.3	782.1	47.1	61.4	3.30
Z010	La Libertad-Comalapa	27.70	ALT3	4.2	9.2	369.8	379.0	8.9	44.5	2.10
Z009	La Hachadura-CA 12	44.20	ALT3	6.3	14.2	481.3	495.5	9.6	39.1	1.52
Z007	Acajutla-La Libertad	76.00	ALT2	0.0	13.7	443.3	457.0			
SUB-TOTAL		574.60		149.4	253.2	18,230.9	18,484.3	1,167.4		

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TABLE 3.7.8 (...continued)
Economic Costs of Maintenance Alternatives Selected for Repaired Roads
Ordered by Present Net Value

PROYECTS 2000										
SEGMENT	DESCRIPTION	LENGTH (Km)	ALT	MAINTENANCE COSTS PERIOD	RECONSTRUCTION AND MAINTENANCE COSTS	VEHICLE OPERATION COSTS	TOTAL COSTS	SAVINGS NET PRESENT VALUE	INTERNAL RATE OF RETURN (%)	SAVINGS NPV MAINTENANCE COSTS PERIOD
Z031	Sn. Martin-Sn. Rafael Cedros	19.20	ALT2	8.1	11.3	1,661.90	1,673.2	89.4	236.2	11.02
Z038	Das Santiago de Ma.-Sn. Miguel	26.20	ALT2	6.4	11.1	1,223.00	1,234.1	63.3	114.5	9.94
Z037	San Miguel-Goascorán	56.00	ALT3	12.7	22.8	2,377.2	2,400.0	125.0	122.3	9.60
Z040	Apopa-Sitio del Niño	24.20	ALT2	10.3	14.7	1,292.8	1,307.5	94.6	145.2	9.15
Z035	San Miguel-Sirama	33.50	ALT3	8.2	14.2	1,101.7	1,115.9	73.0	112.4	8.98
Z034	Km 84-Desvio Santiago de Ma.	41.50	ALT3	10.5	17.8	1,353.9	1,371.7	89.1	102.6	8.53
Z039	Apopa-Quitasol	35.90	ALT2	14.9	21.3	1,719.3	1,740.6	120.2	160.1	8.09
Z036	San Rafael Cedros-Km 64	41.30	ALT3	12.4	19.8	1,889.4	1,909.2	99.3	140.0	8.01
Z033	San Miguel-El Delirio	15.30	ALT3	4.3	7.1	442.7	449.7	28.4	MULT	6.60
Z032	Quitasol-El POY	49.00	ALT4	5.7	14.4	426.3	440.8	3.4	30.7	0.60
SUB-TOTAL		342.40		93.4	154.4	13,488.2	13,642.7	785.7		
TOTAL		917.00		242.8	407.6	31,719.1	32,127.0	1,953.1		

Source: Frederic R. Harris, Inc.

TABLE 3.7.9
Economic Costs of Base Maintenance Alternatives For Repaired Roads
(in million colones of 1994-discount rate 12%)

PROYECTS 1995						
SEGMENT	DESCRIPTION	LENGTH (Km)	ALT	OPERATION AND MAINTENANCE COSTS	VEHICULAR OPERATION COSTS	TOTAL COSTS
Z002	La Cuchilla-Acajutla	125.60	ALTO	92.7	7,386.8	7,479.6
Z004	San Salvador-Apopa	18.60	ALTO	20.0	2,504.2	2,524.3
Z007	Acajutla-La Libertad	76.00	ALTO	13.7	443.3	457.0
Z008	Santa Ana-Anguiatu	58.60	ALTO	15.7	823.7	839.4
Z009	La Hachadura-CA 12	44.20	ALTO	8.0	497.1	505.1
Z010	La Libertad-Comalapa	27.70	ALTO	5.0	382.9	387.9
Z011	Zacatecoluca-Usulután	51.90	ALTO	28.1	1,604.9	1,633.0
Z012	Portezuelo-El Jobo	44.10	ALTO	26.3	1,476.3	1,502.5
Z013	Usulután-El Delirio	31.60	ALTO	20.1	1,035.0	1,055.1
Z015	Comalapa-Zacatecoluca	26.00	ALTO	16.1	1,915.1	1,931.3
Z021	Portezuelo-Zacatecoluca	27.60	ALTO	14.8	492.8	507.5
Z025	CA 1-Sensutepeque	42.50	ALTO	19.6	809.6	829.2
SUB-TOTAL		574.60	—	280.2	19,371.7	19,651.9

TABLE 3.7.9 (...continued)
Economic Costs of Base Maintenance Alternatives For Repaired Roads
(in million colones of 1994-discount rate 12%)

PROYECTS 2000						
SEGMENT	DESCRIPTION	LENGTH (Km)	ALT	OPERATION AND MAINTENANCE COSTS	VEHICULAR OPERATION COSTS	TOTAL COSTS
Z031	San Martín-San Rafael Cedros	19.20	ALTO	15.5	1,747.0	1,762.5
Z032	Quitasol-El POY	49.00	ALTO	8.8	435.3	444.2
Z033	San Miguel-El Delirio	15.30	ALTO	10.3	467.8	478.1
Z034	Km 64-Desvío Santiago de María	41.50	ALTO	19.4	1,441.4	1,460.8
Z035	San Miguel-Sirama	33.50	ALTO	6.3	1,182.6	1,188.9
Z036	San Rafael Cedros-Km 64	41.60	ALTO	28.4	1,980.2	2,008.6
Z037	San Miguel-Goascorán	56.00	ALTO	11.0	2,513.9	2,525.0
Z038	Desvío Santiago de María-San Miguel	26.20	ALTO	4.8	1,292.5	1,297.3
Z039	Apopa-Quitasol	35.90	ALTO	27.3	1,833.4	1,860.7
Z040	Apopa-Sitio del Niño	24.20	ALTO	17.5	1,384.5	1,384.5
SUB-TOTAL		342.40	------	149.5	14,278.6	14,428.2
TOTAL		917.00	------	429.7	33,650.3	34,080.1

Source: Frederic R. Harris, Inc.

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The ordering shown in the preceding tables indicate that investment must be directed preferentially towards those roads with greater traffic volumes in order to make the investment the most efficient possible.

3.8 Calculation of Funding Needs for Road Maintenance

Calculation of funding costs of a road maintenance program based on analysis carried out for the current paved road network, with projects under execution and the ones which have their funding assured, was done at 1994 constant prices.

As a complementary exercise, costs of a maintenance program of the non-paved network was calculated, based on routine and periodic maintenance costs estimated by SIAMV.

3.8.1 Paved Road Network

Table 3.8.1 presents the resources demand per year and per type of maintenance for the total paved road network. The costs of projects to be constructed with loan funds which have not begun to be executed as yet, are not included in the calculations, since its inclusion would have distorted the economic evaluation of the maintenance program.

Figures presented indicate that the demand for resources for periodic maintenance during the first two years is the highest that will arise during the period. If compared the 369.85 millions necessary in these two years with the 268.2 millions necessary during the period 2009 to 2010, which is the period that has the second largest funding needs, it is found that this last one represents only 72% of the costs of the first biennium. This result indicates the considerable reduction of funds demand which may be achieved with the establishment of a road maintenance program which allows to rehabilitate roads which so require at present and then guarantee roads in good conditions due to the execution of regular periodic maintenance works.

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TABLE 3.8.1
Financial Costs of Maintenance Alternatives Selected for the Total Paved Road Network
(in millions colones of 1994)

PAVED LENGTH 2016 KM			
PERIOD	MAINTENANCE PERIOD COSTS	MAINTENANCE RECURRENT COSTS	TOTALS
1995	212 316	53 034	265 350
1996	157 533	51 676	209 209
1997	64.573	51 692	116 266
1998	54 245	51 691	105 936
1999	27 342	51 707	79 050
2000	59 255	52.126	111 381
2001	94.439	52 200	146 638
2002	180 611	52 050	232 661
2003	73 961	52.109	125.970
2004	106.496	52 003	158 499
2005	103.374	52.011	155.385
2006	138.106	51.973	190.080
2007	124.283	51.835	176.118
2008	123.938	51.859	175.796
2009	133.632	52.081	185 714
2010	134.614	52.026	186.639
2011	97.431	52.151	149 582
2012	115.272	52.042	167.313
2013	78.554	51.847	130 401
2014	63.697	52.020	115 718
FINANCIAL COSTS WITHOUT DISCOUNT :			
——	2143.572	1040 133	3183 705
FINANCIAL COSTS WITH DISCOUNT :			
.0%	2143.572	1040 133	3183 705
12.0%	800 845	428.149	1228 995
20.0%	472.959	299 710	772 669

Source: Frederic R. Harris, Inc

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3.8.2 Non-Paved Road Network

To calculate financial costs for a maintenance program of the non paved road network, regardless of its economic analysis, estimates were made of the needs for a program which leads to have 50% of its roads in good conditions, 30% in fair condition and 20% in bad condition at the end of 5 years and to maintain constant these proportions starting from the time they are reached. Therefore, investments in routine maintenance were calculated to serve the overall condition of the network during each year and periodic maintenance expenses every six years, per road. Results obtained are shown in Table 3.8.2. The routine maintenance costs for rural roads are given in Annex 3.6.5-A and the revetment costs of non-paved roads are given in Annex 3.6.5-B.

As these calculations do not result from an analysis of economic and social benefits, they only may be considered as illustrative about the magnitude of the resources to establish a maintenance program as the one described, but not used to carry out a financial programming.

TABLE 3.8.2

Financial Costs of Maintenance for the Non-Paved Road Network
(in thousand colones of 1994)

NON-PAVED LENGTH 7978 KM					
PERIOD	ROUTINE MAINTENANCE			PERIOD	TOTAL
	ROADS IN GOOD CONDITIONS	ROADS IN FAIR CONDITIONS	ROADS IN BAD CONDITIONS	OVERLAY	
1995	21,077	91,470	147,077	0 000	259,718
1996	21,077	90,564	127,863	85,319	324,820
1997	34,329	90,564	108,648	85,319	318,857
1998	47,581	90,564	89,433	85,319	312,894
1999	60,834	90,564	70,218	85,319	306,931
2000	74,086	90,564	51,003	85,316	300,969
2001	66,261	90,564	51,002	13,693	343,519
2002	74,086	90,564	51,002	85,319	300,968
2003	74,086	90,564	51,002	85,319	300,968
2004	74,086	90,564	51,002	85,319	300,968
2005	74,086	90,564	51,002	85,319	300,968
2006	74,086	90,564	51,002	85,316	300,968
2007	66,261	90,564	51,003	13,693	343,519
2008	74,086	90,564	51,002	85,319	300,968
2009	74,086	90,564	51,002	85,319	300,968
2010	74,086	90,564	51,002	85,319	300,968
2011	74,086	90,564	51,002	85 319	300,968
2012	74,086	90,564	51,002	85,316	300,968
2013	66,261	90,564	51,002	13,693	343,519
2014	74,086	90,564	51,002	85,316	300,96
TOTAL					6 164,390

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3.9 Needs for Additional Investment

3.9.1 Road Investments with Committed Resources

MOP carries out an important road investment program funded by several sources. The DGC plans to construct works for a total amount close to US$420 millions, during its four year program 1995-1998, according to a document prepared for the BID's Analysis Mission about the ongoing Road Maintenance and Rehabilitation Program. This large scope program, is formed by three major components or sub-programs:

1) Institutional and Policy strengthening of the road subsector (commented in the next section and in Chapter 8)

2) Rehabilitation and maintenance of the road network and

3) Environmental development (analyzed in Chapter 9).

In relation to infrastructure, the program proposes to accelerate the rehabilitation and reconstruction process of the critical sections of the main highways, rural roads, bridges and some urban roads and give continuity to the under construction rehabilitation and maintenance programs of main highways and rural roads. It is planned to:

- Rehabilitate or reconstruct 394.6 km of paved roads, with BID, OECF (Japanese Assistance) and BCIE resources.

- Carry out the routine maintenance of the network with GOES resources.

- Rehabilitate 455.15 km of rural non-paved roads, with BID resources and,

- Reconstruct 3 large bridges with OECF and BCIE resources.

Paved road projects with committed resources and finished feasibility studies sum 416.8km.

The consultant reviewed the priorization analysis presented by the DGC in that document and considers them reasonable.[2]

However, attending to the terms of reference of this study, which include the priorization analysis for planned investments, the Consultant has considered:

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2 The assessment system established by the DGC has 9 evaluation elements, whose maximum grades are the following: current physical condition (90), annual daily average traffic (TPD) of 1993 (60), weight volume (60), annual growth rate of TPD (10), location (10), financial evaluation indicators (60), project continuity (100), importance in relation to regional political agreements (100) and commercial movement (100). Grades obtained by the roads purpose of the evaluation vary from 330 to 540, of a maximum possible of 590.

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1. Indicators obtained in the feasibility studies of the rehabilitation projects with committed resources (internal return rates and net present value) and

2. Indicators obtained by the Consultant for these same projects, within the economic analysis of the afterwards maintenance program for these same roads.

The first indicators reflect the conditions and traffic growth rate of the roads according to results of their feasibility studies, while the last reflect the traffic growth rates and deterioration of pavements according to this Study.

Roads evaluated were grouped according to their priority order indicated in Table 3.9.1. Summarizing, large variations are not shown comparing with results of the DGC's analysis. It is important to point out that a list of projects funded by the OECF (Japanese Assistance) were added, which were given priority one, since the study identified congestion problems in these roads and the maintenance analysis confers them high economic indicators.

In relation to bridges, it is considered that their low indicators reflect the need to improve the evaluation methodology, to take into account factors such as: waiting time -which grow in an exponential form when high traffic volumes arise-, reduction of accident risks and traffic interruption as well as reduction of maintenance costs when passing from provisional to permanent structures.

Using a revised methodology as described, indicators should present more positive results.

3.9.2 Analysis of Traffic Capacity of the Main Network

As central objective of this study in relation to road investments, the Consultant proposed to analyze the needs for a main highway network formed by the main corridors indicated in Chapter 2 of this Study.

To this purpose the procedures described below were followed:

- Projections of interurban traffic demand, by origin and destination, between the 25 zones in which the country was divided, by five year periods until year 2015.

- Definition of the Trend Scenario, which includes the road network defined in Chapter 2 and all those roads with committed resources.

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TABLE 3.9.1
Economic Evaluation Indicators and Priority Proposed for the Paved Road Projects with Committed Resources

PROJECTS NAME	SOURCE (1)	LENGTH KM	FEASIBILITY ANALYSIS (a)		FUTURE MAINTENANCE (b)		PRIORITY
			IRR (%)	NPV (2)	IRR (%)	NPV (2)	
Sonsonate - Santa Ana	BID	38.30	71 00	398 0	ND	ND	1
San Miguel - Agua Salada - Guascoran	BID	55 50	35 50	258 7	122 3	125 0	1
San Jose las Flores - Quitasol	BID (3)	32.40	24 30	69 5	190 1	120 2	1
Apopa - Sitio del Niño	BID	24 10	49 50	286.4	145 2	94 6	1
CA1 -San Martin - San Rafael Cedros	Japan	21.10	20 34	496 2	236 2	89 4	1
CA1 -Troncal del Norte - Calle Tonacatepeque	Japan	3 80	71 00	315 4	ND	ND	1
(CA-1 new) Calle Tonacatepeque-San Martin	BID	25 05	----	---	----	----	1(4)
Bridge San Marcos Lempa	Japan	0 90	10 39	18 0	ND	ND	1
Bridge Cuscatlan s/ Rio Lempa	Japan	---	0 77	82 0	ND	ND	1
El Portezuelo - Ahuachapán - El Jobo	BID	44.80	20 34	101.1	102 5	93 7	2
San Miguel - Sirama	BCIE	33.00	28 90	328 9	112 4	73 0	2
CA1-Km 64 desvio Santiago de Maria	BID	31 80	23 42	158 7	102 6	89 1	2
(CA-1) desvio Santiago de Mora-San Miguel	BID	26.30	----	---	----	----	2 (4)
San Miguel - El Delirio	BID	15 00		13 3	16 93	28 4	3
CA4 Quitazol - El Poy	BID (3)	46 00	15 40	231 0	30 7	3 4	3
SEGMENT CA 4 CONEXION CA 1 - CA 2	BID	23.50	19 15	212 3	ND	ND	3
SUBTOTAL (WITH ANALYSIS)							
T O T A L							

(1) Possible source of resources. (2) In million of Colones of 1994. (ND) Not Available. (3) Carreteras Troncales Project. (4) By analogy to the above segment.

Source: (a) Pre-investment Studies Bureau, DGC, (b) Frederic R. Harris, Inc.

- Assignation of the projected demand to the network, through the utilization of the TRANUS model.

- Analysis of the road capacity and service levels of the road network of the Trend Scenario, with the current traffic demand and the projected for the years selected for the analysis.

- Identification of the network sections with congestion problems in the different years of analysis, based on:

    - The network of the base year (1992)

    - The improved network with the present planned investments (2005)

    - The network of year 2005 with improvements proposed by the Study and traffic of the year 2015. See Table 3.9.2.

This capacity analysis is ilustrated in Figures 3.9.1 to 3.9.7 printed from the graphics module of the TRANUS model. Figure 3.9.1 shows the traffic assigned to the network in 1992; levels of service for this year are shown in Figure 3.9.2. These Figures for 2005 are 3.9.3 and 3.9.4. The levels of service for 2010 are shown in Figure 3.9.5, where one notes important new bottlenecks, specially Sitio del Niño-Apopa and CA-1 East, which worsen in 2015 (Figures 3.9.6 and 3.9.7).

The sections that are foreseen to be congested in the future, are concentrated in the region close to the Metropolitan Area of San Salvador. No other future deficiencies in capacity have been identified because of the important investments currently in progress and others already scheduled.

It may be stated that in the base year of 1992, no important capacity constraints were identified, specially in the urban and sub-urban zone of San Salvador, where it is acknowledged these constraints already exist. This is explained by different factors, among them:

- Not including in our Study's traffic analysis of the Urban network.[3]

- The consequent need to avoid deviations in the analysis because of excessive weight of the negative effects of the urban traffic over the interurban flows.

- The model, of nationwide scope, does not consider peak hours and uniformly distributes the demand in 16-hour days, contrary to the urban models which normally consider peak hours traffic.

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3 The sections which connect at downtown San Salvador are defined as theoretical sections, with allocated capacities as fully available in the main highway network These sections are the ones connecting downtown with the northern exit of San Salvador, Ilopango, San Marcos, detour to La Libertad and Santa Tecla, and the starting points for the interurban roads.

TABLE 3.9.2
Capacity Limitations, Traffic Forecasts
and Possible Improvements of the Road Sections, 2005-2015

SECTION		BASE YEAR		WITH CCOMMITTED RESOURCES			WITH POSSIBLE ADDITIONAL IMPROVEMENTS		
NAME	NODES	CAP. 1992	LOS 1992	LOS 2005	LOS 2005	LOS 2015	VPD 2015	CAP.2015	LOS 2015
La Cuchilla - Sitio del Niño	508-402	3000	A	3000	A	A	14437	3000	B
CA-8 - Sitio del Niño	304-402	—	—	—	—	—	3962	1300	A
Sitio del Niño - Apopa	402-507	950	A	1100	A	E	11913	3000	A
Salida Norte - Apopa	505-507	2000	A	2000	A	B	12874	2000	A
Apopa - San Martin	507-511	—	—	—	—	—	1661(2)	1250	A
Connector - Ilopango	506-514	—	—	—	—	—	11182	2500	A
Ilopango - San Martin	506-511	950	B	1050	A	F	671	1050	A
Ilopango - San Martin Nueva	514-511	—	—	3000	A	—	26290	4200	B
San Martin - Cojutepeque	511-701	950	B	3000	A	C	28622	4200	B
- La Cuchilla - Santa Tecla	508-502	2500	A	2500	A	D	25592	3700	B
Santa Tecla - La Libertad Junction	502-503	1500	A	1500	A	C	16472	3000 (1)	A
La Libertad Junction - San Marcos	503-504	—	—	—	—	—	3952	1300	A
Cojutepeque-Sn.Rafael Cedros	701-702	1150	A	3000	A	E	15289	3000	A
Sn.Rafael Cedros-Sn.Vicente Junction	702-1002	3000	A	3000	A	A	12069	3000	A
San Vicente Junction-San Vicente	1002-1001	900	A	900	A	A	5770	900	B
Km. 64 Puente Cuscatlán	1004-1005	850	A	1250	A	B	7480	1250	B
Pte.Cuscatlán-Desv.Stgo de Ma.	1005-1003	1000	A	1300	A	B	7480	1300	A
Km 64 Desvio San Vicente	1002-1004	1000	A	1200	A	A	7480	1200	A
Des.Santiago de María -S. Miguel	1603-1301	1100	A	1400	A	A	7284	1400	A
Km 18 - San Miguel	1301-1202	850	A	1250	A	B	7395	1250	B

VPD: Vehicles per day, LOS Level of Service
(1) In order to simplify the table, capacities are shown by vehicles-equivalent per hour.
(2) The VPD does not reflect the variation related to the participation per type of vehicle.
Source: Frederic R. Harris, Inc.

Therefore, while the demand allocated by the model is calibrated with the traffic load observed during the base year, capacity limitations offered by the urban network might have been underestimated.

3.9.3 Identification of Additional Road Investment Needs

Based on forecasted capacity limitations possible additional investments have been studied, starting from the following:

- Proposals from the Directorate for Extraordinary Budget of the General Directorate of Roads.
- Roads planned by the Office of Planning for the Metropolitan Area of San Salvador (OPAMSS), even thought they do not have preliminary studies.
- Needs identified by the TRANUS model.

Within the investments analyzed predominate the ones which look for the reduction of the metropolitan vehicle congestion impact over interurban traffic costs.

The identification of these investments are made at a pre-feasibility level. The technical feasibility and its social feasibility (in relation to issues such as displacement of communities) must be made under more detailed studies.

For analysis, roads thus identified have been grouped in three programs for:

- Northern bypass road
- Southern bypass road and
- East-West Highway

At the right time, each of these programs require feasibility studies, to select alternatives and define, among others, alignments, geological and geometric conditions, local and regional traffic flows, etc.

In addition to the important road maintenance program of the existing road network, analyses in another section of this chapter, the identified programs are briefly described below and described in detail in Annex 3.9.1.

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a. The Northern Bypass Road

This program has three different alternatives. All of them include two common sections to the alternatives of the Northern and Southern Bypass Road (see Figure 3.9.8):

- The Ilopango Connector. Between the existing CA-1 and the new CA-1, in order to reduce the overload of the first one and facilitate access to the second one.

- Widening the new CA-1, already planned as a 4-lane, between the intersection CA-1 new/road to Tonacatepeque and Cojutepeque, reprogramming it to be built in a future year as a 6-lane road.

It has been decided to include these two sections in the Northern Bypass road program, because this probably is the priority program.

Alternative 1

Comprises, in addition to the above sections, CA-8 -Sitio del Niño - Apopa - San Martín, that could easily service interurban cargo transportation, to divert a considerable traffic volume from the urban center. It should be noted that in 1995, the design was started for the rehabilitation of the main section, Sitio del Niño - Apopa. However, with this improvement, the model indicates an E service level for year 2010, which suggests the need for its widening.

The other two sections are new construction:

- CA-8 - Sitio del Niño and
- Apopa - San Martín

These sections are not programmed and require environmental and feasibility analysis. (See Chapter 9 for specifications of environmental studies).

Alternative 2

Comprises the following sections:

- La Cuchilla - Santa Tecla (widening to 6 lanes). It is analyzed as part of the second program, Southern Bypass).

- Santa Tecla - Northwestern Bypass - Intersection Northern Main Highway. This is new construction, identified by OPAMSS.

- Northern Main Highway - Road to Tonacatepeque - San Martín (New CA-1).

Figure 3.9.1
Assigned Traffic in standard vehicles - 1992

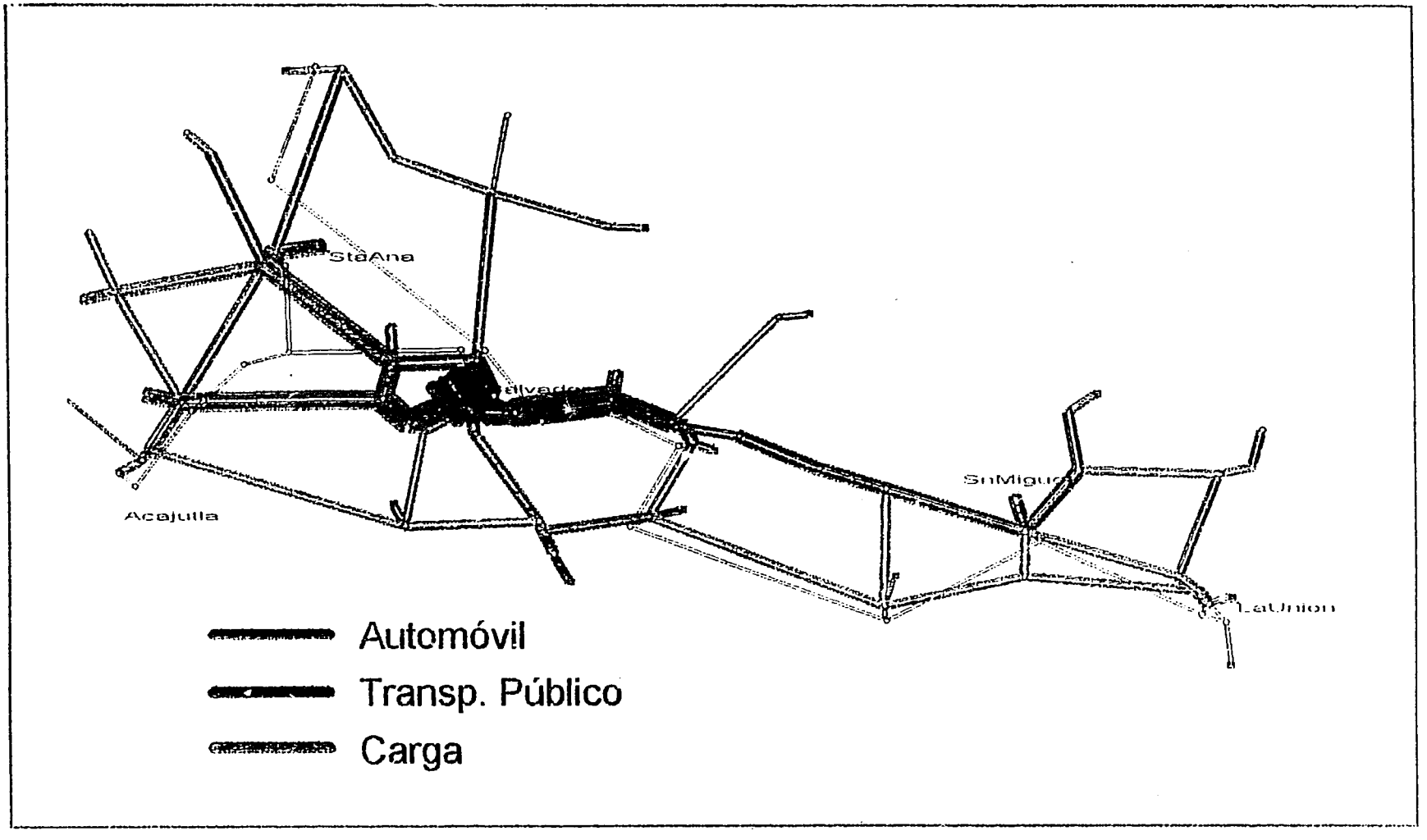

Figure 3.9.2
Level of Service - Highways - 1992

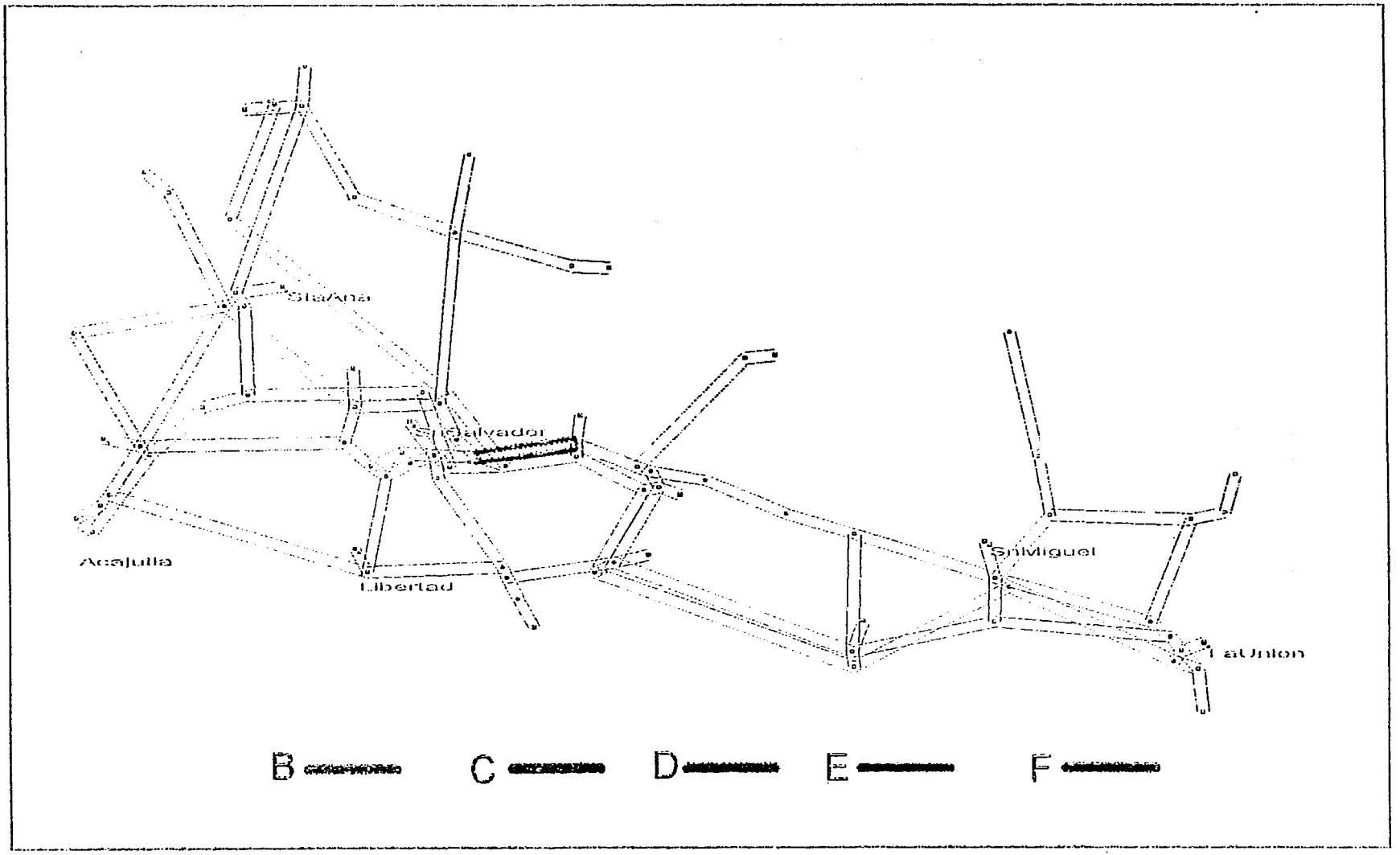

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Figure 3.9.3
Assigned Traffic in standard vehicles - 2005

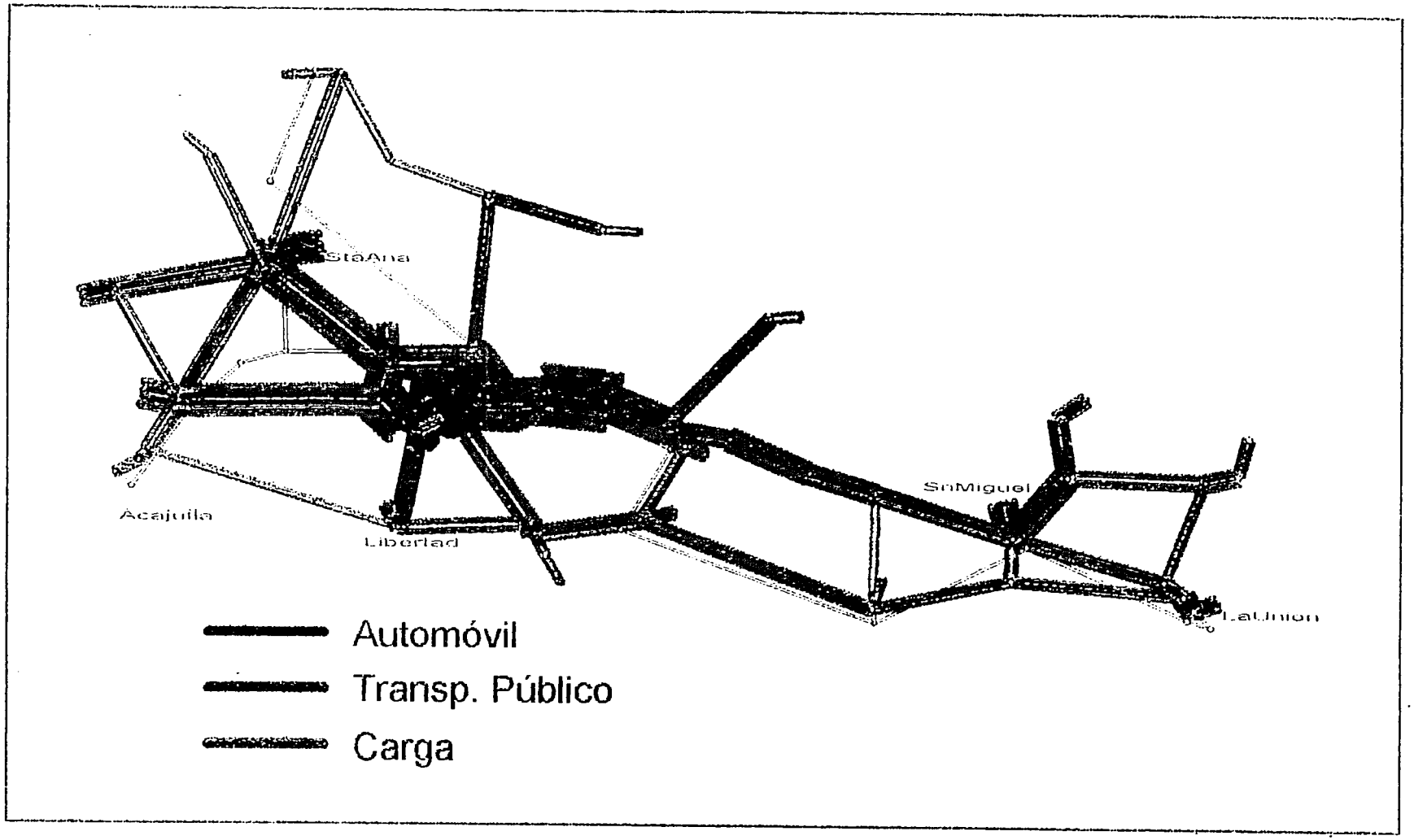


Figure 3.9.4
Level of Service - Highways - 2005

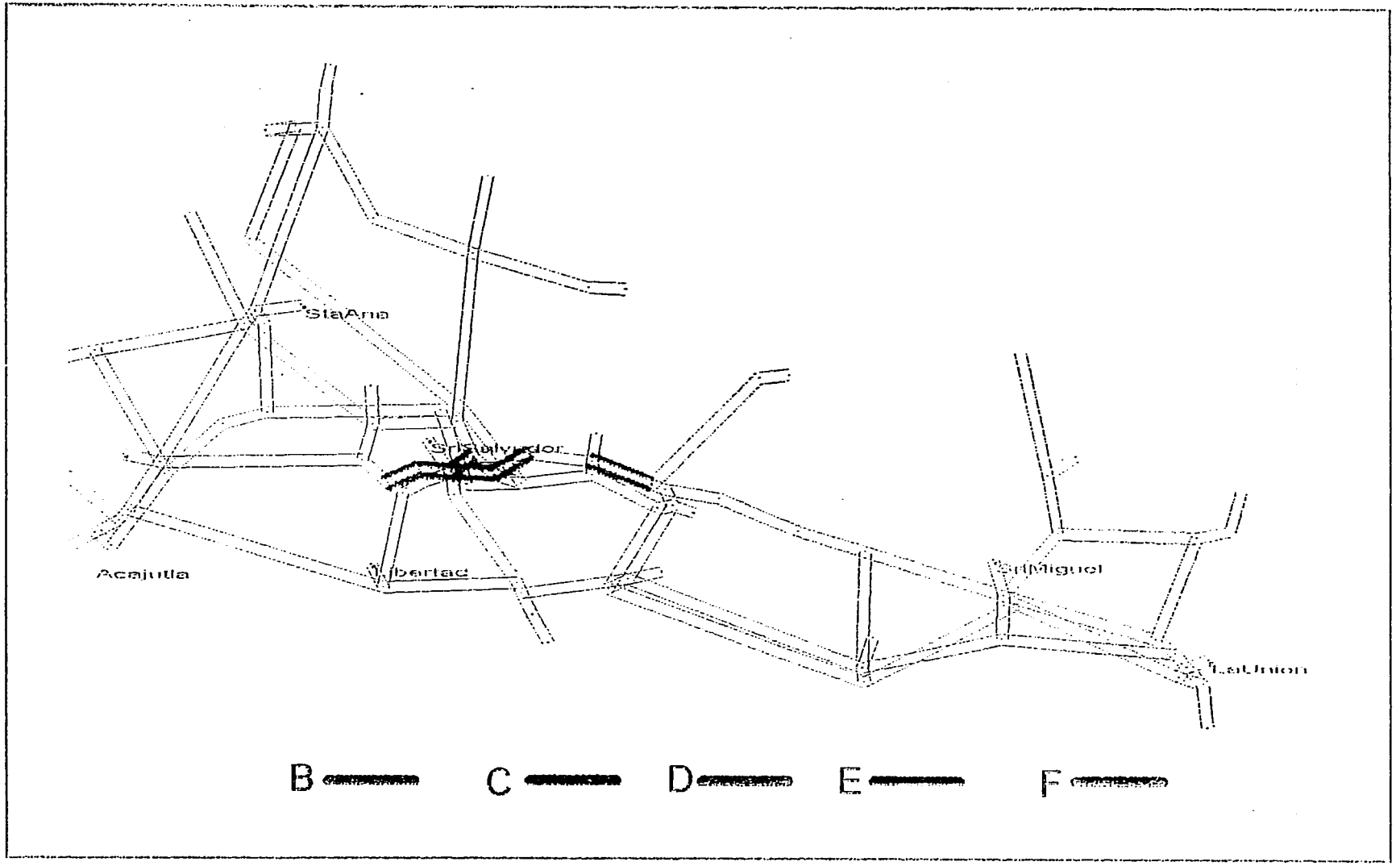


Figure 3.9.5
Level of Service - Highways - 2010

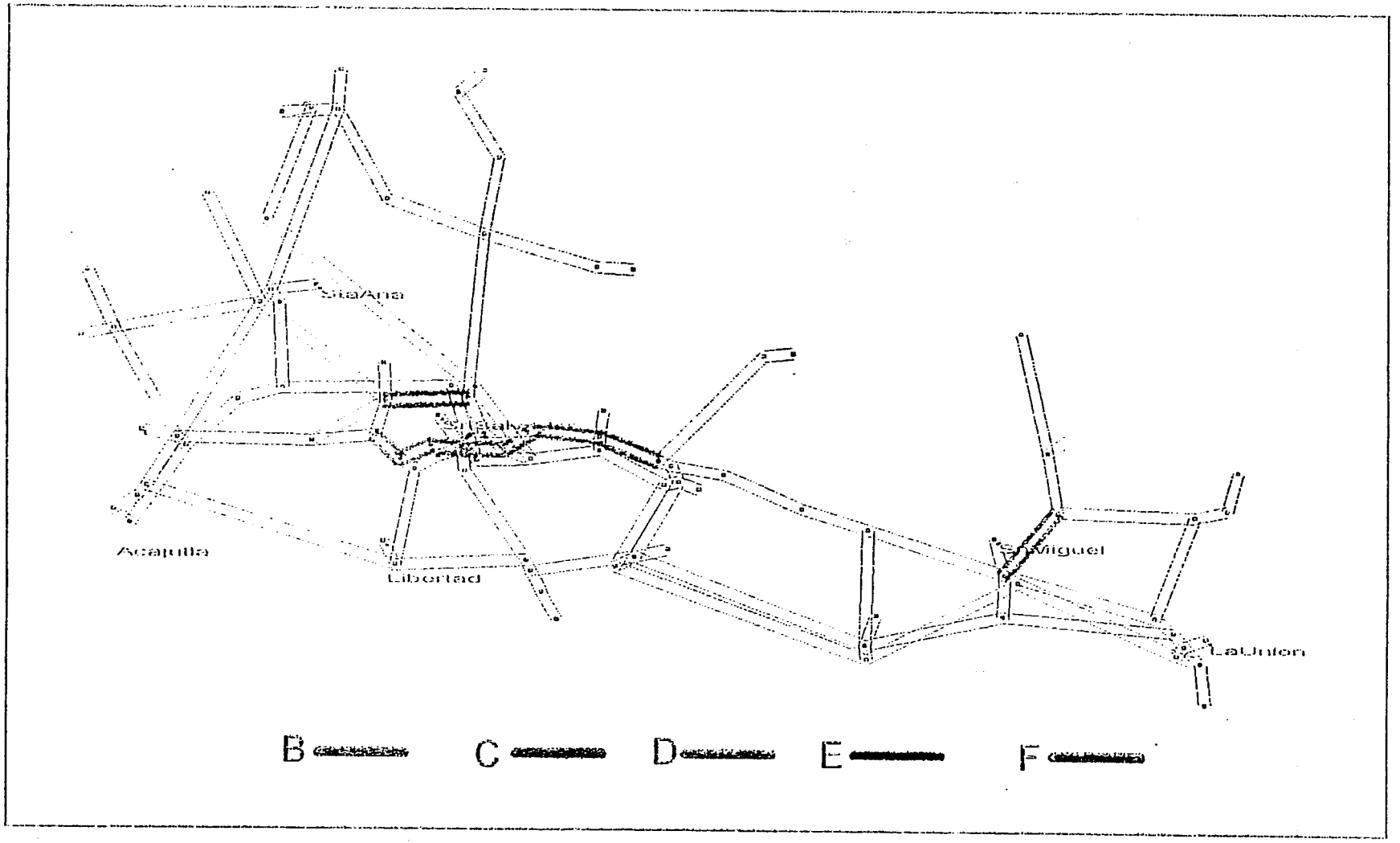


Figure 3.9.6
Assigned Traffic in standard vehicles - 2015

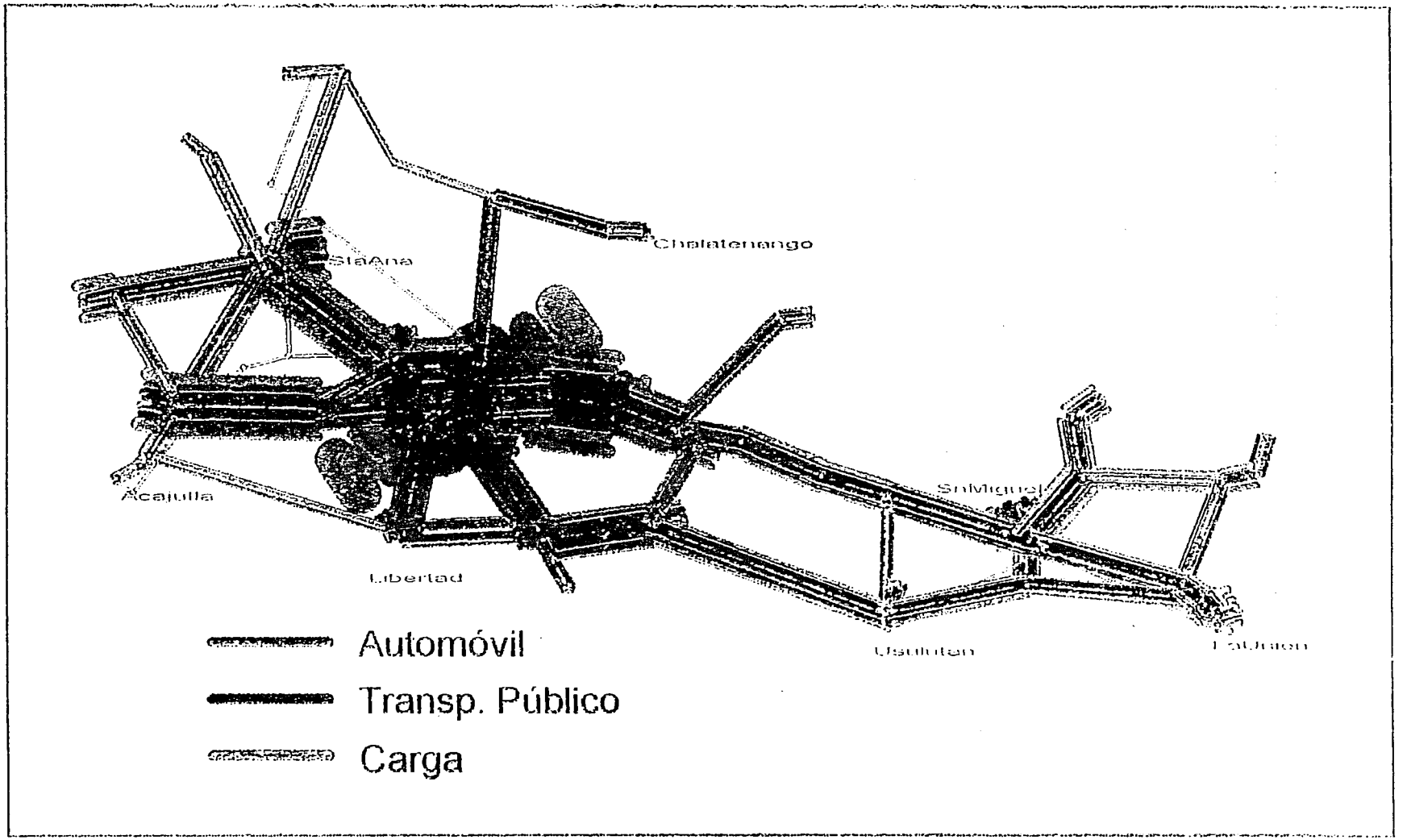


Figure 3.9.7
Level of Service - Highways - 2015

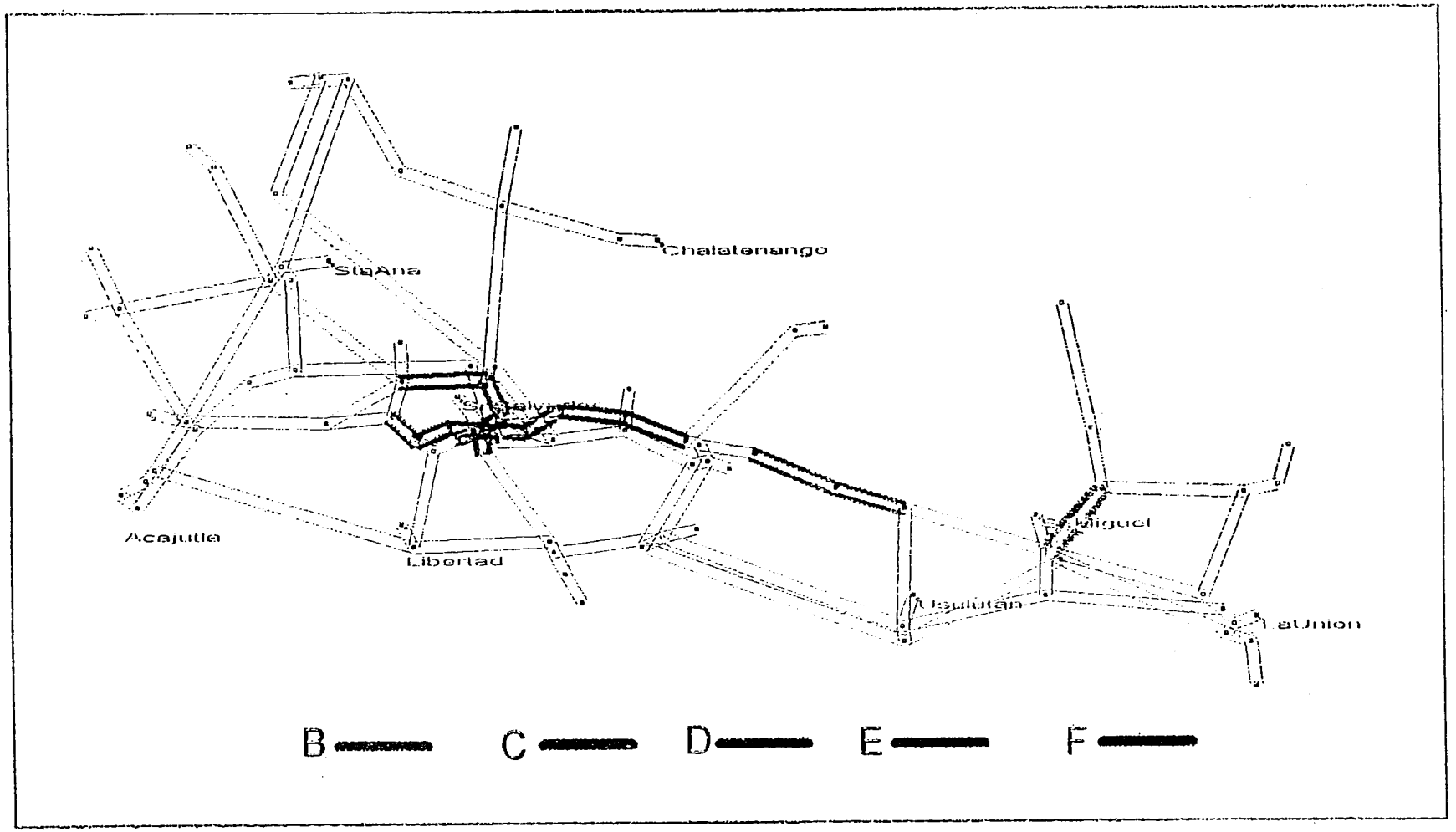
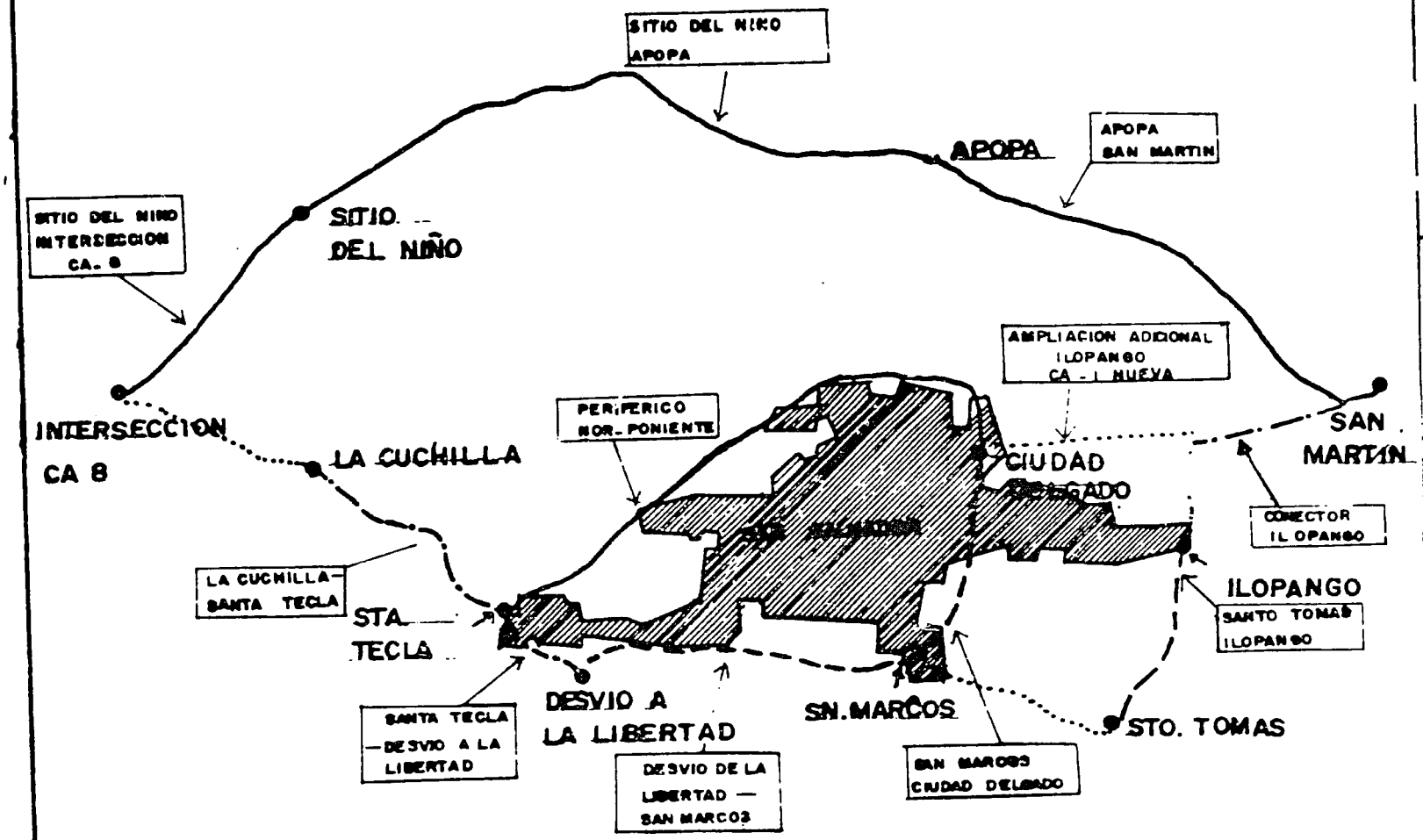


FIGURE 3.9.8
Bypass Roads



CIRCUNVALACION NORTE ———

CIRCUNVALACION SUR - - - - -

TRAMOS COMUNES A LA CIRCUNVALACION NORTE Y SUR

CON MEJORA PROPUESTA —.—.—

SIN INVERSION ADICIONAL .....

FIGURE 3.9.8
Bypass Roads

INTERMODAL TRANSPORTATION STUDY
EL SALVADOR

U.S.A.I.D - G.O.E.S

Source: Frederic R. Harris Inc.

Date June, 1995

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Among the disadvantages of Alternative 2 are the overload to section La Cuchilla - Santa Tecla, the difficulties for the construction of the Northwestern Bypass road and the mixture o urban and interurban flows which will result in this route.

Alternative 3

This alternative assumes the construction of the two alternatives described before.

b. Southern Bypass Road

The analysis of this program is much more complex. In addition to the two Sections commor with Northern Bypass, it has three alternatives. Alternative number 3 was analyzed more ir depth and is shown immediately below (see Figure 3.9.8).

Alternative 3

Comprises four additional sections which are described as follows:

- Widening to 6 lanes the La Cuchilla - Santa Tecla section: It is a section of the roac of minimum cost for a large number of trips with national and international origin anc destination. Despite the rehabilitation works which are been finished in the CA-2 highway (Coastal), a large proportion of cargo and passenger transport will continu preferring this route because it is shorter and a better type of road. As the urba congestion gets worse and even though the Northern Bypass road is timely built, th preference for the southern road will remain, in the case of passenger and carg vehicles with destination to the East and the CA-1.

- The Construction of the Southern Bypass OPAMSS road, from Santa Tecla to th detour to La Libertad. Currently the pass through downtown Santa Tecla is highl congested. To alleviate this situation it is proposed to carry out a feasibility study c a southern bypass road for this city, with the characteristics of a special road.

- The construction of the Southern Bypass OPAMSS road, from the detour to La Liberta to the Comalapa Highway close to San Marcos. The technical feasibility of this roa is considered uncertain, because it goes through populated areas or of difficu topography, which will exclude cargo transit if it does not include structural works c major cost. Traffic projections show that with the future congestion, interurban traffi will be obligated to take the route to La Libertad. Even though this road will b widened and will be able to handle the demand of deviated traffic, represents a increase in trip distance exceeding 10 km.

- The construction of a new road from Santa Tomás to Ilopango. If traffic flowing fr origins such as Sonsonate and Acajutla to Eastern CA-1 utilizes a small section of t

Highway to Comalapa, between San Marcos and Santa Tomás, it could take the proposed road, avoiding large part of the urban traffic. This road will also facilitate access between the International Airport and the industrial area of San Bartolo and the Eastern CA-1. The traffic coming from this route should not use the existing CA-1, already overloaded. It is proposed to cross the existing CA-1, through a viaduct or at level, and follow up to the new CA-1, by the denominated Ilopango Connector, identified as a section of the Northern Bypass road.

Alternative 1

In this case it is omitted the route Detour to La Libertad - San Marcos, using the Southern and Comalapa Highways, even though the first one would be overloaded.

Alternative 2

Another option would be to build additionally the OPAMSS Eastern Bypass road between San Marcos and Ciudad Delgado, passing through a densely populated area, with high financial and social costs, taking interurban traffic to the urban area, but connecting it more directly to the new CA-1.

c. Northern Longitudinal Road (CA-3) (Figure 3.9.2)

This road was considered in 1978 when the project profile was prepared. It was included in a scenario of the TRANUS model, even knowing the road will not provide important benefits for the following reasons:

- The model, prepared as a part of this Study, did not considered the development impact that a penetration road as such will have and do not analyze the regional aspects. With additional information, the Model does have capacity to evaluate these impacts.

  A demand matrix adopted does not consider potential commercial and social relations actually restrained between areas from Guatemala and the Departments of Santa Ana, Chalatenango, Cuscatlán, Northern Usulután, Morazán and Northern La Unión. A small traffic reallocation is considered between the Port of Santa Tomás de Castilla, and the northern region as are San Salvador, the Northern Longitudinal Road, as well as San Miguel. However, there will be a tendency of the traffic between the East and the Atlantic to use Port of Cortés. Sections of the CA-7 to Concepción de Oriente are not included.

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FIGURE 3.9.9
Road Projects

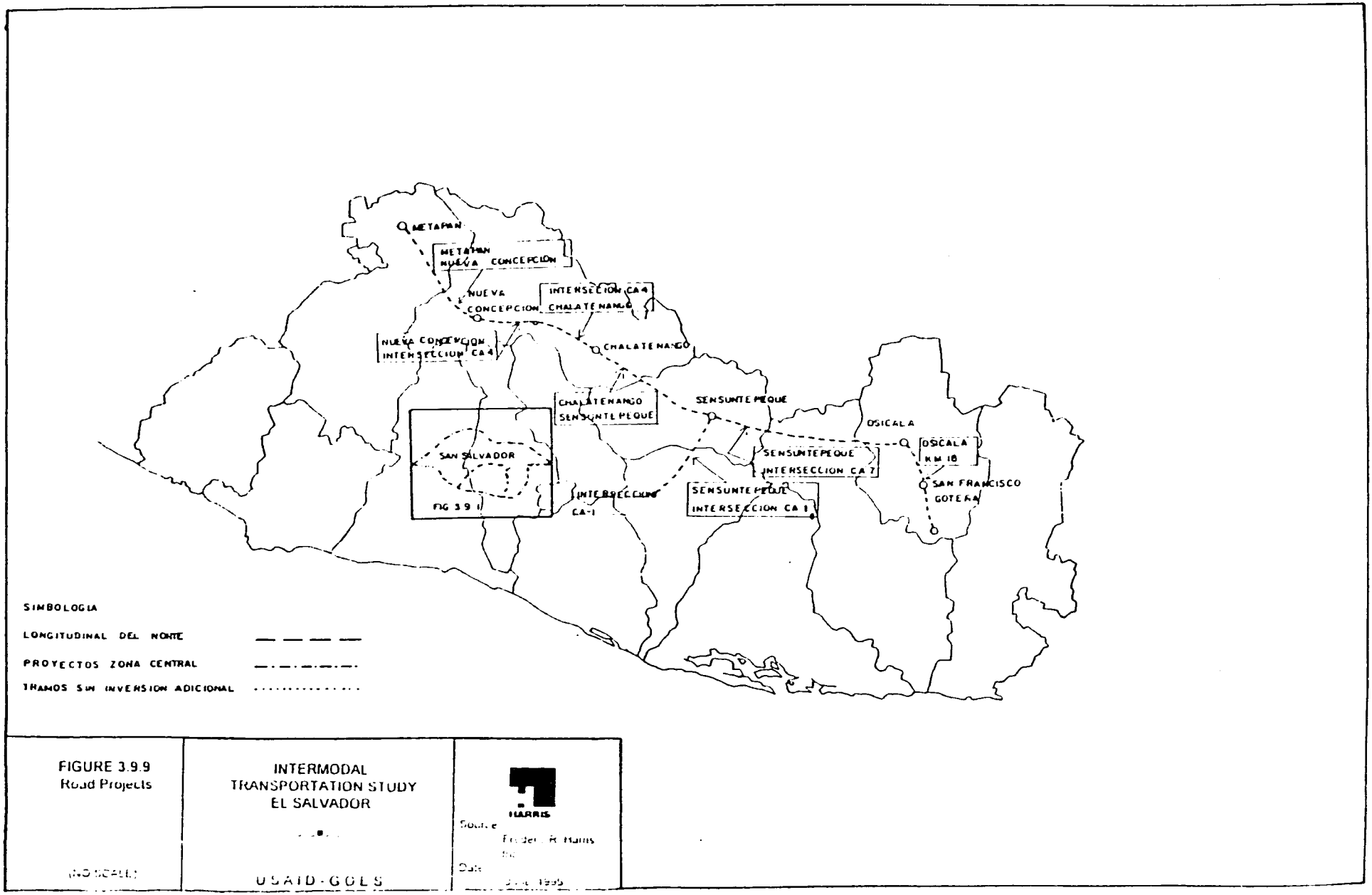

FIGURE 3.9.9 Road Projects (NO SCALE)	INTERMODAL TRANSPORTATION STUDY EL SALVADOR USAID-GOES	HARRIS Source Frederic R. Harris Inc. Date June 1995

- Traffic can not be forecasted or assigned to justify considering a primary road, but only a secondary. This can be a consequence of the longer distances and the topography of the CA-3's region, more difficult than the CA-1's region.

Therefore, it is proposed to carry out a development plan for the Northern Region and the Northern Longitudinal Road. Feasibility studies and development plans for the region must consider issues such as road, agro-forest, mining, industrial, education, sanitation, energetic. The feasibility of the roads will depend on the complementarity of these programs and will require a detailed analysis of its area of influence and its economic and agriculture potential.

It is recommended that road studies include the following sections:

- Metapán - Nueva Concepción (construction)

- Nva. Concepción - Intersection CA-4/Chalatenango (reconstruction)

- Chalatenango - Sensuntepeque - Osicala (CA-7) (Construction)

The following complementary roads should be considered in the framework of the same study (Figure 3.9.9):

- Oscicala - San Francisco Gotera - km 18 (Military Route) (CA-7). It becomes necessary to consider the rehabilitation of these sections for which considerable traffic is forecasted from kilometer 18 to San Francisco and lesser from there to Oscicala.

- Sensuntepeque - Intersection CA-1. This section will improve the access from Sensuntepeque to CA-1 and the connection between the CA-1 and CA-3 through this city.

The sections from CA-7 to Concepción de Oriente and El Sauce to the intersection with CA-1 have not been included, because the distance to El Amatillo is longer through this route than by CA-7. This sections, initially planned as part of this program, could be analyzed in the context of a study of road needs in Morazán Department.

3.9.4 Studies with Possibility of Additional Investments

a. Special Monitoring of Traffic Growth in the Eastern Panamerican Road

Important investments are already anticipated for the widening and the rehabilitation of the Eastern CA-1 up to the border with Honduras at El Amatillo. Among them we can mention:

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- Widening to 4 lanes the sector from San Rafael Cedros - San Martin (poi defined in this Study as the eastern junction of the bypass programs).

- Reconstruction of the primary highway from km 64 to Detour to Santiago c Maria.

- Reconstruction of the Cuscatlán Bridge.

- Reconstruction and improvement of the primary highway of the sections Sa Miguel- Goascorán and San Miguel - Sirama.

However, it should be noted that current preference for the CA-2 is because of the prese deteriorated condition of the CA-1. When both highways are in good conditions, the TRANU model reallocates important traffic. Even though the advantageous topographic conditions the CA-2, distances by CA-1 are less. Besides, its access will be facilitated if it is decided construct the proposed bypass highways for the San Salvador area. On the other hand, should be noted that impressive traffic growth rates have been observed in the eastern pa of the country during 1992-1995.

Significative capacity improvements of these highways are totally reflected in the TRANU model. However, some sections indicate B service level for year 2015. This may indicate th during the second decade of the XXI century expansion of capacity may be needed.

Therefore, it is proposed to monitor traffic growth at the Eastern CA-1, starting this activi before year 2000. It should be a detailed control of traffic flows in these highways with th purpose of avoiding surprises and anticipating additional improvements, if these wer necessary.

Also deserve consideration the access roads to CA-1, connecting roads to CA-2 as are th following sections of secondary type:

- Detour to San Vicente - San Vicente - Tecoluca (reconstruction)

- Tecoluca - El Playón (new construction, shortening distances between CA-1 an CA-2, for example from Cojutepeque to Usulután).

- Villa El Triunfo - Usulután (reconstruction)

The TRANUS model could be used in the future by the GOES for more detail of needs of th road network, as well as to analyze the feasibility of construction and rehabilitation of othe roads, from new special ones to maintenance of rural roads.

3.9.5 Estimates of Investment Costs for the Road Programs

Starting from unit construction costs estimated in this chapter, investment costs for the programs identified were calculated in million colones of 1994. The results are in Table 3.9.3. Preinvestment costs are also shown, according to cost of studies and designs recently contracted. An investment programming is specified in terms of 3 to 5 years according to the extension of the identified work.

TABLE 3.9.3
Costs of Road Programs to be Evaluated
(in million colones of 1994)

ALTERNATIVE - SECTION	LENGTH KM	ACTIVITY	CHARACTERISTIC	COST
Northern Bypass - Alternative 1				
Intersection CA-8 - Sitio del Niño	8.00	Construction	Primary	107.62
Sitio del Niño - Apopa	24.10	Widening	Especial (4 lanes)	232.28
Apopa - San Martin	17.00	Construction	Primary	271.36
Calle Tonacatepeque-Cojutepeque (CA-1 New)	25.05	Widening	Special(6 lanes)	377.90
Conector Ilopango CA-1 Present - CA-1 New	1.20	Construction	Special(4 lanes)	24.25
TOTAL - ALTERNATIVE 1	**76.35**			**1,013.41**
Northern Bypass - Alternative 2				
La Cuchilla - Santa Tecla	9.00	Widening	Special(6 lanes)	139.15
Santa Tecla - North-West Bypass	17.46	Construction	Special(4 lanes)	352.78
Main North Road-Road to Tonacatepeque	3.80 (1)	Construction	Special(4 lanes)	
Road to Tonacatepeque-Cojutepeque	25.05	Widening	Special(6 lanes)	377.90
Ilopango Connector (Existing CA-1-New CA-1)	1.20	Construction	Special(4 lanes)	24.25
TOTAL ALTERNATIVE 2	**56.51**			**894.08**
Northern Bypass-Alternative 3				
ALTERNATIVA 1				1102.80
ALTERNATIVA 2 (Additional Cost)				491.93
TOTAL ALTERNATIVE 3				**1,504.70**

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TABLE 3.9.3 (...continued)
Costs of Road Programs to be Evaluated
(in million colones of 1994)

ALTERNATIVE - SECTION	LENGTH KM	ACTIVITY	CHARACTERISTIC	COS
Southern Bypass - Alternative 1				
La Cuchilla - Santa Tecla	9.00	Widening	Special (6 lanes)	13
Southern Bypass (Santa Tecla-desvio a La Libertad)	3.80	Construction	Special (4lanes)	7
Ilopango - Santo Tomas	9.00	Construction	Primary	13
TOTAL ALTERNATIVE 1	**21.80**			**35**
Southern Bypass - Alternativo 2				
La Cuchilla - Santa Tecla	9.00	Widening	Special(6 lanes)	13
Periferico Sur (Santa Tecla - Desvio a La Libertad)	3.80	Construction	Special(4 lanes)	7
Periferico Sur (Desvio a la Libertad - San Marcos)	10.80	Construction	Primary	8
Periferico Oriente (San Marcos - Ciudad Delgado)	5.60	Construction	Special(4 lanes)	11
Ilopango - Santo Tomas	9.00	Construction	Primary	13
TOTAL ALTERNATIVE 2	**38.20**			**55**
Southern Bypass - Alternative 3				
La Cuchilla - Santa Tecla	9.00	Widening	Special(6 lanes)	13
Periferico Sur (Sta. Tecla - Desvio a La Libertad)	3.80	Construction	Special(4 lanes)	7
Periferico Sur (Desvio a la Libertad - San Marcos)	10.80	Construction	Special(4 lanes)	8
Ilopango - Santo Tomas	9.00	Construction	Primary	13
TOTAL ALTERNATIVE 3	**32.60**			**43**
Northern East-West Highway				
Metapan - Nueva Concepción	39.00	Construction	Secondary	51
Neuva Concepcion - Interseccion CA-4	18.00	Reconstruc.	Secondary	4
Intersection CA-4 - Chalatenango	28.00	Reconstruc.	Secondary	6
Chalatenango - Sensuntepeque	62.10	Construction	Secondary	82
Sensuntepeque - Intersetcion CA-7 (Osicala)	92.50	Construction	Secondary	1.22
TOTAL	**239.60**			**2.680**
Complementary				
Oscicala-Km 18 (—CA-7)	29.00	Reconstruc.	Secondary	7
Sensuntepeque-Junction CA-1	30.00	Construction	Secondary	39
TOTAL	**59.00**			**469**

Source: Frederic R. Harris, Inc.
(1) Existent Highway

3.10 Privatization of Road Maintenance

The maintenance deficiencies showed in the road network in El Salvador and the funding difficulties to provide it, together with the little institutional experience to privatize road maintenance activities, makes it possible to state that, under present work schemes it is not likely to make it be efficient, keep its cost within reasonable margins and reach the goal of having a network in good operating conditions. Therefore, following we propose the privatization of the same as an alternative to the existing situation.

It should be remembered that in this document it is understood as road maintenance an activity which intends to preserve roads in good operating conditions, so that investments on the same reach maximum efficiency and produce the greater possible benefits for the Country's economy. Therefore, the propositions related to possible privatization run around this main idea.

3.10.1 Necessary Conditions to Privatize

In order to go ahead with a privatization process of road maintenance activities, which may be successful and have continuity through time, it is necessary to have:

- A legal definition of sufficient and permanent funding sources, which will allow long term planning in order to make the possibility of participation in the process attractive to the private sector.

- A state organization with resources and technical capacity to manage the road network, to be in condition to plan the works in advance, contract works execution and control and evaluate their results.

3.10.2 Objectives of Maintenance Privatization

It is common to assume that privatization of road maintenance will consist in reassigning responsibility for the execution of the works and free state organizations of the role of constructing and maintaining roads by contracting construction companies to carry out the works. This approach lacks soundness to be considered valid, because ignores the main objectives of road investment, which are:

- Insure the efficiency of the public expenditures in providing maintenance.

- Achieve that the general condition of the road network subject to process is kept within appropriate quality parameters.

- Pay for the works prices in accordance with their effective cost.

- Decrease the financial needs to provide maintenance.

- Protect public interest.

The privatization of periodic maintenance, in order to make the process efficient and to con with the mentioned objectives, involves a reorganization process of the road sector which allow the redistribution of tasks related to road maintenance. The three main tasks wh should be assigned are:

- The managing and administration of the network.

- The physical execution of works.

- Surveillance and protection of public interest.

The first consists, in brief, in definig as to where, when and what type of works are to carried out in order to preserve the road infrastructure. The second refers to who accomplish them and the third is related to the responsibility before the community in rela to the efficiency of the investments realized and the maintenance condition of the roads

The first and the last of these tasks are closely linked: if a rational investment planning ex and goes along with execution programs, duly funded, works can be carried out timely produce maximum economic and social benefits. However, to be able to plan, the sta control and evaluation systems of the road network and the works quality -implicit in planning process- must operate correctly.

The transference of responsibility to private construction companies of physical works preventive maintenance, is a decision that may help for the country to have a road syster good operation conditions at the least reasonable cost.

However, in order for this to happen the necessary conditions should be met about func for road maintenance and the establishment of an appropriate road management system the last one does not exist,the execution of the works would be out of time and it perpetuate the construction or reconstruction, rehabilitation cycle for lack of maintenance, has very high costs for the global economy.

As the DGC is at present just about to receive the Road Administration and Maintena System -SIAMV-from the consultants who are developing it, it is essential to generate institutional conditions to put it into operation within the least possible time . Being so a

having solved the funding matter, will have the second basic element to make possible success of the road maintenance, through sectorial reorganization.

3.10.3 Privatization Alternatives of Routine Maintenance

Routine maintenance is the road activity which at present receives less attention within the DGC budget, even though the agency has more than the necessary personnel to attend the total network under its responsibility. However, this maintenance is essential to insure that roads do not suffer the normal deterioration process, that are not affected by elements other than traffic, the climate of the zone, the age and structure characteristics of pavements. When this activity is not carried out in an adequate and timely manner, the deterioration process of pavements is accelerated and the demand for resources to recover the quality of the same grows in a greater proportion.

Under these circumstances, where maintenance resources are almost exclusively destinated to salary payment, the option which appears more indicated to insure routine maintenance of the road network, is to reduce personnel at the DGC and privatize the execution of these type of works by hiring small companies formed for that specific purpose.

a. Contracting Micro-enterprises for Routine Maintenance[4]

In some Latin American countries the contracting of routine maintenance with micro-enterprises has proved successful. They are formed by individuals with the following characteristic profiles:

- Their place of residence is within the zone were the road under contract is located.
- They belong to low educational strata and lowest income.
- The majority of members are rural laborers without special training
- The number of members should not exceed a maximum of 17 or 18 persons.

In the case of El Salvador, this option may be adapted in such manner that, without excluding the possibility of forming the micro-enterprises with local people, the forming of these type of organizations be promoted among ex-officers from the DGC, separated from the agency through the application of a compensated retirement plan.

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4 Colombia started in year 1984 a privatization process for routine maintenance of the road network, paved and unpaved, through the creation of routine maintenance micro-enterprises. In year 1987 Colombia counted with 203 micro-enterprises, 2516 members and 10855 kilometers of its network were attended by these type of organizations. Given the positive results obtained, the project was reinforced with the participation of the United Nations Development Program -UNDP- in 1987. As a result of the support received, in 1992 398 micro-enterprises were operating. with 5004 members and 21416 kilometers of the network under contract.

This alternative offers evident advantages to make the plan successful, to have goo acceptance among the labor unions and produces good results for the country, not only in th road maintenance field but in work distribution in order to improve investment efficienc Specific advantages are:

- Uses of the expertise of individuals that for years realized a good part of th works to be contracted.

- Decreases the social and political impact of suppression of posts within th state body.

- Creates new enterprises and permanent work sources for non qualifi personnel.

- Improvement of income levels of the individuals forming the micro-enterpris and, in consequence, the standard of living of the depending families.

- Potentiality of the micro-enterprises as investment option for the severance p received by workers.

- Possibility of handling, with clearly defined environmental criteria, roadwa with contracts for routine maintenance. In order to do this, specific clauses such respect should be established for obligatory compliance, making the mic entrepreneurs conscious of their importance.

- Lower cost of the works and therefore, improvement of government efficien in application of resources.

- Higher efficiency levels in relation to opportunity, quality and output of the wor ordered, when counting with personnel dedicated exclusively and permanen to the attention of the roads under contract.

- Extensive capability to introduce corrections and modifications to the form execution of the works. The proposed profile for micro-entrepreneurs propitiat it.

Not withstanding the advantages of creating micro-enterprises based on ex-DGC office potential problems exist which should not be ignored. Among them are :

- Displacement problem arises and/or the use of vehicles and group identity groups are formed with individuals whose residences are located in differ towns.

- Leadership conflicts arises if they have different cultural origin or different education levels.

When members of the micro-enterprise belong to the same geographic-cultural area and have homogeneous characteristics, Transportation, the holding of meetings, development workshops, and development of additional productive projects are easier.

b. Contracting with Private Engineering Companies

The alternative to contract routine maintenance with private engineering companies is a latent possibility, but it is considered not attractive and should not be recommended for the following reasons:

- It is likely that the engineering companies hire the same personnel which could form the micro-enterprises or individuals with similar profiles for the execution of the works. The role of the enterprise will then be as an intermediary between the government and workers in order to carry out the works and increase the cost of the same.

- The possibilities for ex-officers from the DGC of being employed by the private enterprise are dim, mainly if these are individuals older than 35 or 40 years. If this personnel can not be hired when privatization of routine maintenance is done the Country, would loose valuable experience that should not be wasted.

- The cost of the works will be higher, because the added value due to the presence of the private enterprise with their overhead costs and profit margins, without being guarantee of better quality of works.

- Within conditions of budgetary restrictions, a lesser coverage of the network will result.

- Economic and social efficiency of the investment will be less. More will be paid for works that can be obtained for less with the same quality. Besides, the benefits of profit distribution among a greater number of individuals will be lost, concentrating them in few hands which will not be doing the actual work to obtain them.
- The majority of social and economic advantages of privatization of routine maintenance through micro-enterprises would not happen.

- Workers will have lower compromise levels on the work responsibility.

- Income for workers would be less, being employees and not entrepreneurs.

3.10.4 Creation of Associative Micro-Enterprises

a. Basic Requirements

In order to create this type of micro-enterprises, certain conditions should be fulfilled wl are the base to consolidate their structure and are listed below:

- Should be of associate character. This means that workers forming them be at the same time partners

- Its internal organization should be democratic.

- Income excedents generated by their labor should be destined in its majorit increase their stock capital, thus making it possible to strengthen t organizations.

- Legal incorporation requirements should be less than those for co-operat in relation to number of members, working capital and internal organizatio

b. Micro-Enterprise Incorporation Process

The process to form the first routine maintenance micro-enterprises for routine maintena should progress gradually, in a manner that produces its acceptance within the grou workers towards which it is directed and decreases the possibility of failure before being into practice.

The elements to take into account to promote the integration and incorporation of pre-ur groups, which will serve as a base to form micro-enterprises and start the transition proc from the present to the new system, are the following:

- Design of a promotion and induction program, directed to show the advanta of creating micro-enterprises for routine maintenance under the di management of workers. Promotion should be centered in the importance necessity of the maintenance work, continuity of the program in time creation of permanent employment. This initial program should not exceed to 6 months period. This task may be carried out with the financial support assistance of international agencies or bodies such as the International La Organization, the United Nations Development Program or USAID collaboration of government entities related with promotion of employment creation of enterprises.

- Establishment of a compensated retirement plan for workers of the DGC, similar to those applied to other government entities. The adoption of this plan should coincide with the stage of promoting micro-enterprises for road maintenance.

- To achieve the transition from the present system to the routine maintenance carried out by micro-enterprises, it is necessary to generate, at an institutional level within the DGC, a project or program in charge of the same, to carry out its initial promotion and to create the conditions within the agency to manage the contracts. Also, the project should design follow-up mechanisms to facilitate evaluation of results obtained and to allow the introduction of adjustments in the contracting of the works.

- The definition of an organizational-administrative model of micro-enterprise according to legal dispositions in force is essential. If legal restraints exist for its incorporation, changes to the law should be proposed to make possible their creation.

- A training program in relation to legal incorporation and operation conditions for micro-enterprises is required, according with previous definition of the organizational administrative model, as well as, about administrative contracting and tax matters.

- A technical training program to carry out maintenance tasks should be established, based on experience of the DGC officers and documents produced under the SIAMV.

- The training program should count with a handbook containing as a minimum:

  * Detailed description of tasks which conform routine maintenance and are to be carried out by the micro-enterprises.

  * Definition of procedures to carry them out.

  * Minimum quality parameters for their acceptance[5]

- In order to contract with the government, it is necessary to have legal representation and therefore by-laws and work and operation regulations should be defined for the enterprises to give them a legal performance frame.

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5 In the form of a guide and without pretending to be exhaustive, descriptions and procedures to carry out main tasks for routine maintenance are presented in subsequent section. However, as the DGC posses the SIAMV, it is convenient to use the established by the consultants of such work in the related document.

- In order to start new enterprises minimum capital contributions should established by the partners interested in forming the micro-enterprises. Giv the income levels of the persons towards whom the initiative is focused t capital, should not exceed 5% of the value of the annual maintenance contrac

- Finally, the level of government support that micro-enterprise will receive facilitate their development should be defined, in terms of:

  * Warranty of service demand

  * Credit facilities for procurement of basic elements in order to carry c the tasks.

  * Possibilities of acquiring used transport vehicles belonging to t government, in easy terms.[6]

3.10.5 Contracting Routine Maintenance

To start a program of contracted routine maintenance, it is convenient the incorporation at least 10 associative micro-enterprises, which are in capacity of assisting between 450 a 600 kilometers of paved roads.

It is proposed that in a first stage of the privatization process roads which are just complete after being rehabilitated or constructed, be the subject of the initial routine maintenan contracts, in a priority order based on the volume of traffic on them.

In second instance, those roads which are in better conditions and which have greater traf volume per lane should be contracted, since these generate greater economical benefits p colon spent.

Insofar as the necessary funds are available and a greater number of micro-enterprises a formed, the contracting process for routine maintenance should be extended looking for t greatest coverage possible of the road network.

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6 A decision in this direction is convenient because transport is fundamental in this type of works. It represents the most important portion of costs of the activity and, when starting, the acquisitive power of micro-entrepreneurs will not allow them to buy through the traditional market. On the other hand, with the transfer of responsibility in executing routine maintenance works by the micro-enterprises, the DGC will have an important amount of spare equipment -trucks and dump trucks- which can be sold to micro-entrepreneurs with payment facilities.

a. Contracting Modalities

Payment for routine maintenance contracts has three alternatives which deserve analysis:

- Contract at a global fixed price per kilometer-year, in which the work defined and maintenance frequency is established.

- Contract by unit prices, with activities and work quantities clearly defined.

- Fixed global price contract per kilometer-year and includes unit prices of several odd activities, as patching and installation of metallic defenses, without establishing precise amounts of works.

In the global price contracts per kilometer it is necessary to establish maximum payment limits per month, while in the unit prices it is not reasonable to set such limits.

From the point of view of the objectives of a routine maintenance project, the global fixed price contracting modality for allows to guarantee, both the continuity of works, as well as the regular availability of workers on the road during the term of the contract. The main inconvenient stands on the difficulty for the micro-enterprise to carry out additional tasks to the basic ones, since there are not agreed prices to carry them out.

The unit price system, linked to amounts of works established per activity and maximum execution time, allows, depending on outputs and work intensity planned by the micro-enterprise, that contracts be finished before ending the time term established. This modality advantageous to the micro-entrepreneurs if compared to the one before, is not favorable for the maintenance of roads, since workers availability may be temporarily lost to carry out works which are necessary although not foreseen in the contracts.

The third option seems to be the best of the three, because it has the advantages of the first one and facilitates the development of additional work within clearly defined contracting and payment rules.

b. Size of Contracts

Selection of activities to be carried out and global planning of contracts should be defined by the DGC technicians, taking into account that the activities to be carried out are different in quality and quantity, and particular to each highway, specially, when dealing with paved and un-paved roads.

The length of the road to be contracted may vary between 45 and 70 kilometers, according with the technicians criteria who will establish the terms of contracts.

c. Micro-Enterprise Operation Systems

Internal organization of micro-enterprises and the way how to plan and develop works, given its character as contractors, should have a level of extensive freedom. Nevertheless, it is advisable that at the beginning organization schemes and work methodology be suggested so that the works will comply with minimum acceptable quality standards.

A form of organization consists in the creation of a committee in charge of planning assigned tasks, in a periodic manner, delegating in one of the partners the direction of the road works. This task may be assigned in a rotative basis between the members of the team, in order to stimulate active participation of all members and make them responsible of the management of the enterprise.

A different alternative is to appoint a head, who may be the legal representative, to handle the planning and assigning of tasks and directs the correct execution of the works.

Once the general organization scheme has been defined, micro-enterprises should establish the manner in which they will carry out the work. They are options such as:

- Carry out the entire activities at once. This means, develop in a simultaneous way all tasks required in the section, assigning specific tasks to individuals or groups. Tasks will be rotated periodically, in order to insure a balanced distribution of work.

- Carry out sequencial works in a joint manner. In this way, all personnel realizes a single task at a time, finishes and continues with the next one until completion of all tasks.

To define which of these two alternatives is the best or if there are others more convenient, should be the result of experience obtained with the maintenance contracts carried out in the future.

With the purpose of restating the enterprise condition of the micro-enterprises it is convenient to request, the keeping of general records of executed work, daily and by member, so detailed physical control and measurements per activity will exist. This type of statistics facilitates internal control and of the enterprise and allows the introduction of corrective measures in relation with members whose outputs are not satisfactory.

d. Size of Micro-Enterprises

As general rule and based on experience in other countries which realize routine road maintenance through micro-enterprises, the number of members of the same should be

in direct relation with the length of the road under contract and this relation should be in the order of one worker per a little over 4 kilometers of road.

The length of the road subject to a routine maintenance contract, as mentioned above, could vary between 45 and 70 kilometers.

e. Duration of Contracts

To make attractive contracts with micro-enterprises and facilitate the formation of these type of organizations, they should be for a minimum term of three years. Nevertheless, the possibility of these contracts being reviewed annually should be considered, either to be cancelled because they did not give the expected results or to introduce modifications in relation to annual value of the contract, quantity of works or unit prices.

Even though the contracting agency is in the obligation to reserve its right of canceling the contracts due to causes imputable to the contractor, it is necessary to foresee mechanisms to avoid when possible the unilateral termination of contracted commitments in order to guarantee the success of the project.

f. Supervision and Control of Maintenance Works

The success of a routine maintenance program with micro-enterprises relies in a high percentage on the quality and objectiveness of the programs proposed for each road by the DGC responsible officers and in the supervision quality over the specific executed tasks.

Within the proposed privatization scheme and considering the consequent reduction of the DGC's plant personnel, supervision of road maintenance contracts is a work field which should be covered by technical ex-officers of the DGC, as they are familiar with the work and with extensive experience in planning and control of these type of works.

It is a fact that the Salvadorean private enterprise did not count until recently with, skilled personnel for the realization of road works and that when they needed to contract road engineers for reconstruction and rehabilitation contracts, in the majority of cases they covered this deficiency with engineers formed at the DGC.

In consequence, and to set basis for a successful routine maintenance program, it is propose to give the necessary facilities to constitute small engineering consulting enterprises formed by ex-officers of the DGC, that have guaranteed, as initial source of work, the supervision of several routine maintenance contracts. In this case, existing companies will not be excluded from participating in bids, but they will be requested that their project director and individuals in charge of supervising the contracts show a

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professional experience -not less than five to three years respectively- in planning, execution and control of road maintenance works.

Major stock capital demands are not required to conform these type of enterprises, neither this should be a basic element for the evaluation of bid proposals. Qualification of bidding firms for the supervision of maintenance contracts should be focused in specific experience of personnel proposed to handle the contract from a technical and administrative point of view.

3.10.6 Basic Activities in Routine Maintenance

Activities which should be considered when preparing routine maintenance contracts are listed below. It must be taken into account the exclusion of those which are exclusive for paved roads, when contracts are related to no paved roads or vice versa:

- Clearing and cleaning side areas
- Cleaning ditches
- Cleaning culverts
- Cleaning bridges
- Hand cleaning of traffic signs
- Hand cleaning of metallic railings
- Removal of small landslides
- Hand reshaping of side slopes
- Patching paved shoulders
- Reshaping non paved shoulders
- Cracks sealing
- Seal Coats
- Superficial and deep patching
- Painting of milestones

- Replacement of traffic signs
- Manual shaping of ditches
- Manual planting of grass
- Manual planting seeds
- Tree planting
- Repair of metallic railings

Some of the listed activities, as grass and tree planting are not included in the SIAMV, but it is convenient to include them to protect side slopes from erosion.

Contracts should consider the supply of required materials to micro-entrepreneurs in order to carry out tasks such as replacement of traffic signs, seals, tree planting, shoulder patching or coating, since production of them should be out of the scope of contracts, which basically are for labor.

In Annex 3.10.6 as a guide for preparing the conditions which must be meet by works contracted with micro-enterprises, is given a description and execution procedures of main tasks for routine maintenance.

3.10.7 General Alternatives for Privatization of Preventive Maintenance

The transfer of the highway maintenance responsability to the private sector, may be partial or total.

In the first case, its participation may be limited to the execution of maintenance works when contracted for this purpose and to guarantee the quality of executed works. In other occasions it is considered its participation as a concessionaire of the road or owner of the same, in charge or realizing the necessary investments to provide a road with excellent characteristics for a considerable time term, in exchange for a direct collection from users for the use of the road, usually, through tolls.

There are options between these two ends that may be more or less attractive, in terms of the local context and the funding possibilities of the activity.

Total privatization, within a system of concessions or sale of the road infrastructure, has risks which have to be considered when contracting. Within this scheme the possibility exists that the enterprise reduces expenses to the minimum to maximize profits and the roads subject to the contract will deteriorate up to inadmissible levels and that when this

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happens provokes fraudulent bankruptcies to take over accrued profits without restoring the roads to acceptable conditions.

3.10.8 Road Management and Administration Contracts

Road management contracts are agreements between the Government, as owner of the highway infrastructure and a third party as a contractor. Through this type of commitments the government transfers the total responsibility of administering a highway or a highway network to the third party and this one is obliged to provide the necessary works to maintain them in adequate functioning and quality conditions and in some cases, to provide other road services as telephone and other equipment facilities in order to attend medical or mechanical emergencies, which as it is obvious, increases the value of the contracts.

The management contracts should be based on very well defined demands about road quality, which should be totally fulfilled by the contractor. Even though, by its character of private enterprise the entity should have full freedom to decide how the contract will be fulfilled, the government's obligation to watch for common interests requires to clearly and completely state the control procedures to be used and the consequences that these may generate in reaction to the needs to carry out works as a response to evaluations realized.

Public bidding should be used to deliver roads through the form of management contracts, to guarantee transparency in their allocation and promote enterprise competence.

The contracting terms should define the funding sources and form of payment for road maitenance works and management.

a. Funding Sources

Three main alternatives exist to finance the road management contracts, which are:

- Road Fund
- Normal budgetary allocations
- Budgetary appropriations within Special Accounts in the Nation's budget, with specific resources to supply them

The creation of a Road Fund supposes important legal modifications to make it possible to create taxes or incomes with specific destination to the same. This will allow to secure considerable resources to attend the road network. In El Salvador, however, as it is in the majority of countries, income of this type are constitutionally prohibited. Therefore the creation of a road fund is not a viable alternative in the short run.

Budgetary allocations, which result from the legislative discussion of the Nation's budget or from internal or external loans, have demonstrated for years that are strongly influenced by political considerations and tend to make investment inefficient. In order to privatize the road network management it is necessary to, if it is decided to fund it through this option, design procedures which will allow the realization of contracts whose funds are insured in time. This is not of easy because national budgets are not prepared for several consecutive years.

Special Accounts within the Nation's budget, which exist in El Salvador and have specific resources, are the most appropriate option to long term fund road management contracts, because it adjusts to legal conditions existing in the country in budgetary matters. The amount of resources available may be anticipated with a special account to attend the road network, as well as contract costs and may project annual cash flows to cover contract obligations. Therefore, with an adequate project planning and disbursements, it is possible to insure the flow of funds required to develop contracts without setbacks.

b. Payment Modalities

In order to pay for road management contracts, difference should be made between the design and construction stage and the one of project operation. In all cases, initial costs should be covered as far as studies and works are realized. Starting from the time when projects begin functioning, payments may be effected in different forms, among others, the following:

- Annual fixed amounts.
- Variable amounts in function of works carried out per year.
- Variable amounts in fuction of accumulated traffic volumes.
- Variable amounts for routine maintenance and variable amounts in function of periodic maintenance tasks carried out

The four systems are valid if an adequate control over road quality and over execution of works exists by the contracting party. However, the best and more efficient is the last one, because it is paid after the satisfactory execution of works. The second is similar to the fourth, but request more control effort to establish the amount of work realized.

c. Period (Term) of Contracts

Terms for these type of contracting may be fixed or of undefined time. In any of the two cases conditions agreed should foresee the form in which the contract may be ended, guaranteeing that at the moment of delivering the roads to the government these should be in acceptable quality conditions.

3.10.9 Road Concessions

A concession is a road management contract whose main characteristic consists in granting the concessionaire the right to fund its participation through direct collection to users of the concessioned roads.

a. Funding Sources

Road concessions obtain the resources to cover investments realized, to operate roads and to maintain them, through toll collection in function of kilometers travelled and the size and weight of vehicles.

Even though the concessionaire is free to propose rates it considers necessary to make the concession viable, it is normal that the government fix maximum collection ceilings per type of vehicle, in function of kilometers travelled and accepts proposals to establish extraordinary collections for the transit of special vehicles or freight.

Different concession modalities exist, but the basic idea is that the concessionaire assumes the risks for eventual traffic variations. Nonetheless, in some countries, in order to make the participation more attractive to potential investors, the government guarantees a minimum traffic level per type of vehicle during the time the concession is in force.

When counting with a minimum traffic guaranteed, investors know which is the minimum annual income they may obtain, which facilitates the decision to participate in bids, since the risks involved are lower. This alternative is interesting, if on the other hand the government assures for itself an important participation over possible additional collection due to considerable traffic increases, not forecasted in the guaranteed traffic projections.

b. Period of Concessions

The period of concessions are defined in the concessionaire's proposals in function of investment amounts, toll fees, traffic volumes and expected return rates. This is one of the elements to be assessed when evaluating proposals with this purpose. Insofar as shorter terms are proposed the assessment will be better.

When concessions are made to advance road rehabilitation works, which would be feasible in some salvadorean roads, the terms may fluctuate around 10 years, depending on additional demands related to services the concessionaires must provide.

Establishing fixed terms in the bidding documents for concessions is an alternative which has the inconvenience of loosing control over the tariff level proposed by concessionaires, which makes the offer selection process more difficult.

3.10.10 Specific Options to Privatize Road Maintenance Management

If investment efficiency and effectiveness in achieving a network in good quality and operation conditions is to be obtained, contracting maintenance works by the Government, without the transference of any other responsibility to the private sector, is not advisable.

Within a system which counts with secure financial sources-which as mentioned before is feasible through the establishment of special accounts in the National Budget- and a management program that allows to plan periodic maintenance tasks and monitor the road conditions, management contracts or concessions are good privatization alternatives for road maintenance in El Salvador.

Concessions, that from a government point of view are more attractive than management contracts, would be feasible in some roads if the reintroduction of tolls is admitted.

The redefinition of the Economic Stabilization and Promotion Fund -special account used to pay for the fuel subsidy- as a fund for the maintenance of the road network, will make feasible long term management contracts.

a. Advantages of Road Management Contracts and Concessions

Road management contracts, when compared with the form how roads are currently maintained, offer the advantages listed below:

- Transfer the great part of road management responsibility from the public to the private sector.
- Guaranteeing timely funding of roads under contract, eliminates political interference over allocation of resources.
- Personnel needs to attend the road network decreases and facilitate the application of personnel policies which allow to pay competitive salaries and establish incentive plans to increase the efficiency of the personnel.
- Guaranties the necessary flexibility to attend the road network.
- Favors and supports the change of financial systems which have proved not to be efficient.
- Users, when knowing that contracting enterprises have the responsibility of road management for long terms and count with the required funds to do so, are in condition to exercise the role of road quality vigilants,since they may demand strict compliance of contracts being certain that resources are available.

Road concessions have the following additional advantages over management contracts:

- Government is free of its responsibility of finding the funding resources.

- Concessionaire has the certainty over its income, since it does not depend upon government disbursements for its funding.

b. Disadvantage of Road Management Contracts and Concessions

From the point of view of government responsibilities before users, road management contracts have some of the inconveniences which have now to provide for road maintenance. Among the most important ones are:

- The responsibility of obtaining funds to finance the contracts remains in the government's hands.

- The risk that road works are not carried out timely and as a response to predefined deterioration conditions remains, due to delays in payments originated by bureaucratic or administrative problems.

- The introduction of budget modifications could jeopardize the subsistence of the special accounts and underfinance the management contracts.

- The contracts form of payment request complex accounting controls and similar to the existing to handle construction contracts.

Concessions do not offer the above disadvantages, but have the ones listed below:

- Concession costs are higher for the population because of the need of having a complex organization for collection, transportation and custody of the funds originated from tolls.

- They are not a desirable option for medium and low traffic highways, which however, still require an adequate maintenance.

- The risk exist that the concessionaire does not carry out, in a timely manner, the necessary works to maintain the roads, if an strict control of its management is not carried out.

- Real or fraud bankruptcies may be declared, for profit appropiation, without returning the roads in good condition.

3.10.11 Proposals Qualification and Evaluation Process

Once the agency, in this case the DGC, has decided to contract the road maintenance works, having secured its financing, it must publish in newspaper and trade magazines tender notices. According to the circunstances, the process could start from prequalification of contractors or the notices can be directed towards already prequalified contractors.

The overall tendering process and evaluation of the tenders consists of:

- Preparation of the tender documents.
- Calling the tender (with or without prequalification).
- Evaluation of the tenders: Operative, financial and business experience; programing of the works.
- Firms selection if there is prequalification.
- Economic evaluation of the proposals.

The evaluation process will end with the awarding of the contract . In the tender documents, special attention should be given to some aspects of the contract that will guarantee to the concessionaire certain toll rates, minimun percentage of income, construction cost overruns, etc.

The overall process of qualification and proposals evaluation for project management or concessions is given in Annex 3.10.11.

3.10.12 Basic Activities to be Developed by Contractors

In a management contract or in a concession, besides the routine maintenance activities already listed in a previous section, contractors or concessionaires should carry out the periodic maintenance tasks required to keep highways within quality parameters defined according to the operation and maintenance regulations that for such effect will be prepared by the General Directorate of Roads.

Basic activities for periodic maintenance on paved roads are:

- Repair pavement
  - ✓ Surface covering of potholes in defective areas
  - ✓ Deep covering of potholes in defective areas

- Surface treatments
- Sealing coats
- Pavement reinforcement or ovearlays
- Signalization and road demarcation
- Repair works

In Annex 3.11.6 a description of the main activities for periodic maintenance of paved roads and its execution procedures are presented with an illustrative character. Nonetheless, it is considered that the General Directorate of Roads should prepare a Manual which considers all the possible activities, both in relation to routine maintenance and for the periodic one of paved and non paved roads, based on the experience of its officers and on the documents prepared to create the SIAMV.

3.10.13 Supervision and Control Procedures for Contract

Contracts should have technical and administrative controls. The first contemplate procedures to follow in order to determine the condition of roads and the form in which its condition will be assessed. The second ones, the actions to take when incompliances arise on the part of contractors in relation to road conditions and timely execution of works.

a. Evaluation Parameters of Road Maintenance Conditions

The necessary evaluation to keep an effective control of the quality of roads delivered under long term management contracts or concessions, should be carried out frequently in order to preserve public interest and avoid the appearing of pernicious deterioration processes for users. In order to comply with this requirement, correlated parameters should be measured with the operation costs level of vehicles, transit safety and the deterioration process of pavements.

The index of pavement condition is a measure that allows the evaluation, in a quantitative manner, of the physical conditions of the same and to establish its general maintenance conditions. At least the following parameters should be evaluated in order to determine it:

- Rugosity
- Fissures and cracks
- Formation of ruts and deformations

- Slipping resistance
- Condition of shoulders
- Signalization

To describe the assessment process of the pavement conditions it is necessary to define some specific terms which, even though may be obvious, should be stated to avoid future confusions and misunderstandings between contractors and supervisors. Following we present such definitions and generalities about some of the parameters which show the importance of evaluation and control:

- Highway Section

A section of a highway with homogeneous conditions in relation to traffic, pavement structure, topography and technical specifications of construction.

- Sector

A subdivision of a highway section with homogeneous conditions in relation to its current maintenance condition.

- Element or Parameter

Each one of the aspects to be evaluated to determine the Condition Index of Pavements.

- Influence Factors

Are ponderation factors of each one of the elements to be evaluated to determine the assessment of the Condition Index of Pavements.

- Rugosity

Rugosity is the main parameter to establish the condition of a pavement. Provides a measure of vertical displacement of vehicle tires in relation to a horizontal surface. Its measure unit is the International Rugosity Index -IRI-, which is expressed in meters by kilometer (m/km).

As rugosity is affected by pavement irregularities such as: waves, plastic deformations, rutting, inadequate repairs, fissures and potholes, by itself is a very approximate measure of the general condition of pavement.

As the extent of the pavement rugosity is greater, comfort level decreases, drivers are obliged to reduce their travelling speed to avoid placing vehicles into excessive mechanic demands and vehicle operation costs increase. Surveys about rugosity influence over operation costs show that these have more effect over light weight vehicles and that increases are of exponential type in relation to the deterioration.

- Fissures and Cracks

Fissures and cracks are fractures of the rolling surface of pavements in higher or less dimension and in different types. This are due, among other causes, to structural fatigue caused by load repetition, important thermic variations, reflection of existing fissures in the lower pavement layers and deficient lateral confinement.

- Formation of Ruts and Deformations

These are localized depressions along the traffic tracks which develop on the paved surface. These result from compacting or lateral displacements of the materials due to the effect of transit loads. Represent a structural insufficiency of pavement or deficient stability of the subgrade-pavement system.

- Slipping Resistance

This parameter measures the friction between the tires of a vehicle and the paved surface on a wet road. Its determination is important because when the surface is excessively smooth or slippery, may present problems of hydroglading for vehicles and be a direct cause of road accidents.

In Annex 3.10.13 details are given about the Procedure to Classifify the Maintenance Condition of Roads.

b. Determination of Condition Index

Table 3.10.1 establishes the classification ranges corresponding to the varied physical conditions of pavements.

The evaluation of the parameters required to establish the Condition Index of Pavement should follow a procedure as the one described below:

- Divide the highway in sections and these as well in sectors, according to previous definitions.

- Evaluate the assessment elements according to the sectorization realized, assigning indexes from (0) to (5) by parameter, as explained in Annex 3.10.13.

- Classify each element for the highway section in study, as ponderated average of grades obtained for each sector.

- Determine the Condition Index for the highway section as the sum of the inputs of the classification of each element by its respective influence factors, which are indicated in Table 3.10.2.

TABLE 3.10.1
Classification Chart of Pavement Status

		CLASSIFICATION RANGE			
ELEMENT	UNIT MEASURE OF CLASSIFICATION	VERY GOOD 5 - 4	GOOD 4 - 3	FAIR 3 - 2	BAD 2 - 1
RUGOSITY	I I R	2 - 3 5	3 5 - 4 5	4 5 - 6 5	6 5 - 12
RUTTING AND DEFORMATIONS	mm	0 - 25	25 - 40	40 - 60	60 - 100
CRACKS	Coeficient F	5 -4	4 - 3	3 - 2	2 - 1
SLIDING RESISTANCE	Sliding Resistance Coeficient	100 - 45		45 - 00	
CONDITION OF SHOULDERS	% Damage	0 - 2	2 - 5	5 -10	10 - 20

TABLE 3.10.2
Influence Factor

ELEMENT	INFLUENCE FACTOR
Rugosity	0.35
Rutting and Deformations	0.20
Cracks	0.20
Sliding Resistance	0.20
Condition of Shoulders	0.05

c. Periodicity in the Evaluation of the Condition Index

The Condition Index should be evaluated, in first instance, with the implementation of the project. Afterwards, with a frequency of six (6) months and when total or partial overlays are applied over the analyzed section.

In the periods comprised between two evaluations, the project supervisor may carry ou evaluations of the parameters which to his judgement are under the requirements with the purpose of ordering the necessary corrections in a timely manner.

d. Fines and Guarantees

Some measures to guard public interest are listed following:

- Non-compliance Fines

Fines do not cover the community for losses due to what a bad management woulc cause to roads. At most these allow the government, if achieves such collection some funds available to restore roads for which users have paid. If bankruptcy problems arise, no possibility exists of collecting fines. The government will ther be facing a situation of a service paid for but not rendered and the need to obligate resources to restore the condition of the roads, but may not be able to compensate users for damages caused.

- Bank Securities and Guarantees

The demand of quality and compliance policies and bank guarantees covering a great proportion of the contract value, is essential to prevent the loss of funds necessary to carry out the required works for highways if the concessionaire does not fulfill or declares bankruptcy. Besides, if non-compliance arises and if an agile verification procedure exists, losses for users are minimized if the guaranteeing company or the guarantors assume the contracts.

3.11 Weight Control for Cargo Vehicles

Experience of weight control for cargo vehicles in Latin American countries, indicates that when these are carried out by state officers they do not meet the objectives for which they were established.

El Salvador is not exception to this situation, as proved when comparing official statistic figures for year 1992 with operation spot checks. It was observed that overload was neither registered nor penalized, but in turn the stations offer a source of additional income for personnel in charge of controls. It was proved that in the majority of cases truck drivers with foreign plates avoid the control and no mechanism exist to prevent this. Besides, statistics show that the number of controlled vehicles by day is low -less than 700 vehicles per day- which represents a high relation of cost control per vehicle.

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The decision of advancing the program to modernize the weight control system, which will include the construction and equipment of 18 weighing stations[7], demands definitions about the form in which control must be achieved, responsibility of the same, and penalties to infractors and characteristics of the operators.

3.11.1 Options for Privatization of Control

As was stated before, the operation of the system by state officers does not offer guaranties of control effectiveness and honesty. Therefore, this activity should be assumed by private enterprises who are in conditions to guarantee an extensive coverage of daily traffic of trucks and be a tool of effectiveness in control to reduce the overload levels.

Different alternatives exist to transfer responsibility of the system to private operators. Among these are:

- Bid its operation and maintenance for a minimum term of 3 years, once the stations have been built and equipped by the DGC.

- Grant the concession for construction, operation and maintenance of the system, freeing the DGC from the design and construction process of the stations.

Since the DGC has already assumed the compromise of directly bidding in a direct form the construction and equipment of the control stations and has the necessary funds to carry out the first stage of the program, which consists of six stations in the western zone of the country, it is considered that the option to be analyzed should be to contract the operation and maintenance of the system.

3.11.2 Funding of The Control System

The funding should be assumed by the DGC. One of the sources could be funds generated by the application of fines. Nonetheless, as control should be efficient and fines, in order to be reasonable, should be imposed by the additional deterioration produced by overloads in relation to the deterioration produced by legal loads, it should not be expected that this source produces the required income to cover the control stations costs. In any case, even if fines should produce important income, the law does not allow that its collection be done by agencies other than the Ministry of Treasury and in consequence, resources should come from the Nation's ordinary budget. The justification

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7 The magnitude of the system is a point that deserves an analysis of the coverage of truck traffic, in terms of tons-kilometer, to establish if it is really required the number of stations planned. An analysis carried out of one day reports in the seven operating stations, showed that over a total of 839 heavy trucks only 21 (2.4%) were controlled in two different points. This would indicate that there are not major traffic overlaps between current stations, but does not allow to establish definitive conclusions in such respect.

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of the expenses to carry out contracts for operation of the system should be based in the potentiality of the same to produce savings in road maintenance costs.

3.11.3 Operation Costs of the Stations

According to experience obtained during visits to control stations in operation, it is calculated that personnel requirements to operate the weight control system proposed by the DGC are similar to the current ones if, as will be reasonable, stations are used as sources to generate statistic information for the sector planning. Under this assumption, a cost estimate was prepared for a control station which forms part of a system formed by 18 stations, with each unit having a construction and equipment cost of 2.5 million colones.

The monthly structure costs per station would be:

-	Maintenance of installations and equipments (3%)	¢	6.250
-	Manager (1/18 of its total time)	¢	700
-	Supervisor (2/3)	¢	2,400
-	System Analyst (1/18)	¢	500
-	Operators (8)	¢	20,000
-	Transportation (2/3)	¢	6,000
-	Subtotal	¢	35,850
-	Multiplier factor 2.2		
-	Total	¢	78,760

Operation costs of the stations do not include, because it is not the responsibility of the contracting entity, guard service and police support which will be essential for the normal operation of the same and to impose respect for the system before transporters.

3.11.4 Qualifications of Contractors

Potential contractors of the system should prove that they have the administrative organization and the financial capacity to manage a minimum of 200 persons, in such a way to guarantee the continuity of the operation even facing eventual delays in disbursements by the contracting agency.

Given the characteristics of the work to be contracted, it is not convenient to request experience in the execution of similar works, in order not to exclude Salvadorean firms interested in participating in the bidding. However, participation of firms with experience should be interesting and positive.

A factor to be taken into account when assessing proposals, which would allow some firms to participate with possibilities of success, is the previous management of entities or groups of individuals in which lines of command, subordination and responsibilities are clearly defined.

In general terms, specialized firms are not required to contract the operation of the system, but enterprises with good organization levels and financial capacity.

3.11.5 Evaluation of Proposals

To select proponents to a public bid to assume control of weights at Salvadorean highways it is recommendable to advance a pre-qualification process which evaluates:

- Administrative Organization

Evaluation parameters should be established for existing administrative organization, to determine if they are able to administrate adequately a contract that requires a permanent staff of a minimum of 200 individuals.

- Financial Capacity

In this aspect pre-qualified firms should be able to demonstrate that they have the financial capacity to cover salary obligations to personnel related to the contract, during a term not lesser than two months.

Besides the legal requirements that all proposals should meet, such as legal representation, surety and fidelity bonds, commitment letters, work site visits, which are of general knowledge and considered not necessary to be detailed in this report, the evaluation process to define the winner of the bid should consider aspects such as:

- Similar work experience, which should be demonstrated presenting a résumé of related contracts, in which it is shown the amounts of the same, periods of execution, contracting entity and all other information which will allow to clearly identify the experience presented.

- Experience in management of organization which request strict controls over their officer's work to avoid taking personal advantage of their positions, describing works realized, their administrative organization and the duration of them.

- Administrative organization of the enterprise, with graphic schemes and description of its functioning.

- Proof of its financial capacity through presentation of its General Balance, Financial Statements to the date of the bid closing and calculations of financial indicators which demonstrate its solvency to attend to obligations derived from the possible awarding of the contract.

- Proposed organization for the implementation of the possible contract and professional profiles of the key personnel and their assigned positions.

- Type of information proposed to collect in the stations under its responsibility, report production and periodicity of the same. Reports should contain statistic information about cargo movement by type of product, traffic volume, number of infractors and magnitude of overloads, and be of easy interpretation and handling.

- Detailed economic proposal, in which it is specified the salary costs per position, direct costs, fringe benefits and profit margins.

- Remuneration levels of individuals directly in charge of the control should be an important factor in the evaluation of the proposal, since low salaries to carry out this task are not an effective tool to reduce the always present risks of corruption.

The selection of the winning proposal should be based in an assessment system which gives greater importance to fulfill the objective of control, rather than the cost of the proposal. This is reasonable, if it is considered that the decision to modernize the system originates from the assumption that an effective control of axle weights generates important economic benefits to the country, by reducing the needs for road maintenance.[8]

3.11.6 Period of Contract

The minimum duration of these type of contracts should be three years, with the purpose of distributing administrative costs of selection, training and dismissal of personnel in a period relatively long and decrease control costs.

3.11.7 Supervision of Contracts and its Effectiveness

The procedure to verify the effectiveness of the contractors' work, which is a DGC responsibility, requires:

> An auxiliary system of portable scales which will allow to realize aleatory samples of trucks at any point of the road network, to verify the effectiveness of controls realized by contractors in relation to traffic covering and reduction of overload.

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8 The decision to implant weight control should be product of an economic analysis that involves all elements that participate in highway transportation, thus selecting an alternative which produces important economic benefits. The evaluation should allow comparison between results of different control scenarios, in combination with different road maintenance strategies. To justify the introduction of weight controls based on the reduction of maintenance cost,without establishing in magnitude, may lead to wrong and expensive decisions for the country, when ignoring the effects that weight control has over on increase vehicular operation costs.

- An information system to manage data collected by control stations, which will provide a data base of easy management for the DGC, that will allow to take quick decisions when finding irregularities in the data or in the behavior trends of the same.

- Fines for noncompliance, agreed upon in the contract, when irregularities are verified which indicate lack of weight control due to deficiencies in its application.

3.11.8 Fines for Overloads

As consequence of control, owners and drivers of infractor vehicles should make payments for violating regulations about authorized limits weights per axle . This payments may be related with costs to provide periodic maintenance to roads or be fixed figures established by legal dispositions, as is in El Salvador.

Violation to regulations could mean excess vehicle gross weight or exclusively load per axle. Excess in load per axle, without simultaneously having vehicle gross weight excess, arise when load is not adequately distributed over the axles.

In order to establish a fine or collection system in relation to responsibility over periodic maintenance costs originated from the overload of trucks, it should be considered that vehicles not overloaded have less individual responsibility, but in all case, proportional to the loads transported per axle. Due to this reason, impose fines to overloaded vehicles and not having a charge system for those who are not, will not be equitable.

The solution stated in this study, is the definition of a system in which the government collects an average rate per vehicle to provide periodic maintenance, which may or may not be explicit, and collect fines from overloaded vehicles in relation to the individual responsibility for each bus or truck controlled at stations.

A collection procedures for overloads consists in:

Assuming that roads require an overlay each n years and calculate its application costs per kilometer -CMP-. Starting with this figure, obtain the medium annual cost for periodic maintenance per kilometer -CAMP-, as follows:

$$CAMP = CMP * Frc$$

Where:

$$Frc = i\,(1 + i)^{n}/(1 + i)^{n-1}$$

i= annual interest rate

As indicated by the theory that deterioration of a road is function of the amount of equivalent axles (NEE) applied during a period; the unit cost for periodic maintenance per equivalent axle per kilometer -CUMP- may be expressed as follows:

$$CUMP = CAMP/NEE$$

The truck factor -FC-, or the number of equivalent axles per axle, is given by:

$$FC = NEE = (P_i/P)^4$$

Where:

P = Pattern load in function of the type of axle, according to Table 3.6.1

P_i= Load corresponding to a heavy axle

Since the objective of the weight control system is to avoid the excess in load per axle, fines should be calculated in relation to the same. Therefore, they should relate with the excess of FC applied against those produced by loaded axles within authorized maximums. If a vehicle has an overload Pe over a legal limit Po, the truck factor corresponding to the load (Pe + Po) is the following:

$$Fcn/Fco = [(Pe + Po)/Po]^4$$

According to these, the increase in FC or equivalent axles, is given by:

$$\Delta FC = Fcn - Fco$$

And the extra cost of maintenance for each kilometer of travel, to be covered by the excess of FC, will be equal to $\Delta FC*CUMP$. From which results that fines due to load per axle excess would be calculated through the expression:

$$Fine = \Delta FC*CUMP* \text{ Length of trip}$$

As the determination of the length of the trip offers control problems and gives way to manipulation of the same, it is convenient to determine through surveys the average length of trips and calculate fines with these values.

3.11.9 Additional Consideration about Weight Control of Cargo Vehicles

Even though the terms of reference do not include an analysis from the consultants about the benefits of establishing a weight control system, at the express request from the General Directorate of Roads, following we present the consultants particular opinions

about the subject and the text of a document from the World Bank is quoted which is considered pertinent:

1. Experience on establishing weight control in countries whose institutional development is still going on, shows that its application is highly expensive, difficult to control, little effective and generates corruption among the actors involved in control and fine impositions.

2. Weight controls may and should play an important role in the planning, construction and maintenance of roads that serve cargo vehicles, so that on the processed data of the loads, the roads must be designed to satisfy the needs of modern transportation. Also, it must serve to avoid circulation of excessively heavy loads that exceed the structures capacity.

   On the other hand, they are a conflictive element with transporters when the objective is to sanction small overloads, that although they affect in great measure to the deterioration process of roads, they allow a more efficient and economical transportation for the country, which is the objective of construction and maintenance of roads.

3. Strict weight controls are justified if the legal load limits are high-for example: 13 tons on single axles, and 20 or 21 in double axles, and overload levels above these limits are significant. If in turn, the objective, is to decrease the demand for resources to maintain roads, limits of authorized loads are relatively low -9 tons for single axles and 16 on tandem axles, in the case of El Salvador- and overload levels are moderate in magnitude, weight control is neither reasonable not recommendable.

4. The most important component of transportation costs are the vehicle operation costs. The participation of road costs - construction and maintenance- within the total transportation cost is low. If a road with a traffic of 1000 vehicles per day is considered, operation costs represent more than 90% of the total costs. If the road has a traffic of around 5000 vehicles, the participation of road costs does not exceed 4% of the total transportation costs. These figures are the result of investigations made by World Bank, but can be verified with the ones obtained in the maintenance analysis carried out by this Study. It shows that total maintenance cost of an adequate maintenance program is only about 2% of total transportation costs, as indicated by figures in Table 3.7.4.

5. If it is taken into account that the decrease in operation costs is a main objective to optimize the transportation system, measures against this objective are not advisable. It is possible to verify, if an economic analysis of the problem is carried out, that a decrease in maintenance cost because of the weight control is minimum and that the increase in operation cost is several times larger than possible savings

in maintenance. This shows that introduction of weight control could be self-defeating.

6. A weight control system increases operation cost of vehicles since they require a greater number of trips to transport the same load. If, besides, weight limits are very restrictive, it is possible that not even reduction of the number of repetitions of the pattern load over the roads is accomplished. If so, lower road maintenance costs are not obtained neither durability of roads increased and therefore, the control objectives are not achieved, but transport becomes more expensive.

7. If avoiding deterioration of pavings through restriction of loads that circulate through them was a purpose by itself, as stated with certain regularity, which is a respectable point of view, but partial and limited about the function that highways should have, transport by truck will be realized in vehicles of 10 to 11 tons of vehicular gross weight, with very high transport costs per ton. Surely and on despite of this, pavements would also have deteriorated by long lack of maintenance and will be likewise stated, that the problem lays in the almost exclusive effect of weights transmitted by cargo vehicles.

8. Load levels in Salvadorean trucks, according with weighing verified by consultants on November 1994, indicates that a real overload problem that could generate an accelerated deterioration process of the road network does not exist. The reasons why excessive overloads do not show with relation to the norms in force are: the regulations themselve, the fact that trucks have vehicle gross weights according to the norms and short trip distances, that do not promote the use of vehicles with higher load capacity because of competitiveness reasons.

9. If we think about the evolution of the automobile industry, that seeks to built more resistant and potent vehicles and in consequence more efficient, it is not reasonable to propose strong restrictions to their circulation, since we loose possibilities of taking advantage of technologies offered by the industry and having lower transportation costs.

10. Highway users are the most affected when they have to circulate on roads in bad condition. The main cause for this situation is the absence of technical programs, adequately funded, for road maintenance and not to the fact that a proportion of cargo vehicles circulate with loads higher than the legal.

11. Transfer the responsibility of road deterioration to transporters has served during many years to justify the inefficiency of agencies in charge of the road network, which are not able to keep them in good condition due to reasons other than truck traffic.

12. A text published in a World Bank document titled "El Deterioro de los Caminos en los Paises en Desarrollo" (Road Deterioration in Developing Countries), when referring to the matter of pavement construction states:

" An important question stated when determining the strategy for paving is that it the construction of paving by stages has economical sense or not. This means start with a design of low strength and reinforce the pavement in the future to adapt it to a greater traffic and to a heavier axle loads. The answer depends on the quality of maintenance that can be given to the less (initial) resistant road . This matter was investigated in the case of Costa Rica and Malí, assuming an annual increase of traffic from 3% to 4% and two levels of load per axle. With a probability of 75% to 90% that maintenance be adequate, the construction by stages would be economic for a traffic volume up to 2,000 or 2,500 vehicles per day, according to axle load. But if the probability of good maintenance is only 30%, strong pavements should be constructed from the beginning, even though the construction cost is higher, to compensate the lack of strength in relation to maintenance. In this case construction by stages will be preferable only with traffic volumes lower than 1,000 vehicles per day and with a light axle load. In all cases pavements should conform minimum design and construction specifications".

"Some countries havo made expensive mistakes when carrying out in stages the construction of pavements based in the assumption - which have proved erred- that maintenance will be adequate and loads per axle will be limited. Heavy loads accelerate road deterioration and even with optimum maintenance the average rugosity of the life cycle continues being greater when the load per axle is heavier. Empiric tests show that damage to pavements increases exponentially (up to the fourth power) as load per axle increases, but the regulation of load per axle has turned out to be extremely difficult and expensive. Many road authorities are now constructing stronger and more expensive pavements than it would be necessary if the load per axle was efficiently controlled. Even when possible to meet the regulation of load per axle, limits of this one should be increased over the present eight to ten tons of load per single axle (and 13 to 16 tons per tandem axle) because the economic advantages of using bigger trucks is superior to the increase in damage to roads (Faiz and Fossberg 1987; Rolt 1981)."

As a conclusion from above, it is recomended that the GOES should abstain of starting the construction and equipment of the new weight control sistems in 18 additional places of the paved road network.

There are not studies or analysis to show that the setting up of an extrict weight control, based on present weight standards, will generate benefits for the country's economy. On the other hand, it is possible that the assessment of a program of the proposed characteristies will give negative economic resoults, even without inclding in the analysis the investment, maintenance and operating costs.

In addition to above, it is considered that the decision on the establishement of weight control in all Central America must be taken jointly by all the countries. This should be the resoult of studies allowing the establishement of optimum weight limits from the economic point of view. The location of these weight stations should maximize the coverage of the ton-kilometers transported on the region.

In the section of Conclusions and Recommendations, serious arguments are given to back the proposal to stop the program of modernization of the weight control system and it is recommended to take an advantage of the existing system in the planning of the road maintenance.

3.12 Analysis of Charges to Users of Interurban Paved Highways

3.12.1 Introduction

a. Purpose

In order to develop an efficient and effective rehabilitation and maintenance program which minimizes the total cost of highway transportation, and a highway improvement and new construction program which adequately responds to the requirements of the demand for ground transportation, it becomes necessary to reckon with annual financial fund flows which guarantee the attainment of the programs.

The purpose of this Study is to compare fiscal income originated by highway transportation with costs estimated to maintain, rehabilitate, improve and expand the interurban paved highway system, and determine the level of charges to highway users, breaking them down by type of vehicle, which guarantee to accomplish of the proposed highway maintenance, rehabilitation, improvement and expansion programs.

b. Org ’ation of the Report

This Section is organized in six parts. The first one, this introduction, presents the purpose and organization of the sections; the second one presents general analysis methodology; the third one presents the results of estimates and projected fiscal income originated by highway transportation; the fourth one presents the results of the estimates and projections of the routine and periodic maintenance costs for interurban paved highways; the fifth one shows the results of the comparative analysis of fiscal incomes and costs; and the sixth one presents the conclusions and recommendations of the analysis.

3.12.2 Methodology

a. Charges to Users as a Funding Source

In El Salvador, financial resources for highway programs come from the Nation's General Fund, through the budgetary allocation of ordinary and extraordinary resources of the Central Government, these last ones are mainly originated by development assistance funds.

Article 224 of the Constitution of El Salvador establishes that all income of Public Treasure will form one single fund, except only for incomes affected to the service of public debt and grants with specific purposes.

Even though taxes or charges dedicated to the highway sector do not exist in El Salvador, there are specific charges identified for users of the highway sector, such as fuel taxes, import taxes for automobiles and spare parts for the same, acquisition and ownership taxes charges for drivers licenses and fines related to the highway sector.

On principle, these users charges utilized in El Salvador, described in Section 1, "Charges to Users Utilized in El Salvador", of next chapter, should generate the resources necessary for the Central Government to fund the highway maintenance, rehabilitation, improvement and expansion programs[9]. Therefore, in El Salvador, it is the direct user of highways who generates the maintenance and expansion resources for the highway network.

b. Equity and Efficiency of Charges to Users

From the point of view of efficiency, charges to users should equal the marginal cost generated by each type of user. The purpose is that the charges paid for each type of user reflect the marginal cost to maintain and expand the highway system generated by this type of user in order to minimize total transportation costs.

From the point of view of equity, charges should vary in proportion to what the user is able to pay and in proportion to external factors generated by the users when utilizing the highways. The purpose is that charges to users which value more the transportation by highway be proportionally higher and charges to users who generate positive external factors, in terms of a better income distribution and greater positive impacts to the general economy, be proportionally less.

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9 Funding mechanisms directed to internalize incomes received from indirect beneficiaries of highway improvement have not recently been utilized, such as charge for increase on property value, special taxes on property, and charges for the impact of new traffic developments. Likewise, private participation has not been used as a funding mechanism for highways.

c. General Calculation Procedure

For obtaining the objective of the study, as for comparing charges to highway users with estimate costs to maintain, rehabilitate, improve and expand the interurban paved highway system, and determine the levels of charges to users, broken down by type of vehicle, which guarantee the obtention of the proposed highway maintenance, rehabilitation, improvement and expansion programs, the following steps should be carried out:

- Estimate fiscal income (charges) by type of vehicle (user).
- Estimate costs generated by type of vehicle.
  - Maintenance costs.
  - Rehabilitation costs.
- Compare charges and costs and estimate subsidies by type of vehicles.
- Identify levels of proposed charges.

Figure 2.2.1 presents in a schematic form the procedure to follow, which is developed in the following sections.

3.12.3 Charges to Users by Type of Vehicle

a. Charges for the Use of the Total Highway Network

In Section 3.3 of this report, the most important charges to the users of the highway sector and estimates of fiscal income originated from such charges for years 1991-1993 (Table 3.3.6) where presented. According to reports about of these years about the Government's financial management, and for year 1992 (Table 3.3.7), according to estimates from the General Directorate of Roads.

In the tables quoted above, a clear breakdown of fuel surcharges and subsidies for highway transportation is not presented, neither are presented fiscal incomes originated from value added tax (IVA) related to highway transportation activities, the IVA over imports of motor vehicles and spare parts and accessories for the same, and IVA over fuel consumption.

Based on a more detailed analysis of charges to users of the highway sector, fiscal income originated by highway transportation were identified and projected for the term 1995 to 2014. The Tables 3.12.1, 3.12.2 and 3.12.3 present summaries of such projections, the

first one presents a breakdown by type of charge to the user, the second one by type of vehicle, and the third one presents the average value by vehicle broken down by type of vehicle. The procedures used for identifying and projecting fiscal incomes totalized in those tables is presented in a detailed manner in Annex 3.12.1.

It may be noted that estimations presented in Tables 3.12.1 to 3.12.3, even though they are adequate for this Study, should be considered as approximates to actual values. Such estimates may be improved through generation of a centralized data base about motor vehicles, fuel consumption for transportation and fiscal income collected. Such information would also serve as a base for other studies about highway transportation, besides the identification of fiscal income originated by the highway sector. It is particularly recommended that, through the DGC or through the Vice Ministry of Transport, as part of the Government´s modernization the coordination, studies and necessary administrative improvements be carried out in order to:

FIGURE 3.12.1
Scheme of the Analysis of Fiscal Income and Costs of the Highway Subsector

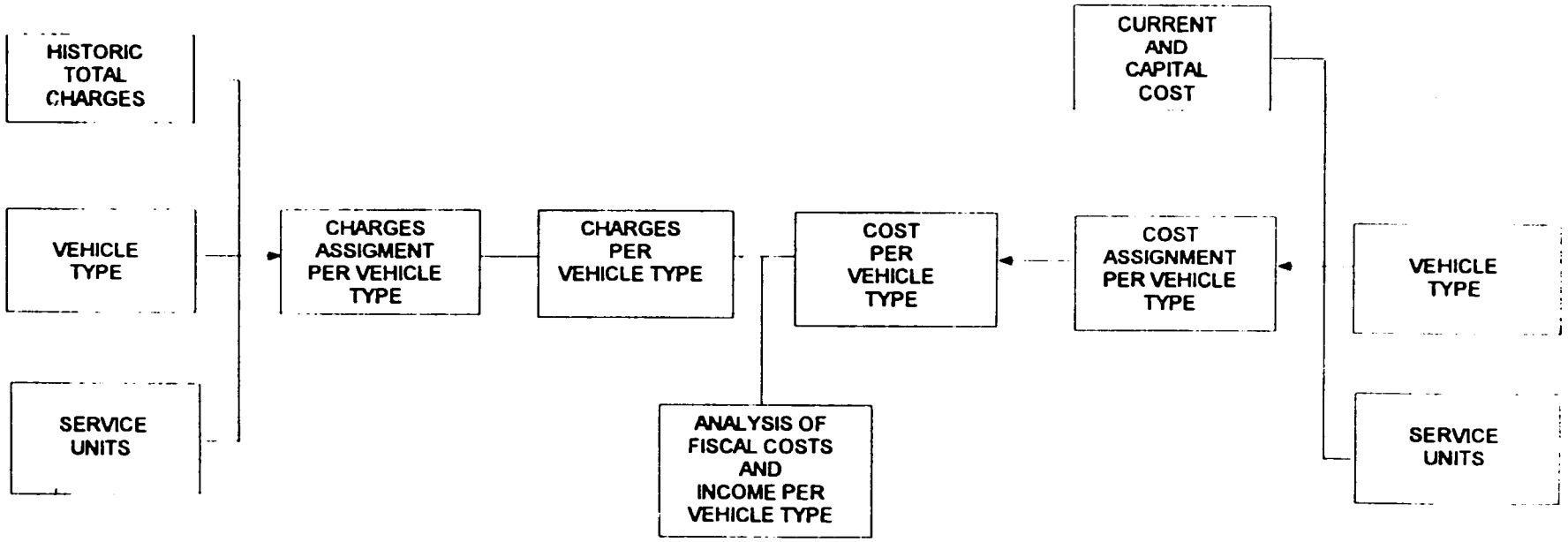

TABLE 3.12.1
Fiscal Income Originated by Highway Transportation Broken down
by Type of Income 1995-2014
(values in millions colones at 1994 prices)

ITEM	1996	1996	1997	1998	1999	2000-2004	2005-2009	2010-1014	TOTAL 1995-2014
Vehicle Registration	63.04	67.67	72.45	77.69	83.34	517.72	740.43	1,064.76	2,687.00
Vehicles Import Duty	221.70	78.29	85.10	92.51	100.55	671.48	1,019.04	1,546.46	3,815.13
IVA to Imported Vehicles	168.50	164.97	177.35	190.68	205.06	1,339.85	1,939.26	2,821.27	7,006.94
Space Parts Import Duty	2.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.43
IVA to Spare Parts Import	24.41	25.78	27.45	29.32	31.29	191.27	267.04	375.35	971.94
Charges to Gasoline	259.61	278.96	299.81	322.30	346.54	2,168.54	3,135.66	4,555.70	11,367.12
MEF Subsidy	(68.86)	(73.74)	(78.97)	(84.59)	(90.65)	(561.21)	(798.56)	(1,142.97)	(2,899.55)
Diesel Subsidy	(200.00)	(200.00)	(200.00)	(200.00)	(200.00)	(1,000.00)	(1,000.00)	(1,000.00)	(4,000.00)
IVA to Gasoline	112.10	120.46	129.47	139.18	149.66	936.58	1,354.49	1,968.13	4,910.07)
IVA to Diesel	72.79	77.66	82.78	88.21	93.91	567.06	766.46	1029.67	2,778.54
Other Charges and Fines	68.86	73.74	78.97	84.59	90.65	561.21	798.56	1,142.97	2,899.55
TOTAL FISCAL INCOME	724.58	613.69	674.44	739.89	810.35	5,392.50	8,222.38	12,361.34	29,539.17

TABLE 3.12.2
Fiscal Income Originated by Highway Transportation Broken down by Type of Vehicle 1995-2014
(Values in Million Colones at 1994 Prices)

ITEM	1995	1996	1997	1998	1999	2000-2004	2005-2009	2010-1014	TOTAL 1995-2014
Automovil	603.38	482.48	524.44	570.08	619.68	4,057.14	6,157.04	9,343.70	22,357 94
Pick-Up	214.40	221.63	233.82	246.68	260.24	1,542.64	2,016.16	2,635.02	7,370 94
Bus	(171.20)	(170.45)	(168.41)	(166.27)	(164.04)	(780.57)	(708.92)	(621.36)	(2,951 22)
Light C2 Truck	11.86	12.04	12.68	13.33	14.02	81.83	105.47	135.86	387 09
Heavy C2 Truck	49.79	41.66	43.83	46.11	48.52	287.22	370.14	476.90	1,355 17
C3 Truck	6.13	6.28	6.60	6.95	7.31	44.37	57.21	73.73	208.58
C3C2 Truck	19.22	20.05	21.48	23.01	24.62	159.87	225.28	317.49	811.02
TOTAL	724.58	613.69	674.44	739.89	810.35	5,392.50	8,222.38	12,361.34	29,539 17

TABLE 3.12.3
Average Fiscal Income by Vehicle Originated by Highway Transportation
Broken down by Type of Vehicle 1995-2014
(Values in Million Colones at 1994 Prices)

ITEM	1995	1996	1997	1998	1999	2000-2004	2005-2009	2010-1014	TOTAL 1995-2014
Automovil	4,315	3,175	3,174	3,175	3,175	3,214	3,214	3,214	3,261
Pick-Up	2,093	2,051	2,051	2,051	2,051	2,064	2,064	2,064	2,063
Bus	(20,054)	(19,180)	(18,205)	(17,266)	(16,363)	(13,845)	(10,290)	(7,383)	(12,433)
Light C2 Truck	2,029	1,958	1,960	1,959	1,959	1,959	1,959	1,959	1,962
Heavy C2 Truck	2,802	2,720	2,721	2,721	2,721	2,760	2,761	2,761	2,755
C3 Truck	3,789	3,690	3,685	3,689	3,688	3,837	3,839	3,839	3,806
C3C2 Truck	7,335	7,145	7,148	7,150	7,145	7,516	7,515	7,516	7,433
AVERAGE	2,613	2,081	2,135	2,187	2,235	2,397	2,701	2,701	2,479

- Systematize the preparation of reports about motor vehicle imports which respond to transport planning needs, in addition to requirements for the control of custom incomes. Such reports should be prepared periodically, breaking down the information about imported units, age of the same, CIF values,duty import fees and IVA per type of vehicles pertinent to transport planning. Similar reports should be prepared for import of spare parts and accessories for transportation vehicles. To the extent possible, such reports should be prepared in a printed manner and magnetic media.

- Systematize the preparation of reports about vehicle registration, breaking down the information of registered units, with detail of units previously registered, new units and discharged units, age and physical characteristics of the same and amounts collected by type of vehicle pertinent to the transport planning. To the extent possible, such reports should be prepared in a printed manner and magnetic media.

- Systematize the preparation of reports about ownership of motor vehicles by individuals and enterprises and fiscal income originated by ownership of them.

- Systematize the preparation of reports about fuel consumption for transportation, gasoline and diesel, prices to consumers and ex-refinery/importer, and surcharges and subsidies to them.

To the extent possible, such reports should be prepared in a printed manner and magnetic media, and be periodical. Such data base, when combined with other pertinent information, such as legislative changes which affect the highway sector, current prices for new and used motor vehicles, average consumption of fuel by type of vehicle, vehicle traffic counting, and weight control, will provide a valuable historic base over which the corresponding analysis may be done.

Following we present the main consideration elements used to prepare the results summarized in Tables 3.12.1 through 3.12.3 and detailed in Annex 3.12.1.

Based on the results summarized in Tables 3.12.1 through 3.12.3, the following general conclusions are obtained in relation to fiscal income originated by highway transportation:

- In general, fiscal collections originated from highway transportation present a balanced situation, without over-concentrating in a single type of charge. Charges include charges for "entering" the system, both initial and annual fixed, such as taxes for importing vehicles (including value added tax, IVA) and charges for the registration of vehicles, and charges for the "use" of the

system, such as surcharges to fuels and taxes over spare parts and accessories for transportation vehicles. Likewise, charges are indexed to the inflation rate, such as the IVA tax, and fixed charges. These last ones must be updated from time to time to avoid loss of real income due to the inflationary effect.

- Globally, it is forecasted a decrease of fiscal income of 111 million colones in 1996, as a consequence of the planned reductions in import taxes for vehicles, which are part of the strategy to globalize the economy[10]. After 1996, it is forecasted that fiscal incomes will grow at an annual compound rate of 8.5% (see Figure 3.12.2).

- In 1995, vehicle import taxes, together with surcharges to gasoline, constitute the main sources of fiscal income. In the future, with the planned reduction in taxes for imports of vehicles, the IVA to vehicles importation and IVA to fuel consumption for transportation, will take a more predominant role.

- The importance of subsidies for preferential consumption of fuels is emphasized (subsidy of diesel consumption for public passenger transportation and fuel subsidy by the public sector and other entities with preferential consumption). In 1995, such subsidies are estimated in a 37% of the total of charges. With the maximum limit imposed to diesel for preferential public passenger transportation of 2.9 million gallons per month, it is projected that such percentage will decrease to a 33.0% of the total income in year 2000, to a 19% in year 2010, and to a 16% in year 2015.

- In relation to charges per type of vehicle, presented in Table 3.12.2, the following results are pointed out:

  - The high participation of fiscal income originated by automobile transportation, which are higher than 80% of total incomes for 1995, and between 75% and 80% during all the analyzed period.

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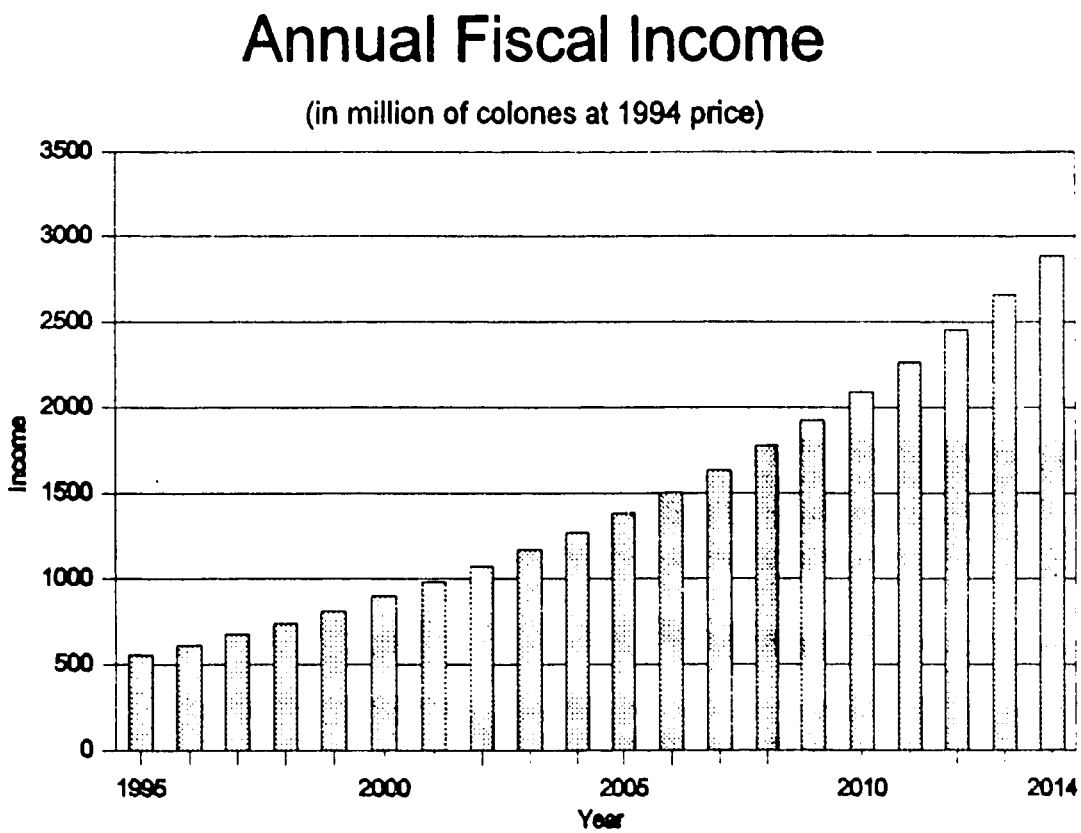
10 At the time this study was completed, the Government of El Salvador was proposing alternatives for fiscal income collection strategies, which include an increase in 40% of IVA and import duties for automobiles up to 50%, including IVA. Since it is not possible to forecast at which will be the final outcome of the different proposals, later on, a sensibility analysis of fiscal income originated by highway transportation is realized, considering the different fiscal strategies.

FIGURE 3.12.2
Projection of Annual Fiscal Income Originated by Highway Transportation



- These are followed in importance by fiscal income originated by pick-up transportation, which reach a 30% of the total income in 1995, even though it is projected these will decrease in importance with time, down to a 20% of total fiscal income in year 2015.

- Negative fiscal incomes (subsidies) originated by bus transportation, which are around 24% of the fiscal income of 1995, are projected to be reduced to a 4% of the fiscal income in year 2015.

- The low participation of the fiscal income originated by truck transportation, which are estimated to be less than 11% of the total income in 1995, will be reduced down to a 7.8% of the fiscal income in year 2015.

- As to average charges per vehicle, presented in Table 3.12.3, the following results are emphasized:

  - It is estimated that the tax reduction for import of vehicles will reduce average fiscal income per vehicle, of each type of vehicle, all together, from 2,613 colones per vehicle in 1995 to 2,081 per vehicle in 1996, a reduction of 20.4%. However, proportionally the greater reduction of average income per vehicle correspond to the automobile, which passes from 4,315 colones per automobile in 1995 to 3,175 colones per automobile in 1996, a reduction of 26.4%.

  - All together, average fiscal income per vehicle were between 2080 colones and 2750 colones during our time of analysis, showing a lower value for 1996 and a greater one for year 2014.

  - According to what it was expected, fiscal income per vehicle originated by truck transportation increase as truck capacity increases, the C2 light trucks presenting lower income per vehicle and the C3S2 the greates income per vehicle.

b. Charges for the Use of Interurban Paved Highways.

In order to estimate fiscal income originated only by transportation on interurban paved highways, the estimated fiscal income for the total of the transport network estimated in the previous section was distributed for the interurban paved highway network based in the ratio of vehicles-kilometers per type of vehicle traveled in interurban paved highways

and the total of vehicles-kilometers. Such proportion varies by type of vehicle and by year of projection.

Fiscal income originated by transportation on interurban paved highways is presented in Table 3.12.4. The procedure used in the identification and projection of fiscal income totalized in such table is presented in a detailed manner in Annex 3.12.1.

3.12.4 Costs of Interurban Paved Highways per Type of Vehicle

In Section 3.8 are presented flows of annual costs for the period 1995-2014, required to carry out the recommended strategy for routine and periodic maintenance of interurban highways. Such strategy presents the best alternative for maintenance both for the entity in charge of providing the roads maintenance, as for the users of them. In this section it is considered that such flows for annual costs for routine and periodic maintenance are applicable for the analysis developed int his section.

To estimate flows of annual costs of ordinary expenses and capital expenses (debt service and GOES contributions to works being carried out and in process for interurban paved roads), projections developed for the calculation of expenditures on the road sector (see Section 3.13) were used. This is summarized in Table 3.12.5 and detailed in Annex 3.12.1.

The following operations were realized in order to estimate maintenance costs originated by transportation on paved interurban highways by type of vehicle:

- Current and routine maintenance costs were distribute among the types of vehicles based on vehicles-kilometers estimated by type of vehicle.
- Periodic maintenance costs were distributed among the types of vehicles based on equivalent axles-kilometers estimated by type of vehicle.
- Other capital costs (debt service for works carried out and in process, GOES contributions for works in process and new proposed works) were distributed based on increase in vehicles-kilometers estimated by type of vehicle.

Table 3.12.6 summarizes the results of operations indicated above. The detail of procedures used in such estimations are presented in Annex 3.12.1.

3.12.5 Comparative Analysis of Fiscal Income and Costs Originated by the Use of Paved Interurban Highways by Type of Vehicle

Table 3.12.7 presents a comparison of fiscal income and costs originated by the use of paved interurban highways, broken down by type of vehicle.

TABLE 3.12.4
Fiscal Income Originated by Transport on Paved Interurban Highways Broken down by Type of Vehicle 1995 - 2014
(Values in Million Colones at 1994 Prices)

ITEM	1995	1996	1997	1998	1999	2000-2004	2005-2009	2010-2014	TOTAL 1995-2014
AUTOMOVIL	196.10	158.74	175.16	193.26	213.17	1,460.83	2,384.92	3,898.49	8,680.67
PICK-UP	156.08	158.91	165.31	171.69	178.52	1,012.60	1,231.66	1,499.70	4,574.47
BUS	(68.14)	(67.84)	(67.03)	(66.18)	(65.29)	(310.36)	(281.30)	(245.93)	(1,172.07)
LIGHT C2 TRUCK	7.32	7.43	7.84	8.25	8.68	50.74	65.35	83.93	239.54
HEAVY C2 TRUCK	30.02	30.66	32.22	33.89	35.61	210.45	270.26	346.78	989.89
C3 TRUCK	4.09	4.23	4.48	4.75	5.02	30.91	40.27	51.98	145.73
C3S2 TRUCK	13.18	13.85	14.93	16.06	17.23	112.67	159.17	223.42	570.51
TOTAL	338.65	305.98	332.91	361.72	392.94	2,567.84	3,870.33	5,858.37	14,028.74

Source: Frederic R. Harris, Inc.

TABLE 3.12.5
Projections of Annual Costs of Paved Interurban Highways 1995 - 2014
(Values in Million Colones at 1994 Prices)

ITEM	1995	1996	1997	1998	1999	2000-2004	2005-2009	2010-2014	TOTAL 1995-2014
CURRENT COST (1)									
HIGHER ADMIN. & PLANNIF. (2)	18.00	18.90	19.85	20.84	21.88	126.95	162.09	206.88	595.39
DGC DIRECT. / COORDIN.(3)	39.75	41.74	43.83	46.02	48.32	280.38	357.85	456.74	1,314.63
EMERGENCY MAINT (4)	20.25	21.26	22.32	23.44	24.61	142.78	182.24	232.56	669.46
AME (5)	8.70	9.14	9.60	10.08	10.58	61.39	78.34	99.95	287.78
TOTAL CURRENT COSTS	86.70	91.04	95.60	100.38	105.39	611.50	780.52	996.13	2,867.26
CAPITAL COSTS									
PAVED ROADS MAINTENANCE									
RUTINARY	53.03	51.68	51.69	51.69	51.71	260.49	259.76	260.09	1,040.13
PERIODIC	212.32	157.53	64.57	54.24	27.34	514.66	623.33	489.57	2,143.57
DEBT SERVICE, COMPLETED WORKS	106.68	103.51	99.95	93.67	93.67	427.85	367.10	361.44	1,653.87
DEBT SERVICE, ONGOING WORKS	0.00	39.40	100.78	172.60	228.48	1,375.80	1,375.80	1,375.80	4,668.66
GOES PATICIPATION	98.27	130.49	149.02	135.09	127.33	0.00	0.00	0.00	540.20
PROPOSED PROJECTS	0.00	0.00	0.00	0.00	0.00	50.00	1,907.00	2,364.00	4,321.00
TOTAL CAPITAL COSTS	470.30	482.61	466.02	507.30	528.53	2,628.80	4,532.99	4,850.89	14,467.43
TOTAL COSTS	557.00	573.65	561.62	607.68	633.92	3,240.30	5,313.51	5,847.02	17,334.69

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(1) All current expenses are supposed to be growing at an annual rate of 5%

(2) Based on average expenses in 1992 and 1993 (according to report of the Government's Financial Administration), increased to 1994 prices by a 10% index.

(3) Taken from financial projection carried out by the DGC

(4) This item is to cover emergency maintenance works, not covered by contracted maintenance. Taken from financial projection carried out by the DGC, reduced by an 80%

(5) Based on 1993 expenses (according to report of the Government's Financial Administration), increased to 1994 prices by a 10% and reduced in a 50%

Source: Frederic R. Harris, Inc.

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TABLE 3.12.6
Costs Originated by Transport on Paved Interurban Highways Broken down
By Type of Vehicle 1995 - 2014
(values in million colones at 1994 prices)

ITEM	1995	1996	1997	1998	1999	2000-2004	2005-2009	2010-2014	TOTAL 1995-2014
AUTOMOVIL	138.22	177.43	222.67	257.48	291.92	1,388.41	2,771.28	3,490.01	8,737.43
PICK-UP	111.11	126.84	144.29	154.71	163.36	691.71	960.73	914.17	3,266.93
BUS	77.67	68.20	50.60	50.66	46.55	283.33	366.46	321.77	1,265.25
LIGH C2 TRUCK	15.89	17.76	19.48	21.06	22.24	98.80	145.85	143.28	484.36
HEAVY C2 TRUCK	160.79	136.35	91.16	90.19	79.07	563.29	758.20	680.21	2,559.25
C3 TRUCK	18.79	16.27	11.25	11.19	9.96	68.97	93.31	83.29	313.04
C3S2 TRUCK	34.56	30.71	22.13	22.60	20.73	145.72	218.25	213.15	707.87
TOTAL	557.00	573.65	561.62	607.68	633.92	3,240.30	5,313.51	5,847.02	17,334.69

SOURCE: FREDERIC R. HARRIS,INC.

TABLE 3.12.7

Fiscal Income and Costs Originated on Transport on Paved Interurban Highways Broken down by Type of Vehicle 1995 - 2014
(Values in Million Colones at 1994 Prices)

ITEM	1995	1996	1997	1998	1999	2000-2004	2005-2009	2010-2014	TOTAL 1995-2014
AUTOMOVIL									
INCOME	196.10	158.74	175.16	193.26	213.17	1,460.83	2,384.92	3,898.49	8,680.67
COSTS	138.22	177.43	222.67	257.48	291.92	1,388.41	2,771.28	3,490.01	8,737.43
SUPERAVIT (DEFICIT)	57.88	(18.69)	(47.51)	(64.22)	(78.75)	72.42	(386.36)	408.48	(56.76)
PICK-UP									
INCOME	156.08	158.91	165.31	171.69	178.52	1,012.60	1,231.66	1,499.70	4,574.47
TOTAL COSTS	111.11	126.84	144.29	154.71	163.36	691.71	960.73	914.17	3,266.93
SUPERAVIT (DEFICIT)	44.97	32.07	21.02	16.98	15.16	320.89	270.93	585.53	1,307.54
BUS									
INCOME	(68.14)	(67.84)	(67.03)	(66.18)	(65.29)	(310.36)	(281.30)	(245.93)	(1,172.07)
TOTAL COSTS	77.67	68.20	50.60	50.66	46.55	283.33	366.46	321.77	1,265.25
SUPERAVIT (DEFICIT)	(145.81)	(136.04)	(117.63)	(116.84)	(111.84)	(593.69)	(647.76)	(567.70)	(2,437.32)
LIGHT C2 TRUCK									
INCOME	7.32	7.43	7.84	8.25	8.68	50.74	65.35	83.93	239.54
TOTAL COSTS	15.89	17.76	19.48	21.06	22.24	98.80	145.85	143.28	484.36
SUPERAVIT (DEFICIT)	(8.57)	(10.33)	(11.64)	(12.81)	(13.56)	(48.06)	(80.50)	(59.35)	(244.82)

TABLE 3.12.7 (...continued)

Fiscal Income and Costs Originated on Transport on Paved Interurban Highways Broken down by Type of Vehicle 1995 - 2014

(Values in Million Colones at 1994 Prices)

HEAVY C2 TRUCK									
INCOME	30.02	30.66	32.22	33.89	35.61	210.45	270.26	346.78	989.89
TOTAL COSTS	160.79	136.35	91.16	90.19	79.07	563.29	758.20	680.21	2,559.25
SUPERAVIT (DEFICIT)	(130.77)	(105.69)	(58.94)	(56.30)	(43.46)	(352.84)	(487.94)	(333.43)	(1,569.36)
C3 TRUCK									
INCOME	4.09	4.23	4.48	4.75	5.02	30.91	40.27	51.98	145.73
TOTAL COSTS	18.79	16.27	11.25	11.19	9.96	68.97	93.31	83.29	313.04
SUPERAVIT (DEFICIT)	(14.70)	(12.04)	(6.77)	(6.44)	(4.94)	(38.06)	(53.04)	(31.31)	(167.31)
C3S2 TRUCK									
INCOME	13.18	13.85	14.93	16.06	17.23	112.67	159.17	223.42	570.51
TOTAL COSTS	34.56	30.71	22.13	22.60	20.73	145.72	218.25	213.15	707.87
SUPERAVIT (DEFICIT)	(21.38)	(16.86)	(7.20)	(6.54)	(3.50)	(33.05)	(59.08)	10.27	(137.36)
TOTAL									
INCOME	338.65	305.98	332.91	361.72	392.94	2,567.84	3,870.33	5,858.37	14,028.74
TOTAL COSTS	557.00	573.65	561.62	607.68	633.92	3,240.30	5,313.51	5,847.02	17,334.69
SUPERAVIT (DEFICIT)	(218.35)	(267.67)	(228.71)	(245.96)	(240.98)	(672.46)	(1,443.18)	11.35	(3,305.95)

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This table results from the estimations of fiscal income and costs described in the two previous sections. The following conclusions are derived from this table:

- Automobiles, even though generate relatively high fiscal income, superior to the total average per vehicle, and their impact over periodic maintenance costs for paved interurban highways is low, result with a fiscal deficit in the order of 60 million colones (at 1994 prices) during the analyzed period, 1995 to 2014, an average of 3 million colones per year. Considering the annual average of 345,800 thousand automobiles, the average deficit per automobile is less than 9 colones per year.

- Pickups, due to their low impact on costs of paved interurban highways, generate a superavit of more than 1,300 million colones for the period under analysis, an average of 65 millions per year. Considering an average per year of 178,6000 units, the average superavit per pick up is more than 360 colones per year.

- For buses, due to the preferential diesel price utilized for public passenger transportation, generate negative fiscal income (subsidies), which together with the costs that buses generate when using paved interurban highways, result in a fiscal deficit for this type of vehicle of approximately 2,450 million colones (at 1994 prices) for the period under analysis, an average of 123 million colones per year. Considering an average per year of 12,850 units, the average deficit per bus is more than 9,570 colones per year, being higher during the first years, then decreasing in relation to the decrease of the average subsidy per unit.

- All together, a deficit of 3,300 million colones is observed (at 1994 prices) for the period under analysis, an average of 165 million colones per year. For the entire period, this deficit is covered by the superavits observed in other road subsectors, and globally, as is indicated in the next section, the road sector presents a superavit.

3.12.6 Conclusions

Two level of crossed subsidies have been identified in the road sector: at subsectors level and at the level of types of vehicles in the subsector of paved interurban highways.

At subsectors level, it is observed that the paved interurban highway subsector generates fiscal income lower than the maintenance, rehabilitation and expansion costs of the paved interurban highway network, while the road sector in general presents a superavit. This result is to be expected, since, comparing with urban transportation, interurban highways generate relatively low income per kilometer, of road, while their level of costs per kilometer tend to be higher due to the high heavy traffic that use them. Although a similar

analysis was not carried out for non-paved roads, it is to be expected that these present a higher deficit.

At the level of the paved interurban highway subsector, it is observed that buses and trucks show substantial deficits. This is due in part, to the greater impact of heavy vehicles over highway maintenance costs. But also, to differentials observed between import duties of automobiles and capital vehicles and the difference in prices between fuel, gasoline and diesel, particularly in relation to diesel preferential prices for public passengers transportation.

Although, differentials in import duties may be justified as promoting the transportation sector and economy in general, the differentials in fuel prices could be introducing distortions to allocation of resources without deriving the benefits expected from subsidies

3.13 Financial Projections for the Road Sector

3.13.1 Fiscal Income Originated from the Use of the Road Sector

Fiscal income originated by transportation using paved interurban highways were presented in Figure 3.12.2 and Table 3.12.4 and analyzed in the previous section.

3.13.2 Costs of the Road Sector

Projections developed for the calculation of expenses for the road sector were used in order to estimate flows of annual current costs and capital costs (debt service and GOES contributions to works on paved interurban highways being carried out and in process and proposed).

Flows of annual costs for the period 1995-2014 were presented in Section 3.8, which were required to carry out the recommended strategy for routine and periodic maintenance of interurban highways. Such strategy presents the best maintenance alternative both for the agency in charge of providing road maintenance, and for the users of roads. It is considered that flows of annual costs for routine and periodic maintenance are applicable to the analysis developed in this section.

Table 3.13.1 presents projections of flows of annual costs for the period 1995-2014 for the road sector as a whole. Such projections are based on the following considerations:

- For current costs, the values of the last two reports about the Government's Financial Management (1992 and 1993) were used and increased in a 10% to calculate an annual value at 1994 prices, and the financial projections from the DGC, applicable to each item, according to the following criteria:

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TABLE 3.13.1

Projections of Annual Costs for the Road Sector - 1995 - 2014

(values in million colones at 1994 prices)

ITEM	1996	1998	1997	1998	1999	2000-2004	2005-2009	2010-2014	TOTAL 1995-2014
CURRENT COST (1)									
HIGHER ADMIN. & PLANNIF. (2)	30.00	31.50	33.08	34.73	36.47	211.56	270.03	344.63	992.00
DGC DIRECT/COORD. (3)	53.00	55.65	58.43	61.35	64.42	373.75	477.04	608.88	1,752.52
EMERG. MAINT. (4)	27.00	28.35	29.77	31.26	32.82	190.40	242.97	310.12	892.69
DUA DIRECT/MAINT. (5)	36.00	37.80	39.69	41.67	43.75	253.85	323.96	413.42	1,190.14
URBAN WORKS COST (5)	44.00	46.20	48.51	50.94	53.49	310.34	396.05	505.45	1,454.98
AME (6)	14.50	15.23	15.99	16.79	17.63	102.29	130.56	166.65	479.64
TOTAL CURRENT COSTS	204.50	214.73	225.47	236.74	248.58	1,442.19	1,840.61	2,349.15	6,761.97
CAPITAL COST									
URBAN WORKS	100.00	105.00	110.25	115.76	121.55	705.24	900.14	1,148.86	3,306.80
NON PAVED ROADS MAINT.									
RUTINARY	62.45	62.71	62.72	62.71	57.62	278.32	278.32	278.32	1,143.17
PERIODIC	0.00	0.00	0.00	0.00	0.00	476.97	476.97	476.97	1,430.91
PAVED ROADS MAINT.									
RUTINARY	53.03	51.68	51.69	51.69	51.71	260.49	259.76	260.09	1,040.13
PERIODIC	212.32	157.53	64.57	54.24	27.34	514.66	623.33	489.57	2,143.57
DEBT SERVICE COMPLETED WORKS	132.45	129.28	125.72	119.44	119.44	556.70	495.95	479.49	2,158.47
DEBT SERVICE ONGOING WORKS	0.00	54.30	126.90	210.40	275.08	1,637.45	1,637.45	1,637.45	5,579.03
GOES PARTICIPATION	189.96	207.16	230.34	205.22	199.45	0.00	0.00	0.00	1,035.13
PROPOSED PROJECTS	0.00	0.00	0.00	0.00	0.00	50.00	1,907.00	2,364.00	4,321.00
TOTAL CAPITAL COST	750.21	767.66	772.20	822.47	852.19	4,479.83	6,578.92	7,134.74	22,158.21
TOTAL COSTS	954.71	982.39	997.67	1,059.21	1,100.77	5,922.02	8,419.53	9,483.89	28,920.18

(1) All current expenses are supposed to be growing at a actual annual rate of 5%

(2) Based on average expenses in 1992 and 1993 (according to report of the Government's Financial Administration), increased to 1994 prices by a 10%

(3) Taken from financial projection carried out by the DGC

(4) This item is to cover emergency maintenance works, not covered by contracted maintenance. Taken from financial projection carried out by the DGC, reduced in an 80%

(5) Based on expenses of 1993 (according to report of the Government's Financial Administration), increased to 1994 prices by a 10%

(6) Based on expenses of 1993 (according to report of the Government's Financial Administration), increased to 1994 prices in a 10% and reduced in a 50%

(7) For 1995, based on expenses of 1993 (according to report of the Government's Financial Administration), increased to 1994 prices in a 10% and with an annual growth rate of 5% for the following years

- For 1995, were used estimated values as detailed below. For the following years, it was considered an annual growth rate of 5%.

- Superior administration and planning. It's based on average expenses reported in 1992 and 1993, increased in a 10% to update to 1994 prices.

- Direction and coordination of the DGC. It's based in projections from the DGC.

- Emergency maintenance. This item is to cover emergency maintenance works, not covered by maintenance contracts assumed in the projections. It's based in financial projections carried out by the DGC, reduced in an 80%, to take into account the introduction of maintenance by contract.

- Direction and coordination of DUA. It's based on expenses reported in 1993, increased in a 10% to update to 1994 prices.

- AME. It's based on expenses reported in 1993, increased in a 10% to update to 1994 prices and reduced in an 50%, to take into account the introduction of maintenance by contract.

- For capital costs, the values of the last two reports about the Government's Financial Management (1992 and 1993) were used and financial projections from the DGC, applicable to each item, according to the following criteria:

  - Urbanization works. For 1995, is based on average expenses reported in 1992 and 1993, increased in a 10% to bring it to 1994 prices. For the following years, an annual growth rate of 5% was considered .

  - Maintenance of non paved works. For routine maintenance, were used projections from the DGC for the 1995-1999 period and for the following years estimates made under this Study. For periodic maintenance, for the 1995-1999 period is being covered by works in process and for the following years projections carried out under this Study were used.

  - Maintenance of paved works. The projections carried out in this Study were used.

- Debt service for realized works. It is based on the financial conditions of works realized. Table A.3.12.21 of Annex 3.12.1 shows annual flows for debt service of realized works, estimated for the total road network.

- Debt service for ongoing woks. It is based on the programmed investment, by funding source, programmed by the DGC for the 1995-1999 period. Table A.3.12.23 of Annex 3.12.1 shows the annual investment flows for works in process (1995-1999 period), estimated for the total road network and for paved interurban roads respectively, and Table A.3.12.21 show annual flows for debt service for works in process estimated for the all the road network. Financial conditions assumed by the funding source are the following:

  ✓ IDB: For 1995, 142.6 million colones non utilized of existing loans at a annual service rate (interests and commissions) of 2.5% and a payment term of 25 years. The balance for such year and the following years, at an annual service rate of 8.0% and a payment term of 25 years.

  ✓ BCIE: At an annual service rate of 9.75% and a payment term of 20 years.

  ✓ AID: grants.

  ✓ JAPAN: For 1995, grants. For the following years, at a service rate plus an adjustment for changes in the exchange rate of foreign currency of 9.75% and a payment term of 25 years.

  ✓ BIRF: At an annual service rate of 7.97% and a payment period of 25 years.

- GOES contributions to works in process. Is based in investments by funding sources programmed by the DGC for the 1995-1999 term.

- Proposed works. Is based in works proposed by this Study. This item was not considered 100% applicable to paved interurban roads.

Based on Table 3.13.1, the following conclusions with relation to costs projections for the road sector are given:

- As a whole, it is forecasted that costs for the road sector will gradually grow in the next years (see Figure 3.13.1), as the national road system is rehabilitated and expanded.

- Participation of current costs remain relatively constant, between a fifth and a fourth fraction of the total costs of the road sector.

- Debt service for works already carried out decreases relatively little, reflecting the importance of debts acquired in the last three years, whose service continues along the period under analysis.

- The most significative increases in costs of the road sector correspond to increases in debt service for works in process, which increase substantially starting the next five years, and the new proposed works starting in the 2005-2009 years.

3.13.3 Comparison of Income and Costs of the Road Sector

In order to compare fiscal income originated by the use of highways with costs to provide for the national road system, Table 3.13.2 presents annual and quinquennial projections for fiscal income and costs of the road sector, for the 1995-2014 term.

In this table it is observed, that while for all the period under analysis de road sector presents a positive balance (superavit) of a little more than 600 million colones (at 1994 prices), for the first fifteen years it presents a negative balance of more than 2,250 million colones. For the 1995-1999 quinquennium, the situation is more critical, showing a deficit higher than 1,500 million colones.

The above projections point out the need for funding mechanisms, to make a bridge between the first years in which funds are required and the future years in which the fiscal capacity will exist to cover expected costs. Alternative mechanisms to overcome the negative balances projected are shown in Chapters 8 and 10.

FIGURE 3.13.1
Projection of Annual Costs for the Road Sector

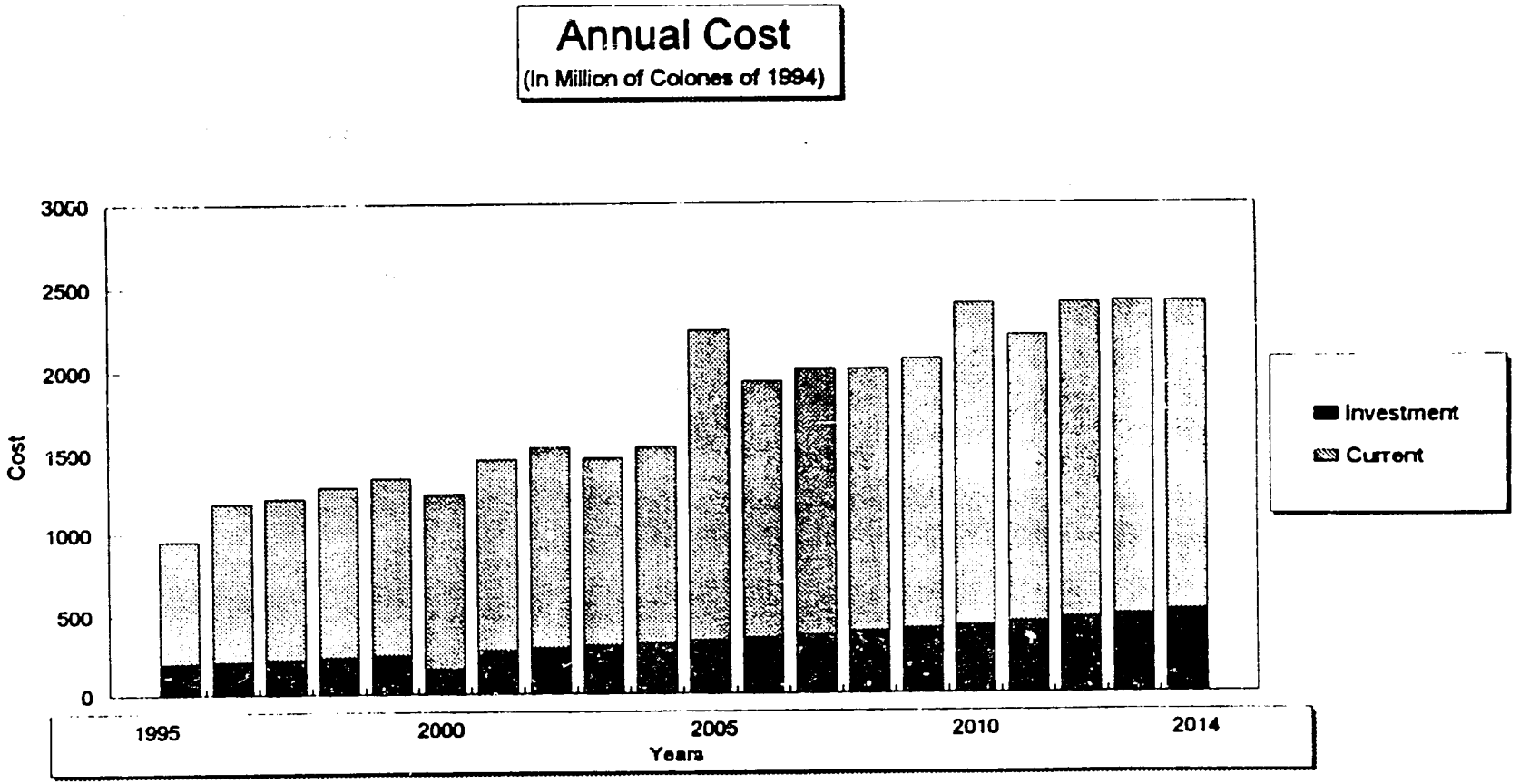

TABLE 3.13.2
Projections of Fiscal Income and Costs for the Road Sector 1995 - 2014
(values in million colones at 1994 prices)

ITEM	1995	1996	1997	1998	1999	2000-2004	2005-2009	2010-2014	TOTAL 1995-2014
FISCAL INCOME	724.58	613.69	674.44	739.89	810.35	5,392.50	8,222.38	12,361.34	29,539.17
COST									
CURRENT COSTS	204.50	214.73	225.47	236.74	248.58	1,442.19	1,840.61	2,349.15	6,761.97
CAPITAL COSTS	750.21	767.66	772.20	822.47	852.19	4,479.83	6,578.92	7,134.74	22,158.21
TOTAL COSTS	954.71	982.39	997.67	1,059.21	1,100.77	5,922.02	8,419.53	9,483.89	28,920.18
SUPERAVIT (DEFICIT)	(230.13)	(368.70)	(323.23)	(319.32)	(290.42)	(529.52)	(197.15)	2,877.45	618.99

3.13.4 Financial Projections of the General Directorate of Roads

The General Directorate of Roads (DGC) has the responsibility for maintenance, rehabilitation and expansion of the interurban road system, both paved as non paved, including within the urban perimeters.

For its operation and maintenance activities carried out directly by the DGC (that is, not giving under contract), the DGC depends on budgetary allocations done annually for all the Central Government. For capital works the DGC reckons with extraordinary resources, through foreign loans, from mainly from the multilateral banking agencies, and contributions from the Government of El Salvador as counterpart of external loans.

In the last years experience has been that while the Central Government timely contributes for local counterpart funds for projects being carried out with external loans, other programs, notably road maintenance, is reduced in its execution due to budgetary funding cuts.

In order to identify the magnitude of the budgetary fund deficiency for interurban road maintenance, both paved as non paved, Table 3.13.3, compares for the 1995-1998 period, the financial projections for road maintenance, prepared by the DGC based on budgetary allocations, with the requirements of funds defined by this Study for maintenance works, presented in the previous section. The deficit may be noted in the table to be about 430 million colones (at 1994 prices) for the four years.

Not having funds available in a secure and effective form to cover the indicated deficit, the routine and periodic maintenance program proposed in this Study can not be carried out 4and costs for the road sector will be even higher than the previously indicated.

TABLE 3.13.3
Projections of Budget Allocations and Annual Requirements for the Sector of Highway Maintenance
(In Million Colones at 1994 Prices)

ITEM	1995	1996	1997	1998
Budget Allocation (1)	147.80	155.19	162.85	171.10
Requirements (2)				
Emergency Maintenance	27.00	28.35	29.77	31.28
Non-Paved Roads Maintenance				
Routine	62.45	62.71	62.72	62.71
Periodic	0.00	0.00	0.00	0.00
Paved Roads Maintenance				
Routine	53.03	51.68	51.69	51.69
Periodic	212.32	157.53	64.57	54.24
TOTAL REQUIREMENTS	354.80	300.27	208.76	199.91
SUPERAVIT (DEFICIT)	(207.00)	(145.08)	(45.81)	(28.81)
TOTAL FOR 1995-1998				(426.70)

(1) Based on the 1995 DGC Financial Projections and projected at a 5% growth rate
(2) Taken from Table 3.13.1

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3.14 Conclusions and Recommendations

The actions that the DGC is taking to modernize the management of the road network must be complemented with decisions about the institutional organization and definition of functions to guarantee the efficiency of investments and that the quality of the road network infrastructure will be maintened.

To this purpose as a first step it is necessary to conform within the DGC, or any other entity that will operated on its behalf, a solid organization with decision making power on how resources should be invested on the road infrastructure. It must be based in an administrative management system , which in the Salvadorean case, is going to be given to a consulting firm in the near feature.

To obtain the advantages of the SIAMV system, as a road network planning management tool, it is necessary to conform a working team that will become familiar with the SIAMV system, its concepts, scope and limitations to get full benefits on the utilization of the system.

The process of technology transfer, from the consulting firm to the DGC should take at least 4 or 5 professionals, engineers and economist, to receive full capacitation to utilize the SIAMV system efficiently.

On the other hand, and while a voluntary compensatory retirement process is carried out by the DGC and AME, it is also absolutely necessary to attend the financial needs for highway and equipment maintenance. If this financing is not attended, it is not possible to think that the future utilization of the SIAMV tool will offer tangible results, because no road network administration can exists without resources for its adequated maintenance.

3.14.1 Application of Resources for Road Infrastructure at a Short and Median Term

The immediate government effort, related to resources utilization within existing budgetary limitations, should be directed towards:

- Avoiding accelerated deterioration processes in roads with greater traffic volume per lane -which generate the greatest economic benefits when they are in good condition- and not necessarily to roads of major category. This means to advance reinforcement works for roads in good or fair condition or rehabilitation of the ones in advanced deteriorated condition.

- Advance a pilot routine maintenance program for roads which have just been repaired within the ongoing reahibilitation/reconstruction programs.

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- Make the budgetary provisions to revert the underfinancing trends for road maintenance, based on benefits this generates to the country's economy.

- Insure adequate funding to periodically update the road inventory and its data base about the condition of the network. This should be a routine and permanent task of good technical quality, which will allow to carry out a follow-up of each inventoried section, with the purpose to prevent the needs for maintenance works and facilitate the calibration of the deterioration models defined in the SIAMV. In this way, in the future the accuracy of the road deterioration simulations should increase and the estimates of benefits of requerided work.

- Advance training programs for the professional personnel in areas such as road maintenance planning, quality control for road construction or the determination of the maintenance condition of the roads, so that they will be better trained to carry out the administration tasks of the road network and will be able, as representative of the public interests, to achieve greater quality level of the contracted works.

3.14.2 General Policies

In matters of general policy about future management and administration of the road network, we have:

- To establish a pavement management system that will provide permanently roads in good condition would generate savings in the order of US$ 520 million in 20 years . The magnitude of this figure is such, that by itself justifies the adoption of a well oriented road maintenance program as a first priority for the GOES.

- To adopt the maintenance plan based on the savings that may generate in vehicle operation costs, it is recommendable to complement the information used by the SIAMV to determine the condition index of the roads with rugosity and sliding resistance measurements. Since the model for vehicle operation costs used by the SIAMV is the VOC of HDM III, based on the geometry of roads and rugosity of its surfaces to calculate operation costs, the rugosity measurement equipment required, is fully justified. Also If, in a near future the road the road network maintenance is given in concessions to private enterprises, the acquisition of the equipment is essential to be able to control road quality.

If a rugosimeter as the Bump Integrator Unit is acquired, designed by TRRL from England, which operates with a speed of 23 km/hour, it is possible to evaluate 100 kilometers per day; so the rugosity of the total paved network can be measured in less than a month.

Other less efficient equipment and not so expensive as the Hi-Lo, which is a mobile rule to measure surface unevenness, allow yields up to 30 kilometers per day. Its cost is less than 3,000 dollars. It requires only a technician to operate it and a vehicle with a driver.

The Mays Meter is a two-wheel trailer to be attached to a normal automobile. It registers directly the vertical movements produced by road irregularities. Allows an approximate yield of 250 kilometers per day. A technician is needed to operate it and a driver for the automobile. Its cost is around 20,000 dollars.

The MuMeter is a trailer designed to measure sliding resistance on wet roads. Should be attached to a vehicle and carry a water tank. It has a yield between 180 and 300 kilometers per day. Its costs around 40,000 dollars.

- For the data base of the road maintenace program that should be adopted, the traffic countting is essential and the information about weights transmitted by commercial vehicles on the roads. In the first case, if will be convenient to systematize the taking and processing of data, which is currently done in a manual form. Information from weighing stations could be available in short time if the fines were eliminated, because then there will not be any reason to incorrectly report information as it happens now. The processing of the mentioned information must be done as to obtain the must reliable data to help in the design of pavements and planning maintenance.

- Concerning non-paved raods, an option to maintain them that produces important benefits is recommended. This consists in providing routine maintenance and passing the motorgrader each time 6,000 and 8,000 vehicles have passed by these roads. The frequency of the motorleveller should increase during the rainy season.

3.14.3 The Axel Weight Control System

- The magnitude, construction and equipment of a new weight control system by axle for commercial vehicles, managed under contract by private enterprises, is a decision which requires economic analysis which have not been carried out. Therefore, this should not proceed while, these analysis are not available and show real benefits for the economy of El Salvador.

- The introduction of a strict control system, without existing a common regulation in the Central American area, is not timely and only creates a

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conflicting element for the economic integration of the Central American States.

- Demands from credit institutions about this matter are based on theories that are under discussion and evaluation for he past 15 years. It has been proved that it gives more advantages to construct stronger pavements that controlling loads and that the last is difficult and expensive.

- In El Salvador , load limits in force are in agreement with the pavement estructures designed in the past. However, the pavement structures are under-designed for the future traffic demand. Therefore the program in process for road reconstruction and rehabilitation should be revised to provide stronger pavements.

- The design of future pavements should be of superior specifications based in number of load pattern repetitions, taking into consideration that even if the new weight control system was established in the future, it it not easy to guarantee its efficiency to avoid overloading.

- It is not convenient to introduce modifications to authorized load limits in the near future. This option could be considered feasible only if market trends indicate higher loads and a consisting road maintenance program is established.

- Even though the existing weight control system is not effective to prevent overload, it has an important effect over medium load levels for trucks, which are kept within very reasonable margins. This, in the consultants opinion, is due to the existence of the regulation itself and the government presence at roads through the weighing system in operation.

- Transporters are the most affected by bad road conditions, they are not the cause.

- The lack of road maintenance programs is the cause of the advanced deterioration of roads.

- The recommendation of not building the new weight control system without having economic studies to justify it, requires that the existing system continues operating without privatization.

The purpose of keeping the existing system should be to generate the necessary information to analyze the convenience of introducing a strict private control system and not to control overload. If it is decided to carry out economic studies about the

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convenience of the weight control system, it is necessary to stop levying fines to obtain reliable information at the control stations.

3.14.4 Privatization

In relation to the privatization of the tasks which are responsibility of the General Directorate of Roads and the Administration of Machinery and Equipment it is recommended:

- To generate the necessary conditions to privatize routine maintenance of the paved and non-paved road network, through contracts with micro-enterprises formed by former employees of the General Directorate of Roads or personnel resident at the zones of the roads to be maintained.

To achieve this objective it is recommend to look for support from international assistance agencies such as the United Nations Development Program, the Agency for International Development or the Labor International Organization.

- Reinforce the assimilation and assembling process of the Integrated Road Administration System - SIAMV - by the General Directorate of Roads, so that it has the necessary foundation to start a road maintenance program based on sound technical-economical considerations.

- Prepare technical and economical support documents to promote the change of the road maintenance funding system. These documents must have as objective to show legislators the benefits that a good maintenance program has for the country's economy, in vehicle operating cost savings, high rate of return for the investments and less resources needs for the sector.

- In the case of non paved roads, it is suggested to look for funding mechanisms to provide periodic maintenance to the roads with greater traffic volumes, allowing the contracting of works with private enterprises.

- In relation with the construction and transport equipment that the DGC and AME have, it is suggested to sell them in public auctions to the best bidder, as the maintenance responsibilities are being transferred to the private sector and keep the machinery required to attend road emergencies and those roads that due to their own characteristics may not be excluded from government responsibility.

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3.14.5 Charges to Road Users

The identification of fiscal income for users charges shows that the automobile, pick up and track transportation generate positive results while bus transportation generates large negative results.

It is needed to systemize all information regarding user charges, such as: importation of vehicles, registry, ownership, gasoline consumption and prices, etc. This information must be in a printed manner and magnetic media.

Regarding fiscal income and costs for the use or the road network, this Study shows that for the study period there is a deficit of about 3,300 million of colones (at 1994 prices), that is an average deficit of 165 million colones per year. However this deficit is covered by a superavit observed in other road subsectors and the overall sector shows a superavit.

The analysis of fiscal income and costs for the road sector shows that if the overall balance for the study period is posite (about 600 million colones at 1994 prices) the first fifteen years shown a negative balance of about 2,250 million colones. The period 1995-1999 is the most critical with a deficit of about 1,500 million colones. This means that it will be neccessary to generate a bridge financing to cover these deficits until the income from the last five years of the Study cover such deficits.

ANNEX 3.2.1

DATA COLLECTED AT THE WEIGHING STATIONS

MUESTREO DE PESAJES DE CAMIONES
VEHICULOS C2

	CARGA			SOBRECARGA			VEHICULOS
	EJE 1	EJE 2	TOTAL	EJE 1	EJE 2	TOTAL	INFRACTORES
ESTACION LOS CHORROS - 18/11/94							
	3750	8700	12450				
	4500	8600	13100				
	4600	10450	15050	100	1450	1550	1
ESTACION CHALCHUAPA - 18/11/94							
	4500	11450	15950		2450	2450	1
	2100	9250	11350		250		1
	3450	9900	13350		900		1
	2850	8650	11500				
	3750	8000	11750				
	4450	10350	14800		1350	1300	1
	1800	3900	5700				
	2900	6950	9850				
	4400	9750	14150		750	650	1
	3600	5900	9500				
	4200	4800	9000				
ESTACION ACAJUTLA - 18/11/94							
	4000	7300	11300				
	4800	10700	15500	300	1700	2000	1
	5100	5200	10300	600			1
	3900	12800	16700		3800	3200	1
	4700	11200	15900	200	2200	2400	1
	6300	10850	17150	1800	1850	3650	1
	5100	11300	16400	600	2300	2900	1
	4700	10400	15100	200	1400	1600	1
ESTACION LA LIBERTAD - 23/11/94							
	3950	9900	13850		900	350	1
	4000	7200	11200				
ESTACION KM 22 - 23/11/94							
	4200	7500	11700				
	4150	5800	9950				
	4600	8600	13200	100			1
	4900	8600	13500	400			1
	5600	12600	18200	1100	3600	4700	1
	3200	5000	8200				
	4300	9400	13700		400	200	1
	3400	6100	9500				
	5900	10600	16500	1400	1600	3000	1
	3700	9100	12800		100		1
	2500	8500	11000				
	4800	9500	14300	300	500	800	1
	3500	6000	9500				
ESTACION METAPAN - 29/11/94							
	4600	9800	14400	100	800	900	1
	4000	14400	18400		5400	4900	1
SUMAS	160750	345000	505750	7200	33700	36550	23
%				4.5%	9.8%	7.2%	
VEHICULOS INFRACTORES				14	20	17	
EXCESO PROMEDIO (kilos)				514	1685	2150	

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MUESTREO DE PESAJES DE CAMIONES
VEHICULOS C3 y T3-S2

	CARGA				SOBRECARGA				VEHICULOS
	EJE 1	EJE 2	EJE 3	TOTAL	EJE 1	EJE 2	EJE 3	TOTAL	INFRACTOR
ESTACION CHALCHUAPA - 18/11/94									
	4600	17300		21900		1300		900	
	4750	19000		23750		3000		2750	
ESTACION ACAJUTLA - 18/11/94									
	4100		17600	21700			1600		
	4600	14300	14000	32900					
	4800	17100	18500	40400		1100	2500	3400	
	4200	16000	17000	37200			1000	200	
	4000	16100	14800	34900		100			
	3800	16300	15100	35200		300			
	5100	15900	16500	37500	100		500	500	
	4300	15500	14800	34600					
	3400	17300	16800	37500		1300	800	500	
	4400	9000	6800	20200					
ESTACION LA LIBERTAD - 23/11/94									
	4850	15100		19950					
ESTACION KM 22 - 23/11/94									
	4300	12200		16500					
	3700	15000	14200	32900					
	3800	14700	11800	30300					
ESTACION METAPAN - 29/11/94									
	4700	15500		20200					
	5500	22000		27500	500	6000		6500	
	3800	15350	15500	34650					
	3100	13100	13300	29500					
	4600	16000	15300	35900					
	4400	16700	14400	35500		700			
	3800	16600	13850	34250		600			
	4450	14350	14800	33600					
SUMAS	103050	360400	265050	728500	600	14400	6400	14750	
%					0.6%	4.0%	2.4%	2.0%	
VEHICULOS INFRACTORES					2	9	5	7	
EXCESO PROMEDIO (kilos)					300	1600	1280	2107	

ANNEX 3.6.1

VEHICULAR GROSS WEIGHT AND NUMBER OF EQUIVALENT AXELS FOR TYPE OF VEHICLE

ANEXO 3.6.1. PESOS BRUTOS MEDIOS POR TIPO DE VEHICULO Y NEE POR CONFIGURACION VEHICULAR

MUESTREO DE PESAJES DE CAMIONES
CALCULO DE PESOS BRUTOS VEHICULARES
VEHICULOS C2

CARGA (Kg)		
EJE 1	EJE 2	TOTAL
3750	8700	12450
4500	8600	13100
4600	10450	15050
4500	11450	15950
2100	9250	11350
3450	9900	13350
2850	8650	11500
3750	8000	11750
4450	10350	14800
1800	3900	5700
2900	6950	9850
4400	9750	14150
3600	5900	9500
4200	4800	9000
4000	7300	11300
4800	10700	15500
5100	5200	10300
3900	12800	16700
4700	11200	15900
6300	10850	17150
5100	11300	16400
4700	10400	15100
3950	9900	13850
4000	7200	11200
4200	7500	11700
4150	5800	9950
4600	8600	13200
4900	8600	13500
5600	12600	18200
3200	5000	8200
4300	9400	13700
3400	6100	9500
5900	10600	16500
3700	9100	12800
2500	8500	11000
4800	9500	14300
3500	6000	9500
4600	9800	14400
4000	14400	18400
PBV		12968

CALCULO DE EJES EQUIVALENTES
VEHICULOS C2

NEE		
EJE 1	EJE 2	TOTAL
0.10422	1.29216	1.39638
0.21611	1.23377	1.44988
0.23597	2.68970	2.92567
0.21611	3.87669	4.09280
0.01025	1.65123	1.66147
0.07466	2.16661	2.24127
0.03477	1.26271	1.29748
0.10422	0.92385	1.02807
0.20666	2.58822	2.79488
0.00553	0.05218	0.05771
0.03727	0.52623	0.56351
0.19753	2.03825	2.23578
0.08852	0.27330	0.36182
0.16399	0.11973	0.28372
0.13492	0.64052	0.77543
0.27976	2.95648	3.23624
0.35654	0.16491	0.52145
0.12192	6.05451	6.17644
0.25717	3.54904	3.80621
0.83021	3.12578	3.95599
0.35654	3.67750	4.03404
0.25717	2.63859	2.89576
0.13830	2.16661	2.29490
0.13492	0.60613	0.74105
0.16399	0.71365	0.87764
0.15632	0.25524	0.41156
0.23597	1.23377	1.46974
0.30381	1.23377	1.53758
0.51829	5.68488	6.20318
0.05526	0.14097	0.19623
0.18018	1.76097	1.94114
0.07043	0.31229	0.38272
0.63860	2.84749	3.48610
0.09877	1.54670	1.64547
0.02059	1.17738	1.19796
0.27976	1.83710	2.11687
0.07909	0.29231	0.37140
0.23597	2.08038	2.31635
0.13492	9.69816	9.83308
NEE/CAMION		2.17474

ANEXO 3 6 1 PESOS BRUTOS MEDIOS POR TIPO DE VEHICULO Y NEE POR CONFIGURACION VEHICUL

MUESTREO DE PESAJES DE CAMIONES
CALCULO DE PESOS BRUTOS VEHICULARES
VEHICULOS T3-S2

CARGA (Kg)			
EJE 1	EJE 2	EJE 3	TOTAL
4100	17250	17600	38950
4600	14300	14000	32900
4800	17100	18500	40400
4200	16000	17000	37200
4000	16100	14800	34900
3800	16300	15100	35200
5100	15900	16500	37500
4300	15500	14800	34600
3400	17300	16800	37500
4400	9000	6800	20200
3700	15000	14200	32900
3800	14700	11800	30300
3800	15350	15500	34650
3100	13100	13300	29500
4600	16000	15300	35900
4400	16700	14400	35500
3800	16600	13850	34250
4450	14350	14800	33600
		PBV	34219

CALCULO DE EJES EQUIVALENTES
VEHICULOS T3-S2

NEE			
EJE 1	EJE 2	EJE 3	TOTAL
0.14892	1.70313	1.84562	3.69758
0.23597	0.80433	0.73893	1.77924
0.27976	1.64466	2.25309	4.17752
0.16399	1.26059	1.60653	3.03110
0.13492	1.29240	0.92287	2.35018
0.10989	1.35782	1.00000	2.46771
0.35654	1.22936	1.42570	3.01160
0.18018	1.11025	0.92287	2.21329
0.07043	1.72297	1.53225	3.32564
0.19753	0.12620	0.04113	0.36486
0.09877	0.97377	0.78207	1.85461
0.10989	0.89818	0.37292	1.38099
0.10989	1.06789	1.11025	2.28802
0.04867	0.56647	0.60186	1.21701
0.23597	1.26059	1.05404	2.55060
0.19753	1.49609	0.82707	2.52069
0.10989	1.46058	0.70777	2.27824
0.20666	0.81564	0.92287	1.94517
		NEE/CAMION	2.35856

MUESTREO DE PESAJES DE CAMIONES
CALCULO DE PESOS BRUTOS VEHICULARES
VEHICULOS C3

CARGA (Kg)		
EJE 1	EJE 2	TOTAL
4600	17300	21900
4750	19000	23750
4850	15100	19950
4300	12200	16500
4700	15500	20200
5500	22000	27500
	PBV	21633

CALCULO DE EJES EQUIVALENTES
VEHICULOS C3

NEE		
EJE 1	EJE 2	TOTAL
0.23597	1.72297	1.95894
0.26829	2.50672	2.77501
0.29160	1.00000	1.29160
0.18018	0.42612	0.60630
0.25717	1.11025	1.36741
0.48225	4.50591	4.98817
	NEE/CAMION	2.16457

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ANNEX 3.6.2

DATA BASE OF ANALYZED ROAD SECTORS WITH THE HDM-III MODEL FROM I N G E C O N DATA

ANEXO 3 6 2 CUADRO 1 CALCULO DE LOS PORCENTAJES DE AREA DETERIORADA POR TIPO DE DANO A PARTIR DE LOS INDICES DE DETERIORO MEDIOS POR TRAMO

NUMERO	CALZADA	D2	D3	D4	D5	ESP RODA	ESP BASE	LONGITUD	D1	%D2	%D3	%D4	COM(IRI)	HUELLA	DESV
1	7.00	0.00	0.00	4.00	4.00	5.00	15.00	26000	0.0	0.0	0.0	35.0	8.5	12	6
2	7.00	1.17	1.84	1.67	1.30	5.00	15.00	15000	0.1	6.7	14.4	11.7	2.5	4	1.4
3	6.00	1.09	1.06	1.74	1.80	5.00	15.00	17600	0.0	5.9	5.5	12.4	3.2	7	2.1
4	9.00	4.00	4.00	3.00	2.00	5.00	15.00	300	1.8	15.0	35.0	25.0	3.5	11	3.3
5	8.00	1.91	2.52	1.04	2.00	5.00	15.00	22600	0.0	14.1	20.2	5.4	3.5	11	3.3
110	7.30	1.00	1.84	0.71	1.06	8.00	20.00	25100	0.0	5.0	13.4	3.5	2.1	4	1.4
111	7.00	3.17	3.52	2.21	1.46	5.00	15.00	58500	0.1	26.7	30.2	17.1	2.7	7	2.1
111	7.00	0.00	0.00	4.00	4.00	5.00	15.00	500	0.0	0.0	0.0	35.0	8.5	32	6
112	8.22	3.43	3.60	2.84	2.03	5.00	15.00	55000	0.2	26.3	31.0	23.4	3.6	11	3.3
113	6.00	2.01	1.94	2.26	2.03	5.00	15.00	18000	0.2	15.1	14.4	17.8	3.6	11	3.3
114	8.37	2.12	2.79	2.55	2.00	5.00	15.00	13000	0.3	16.2	22.9	20.5	3.5	11	3.3
115	6.00	3.95	3.91	3.59	2.00	5.00	15.00	11100	0.2	34.5	34.1	30.9	3.5	11	3.3
116	6.00	3.80	3.36	2.67	2.00	5.00	15.00	7500	0.2	33.0	26.8	21.7	3.5	11	3.3
116	8.00	0.00	0.00	4.00	4.00	5.00	15.00	200	0.0	0.0	0.0	35.0	8.5	32	6
128	8.00	1.00	1.00	0.65	2.00	5.00	15.00	9200	0.0	5.0	5.0	3.3	3.5	11	3.3
194	7.00	2.68	2.65	1.74	1.44	5.00	15.00	41700	0.0	21.8	21.5	12.[illegible]	2.7	7	2.1
195	7.00	3.33	3.58	3.12	1.95	5.00	15.00	19300	0.0	28.3	30.6	26.2	3.4	7	2.1
196	7.00	1.27	1.27	4.00	3.17	5.00	15.00	1500	0.0	7.7	7.7	35.0	6.2	21	5.2
196	7.00	2.00	2.00	1.00	2.00	5.00	15.00	530	0.0	15.0	15.0	8.0	3.5	11	3.3
196	7.00	3.34	3.32	1.92	1.94	5.00	15.00	19800	0.1	26.4	26.2	14.2	3.4	7	2.1
197	8.00	0.00	0.70	1.88	2.00	5.00	15.00	8400	0.0	0.0	3.5	13.8	3.5	11	3.3
198	8.00	1.24	1.68	2.34	2.26	5.00	15.00	6800	0.1	7.4	11.8	18.4	4.1	11	3.3
199	9.00	1.18	1.30	1.34	1.00	5.00	15.00	19400	0.0	6.8	8.0	8.4	2.0	4	1.4
200	8.00	0.00	0.00	4.00	4.00	5.00	15.00	300	0.0	0.0	0.0	35.0	8.5	32	6
200	6.00	1.88	2.33	2.52	2.00	5.00	15.00	10500	0.1	13.8	18.3	20.2	3.5	11	3.3
203	8.00	1.14	2.10	1.47	1.00	5.00	15.00	17800	0.1	6.4	16.0	9.7	2.0	4	1.4
203	8.00	1.00	2.00	1.00	1.00	5.00	15.00	500	0.0	5.0	15.0	5.0	2.0	4	1.4
204	8.00	1.00	2.00	1.00	2.00	5.00	15.00	700	0.5	5.0	15.0	5.0	3.5	11	3.3
206	8.00	0.00	0.00	0.00	1.00	5.00	15.00	700	0.0	0.0	0.0	0.0	2.0	4	1.4
207	8.00	1.75	1.75	2.00	2.00	5.00	15.00	2000	0.1	12.5	12.5	15.0	3.5	11	3.3
208	8.00	1.65	2.00	3.60	2.00	5.00	15.00	10000	0.8	13.5	15.0	31.0	3.5	11	3.3
209	8.00	2.00	3.00	3.00	2.00	5.00	15.00	1000	0.2	15.0	25.0	25.0	3.5	11	3.3
210	8.00	0.00	1.00	1.75	2.00	5.00	15.00	2000	0.0	0.0	5.0	12.5	3.5	11	3.3
265	8.82	1.00	2.25	0.17	1.58	8.00	20.00	6000	0.0	5.0	17.5	0.8	2.9	7	2.1
266	7.30	1.20	1.83	1.10	1.12	8.00	20.00	26100	0.0	7.0	13.3	6.0	2.2	4	1.4
268	7.00	1.48	2.09	0.62	1.00	5.00	15.00	23500	0.1	8.8	15.9	3.1	2.0	4	1.4
267	7.00	1.00	1.61	0.81	1.00	5.00	15.00	11800	0.0	5.0	11.1	4.0	2.0	4	1.4
268	7.00	3.11	3.14	2.51	2.02	5.00	15.00	16800	0.2	26.1	26.4	20.1	3.5	11	3.3
269	8.00	3.48	2.55	3.20	2.00	5.00	15.00	8900	0.2	29.9	20.5	27.0	3.5	11	3.3
270	8.00	3.70	2.56	3.52	2.00	5.00	15.00	14200	0.1	32.0	20.8	30.2	3.5	11	3.3
271	6.00	1.85	2.17	1.50	2.00	5.00	15.00	11400	0.0	13.5	16.7	10.0	3.5	11	3.3
272	8.00	4.00	4.00	4.00	2.00	5.00	15.00	1000	0.3	35.0	35.0	35.0	3.5	11	3.3
273	8.00	2.48	2.43	1.78	2.33	5.00	15.00	2100	0.5	19.8	18.3	12.8	4.3	11	3.3
274	8.20	1.93	1.93	1.60	2.00	5.00	15.00	1500	0.1	14.3	14.3	11.0	3.5	11	3.3
288	8.00	1.60	1.63	1.49	2.00	5.00	15.00	10400	0.2	11.0	11.3	8.8	3.5	11	3.3
330	7.00	1.55	3.00	2.08	1.89	5.00	15.00	21600	0.3	10.5	25.0	15.9	3.3	7	2.1
330	7.00	0.00	0.00	4.00	4.00	5.00	15.00	12400	0.0	0.0	0.0	35.0	8.5	32	6
331	8.00	3.40	2.81	2.77	1.56	5.00	15.00	15000	0.1	28.0	24.1	22.7	2.9	7	2.1
332	8.00	1.73	1.81	1.65	1.26	5.00	15.00	26000	0.1	12.3	13.1	11.5	2.4	4	1.4
333	8.00	0.00	0.00	0.00	1.25	5.00	15.00	800	0.0	0.0	0.0	0.0	2.4	4	1.4
334	8.00	1.87	2.01	2.17	1.28	5.00	15.00	18000	0.0	14.7	15.1	18.7	2.4	4	1.4
336	8.00	2.00	2.00	3.00	1.00	5.00	15.00	980	0.1	15.0	15.0	25.0	2.0	4	1.4
429	8.50	2.47	1.87	0.26	2.00	8.00	20.00	7800	0.4	16.7	11.7	1.3	3.3	11	3.3
430	7.51	1.30	1.34	0.81	1.20	8.00	20.00	17500	0.3	8.0	8.4	3.0	2.3	4	1.4
431	8.00	3.00	2.88	1.83	2.00	5.00	15.00	7500	3.0	25.0	21.8	13.3	3.5	11	3.3
432	8.00	3.00	3.00	3.00	3.00	5.00	15.00	1500	1.1	25.0	25.0	25.0	5.8	21	5.2
432	9.00	2.86	2.81	2.77	2.20	5.00	15.00	10100	3.4	23.5	24.1	22.7	4.0	11	3.3
433	8.00	1.15	1.21	0.98	2.00	5.00	15.00	10000	0.1	8.5	7.1	4.8	3.5	11	3.3
434	7.01	3.27	2.41	2.88	2.00	5.00	15.00	45400	0.1	27.7	18.1	21.8	3.5	11	3.3
435	7.00	0.67	0.33	0.33	1.17	5.00	15.00	3000	0.4	3.3	1.7	1.7	2.3	4	1.4
435	0.00	2.00	3.00	3.00	2.00	0.00	0.00	500	2.0	15.0	25.0	25.0	3.5	11	3.3
436	8.82	1.71	2.28	1.69	1.88	5.00	15.00	12800	0.7	12.1	17.0	11.9	3.3	7	2.1
438	6.00	0.00	0.00	0.00	1.00	5.00	15.00	1400	0.0	0.0	0.0	0.0	2.0	4	1.4
438	8.00	0.00	0.00	0.00	1.00	5.00	15.00	8540	0.0	0.0	0.0	0.0	2.0	4	1.4
437	8.00	3.70	3.38	2.32	2.13	5.00	15.00	4700	0.1	32.0	28.8	18.2	3.8	11	3.3
437	8.00	0.00	0.00	4.00	4.00	5.00	15.00	3700	0.0	0.0	0.0	35.0	8.5	32	6
438	8.00	0.67	2.33	1.33	2.00	5.00	15.00	1500	0.0	3.3	18.3	8.3	3.5	11	3.3
438	8.00	1.42	2.85	1.58	2.00	5.00	15.00	8500	0.1	8.2	21.5	10.8	3.5	11	3.3
439	8.45	2.00	2.00	2.00	2.00	5.00	15.00	2000	0.9	15.0	18.0	15.0	3.5	11	3.3
440	8.00	1.00	1.00	3.00	2.00	5.00	15.00	500	0.5	5.0	5.0	25.0	3.5	11	3.3
441	8.00	2.00	2.00	2.00	2.00	5.00	15.00	200	0.1	15.0	15.0	15.0	3.5	11	3.3
441	7.13	1.17	1.08	0.81	1.94	5.00	15.00	6400	0.3	6.7	5.9	4.1	3.4	7	2.1
442	8.00	0.00	0.50	0.25	2.00	5.00	15.00	2000	0.3	0.0	2.5	1.3	3.5	11	3.3
443	8.17	2.70	2.72	2.54	2.48	5.00	15.00	7100	0.7	22.0	22.2	20.4	4.8	16	4

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ANEXO 3 6 2 CUADRO 1 CALCULO DE LOS PORCENTAJES DE AREA DETERIORADA POR TIPO DE DAÑO A PARTIR DE LOS INDICES DE DETERIORO MEDIOS POR TRAMO

444	6.00	2.70	2.00	0.70	2.00	5.00	15.00	2000	0.0	27.0	15.0	3.5	3.5	11
445	6.00	3.00	3.00	1.00	3.00	5.00	15.00	1000	1.9	25.0	25.0	25.0	5.8	21
453	9.00	1.00	1.00	0.00	2.00	5.00	15.00	1000	0.2	5.0	5.0	0.0	3.5	11
511	9.00	2.00	2.00	0.00	2.00	5.00	15.00	1000	0.2	15.0	15.0	0.0	3.5	11
529	6.00	3.09	3.15	3.40	2.14	5.00	15.00	19200	0.1	25.9	28.8	29.0	3.8	11
530	6.00	1.00	1.00	1.00	2.00	5.00	15.00	1000	0.1	5.0	5.0	5.0	3.5	11
531	6.00	4.00	4.00	4.00	2.00	5.00	15.00	6200	0.1	35.0	35.0	35.0	3.5	11
532	6.00	3.00	4.00	4.00	2.00	5.00	15.00	500	0.1	25.0	35.0	35.0	3.5	11
532	6.00	2.44	3.37	4.00	1.96	5.00	15.00	23300	0.1	19.4	28.7	35.0	3.4	7
651	6.00	2.98	2.98	3.13	2.03	5.00	15.00	31350	0.2	24.8	24.8	26.3	3.8	11
652	6.00	2.00	2.00	1.00	2.00	5.00	15.00	6000	0.0	15.0	15.0	5.0	3.5	11
653	6.00	3.00	3.00	4.20	3.00	5.00	15.00	2500	1.5	25.0	25.0	35.0	5.8	21
721	7.00	1.07	1.00	2.53	2.55	5.00	15.00	14600	1.4	5.7	5.0	20.3	4.8	16
722	6.00	3.94	1.03	3.19	2.03	5.00	15.00	18000	0.2	34.4	5.3	26.9	3.8	11
723	6.00	1.55	2.15	2.81	1.64	5.00	15.00	18500	0.1	10.5	18.5	21.1	3.0	7
724	6.00	3.44	1.14	2.00	2.00	5.00	18.00	3700	0.2	29.8	8.4	16.0	3.8	11
725	6.00	4.00	2.00	3.00	2.00	5.00	15.00	400	0.0	35.0	15.0	25.0	3.5	11
726	6.00	3.00	1.00	1.00	1.00	5.00	15.00	1700	0.0	25.0	5.0	5.0	2.0	4
727	6.00	0.00	0.00	4.00	4.00	5.00	15.00	500	0.0	0.0	0.0	35.0	8.5	32
727	6.00	0.00	0.00	4.00	4.00	5.00	15.00	1500	0.0	0.0	0.0	35.0	8.5	32
727	6.00	2.50	1.00	2.75	2.25	5.00	15.00	2000	1.5	20.0	5.0	22.5	4.1	11
728	6.00	1.96	1.94	3.00	2.11	5.00	15.00	5300	1.4	14.8	14.4	25.0	3.8	11
812	7.30	1.03	1.20	0.20	1.00	8.00	20.00	20000	0.1	5.2	7.0	1.0	2.0	4
812	7.30	0.00	0.00	4.00	4.00	8.00	20.00	1500	0.0	0.0	0.0	35.0	8.5	32
813	7.00	3.20	3.08	1.65	1.92	5.00	15.00	10900	0.8	27.0	25.8	11.5	3.4	7
814	7.00	1.00	1.00	0.00	1.00	5.00	15.00	500	0.0	5.0	5.0	0.0	2.0	4
814	7.02	3.10	2.02	0.77	0.98	5.00	15.00	25500	0.1	26.0	15.2	3.8	8.5	32
815	6.00	3.97	1.00	1.97	1.97	5.00	15.00	32000	0.1	34.7	5.0	14.7	3.5	7
816	6.00	3.76	1.00	1.95	1.93	5.00	15.00	16000	0.6	32.6	5.0	14.5	3.4	7
817	6.00	2.33	2.63	3.00	1.00	5.00	15.00	6000	0.3	18.3	23.3	25.0	2.0	4
818	6.00	2.50	1.55	2.11	2.05	5.00	15.00	19000	0.5	20.0	10.5	16.1	3.8	11
819	6.00	4.00	1.00	3.00	2.00	5.00	15.00	1000	1.1	35.0	5.0	25.0	3.5	11
820	6.00	4.00	1.00	3.00	2.00	5.00	15.00	500	0.5	35.0	5.0	25.0	3.5	11
821	6.00	0.00	0.00	4.00	4.00	5.00	15.00	500	0.0	0.0	0.0	35.0	8.5	32
821	6.13	2.71	1.40	1.13	1.88	5.00	15.00	22500	0.6	22.1	9.0	6.3	3.0	7
822	6.00	1.38	1.41	3.53	2.88	5.00	15.00	15000	0.0	8.5	8.1	30.3	5.1	16
841	7.00	3.48	3.11	2.07	1.86	5.00	15.00	31000	0.1	29.8	26.1	19.7	3.5	7
842	6.00	3.31	3.97	3.31	3.38	5.00	15.00	18000	1.5	26.1	34.7	28.1	6.8	27
843	6.00	3.52	4.00	3.38	3.33	5.00	15.00	10500	1.3	30.2	35.0	28.8	6.7	27
844	6.00	1.35	1.47	0.44	1.88	5.00	15.00	32600	1.7	8.5	9.7	2.2	3.3	7
845	6.00	0.00	0.00	0.00	1.00	5.00	15.00	5000	0.0	0.0	0.0	0.0	2.0	4
847	6.00	0.72	0.72	0.44	1.33	5.00	15.00	9000	0.2	3.6	3.6	2.2	2.5	7
848	6.00	0.32	0.32	0.32	1.42	5.00	15.00	9500	0.2	1.6	1.6	1.6	2.6	7
849	6.00	0.61	0.88	0.14	1.95	5.00	15.00	11600	0.0	3.1	4.4	0.7	3.4	7
850	6.00	0.00	0.00	0.00	1.00	5.00	15.00	800	0.5	0.0	0.0	0.0	2.0	4
1055	7.00	1.39	2.42	1.63	1.15	5.00	15.00	40500	0.2	8.9	18.2	11.3	2.2	4
1056	6.00	1.53	2.04	1.17	1.02	5.00	15.00	18800	0.1	10.3	15.4	8.7	2.0	4
1057	6.00	2.82	3.51	2.57	1.00	5.00	15.00	14800	0.3	23.2	30.1	20.7	2.0	4
1058	6.00	1.10	3.38	2.41	1.08	5.00	15.00	15300	0.3	6.0	28.8	18.1	2.1	4
1059	6.00	1.00	4.00	4.00	1.00	5.00	15.00	4720	0.1	5.0	35.0	36.0	2.0	4
1060	6.00	1.54	1.70	1.65	1.95	5.00	15.00	3700	0.8	10.4	12.0	11.5	3.4	7
1061	6.00	1.35	1.35	1.41	2.00	5.00	15.00	8500	0.3	8.5	8.5	8.1	3.5	11
1062	6.00	0.00	0.00	4.00	4.00	5.00	15.00	1600	0.0	0.0	0.0	35.0	8.5	32
1062	6.00	1.00	3.27	2.63	1.47	5.00	15.00	9800	0.8	5.0	27.7	21.5	2.7	7
1063	6.00	1.89	4.00	4.00	2.44	5.00	15.00	900	2.3	13.9	35.0	36.0	4.5	16
1063	6.00	0.58	1.54	4.00	3.82	5.00	15.00	2600	0.0	2.9	10.4	36.0	7.5	27
1063	6.00	0.00	4.00	4.00	1.00	5.00	15.00	800	0.0	0.0	36.0	35.0	2.0	4
1064	6.00	1.68	3.29	1.28	1.00	5.00	15.00	1900	0.1	11.8	27.6	7.6	2.0	4
1065	6.00	2.00	2.30	1.30	2.30	5.00	15.00	10000	0.2	15.0	18.0	8.0	4.2	11
1066	6.00	0.00	3.67	3.67	2.67	5.00	15.00	1500	0.0	0.0	31.7	31.7	5.0	16
1066	6.00	1.00	1.00	0.00	0.00	5.00	15.00	600	0.1	5.0	5.0	0.0	8.5	32
1066	6.00	1.10	1.93	1.27	1.85	5.00	15.00	15000	1.2	8.0	14.3	7.7	3.3	7
1067	6.00	0.00	0.00	4.00	4.00	5.00	15.00	100	0.0	0.0	0.0	35.0	8.5	32
1067	6.00	4.00	4.00	4.00	2.29	5.00	15.00	1700	2.2	35.0	35.0	35.0	4.2	11
1172	7.00	2.00	0.00	0.00	2.00	5.00	15.00	14800	0.3	15.0	0.0	0.0	3.5	11
1173	6.00	2.22	1.70	0.68	1.21	5.00	15.00	18000	0.0	17.2	12.0	3.4	2.3	4
1174	0.00	0.02	0.00	3.70	2.03	0.00	0.00	19700	0.8	0.1	0.0	32.0	3.8	11
1174	6.00	1.00	1.00	0.00	1.00	5.00	15.00	19000	0.1	5.0	5.0	0.0	2.0	4
1175	6.00	0.00	1.00	0.00	2.00	5.00	15.00	300	0.0	0.0	5.0	0.0	3.5	11
1176	6.00	2.00	1.00	2.00	2.00	5.00	15.00	1000	0.8	15.0	5.0	15.0	3.5	11
1230	7.00	1.00	1.49	0.84	1.01	5.00	15.00	34000	0.1	5.0	9.9	4.2	2.0	4
1231	7.00	1.00	1.00	1.00	2.02	5.00	15.00	32500	0.2	5.0	5.0	5.0	3.5	11
1232	7.00	1.70	3.58	3.17	2.15	5.00	15.00	20000	1.2	12.0	30.8	28.7	3.8	11
1233	7.00	1.00	1.00	1.00	1.00	5.00	15.00	6000	0.0	5.0	5.0	5.0	2.0	4

ANEXO 3.6.2 CUADRO 1 CALCULO DE LOS PORCENTAJES DE AREA DETERIORADA POR TIPO DE DAÑO A PARTIR DE LOS INDICES DE DETERIORO MEDIOS POR TRAMO

1234	6.00	4.00	4.00	2.00	3.00	5.00	15.00	16700	0.1	35.0	35.0	15.0	5.8	21	5.2
1236	6.00	1.00	1.00	1.00	2.00	3.00	15.00		0.1	28.0	5.0	5.0	3.5	11	3.3
1236	6.00	1.00	3.52	3.05	1.00	5.00	15.00	2100	0.5	5.0	30.2	25.5	2.0	4	1.4
1237	6.00	0.00	0.00	0.00	1.00	5.00	15.00	3600	0.1	0.0	0.0	0.0	2.0	4	1.4
1238	6.00	1.00	1.00	1.00	3.00	5.00	15.00	5200	0.4	5.0	5.0	5.0	5.8	21	5.2
1239	6.00	1.00	1.00	1.00	3.00	5.00	15.00	12500	1.7	5.0	5.0	5.0	5.8	21	5.2
1319	7.00	3.33	3.66	1.10	1.71	5.00	15.00	2100	0.5	26.3	33.6	6.0	3.1	7	2.1
1340	7.30	1.00	1.00	0.00	1.00	8.00	20.00	2000	0.0	5.0	5.0	0.0	2.0	4	1.4
1340	7.30	0.00	0.00	0.00	1.00	8.00	20.00	14300	0.0	0.0	0.0	0.0	2.0	4	1.4
1341	7.00	0.00	0.00	0.00	1.00	5.00	15.00	14500	0.0	0.0	0.0	0.0	2.0	4	1.4
1342	6.00	3.00	1.00	2.00	1.00	5.00	15.00	1500	0.0	25.0	5.0	15.0	2.0	4	1.4
1348	6.00	1.20	1.10	0.37	1.77	5.00	15.00	3000	0.2	7.0	6.0	1.8	3.2	7	2.1
1351	6.00	1.00	1.00	1.00	2.00	5.00	15.00	500	0.3	5.0	5.0	5.0	3.5	11	3.3
1351	6.00	1.29	1.34	1.34	2.00	5.00	15.00	10300	0.3	7.8	8.4	8.4	3.5	11	3.3
1351	6.00	1.56	1.00	1.00	2.00	5.00	15.00	900	0.3	10.8	5.0	5.0	3.5	11	3.3
1352	6.00	1.00	1.00	0.00	1.07	5.00	15.00	1500	0.0	5.0	5.0	0.0	2.1	4	1.4
1353	6.00	1.00	3.55	2.55	1.09	5.00	15.00	1100	0.0	5.0	30.5	20.5	2.1	4	1.4
1354	6.00	1.00	1.00	1.00	2.00	5.00	15.00	3000	0.3	5.0	5.0	6.0	3.6	11	3.3
1356	7.00	1.00	1.00	0.00	1.13	5.00	15.00	4000	0.3	5.0	5.0	0.0	2.2	4	1.4
1356	7.00	0.00	0.00	0.00	1.00	5.00	15.00	17000	0.0	0.0	0.0	0.0	2.0	4	1.4
1363	6.00	2.26	2.29	1.87	2.03	5.00	15.00	15900	1.6	17.6	17.9	13.7	3.6	11	3.3
1363	6.00	2.89	2.89	0.22	2.00	5.00	15.00	1600	0.8	23.9	23.9	1.1	3.5	11	3.3
1364	7.00	0.00	0.00	0.00	1.00	5.00	15.00	500	0.0	0.0	0.0	0.0	2.0	4	1.4
1364	7.00	0.00	0.00	0.00	1.00	5.00	15.00	4700	0.0	0.0	0.0	0.0	2.0	4	1.4
1367	6.00	3.00	1.00	3.00	3.00	5.00	15.00	800	0.4	25.0	5.0	25.0	5.8	21	5.2
1369	6.00	4.00	1.00	3.00	3.00	5.00	15.00	1000	0.6	35.0	5.0	25.0	5.8	21	5.2
1371	6.00	1.75	2.00	1.50	2.00	5.00	15.00	4000	0.0	12.5	15.0	10.0	3.5	11	3.3
1373	7.00	4.00	4.00	4.00	4.00	5.00	15.00	500	0.0	35.0	35.0	35.0	8.5	32	8
1373	7.00	3.72	3.55	2.07	2.23	5.00	15.00	54200	0.8	32.2	30.5	15.7	4.0	11	3.3
1374	7.30	1.00	2.14	1.24	1.14	8.00	20.00	28500	0.0	5.0	18.4	7.4	2.2	4	1.4
1374	9.13	1.00	1.17	1.00	1.00	8.00	20.00	6000	0.0	5.0	6.7	5.0	2.0	4	1.4
1375	7.30	1.00	1.28	0.37	1.00	8.00	20.00	21500	0.1	5.0	7.8	1.9	2.0	4	1.4
1376	7.72	1.00	1.00	0.19	1.00	8.00	20.00	17500	0.1	5.0	5.0	1.0	2.0	4	1.4
1377	7.30	0.00	0.00	0.00	1.00	8.00	20.00	16300	0.0	0.0	0.0	0.0	2.0	4	1.4
1378	7.30	1.79	1.82	0.94	1.17	8.00	20.00	25000	0.0	5.0	11.2	4.7	2.3	4	1.4
1379	7.00	0.67	0.56	0.56	1.18	5.00	15.00	9000	0.2	3.3	2.8	2.8	2.2	4	1.4
1380	7.00	0.00	0.00	4.00	4.00	5.00	15.00	3700	0.0	0.0	0.0	36.0	8.5	32	8
1380	7.00	0.00	0.00	4.00	4.00	5.00	15.00	13400	0.0	0.0	0.0	36.0	8.5	32	8
1381	8.50	2.30	1.28	0.00	2.00	8.00	20.00	7600	0.4	18.0	7.8	0.0	3.5	11	3.3

ANEXO 3 8 2 CUADRO 2 BASE DE DATOS DE LOS TRAMOS DE LA RED ANALIZADA CON EL HDM III, CON BASE EN LOS DATOS DEL INGECON DEL SIAMV

T V	CODIGO	NUMERO		NOMBRE TRAMO	LONG	CALZ	R	C H	HOMBR	ESPESORES ROD	BAS	SUB	IIR	FIS ABI D2	OT FISI D3	FIS TOTA D6	BACH D1	HUEL	DESV	OTROS D4	COMO D5	DEFL	CBR	SNC	SNSG
2	MA210001	1		CA 2 LD SONSONATE-FRONTERA GUATEMALA(LA HACHADURA)	26 0	7 00	1	40	2 35	5	15	15	8 5	0 00	0 00	0 00	0 00	32	8	35 00	8 50	138	4 8	2 81	0 52
2	MA210002	2		CA 8 TRAMO AHUACHAPAN-EL JOBO	15 0	7 00	1	40	2 35	5	15	15	4 5	6 67	14 40	21 07	0 07	4	1 4	11 67	2 45	174	3 [illegible]	2 26	0 17
3	MA310003	3		INTERCNX(CA 1 CA 8) AHUACHAPAN-S ANA(T AHUACHAPAN)	17 8	6 00	1 5	120	1 00	5	15	15	4 5	5 85	5 45	11 31	0 02	7	2 1	12 39	3 19	178	3 [illegible]	2 23	0 14
3	MA310005	5		AHUACHAPAN-ATACO-APANECA L D SONSONATE	22 8	6 00	3	120	1 00	5	15	15	4 2	14 12	20 18	34 30	0 03	11	3 3	5 44	3 50	160	3 7	2 38	0 29
1	MB110110	110		ASS L D LA LIBERTAD-EL PORTEZUELO CI	25 1	7 30	2	25	4 00	8	20	20	3 5	5 00	13 45	18 45	0 00	4	1 4	3 53	2 08	58	14 8	4 51	1 52
2	MB210111	111		CA 12 TRAMO SANTA ANA-METAPAN-ANGUIATU	57 0	7 00	1	40	2 35	5	15	15	8	26 68	30 22	56 88	0 15	7	2 1	17 05	2 72	148	4 1	2 50	0 41
3	MB310112A	112	A	CA 1 LD LA LIBERTAD SANTA AN'	27 4	8 22	1 5	120	1 50	5	15	15	4 5	29 29	31 02	60 31	0 22	11	3 3	23 42	3 57	201	2 8	2 08	0 03
3	MB310112B	112	B	CA 1 SANTA ANA-FRONTERA con GUATEMALA	27 8	8 22	1 5	120	1 50	5	15	15	4 5	29 29	31 02	60 31	0 22	11	3 3	23 42	3 57	201	2 8	2 08	0 03
3	MB310113	113		CA 12 TRAMO L D SONSONATE SAN JORGE-CA 1	18 0	8 00	1 5	120	1 00	5	15	15	4 5	15 11	14 44	29 56	0 19	11	3 3	17 58	3 58	228	2 5	1 90	0 18
3	MB310114	114		INTERCONEXIONICA 1 CA 8(CHALCHUAPA-L D AHUACHAPAN	13 0	8 37	1 5	120	1 50	5	15	15	4 5	18 23	22 92	39 15	0 30	11	3 3	20 46	3 50	160	3 2	2 21	0 12
3	MB310115	115		INTERCONEX (CA 1-CA 8)D V EL CONGO-EL ZUNZA(T STA ANA)	11 1	5 00	1 5	120	1 00	5	15	15	6	34 55	34 10	68 65	0 25	11	3 3	30 95	3 50	175	3 3	2 25	0 16
3	MB310116	116		CA 1 EL CONGO-LAGO DE COATEPEQUE	7 7	6 00	1 5	120	1 00	5	15	15	6	32 14	27 86	60 00	0 22	11	3 3	22 01	3 63	160	3 2	2 21	0 12
3	MB310128	128		L D SONSONATE-CERRO VERDE	9 2	6 00	3	120	1 00	5	15	15	3	5 00	5 00	10 00	0 00	11	3 3	3 28	3 50	165	3 8	2 33	0 25
2	MC210194	194		CA 8 TRAMO SONSONATE-L D LA LIBERTAD	41 7	7 50	1	40	2 35	5	15	15	3 5	21 81	21 50	43 31	0 00	7	2 1	12 39	2 58	172	3 4	2 27	0 19
2	MC210195	195		CA 12 TRAMO SONSONATE-ACAJUTLA	19 3	7 00	1	40	2 35	5	15	15	4 5	28 28	30 60	58 88	0 02	7	2 1	28 19	3 42	128	5 2	2 74	0 65
2	MC210196	196		CA 2 TRAMO D V ACAJUTLA-L D LA LIBERTAD	21 5	7 00	1	40	2 35	5	15	15	3	26 70	26 47	53 17	0 07	11	3 3	15 39	3 60	144	4 3	2 54	0 46
3	MC310197	197		CA 12 PLAYA LOS COBANOS	5 4	5 00	1 5	120	1 00	5	15	15	3 5	0 00	3 51	3 51	0 01	11	3 3	13 81	3 50	145	4 3	2 53	0 44
3	MC310198	198		CA 8 SAN JULIAN	5 8	6 50	1 5	120	1 00	5	15	15	3 5	7 35	11 78	19 12	0 10	11	3 3	15 38	4 11	175	3 3	2 25	0 18
3	MC310199	199		CA 12 TRAMO L D SANTA ANA SONZACATE	19 4	8 50	3	120	1 00	5	15	15	3 5	8 50	7 99	14 79	0 02	4	1 4	8 35	2 00	191	3 0	2 13	0 04
3	MC310200	200		INTERCONEXIONICA 1 CA 8)-EL CONGO-EL ZUNZA KM 45	10 8	6 50	1 5	120	1 00	5	15	15	4 5	13 38	17 32	31 20	0 08	11	3 3	20 85	3 64	155	3 9	2 43	0 34
3	MC310207	207		CA 8 TRAMO SONSONATE NAHUIZALCO-SALCOATITAN-L D AHUACH	18 3	6 50	3	120	1 00	5	15	15	3 5	8 37	15 98	22 35	0 09	4	1 4	9 54	2 00	182	3 1	2 19	0 11
3	MC310207	207		CA 8 JUAYUA	2 0	5 30	1 5	120	1 00	5	15	15	4 7	12 50	12 50	25 00	0 11	11	3 3	15 00	3 50	190	3 0	2 14	0 05
3	MC310208	208		JUAYUA SAN JOSE LA MAJADA CA 12	10 0	5 30	1 5	120	1 00	5	15	15	5	13 50	15 00	28 50	0 75	11	3 3	31 00	3 50	178	3 3	2 24	0 15
3	MC310210	210		CA 8-CALUCO	2 0	6 50	1 5	120	1 00	5	15	15	4 5	0 00	5 00	5 00	0 05	11	3 3	12 50	3 50	156	3 8	2 42	0 33
1	MD120285A	285	A	ASS SANTA TECLA LA CUCHILLA (CD)	11 5	7 57	0	25	4 00	8	20	20	4 5	8 51	14 07	20 68	0 00	4	1 4	5 09	2 30	153	1 9	2 45	0 55
1	MD120285B	285	B	ASS LA CUCHILLA-SITIO DEL NINO (CD)	8 5	7 57	0	25	4 00	8	20	20	3 5	8 61	14 07	20 68	0 00	4	1 4	5 09	2 30	29	30 0	6 98	3 99
1	MD120285C	285	C	ASS SITIO DEL NINO-KM 35 (CD)	7 5	7 57	0	25	4 50	8	20	20	3 5	8 61	14 07	20 68	0 00	4	1 4	5 09	2 30	96	3 7	3 28	0 29
1	MD120285D	285	D	ASS KM 35-LD SANTA ANA (CD)	6 8	7 57	0	25	4 00	8	20	20	3 5	8 61	14 07	20 68	0 00	4	1 4	5 09	2 30	96	3 7	3 28	0 29
2	MD220286	286		CA 4 TRAMO CA 1 LA LIBERTAD	23 5	7 00	1	40	2 35	5	15	15	3 5	9 94	13 59	25 53	0 08	4	1 4	3 09	2 00	75	21 9	3 64	1 75
2	MD220287	287		CA 8 TRAMO PASO DOS NIVELES-L D SONSONATE	11 8	7 50	1	40	2 35	5	15	15	3 5	5 00	11 10	18 10	0 00	4	1 4	4 03	2 00	177	3 3	2 23	0 14
2	MD220288	288		CA 2 TRAMO LA LIBERTAD L D LA PAZ	18 8	7 00	1	40	2 35	5	15	15	4 5	28 10	28 39	52 49	0 21	11	3 3	20 09	3 53	196	2 9	2 09	0 01
3	MD320269	269		CA 1 TRAMO KM 35 L D SANTA ANA	5 9	6 00	1 5	120	1 00	5	15	15	4 5	29 93	20 51	50 43	0 18	11	3 3	27 03	3 50	201	2 8	2 08	0 03
3	MD320270	270		INTRCX(AUTOP CA 4)SITIO-NI O-QUEZALT-L D S SALV	14 2	6 00	1 5	120	1 00	5	15	15	6	32 04	20 56	52 61	0 12	11	3 3	30 21	3 50	283	2 2	1 74	0 35
3	MD320271	271		AUTOPISTA-SAN JUAN OPICO	11 4	8 00	1 5	120	1 00	5	15	15	4	13 51	16 67	30 18	0 04	11	3 3	10 00	3 50	195	2 9	2 10	0 01
1	MD320273	273		QUEZALTEPEQUE LA TOMA	2 1	5 00	1 5	120	1 00	5	15	15	4 3	19 76	19 29	39 05	0 54	11	3 3	12 62	4 27	220	2 6	1 85	0 14
1	MD320274	274		SANTA TECLA-CA 4	1 5	6 20	1 5	120	1 50	5	15	15	4	14 33	14 33	28 67	0 08	11	3 3	11 00	3 50	190	3 0	2 14	0 06
3	MD320288	288		CA 8-ATEOS-JAYAQUE	10 4	6 00	1 5	120	1 00	5	15	15	3 8	10 96	11 35	22 31	0 18	11	3 3	9 90	3 50	170	3 4	2 29	0 20
3	ME320330	330		CA 4 TRAMO TEJUTLA-EL POY	34 0	7 00	3	120	1 50	5	15	15	6	6 68	15 85	22 53	0 19	18	4	22 85	5 22	153	3 8	2 45	0 36
3	MN320331A	331	A	PUENTE COLIMA (LD) - DESVIO a CHALATENANGO	4 5	6 00	1 5	120	1 00	5	15	15	6	29 00	24 13	53 13	0 05	7	2 1	22 67	2 68	147	4 2	2 51	0 42
3	MN320331B	331	B	DESVIO a CHALATENANGO - TEJUTLA	10 5	6 00	1 5	120	1 00	5	15	15	6	29 00	24 13	53 13	0 05	7	2 1	22 67	2 68	147	4 2	2 51	0 42
3	ME320332	332		CA 3 TRAMO CA 4-CHALATENANGO	28 0	6 00	1 5	120	1 00	5	15	15	4 2	12 32	13 14	25 48	0 05	4	1 4	11 54	2 38	150	4 1	2 48	0 38
3	ME320334	334		CA 3 TRAMO CA 4-NUEVA CONCEPCION	18 0	6 00	1 5	120	1 00	5	15	15	3 9	14 72	15 06	29 78	0 01	4	1 4	16 67	2 42	160	3 7	2 38	0 29
1	MF120429	429		BOULEVARD DEL EJERCITO-ILOPANGO	7 8	6 50	0	25	4 00	8	20	20	3 7	19 74	11 71	31 45	0 37	11	3 3	1 32	3 50	123	2 5	2 81	0 19
1	MF120430	430		AUTOPISTA SAN SALVADOR-COMALAPA 49 AV SUR- LD LA PAZ	17 5	7 51	0	25	4 00	8	20	20	3 5	7 97	9 43	18 40	0 27	4	1 4	3 03	2 30	117	2 7	2 90	0 10
3	MF320431	431		CA 4 KM 17-TONACATEPEQUE	7 5	6 00	1 5	120	1 00	5	15	15	5	25 00	21 60	46 60	2 98	11	3 3	13 27	3 50	130	5 1	2 71	0 62
3	MF320432	432		MEJICANOS-MARIONA INTERSECCION (APOPA-NEJAPA)	11 8	5 00	1 5	120	1 00	5	15	15	4 5	23 71	24 22	47 93	3 09	11	3 3	23 02	4 19	135	4 8	2 86	0 56
3	MF320433A	433	A	CA 1 DESVIO ILOPANGO (KM 101) - DESVIO APULO	4 0	6 00	1 5	120	1 00	5	15	15	3 5	6 50	7 10	13 60	0 07	11	3 3	4 60	3 50	120	5 9	2 83	0 78
3	MF320433B	433	B	CA 1 DESVIO APULO (LD COSCATLAN	6 0	6 00	1 5	120	1 00	5	15	15	3 5	6 50	7 10	13 60	0 07	11	3 3	4 60	3 50	125	5 4	2 78	0 69
3	MF320434A	434	A	CA 4 SAN SALVADOR APOPA	9 3	7 01	1 5	120	1 50	5	15	15	4 5	27 73	10 12	46 85	0 10	11	3 3	21 87	3 50	186	3 1	2 16	0 06
1	MF320434B	434	B	CA 4 APOPA GUAZAPA	10 1	7 01	1 5	120	1 50	5	15	15	4 5	27 73	19 12	46 85	0 10	11	3 3	21 87	3 50	186	3 1	2 16	0 06
3	MF320434C	434	C	CA 4 GUAZAPA-AGUILARES	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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ANEXO 3.6.2 CUADRO 2 BASE DE DATOS DE LOS TRAMOS DE LA RED ANALIZADA CON EL HDM III CON BASE EN LOS DATOS DEL INGECON DEL SIAMV

TV	CODIGO	NUMERO		NOMBRE TRAMO	LONG	CALZ	R	C H	HOMBR	ESPESORES ROD	BAS	SUB	IIR	FIS ABI D2	CT FISU D3	FIS TOTA D6	BACH D1	HUEL	DESV	OTROS D4	COMO D5	DEFL	CBR	SNC	SNSG
3	MF320435B	435	B	INTERCX CA 1-CA 2 - COMALAPA SAN MARCOS-SANTO TOMAS	4.6	6.66	1.5	120	1.50	5	15	15	3	10.22	14.18	24.39	0.67	7	2.1	9.66	3.09	192	3.0	2.12	0.03
3	MF320435C	435	C	INTERCX CA 1-CA 2 - COMALAPA SANTO TOMAS-LD LA PAZ	8.2	6.66	1.5	120	1.50	5	15	15	3	10.22	14.18	24.39	0.67	7	2.1	9.66	3.09	192	3.0	2.12	0.03
3	MF320436	436		SAN SALVADOR-LOS PLANES DE RENDEROS	7.9	6.00	1.5	120	1.00	5	15	15	2	0.00	0.00	0.00	0.00	4	1.4	0.00	2.00	192	3.0	2.12	0.03
3	MF320437	437		CA 1 APULO-CORINTO	8.4	6.00	1.5	120	1.00	5	15	15	5.9	17.92	16.13	34.05	0.07	21	5.2	25.00	5.87	192	3.0	2.12	0.03
3	MF320438	438		INTERCONEXION CA 1-CA 4-L.D LA LIBERTAD	10.0	6.00	1.5	120	1.00	5	15	15	4.5	8.35	21.00	29.35	0.08	11	3.3	10.40	3.50	199	2.8	2.07	0.01
3	MF320439	439		CA 4-PALECA-CIUDAD DELGADO	2.0	6.45	1.5	120	1.50	5	15	15	3.5	15.00	15.00	30.00	0.86	11	3.3	15.00	3.50	203	2.8	2.05	0.04
3	MF320441	441		CA 4 LA GARITA SOYAPANGO-CA 1	6.6	7.09	1.5	120	1.50	5	15	15	3.4	5.97	6.21	13.18	0.27	7	2.1	4.39	3.41	187	3.0	2.16	0.07
3	MF320442	442		SAN MARTIN-SUCHITOTO(TRAMO SAN SALVADOR)	2.0	6.00	1.5	120	1.00	5	15	15	3.5	0.00	2.50	2.50	0.25	11	3.3	1.25	3.50	175	3.3	2.25	0.16
3	MF320443	443		PLANES DE RENDEROS-PANCHIMALCO	7.1	6.17	1.5	120	1.50	5	15	15	4.6	22.04	22.18	44.23	0.71	16	4	20.35	4.60	166	3.1	2.16	0.08
3	MF320444	444		PLANES DE RENDEROS-PUERTA DEL DIABLO	2.0	6.00	1.5	120	1.00	5	15	15	3.5	22.00	15.00	37.00	0.04	11	3.3	3.50	3.50	175	3.3	2.25	0.16
3	MG320529	529		CA 1 TRAMO L.D SAN SALVADOR-SAN RAFAEL CEDROS	19.2	6.00	1.5	120	1.00	5	15	15	3.6	25.89	26.46	52.34	0.05	11	3.3	29.01	3.62	153	3.9	2.45	0.38
3	MG320531	531		CA 1 SAN RAFAEL CEDROS-ILOBASCO (TRAMO CUSCATLAN)	6.2	6.00	1.5	120	1.00	5	15	15	3.5	35.00	35.00	70.00	0.07	11	3.3	35.00	3.50	187	3.0	2.16	0.07
3	MG320532	532		SAN MARTIN-SUCHITOTO (TRAMO CUSCATLAN)	23.8	6.00	1.5	120	1.00	5	15	15	3.4	19.50	28.87	48.38	0.09	7	2.1	35.00	3.44	158	3.8	2.42	0.33
3	MH320551	551		RAMAL (CA 1-ILOBASCO)-SENSUNTEPEQUE	31.4	6.00	1.5	120	1.00	5	15	15	3.6	24.57	24.57	49.14	0.23	11	3.3	26.32	3.57	160	3.7	2.38	0.29
3	MH320552	552		CA 1-ILOBASCO(TRAMO CABANAS)	6.0	6.00	1.5	120	1.00	5	15	15	3.5	15.00	15.00	30.00	0.00	11	3.3	5.00	3.50	145	4.3	2.53	0.44
3	MH320553	553		ILOBASCO-CASERIO LA QUESERA	2.5	6.00	1.5	120	1.00	5	15	15	5.8	25.00	25.00	50.00	1.50	21	5.2	35.00	5.50	201	2.5	2.06	0.03
1	MI320721	721		CA 2 TRAMO L.D LA PAZ PTE SN MARCOS	14.6	7.30	1	40	2.35	5	15	15	4.5	5.68	5.00	10.68	1.44	16	4	20.34	4.75	141	4.5	2.58	0.49
3	MI320722	722		CA 1 KM 10-PUENTE CUSCATLAN	15.0	6.00	1.5	120	1.00	5	15	15	6	34.44	5.25	39.72	0.22	11	3.3	28.94	3.56	166	3.5	2.13	0.24
3	MI320723	723		INTERC CA 1 CA 2)S VICENTE ZACAT(T S VICENTE)	16.5	6.00	1.5	120	1.00	5	15	15	3.0	10.45	16.52	26.97	0.08	7	2.1	21.06	2.95	172	3.4	2.27	0.19
3	MI320724	724		CA 1(KM 55)-SAN VICENTE	3.7	6.00	1.5	120	1.00	5	15	15	3.5	29.59	6.35	35.95	0.16	11	3.3	15.00	3.50	166	3.1	2.16	0.38
3	MI320725	725		CA 1 KM 57) APASTEPEQUE	1.7	6.00	1.5	120	1.00	5	15	15	2.0	25.00	5.00	30.00	0.00	4	1.4	5.00	[illegible]	165	3.6	2.33	0.25
3	MI320727	727		CA 1 KM 62) LAGUNA APASTEPEQUE STA CLARA	4.0	6.00	1.5	120	1.00	5	15	15	6.3	10.00	2.50	12.50	0.75	21	5.2	26.75	5.29	158	3.5	2.40	0.31
3	MI320728	728		CA 1-D 7 AGUACAYO-SN SEBASTIAN	5.3	6.00	1.5	120	1.00	5	15	15	3.8	14.62	14.43	29.06	1.42	11	3.3	25.00	3.75	148	4.1	2.50	0.41
1	MJ120812	812		AUTOP S SALV-COMALAP T L D LA PAZ-AEROP AMBAS CAL-	21.5	7.30	0	25	4.00	6	20	20	3.5	4.56	6.51	11.40	0.09	7	2.1	3.37	2.45	144	2.0	2.54	-0.45
2	MJ220813	813		CA 2 TRAMO COMALAPA-L.D LA LIBERTAD	10.9	7.00	1	40	2.35	5	15	15	4.5	27.02	25.64	52.66	0.75	7	2.1	11.51	3.38	139	4.6	2.60	0.51
2	MJ220814	814		AUTOPISTA COMALAPA-ZACATECOLUCA	26.0	7.02	1	40	2.35	5	15	15	8	25.98	15.22	41.20	0.14	32	8	3.54	6.50	164	3.1	2.16	0.09
3	MJ320815	815		CA 2 TRAMO COMALAPA-L.D SAN VICENTE	32.0	6.00	1.5	120	1.00	5	15	15	5	34.69	5.00	39.69	0.05	7	2.1	14.69	3.45	163	3.6	2.35	0.26
3	MJ320816	816		INTERCNX CA 1-CA 2)S SALV COMALAPA(T LA PAZ)	16.0	6.00	1.5	120	1.00	5	15	15	3.4	32.58	5.00	37.58	0.56	7	2.1	14.50	3.39	142	4.4	2.57	0.46
3	MJ320817	817		INTERCNX(CA 1-CA 2)ZACAT -S VICENTE(T LA PAZ)	6.0	6.00	1.5	120	1.00	5	15	15	2.0	18.33	23.33	41.67	0.30	4	1.4	25.00	2.00	178	3.3	2.24	0.15
3	MJ320819	819		CA 2 LA FLECHA-LA HERRADURA	19.0	6.00	1.5	120	1.00	5	15	15	3.6	20.00	10.53	30.53	0.50	11	3.3	16.05	3.32	155	3.5	2.33	0.35
3	MJ320821	821		R CA 2 LA HERRADURA)-SAN MARCELINO-EL ZAPOTE	23.0	6.13	1.5	120	1.50	5	15	15	3.0	22.11	9.00	31.11	0.59	7	2.1	5.33	3.03	191	2.9	2.09	[illegible]
3	MJ320822	822		CA 2 KM 45 5-SAN PEDRO NONUALCO	15.0	6.00	1.5	120	1.00	5	15	15	5.1	8.47	9.13	17.60	0.05	16	4	30.27	5.09	141	4.4	2.55	0.47
2	MK230941	941		CA 2 TRAMO PUENTE SAN MARCOS LEMPA-USULUTAN	31.0	7.00	1	40	2.35	5	15	15	4.5	29.76	26.15	55.90	0.07	7	2.1	15.66	3.47	179	3.2	2.22	0.13
3	MK330942	942		CA 1 TRAMO PUENTE CUSCATLAN-EL TRIUNFO	18.0	6.00	1.5	120	1.00	5	15	15	4.5	28.06	34.72	52.78	1.46	27	8	28.06	6.78	147	4.2	2.51	[illegible]
3	MK330943	943		TRAMO CA 1 KM 105-MERCEDES UMA A-BERLIN	10.5	6.00	1.5	120	1.00	5	15	15	6.7	30.24	35.00	65.24	1.35	27	8	28.81	6.70	135	4.6	2.65	0.56
3	MK330944	944		INTCNX CA 1-CA 2 TRIUNFO-STGO/MA-TECAPAN-CA 2	32.6	6.00	1.5	120	1.00	5	15	15	3.3	8.50	9.72	18.22	1.75	7	2.1	2.22	3.33	165	3.6	2.33	0.25
3	MK330945	945		CA 2-SANTA ELENA	5.0	6.00	1.5	120	1.00	5	15	15	2.0	0.00	0.00	0.00	0.00	4	1.4	0.00	2.00	172	3.4	2.27	0.19
3	MK330947	947		CA 2-JIQUILISCO-PUERTO EL TRIUNFO	9.0	6.00	1.5	120	1.00	5	15	15	2.5	3.61	3.61	7.22	0.22	7	2.1	2.22	2.50	154	3.9	2.44	0.35
3	MK330948	948		CA 1-ESTANZUELAS	9.5	6.00	1.5	120	1.00	5	15	15	2.6	1.58	1.58	3.16	0.21	7	2.1	1.58	2.63	187	3.0	2.16	0.07
3	MK330949	949		SANTIAGO DE MARIA-ALEGRIA-BERLIN	11.6	6.00	1.5	120	1.00	5	15	15	3.4	3.06	4.44	7.50	0.03	7	2.1	0.69	3.42	166	3.5	2.31	0.22
2	ML231055	1055		CA 2 TRAMO L.D USULUTAN-L.D LA UNION	40.5	7.00	1	40	2.35	5	15	15	3.5	8.93	19.20	28.12	0.24	4	1.4	11.32	2.22	157	3.6	2.41	0.32
3	ML331056	1056		CA 1 TRAMO SAN MIGUEL-L.D LA UNION	18.6	6.00	1.5	120	1.00	5	15	15	3.5	10.30	15.36	25.65	0.07	4	1.4	6.73	2.03	209	2.7	2.01	-0.06
3	ML331057	1057		CA 7 TRAMO CA 1-L.D MORAZAN (SANTA ANITA)	14.8	6.00	1.5	120	1.00	5	15	15	6	23.18	30.07	53.24	0.32	4	1.4	20.74	2.00	133	4.9	2.57	0.59
3	ML331058	1058		INTERCONEXION (CA 1-CA 2) CA 1-CA 2 EL DELIRIO	15.3	6.00	1.5	120	1.00	5	15	15	4.5	5.98	28.79	34.77	0.31	4	1.4	19.12	2.13	165	3.1	2.17	0.08
3	ML331059	1059		CA 1-NUEVA GUADALUPE-CHINAMECA	4.7	6.00	1.5	120	1.00	[illegible]	15	15	4.5	5.00	35.00	40.00	0.11	4	1.4	35.00	2.00	128	5.2	2.74	0.65
3	ML331060	1060		JUCUAPA-CHINAMECA	3.7	6.00	1.5	120	1.00	5	15	15	3.4	10.41	12.03	22.43	0.61	7	2.1	11.49	3.42	145	4.3	2.53	0.44
3	ML331061	1061		CA 2-EL CUCO	6.5	6.00	1.5	120	1.00	5	15	15	3.5	8.53	8.53	17.06	0.34	11	3.3	9.12	3.50	192	3.0	2.12	0.03
3	ML331062	1062		CA 1-LA PLACITA	11.4	6.00	1.5	120	1.00	5	15	15	3.5	4.30	23.77	28.07	0.54	11	3.3	23.42	3.52	201	2.5	2.06	0.03
3	ML331063	1063		RAMAL INTERCONEXION(CA 1 CA 2) CANTON EL PROGRESO	4.1	6.00	1.5	120	1.50	5	15	15	6.0	4.68	19.19	24.27	0.51	21	5.2	35.00	6.02	162	3.1	2.19	[illegible]
[illegible]	[illegible]	1064		CA 1-MONCAGUA	1.9	6.00	1.5	120	1.00	5	15	15	2.0	11.64	27.63	39.47	0.05	4	1.4	7.63	[illegible]	143	4.4	2.55	0.47
[illegible]	[illegible]	[illegible]		PLACITAS-SAN JORGE SAN RAFAEL ORIENTE-CA 2	17.1	6.00	1.5	120	1.00	5	15	15	3.6	5.44	15.53	20.98	1.03	11	3.3	9.50	3.82	132	5	2.69	[illegible]
[illegible]	[illegible]	[illegible]		RUTA MILITAR CA7 - LD LA UNION	14.6	7.00	1.5	120	1.50	5	15	15	4.5	15.00	[illegible]	[illegible]	[illegible]	11	3.3	[illegible]	[illegible]	[illegible]	5	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible] SAN MIGUEL - DESVIO SAN FCO GOTERA	5.1	6.00	1.5	120	1.00	5	15	15	4.5	17.22	12.00	[illegible]	0.05	4	1.4	1.44	2.32	[illegible]	1.9	[illegible]	[illegible]

ANEXO 3 # 2. CUADRO 2. BASE DE DATOS DE LOS TRAMOS DE LA RED ANALIZADA CON EL HDM III, CON BASE EN LOS DATOS DEL INGECON DEL SIAMV

T	CODIGO	NUMERO		NOMBRE TRAMO	LONG	CALZ	R	C H	HOMBR	ESPESORES			IIR	FIS ABI	OT FISU	FIS TOTA	BACH	HUEL	DESV	OTROS	COMO	DEFL	CBR	SNC	SNSG
V										ROD	BAS	SUB		D2	D3	D6	D1			D4	D5				
3	MN3311738	1173	B	DESVIO a SAN FCO GOTERA - SAN FCO GOTERA	12 8	6 00	1 5	120	1 00	5	15	15	4 5	17 22	12 00	29 22	0 05	4	1 4	3 44	2 32	133	4 8	2 87	0 58
2	MN231230	1230		CA 1 SIRAMA-EL AMATILLO	34 0	7 00	1	40	2 35	5	15	15	3 5	5 00	9 85	14 85	0 1_	4	1 4	4 19	2 02	132	5 0	2 68	0 60
2	MN231231	1231		CA 2 LD SAN MIGUEL - RAMAL (SIRAMA-LA UNION)	32 5	7 00	1	40	2 35	5	15	15	4 5	5 00	5 30	10 00	0 22	11	3 3	5 00	3 54	139	4 6	2 80	0 51
2	MN231232	1232		RUTA MILITAR LD SAN MIGUEL-CA1	20 0	7 00	1	40	2 35	5	15	15	4 5	12 00	30 75	42 75	1 24	11	3 3	28 70	3 83	128	5 1	2 73	0 64
2	MN231233	1233		CA1 SIRAMA - LA UNION	8 0	7 00	1	40	2 35	5	15	15	3 5	5 00	5 00	10 00	0 01	4	1 4	5 00	2 00	144	4 3	2 54	0 46
3	MN331234	1234		CA 1 LD SAN MIGUEL-SIRAMA	18 7	6 00	1 5	120	1 00	5	15	15	6	35 00	35 00	70 00	0 06	21	5 2	15 00	5 80	182	3 6	2 38	0 27
3	MN331235	1235		LA UNION CUTUCO -CORSAIN	2 0	6 00	1 5	120	1 00	5	15	15	3 5	5 00	5 30	10 00	0 10	11	3 3	5 00	3 50	123	5 6	2 81	0 72
3	MN331236	1236		CA 1 - PASAQUINA	2 1	6 00	1 5	120	1 00	5	15	15	2 0	5 00	30 24	35 24	0 53	4	1 4	25 46	2 00	176	3 3	2 24	0 15
3	MN331237	1237		LA UNION - CONCHAGUA	3 8	6 00	1 5	120	1 00	5	15	15	2 0	0 00	0 00	0 00	0 10	4	1 4	0 00	2 00	132	5 0	2 69	0 60
3	MN331238	1238		RUTA MILITAR - BOLIVAR	5 2	6 00	1 5	120	1 00	5	15	15	5 8	5 00	5 00	10 00	0 44	21	5 2	5 00	5 80	145	4 3	2 53	0 44
3	MN331239	1239		CA 1- SIRAMA - LA UNION	12 5	6 00	1 5	120	1 00	5	15	15	5 8	5 00	5 00	10 00	1 71	21	5 2	5 00	5 80	187	3 0	2 18	0 07
2	MJ221319	1319		INTERCONEXION AUTOPISTA COMALAPA-CA 2	2 1	7 00	1	40	2 35	5	15	15	6	28 33	33 57	61 90	0 46	7	2 1	5 95	3 07	69	34 2	4 04	1 95
1	MI121340	1340		CA 1 TRAMO LD CUSCATLAN-D V A SAN VICENTE.	16 3	7 30	0	25	4 00	5	20	20	2	0 61	0 61	1 23	0 00	4	1 4	0 00	2 00	115	2 7	2 93	-0 08
2	MI221341	1341		CA 1 TRAMO D V A SN VICENTE-KM 70	14 5	7 00	1	40	2 35	5	15	15	2	0 00	0 00	0 00	0 00	4	1 4	0 00	2 00	118	6 3	2 91	0 63
3	MI321342	1342		CA 1 KM 60)-APASTEPEQUE	1 5	6 00	1 5	120	1 00	5	15	15	2 0	25 00	5 30	30 00	0 00	4	1 4	15 00	2 00	120	5 9	2 85	0 78
3	MF321348	1348		RIPLAN DEL PINO-S JOSE CORTEZ/S SEBASTIAN-C DELGADO	3 0	6 00	1 5	120	1 00	5	15	15	3 2	7 00	6 00	13 00	0 19	7	2 1	1 83	3 15	130	5 1	2 71	0 62
3	ML331351	1351		MONCAGUA-CHAPELTIQUE	11 7	6 00	1 5	120	1 50	5	15	15	3 5	7 99	7 99	15 98	0 33	11	3 3	7 99	3 50	143	4 4	2 55	0 47
3	ML331352	1352		CA 1 KM 130)-QUELEPA	1 5	6 00	1 5	120	1 00	5	15	15	2 1	5 00	5 30	10 00	0 00	4	1 4	0 00	2 10	120	5 9	2 85	0 78
3	ML331353	1353		RAMAL CA 2-EL CUCO-CHIRILAGUA	1 1	5 00	1 5	120	1 00	5	15	15	2 1	5 00	30 45	35 45	0 01	4	1 4	20 45	2 14	111	6 8	3 30	0 91
3	ML331354	1354		CA 1 LOLOTIQUE	3 0	6 00	1 5	120	1 00	5	15	15	3 5	5 00	5 00	10 00	0 27	11	3 3	5 00	3 50	102	6 2	3 18	1 07
2	ML231356	1356		CA 1 TRAMO LD USULUTAN SAN MIGUEL	21 0	7 00	1	40	2 35	5	15	15	2	0 95	0 95	1 90	0 05	4	1 4	0 00	2 04	95	9 8	3 31	1 22
3	MF321383	1383		CA 2 KM 47-ROSARIO DE MORA-PANCHIMALCO	17 7	6 00	1 5	120	1 00	5	15	15	4 5	18 45	18 50	36 95	1 48	11	3 3	12 48	3 56	100	5 6	3 20	1 11
2	MK231384	1384		CA 1 TRAMO EL TRIUNFO-LD SAN MIGUEL	5 2	7 00	1	40	2 35	5	15	15	3 5	0 00	0 00	0 00	0 01	4	1 4	0 00	2 00	105	7 7	3 10	1 01
3	MC311371	1371		RAMAL EL CONGO-EL ZUNZAL-CERRO VERDE (SONSONATE)	4 0	6 00	3	120	1 00	5	15	15	3 5	12 50	15 00	27 50	0 30	11	3 3	10 00	3 50	121	5 6	2 84	0 75
2	MD221371	1371		CA 2 TRAMO LA LIBERTAD LD SONSONATE	54 7	7 00	1	40	2 35	5	15	15	6	32 24	10 55	62 79	0 31	11	3 3	15 92	4 07	108	7 2	3 65	0 96
1	MD121374A	1374	A	ASS SANTA TECLA-LA CUCHILLA (CI)	11 5	7 62	0	25	4 00	5	20	20	3 5	5 00	14 68	19 68	0 00	4	1 4	7 00	2 17	229	1 1	1 90	1 10
1	MD121374B	1374	B	ASS LA CUCHILLA SITIO DEL NINO (CI)	7 5	7 62	0	25	4 00	5	20	20	3 5	5 00	14 68	19 68	0 00	4	1 4	7 00	2 17	50	34 5	4 95	1 06
1	MD121374C	1374	C	ASS SITIO DEL NINO (KM 15 -CI)	5 5	7 62	0	25	4 00	5	20	20	3 5	5 00	14 68	19 68	0 00	4	1 4	7 00	2 17	103	3 3	3 14	0 15
1	MD121374D	1374	D	ASS KM 35-LD SANTA ANA (CI)	6 6	7 62	0	25	4 00	8	20	20	3 5	5 00	14 68	19 68	0 00	4	1 4	7 00	2 17	103	3 3	3 14	0 15
1	MJ121375	1375		AUTOP E BAL / COMALAP T E D LA PAZ-AEROP AMBAS CAL	21 5	7 30	0	25	4 00	8	20	20	3 5	5 00	7 58	12 58	0 10	4	1 4	1 86	2 00	124	2 4	2 79	0 20
1	MF121376	1376		AUTOPISTA SAN SALVADOR-COMALAPA 49 AV SUR- LD LA PAZ	17 5	7 72	0	25	4 00	5	20	20	3 5	5 00	5 00	10 00	0 08	4	1 4	0 97	2 00	125	2 4	2 78	0 21
1	MI121377	1377		CA 1 TRAMO LD CUSCATLAN D V A SAN VICENTE	16 3	7 30	0	25	4 00	5	20	20	2	0 00	0 00	0 00	0 00	4	1 4	0 00	2 00	118	3 6	2 88	0 11
1	MB111378	1378		ASS LD LA LIBERTAD EL PORTEZUELO CD	25 0	7 30	2	25	4 00	8	20	20	3 5	5 00	11 16	16 16	0 00	4	1 4	4 72	2 28	88	9 2	4 18	1 16
2	MK331379	1379		CA 2 TRAMO USULUTAN-LD SAN MIGUEL	9 0	7 00	1	40	2 35	5	15	15	3 5	3 33	2 78	6 11	0 22	4	1 4	2 78	2 23	165	3 6	2 33	0 25
2	MC211380	1380		CA 2 TRAMO D V ACAJUTLA-LD AHUACHAPAN	17 5	7 00	1	40	2 35	5	15	15	8 5	0 00	0 00	0 00	0 00	32	8	35 00	8 50	125	5 4	2 78	0 69
1	MF121381	1381		BOULEVARD DEL EJERCITO-LOPANGO	7 3	5 50	0	25	4 00	8	20	20	3 5	18 03	7 76	25 79	0 42	7	2 1	0 00	3 50	134	2 2	2 86	0 33

ANEXO 3.6.2 CUADRO 3 BASE DE DATOS PARA LA RED VIAL ANALIZADA A PARTIR DE LOS DATOS DEL INGECON DEL SIAMV

LA CUCHILLA SONSONATE ACAJUTLA

V	CODIGO	NUMERO_		LONG	CALZAD	HOMBR	ESP_RO	ESP_BA	ESP_SU	ESP_RO	ESP_BA	ESP_SU	SNC	CBR	SNSG
1	MD120267	267-1	N	8.00	14.60	2.65	10.00	15.00	15				3.02	3.3	0.14
		267-2	N	5.50	14.60	2.65	10.00	15.00	35				3.81	3.3	0.14
1	MC110194	194-1	N	8.50	14.60	2.65	10.00	15.00	15				3.08	3.4	0.19
		194-2	N	18.68	14.60	2.65	10.00	15.00	20				3.26	3.4	0.19
		194-3	N	4.00	14.60	2.65	10.00	15.00	30				3.65	3.4	0.19
1	MC110195	195-1	N	14.13	14.60	2.65	10.00	20.00	30				4.35	5.2	0.65
		195-2	N	4.00	14.60	2.65	10.00	20.00	25				4.18	5.2	0.65

ACAJUTLA-LA LIBERTAD

V	CODIGO	NUMERO_		LONG	CALZAD	HOMBR	ESP_RO	ESP_BA	ESP_SU	ESP_RO	ESP_BA	ESP_SU	SNC	CBR	SNSG
1	MC110196	196	N	21.8	7.30	2.35	7.50	15.00	0.00	5	15	15	4.00	4.3	0.46
1	MD121373	1373	N	54.20	7.30	2.35	7.50	15.00	0.00	5	15	15	4.51	7.2	0.96

LA LIBERTAD-COMALAPA

V	CODIGO	NUMERO_		LONG	CALZAD	HOMBR	ESP_RO	ESP_BA	ESP_SU	ESP_RO	ESP_BA	ESP_SU	SNC	CBR	SNSG
1	MD120268	268	N	16.8	7.30	2.35	10.00	15.00	10	5.00	15.00	15.00	4.34	2.9	0.01
1	MJ120813	813	N	10.9	7.30	2.35	10.00	15.00	10	5.00	15.00	15.00	4.85	4.8	0.51

COMALAPA-ZACATECOLUCA

V	CODIGO	NUMERO_		LONG	CALZAD	HOMBR	ESP_RO	ESP_BA	ESP_SU	ESP_RO	ESP_BA	ESP_SU	SNC	CBR	SNSG
1	MJ120814	814	N	26.0	7.30	2.35	10.00	40.00		5.00	15.00	15.00	5.21	3.1	0.09

ZACATECOLUCA-USULUTAN

V	CODIGO	NUMERO_		LONG	CALZAD	HOMBR	ESP_RO	ESP_BA	ESP_SU	ESP_RO	ESP_BA	ESP_SU	SNC	CBR	SNSG
1	MJ120815	815-1	N	8.26	7.30	2.35	8.00	16.00			13.00	15	3.27	3.6	0.26
1	MI120721	721-1	N	2.44	7.30	2.35	8.00	16.00			13.00	15	3.50	4.5	0.49
		721-2	N	12.16	7.30	2.35	8.00	25.00			10	15	3.87	4.5	0.49
1	MK130941	941-1	N	29.00	7.30	2.35	8.00	26.00			10	15	3.51	3.2	0.13
		941-2	N	2.00	7.30	2.35	8.00	33.50			7.50	15	3.77	3.2	0.13

USULUTAN-EL DELIRIO

V	CODIGO	NUMERO_		LONG	CALZAD	HOMBR	ESP_RO	ESP_BA	ESP_SU	ESP_RO	ESP_BA	ESP_SU	SNC	CBR	SNSG
1	MK131379	1379-1	N	3.02	7.30	2.35	5.00	14.00	0.00	5.00	15.00	15.00	3.35	3.6	0.25
		1379-2	N	5.98	7.30	2.35	5.00	12.00	0.00	5.00	15.00	15.00	3.26	3.6	0.25
1	ML131055	1055-1	N	22.83	7.30	2.35	5.00	12.00	0.00	5.00	15.00	15.00	3.33	3.8	0.32

EL PORTEZUELO-SAN CRISTOBAL

V	CODIGO	NUMERO_		LONG	CALZAD	HOMBR	ESP_RO	ESP_BA	ESP_SU	ESP_RO	ESP_BA	ESP_SU	SNC	CBR	SNSG
3	MB310112B	112	N	27.6	6.00	1.50	10.00	15.00		5.00	13.00	18.00	3.95	2.8	0.03

LA HACHADURA-INTERSECCION CA12

V	CODIGO	NUMERO_		LONG	CALZAD	HOMBR	ESP_RO	ESP_BA	ESP_SU	ESP_RO	ESP_BA	ESP_SU	SNC	CBR	SNSG
1	MA110001	1	N	26.5	7.30	2.35	8.00	18.00	17.00				3.93	9.0	0.52
1	MC111380	1380	N	17.7	7.30	2.35	8.00	18.00	17.00				3.93	9.0	0.69

SANTA ANA-METAPAN-ANGUIATU

V	CODIGO	NUMERO_		LONG	CALZAD	HOMBR	ESP_RO	ESP_BA	ESP_SU	ESP_RO	ESP_BA	ESP_SU	SNC	CBR	SNSG
2	MB210111	111-1	N	18.0	7.30	1.10	10.00	35.00	15.00				4.23	4.1	0.41
		111-2	N	20.0	7.30	1.10	7.50			5.00	15.00	15.00	3.25	4.1	0.41
		111-3	N	20.8	7.30	1.10	5.00			5.00	15.00	15.00	2.85	4.1	0.41

SAN SALVADOR-APOPA

V	CODIGO	NUMERO_		LONG	CALZAD	HOMBR	ESP_RO	ESP_BA	ESP_SU	ESP_RO	ESP_BA	ESP_SU	SNC	CBR	SNSG
1	MF120434A	434A-1	N	1.74	14.60	0.00	5.00	20.00	32.00				3.07	3.1	0.08
		434A-2	N	7.56	14.60	3.00	5.00	20.00	32.00				3.07	3.1	0.08

APOPA-QUITASOL

V	CODIGO	NUMERO_		LONG	CALZAD	HOMBR	ESP_RO	ESP_BA	ESP_SU	ESP_RO	ESP_BA	ESP_SU	SNC	CBR	SNSG
1	MF120434B	434B	N	4.82	7.30	2.35	5.00	20.00	30.00				2.99	3.1	0.08
1	MF120434C	434C	N	15.36	7.30	2.35	10.00	20.00	25.00				3.58	3.1	0.08
1	MF120434D	434D	N	15.70	7.30	2.35	10.00	25.00		5.00	15.00	15.00	4.49	3.1	0.08

ANEXO 3.6.2 CUADRO 3 BASE DE DATOS PARA LA RED VIAL ANALIZADA A PARTIR DE LOS DATOS DEL INGECON DEL SIAMV

QUITASOL-EL POY

V	CODIGO	NUMERO_		LONG	CALZAD	HOMBR	ESP_RO	BAS_AS	ESP_BA	ESP_SU			SNC	CBR	SNSC
3	MN320331A	331A	N	4.5	6.00		4.00	10.00	15.00	20.00			4.20	6.2	0.8
3	MN320331B	331B	N	10.5	6.00		4.00	8.00	15.00	15.00			3.85	6.9	0.9
3	ME320330	330	N	34.0	7.00		4.00	7.00	15.00	15.30			3.71	6.7	0.9

EL PORTEZUELO-EL JOBO

V	CODIGO	NUMERO_		LONG	CALZAD	HOMBR	ESP_RO	ESP_BA	ESP_SU	ESP_RO	ESP_BA	ESP_SU	SNC	CBR	SNSC
2	MA210002	2.1	N	3.19	7.00		7.50	15.00	15.00				2.65	3.3	0.1
		2.2	N	3.19			10.00	15.00	15.00				3.05	3.3	0.1
3	MA310003	3	N	14.05	6.00		10.00	15.00	42.50				4.10	3.2	0.14
3	MB310114	114	N	11.66	6.37		10.00	15.00	15.00				3.00	2	0.12

SAN MIGUEL-EL DELIRIO

V	CODIGO	NUMERO_		LONG	CALZAD	HOMBR	ESP_RO	ESP_BA	ESP_SU	ESP_RO	ESP_BA	ESP_SU	SNC	CBR	SNSC
1	ML131058	1058	N	15.3	7.30	2.35	5.00	20.00	16.50		3.50	15.00	3.12	3.1	0.06

SAN MIGUEL-AGUA SALADA-GOASCORAN

V	CODIGO	NUMERO_		LONG	CALZAD	HOMBR	ESP_RO	ESP_BA	ESP_SU	ESP_RO	ESP_BA	ESP_SU	SNC	CBR	SNSC
1	ML131057	1057.1	N	8.00	7.30	2.85	10.00	25.00		5.00	15.00	15.00	5.00	4.9	0.59
		1057.2	N	7.68	7.30	2.85	10.00	20.00		5.00	15.00	15.00	4.76	4.9	0.59
1	MN131173A	1173A	N	5.10	7.30	2.85	10.00	30.00		5.00	15.00	15.00	5.23	4.9	0.59
1	MN131172	1172	N	13.22	7.30	2.85	10.00	30.00		5.00	15.00	15.00	5.38	5.7	0.7
1	MN131232	1232	N	20.50	7.30	2.85	10.00	20.00		5.00	15.00	15.00	4.81	5.1	0.8
2	MN231230	1230A	N	1.47	7.30	2.85	10.00	20.00		5.00	15.00	15.00	4.34	3.3	0.16

SAN MIGUEL-SIRAMA

V	CODIGO	NUMERO_		LONG	CALZAD	HOMBR	ESP_RO	ESP_BA	ESP_SU	ESP_RO	ESP_BA	ESP_SU	SNC	CBR	SNSC
3	ML331058	1058	N	22.3	6.00	1	10.00	20.00	51.00				4.45	2.7	0.04
3	MN331234	1234	N	10.1	6.00	1	10.00	20.00	45.00				4.57	3.6	0.2

APOPA-SITIO DEL NINO

V	CODIGO	NUMERO_		LONG	CALZAD	HOMBR	ESP_RO	ESP_BA	ESP_SU	ESP_RO	ESP_BA	ESP_SU	SNC	CBR	SNSC
3	MD320270	270	N	14.2	6.00		15.00			5.00	15.00	15.00	3.67	2.2	0.35
3	MF320438	438	N	10.0	6.00		15.00			5.00	15.00	15.00	4.00	2.8	0.0

SAN MARTIN-SAN RAFAEL CEDROS

V	CODIGO	NUMERO_		LONG	CALZAD	HOMBR	ESP_RO	BAS_AS	ESP_SU	ESP_RO	ESP_BA	ESP_SU	SNC	CBR	SNSC
1	MG120529	529	N	19.2	14.60	4.00	5.00	15.00	35.00				3.24	3.0	0.3

SAN RAFAEL CEDROS-KM 64

V	CODIGO	NUMERO_		LONG	CALZAD	HOMBR	ESP_RO	BAS_AS	ESP_SU	ESP_RO	ESP_BA	ESP_SU	SNC	CBR	SNSC
2	MI221340	1340	N	16.3	7.30	2.35	8.00	20.00	30.00				3.32	2.7	0.0
2	MI221377	1377	N	16.3	7.30	2.35	8.00	20.00	30.00				3.28	2.9	-0.1
2	MI221341	1341A	N	9.0	7.30	2.35	5.00	20.00	30.00				3.74	6.3	0.8

KM 64-DESVIO SANTIAGO DE MARIA

V	CODIGO	NUMERO_		LONG	CALZAD	HOMBR	ESP_RO	BAS_AS	ESP_SU	ESP_RO	ESP_BA	ESP_SU	SNC	CBR	SNSC
2	MI220722	722	N	18.0	7.30	2.35	5.00	15.00	35.00				3.11	3.5	0.2
2	MI221341	1341B	N	5.5	7.30	2.35	5.00	15.00	35.00				3.70	6.3	0.8
2	MK230942	942	N	18.0	7.30	2.35	5.00	15.00	35.00				3.30	4.2	0.4

DESVIO SANTIAGO DE MARIA-SAN MIGUEL

V	CODIGO	NUMERO_		LONG	CALZAD	HOMBR	ESP_RO	BAS_AS	ESP_SU	ESP_RO	ESP_BA	ESP_SU	SNC	CBR	SNSC
2	ML231356	1356	N	21.0	7.30	2.85	5.00	15.00	35.00				4.09	9.8	1.2
2	MK231364	1364	N	5.2	7.30	2.85	5.00	15.00	35.00				3.89	7.7	1.0

ANNEX 3.6.5-A

ROUTINE MAINTENANCE COST

COSTO POR KILOMETRO PROMEDIO
DE MANTENIMIENTO RUTINARIO (COLONES)

TIPO DE CARRETERA	COSTO POR KILOMETRO				
	MB	B	R	M	MM
Especial					
Financiero	41,056.19	48,615.10	242,687.82	407,206.70	423,085.20
Economico	33,665.98	39,864.26	199,003.43	333,908.52	346,928.85
Primaria					
Financiero	22,161.74	25,941.19	136,801.05	235,513.85	241,730.21
Economico	18,172.57	21,271.72	112,176.53	193,120.79	198,218.19
Secundaria					
Financiero	22,054.62	25,464.42	101,967.32	165,397.50	170,932.61
Economico	18,084.74	20,880.76	83,612.96	135,625.56	140,164.33
Rural					
Financiero	21,547.47	23,103.79	37,886.92	30,070.64	34,670.44
Economico	17,668.88	18,945.05	31,067.18	24,657.85	28,429.67

CUADRO No. 1
COSTOS POR KILOMETRO DE MANTENIMIENTO RUTINARIO (COLONES)
CARRETERA ESPECIAL

ACTIVIDAD	UNIDAD	COSTO UNITARIO	VOLUMEN DE OBRA					COSTO TOTAL				
			MB	B	R	M	MM	MB	B	R	M	MM
Chapeo y limpieza zona lateral	m2	1 35	6 000	6.000	6.000	6.000	6 000	8.127 33	8.127 33	8.127 33	8 127 33	8 127 33
Limpieza de alcantarillas	ml	40 64	40	80	120	120	120	1.625 47	2 438 20	4 876 40	4 876 40	4 876 40
Limpieza y conformacion manual de cunetas	ml	10 16	600	600	1 200	1 200	1.200	6 095 50	6 095 50	12 191 00	12 191 00	12 191 00
Limpieza y conformacion mecanizada de cunetas	ml	3 31	1 400	1 400	2 800	2 800	2 800	4 634 85	4 634 85	9 269 71	9 269 71	9 269 71
Bacheo de hombros	m3	1 522 42	0	0	2	10	10	0 00	0 00	2.591 35	15 548 10	15 548 10
Revestimiento de hombros	m3	298 80	0	0	511	1 021	1 021	0 00	0 00	152 579 90	305 159 81	305 159 81
Remocion de derrumbes	m3	37 71	2	2	4	6	6	75 41	75 41	150 82	226 24	226 24
Minamiento de taludes en corte	m2	41 66	10	10	20	30	30	416 60	416 60	833 21	1 249 81	1 249 81
Sello de grietas	ml	17 23	20	100	1 160	200	0	344 58	1 722 90	19 985 59	3 445 79	0 00
Riego de sello localizado	m2	26 84	60	260	520	1 080	1 800	1 610 36	6 978 21	13 956 43	28 986 43	48 310 72
Pintura de hitos kilometricos	c/u	135 25	2	2	2	2	2	270 51	270 51	270 51	270 51	270 51
Limpieza de rotulos de transito	c/u	156 55	16	16	16	16	16	2.504 77	2.504 77	2 504 77	2 504 77	2 504 77
Franjas de transito	ml	6 14	2 500	2.500	2.500	2 500	2 500	15 350 81	15 350 81	15 350 81	15 350 81	15 350 81
TOTAL								41.058.19	48.615.10	242.687.82	407.206.70	423.085.20

CONDICION DE LA CARRETERA:

MB Muy Buena

B Buena

R Regular

M Mala

MM Muy Mala

NOTA

En este costo por Kilometro no se ha incluido el bacheo.

El costo del bacheo se presenta en el CUADRO No

Los costos incluyen IVA.

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CUADRO No. 2
COSTOS POR KILOMETRO DE MANTENIMIENTO RUTINARIO (COLONES)
CARRETERA PRIMARIA

ACTIVIDAD	UNIDAD	COSTO UNITARIO	VOLUMEN DE OBRA					COSTO TOTAL				
			MB	B	R	M	MM	MB	B	R	M	MM
Chapeo y limpieza zona lateral	m2	1 35	3,000	3 000	3,000	3 000	3.000	4,063 67	4 063 67	4,063 67	4,063 67	4 063 [illegible]
Limpieza de alcantarillas	ml	40 64	20	30	60	60	60	812 73	1,219 10	2,438 20	2 438 20	2 438 [illegible]
Limpieza y conformacion manual de cunetas	ml	10 16	300	300	600	600	600	3 047 75	3,047 75	6 095 50	6 095 50	6 095 50
Limpieza y conformacion mecanizada de cunetas	ml	3 31	700	700	1 400	1 400	1 400	2,317 43	2,317 43	4 634 85	4 634 85	4 634 [illegible]
Bacheo de hombros	m3	1,522 42	0	0	1	6	6	0 00	0 00	1 522 42	9,134 51	9,134 51
Revestimiento de hombros	m3	298 80	0	0	300	600	600	0 00	0 00	89 640 69	179 281 39	179 281 [illegible]
Remocion de derrumbes	m3	37 71	2	2	4	6	6	75 41	75 41	150 82	226 24	226 [illegible]
Afinamiento de taludes en corte	m2	41 66	10	10	20	30	30	416 60	416 60	833 21	1 249 81	1 249 [illegible]
Sello de grietas	ml	17 23	10	50	580	200	0	172 29	861 45	9,992 79	3 445 79	0 00
Riego de sello localizado	m2	26 84	30	130	260	540	900	805 18	3 489 11	6 978 21	14 493 22	24 155 [illegible]
Pintura de hitos kilometricos	c/u	135 25	2	2	2	2	2	270 51	270 51	270 51	270 51	270 51
Limpieza de rotulos de transito	c/u	156 55	16	16	16	16	16	2,504 77	2,504 77	2,504 77	2 504 77	2 504 [illegible]
Franjas de transito	ml	6 14	1 250	1 250	1,250	1 250	1,250	7 675 40	7,675 40	7 675 40	7,675 40	7 675 [illegible]
TOTAL								22,161.74	25,941.19	136,801.05	235,513.85	241,730 21

CONDICION DE LA CARRETERA:

MB Muy Buena

B Buena

R Regular

M Mala

MM Muy Mala

NOTA :

En este costo por Kilometro no se ha incluido el bacheo.

El costo del bacheo se presenta en el CUADRO No

Los costos incluyen IVA.

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CUADRO No. 3
COSTOS POR KILOMETRO DE MANTENIMIENTO RUTINARIO (COLONES)
CARRETERA SECUNDARIA

ACTIVIDAD	UNIDAD	COSTO UNITARIO	VOLUMEN DE OBRA					COSTO TOTAL				
			MB	B	R	M	MM	MB	B	R	M	MM
Chapeo y limpieza zona lateral	m2	1.35	3.000	3.000	3.000	3.000	3.000	4.063 67	4.063 67	4 063 67	4.063 67	4 063 67
Limpieza de alcantarillas	ml	40 64	20	30	60	60	60	812 73	1.219 10	2.438 20	2 438 20	2 438 20
Limpieza y conformacion manual de cunetas	ml	10.18	300	300	600	600	600	3.047 75	3.047 75	6.095 50	6 095 50	6 095 50
Limpieza y conformacion mecanizada de cunetas	ml	3 31	700	700	1.400	1.400	1.400	2.317 43	2.317 43	4 634 85	4 634 85	4 634 [illegible]
Bacheo de hombros	m3	1.522.42	0	0	1	4	4	0 00	0 00	971 76	5.830 54	5 830 54
Revestimiento de hombros	m3	298 80	0	0	191	383	383	0 00	0 00	57 217 48	114 434 93	114.434 93
Remocion de derrumbes	m3	37 71	2	2	4	6	6	75 41	75 41	150 82	226 24	226 24
Alineamiento de taludes en corte	m2	41 66	10	10	20	30	30	416 60	416 60	833 21	1 249 81	1 249 81
Sello de grietas	ml	17 23	9	45	516	178	0	153 41	767 04	8 897 69	3 068 17	0 00
Riego de sello localizado	m2	26 84	27	116	232	481	801	716 94	3 106 74	6.213 48	12 904 92	21 508 20
Pintura de hitos kilometricos	c/u	135 25	2	2	2	2	2	270 51	270 51	270 51	270 51	270 51
Limpieza de rotulos de transito	c/u	158 55	16	16	16	16	16	2 504 77	2.504 77	2 504 77	2.504 77	2 504 77
Franjas de transito	ml	6 14	1.250	1.250	1.250	1.250	1.250	7.675 40	7.675 40	7.675 40	7.675 40	7 675 40
TOTAL								22.054 62	25.464.42	101.967.32	165.397.50	170.932 61

CONDICION DE LA CARRETERA:

MB Muy Buena

B Buena

R Regular

M Mala

MM Muy Mala

NOTA :

En este costo por Kilometro no se ha incluido el bacheo.

El costo del bacheo se presenta en el CUADRO No.

Los costos incluyen IVA.

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CUADRO No. 8

COSTOS POR KILOMETRO DE MANTENIMIENTO RUTINARIO (COLONES)

CAMINO RURAL

ACTIVIDAD	UNIDAD	COSTO UNITARIO	VOLUMEN DE OBRA					COSTO TOTAL				
			MB	B	R	M	MM	MB	B	R	M	MM
Chapeo y limpieza zona lateral	m2	1 35	3 000	3 000	3 000	3 000	3 000	4 063 67	4.063 67	4 063 67	4 063 67	4 063 67
Limpieza de alcantarillas	ml	40 64	20	30	60	60	60	812 73	1.219 10	2 438 20	2 438 20	2 438 20
Limpieza y conformacion manual de cunetas	ml	10 16	300	300	600	600	600	3 047 75	3.047 75	6 095 50	6 095 50	6 095 50
Limpieza y conformacion mecanizada de cunetas	ml	3 31	700	700	1.400	1.400	1.400	2.317 43	2 317 43	4.634 85	4 634 85	4 634 85
Conformacion de superficie de rodamiento	m2	1 80	6 000	6 000	9 000	1.200	1.200	10 813 88	10 813 88	16 220 82	2 162 78	2 162 78
Rellenos parciales	m2	229 99	0	5	15	40	60	0 00	1.149 95	3 449 85	9 199 60	13 799 39
Remocion de derrumbes	m3	37 71	2	2	4	6	6	75 41	75 41	150 82	226 24	226 24
Afinamiento de taludes en corte	m2	41 66	10	10	20	30	30	416 60	416 60	833 21	1 249 81	1 249 81
TOTAL								21.547.47	23.103.79	37 886 92	30.070.64	34 670 13

CONDICION DE LA CARRETERA

MB Muy Buena

B Buena

R Regular

M Mala

MM Muy Mala

NOTA

Los costos incluyen IVA

MEMORIA DE CALCULO DE COSTOS ECONOMICOS

MANTENIMIENTO RUTINARIO (COLONES)

TIPO DE CARRETERA	%	COSTO POR KILOMETRO				
		MB	B	R	M	MM
Especial						
- Costo Financiero		41,056.19	48,615.10	242,687.82	407,206.70	423,085.20
COMPOSICION DEL MANTENIMIENTO						
Mano de obra calificada	42.01	17,247.70	20,423.20	101,953.15	171,067.54	177,738.09
Mano de obra no calificada	9.69	3,978.34	4,710.80	23,516.45	39,453.33	40,996.96
Materiales nacionales	4.12	1,691.51	2,002.94	9,998.74	16,776.92	17,431.11
Materiales extranjeros	30.34	12,456.45	14,749.52	73,631.49	123,548.51	128,364.10
Maquinaria y equipo	13.84	5,682.18	6,728.33	33,587.99	56,357.41	58,554.99
ENCIMA DE SOMBRA						
Mano de obra calificada	0.9744	16,006.16	19,900.37	99,548.15	166,663.21	173,168.90
Mano de obra no calificada	0.4000	1,591.34	1,884.32	9,406.58	15,783.33	16,398.78
Materiales nacionales	0.3768	1,483.12	1,756.16	8,766.39	14,710.00	15,283.67
Materiales extranjeros	0.7600	9,466.90	11,209.36	55,959.93	93,895.35	97,556.38
Maquinaria y equipo	0.7600	4,313.45	5,113.53	25,526.88	42,831.63	44,501.79
- Costo Economico		33,665.98	39,864.26	199,003.43	333,908.52	346,928.85

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MEMORIA DE CALCULO DE COSTOS ECONOMICOS

MANTENIMIENTO RUTINARIO (COLONES)

TIPO DE CARRETERA	%	COSTO POR KILOMETRO				
		MB	B	R	M	MM
Primaria						
- Costo Financiero		22,161.74	25,941.19	136.801.05	235,513.85	241.730.21
COMPOSICION DEL MANTENIMIENTO						
Mano de obra calificada	42.01	9,310 15	10,897 90	57 470 12	98 939 37	101 550 [illegible]
Mano de obra no calificada	9 69	2 147 47	2 513 70	13 256 [illegible]	22 821 29	23 423 [illegible]
[illegible] nacionales	4 12	913 06	1 068 78	5 636 [illegible]	9 703 17	9 [illegible]
[illegible] extranjeros	30 34	6 723.37	7 870 [illegible]	41 [illegible] 44	71 484 90	73 [illegible]
[illegible] y equipo	13 84	3 067 19	3 590 26	18 [illegible] 27	32 395 12	33 [illegible]
[illegible] COMERA						
[illegible] obra calificada	0 9744	9 071 81	10 618 91	55 [illegible] 39	96 406 52	98 [illegible]
[illegible] obra no calificada	0 4000	858 39	1,005 48	5 [illegible] 41	9 128 52	9 [illegible]
[illegible] nacionales	0 6768	800 57	937 1[illegible]	4 941 [illegible]	8 [illegible] 74	8 [illegible]
[illegible] extranjeros	0 7600	5,110 14	5,981 62	31 [illegible] 13	54 [illegible] 73	[illegible]
[illegible] y equipo	0 7600	2,331 06	2,728 60	14 [illegible] 26	24 772 29	25 [illegible]
- Costo Economico		18,172.57	21,271.72	112,176.53	193,120.79	198,213.19

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MEMORIA DE CALCULO DE COSTOS ECONOMICOS

MANTENIMIENTO RUTINARIO (COLONES)

TIPO DE CARRETERA	%	COSTO POR KILOMETRO				
		MB	B	R	M	MM
Secundaria						
- Costo Financiero		**22,054.62**	**25,464.42**	**101,967.32**	**165,397.50**	**170,932.61**
COMPOSICION DEL MANTENIMIENTO						
Mano de obra calificada	42.01	9,265.15	10,697.50	42,836.47	69,483.49	71,808.79
Mano de obra no calificada	9.69	2,137.09	2,467.50	9,880.63	16,027.02	16,563.37
Materiales nacionales	4.12	908.65	1,049.13	4,201.35	6,814.38	7,042.42
Materiales extranjeros	30.34	6,691.37	7,725.91	30,936.89	50,181.60	51,860.45
Maquinaria y equipo	13.84	3,052.36	3,524.26	14,112.24	22,891.01	23,657.07
FACTOR SOMBRA						
Mano de obra calificada	0.9744	9,027.96	10,423.74	41,750.35	67,704.71	69,970.49
Mano de obra no calificada	0.4000	854.84	987.00	3,952.25	6,410.81	6,625.35
Materiales nacionales	0.8768	796.70	919.64	3,683.43	5,971.36	6,174.60
Materiales extranjeros	0.7600	5,085.44	5,871.69	23,512.03	38,136.02	39,414.33
Maquinaria y equipo	0.7600	2,319.79	2,678.45	10,725.36	17,397.17	17,979.38
- Costo Economico		**13,084.74**	**20,880.76**	**33,512.96**	**135,525.56**	**140,164.33**

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MEMORIA DE CALCULO DE COSTOS ECONOMICOS

MANTENIMIENTO RUTINARIO (COLONES)

TIPO DE CARRETERA	%	COSTO POR KILOMETRO				
		MB	B	R	M	MM
Rural						
- Costo Financiero		21,547.47	23,103.79	37,886.92	30,070.64	34,670.44
COMPOSICION DEL MANTENIMIENTO						
Mano de obra calificada	42.01	9,052.09	9,705.90	15,916.29	12,632.67	14,565.05
Mano de obra no calificada	9.69	2,087.95	2,238.76	3,671.24	2,913.34	3,359.37
Materiales nacionales	4.12	887.76	951.38	1,560.94	1,238.91	1,428.42
Materiales extranjeros	30.34	6,537.50	7,009.69	11,494.39	9,123.43	10,519.01
Maquinaria y equipo	13.84	2,982.17	3,197.56	5,243.55	4,161.78	4,798.39
ADITIVO SOMERA						
Mano de obra calificada	0.9744	8,620.36	9,457.43	15,508.34	12,309.28	14,192.16
Mano de obra no calificada	0.4000	835.16	895.50	1,468.50	1,165.54	1,343.83
Materiales nacionales	0.8765	778.38	834.60	1,368.63	1,086.26	1,252.44
Materiales extranjeros	0.7600	4,968.50	5,327.36	8,736.12	6,933.81	7,994.45
Maquinaria y equipo	0.7600	2,266.45	2,430.15	3,985.10	3,162.95	3,645.79
- Costo Económico		17,668.33	18,945.05	31,067.13	24,657.85	28,429.67

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ANALISIS DE COSTOS UNITARIOS

PARTIDA : CHAPIA Y LIMPIEZA DE ZONA LATERAL
UNIDAD : M2
RENDIM. (R) : 1,500
MONEDA : COLONES

18 Mar 95

A) EQUIPO	NUMERO	HORAS TRAB.	COSTO/HORA	COSTO
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (1)			0.00
	Costo Unitario = (1) / (R)			0.00

B) MANO DE OBRA	NUMERO	HORAS TRAB.	SALARIO/HORA	COSTO
Peon	10	8	12.96	1,036.80
Caporal	1	8	13.81	110.48
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (2)			1,147.28
	Costo Unitario = (2) / (R)			0.76

C) MATERIALES	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Herramientas	1.00		172.09	172.09
(15% de M.O.)				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (3)			172.09
	Costo Unitario = (3) / (R)			0.11

D) TRANSPORTE	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (4)			0.00
	Costo Unitario = (4) / (R)			0.00

E) COSTO UNITARIO DIRECTO = (A) + (B) + (C) + (D)	0.88
F) COSTO UNITARIO INDIRECTO = (E) x 0.40	0.35
G) COSTO UNITARIO TOTAL = (E) + (F)	1.23
H) COSTO UNITARIO TOTAL CON IVA = (G) x 1.10	1.35

OBSERVACIONES :

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ANALISIS DE COSTOS UNITARIOS

PARTIDA : LIMPIEZA DE ALCANTARILLAS
UNIDAD : ML
RENDIM. (R) : 50
MONEDA : COLONES

18 Mar 95

A) EQUIPO	NUMERO	HORAS TRAB.	COSTO/HORA	COSTO
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (1)			0.00
	Costo Unitario = (1) / (R)			0.00

B) MANO DE OBRA	NUMERO	HORAS TRAB.	SALARIO/HORA	COSTO
Peon	10	8	12.96	1,036.80
Caporal	1	8	13.81	110.48
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (2)			1,147.28
	Costo Unitario = (2) / (R)			22.95

C) MATERIALES	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Herramientas	1.00		172.09	172.09
(15% de M.O.)				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (3)			172.09
	Costo Unitario = (3) / (R)			3.44

D) TRANSPORTE	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (4)			0.00
	Costo Unitario = (4) / (R)			0.00

E) COSTO UNITARIO DIRECTO = (A) + (B) + (C) + (D)	26.39
F) COSTO UNITARIO INDIRECTO = (E) x 0.40	10.55
G) COSTO UNITARIO TOTAL = (E) + (F)	36.94
H) COSTO UNITARIO TOTAL CON IVA = (G) x 1.10	40.64

OBSERVACIONES

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ANALISIS DE COSTOS UNITARIOS

PARTIDA : LIMPIEZA Y CONFORMACION MANUAL DE CUNETAS
UNIDAD : ML
RENDIM. (R) : 200
MONEDA : COLONES

18-Mar-95

A) EQUIPO	NUMERO	HORAS TRAB.	COSTO/HORA	COSTO
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (1)			0.00
	Costo Unitario = (1) / (R)			0.00

B) MANO DE OBRA	NUMERO	HORAS TRAB.	SALARIO/HORA	COSTO
Peon	10	8	12.96	1,036.80
Caporal	1	8	13.81	110.48
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (2)			1,147.28
	Costo Unitario = (2) / (R)			5.74

C) MATERIALES	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Herramientas	1.00		172.09	172.09
(15% de M.O.)				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (3)			172.09
	Costo Unitario = (3) / (R)			0.86

D) TRANSPORTE	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (4)			0.00
	Costo Unitario = (4) / (R)			0.00

E) COSTO UNITARIO DIRECTO = (A) + (B) + (C) + (D)	6.60
F) COSTO UNITARIO INDIRECTO = (E) x 0.40	2.64
G) COSTO UNITARIO TOTAL = (E) + (F)	9.24
H) COSTO UNITARIO TOTAL CON IVA = (G) x 1.10	10.16

OBSERVACIONES :

ANALISIS DE COSTOS UNITARIOS

PARTIDA : LIMPIEZA Y CONFORMACION MECANIZADA DE CUNETAS
UNIDAD : ML
RENDIM. (R) : 2,000
MONEDA : COLONES

18-Mar-95

A) EQUIPO	NUMERO	HORAS TRAB.	COSTO/HORA	COSTO
Motoniveladora	1	8	400.00	3,200.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (1)			3,200.00
	Costo Unitario = (1) / (R)			1.60

B) MANO DE OBRA	NUMERO	HORAS TRAB.	SALARIO/HORA	COSTO
Peon	5	8	12.96	518.40
Caporal	1	8	13.81	110.48
Operador de equipo	1	8	18.00	144.00
Ay. operador equipo	1	8	13.98	111.84
				0.00
				0.00
				0.00
	Costo Parcial (2)			884.72
	Costo Unitario = (2) / (R)			0.44

C) MATERIALES	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Combustible	25.00	Gal.	7.50	187.50
Lubricantes	0.50	Gal.	54.55	27.27
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (3)			214.77
	Costo Unitario = (3) / (R)			0.11

D) TRANSPORTE	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (4)			0.00
	Costo Unitario = (4) / (R)			0.00

E) COSTO UNITARIO DIRECTO = (A) + (B) + (C) + (D)	2.15
F) COSTO UNITARIO INDIRECTO = (E) x 0.40	0.86
G) COSTO UNITARIO TOTAL = (E) + (F)	3.01
H) COSTO UNITARIO TOTAL CON IVA = (G) x 1.10	3.31

OBSERVACIONES :

ANALISIS DE COSTOS UNITARIOS

PARTIDA : BACHEO DE HOMBROS
UNIDAD : M3
RENDIM. (R) : 10
MONEDA : COLONES

18-Mar 95

A) EQUIPO	NUMERO	HORAS TRAB.	COSTO/HORA	COSTO
Camion de volteo	1	5	200 00	1,000 00
Rodillo manual	1	8	80 00	360 00
				0 00
				0 00
				0.00
				0 00
				0 00
	Costo Parcial (1)			1,360.00
	Costo Unitario = (1) / (R)			136.00

B) MANO DE OBRA	NUMERO	HORAS TRAB.	SALARIO/HORA	COSTO
Peon	10	8	12.96	1,036 80
Caporal	1	8	13.81	110 48
Motorista veh pesado	1	8	16.45	131 60
				0 00
				0.00
				0.00
				0 00
	Costo Parcial (2)			1,278.88
	Costo Unitario = (2) / (R)			127.89

C) MATERIALES	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Asfalto RC-2	40 00	Gal.	6.38	254 55
Mezcla Asfaltica	10 00	m3	672.67	6,726 73
Arena	0 80	m3	63.64	50 91
Combustible	25 00	Gal	7 50	187.50
Lubricante	0 50	Gal.	54 55	27 27
				0.00
				0.00
	Costo Parcial (3)			7,246.95
	Costo Unitario = (3) / (R)			724.70

D) TRANSPORTE	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
				0 00
				0 00
				0 00
				0.00
				0.00
				0.00
				0 00
	Costo Parcial (4)			0.00
	Costo Unitario = (4) / (R)			0.00

E) COSTO UNITARIO DIRECTO = (A) + (B) + (C) + (D)	988.58
F) COSTO UNITARIO INDIRECTO = (E) x 0.40	395.43
G) COSTO UNITARIO TOTAL = (E) + (F)	1,384.02
H) COSTO UNITARIO TOTAL CON IVA = (G) x 1.10	1,522.42

OBSERVACIONES

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ANALISIS DE COSTOS UNITARIOS

PARTIDA : REVESTIMIENTO DE HOMBROS
UNIDAD : M3
RENDIM. (R) : 180
MONEDA : COLONES

18 Mar 95

A) EQUIPO	NUMERO	HORAS TRAB.	COSTO/HORA	COSTO
Motoniveladora	1	4	400 00	1,600 00
Cargador	1	3	360 00	1,080 00
Pipa de agua	1	3	140 00	420 00
Aplanadora	1	5	180 00	900 00
				0 00
				0.00
				0 00
	Costo Parcial (1)			4,000.00
	Costo Unitario = (1) / (R)			22.22

B) MANO DE OBRA	NUMERO	HORAS TRAB.	SALARIO/HORA	COSTO
Peon	10	8	12.96	1,036 80
Caporal	1	8	13 81	110 48
Operador de equipo	3	8	18 00	432 00
Ay. operador equipo	3	8	13 98	335.52
Motorista veh. pesado	1	8	16.45	131 60
				0 00
				0 00
	Costo Parcial (2)			2,046.40
	Costo Unitario = (2) / (R)			11.37

C) MATERIALES	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Material selecto	180 00	m3	72.73	13,090.91
Combustible	60 00	Gal	7 50	450.00
Lubricante	1 20	Gal.	54.55	65.45
				0.00
				0 00
				0 00
				0.00
	Costo Parcial (3)			13,606.36
	Costo Unitario = (3) / (R)			75.59

D) TRANSPORTE	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Material selecto	180	m3	84 85	15,272.18
				0 00
				0.00
				0.00
				0.00
				0.00
				0 00
	Costo Parcial (4)			15,272.18
	Costo Unitario = (4) / (R)			84.85

E) COSTO UNITARIO DIRECTO = (A) + (B) + (C) + (D)	194.03
F) COSTO UNITARIO INDIRECTO = (E) x 0.40	77 01
G) COSTO UNITARIO TOTAL = (E) + (F)	271.04
H) COSTO UNITARIO TOTAL CON IVA = (G) x 1.10	298.80

OBSERVACIONES

ANALISIS DE COSTOS UNITARIOS

PARTIDA : REMOCION DE DERRUMBES
UNIDAD : M3
RENDIM. (R) : 400
MONEDA : COLONES

18 Mar 95

A) EQUIPO	NUMERO	HORAS TRAB.	COSTO HORA	COSTO
Cargador	1	6	360.00	2,160 00
Camion de volteo	4	8	200 00	6,400 00
				0 00
				0 00
				0 00
				0 00
				0 00
	Costo Parcial (1)			8,560.00
	Costo Unitario = (1) / (R)			21 40

B) MANO DE OBRA	NUMERO	HORAS TRAB.	SALARIO/HORA	COSTO
Operador de equipo	1	6	18 00	108 00
Ay. operador equipo	1	6	13.98	83 88
Motorista veh pesado	4	8	18.45	526 40
				0 00
				0 00
				0 00
				0 00
	Costo Parcial (2)			718.28
	Costo Unitario = (2) / (R)			1.80

C) MATERIALES	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Combustible	60 00	Gal	7 50	450 00
Lubricante	1 20	Gal	54.55	65 45
				0 00
				0 00
				0 00
				0 00
				0 00
	Costo Parcial (3)			515 45
	Costo Unitario = (3) / (R)			1.28

D) TRANSPORTE	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
				0 00
				0 00
				0 00
				0 00
				0 00
				0 00
				0 00
	Costo Parcial (4)			0.00
	Costo Unitario = (4) / (R)			0.00

E) COSTO UNITARIO DIRECTO = (A) + (B) + (C) + (D)	24.48
F) COSTO UNITARIO INDIRECTO = (E) x 0.40	9.79
G) COSTO UNITARIO TOTAL = (E) + (F)	34.28
H) COSTO UNITARIO TOTAL CON IVA = (G) x 1.10	37.71

OBSERVACIONES

ANALISIS DE COSTOS UNITARIOS

PARTIDA : AFINAMIENTO DE TALUDES EN CORTE
UNIDAD : M2
RENDIM. (R) : 60
MONEDA : COLONES

18-Mar-95

A) EQUIPO	NUMERO	HORAS TRAB.	COSTO/HORA	COSTO
Camion	1	2	200.00	400.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (1)			400.00
	Costo Unitario = (1) / (R)			6.67

B) MANO DE OBRA	NUMERO	HORAS TRAB.	SALARIO/HORA	COSTO
Peon	10	8	12.96	1,036.80
Caporal	1	8	13.81	110.48
Motorista veh pesado	1	2	16.45	32.90
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (2)			1,180.18
	Costo Unitario = (2) / (R)			19.67

C) MATERIALES	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Combustible	5.00	Gal	7.50	37.50
Lubricante	0.10	Gal	54.55	5.45
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (3)			42.95
	Costo Unitario = (3) / (R)			0.72

D) TRANSPORTE	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (4)			0.00
	Costo Unitario = (4) / (R)			0.00

E) COSTO UNITARIO DIRECTO = (A) + (B) + (C) + (D)	27.05
F) COSTO UNITARIO INDIRECTO = (E) x 0.40	10.82
G) COSTO UNITARIO TOTAL = (E) + (F)	37.87
H) COSTO UNITARIO TOTAL CON IVA = (G) x 1.10	41.66

OBSERVACIONES

ANALISIS DE COSTOS UNITARIOS

PARTIDA : SELLO DE GRIETAS
UNIDAD : ML
RENDIM. (R) : 425
MONEDA : COLONES

18 Mar 95

A) EQUIPO	NUMERO	HORAS TRAB.	COSTO HORA	COSTO
Camion de volteo	1	8	200.00	1 600.00
Compresor	1	8	182.00	1,456.00
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (1)			3,056.00
	Costo Unitario = (1) / (R)			7.19

B) MANO DE OBRA	NUMERO	HORAS TRAB.	SALARIO/HORA	COSTO
Peon	10	8	12.96	1,036.80
Caporal	1	8	13.81	110.48
Motorista veh. pes.	1	8	16.45	131.60
Operador equipo	1	8	18.00	144.00
				0.00
				0.00
				0.00
	Costo Parcial (2)			1,422.88
	Costo Unitario = (2) / (R)			3.35

C) MATERIALES	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Asfalto RC-2	12.75	Gal	6.36	81.14
Arena	0.09	m3	63.64	5.73
Aceite diesel	22.00	Gal	7.50	165.00
Lubricantes	0.44	Gal	54.55	24.00
				0.00
				0.00
				0.00
	Costo Parcial (3)			275.86
	Costo Unitario = (3) / (R)			0.65

D) TRANSPORTE	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (4)			0.00
	Costo Unitario = (4) / (R)			0.00

E) COSTO UNITARIO DIRECTO = (A) + (B) + (C) + (D)	11.19
F) COSTO UNITARIO INDIRECTO = (E) x 0.40	4.48
G) COSTO UNITARIO TOTAL = (E) + (F)	15.68
H) COSTO UNITARIO TOTAL CON IVA = (G) x 1.10	17.23

OBSERVACIONES

ANALISIS DE COSTOS UNITARIOS

PARTIDA : RIEGO DE SELLO LOCALIZADO
UNIDAD : M2
RENDIM. (R) : 300
MONEDA : COLONES

16 Mar 95

A) EQUIPO	NUMERO	HORAS TRAB.	COSTO/HORA	COSTO
Camion de volteo	1	8	200 00	1,600 00
Rodillo manual	1	8	60 00	480 00
				0 00
				0 00
				0 00
				0 00
				0 00
	Costo Parcial (1)			2,080.00
	Costo Unitario = (1) / (R)			6.93

B) MANO DE OBRA	NUMERO	HORAS TRAB.	SALARIO/HORA	COSTO
Peon	20	8	12 96	2,073 60
Caporal	2	8	13 81	220.96
Motorista veh pes	1	8	16.45	131 60
				0 00
				0 00
				0 00
				0 00
	Costo Parcial (2)			2,426.16
	Costo Unitario = (2) / (R)			8.09

C) MATERIALES	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Asfalto RC-2	55 00	Gal	6 36	350 00
Arena	1 80	m3	63 64	114 55
Aceite diesel	30 00	Gal.	7 50	225 00
Lubricantes	0 60	Gal.	54.55	32 73
				0 00
				0 00
				0 00
	Costo Parcial (3)			722.27
	Costo Unitario = (3) / (R)			2.41

D) TRANSPORTE	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
				0 00
				0.00
				0.00
				0.00
				0.00
				0.00
				0 00
	Costo Parcial (4)			0.00
	Costo Unitario = (4) / (R)			0.00

E) COSTO UNITARIO DIRECTO = (A) + (B) + (C) + (D)	17.43
F) COSTO UNITARIO INDIRECTO = (E) x 0 40	6.97
G) COSTO UNITARIO TOTAL = (E) + (F)	24.40
H) COSTO UNITARIO TOTAL CON IVA = (G) x 1.10	26.84

OBSERVACIONES :

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ANALISIS DE COSTOS UNITARIOS

PARTIDA : PINTURA DE MOJONES DE KILOMETRAJE
UNIDAD : C/U
RENDIM. (R) : 3.12
MONEDA : COLONES

18-Mar 95

A) EQUIPO	NUMERO	HORAS TRAB	COSTO/HORA	COSTO
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (1)			0.00
	Costo Unitario = (1) / (R)			0.00

B) MANO DE OBRA	NUMERO	HORAS TRAB.	SALARIO/HORA	COSTO
Pintor	1	8	13.81	110.48
Ayudante	1	8	12.96	103.68
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (2)			214.16
	Costo Unitario = (2) / (R)			68.64

C) MATERIALES	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Herramientas	1.00		32.12	32.12
(15% de M.O.)				0.00
Pintura para hitos	0.19	Gal	145.98	27.74
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (3)			59.86
	Costo Unitario = (3) / (R)			19.19

D) TRANSPORTE	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (4)			0.00
	Costo Unitario = (4) / (R)			0.00

E) COSTO UNITARIO DIRECTO = (A) + (B) + (C) + (D)	87.83
F) COSTO UNITARIO INDIRECTO = (E) x 0.40	35.13
G) COSTO UNITARIO TOTAL = (E) + (F)	122.96
H) COSTO UNITARIO TOTAL CON IVA = (G) x 1.10	135.25

OBSERVACIONES

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ANALISIS DE COSTOS UNITARIOS

PARTIDA : LIMPIEZA DE ROTULOS DE TRANSITO
UNIDAD : C/U
RENDIM. (R) : 3.00
MONEDA : COLONES

18 Mar 95

A) EQUIPO	NUMERO	HORAS TRAB.	COSTO/HORA	COSTO
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (1)			0.00
	Costo Unitario = (1) / (R)			0.00

B) MANO DE OBRA	NUMERO	HORAS TRAB.	SALARIO HORA	COSTO
Pintor	1	8	13.81	110.48
Ayudante	1	8	12.98	103.68
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (2)			214.16
	Costo Unitario = (2) / (R)			71.39

C) MATERIALES	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Herramientas	1.00		32.12	32.12
(15% de M.O.)				0.00
Esmalte anticorrosivo	0.30	Gal	195.60	58.68
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (3)			90.80
	Costo Unitario = (3) / (R)			30.27

D) TRANSPORTE	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (4)			0.00
	Costo Unitario = (4) / (R)			0.00

E) COSTO UNITARIO DIRECTO = (A) + (B) + (C) + (D)	101.65
F) COSTO UNITARIO INDIRECTO = (E) x 0.40	40.68
G) COSTO UNITARIO TOTAL = (E) + (F)	142.32
H) COSTO UNITARIO TOTAL CON IVA = (G) x 1.10	156.55

OBSERVACIONES

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ANALISIS DE COSTOS UNITARIOS

PARTIDA : FRANJAS DE TRANSITO
UNIDAD : ML
RENDIM. (R) : 168
MONEDA : COLONES

18 Mar 95

A) EQUIPO	NUMERO	HORAS TRAB.	COSTO HORA	COSTO
Equipo senalizacion	1	8	50 00	400 00
				0 00
				0 00
				0 00
				0 00
				0 00
				0 00
	Costo Parcial (1)			400.00
	Costo Unitario = (1) / (R)			2.41

B) MANO DE OBRA	NUMERO	HORAS TRAB.	SALARIO HORA	COSTO
Operador de equipo	1	8	18 00	144 00
Ay operador equipo	1	8	13 98	111 84
				0 00
				0 00
				0 00
				0 00
				0 00
	Costo Parcial (2)			255.84
	Costo Unitario = (2) / (R)			1.54

C) MATERIALES	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Microesfera de vidrio	0 500	Lb	9 00	4 50
Pintura tipo trafico	0 009	Gal	165 00	1 49
Thinor	0 002	Gal	27 00	0 05
				0 00
				0 00
				0 00
				0 00
	Costo Parcial (3)			5.04
	Costo Unitario = (3) / (R)			0.04

D) TRANSPORTE	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
				0 00
				0 00
				0 00
				0 00
				0 00
				0 00
				0 00
	Costo Parcial (4)			0.00
	Costo Unitario = (4) / (R)			0.00

E) COSTO UNITARIO DIRECTO = (A) + (B) + (C) + (D)	3.99
F) COSTO UNITARIO INDIRECTO = (E) x 0 40	1.59
G) COSTO UNITARIO TOTAL = (E) + (F)	5.58
H) COSTO UNITARIO TOTAL CON IVA = (G) x 1.10	6.14

OBSERVACIONES

ANNEX 3.6.5-B

PERIODIC MAINTENANCE COST

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COSTO POR KILOMETRO PROMEDIO DE MANTENIMIENTO PERIODICO (COLONES) CONDICION FISICA DE LA VIA: REGULAR

TIPO DE CARRETERA	COSTO POR KILOMETRO			
	Recarpeteo	Trat. simple	Sello	Revest.
Primaria				
Financiero	778.804.48	152 385.50	89 902 02	0 00
Economico	620.064.13	121.329.34	71,579 96	0.00
Rural				
Financiero	0 00	0.00	0 00	165 219 68
Economico	0 00	0 00	0 00	131 548 07

NOTA: En El Salvador se utiliza con mas frecuencia el recarpeteo, sin embargo se presenta el costo utilizando las otras dos opciones

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CUADRO No. 4
COSTOS POR KILOMETRO DE MANTENIMIENTO PERIODICO (COLONES)
CARRETERA PRIMARIA

ACTIVIDAD	UNIDAD	COSTO UNITARIO	VOLUMEN DE OBRA					COSTO TOTAL				
			MB	B	R	M	MM	MB	B	R	M	MM
Recarpeteo con mezcla asfaltica en caliente (7 cm)	m2	98.51	0	7,300	0	0	0	0.00	719,120.16	0.00	0.00	0.00
Tratamiento superficial simple (Hombros)	m2	12.70	0	4,700	0	0	0	0.00	59,684.32	0.00	0.00	0.00
TOTAL								0.00	778,804.48	0.00	0.00	0.00

CONDICION DE LA CARRETERA.

MB Muy Buena

B Buena

R Regular

M Mala

MM Muy Mala

NOTAS

Para este tipo de mantenimiento solo se considero la actividad de recapeo para la carpeta de rodamiento y para la hombros tratamiento superficial simple y las actividades de mantenimiento rutinario deberan ser realizadas por la empresas que las tiene bajo su responsabilidad.

Los costos incluyen IVA.

CUADRO No. 4 (A)
COSTOS POR KILOMETRO DE MANTENIMIENTO PERIODICO (COLONES)
CARRETERA PRIMARIA

ACTIVIDAD	UNIDAD	COSTO UNITARIO	VOLUMEN DE OBRA					COSTO TOTAL				
			MB	B	R	M	MM	MB	B	R	M	MM
Tratamiento superficial simple	m2	12 70	0	7,300	0	0	0	0 00	92,701.18	0 00	0 00	0 0
Tratamiento superficial simple (Hombros)	m2	12.70	0	4.700	0	0	0	0.00	59,684.32	0 00	0 00	0 0
TOTAL								0.00	152,385.50	0.00	0.00	0 0

CONDICION DE LA CARRETERA

MB : Muy Buena

B : Buena

R : Regular

M : Mala

MM : Muy Mala

NOTAS

Este es otro tipo de mantenimiento en cual solo se aplica tratamiento superficial simple tanto en la carpeta de rodamiento como en los hombros y el mantenimiento siempre sera realizado

Los costos incluyen IVA.

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CUADRO No. 4 (B)
COSTOS POR KILOMETRO DE MANTENIMIENTO PERIODICO (COLONES)
CARRETERA PRIMARIA

ACTIVIDAD	UNIDAD	COSTO UNITARIO	VOLUMEN DE OBRA					COSTO TOTAL				
			MB	B	R	M	MM	MB	B	R	M	MM
Capa de sello con grava #0	m2	7.49	0	7,300	0	0	0	0.00	54,690.39	0.00	0.00	0.00
Capa de sello con grava #0	m2	7.49	0	4,700	0	0	0	0.00	35,211.62	0.00	0.00	0.00
TOTAL								0.00	89,902.02	0.00	0.00	0.00

CONDICION DE LA CARRETERA

MB Muy Buena

B Buena

R Regular

M Mala

MM Muy Mala

NOTAS

Este es otro tipo de mantenimiento en cual solo se aplica una capa de sello con grava #0 tanto en la carpeta de rodamiento como en los hombros y el mantenimiento siempre sera realizado.

Los costos incluyen IVA.

CUADRO No. 9

COSTOS POR KILOMETRO DE MANTENIMIENTO PERIODICO (COLONES)

CAMINO RURAL

ACTIVIDAD	UNIDAD	COSTO UNITARIO	VOLUMEN DE OBRA					COSTO TOTAL				
			MB	B	R	M	MM	MB	B	R	M	MM
Revestimiento de caminos	m3	183.58	0	0	900	0	0	0.00	0.00	165.219.88	0.00	0.00
TOTAL								0.00	0.00	165.219.88	0.00	0.00

CONDICION DE LA CARRETERA:

MB : Muy Buena

B : Buena

R : Regular

M : Mala

MM : Muy Mala

NOTA

Los costos incluyen IVA

MEMORIA DE CALCULO DE COSTOS ECONOMICOS
MANTENIMIENTO PERIODICO (COLONES)
CARRETERA PRIMARIA

ACTIVIDAD	%	COSTO TOTAL				
		MB	B	R	M	MM
Utilizando recarpeteo						
- Costo Financiero		**0.00**	**776,804.48**	**0.00**	**0.00**	**0.00**
COMPOSICION DEL MANTENIMIENTO						
Mano de obra calificada	5.70	0.00	52,179.90	0.00	0.00	0.00
Mano de obra no calificada	9.80	0.00	76,322.84	0.00	0.00	0.00
Materiales nacionales	43.90	0.00	380,685.39	0.00	0.00	0.00
Materiales extranjeros	15.00	0.00	116,820.67	0.00	0.00	0.00
Maquinaria y equipo	19.60	0.00	152,545.66	0.00	0.00	0.00
FACTOR SOMBRA						
Mano de obra calificada	0.9744	0.00	50,844.09	0.00	0.00	0.00
Mano de obra no calificada	0.4000	0.00	30,529.14	0.00	0.00	0.00
Materiales nacionales	0.8785	0.00	334,316.47	0.00	0.00	0.00
Materiales extranjeros	0.7600	0.00	88,783.71	0.00	0.00	0.00
Maquinaria y equipo	0.7600	0.00	116,010.72	0.00	0.00	0.00
- Costo Economico		**0.00**	**620,084.13**	**0.00**	**0.00**	**0.00**

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MEMORIA DE CALCULO DE COSTOS ECONOMICOS
MANTENIMIENTO PERIODICO (COLONES)
CARRETERA PRIMARIA

ACTIVIDAD	%	COSTO TOTAL				
		MB	B	R	M	MM
Utilizando tratamiento simple						
- Costo Financiero		**0.00**	**152,385.50**	**0.00**	**0.00**	**0.00**
COMPOSICION DEL MANTENIMIENTO						
Mano de obra calificada	6 70	0.00	10,209.83	0 00	0.00	0 00
Mano de obra no calificada	9 80	0 00	14 933.78	0 00	0 00	0 00
Materiales nacionales	48 90	0 00	74 516 51	0 00	0 00	0 00
Materiales extranjeros	15 00	0.00	22.857 83	0 00	0.00	0 00
Maquinaria y equipo	19 60	0 00	29.867.56	0 00	0 00	0 00
FACTOR SOMBRA						
Mano de obra calificada	0 9744	0 00	9.948 46	0 00	0.00	0 00
Mano de obra no calificada	0.4000	0 00	5,973.51	0 00	0 00	0 00
Materiales nacionales	0.8768	0 00	65 336 08	0 00	0 00	0 00
Materiales extranjeros	0.7600	0 00	17.371 95	0 00	0 00	0 00
Maquinaria y equipo	0 7600	0.00	22.699.34	0.00	0.00	0 00
- Costo Economico		**0.00**	**121,329.34**	**0.00**	**0.00**	**0.00**

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MEMORIA DE CALCULO DE COSTOS ECONOMICOS
MANTENIMIENTO PERIODICO (COLONES)
CARRETERA PRIMARIA

ACTIVIDAD	%	COSTO TOTAL				
		MB	B	R	M	MM
Utilizando sello						
- Costo Financiero		**0.00**	**89,902.02**	**0.00**	**0.00**	**0.00**
COMPOSICION DEL MANTENIMIENTO						
Mano de obra calificada	6.70	0.00	6,023.44	0.00	0.00	0.00
Mano de obra no calificada	9.80	0.00	8,810.40	0.00	0.00	0.00
Materiales nacionales	48.90	0.00	43,962.09	0.00	0.00	0.00
Materiales extranjeros	15.00	0.00	13,485.30	0.00	0.00	0.00
Maquinaria y equipo	19.60	0.00	17,620.80	0.00	0.00	0.00
FACTOR SOMBRA						
Mano de obra calificada	0.9744	0.00	5,869.24	0.00	0.00	0.00
Mano de obra no calificada	0.4000	0.00	3,524.16	0.00	0.00	0.00
Materiales nacionales	0.8768	0.00	38,545.96	0.00	0.00	0.00
Materiales extranjeros	0.7600	0.00	10,248.83	0.00	0.00	0.00
Maquinaria y equipo	0.7600	0.00	13,391.80	0.00	0.00	0.00
- Costo Economico		**0.00**	**71,579.98**	**0.00**	**0.00**	**0.00**

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MEMORIA DE CALCULO DE COSTOS ECONOMICOS
MANTENIMIENTO PERIODICO (COLONES)
CAMINO RURAL

ACTIVIDAD	%	COSTO TOTAL				
		MB	B	R	M	MM
Revestimiento de caminos						
- Costo Financiero		**0.00**	**0.00**	**165.219.88**	**0.00**	**0.00**
COMPOSICION DEL MANTENIMIENTO						
Mano de obra calificada	5.70	0.00	0.00	11.069.73	0.00	0.00
Mano de obra no calificada	9.8[illegible]	0.00	0.00	15.191.55	0.00	0.00
Materiales nacionales	48.90	0.00	0.00	80.792.52	0.00	0.00
Materiales extranjeros	15.00	0.00	0.00	24.782.98	0.00	0.00
Maquinaria y equipo	19.50	0.00	0.00	32.363.10	0.00	0.00
FACTOR SOMBRA						
Mano de obra calificada	0.9744	0.00	0.00	10.786.35	0.00	0.00
Mano de obra no calificada	0.4600	0.00	0.00	6.476.62	0.00	0.00
Materiales nacionales	0.8758	0.00	0.00	70.838.88	0.00	0.00
Materiales extranjeros	0.7600	0.00	0.00	18,835.07	0.00	0.00
Maquinaria y equipo	0.7600	0.00	0.00	24.611.15	0.00	0.00
- Costo Economico		**0.00**	**0.00**	**131,548.07**	**0.00**	**0.00**

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ANALISIS DE COSTOS UNITARIOS

PARTIDA : RECARPETEO CON MEZCLA ASFALTICA EN CALIENTE
UNIDAD : M2
RENDIM. (R) : 2,143
MONEDA : COLONES

18 Mar 95

A) EQUIPO	NUMERO	HORAS TRAB.	COSTO HORA	COSTO
Aplanadora	1	8	180.00	1,440.00
Compresor	1	8	182.00	1,456.00
Pavimentadora	1	8	800.00	6,400.00
Distribuidor asfaltico	1	8	225.00	1,800.00
Compact. neumatica	1	8	180.00	1,440.00
				0.00
				0.00
	Costo Parcial (1)			12,536.00
	Costo Unitario = (1) / (R)			5.85

B) MANO DE OBRA	NUMERO	HORAS TRAB.	SALARIO HORA	COSTO
Peon	12	8	12.96	1,244.16
Caporal	1	8	13.81	110.48
Operador de equipo	5	8	18.00	720.00
Ay. operador equipo	6	8	13.98	671.04
Personal laboratorio	1	8	20.65	165.20
				0.00
				0.00
	Costo Parcial (2)			2,910.88
	Costo Unitario = (2) / (R)			1.36

C) MATERIALES	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Mezcla asfaltica	150.00	m3	672.67	100,900.91
Asfalto liquido RC-2	900.00	Gal	6.36	5,727.27
Combustible	150.00	Gal	7.50	1,125.00
Lubricante	4.50	Gal	54.55	245.45
				0.00
				0.00
				0.00
	Costo Parcial (3)			107,998.64
	Costo Unitario = (3) / (R)			50.40

D) TRANSPORTE	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Mezcla asfaltica	150.00	m3	90.91	13,636.36
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (4)			13,636.36
	Costo Unitario = (4) / (R)			6.36

E) COSTO UNITARIO DIRECTO = (A) + (B) + (C) + (D)	63.97
F) COSTO UNITARIO INDIRECTO = (E) x 0.40	25.59
G) COSTO UNITARIO TOTAL = (E) + (F)	89.55
H) COSTO UNITARIO TOTAL CON IVA = (G) x 1.10	98.51

OBSERVACIONES

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ANALISIS DE COSTOS UNITARIOS

PARTIDA : TRATAMIENTO SUPERFICIAL SIMPLE
UNIDAD : M2
RENDIM. (R) : 5,000
MONEDA : COLONES

18 Mar 95

A) EQUIPO	NUMERO	HORAS TRAB.	COSTO/HORA	COSTO
Compact. neumatica	1	6	180.00	1,080.00
Aplanadora	1	6	180.00	1,080.00
Compresor	1	1	182.00	728.00
Cargador	1	2	360.00	720.00
Esparcidor agregado	1	8	187.00	1,496.00
Distribuidor de asfalto	1	8	225.00	1,800.00
				0.00
	Costo Parcial (1)			6,904.00
	Costo Unitario = (1) / (R)			1.38

B) MANO DE OBRA	NUMERO	HORAS TRAB.	SALARIO/HORA	COSTO
Peon	10	8	12.06	1,036.00
Caporal	1	8	13.81	110.40
Operador de equipo	4	8	18.00	720.00
Ay. operador equipo	5	8	13.98	558.20
				0.00
				0.00
				0.00
	Costo Parcial (2)			2,424.60
	Costo Unitario = (2) / (R)			0.48

C) MATERIALES	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Asfalto liquido RC-2	2,100.00	Gal	6.36	13,356.00
Grava	60.00	m3	163.64	9,818.10
Combustible	85.00	Gal	7.50	637.50
Lubricante	1.70	Gal	54.55	92.73
Kerosene	1.00		307.50	307.50
Herramientas	1.00		600.00	600.00
				0.00
	Costo Parcial (3)			26,809.84
	Costo Unitario = (3) / (R)			5.36

D) TRANSPORTE	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Grava	60.00	m3	81.85	5,090.73
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (4)			5,090.73
	Costo Unitario = (4) / (R)			1.02

E) COSTO UNITARIO DIRECTO = (A) + (B) + (C) + (D)	8.25
F) COSTO UNITARIO INDIRECTO = (E) x 0.40	3.30
G) COSTO UNITARIO TOTAL = (E) + (F)	11.51
H) COSTO UNITARIO TOTAL CON IVA = (G) x 1.10	12.70

OBSERVACIONES

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ANALISIS DE COSTOS UNITARIOS

PARTIDA : CAPA DE SELLO CON GRAVA #0
UNIDAD : M2
RENDIM. (R) : 6,500
MONEDA : COLONES

18 Ene 98

A) EQUIPO	NUMERO	HORAS TRAB.	COSTO HORA	COSTO
Compresor	1	1	182.00	728.00
Aplanadora y neumat	2	1	180.00	1,080.00
Cargador	1	2	360.00	720.00
Distribuidor de asfalto	1	8	225.00	1,800.00
Esparcidor agregado	1	8	187.00	1,496.00
				0.00
				0.00
	Costo Parcial (1)			5,824.00
	Costo Unitario = (1) / (R)			0.90

B) MANO DE OBRA	NUMERO	HORAS TRAB.	SALARIO/HORA	COSTO
Peon	15	8	12.95	1,555.20
Caporal	1	8	13.81	110.48
Operador de equipo	5	8	18.00	720.00
Ay. operador equipo	5	8	13.98	559.20
				0.00
				0.00
				0.00
	Costo Parcial (2)			2,944.88
	Costo Unitario = (2) / (R)			0.45

C) MATERIALES	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Asfalto liquido RC-2	1,300.00	Gal	6.36	8,272.73
Grava #0	55.00	m3	163.64	9,000.00
Combustible	95.00	Gal	7.50	712.50
Lubricante	1.00	Gal	54.55	103.61
Varios	1.00		1,000.00	1,000.00
				0.00
				0.00
	Costo Parcial (3)			19,088.88
	Costo Unitario = (3) / (R)			2.94

D) TRANSPORTE	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Grava #0	46.00	m3	81.82	3,763.64
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (4)			3,763.64
	Costo Unitario = (4) / (R)			0.58

E) COSTO UNITARIO DIRECTO = (A) + (B) + (C) + (D)	4.84
F) COSTO UNITARIO INDIRECTO = (E) x 0.40	1.95
G) COSTO UNITARIO TOTAL = (E) + (F)	6.81
H) COSTO UNITARIO TOTAL CON IVA = (G) x 1.10	7.49

OBSERVACIONES

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ANALISIS DE COSTOS UNITARIOS

PARTIDA : REVESTIMIENTO DE CAMINOS
UNIDAD : M3
RENDIM. (R) : 180
MONEDA : COLONES

26 Mar-95

A) EQUIPO	NUMERO	HORAS TRAB.	COSTO/HORA	COSTO
Camiones de volteo	5	8	200 00	8,000 00
Motoniveladora	1	8	400 00	3,200 00
Cargador	1	5	300 00	1,800 00
Pipa de agua	1	8	140 00	1,120 00
Aplanadora	1	8	180 00	1,440 00
				0 00
				0 00
	Costo Parcial (1)			15,560.00
	Costo Unitario = (1) / (R)			86.44

B) MANO DE OBRA	NUMERO	HORAS TRAB.	SALARIO/HORA	COSTO
Peon	10	8	12 96	1 038 80
Caporal	1	8	13 81	110 48
Operador de equipo	3	8	18 00	432 00
Ay operador equipo	3	8	13 98	335 52
Motorista veh pesado	6	8	16 15	789 60
				0 00
				0 00
	Costo Parcial (2)			2,704.40
	Costo Unitario = (2) / (R)			15.02

C) MATERIALES	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Balasto	160 00	m3	11 38	1,810 18
Aceite diesel	160 00	Gal	7 50	1,200 00
Lubricante	3 20	Gal	54 55	174 55
				0.00
				0 00
				0 00
				0.00
	Costo Parcial (3)			3,192.73
	Costo Unitario = (3) / (R)			17.74

D) TRANSPORTE	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
				0.00
				0 00
				0.00
				0 00
				0 00
				0 00
				0 00
	Costo Parcial (4)			0.00
	Costo Unitario = (4) / (R)			0.00

E) COSTO UNITARIO DIRECTO = (A) + (B) + (C) + (D)	119.21
F) COSTO UNITARIO INDIRECTO = (E) x 0.40	47.68
G) COSTO UNITARIO TOTAL = (E) + (F)	166.89
H) COSTO UNITARIO TOTAL CON IVA = (G) x 1.10	183.58

OBSERVACIONES

ANALISIS DE COSTOS UNITARIOS

PARTIDA : CONFORMACION SUPERFICIE DE RODAMIENTO
UNIDAD : M2
RENDIM. (R) : 5,000
MONEDA : COLONES

25-Mar-95

A) EQUIPO	NUMERO	HORAS TRAB.	COSTO/HORA	COSTO
Motoniveladora CAT 120	1	8	400 00	3,200 00
Aplanadora	1	5	180 00	900 00
Pipa de agua	1	5	140 00	700 00
				0.00
				0.00
				0.00
				0 00
	Costo Parcial (1)			4,800.00
	Costo Unitario = (1) / (R)			0.96

B) MANO DE OBRA	NUMERO	HORAS TRAB.	SALARIO/HORA	COSTO
Operador equipo terr	2	8	18 00	288 00
Ayudante de operador	1	8	13 90	111 84
Motorista veh. pesado	1	8	16 45	131 60
				0 00
				0.00
				0.00
				0 00
	Costo Parcial (2)			531.44
	Costo Unitario = (2) / (R)			0.11

C) MATERIALES	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Diesel	65 00	Gal	7 50	487 50
Lubricante	0 60	Gal	54 55	32 73
				0.00
				0.00
				0.00
				0 00
				0 00
	Costo Parcial (3)			520.23
	Costo Unitario = (3) / (R)			0.10

D) TRANSPORTE	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
				0 00
				0 00
				0 00
				0 00
				0.00
				0.00
				0.00
	Costo Parcial (4)			0.00
	Costo Unitario = (4) / (R)			0.00

E) COSTO UNITARIO DIRECTO = (A) + (B) + (C) + (D)	1.17
F) COSTO UNITARIO INDIRECTO = (E) x 0.40	0.47
G) COSTO UNITARIO TOTAL = (E) + (F)	1.64
H) COSTO UNITARIO TOTAL CON IVA = (G) x 1.10	1.80

OBSERVACIONES

ANALISIS DE COSTOS UNITARIOS

PARTIDA : RELLENOS PARCIALES
UNIDAD : M2
RENDIM. (R) : 90
MONEDA : COLONES

25-Mar-95

A) EQUIPO	NUMERO	HORAS TRAB.	COSTO/HORA	COSTO
Motoniveladora	1	8	400 00	3,200.00
Camion de volteo	3	8	200 00	4,800 00
Cargador	1	4	360 00	1,440 00
Camion tanque	1	4	140 00	560.00
				0.00
				0.00
				0 00
	Costo Parcial (1)			10,000.00
	Costo Unitario = (1) / (R)			111.11

B) MANO DE OBRA	NUMERO	HORAS TRAB.	SALARIO/HORA	COSTO
Operador equipo terr.	1 5	8	18 00	216 00
Ayudante de operador	1 5	8	13 98	167 76
Motorista veh. pesado	3 5	8	16 45	460.60
Peon	5	8	12 96	518.40
Caporal	1	8	13 81	110 48
				0.00
				0 00
	Costo Parcial (2)			1,473.24
	Costo Unitario = (2) / (R)			16.37

C) MATERIALES	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Diesel	110 00	Gal	7 50	825 00
Lubricante	2 20	Gal.	54 55	120.00
Balasto	90 00	M3	11 36	1,022.73
				0 00
				0.00
				0.00
				0.00
	Costo Parcial (3)			1,967.73
	Costo Unitario = (3) / (R)			21.86

D) TRANSPORTE	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
				0 00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (4)			0.00
	Costo Unitario = (4) / (R)			0.00

E) COSTO UNITARIO DIRECTO = (A) + (B) + (C) + (D)	149.34
F) COSTO UNITARIO INDIRECTO = (E) x 0.40	59.74
G) COSTO UNITARIO TOTAL = (E) + (F)	209.08
H) COSTO UNITARIO TOTAL CON IVA = (G) x 1.10	229.99

OBSERVACIONES :

ANNEX 3.6.5-C

INVESTMENT COSTS

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COSTO POR KILOMETRO PROMEDIO
DE INVERSION POR CATEGORIA (COLONES)

CATEGORIAS	COSTO/KM. FINANCIERO	COSTO/KM. ECONOMICO
RECONSTRUCCION PAVIMENTOS		
Especial	4,288,957.79	3,414,868.19
Primaria	2,280,963.88	1,816,103.44
Secundaria	2,050,921.81	1,632,943.94
AMPLIACION		
Especial (4 vias) a Especial (6 vias)	12,200,177.14	9,713,781.04
De secundaria a especial	10,673,563.76	8,657,531.47
De primaria a especial	8,738,009.18	6,957,202.91
De secundaria a primaria	5,038,235.82	4,011,443.36
Primaria (mejoramiento 13 curvas)	2,335,402.98	1,859,447.85
CONSTRUCCION		
Especial (6 vias)	28,843,715.56	22,965,366.33
Especial (4 vias)	16,076,212.68	12,799,880.53
Primaria	12,209,515.94	9,721,216.59
Secundaria	9,705,308.41	7,727,366.56

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MEMORIA DE CALCULO DE COSTOS DE INVERSION POR CATEGORIA

CATEGORIA	LONG KM	CONST	SUPER.	ROW	FACT	DISEÑO	INV TOTAL	COSTO KM
RECONSTRUCCION PAVIMENTOS								
Especial	1	3 999 996 10	210 400 40	2 741 50	36 783 61	38 036 19	4.288 957 79	4 288 957 79
Primaria	58 8	83 401.249 42	5 151.394 41	220 000 00	1.297.725 76	1 480 519.17	91 530 888 78	1 556 647 77
	44 4	79 712 589 00	5 744 964 93	166 122 45	1.143 234 60	1.865.287 37	88 632 198 35	1 996 220 68
	27 6	69.976 046 41	4 183 815 03	183 359 93	1.015 227 64	1 049 798 84	76 408 247 85	2 768 414 76
	26 1	60 397 044 64	4 490.272 36		960 052 22	990 744 56	66 843 113 78	2 561 038 64
	55	116 814 045 33	6 144 436 45	525 000 00	1.416 168 99	1 464 393 32	126 364 044 06	2 297 526 07
	34	76 876.392 83	5.551 582 02	225 878 17	1.250 642 74	1 293.230 46	85.201 726 22	2 505 933 12
Secundaria	28	62 704 507 58	4 261 741 84	188 017 32	1.029 941 09	1 065 013 32	69 255 281 14	2 473 402 91
	44 3	60 975 409 75	6 551 047 14	294 305 57	1.140 659 75	1 178 502 25	72 138 923 86	1 628 440 72
AMPLIACION								
Especial (4 vías) a Especial (6 vías)	1	9 869 406 56	1 356 931 78	857 019 00	36 783 61	38 036 19	12 200 177 14	12 200 177 14
De secundaria a especial	23 1	200 483 361 36	27 604 822 60	20 721 138 88	1 052 045 68	1 317 953 98	251 178 302 90	10 872 503 76
De primaria a especial	9 3	83 714 080 56	11 113 029 64	8 340 276 69	478 922 60	998 754 28	101 647 603 76	10 939 896 07
	64	338 669 511 77	16 311 756 77	57 409 215 93	1 647 905 73	2 925 000 00	416 954 370 20	6 546 162 03
De secundaria a primaria	5 3	20 850 545 46	2 854 749 81	2 614 810 38	194 953 13	347 392 79	26 862 451 56	5 066 387 05
	30 4	127 463 711 89	17 451 676 08	15 984 878 56	829 455 00	903 923 21	162 633 646 74	5 019 557 02
	47 5	186 866 096 13	25 582 021 88	23 434 621 25	1 476 400 00	1 405 121 08	238 771 260 44	5 026 763 38
Primaria (mejoramiento 13 curvas)	76	150 129 457 89	8 579 941 51	14 800 813 48	1.956 888 05	2 023 525 31	177 490 626.24	2 335 402 99
CONSTRUCCION								
Especial (6 vías)	1	23 402.957 64	2 340 295 76	3.025.642 36	36.783.61	38 036 19	28 843.715.56	28 843 715 56
Especial (4 vías)	5 3	35.049.437 74	2.199.087 75	3.225.536.73	292 429 70	302.387 71	41.068 879 63	7.748 845 21
	2 8	57 624.091 80	1.881 495 00	8 471.798 60	144 191 75	208 447 25	68.330 024 40	24.403 580 14
Primaria	1	10 927 451 04	1.082.745 10	114 500 00	36 783 61	38 036 19	12.209 515 94	12.209 515 94
Secundaria	1	8 650 898 74	865 089 87	114 500 00	36 783 61	38 036 19	9 705 308 41	9.705 308 41

MEMORIA DE CALCULO DE COSTOS ECONOMICOS

INVERSION RECONSTRUCCION DE PAVIMENTOS

TIPO DE CARRETERA	%	COSTOS POR KILOMETRO
Especial		
- Costo Financiero		**4.288.957.79**
COMPOSICION DE LA INVERSION		
Mano de obra calificada	6.70	287 360 17
Mano de obra no calificada	9.80	420 317 36
Materiales nacionales	48.90	2 097 300 36
Materiales extranjeros	15.00	643 343 67
Maquinaria y equipo	19.60	840 635 73
FACTOR SOMBRA		
Mano de obra calificada	0.9744	280 [illegible] 75
Mano de obra no calificada	0.4000	168 127 15
Materiales nacionales	0.8768	1 836 912 96
Materiales extranjeros	0.7600	488 941 18
Maquinaria y equipo	0.7600	638 663 15
- Costo Economico		**3,114.863.19**

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MEMORIA DE CALCULO DE COSTOS ECONOMICOS

INVERSION RECONSTRUCCION DE PAVIMENTOS

TIPO DE CARRETERA	%	COSTOS POR KILOMETRO
Primaria		
- Costo Financiero		**2.280.963.88**
COMPOSICION DE LA INVERSION		
Mano de obra calificada	6.70	152.824.58
Mano de obra no calificada	9.80	223.534.46
Materiales nacionales	48.90	1.115.391.34
Materiales extranjeros	15.00	342.144.58
Maquinaria y equipo	19.60	447.068.92
FACTOR SOMBRA		
Mano de obra calificada	0.9744	148.912.37
Mano de obra no calificada	0.4000	89.413.76
Materiales nacionales	0.8766	977.975.12
Materiales extranjeros	0.7600	260.029.38
Maquinaria y equipo	0.7600	339.772.38
- Costo Economico		**1.316.103.44**

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MEMORIA DE CALCULO DE COSTOS ECONOMICOS

INVERSION RECONSTRUCCION DE PAVIMENTOS

TIPO DE CARRETERA	%	COSTOS POR KILOMETRO
Secundaria		
- Costo Financiero		2.050 921.81
COMPOSICION DE LA INVERSION		
Mano de obra calificada	6 70	137 411 75
Mano de obra no calificada	9 80	200 990 34
Materiales nacionales	48 90	[illegible]
Materiales extranjeros	15 00	307 639 27
Maquinaria y equipo	19 60	401 961 87
FACTOR SOMBRA		
Mano de obra calificada	0 9744	[illegible]
Mano de obra no calificada	0 4000	[illegible]
Materiales nacionales	0.6766	[illegible]
Materiales extranjeros	0 7600	[illegible]
Maquinaria y equipo	0 7600	[illegible]
- Costo Economico		1.652.540.94

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MEMORIA DE CALCULO DE COSTOS ECONOMICOS

INVERSION AMPLIACION DE CARRETERAS

TIPO DE CARRETERA	%	COSTOS POR KILOMETRO
Especial de 4 vias a Especial de 6 vias		
- Costo Financiero		12.200.177.14
COMPOSICION DE LA INVERSION		
Mano de obra calificada	5.70	[illegible]
Mano de obra no calificada	9.80	[illegible]
Materiales nacionales	46.90	[illegible]
Materiales extranjeros	15.00	[illegible]
Maquinaria y equipo	19.60	2.391.234.72
FACTOR SOMERA		
Mano de obra calificada	0.9744	[illegible]
Mano de obra no calificada	0.4000	478.245.94
Materiales nacionales	0.5755	[illegible]
Materiales extranjeros	0.7600	[illegible]
Maquinaria y equipo	0.7600	[illegible]
- Costo Economico		9.713.791.04

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MEMORIA DE CALCULO DE COSTOS ECONOMICOS

INVERSION AMPLIACION DE CARRETERAS

TIPO DE CARRETERA	%	COSTOS POR KILOMETRO
Primaria a Especial de 4 vias		
- Costo Financiero		8.738.039.18
COMPOSICION DE LA INVERSION		
Mano de obra calificada	6.70	585 446.61
Mano de obra no calificada	9.80	856 324.91
Materiales nacionales	48.90	4 272 685.49
Materiales extranjeros	15.00	1 310 701.38
Maquinaria y equipo	19.60	1 712 645.60
FACTOR SOMBRA		
Mano de obra calificada	0.9744	570 459.18
Mano de obra no calificada	0.4000	342 829.96
Materiales nacionales	0.6755	3 746 456.87
Materiales extranjeros	0.7600	996 133.05
Maquinaria y equipo	0.7600	1 301 613.85
- Costo Economico		**6.957.202.91**

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MEMORIA DE CALCULO DE COSTOS ECONOMICOS

INVERSION AMPLIACION DE CARRETERAS

TIPO DE CARRETERA	%	COSTOS POR KILOMETRO
Secundaria a Especial de 4 vias		
- Costo Financiero		10.873.563.76
COMPOSICION DE LA INVERSION		
Mano de obra calificada	6.79	728.525.77
Mano de obra no calificada	9.81	1.053.[illegible]
Materiales nacionales	49.99	5.317.17[illegible]
Materiales extranjeros	15.00	1.691.[illegible]
Maquinaria y equipo	19.00	2.131.21[illegible]
FACTOR SOMBRA		
Mano de obra calificada	0.9744	709.[illegible]
Mano de obra no calificada	0.4001	4.[illegible]
Materiales nacionales	0.8703	4.552.[illegible]
Materiales extranjeros	0.7600	1.299.[illegible]
Maquinaria y equipo	0.7600	1.619.[illegible]
- Costo Economico		8.657.531.47

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MEMORIA DE CALCULO DE COSTOS ECONOMICOS

INVERSION CONSTRUCCION DE CARRETERAS

TIPO DE CARRETERA	%	COSTOS POR KILOMETRO
Especial de 6 vias		
- Costo Financiero		25.840.715.56
COMPOSICION DE LA INVERSION		
Mano de obra calificada	6.71	1.942.521.94
Mano de obra no calificada	9.91	2.826.654.12
Materiales nacionales	45.90	14.104.575.91
Materiales extranjeros	15.00	4.326.557.33
Maquinaria y equipo	19.50	5.555.356.25
FACTOR SOMBRA		
Mano de obra calificada	0.8744	1.583.055.21
Mano de obra no calificada	0.4000	1.130.673.55
Materiales nacionales	0.8781	12.386.893.13
Materiales extranjeros	0.7500	3.245.168.57
Maquinaria y equipo	0.7500	4.296.559.57
- Costo Economico		**22.965.356.33**

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MEMORIA DE CALCULO DE COSTOS ECONOMICOS

INVERSION CONSTRUCCION DE CARRETERAS

TIPO DE CARRETERA	%	COSTOS POR KILOMETRO
Especial de 4 vias		
Costo Financiero		1.076.212.88
DISTRIBUCION DE LA INVERSION		
Mano de obra calificada	[illegible]	177.106.25
Mano de obra no calificada	[illegible]	1.075.[illegible]
Materiales nacionales	[illegible]	[illegible]
Materiales extranjeros	[illegible]	[illegible]
Maquinaria y equipo	[illegible]	[illegible]
FACTOR SOMBRA		
Mano de obra calificada	[illegible]	[illegible]
Mano de obra no calificada	[illegible]	[illegible]
Materiales nacionales	[illegible]	[illegible]
Materiales extranjeros	[illegible]	[illegible]
Maquinaria y equipo	[illegible]	[illegible]
Costo Economico		12.795.880.53

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MEMORIA DE CALCULO DE COSTOS ECONOMICOS

INVERSION CONSTRUCCION DE CARRETERAS

TIPO DE CARRETERA	%	COSTOS POR KILOMETRO
Primaria		
- Costo Financiero		**12.209.515.94**
DESCOMPOSICION DE LA INVERSION		
Mano de obra calificada	6.70	818.037.57
Mano de obra no calificada	9.80	1.196.532.56
Materiales nacionales	48.90	5.970.433.29
Materiales extranjeros	15.00	1.831.427.39
Maquinaria y equipo	19.60	2.393.055.12
FACTOR SOMBRA		
Mano de obra calificada	0.9744	797.395.51
Mano de obra no calificada	0.4000	478.613.02
Materiales nacionales	0.8766	5.234.898.45
Materiales extranjeros	0.7600	1.391.864.62
Maquinaria y equipo	0.7600	1.818.729.49
- Costo Economico		**9.721.216.59**

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MEMORIA DE CALCULO DE COSTOS ECONOMICOS

INVERSION CONSTRUCCION DE CARRETERAS

TIPO DE CARRETERA	%	COSTOS POR KILOMETRO
Secundaria		
- Costo Financiero		**9.705.308.41**
COMPOSICION DE LA INVERSION		
Mano de obra calificada	6.70	650 255.66
Mano de obra no calificada	9.80	951 120.22
Materiales nacionales	48.90	4 745 895.81
Materiales extranjeros	15.00	1 455 796.26
Maquinaria y equipo	19.60	1 902 240.45
FACTOR SOMBRA		
Mano de obra calificada	0.9744	633 609.12
Mano de obra no calificada	0.4000	380 448.89
Materiales nacionales	0.8769	4 161 231.45
Materiales extranjeros	0.7600	1 106 405.16
Maquinaria y equipo	0.7600	1 445 702.74
- Costo Economico		**7,727.366.56**

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MEMORIA DE CALCULO DE COSTOS ECONOMICOS

INVERSION AMPLIACION DE CARRETERAS

TIPO DE CARRETERA	%	COSTOS POR KILOMETRO
Mejoramiento de Primaria		
- Costo Financiero		**2.335 402.98**
COMPOSICION DE LA INVERSION		
Mano de obra calificada	6 70	156 472 00
Mano de obra no calificada	9.80	228 865 49
Materiales nacionales	48 90	1 142 013 06
Materiales extranjeros	15 00	350 610 45
Maquinaria y equipo	19 60	457 738 95
FACTOR SOMBRA		
Mano de obra calificada	0 9744	152 485 32
Mano de obra no calificada	0 4000	91 547 60
Materiales nacionales	0.8766	1 001 316 17
Materiales extranjeros	0.7600	266 235 94
Maquinaria y equipo	0.7600	347 881 68
- Costo Economico		**1,859.447.85**

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MEMORIA DE CALCULO DE COSTOS ECONOMICOS

INVERSION AMPLIACION DE CARRETERAS

TIPO DE CARRETERA	%	COSTOS POR KILOMETRO
Secundaria a primaria		
- Costo Financiero		**5.038.235.82**
COMPOSICION DE LA INVERSION		
Mano de obra calificada	5.71	[illegible]
Mano de obra no calificada	9.80	[illegible]
Materiales nacionales	[illegible]	[illegible]
Materiales extranjeros	[illegible]	[illegible]
Maquinaria y equipo	[illegible]	[illegible]
FACTOR SOMBRA		
Mano de obra calificada	0.9744	[illegible]
Mano de obra no calificada	[illegible]	[illegible]
Materiales nacionales	0.6735	[illegible]
Materiales extranjeros	0.7600	[illegible]
Maquinaria y equipo	0.7600	[illegible]
- Costo Economico		**4.011.443.36**

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ANNEX 3.6.5-D

PATCHING COSTS

COSTO POR KILOMETRO PROMEDIO DE BACHEO (COLONES)

TIPO DE CARRETERA	COSTO POR KILOMETRO				
	MB	B	R	M	MM
Especial					
Financiero	0.00	7,694.22	39,793.33	76,942.22	115,413.33
Economico	0.00	6,309.24	32,630.44	63,092.44	94,638.65
Primaria					
Financiero	0.00	3,847.11	19,896.67	38,471.11	57,706.67
Economico	0.00	3,154.62	16,315.22	31,546.22	47,319.33
Secundaria					
Financiero	0.00	3,425.51	17,716.21	34,255.10	51,382.65
Economico	0.00	2,808.91	14,527.25	28,089.10	42,133.65

COSTO POR METRO CUADRADO DE BACHEO (COLONES)

Bacheo	C/M2
Profundo	
Financiero	330.56
Economico	271.05
Superficial	
Financiero	87.91
Economico	72.09

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CUADRO No. 5
COSTOS POR KILOMETRO DE BACHEO (COLONES)
CARRETERA ESPECIAL

ACTIVIDAD	UNIDAD	COSTO UNITARIO	VOLUMEN DE OBRA					COSTO TOTAL				
			MB	B	R	M	MM	MB	B	R	M	MM
Bacheo superficial	m2	87.91	0	80	400	800	1.200	0.00	7.033.11	35.165.55	70.331.11	105.496.5
Bacheo profundo	m2	330.56	0	2	14	20	30	0.00	661.11	4.627.78	6.611.11	9.916.
TOTAL								0.00	7.694.22	39.793.33	76.942.22	115.413.3

CONDICION DE LA CARRETERA:

MB Muy Buena

B Buena

R Regular

M Mala

MM Muy Mala

NOTAS :

El bacheo es una actividad que se realiza en el mantenimiento rutinario, por razones de procesamiento de la informacion se presenta en una tabla separada

Los costos incluyen IVA

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CUADRO No. 6
COSTOS POR KILOMETRO DE BACHEO (COLONES)
CARRETERA PRIMARIA

ACTIVIDAD	UNIDAD	COSTO UNITARIO	VOLUMEN DE OBRA					COSTO TOTAL				
			MB	B	R	M	MM	MB	B	R	M	MM
Bacheo superficial	m2	87.91	0	40	200	400	600	0.00	3.516.56	17.582.78	35.165.56	52.748.33
Bacheo profundo	m2	330.56	0	1	7	10	15	0.00	330.56	2.313.89	3.305.56	4.958.33
TOTAL								0.00	3.847.11	19.896.67	38.471.11	57.706.67

CONDICION DE LA CARRETERA

MB Muy Buena

B Buena

R Regular

M Mala

MM Muy Mala

NOTAS

El bacheo es una actividad que se realiza en el mantenimiento rutinario por razones de procesamiento de la informacion se presenta en una tabla separada

Los costos incluyen IVA

CUADRO No. 7
COSTOS POR KILOMETRO DE BACHEO (COLONES)
CARRETERA SECUNDARIA

ACTIVIDAD	UNIDAD	COSTO UNITARIO	VOLUMEN DE OBRA					COSTO TOTAL				
			MB	B	R	M	MM	MB	B	R	M	MM
Bacheo superficial	m2	87.91	0	36	178	356	534	0 00	3.131 18	15.655 90	31.311 80	46 95[illegible]
Bacheo profundo	m2	330 56	0	1	8	9	13	0 00	294 33	2.060 31	2.943 30	4 414 [illegible]
TOTAL								0.00	3.425.51	17.716.21	34.255.10	51.382 [illegible]

CONDICION DE LA CARRETERA

MB Muy Buena

B Buena

R Regular

M Mala

MM Muy Mala

NOTAS

El bacheo es una actividad que se realiza en el mantenimiento rutinario por razones de procesamiento de la informacion se presenta en una tabla separada

Los costos incluyen IVA.

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MEMORIA DE CALCULO DE COSTOS ECONOMICOS

BACHEO (COLONES)

TIPO DE CARRETERA	%	COSTO/METRO CUADRADO
Bacheo superficial		
- Costo Financiero		**87.91**
COMPOSICION DEL MANTENIMIENTO		
Mano de obra calificada	42.01	36.93
Mano de obra no calificada	9.85	8.52
Materiales nacionales	4.12	3.62
Materiales extranjeros	30.34	26.67
Maquinaria y equipo	13.84	12.17
FACTOR SOMBRA		
Mano de obra calificada	1.9744	35.99
Mano de obra no calificada	1.4000	3.41
Materiales nacionales	0.6788	3.18
Materiales extranjeros	0.7600	20.27
Maquinaria y equipo	0.7600	9.25
- Costo Economico		**72.09**

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MEMORIA DE CALCULO DE COSTOS ECONOMICOS

BACHEO (COLONES)

TIPO DE CARRETERA	%	COSTO/METRO CUADRADO
Bacheo profundo		
- Costo Financiero		**330.56**
COMPOSICION DEL MANTENIMIENTO		
Mano de obra calificada	42.01	138.87
Mano de obra no calificada	9.69	32.03
Materiales nacionales	4.12	13.62
Materiales extranjeros	30.34	100.29
Maquinaria y equipo	13.84	45.75
FACTOR SOMBRA		
Mano de obra calificada	0.9744	135.31
Mano de obra no calificada	0.4000	12.81
Materiales nacionales	0.8766	11.94
Materiales extranjeros	0.7600	76.22
Maquinaria y equipo	0.7600	34.77
- Costo Economico		**271.05**

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ANALISIS DE COSTOS UNITARIOS

PARTIDA : BACHEO SUPERFICIAL (MEZCLA EN CALIENTE)
UNIDAD : M2
RENDIM. (R) : 120
MONEDA : COLONES

18-Mar-95

A) EQUIPO	NUMERO	HORAS TRAB.	COSTO/HORA	COSTO
Rodillo Manual	1	5	60.00	300 00
Camion de volteo	1	3	200.00	600 00
				0 00
				0.00
				0 00
				0.00
				0.00
	Costo Parcial (1)			900.00
	Costo Unitario = (1) / (R)			7.50

B) MANO DE OBRA	NUMERO	HORAS TRAB.	SALARIO/HORA	COSTO
Peon	12	8	12 96	1,244 16
Caporal	1	8	13.81	110 48
Operador eq. liviano	1	8	14.69	117 52
Motorista veh. pesado	1	8	16 45	131 60
				0 00
				0.00
				0 00
	Costo Parcial (2)			1,603.76
	Costo Unitario = (2) / (R)			13.36

C) MATERIALES	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Mezcla asfaltica	6 00	m3	672.67	4,036 01
Asfalto liquido RC-2	36 00	Gal	6.36	229 09
Combustible	10 00	Gal	7.50	75 00
Lubricante	0 12	Gal	54 55	6 55
				0 00
				0 00
				0 00
	Costo Parcial (3)			4,346.67
	Costo Unitario = (3) / (R)			36.22

D) TRANSPORTE	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
				0 00
				0.00
				0.00
				0.00
				0 00
				0.00
				0.00
	Costo Parcial (4)			0.00
	Costo Unitario = (4) / (R)			0.00

E) COSTO UNITARIO DIRECTO = (A) + (B) + (C) + (D)	57.09
F) COSTO UNITARIO INDIRECTO = (E) x 0.40	22.83
G) COSTO UNITARIO TOTAL = (E) + (F)	79.92
H) COSTO UNITARIO TOTAL CON IVA = (G) x 1.10	87.91

OBSERVACIONES :

ANALISIS DE COSTOS UNITARIOS

PARTIDA : BACHEO PROFUNDO
UNIDAD : M2
RENDIM. (R) : 18
MONEDA : COLONES

18-Mar-95

A) EQUIPO	NUMERO	HORAS TRAB.	COSTO/HORA	COSTO
Rodillo Manual	1	5	60.00	300.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (1)			300.00
	Costo Unitario = (1) / (R)			16.67

B) MANO DE OBRA	NUMERO	HORAS TRAB.	SALARIO/HORA	COSTO
Peon	12	8	12.96	1,244.16
Caporal	1	8	13.81	110.48
Operador eq. liviano	1	8	14.69	117.52
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (2)			1,472.16
	Costo Unitario = (2) / (R)			81.79

C) MATERIALES	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Mezcla asfaltica	1.26	m3	672.67	847.57
Asfalto liquido RC-2	5.40	Gal	6.36	34.33
Material selecto	6.20	m3	72.73	450.91
Combustible	10.00	Gal	7.50	75.00
Lubricante	0.10	Gal	54.55	5.45
				0.00
				0.00
	Costo Parcial (3)			1,413.29
	Costo Unitario = (3) / (R)			78.52

D) TRANSPORTE	CANTIDAD	UNIDAD	COSTO UNIT.	COSTO
Mezcla asfaltica	1.26	m3	90.91	114.55
Material selecto	6	m3	90.91	563.64
				0.00
				0.00
				0.00
				0.00
				0.00
	Costo Parcial (4)			678.18
	Costo Unitario = (4) / (R)			37.68

E) COSTO UNITARIO DIRECTO = (A) + (B) + (C) + (D)	214.65
F) COSTO UNITARIO INDIRECTO = (E) x 0.40	85.86
G) COSTO UNITARIO TOTAL = (E) + (F)	300.51
H) COSTO UNITARIO TOTAL CON IVA = (G) x 1.10	330.56

OBSERVACIONES :
Considera remocion y reemplazo del material de base

BEST AVAILABLE COPY

ANNEX 3.6.7

ANALYSIS OF ROAD MAINTENANCE

ANEXO 3 6.7 CUADRO 1 ANALISIS DE MANTENIMIENTO VIAL GRUPOS DE VIAS POR CATEGORIA y NIVEL DE TRAFICO

TIPO VIA	NUMERO VIA O GRUPO		LONG	T R A F I C O								
				TPD	AUTOS	PIC UP	BUSES	C2P	C2	C3	T3S2	CAMION
	Z001											
1	110		25 1	2994	988	1018	210	140	420	54	163	638
1	1378		25 0	2994	988	1018	210	140	420	54	163	638
1	265	D	6 6	3080	770	1109	216	209	628	30	116	776
1	1374	D	6 6	3080	770	1109	216	209	628	30	116	776
1	1374	C	8 5	3985	956	1514	399	226	678	67	145	890
1	265	C	7 5	3985	956	1514	399	226	678	67	145	890
1	1375		21 5	4425	2080	1637	221	110	329	24	24	377
1	612		21 5	4425	2080	1637	221	110	329	24	24	377
			122 3	3636	1344	1310	239	148	444	43	107	594
	Z003											
1	1374	B	7 5	5926	1600	2311	415	296	888	144	272	1304
1	265	B	8 5	5926	1600	2311	415	296	888	144	272	1304
1	1376		17 5	7776	3033	2722	855	233	700	126	105	933
1	430		17 5	7776	3033	2722	855	233	700	126	105	933
1	265	A	11 5	7914	2453	2849	1029	293	878	142	269	1290
1	1374	A	11 5	7914	2453	2849	1029	293	878	142	269	1290
			74	7419	2543	2672	814	265	796	136	192	1124
	Z005											
1	1381		7.6	17876	6972	6078	2681	456	1368	150	172	1689
1	429		7.6	17876	6972	6078	2681	456	1368	150	172	1689
			15.2	17876	6972	6078	2681	456	1368	150	172	1689
	Z006											
2	1231		32.5	541	76	298	54	28	84	1	0	85
	Z014											
2	1233		6.0	2075	374	1017	249	97	291	22	26	339
2	1319		2.1	2099	441	1343	42	55	164	27	27	218
2	266		23 5	3698	1331	1590	296	105	314	43	19	376
			31.6	3284	1090	1465	270	100	299	36	21	359
	Z016											
3	1063		4.1	51	5	41	0	1	4	0	0	4
3	1342		1 5	153	15	80	49	2	7	0	0	7
3	197		8.4	159	35	72	27	6	19	0	0	19
3	1352		1 5	160	54	70	24	3	8	0	0	8
3	949		11 6	170	15	119	14	6	17	0	0	17
3	1371		4.0	178	52	68	11	12	36	0	0	36
3	1066		17 1	199	33	86	34	11	33	0	0	33
			48.2	168	29	85	23	8	23	0	0	23
	Z017											
3	126		9 2	210	40	86	11	18	55	0	0	55
3	946		9 5	210	23	120	42	6	19	0	0	19
3	1237		3.8	221	35	124	38	6	17	2	0	19
3	1354		3.0	234	29	148	21	17	50	0	0	50
3	727		4.0	272	54	174	11	8	24	0	0	24
3	653		2.5	276	44	155	39	10	29	0	0	29
3	115		11.1	300	69	114	30	17	52	5	13	70
3	1363		17.7	305	79	122	79	6	18	0	0	18
3	210		2.0	351	53	211	26	14	42	1	3	46
3	1062		11.4	374	62	202	19	16	49	6	0	55
3	726		5.3	382	42	290	34	4	11	0	0	11
3	1353		1.1	383	66	189	66	10	29	0	0	29
			60.6	291	56	146	39	11	33	2	2	37

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ANEXO 3 6 7 CUADRO 1 ANALISIS DE MANTENIMIENTO VIAL GRUPOS DE VIAS POR CATEGORIA y NIVEL DE TRAFICO

TIPO VIA	NUMERO VIA O GRUPO		LONG	T	R	A	F	I	C	O	
				TPD	AUTOS	PIC UP	BUSES	C2P	C2	C3	T3S2	CAMION
	Z018											
3	726		1 7	403	93	218	64	7	21	0	0	21
3	200		10 8	404	85	154	44	26	79	5	11	95
3	444		2 0	454	136	154	132	8	24	0	0	24
3	532		23 8	467	112	243	51	15	45	1	0	46
3	1238		5 2	502	110	266	30	24	72	0	0	72
3	1235		2 0	502	166	226	25	18	55	0	12	67
3	1061		8 5	530	133	286	0	28	83	0	0	83
3	1239		12.5	535	60	305	59	25	75	1	0	76
3	943		10 5	530	107	284	64	20	59	1	1	61
3	208		10 0	551	149	306	44	12	36	[illegible]	1	37
			87	494	111	256	48	20	59	1	2	62
	Z019											
3	822		15 0	617	80	346	31	40	119	2	0	121
3	945		5 0	734	103	374	176	20	61	0	0	61
3	435	C	8 2	738	89	339	214	23	70	3	0	73
3	118		7 7	770	185	406	62	28	84	1	2	87
3	198		6 8	782	164	414	63	31	94	13	3	109
3	816		16.0	794	167	326	206	23	68	3	2	73
			58.7	731	130	358	124	29	86	3	1	90
	Z020											
3	334		18 0	802	126	473	46	38	113	2	0	115
3	1351		11.7	825	149	371	149	38	113	6	0	119
3	944		32 6	836	201	376	100	39	116	5	0	120
3	5		22 8	840	126	470	59	43	129	11	2	142
3	273		2.1	845	203	431	25	41	124	17	4	145
3	1236		2.1	881	106	467	255	28	79	0	0	79
3	1060		3.7	886	177	461	151	24	73	0	0	73
3	286		10 4	954	124	611	57	35	105	11	11	127
3	431		7 5	992	179	436	119	64	192	3	0	194
			110 9	854	157	442	89	40	120	6	2	127
	Z022											
3	443		7 1	1032	258	341	155	70	209	0	0	209
3	113		16 0	1083	227	509	97	55	164	7	22	194
3	1059		4 7	1119	380	425	179	33	99	1	1	101
3	1064		1 9	1151	207	518	253	42	127	3	0	130
3	821		23 0	1161	267	650	35	49	147	2	10	160
3	332		28 0	1181	224	650	106	49	146	6	0	152
			82 72	1137	246	577	98	51	153	4	8	165
	Z023											
3	818		19 0	1216	256	560	85	76	226	0	13	241
3	199		19 4	1219	268	622	98	51	153	9	19	181
3	947		9 0	1231	271	603	185	38	114	14	7	134
3	207		2 0	1235	235	818	185	46	139	12	0	151
3	269		6 9	1256	214	703	138	49	148	2	2	152
3	203		18 3	1385	346	665	166	47	142	10	8	160
3	817		6.0	1476	295	317	162	122	365	15	0	380
			80 6	1280	280	614	130	60	179	6	10	197
	Z024											
3	437		8 4	1506	256	602	45	128	384	90	0	474
3	112	A	27 4	1556	280	794	249	55	166	2	9	178
3	442		2 0	1743	488	610	366	68	205	3	3	211
3	435	B	4 6	1796	395	916	305	44	131	2	4	136
3	724		3 7	1935	503	946	232	58	175	13	5	193
3	271		11 4	1984	397	1131	119	75	225	30	7	262
			57 5	1684	330	846	201	70	209	21	8	237

ANEXO 3 6 7 CUADRO 1 ANALISIS DE MANTENIMIENTO VIAL. GRUPOS DE VIAS POR CATEGORIA y NIVEL DE TRAFICO

TIPO VIA	NUMERO VIA O GRUPO		LONG	T R A F I C O								
				TPD	AUTOS	PIC UP	BUSES	C2P	C2	C3	T3S2	CAMION
	Z026											
3	723		16 5	2074	477	1203	83	65	194	19	34	247
3	1173	B	12 9	2127	383	1234	128	93	279	8	4	290
3	1348		3 0	2175	761	1131	22	63	190	8	0	198
			32 4	2104	466	1206	95	76	227	13	19	259
	Z027											
3	439		2 0	3107	808	1429	124	162	467	67	30	583
3	438		7 9	3824	1224	1109	612	213	640	26	0	666
3	432		11 6	4506	1623	1848	270	171	512	61	23	596
			21 54	4126	1400	1537	383	186	557	49	15	621
	Z028											
3	274		1 5	6710	3020	2147	672	149	448	20	54	522
	Z029											
3	435	A	3.5	10750	3440	3763	2258	310	929	52	0	980
3	441		6.6	11265	4627	4401	903	318	955	68	14	1036
3	433	B	6.0	12566	3267	4901	2388	432	1357	101	101	1558
			16 1	11646	3662	4448	1751	366	1099	76	43	1219
	Z030											
3	433	A	4.0	20555	5961	8839	2672	701	2104	154	123	2382

Nota:
Los numeros de los tramos que componen cada grupo corresponden a los cuatro ultimos digitos significativos de los codigos del inventario vial. Cuando fue necesario, los tramos se dividieron en secciones.

ANEXO 3.6 7. CUADRO 2 ANALISIS DE MANTENIMIENTO VIAL. GRUPOS DE VIAS CON PROYECTOS EN EJECUCION O FINAN

LA CUCHILLA-ACAJUTLA				Z002	T	R	A	F	I	C	O	
VIA	NUMERO_VIA		LONGITUD	TPD	AUTOS	PICKUP	BUSES	C2P	C2	C3	C3S2	CAMI
1	267-1	N	8.00	6663	1337	2807	601	339	1017	252	329	15
	267-2	N	5.50	6663	1337	2807	601	339	1017	252	329	15
1	194-1	N	8.50	5105	1174	2195	511	239	717	61	208	9
	194-2	N	18.68	5105	1174	2195	511	239	717	61	208	9
	194-3	N	4.00	5105	1174	2195	511	239	717	61	208	9
1	195-1	N	14.13	4571	731	1783	274	290	869	196	428	14
	195-2	N	4.00	4571	731	1783	274	290	869	196	428	14
			62.81	5290	1081	2208	462	275	825	141	298	12

SAN SALVADOR-APOPA				Z004	T	R	A	F	I	C	O	
V	NUMERO_VIA		LONGITUD	TPD	AUTOS	PICKUP	BUSES	C2P	C2	C3	C3S2	CAMI
1	434A-1	N	1.74	12066	3378	4223	2413	451	1354	123	123	16
	434A-2	N	7.56	12066	3378	4223	2413	451	1354	123	123	16
			9.30	12066	3378	4223	2413	451	1354	123	123	16

ACAJUTLA-LA LIBERTAD				Z007	T	R	A	F	I	C	O	
V	NUMERO_VIA		LONGITUD	TPD	AUTOS	PICKUP	BUSES	C2P	C2	C3	C3S2	CAMI
2	196	N	21.80	548	49	252	44	42	125	14	22	2
2	1373	N	54.20	604	85	290	66	30	91	28	15	1
			76.00	588	74	279	60	33	100	24	17	1

SANTA ANA-METAPAN-ANGUIATU				Z008	T	R	A	F	I	C	O	
V	NUMERO_VIA		LONGITUD	TPD	AUTOS	PICKUP	BUSES	C2P	C2	C3	C3S2	CAMI
2	111-1	N	18.00	1037	135	353	83	62	185	23	196	4
	111-2	N	20.00	1037	135	353	83	62	185	23	196	4
	111-3	N	20.80	1037	135	353	83	62	185	23	196	4
			58.80	1037	135	353	83	62	185	23	196	4

LA HACHADURA-CA12				Z009	T	R	A	F	I	C	O	
V	NUMERO_VIA		LONGITUD	TPD	AUTOS	PICKUP	BUSES	C2P	C2	C3	C3S2	CAMI
2	1	N	26.50	1004	141	371	120	58	173	30	111	3
2	1380	N	17.70	1155	104	681	81	61	182	6	40	2
			44.20	1064	126	496	105	59	176	20	83	2

LA LIBERTAD-COMALAPA				Z010	T	R	A	F	I	C	O	
V	NUMERO_VIA		LONGITUD	TPD	AUTOS	PICKUP	BUSES	C2P	C2	C3	C3S2	CAMI
2	268	N	16.80	1199	216	564	108	59	176	22	53	3
2	813	N	10.90	1790	289	1110	107	63	189	27	24	2
			27.70	1432	237	778	108	61	182	24	42	2

ZACATECOLUCA-USULUTAN				Z011	T	R	A	F	I	C	O	
V	NUMERO_VIA		LONGITUD	TPD	AUTOS	PICKUP	BUSES	C2P	C2	C3	C3S2	CAMI
2	615-1	N	6.26	2205	463	992	287	103	309	23	28	3
2	721-1	N	2.44	2511	552	1256	126	118	355	35	69	4
	721-2	N	12.16	2511	552	1256	126	118	355	35	69	4
2	941-1	N	29.00	3367	640	1616	269	179	537	42	84	6
	941-2	N	2.00	3367	640	1616	269	179	537	42	84	6
			51.86	2986	594	1439	231	153	458	38	73	5

EL PORTEZUELO-EL JOBO				Z012	T	R	A	F	I	C	O	
V	NUMERO_VIA		LONGITUD	TPD	AUTOS	PICKUP	BUSES	C2P	C2	C3	C3S2	CAMI
2	2-1	N	3.19	1153	208	553	115	49	147	8	72	2
	2-2	N	3.19	1153	208	553	115	49	147	8	72	2
2	3	N	14.05	2775	749	1110	444	100	301	19	52	3
2	114	N	11.66	4411	1323	1764	618	148	445	35	78	5
			32.09	3047	850	1237	442	108	323	23	65	4

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ANEXO 3 6 7 CUADRO 2 ANALISIS DE MANTENIMIENTO VIAL GRUPOS DE VIAS CON PROYECTOS EN EJECUCION O FINANCIADAS

USULUTAN-EL DELIRIO				Z013	T	R	A	F	I	C	O	
V	NUMERO_VIA		LONGITUD	TPD	AUTOS	PICKUP	BUSES	C2P	C2	C3	C3S2	CAMION
2	1379-1	N	3 02	6911	1244	3594	622	323	969	87	73	1451
	1379-2	N	5 98	6911	1244	3594	622	323	969	87	73	1451
2	1055-1	N	22 63	1689	405	726	135	79	238	21	84	422
			31.63	3175	644	1542	274	149	446	40	81	715

COMALAPA-ZACATECOLUCA				Z015	T	R	A	F	I	C	O	
V	NUMERO_VIA		LONGITUD	TPD	AUTOS	PICKUP	BUSES	C2P	C2	C3	C3S2	CAMION
2	814	N	26 00	6216	1803	1927	497	388	1164	159	278	1989

EL PORTEZUELO-SAN CRISTOBAL				Z021	T	R	A	F	I	C	O	
V	NUMERO_VIA		LONGITUD	TPD	AUTOS	PICKUP	BUSES	C2P	C2	C3	C3S2	CAMION
3	112	N	27.60	1093	166	503	164	51	153	7	29	189

CA1-SENSUNTEPEQUE				Z025	T	R	A	F	I	C	O	
V	NUMERO_VIA		LONGITUD	TPD	AUTOS	PICKUP	BUSES	C2P	C2	C3	C3S2	CAMION
3	531	N	19.30	2367	379	1326	166	114	343	35	5	383
3	651	N	9.00	863	230	450	62	34	103	4	0	107
3	652	N	14.20	2034	366	1159	122	89	267	4	27	298
			42.50	1941	343	1085	128	89	267	18	11	296

VIAS CON FINANCIACION, SIN FECHA DEFINIDA PARA ENTRAR EN OPERACION (2000)

S MARTIN-S RAFAEL CEDROS				Z031	T	R	A	F	I	C	O	
V	NUMERO_VIA		LONGITUD	TPD	AUTOS	PICKUP	BUSES	C2P	C2	C3	C3S2	CAMION
1	529	N	19 20	6027	1205	2833	964	236	707	41	41	789

QUITASOL-EL POY				Z032	T	R	A	F	I	C	O	
V	NUMERO_VIA		LONGITUD	TPD	AUTOS	PICKUP	BUSES	C2P	C2	C3	C3S2	CAMION
2	331A	N	4 54	2471	445	1166	247	141	423	18	12	452
2	331B	N	10 46	827	141	488	25	41	122	2	9	133
2	330	N	34 00	360	68	133	11	34	102	1	10	114
			49 00	655	119	306	36	45	136	3	10	149

SAN MIGUEL-EL DELIRIO				Z033	T	R	A	F	I	C	O	
V	NUMERO_VIA		LONGITUD	TPD	AUTOS	PICKUP	BUSES	C2P	C2	C3	C3S2	CAMION
2	1058	N	15.30	2131	448	1066	170	91	272	16	67	357

KM 64-DV SANTIAGO DE MARIA				Z034	T	R	A	F	I	C	O	
V	NUMERO_VIA		LONGITUD	TPD	AUTOS	PICKUP	BUSES	C2P	C2	C3	C3S2	CAMION
2	722	N	18 00	2569	617	1413	160	71	213	50	25	289
2	1341B	N	5.50	2336	561	1356	187	49	147	12	26	185
2	942	N	18.00	1909	496	802	229	84	252	23	23	298
			41.50	2252	557	1140	202	74	221	33	24	279

SAN MIGUEL-SIGAMA				Z035	T	R	A	F	I	C	O	
V	NUMERO_VIA		LONGITUD	TPD	AUTOS	PICKUP	BUSES	C2P	C2	C3	C3S2	CAMION
2	1056	N	22.29	2669	507	1068	160	209	610	84	37	731
2	1234	N	10 10	1745	244	768	157	117	350	17	92	459
			32 39	2381	425	974	159	176	529	63	54	646

SAN RAFAEL CEDROS-KM 64				Z036	T	R	A	F	I	C	O	
V	NUMERO_VIA		LONGITUD	TPD	AUTOS	PICKUP	BUSES	C2P	C2	C3	C3S2	CAMION
2	1340	N	16 30	3232	1034	1293	452	93	278	23	59	360
2	1377	N	16 30	3232	1034	1293	452	93	278	23	59	360
2	1341A	N	9 00	2336	561	1356	187	49	147	12	26	185
			41 60	3039	932	1306	395	83	250	20	52	322

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ANEXO 3 6 7 CUADRO 2 ANALISIS DE MANTENIMIENTO VIAL GRUPOS DE VIAS CON PROYECTOS EN EJECUCION O FINA

SAN MIGUEL-GOASCORAN				Z037	T	R	A	F	I	C	O	
V	NUMERO_VIA		LONGITUD	TPD	AUTOS	PICKUP	BUSES	C2P	C2	C3	C3S2	CA
2	1057-1	N	8.00	4207	1136	1851	337	212	636	16	18	
	1057-2	N	7.66	4207	1136	1851	337	212	636	18	18	
2	1173A	N	5.10	4236	636	2712	297	133	400	12	47	
2	1172	N	13.22	3489	768	2059	209	104	313	5	32	
2	1232	N	20.50	2348	493	1268	188	91	272	8	28	
2	1230A	N	1.47	1136	171	626	91	45	136	2	55	
			55.97	3279	743	1733	242	131	392	10	28	

DV SANTIAGO DE MARIA-S MIGUEL				Z038	T	R	A	F	I	C	O	
V	NUMERO_VIA		LONGITUD	TPD	AUTOS	PICKUP	BUSES	C2P	C2	C3	C3S2	CA
2	1356	N	21.00	3367	909	1414	505	121	364	32	22	
2	1364	N	5.20	3323	864	1529	299	145	436	25	25	
			26.20	3356	900	1437	464	126	378	31	22	

APOPA-QUITASOL				Z039	T	R	A	F	I	C	O	
V	NUMERO_VIA		LONGITUD	TPD	AUTOS	PICKUP	BUSES	C2P	C2	C3	C3S2	CA
2	434B	N	4.82	3911	900	1447	704	185	555	52	69	
2	434C	N	15.36	4240	594	1738	297	322	967	161	161	
2	434D	N	15.70	2840	398	1363	227	194	581	60	17	
			35.88	3583	549	1535	321	248	743	102	86	

APOPA-SITIO DEL NINO				Z040	T	R	A	F	I	C	O	
V	NUMERO_VIA		LONGITUD	TPD	AUTOS	PICKUP	BUSES	C2P	C2	C3	C3S2	CA
2	270	N	14.20	3060	431	1324	165	236	709	91	103	
2	438	N	10.00	5241	943	2254	419	353	1060	97	114	
			24.20	3973	643	1708	282	285	854	94	107	

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ANNEX 3.7.3

ANALYSIS OF ROAD MAINTENACE, ECONOMIC COST OF GROUPS OF MAINTENACE ALTERNATIVES

CUADRO 1

COSTOS ECONOMICOS DE LAS SEGUNDAS ALTERNATIVAS DE MANTENIMIENTO
(ORDENADAS POR VPN) PARA LA RED TOTAL PAVIMENTADA.
EN MILLONES DE COLONES DE 1994. TASA DE DESCUENTO: 12%

TRAMO	LONGITUD (KM)	ALT	COSTOS RECONST Y MANT	COSTOS OPERACION VEHICULAR	COSTOS TOTAL	COMPARACION	VALOR PRESENTE NETO	TASA INTERNA RETORNO (%)
Z001	122.30	ALT	146.9	4861.2	5008.1	ALT1 VS ALTO	483.2	63.4
Z002	125.60	ALT	95.1	6917.7	7012.8	ALT1 VS ALTO	466.8	124.6
Z003	74.00	ALT	108.0	6054.3	6162.3	ALT1 VS ALTO	631.1	123.9
Z004	18.60	ALT	17.2	2322.2	2339.4	ALT1 VS ALTO	184.8	228.8
Z005	15.20	ALT	29.4	2918.2	2947.6	ALT1 VS ALTO	619.8	270.2
Z006	77.03	ALT	50.9	378.8	429.5	ALT4 VS ALTO	34.1	MULT
Z007	86.00	ALT	26.3	489.7	516.0	ALT3 VS ALTO	1.0	14.5
Z008	66.80	ALT	28.2	876.8	905.0	ALT3 VS ALTO	48.6	54.5
Z009	50.80	ALT	15.2	557.9	573.1	ALT4 VS ALTO	7.5	43.3
Z010	45.57	ALT	17.9	604.7	622.7	ALT2 VS ALTO	15.5	37.7
Z011	51.90	ALT	27.9	1491.5	1519.4	ALT2 VS ALTO	113.6	85.4
Z012	44.10	ALT	24.3	1381.6	1405.9	ALT2 VS ALTO	96.6	87.7
Z013	31.60	ALT	17.4	968.7	986.1	ALT2 VS ALTO	69.0	95.9
Z014	31.60	ALT	27.3	1043.3	1070.6	ALT2 VS ALTO	100.8	73.8
Z015	26.00	ALT	18.5	1787.9	1806.4	ALT1 VS ALTO	124.9	138.4
Z016	63.20	ALT	21.0	107.4	128.4	ALT5 VS ALTO	-1.6	7.4
Z017	86.60	ALT	35.2	253.9	289.1	ALT5 VS ALTO	8.4	20.7
Z018	91.00	ALT	67.5	435.0	502.5	ALT3 VS ALTO	26.6	MULT
Z019	61.70	ALT	39.5	428.0	467.5	ALT3 VS ALTO	32.6	MULT
Z020	111.91	ALT	70.7	850.5	921.2	ALT3 VS ALTO	75.2	MULT
Z021	27.60	ALT	17.1	465.1	482.3	ALT3 VS ALTO	25.2	50.6
Z022	82.70	ALT	56.1	750.7	806.8	ALT3 VS ALTO	71.2	46.7
Z023	80.60	ALT	48.8	943.9	992.7	ALT3 VS ALTO	79.9	50.7
Z024	57.50	ALT	68.8	925.1	994.0	ALT2 VS ALTO	82.6	61.3
Z025	42.50	ALT	26.4	756.6	783.0	ALT2 VS ALTO	46.2	52.1
Z026	58.14	ALT	56.0	1131.4	1187.6	ALT2 VS ALTO	107.3	54.4
Z027	21.50	ALT	29.5	942.5	972.0	ALT1 VS ALTO	80.2	72.4
Z028	1.50	ALT	2.5	112.1	114.6	ALT1 VS ALTO	10.2	MULT
Z029	16.10	ALT	29.6	1952.2	1981.8	ALT1 VS ALTO	148.4	174.3
Z030	4.00	ALT	6.9	827.8	834.6	ALT1 VS ALTO	200.3	310.9
Z031	19.20	ALT	14.5	1656.2	1670.7	ALT1 VS ALTO	91.9	183.6
Z032	49.00	ALT	15.5	422.9	438.5	ALT3 VS ALTO	5.7	28.7
Z033	15.30	ALT	8.4	440.6	449.1	ALT2 VS ALTO	29.1	95.4
Z034	41.50	ALT	24.7	1343.7	1368.3	ALT1 VS ALTO	92.5	69.9
Z035	33.50	ALT	17.1	1094.8	1111.9	ALT2 VS ALTO	77.0	96.7
Z036	41.60	ALT	29.5	1873.7	1903.2	ALT1 VS ALTO	105.4	93.9
Z037	56.00	ALT	29.1	2358.1	2387.2	ALT1 VS ALTO	137.8	82.5
Z038	26.20	ALT	13.2	1219.0	1232.2	ALT1 VS ALTO	65.1	90.0
Z039	35.90	ALT	27.3	1711.6	1738.9	ALT1 VS ALTO	121.8	136.5
Z040	24.20	ALT	18.7	1288.9	1307.6	ALT1 VS ALTO	94.5	115.0
TOTAL	2016.05		1424.0	56946.2	58370.4		4810.8	

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CUADRO 2

COSTOS ECONOMICOS DE LAS TERCERAS ALTERNATIVAS DE MANTENIMIENTO
(ORDENADAS POR VPN) PARA LA RED TOTAL PAVIMENTADA.
EN MILLONES DE COLONES DE 1994. TASA DE DESCUENTO: 12%

TRAMO	LONGITUD (KM)	ALT	COSTOS RECONST Y MANT	COSTOS OPERACION VEHICULAR	COSTOS TOTAL	COMPARACION	VALOR PRESENTE NETO	TASA INTERNA RETORNO (%)
Z001	122.30	ALT	93.9	4932.9	5026.8	ALT3 VS ALTO	464.5	93.8
Z002	125.60	ALT	60.7	6995.3	7056.0	ALT3 VS ALTO	423.5	185.9
Z003	74.00	ALT	70.2	6158.8	6229.0	ALT3 VS ALTO	564.3	195.0
Z004	18.60	ALT	11.7	2359.2	2370.9	ALT3 VS ALTO	153.4	352.1
Z005	15.20	ALT	19.3	2970.9	2990.2	ALT3 VS ALTO	577.2	445.5
Z006	77.03	ALT	58.2	372.8	431.1	ALT3 VS ALTO	32.5	MULT
Z007	86.00	ALT	16.2	501.6	517.9	ALT6 VS ALTO	-0.8	NING
Z008	66.80	ALT	19.3	901.7	921.0	ALT5 VS ALTO	32.6	91.2
Z009	50.80	ALT	12.5	567.0	579.5	ALT5 VS ALTO	1.0	35.6
Z010	45.57	ALT	22.1	602.9	625.1	ALT1 VS ALTO	13.0	28.4
Z011	51.90	ALT	33.7	1489.5	1523.2	ALT1 VS ALTO	109.8	68.1
Z012	44.10	ALT	29.2	1378.5	1407.7	ALT1 VS ALTO	94.8	70.0
Z013	31.60	ALT	22.0	966.4	988.4	ALT1 VS ALTO	66.7	MULT
Z014	31.60	ALT	35.3	1040.8	1076.0	ALT1 VS ALTO	95.3	58.2
Z015	26.00	ALT	12.0	1802.2	1814.2	ALT3 VS ALTO	117.1	MULT
Z016	63.20	ALT	20.0	109.2	129.2	ALT6 VS ALTO	-2.5	-9.2
Z017	86.60	ALT	47.4	247.4	294.9	ALT4 VS ALTO	2.6	13.5
Z018	91.00	ALT	62.0	440.8	502.7	ALT4 VS ALTO	26.3	21.3
Z019	61.70	ALT	35.7	433.8	469.5	ALT4 VS ALTO	30.5	35.9
Z020	111.91	ALT	56.2	886.3	942.5	ALT5 VS ALTO	53.9	MULT
Z021	27.60	ALT	13.2	476.6	489.8	ALT5 VS ALTO	17.7	MULT
Z022	82.70	ALT	45.1	782.3	827.4	ALT5 VS ALTO	50.6	63.4
Z023	80.60	ALT	39.3	984.4	1023.6	ALT5 VS ALTO	49.0	73.2
Z024	57.50	ALT	85.2	919.4	1004.6	ALT1 VS ALTO	72.0	42.7
Z025	42.50	ALT	32.1	754.2	786.3	ALT1 VS ALTO	42.9	41.1
Z026	58.14	ALT	72.5	1127.3	1199.8	ALT1 VS ALTO	95.1	42.3
Z027	21.50	ALT	20.7	956.2	976.9	ALT3 VS ALTO	75.3	103.9
Z028	1.50	ALT	1.6	113.8	115.4	ALT3 VS ALTO	9.5	MULT
Z029	16.10	ALT	19.6	1983.9	2003.5	ALT3 VS ALTO	126.7	MULT
Z030	4.00	ALT	4.5	843.2	847.7	ALT3 VS ALTO	187.3	480.3
Z031	19.20	ALT	9.4	1670.4	1679.8	ALT3 VS ALTO	82.7	281.4
Z032	49.00	ALT	10.2	435.3	445.5	ALT6 VS ALTO	-1.4	NING
Z033	15.30	ALT	10.7	439.5	450.1	ALT1 VS ALTO	28.0	MULT
Z034	41.50	ALT	20.9	1348.4	1369.3	ALT2 VS ALTO	91.5	87.7
Z035	33.50	ALT	21.4	1092.9	1114.3	ALT1 VS ALTO	74.6	76.3
Z036	41.60	ALT	23.2	1880.1	1903.3	ALT2 VS ALTO	105.2	118.4
Z037	56.00	ALT	25.6	2366.0	2391.6	ALT2 VS ALTO	133.4	104.6
Z038	26.20	ALT	10.5	1228.2	1238.7	ALT3 VS ALTO	58.7	133.8
Z039	35.90	ALT	17.8	1731.5	1749.3	ALT3 VS ALTO	111.4	241.5
Z040	24.20	ALT	11.9	1304.1	1316.0	ALT3 VS ALTO	86.1	170.1
TOTAL	2016.05		1233.0	57595.7	58828.7		4351.9	

ANEXO 3.7.3. ANALISIS DE MANTENIMIENTO VIAL. COSTOS ECONOMICOS DE GRUPOS DE ALTERNATIVAS DE MAN

CUADRO 3

COSTOS ECONOMICOS DE LAS CUARTAS ALTERNATIVAS DE MANTENIMIENTO
(ORDENADAS POR VPN) PARA LA RED TOTAL PAVIMENTADA.
EN MILLONES DE COLONES DE 1994. TASA DE DESCUENTO: 12%

TRAMO	LONGITUD (KM)	ALT	COSTOS RECONST Y MANT	COSTOS OPERACION VEHICULAR	COSTOS TOTAL	COMPARACION	VALOR PRESENTE NETO	TASA INTERNA RETORNO (%)
Z001	122.30	ALT	85.7	5083.3	5169.0	ALT5 VS ALTO	322.3	150.8
Z002	125.60	ALT	75.6	7103.6	7179.2	ALT4 VS ALTO	300.4	207.6
Z003	74.00	ALT	102.2	6259.0	6361.2	ALT4 VS ALTO	432.2	164.7
Z004	18.60	ALT	15.7	2356.0	2371.7	ALT4 VS ALTO	152.6	325.3
Z005	15.20	ALT	26.2	3014.6	3040.7	ALT4 VS ALTO	526.7	NING
Z006	77.03	ALT	43.1	390.6	433.7	ALT5 VS ALTO	30.1	MULT
Z007	86.00	ALT	24.6	493.6	518.2	ALT4 VS ALTO	-1.0	MULT
Z008	66.80	ALT	18.2	912.6	930.9	ALT6 VS ALTO	22.7	91.1
Z009	50.80	ALT	11.1	568.8	579.9	ALT6 VS ALTO	0.6	33.6
Z010	45.57	ALT	11.3	624.2	635.5	ALT6 VS ALTO	2.6	70.1
Z011	51.90	ALT	23.7	1518.3	1542.0	ALT4 VS ALTO	91.0	110.2
Z012	44.10	ALT	20.9	1405.3	1426.2	ALT4 VS ALTO	76.3	111.0
Z013	31.60	ALT	15.9	982.2	998.1	ALT4 VS ALTO	57.0	MULT
Z014	31.60	ALT	21.4	1082.2	1103.6	ALT5 VS ALTO	67.7	113.7
Z015	26.00	ALT	12.2	1836.4	1848.5	ALT4 VS ALTO	82.7	MULT
Z016	63.20	ALT	28.8	104.6	133.3	ALT4 VS ALTO	-6.7	MULT
Z017	86.60	ALT	52.1	244.0	296.2	ALT3 VS ALTO	1.2	12.6
Z018	91.00	ALT	53.5	452.2	505.6	ALT5 VS ALTO	23.3	MULT
Z019	61.70	ALT	27.9	455.1	483.0	ALT6 VS ALTO	17.0	MULT
Z020	111.91	ALT	49.2	912.4	961.7	ALT6 VS ALTO	34.7	MULT
Z021	27.60	ALT	11.6	482.1	493.7	ALT6 VS ALTO	13.8	MULT
Z022	82.70	ALT	40.0	807.4	847.4	ALT6 VS ALTO	30.5	MULT
Z023	80.60	ALT	34.7	1013.4	1048.1	ALT6 VS ALTO	24.5	MULT
Z024	57.50	ALT	57.4	951.6	1009.0	ALT5 VS ALTO	67.6	72.4
Z025	42.50	ALT	17.9	774.1	792.0	ALT5 VS ALTO	37.2	82.6
Z026	58.14	ALT	45.3	1175.0	1220.4	ALT5 VS ALTO	74.5	76.8
Z027	21.50	ALT	20.5	971.0	991.5	ALT5 VS ALTO	60.7	95.5
Z028	1.50	ALT	2.1	115.3	117.3	ALT4 VS ALTO	7.5	MULT
Z029	16.10	ALT	28.5	2019.4	2047.9	ALT4 VS ALTO	82.3	MULT
Z030	4.00	ALT	6.2	849.5	855.7	ALT4 VS ALTO	179.3	NING
Z031	19.20	ALT	12.5	1695.9	1708.3	ALT4 VS ALTO	54.2	320.0
Z032	49.00	ALT	11.1	435.3	446.4	ALT5 VS ALTO	-2.3	NING
Z033	15.30	ALT	7.7	447.0	454.7	ALT4 VS ALTO	23.4	MULT
Z034	41.50	ALT	18.2	1367.2	1385.3	ALT4 VS ALTO	75.5	113.4
Z035	33.50	ALT	13.7	1118.5	1132.2	ALT4 VS ALTO	56.7	132.3
Z036	41.60	ALT	22.6	1918.7	1941.3	ALT4 VS ALTO	67.3	MULT
Z037	56.00	ALT	21.9	2408.4	2430.3	ALT4 VS ALTO	94.7	154.0
Z038	26.20	ALT	10.2	1241.7	1251.9	ALT4 VS ALTO	45.5	160.0
Z039	35.90	ALT	21.4	1753.8	1775.2	ALT4 VS ALTO	85.5	MULT
Z040	24.20	ALT	14.6	1338.1	1352.7	ALT4 VS ALTO	49.4	MULT
TOTAL	2016.05		1137.2	58682.5	59819.6		3361.3	

CUADRO 4

COSTOS ECONOMICOS DE LAS QUINTAS ALTERNATIVAS DE MANTENIMIENTO
(ORDENADAS POR VPN) PARA LA RED TOTAL PAVIMENTADA.
EN MILLONES DE COLONES DE 1994. TASA DE DESCUENTO: 12%

TRAMO	LONGITUD (KM)	ALT	COSTOS RECONST Y MANT	COSTOS OPERACION VEHICULAR	COSTOS TOTAL	COMPARACION	VALOR PRESENTE NETO	TASA INTERNA RETORNO (%)
Z001	122.30	ALT	110.2	5066.0	5176.2	ALT4 VS ALTO	315.1	114.5
Z002	125.60	ALT	60.4	7143.8	7204.2	ALT5 VS ALTO	275.4	MULT
Z003	74.00	ALT	79.5	6312.6	6392.1	ALT5 VS ALTO	401.2	225.6
Z004	18.60	ALT	12.2	2367.8	2380.0	ALT5 VS ALTO	144.3	427.1
Z005	15.20	ALT	20.1	3031.4	3051.6	ALT5 VS ALTO	515.8	NING
Z006	77.03	ALT	51.1	419.5	470.7	ALT1 VS ALTO	-7.1	-54.1
Z007	86.00	ALT	16.7	501.6	518.4	ALT5 VS ALTO	-1.2	NING
Z008	66.80	ALT	32.2	915.7	947.9	ALT1 VS ALTO	5.7	24.6
Z009	50.80	ALT	18.3	565.1	583.4	ALT1 VS ALTO	-2.9	NING
Z010	45.57	ALT	12.5	623.2	635.7	ALT5 VS ALTO	2.5	51.8
Z011	51.90	ALT	19.4	1524.7	1544.2	ALT5 VS ALTO	88.8	142.6
Z012	44.10	ALT	18.2	1411.9	1430.0	ALT5 VS ALTO	72.5	143.6
Z013	31.60	ALT	12.9	987.3	1000.2	ALT5 VS ALTO	54.9	MULT
Z014	31.60	ALT	27.3	1080.2	1107.4	ALT4 VS ALTO	63.9	MULT
Z015	26.00	ALT	11.8	1845.5	1857.3	ALT5 VS ALTO	74.0	MULT
Z016	63.20	ALT	33.4	103.1	136.5	ALT3 VS ALTO	-9.7	0.5
Z017	86.60	ALT	40.7	265.8	306.5	ALT2 VS ALTO	-9.1	-23.8
Z018	91.00	ALT	53.7	484.8	538.5	ALT1 VS ALTO	-9.5	NING
Z019	61.70	ALT	42.2	464.8	506.9	ALT1 VS ALTO	-6.9	-65.6
Z020	111.91	ALT	80.3	920.8	1001.1	ALT1 VS ALTO	-4.7	-36.1
Z021	27.60	ALT	17.2	488.0	505.1	ALT1 VS ALTO	2.4	MULT
Z022	82.70	ALT	62.7	820.7	883.4	ALT1 VS ALTO	-5.4	-20.3
Z023	80.60	ALT	56.7	1017.7	1074.3	ALT1 VS ALTO	-1.7	MULT
Z024	57.50	ALT	74.4	945.6	1020.0	ALT4 VS ALTO	56.6	49.9
Z025	42.50	ALT	22.3	770.3	792.6	ALT4 VS ALTO	36.6	63.3
Z026	58.14	ALT	37.0	1192.8	1229.7	ALT6 VS ALTO	65.1	91.4
Z027	21.50	ALT	26.4	966.0	992.3	ALT4 VS ALTO	59.8	74.4
Z028	1.50	ALT	1.7	116.1	117.8	ALT5 VS ALTO	7.0	MULT
Z029	16.10	ALT	23.6	2025.9	2049.5	ALT5 VS ALTO	80.8	MULT
Z030	4.00	ALT	4.6	867.1	871.6	ALT5 VS ALTO	163.3	NING
Z031	19.20	ALT	9.9	1702.6	1712.5	ALT5 VS ALTO	50.1	424.0
Z032	49.00	ALT	17.6	429.6	447.2	ALT1 VS ALTO	-3.0	-5.5
Z033	15.30	ALT	6.2	449.6	455.8	ALT5 VS ALTO	22.3	MULT
Z034	41.50	ALT	14.9	1372.2	1387.1	ALT5 VS ALTO	73.7	146.4
Z035	33.50	ALT	11.4	1121.9	1133.3	ALT5 VS ALTO	55.6	173.0
Z036	41.60	ALT	19.7	1924.3	1944.9	ALT5 VS ALTO	64.6	206.2
Z037	56.00	ALT	18.4	2413.4	2431.8	ALT5 VS ALTO	93.2	201.0
Z038	26.20	ALT	8.5	1244.2	1252.8	ALT5 VS ALTO	44.6	210.0
Z039	35.90	ALT	17.2	1760.1	1777.2	ALT5 VS ALTO	83.5	MULT
Z040	24.20	ALT	11.7	1341.5	1353.2	ALT5 VS ALTO	48.9	MULT
TOTAL	2016.05		1215.2	59005.2	60220.0		2960.9	

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CUADRO 5

COSTOS ECONOMICOS DE LAS SEXTAS ALTERNATIVAS DE MANTENIMIENTO
(ORDENADAS POR VPN) PARA LA RED TOTAL PAVIMENTADA.
EN MILLONES DE COLONES DE 1994. TASA DE DESCUENTO: 12%

TRAMO	LONGITUD (KM)	ALT	COSTOS RECONST Y MANT	COSTOS OPERACION VEHICULAR	COSTOS TOTAL	COMPARACION	VALOR PRESENTE NETO	TASA INTERNA RETORNO (%)
Z001	122.30	ALT	70.2	5145.1	5215.3	ALT6 VS ALTO	276.0	181.3
Z002	125.60	ALT	52.3	7199.6	7251.9	ALT6 VS ALTO	227.7	MULT
Z003	74.00	ALT	65.0	6405.5	6470.5	ALT6 VS ALTO	322.8	311.8
Z004	18.60	ALT	9.8	2407.8	2417.6	ALT6 VS ALTO	106.7	NING
Z005	15.20	ALT	16.6	3080.6	3097.3	ALT6 VS ALTO	470.1	NING
Z006	77.03	ALT	51.1	419.5	470.7	ALT2 VS ALTO	-7.1	-54.1
Z007	86.00	ALT	30.9	494.7	525.6	ALT2 VS ALTO	-8.5	-20.2
Z008	66.80	ALT	32.2	915.7	947.9	ALT2 VS ALTO	5.7	24.6
Z009	50.80	ALT	18.3	565.1	583.4	ALT2 VS ALTO	-2.9	NING
Z010	45.57	ALT	14.3	622.8	637.2	ALT4 VS ALTO	1.0	24.7
Z011	51.90	ALT	18.4	1540.5	1558.9	ALT6 VS ALTO	74.1	MULT
Z012	44.10	ALT	16.3	1421.9	1438.3	ALT6 VS ALTO	64.3	169.4
Z013	31.60	ALT	12.7	995.8	1008.5	ALT6 VS ALTO	46.6	MULT
Z014	31.60	ALT	17.8	1091.1	1108.9	ALT6 VS ALTO	62.5	133.9
Z015	26.00	ALT	10.0	1859.7	1869.6	ALT6 VS ALTO	61.6	MULT
Z016	63.20	ALT	26.1	110.4	136.6	ALT2 VS ALTO	-9.8	NING
Z017	86.60	ALT	41.2	265.7	306.8	ALT1 VS ALTO	-9.4	-25.3
Z018	91.00	ALT	53.3	485.3	538.7	ALT2 VS ALTO	-9.7	NING
Z019	61.70	ALT	42.2	464.8	506.9	ALT2 VS ALTO	-6.9	-65.6
Z020	111.91	ALT	79.6	922.0	1001.6	ALT2 VS ALTO	-5.1	-36.2
Z021	27.60	ALT	17.2	488.0	505.1	ALT2 VS ALTO	2.4	MULT
Z022	82.70	ALT	62.7	820.7	883.4	ALT2 VS ALTO	-5.4	-20.3
Z023	80.60	ALT	55.2	1022.9	1078.1	ALT2 VS ALTO	-5.4	MULT
Z024	57.50	ALT	49.0	973.2	1022.2	ALT6 VS ALTO	54.4	91.0
Z025	42.50	ALT	16.9	781.2	798.1	ALT6 VS ALTO	31.1	97.4
Z026	58.14	ALT	57.4	1175.4	1232.8	ALT4 VS ALTO	62.1	MULT
Z027	21.50	ALT	17.4	991.9	1009.3	ALT6 VS ALTO	42.8	106.3
Z028	1.50	ALT	1.4	118.9	120.3	ALT6 VS ALTO	4.6	MULT
Z029	16.10	ALT	18.7	2061.0	2079.7	ALT6 VS ALTO	50.6	-11.4
Z030	4.00	ALT	3.8	873.2	876.9	ALT6 VS ALTO	158.0	NING
Z031	19.20	ALT	8.3	1716.7	1725.1	ALT6 VS ALTO	37.5	MULT
Z032	49.00	ALT	17.6	429.6	447.2	ALT2 VS ALTO	-3.0	-5.5
Z033	15.30	ALT	6.1	453.9	460.0	ALT6 VS ALTO	18.1	MULT
Z034	41.50	ALT	13.7	1384.4	1398.1	ALT6 VS ALTO	62.7	171.2
Z035	33.50	ALT	9.9	1130.4	1140.3	ALT6 VS ALTO	48.6	201.0
Z036	41.60	ALT	16.8	1935.5	1952.3	ALT6 VS ALTO	56.3	246.1
Z037	56.00	ALT	16.1	2426.4	2442.5	ALT6 VS ALTO	82.5	236.0
Z038	26.20	ALT	7.5	1250.7	1258.1	ALT6 VS ALTO	39.2	247.0
Z039	35.90	ALT	15.7	1279.4	1294.6	ALT6 VS ALTO	66.2	MULT
Z040	24.20	ALT	10.0	1349.5	1359.4	ALT6 VS ALTO	42.7	MULT
TOTAL	2016.05		1099.0	59576.6	60675.8		2505.6	

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ANNEX 3.7.4

ANALYSIS OF ROAD MAINTENANCE, SELECTION OF ALTERNATIVES

ANEXO 3.7.4. ANALISIS DE MANTENIMIENTO VIAL. SELECCION DE ALTERNATIVAS.

CODIGO GRUPO	LONGITUD	TPD	CAMIONES	MANTENIMIENTO		TIPO DE VIA
				ALTERNATIVA	NORMAS	
Z001	122.30	3636	594	2	1	1
Z002	125.62	5290	1264	2	1	1
Z031	38.40	6027	789	2	1	1
Z003	74.00	7419	1124	2	1	1
Z004	18.60	12066	1600	2	1	1
Z005	15.20	17876	1689	2	1	1
Z006	32.50	541	85	6	2	2
Z007	76.00	588	174	0	2	2
Z032	49.00	655	149	4	1	2
Z008	58.80	1037	405	4	2	2
Z009	44.20	1064	280	3	2	2
Z010	27.70	1432	284	3	1	2
Z033	15.30	2131	357	3	1	2
Z034	41.50	2252	279	3	1	2
Z035	32.39	2381	646	3	1	2
Z011	51.86	2986	569	3	1	2
Z036	41.60	3039	322	3	1	2
Z012	44.14	3047	410	3	1	2
Z013	31.63	3175	715	3	1	2
Z037	55.97	3279	431	3	1	2
Z014	31.60	3284	359	3	1	2
Z038	26.20	3358	431	2	1	2
Z039	35.88	3583	931	2	1	2
Z040	24.20	3973	1055	2	1	2
Z015	26.00	6216	1989	2	1	2
Z016	48.20	168	23	0	2	3
Z017	77.50	291	37	6	2	3
Z018	87.00	494	62	6	2	3
Z019	58.70	731	90	5	2	3
Z020	110.90	854	127	4	2	3
Z021	27.40	1093	189	4	2	3
Z022	82.72	1137	165	4	2	3
Z023	80.60	1280	197	4	2	3
Z024	57.50	1684	237	3	1	3
Z025	42.50	1941	296	3	1	3
Z026	32.40	2104	259	3	1	3
Z027	21.54	4126	621	2	1	3
Z028	1.50	6710	522	2	1	3
Z029	16.10	11646	1219	2	1	3
Z030	4.00	20555	2382	2	1	3
TOTAL	1889.15					

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ANNEX 3.9.1

DESCRIPTION OF INVESTMENT PROGRAMS

1. PROGRAMA CIRCUNVALACIÓN NORTE

El Programa Circunvalación Norte se plantea en base a los resultados obtenidos en el presente estudio y para el mismo se proponen tres alternativas, las cuales serán descritas por separado puntualizando las ventajas y desventajas en la construcción de cada una de ellas.

Este Programa tiene tres alternativas diferentes. Todas ellas incluyen dos tramos comunes a las alternativas de las Circunvalaciones Norte y Sur. El primer tramo consiste en la ampliación a 4 carriles de la CA-1 nueva, ya programada entre la calle a Tonacatepeque y Cojutepeque, reprográmandola para construirla de 6 carriles en toda su extensión[1]. Esto soluciona uno de los cuellos de botella más importantes del país, para dar acceso del área metropolitana a la CA-1 Oriental que quedará más sería con los flujos de tráfico que traerán las Circunvalaciones y el tráfico desviado de la CA-2 como resultado de las mejoras a la CA-1.

El segundo tramo en común a las 2 Circunvalaciones es el Conector Ilopango de la CA-1 existente a la CA-1 nieva, con el objeto de reducir la sobrecarga de la primera y facilitar el acceso a la segunda. Este tramo se propone como construcción de una vía nueva con características de carretera especial de 4 carriles con una longitud aproximada de 1.2 Km.

Se ha decidido incluir estos tramos en el programa de la Circunvalación Norte por ser éste problablemente el programa prioritario.

Adicionalmente para la Alternativa 1, el tramo Apopa - San Martín se considera de mucha importancia debido a que a pesar de contar en este momento con la actual CA-1 (Boulevard del Ejército - San Martín) y tomando en cuenta que se tendrá en funcionamiento la nueva CA-1 (Troncal del Norte - San Martín), aun así, se hace primordial la construcción de este tramo para evitar el congestionamiento que se formaría en el tramo Apopa - San Salvador con el trafico generado por la ruta Intersección CA-8 - Sitio del Niño - Apopa el cual estaría obligado a tomar la Troncal del Norte para incorporase posteriormente a la Nueva CA-1, esto seria si es trafico de paso entre el occidente y oriente del país.

Se considera que la construcción de esta alternativa es muy factible ya que prácticamente esta ubicado en un sector calificado como rural por lo tanto la adquisición de los derechos de vía seria menos costosa en términos monetarios que si fuera en sector urbano; además con esta ruta se logra que el trafico de paso sea desviado de las ciudades.

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[1] La CA-1 nueva, en construcción, tiene actualmente características de carretera especial de 6 carriles de la carretera Troncal del Norte hasta la calle a Tonacatepeque y se convierte en una de 4 carriles a partir de este punto.

En la Alternativa 2, la ruta que se plantea se acerca un poco mas al area metropolitana y se a basado en el plan de desarrollo urbano para dicha area.

Esta alternativa presenta la facilidad de que algunos de los corredores que se utilizarian para su construcción ya están reservados, es decir, sea limitado la construcción de viviendas.

La Alternativa 3 es la construcción de las dos alternativas planteadas, ya que la Alternativa 1 no es excluyente de la Alternativa 2, y con ambas vías construidas se lograría que los usuarios de paso no tengan que cruzar el area metropolitana, evitando asi agravar los congestionamientos que actualmente se tienen.

1.1 Alternativa 1

Se compone de cinco tramos de carretera, tres de ellos son de apertura siendo dos con características de diseño de carretera primaria y uno especial; otros dos tramos son de ampliación para llevarlos a características de diseño de carretera especial de cuatro y seis carriles respectivamente.

Los tramos en mención son los siguientes:

	Long. Km.	
Intersección CA-8 - Sitio del Niño	8.00	Construcción
Sitio del Niño - Apopa	24.10	Ampliación
Apopa - San Martín	17.00	Construcción
Calle Tonacatepeque-Cojutepeque (CA-1 nueva)	25.05	Ampliación
Conector Ilopango (CA-1 nueva)	1.20	Construcción
TOTAL	75.35	

El tramo Intersección CA-8 - Sitio del Niño consiste en la construcción de 8.00 Kilómetros de carretera primaria para unir la Ruta CA-8 que actualmente esta siendo ampliada a carretera especial de cuatro carriles, este tramo se encuentra ubicado en el departamento de La Libertad.

El tramo Sitio del Niño - Apopa es un proyecto de ampliación de una carretera primaria a una especial de cuatro carriles, con una longitud aproximada de 24.10 kilómetros entre los departamentos de La Libertad y San Salvador.

En la actualidad se esta elaborando el diseño final de la ampliación de este tramo para dejarlo con características de carretera primaria ya que su condición en este momento es de carretera secundaria.

El tramo Apopa - San Martín se propone como la construcción de una carretera con características de primaria de aproximadamente 17.00 kilómetros entre los departamentos de San Salvador y Cuscatlan.

La inversión estimada para la construcción de esta alternativa asciende a la suma de ¢ 1,013 millones de colones distribuidos de la siguiente manera:

	Millones - Colones	Característica
Intersección CA-8 - Sitio del Niño	107.62	Primaria
Sitio del Niño - Apopa	232.28	Especial (4 carriles)
Apopa - San Martín	271.36	Primaria
Calle Tonacatepeque-Cojutepeque (CA-1 nueva)	377.90	Ampliación
Conector Ilopango (CA-1 nueva)	24.25	Construcción
TOTAL ALTERNATIVA 1	1,012.76	

1.2 Alternativa 2

Además de los 2 tramos comunes, la alternativa 2 del Programa Circunvalación Norte plantea una posible ampliación en el tramo La Cuchilla - Santa Tecla para convertirla en una carretera especial de seis vías, con una longitud aproximada de 9.00 km.; en otro caso podría estudiarse la opción de construir un paso alterno, ya que es indispensable encontrar una solución para este tramo que se nos convierte prácticamente en un embudo, provocando un atraso en el tiempo de recorrido de los usuarios incrementando también los costos de operación vehicular.

El siguiente tramo en esta alternativa es la construcción de una vía con características de carretera especial de cuatro carriles, denominado Santa Tecla - Periférico Nor-poniente hasta intersectar con la Carretera Troncal del Norte a la altura de Ciudad Delgado, sobre el alineamiento planteado por la Oficina de Planificación del Aérea Metropolitana de San Salvador (OPAMSS) en el Plan de Desarrollo Urbano del Aérea Metropolitana de San Salvador Metroplan 2000; este tramo tiene una longitud aproximada de 17.46 km.

Los tramos descritos para esta alternativa son:

	Long. Km.	
La Cuchilla - Santa Tecla	9.00	Ampliación
Santa Tecla - Periférico Nor-Poniente	17.46	Construcción
Troncal del Norte - Calle a Tonacatepeque	----	Construcción
Calle Tonacatepeque-Cojutepeque (CA-1 nueva)	25.05	Ampliación
Conector Ilopango (CA-1 nueva)	1.20	Construcción
TOTAL	52.71	

El costo estimado a invertir en la construcción de esta alternativa solo considera los primeros dos tramos ya que los otros por ser parte de la Nueva CA-1 es una inversión que ya esta prevista por el Ministerio de Obras Publicas, la inversión estimada asciende a la cantidad de ¢ 894 millones de colones distribuidos asi:

	Millones-Colones	Característica
La Cuchilla - Santa Tecla	139.15	Especial (6 carriles)
Santa Tecla - Periférico Nor-poniente	352.78	Especial (4 carriles)
Calle Tonacatepeque-Cojutepeque (CA-1 nueva)	377.90	Ampliación
Conector Ilopango (CA-1 nueva)	24.25	Construcción
TOTAL ALTERNATIVA 2	894.08	

1.3 Alternativa 3

En esta alternativa se plantea la construcción de las dos opciones antes mencionadas es decir brindando a los usuarios dos vías distintas para lograr el paso entre las zonas occidental y oriental del país sin la necesidad de cruzar el centro de la capital, obteniendo así un beneficio en el tiempo de recorrido ya que se evitan el congestionamiento de la cuidad.

La inversión estimada para esta alternativa es la siguiente:

	Millones de Colones
Alternativa 1	1,012.76
Alternativa 2 (costo adicional)	491.93
TOTAL ALTERNATIVA 3	1,504.69

2. PROGRAMA CIRCUNVALACIÓN SUR

Este Programa es el resultado del estudio de diferentes escenarios en donde sea escogido las alternativas de solución mas viables para ayudar a descongestionar las vías del Area Metropolitana de San Salvador y ofrecer a los usuarios rutas con mayor capacidad reduciendo asi los tiempos de recorrido, obteniendo a la vez ahorro en los costos de operación.

El Programa Circunvalación Sur plantea tres alternativas descritas a continuación:

Todas incluyen 2 tramos ya descritos , comunes al programa Circunvalación Norte, el Conector Ilopango de la CA-1 existente a la CA-1 nueva, una carretera especial , y la CA-1 nueva de la calle a Tonacatepeque a Cojutepeque, una vía especial de 6 carriles Sin embargo no se los repiten en la descripción ni en los cálculos de este programa.

2.1 Alternativa 1

Está compuesta por 5 tramos, el primero denominado La Cuchilla - Santa Tecla. Para este tramo se plantea una posible ampliación para convertirla en una carretera especial de seis vías, con una longitud aproximada de 9.00 km., ubicado en el Departamento de La Libertad, tal como fue descrito en la Alternativa 2 del Programa Circunvalación Norte.

El segundo tramo es el Periférico Sur desde Santa Tecla hasta el desvío a La Libertad, el cual consiste en la construcción de 3.80 km. de carretera con características de especial de cuatro carriles.

En el tercer tramo se plantea la construcción de 9.00 km. de carretera primaria desde Santo Tomas hasta Ilopango, donde inserta Santa Tecla con la CA-1 existente el cual desviara una proporción del trafico que viene de la zona oriental por la actual CA-1 hacia el Aeropuerto Internacional de El Salvador y viceversa, evitando así el paso por la capital. Estos ultimos tres tramos ubicados en el departamento de San Salvador. Los otros 2 son los tramos comunes.

Los tramos descritos para esta alternativa son:

	Long. Km.	
La Cuchilla - Santa Tecla	9.00	Ampliación
Periférico Sur (Sta.Tecla-Desvío a La Libertad)	3.80	Construcción
Ilopango - Santo Tomas	9.00	Construcción
TOTAL A CONSTRUIR/AMPLIAR	21.80	

La inversión estimada para la construcción de esta alternativa asciende a la suma de ¢ 364 millones de colones distribuidos de la siguiente manera:

	Millones de Colones	Característica
La Cuchilla - Santa Tecla	139.15	Especial (6 carriles)
Periférico Sur (Sta.Tecla-Desvío a La Libertad)	76.78	Especial (4 carriles)
Ilopango - Santo Tomas	138.38	Primaria
TOTAL ALTERNATIVA 1	354.31	

2. 2 Alternativa 2

Se compone de un tramo de ampliación de 9.00 km. de carretera especial de seis carriles, la construcción de cuatro tramos de característica especial de cuatro carriles, otro de construcción de especial de seis carriles y el ultimo es la construcción de 9.00 km. de carretera primaria.

Los tramos en mención son los siguientes:

	Long. Km.	
La Cuchilla - Santa Tecla	9.00	Ampliación
Periférico Sur (Sta.Tecla-Desvío a La Libertad)	3.80	Construcción
Periférico Sur (Desvío a la Libertad -San Marcos)	10.80	Construcción
Periférico Oriente (San Marcos-Ciudad Delgado)	5.60	Construcción
Santo Tomas-Ilopango	9.00	Construcción
TOTAL A CONSTRUIR / AMPLIAR	38.20	

Para el primer tramo La Cuchilla - Santa Tecla se propone la ampliación de la vía tal como fue descrita en la Alternativa 2 del Programa Circunvalación Norte.

El segundo tramo Periférico Sur desde Santa Tecla hasta el desvío a La Libertad también esta incluido en la Alternativa 1 descrita para este Programa.

En el tercer tramo se tiene la continuación del Periférico Sur desde el desvío a La Libertad hasta San Marcos, construyéndose 7.80 km. de carretera especial con cuatro carriles.

El siguiente tramo es el Periférico Oriente con una construcción de 5.60 km. de carretera especial de cuatro carriles desde San Marcos hasta Ciudad Delgado, finalizando en la lugar donde la Nueva CA-1 intersecta con la Troncal del Norte.

El ultimo tramo es Santo Tomás-Ilopango, el cual también fue descrito en la alternativa 1 de este Programa.

A partir de el punto de intersección entre la Nueva CA-1 y la Troncal del Norte, se integran a esta alternativa los tramos comunes descritos en el programa de Circunvalación Norte.

El costo estimado a invertir en la construcción de esta alternativa no incluye el costo de los dos tramos que forman parte de la Nueva CA-1 ya que es una inversión prevista por el Ministerio de Obras Publicas, la inversión estimada asciende a la cantidad de ¢ 552 millones de colones distribuidos así:

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	Millones de Colones	Característica
La Cuchilla - Santa Tecla	139.15	Especial (6 carriles)
Periférico Sur (Sta.Tecla-Desvío a La Libertad)	76.78	Especial (4 carriles)
Periférico Sur (Desvío a la Libertad-San Marcos)	84.24	Primaria
Periférico Oriente (San Marcos-Ciudad Delgado)	113.15	Especial (4 carriles)
Santo Tomas-Ilopango	138.38	Primaria
TOTAL ALTERNATIVA 2	551.70	

2. 3 Alternativa 3

Esta alternativa esta integrada por una combinación de los tramos de las dos opciones descritas anteriormente.

Se compone de un tramo de ampliación de 9.00 km. de carretera especial de seis carriles la construcción de un tramo de característica especial de cuatro carriles y la construcción de otros dos de carretera primaria.

Los tramos en mención son los siguientes:

	Long. Km.	
La Cuchilla - Santa Tecla	9.00	Ampliación
Periférico Sur (Sta.Tecla-Desvío a La Libertad)	3.80	Construcción
Periférico Sur (Desvío a la Libertad -San Marcos)	10.80	Construcción
Santo Tomas-Ilopango	9.00	Construcción
TOTAL A CONSTRUIR/AMPLIAR	32.60	

Para el primer tramo La Cuchilla - Santa Tecla se propone la ampliación de la vía tal como fue descrita en la Alternativa 2 del Programa Circunvalación Norte.

El segundo tramo Periférico Sur desde Santa Tecla hasta el desvío a La Libertad también esta incluido en la Alternativa 1 descrita para este Programa.

El tercer tramo Periférico Sur desde el desvío a La Libertad hasta San Marcos, fue descrito en la alternativa anterior.

El cuarto tramo es Santo Tomás-Ilopango, el cual también fue descrito en la alternativa 1 de este Programa.

El costo estimado a invertir en la construcción de esta alternativa asciende a la cantidad de ¢ 439 millones de colones distribuidos así:

Y para finalizar, dos tramos comunes a la Circunvalación Norte.

	Millones de Colones	Característica
La Cuchilla - Santa Tecla	139.15	Especial (6 carriles)
Periférico Sur (Sta.Tecla-Desvío a La Libertad)	76.11	Especial (4 carriles)
Periférico Sur (Desvío a la Libertad-San Marcos)	84.24	Primaria
Santo Tomas-Ilopango	138.38	Primaria
TOTAL ALTERNATIVA 3	438.55	

4. PROGRAMA LONGITUDINAL DEL NORTE

El programa consiste en la construcción de aproximadamente 193.50 Km. y de la reconstrucción de 46.0 de carretera secundaria, ubicada en la zona norte del país, uniendo las zonas Occidental y Oriental del territorio.

Este corredor vial es de importante necesidad para emprender gran cantidad de proyectos, de desarrollo económico y social, en beneficio de una zona que sufrió durante los últimos diez años, tremendas pérdidas de vidas, destrucción de hogares, disgregación de miles de familias, y la emigración de un considerable porcentaje de la población.

La Carretera Longitudinal del Norte esta calificada como una segunda vía alterna a la Carretera Panamericana. El Programa esta compuesto de cinco tramos de la carretera Longitudinal del Norte y de dos tramos complementarios.

Los tramos del Programa son los siguientes:

Longitudinal del Norte	Long. Km.	
Metapán - Nueva Concepción	39.00	Construcción
Nueva Concepción - Intersección CA-4	18.00	Reconstrucción
Intersección CA-4 - Chalatenango	28.00	Reconstrucción
Chalatenango - Sensuntepeque	62.10	Construcción
Sensuntepeque - Intersección CA-7 (Osicala)	92.50	Construcción
TOTAL	239.60	

Complementarios	Long. Km.	
Osicala - km. 18.00 (Sobre la CA-7)	29.00	Reconstrucción
Sensuntepeque-Intersección CA-1 (Desvío a San Vicente)	30.00	Construcción
TOTAL	59.00	

En una descripción de poniente a oriente la Carretera Longitudinal del Norte comprende los tramos siguientes:

Primer tramo: Metapán - Nueva Concepción, comienza en la ciudad de Metapán; y une hacia el oriente, los pueblos de Santa Rosa Guachipilín y Masahuat con la ciudad de Nueva Concepción, en el departamento de Chalatenango, con una longitud aproximada de 39.00 Km. La construcción de este Tramo se inicio en 1977 y como consecuencia de los problemas originados por el conflicto, los trabajos fueron suspendidos en 1980. Se estima que a la fecha de suspensión, se habia realizado un 30% del trabajo, a la fecha se considera que transcurridos catorce años ya se a perdido en su totalidad.

Segundo tramo: Nueva Concepción - Intersección CA-4, esta constituido por la reconstrucción de una longitud de 18.00 Km. aproximadamente de carretera secundaria, comprendidos entre Nueva Concepción y la Carretera Troncal del Norte (CA-4). Fue construida en 1977-80, como parte del Proyecto Metapán - Troncal del Norte (CA-4).

Tercer tramo: Intersección CA-4 - Chalatenango, comprende la reconstrucción 28.00 Km. de carretera entre la Ruta CA-4 y la ciudad de Chalatenango. Esta construida con características de Secundaria.

Cuarto tramo: Chalatenango - Sensuntepeque, este tramo consiste en la apertura de 62.10 Km. aproximadamente de carretera secundaria, entre la ciudad de Chalatenango y Sensuntepeque.

Quinto tramo: Sensuntepeque - Intersección CA-7 (Osicala), consiste en la apertura de aproximadamente 92.50 Km de carretera secundaria, entre la ciudad de Sensuntepeque uniendo los pueblos de Nuevo Edén de San Juan, San Gerardo y San Luis de La Reina hasta llegar a Osicala.

Los tramos complementarios son los siguientes:

El Tramo Osicala - Km 18.00 , sobre la carretera CA-7, se propone para reconstrucción ya que servira de conexión a la longitudinal del Norte hacia la Ruta Militar la cual conduce

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hacia la frontera de El Amatillo, tiene una longitud aproximada de 29.00 Km con caracteristicas de secundaria.

El tramo Sensuntepeque - Intersección CA-1, comprende la construcción de aproximadamente 30.00 Km de carretera secundaria hasta la CA-1 uniendo las poblaciones de San Jerónimo y Santa Clara.

La inversion estimada para la implementación del Programa Longitudinal del Norte es la siguiente:

Longitudinal del Norte	**Millones de colones**	
Metapán - Nueva Concepción	517.21	Secundaria
Nueva Concepción - Intersección CA-4	44.25	Secundaria
Intersección CA-4 - Chalatenango	68.83	Secundaria
Chalatenango - Sensuntepeque	823.57	Secundaria
Sensuntepeque - Intersección CA-7 (Osicala)	1,226.73	Secundaria
TOTAL	2,680.58	

Complementarios	**Millones de colones**	
Osicala - Km 18.00 (Sobre CA-7)	71.29	Secundaria
Sensuntepeque - Intersección CA-1 (Desvío a San Vicente)	397.86	Secundaria
TOTAL	469.14	

ANNEX 3.10.6

MAINTENANCE BASIC ACTIVITIES

En este Anexo se presenta como una guía para la elaboración de las condiciones que deben cumplir las obras contratadas con las microempresas, la descripción y los procedimientos de ejecución de las principales tareas de mantenimiento rutinario.

a. Actividades Básicas de Mantenimiento Rutinario

a.1 Limpieza de Alcantarillas y Estructuras de Drenaje

- Descripción

Este trabajo comprende la limpieza periódica de las obras de drenaje , tales como alcantarillas de tubería de concreto o metálicas y de otras estructuras de drenaje como alcantarillas de cajón y pontones. Su objetivo es el de mantenerlas libres de material depositado que impida el libre flujo del agua y de materiales de arrastre y palos que tiendan a formar una barrera que obstruya el funcionamiento apropiado de la obra de drenaje correspondiente.

- Procedimientos

Los trabajos de limpieza de alcantarillas y estructuras de drenaje se deberán ejecutar en los sitios señalados por el interventor o en donde se presenten obstrucciones o taponamientos por causa de lluvias o arrastre de materiales.

En el caso de alcantarillas metálicas, durante la operación de limpieza deberá revisarse el estado de la lámina y de la capa de protección.

La limpeza de alcantarillas deberá ejecutarse por lo menos dos veces al año o cuando el área de la sección transversal esté obstruida en más del 20% o la altura de los desechos sobrepase la cuarta parte de la luz vertical de la alcantarilla.

La limpieza de las demás estructuras de drenaje deberá ejecutarse por lo menos una vez al año.

En general, las obras deberán limpiarse por métodos manuales.

a.2 Limpieza de Cunetas, Zanjas, Canales y Descoles

- Descripción

Este trabajo comprende la limpieza de cunetas, descoles y zanjas de coronación o canales de drenaje y descoles, para evitar un funcionamiento inadecuado que afecte la estabilidad de las bancas.

- Procedimientos

Los trabajos de limpieza de cunetas, zanjas de coronación, canales y descoles (estructura de desague final de los canales, alcantarillas, cunetas al drenaje natural del terreno) deberán ejecutarse en los sitios señalados por el interventor o en donde se presenten obstrucciones y taponamientos por causa de lluvias o arrastre de materiales.

La limpieza se ejecutará a mano, con una frecuencia mínima de dos veces por año, pero en todo caso, cada vez que los sedimentos u obstáculos impidan el flujo normal del agua.

a.3 Limpieza General de Zonas y Chapeo

- Descripción

Este trabajo comprende el chapeo y la limpieza general de zonas aledañas y complementarias a la vía tales como áreas de parqueo, maniobras y accesos inmediatos a la carretera.

Comprende todas las labores necesarias para mantener la zona de la vía libre de obstáculos, ramas, troncos, arbustos, piedras, animales muertos señales, avisos, vallas y demás objetos que impidan u obstaculicen la visibilidad, el tránsito o el drenaje de la vía.

- Procedimientos

Los trabajos de limpieza general de zonas y chapia se deberán ejecutar a lo largo de la vía y en sitios especificos señalados por el interventor donde se presente acumulación de desechos o vegetación.

Se ejecutarán a mano o por medios mecánicos, incluyendo guadañadoras con una frecuencia mínima de dos veces al año o cuando los desechos impidan el flujo normal del agua o la adecuada visibilidad para los usuarios de la vía.

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Se deben retirar obstáculos tales como piedras, vallas, avisos y demás objetos que el interventor señale. Todos los materiales y objetos provenientes de esta operación deberán removerse y llevarse a los sitios que indique el interventor, disponiéndolos en tal forma que no den mala apariencia, no causen erosión, no impidan la visibilidad, ni produzcan inestabilidad en los taludes o perjudiquen el drenaje de la vía. El trabajo incluye la poda de árboles que obstaculicen la visibilidad. No se permitirá la quema en el sitio de ningún material.

a.4 Limpieza Manual de Derrumbes

- Descripción

Este trabajo comprende la remoción, cargue, transporte y desecho de materiales provenientes de pequeños derrumbes o deslizamientos de taludes que puedan ser despejados con trabajo manual.

- Procedimientos

Las labores de remoción y despeje de la vía para dar tránsito deberán iniciarse dentro de las 12 horas siguientes a la ocurrencia del derumbe. Si este cae sobre cabezales de alcantarillas o sobre pavimento, deberá extraerse con las precauciones necesarias y evitando causar daños a las obras.

Los materiales provenientes de los derrumbes deben desecharse en sitios que cuenten con la aprobación del interventor.

El despeje del derrumbe deberá hacerse con las precauciones debidas, señalizando apropiadamente el sitio de los trabajos.

a.5 Sellado de Grietas

- Descripción

Este trabajo comprende las labores necesarias para sellar grietas en pavimentos asfálticos o de concreto hidráulico, tales como: limpieza, secado y relleno de la grieta con productos bituminosos o con una mezcla de estos con arena o con otro material debidamente aprobado por el interventor. Los materiales necesarios para la ejecución de los trabajos serán provistos por la Dirección General de Caminos o por quién ella señale.

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- Procedimiento de Construcción

Los trabajos deberán ejecutarse en los sitios señalados por el intervent utilizando los materiales requeridos según la magnitud de la grieta, prev remoción de los materiales sueltos o inadecuados. Se podrán utiliz equipos mecánicos o métodos manuales para la ejecución de es operación.

b. Actividades Básicas de Mantenimeitno Periodico

b.1 Reparación de Pavimento

- Descripción

Este trabajo comprende la demarcación de áreas falladas o deterioradas p debajo de los patrones mínimos de calidad definidos en los procedimient para determinar el índice de estado de los pavimentos; investigación de l causas de las fallas y diseño de las obras requeridas para resolverla excavaciones hasta los niveles de falla; remoción de los materiales produc de las mismas; cargue y transporte de los materiales excavados hasta sitio de desecho que indique el interventor; compactación e imprimación c productos asfálticos del fondo de la excavación; imprimación de las pared de la excavación y relleno con material de base y mezcla asfáltica q cumpla con las especificaciones técnicas definidas para este tipo materiales de construcción

- Procedimiento de Construcción

Para realizar los trabajos de reparación de pavimento se utilizarán, preferencia, equipos mecánicos.

Los bordes de la caja excavada deberán formar ángulos rectos en s vértices y las paredes de la misma ser verticales. El fondo de la excavaci será plano y deberá compactarse al 95% de la densidad máxima d ensayo Proctor Modificado. En ningún caso se dejarán excavacion expuestas al tránsito. El área reparada deberá quedar a nivel con el res del pavimento y tener una textura de similares condiciones. No se aceptar reparaciones que afecten la normal circulación del tráfico, induzcan reducciones de velocidad o presenten irregularidades que disminuyan calidad general de la vía. En caso tal que la reparación no sea satisfactori deberá demolerse y proceder a un nuevo arreglo.

b.2 Refuerzo del Pavimento

- Descripción

Comprende la colocación de carpeta asfáltica, de especificaciones técnicas acordes con las normas de construcción existentes, a lo largo y ancho de un tramo de carretera cuyo índice de estado se encuentra por debajo del mínimo admisible y el cual no puede ser reparado para obtener una calificación aceptable. En cualquier caso la rugosidad máxima tolerable será de 3.8 m/Km., valor por encima del cual el contratista deberá proceder al refuerzo de la estructura.

- Procedimientos

Los trabajos de refuerzo del pavimento deberán ejecutarse con máquinaria apropiada (finalizadoras de asfalto) y estarán sometidos a evaluación posterior para determinar su índice de estado y rugosidad. En caso que estos no sean aceptablea, el contratista estará en la obligación de solventar la deficiencia mediante la aplicación de otra capa de refuerzo.

b.3 Reparación General de Obras

- Descripción

Este trabajo comprende las labores necesarias para reparar obras deterioradas por cualquier causa. En general, incluye obras de drenaje y contención tales como cunetas, canales revestidos, alcantarillas y muros de contención en concreto y con gaviones. Incluye también los trabajos requeridos para corregir las causas del deteriodo o falla de las obras, tales como pendientes o secciones inadecuadas.

- Procedimientos de Construcción

Los trabajos de reparación general de las obras deberán realizarse en la oportunidad señalada por el interventor, utilizando equipos y materiales acordes con el daño a reparar y el tamaño de la obra.

Se podrán utilizar equipos mecánicos o métodos manuales o una combinación de ambos, según la magnitud y clase de obra por reparar.

b.4 Señalización

- Descripción

Comprende el retiro de señales deterioradas y el suministro e instalación de señales verticales de tránsito y demarcación con pintura reflectiva.

- Procedimientos

Los trabajos de señalización y demarcación se deberán ejecutar en los sitios señalados por el interventor, utilizando los materiales indicados en las normas vigentes de la Dirección General de Caminos.

El concesionario debe garantizar que la señalización horizontal, en todo momento y en todo punto de línea demarcada produzca como mínimo 150 milicandelas/pie^2-lux.

Las señales verticales deberán tener una reflectividad mínima del 75% respecto al valor exigido por las normas para su instalación. En caso de presentar una reflectividad menor a esta, deberán reponerse en forma inmediata.

Cuando las señales presenten deterioro por causas externas como vandalismo o accidentes de tránsito, deberán reponerse, en todo o en parte, de acuerdo con la evaluación que de su estado realice el interventor. En cualquier caso, las señales deben ser completamente nítidas para los usuarios de las vías, de manera que la información sea inequívoca y precisa.

ANNEX 3.10.11

QUALYFICATION METHOD AND OFFER EVALUATION

En este Anexo 3.10.11 se presenta un sistema de calificación que puede tomarse como guía para evaluar propuestas para licitaciones de Contratos de Gestión o Concesiones.

a. Documentos de Calificación

- Balance General y Estados Financieros, con fecha de cierre del último año fiscal, auditados por Contador Público Certificado. Deben acompañarse de los documentos y anexos de soporte.

- Relación de los contratos de obra, de características afines con los trabajos objeto de la licitación, ejecutados en los últimos cuatro (4) años. Para cada uno debe incluirse:

  * País y localidad
  * Nombre y dirección de la entidad contratante
  * Valor del contrato
  * Valor actualizado del contrato, en colones, a la fecha de apertura de la licitación
  * Objeto del contrato
  * Forma de ejecución: individual, en consorcio, como unión temporal, en asociación o como subcontratista
  * Fechas de iniciación y terminación de las obras.
  * Tiempos de ejecución: contractual inicial y real

Deben anexarse los documentos de soporte que permitan la correcta interpretación de la relación. La Dirección General de Caminos podrá pedir información o documentos adicionales en caso de estimarlo conveniente.

En caso que el licitante proponga sub-contratistas para la construcción de las obras objeto de la licitación, deberá relacionar los contratos ejecutados por el o los sub-contratistas propuestos, con la misma información solicitada al licitante.

Las personas jurídicas con menos de un año de constituidas serán calificadas tomando en consideración los factores de evaluación de cada uno de sus socios, para lo cual deberá presentarse la información en forma individual.

En el caso de consorcios, uniones temporales o promesas de asociación futura entre empresas debidamente constituidas, cada integrante deberá presentar la documentación individualmente y cada una de ellas se analizará en forma separada. La calificación de consorcio, unión temporal o promesa de asociación futura, se obtendrá por acumulación de los análisis individuales de la documentación.

b. Precalificacion del Proponente

- Capacidad Operativa

Los licitantes, los integrantes del consorcio, la unión temporal o promesa de asociación futura o sus sub-contratistas, deberán cumplir con lo estipulado en este numeral.

El valor de los contratos de obra similares a los trabajos objeto de la licitación, ejecutados por el licitante, los integrantes del consorcio, la unión temporal o la promesa de asociación futura o por sus sub-contratistas en los últimos 48 (cuarenta y ocho) meses, actualizado a la fecha de apertura de la licitación, debe ser igual o superior a 1.5 veces el costo de la obra -CO- calculado por el licitante.

- Capacidad Financiera

1- Cobertura del Flujo de Caja -CFC-

La cobertura del flujo de caja establece la capacidad del proponente para emprender la realización de la obra con sus propios recursos, sin acudir al crédito, de acuerdo con los datos suministrados en los estados financieros.

La cobertura del flujo de caja debe ser mayor o igual a doce punto cinco por ciento (12.5%).

$$CFC = \frac{AR}{CO} > 12.5\%$$

En donde:

Activo Realizable -AR-, corresponde a los valores agregados de :

- **Efectivo : Caja, bancos y otros depósitos.**

- Inversiones, préstamos (diferentes de préstamos a socios o consorciados) y bienes recibidos en pago, que puedan ser monetizados durante el tiempo de ejecución de la obra.

- Deudas comerciales y cuentas por cobrar con plazo inferior a un año.

- Inventarios. Existencias de materia prima y productos en procesos que puedan aplicarse a la construcción de la obra.

Costo de la Obra -CO- propuesto por el licitante. Incluye el valor de:

- Los diseños

- La construcción

- Los predios a adquirir

- La interventoría durante la construcción.

2. Liquidez Inmediata -LI-

La liquidez inmediata debe ser mayor o igual a uno punto cero (1.0)

$$LI = \frac{AR}{PE} > 1.0$$

En donde:

Pasivos Exigibles -PE-, son obligaciones cuya cancelación se espera en un plazo no mayor de un año.

3. Capital de Trabajo -CT-

El capital de trabajo -CT- es igual al activo realizable -AR- menos los pasivos exigibles -PE- y debe ser mayor o igual al 4% del costo de la obra -CO- a la fecha de apertura de la licitación.

$$CT = (AR - PE) > 4\% \ CO$$

4. Patrimonio Líquido -PL-

El patrimonio líquido es igual al patrimonio total menos el pasivo total, y debe ser mayor o igual al 7% del costo de la obra a la fecha de apertura de la licitación.

$$PL = (PT - Pa) > 7\% \ CO$$

En donde:

Patrimonio Total -PT- es el patrimonio total del Balance General.
Pasivo Total -Pa- es el pasivo total del Balance General

Los proponentes que no alcancen los valores mínimos, no serán calificados. Las ofertas que cumplan con las condiciones establecidas en este numeral, se considerarán para la segunda fase de la calificación.

c. Calificación de la Propuesta Financiera.

La propuesta financiera se evaluará en términos de su compatibilidad y coherencia con el concepto general de trabajo establecido en la oferta. Esto significa que la propuesta financiera debe ajustarse en un todo a lo establecido en la propuesta para la elaboración de los diseños, la propuesta para la construcción de las obras y la propuesta para la operación del proyecto.

Debe ser coherente con:

* Los programas de inversión
* La organización propuesta para la construcción de las obras
* El programa de utilización del equipo
* El programa de conservación ofrecido para el mantenimiento de la obra
* La estructura administrativa y técnica concebida para la construcción y la operación del proyecto.

La propuesta financiera se calificará de acuerdo con el siguiente procedimiento :

- Etapa de Diseño, Programación y Construcción

Para las etapas de diseño, programación y construcción, debe elaborarse una proyección mensual del origen y la aplicación de los recursos, en donde se describan las fuentes de los fondos necesarios para cubrir los costos de constitución y legalización de los contratos, de elaboración de los diseños y de la construcción de las obras, así como los programas de aplicación de los mismos. Este estado de fuentes y usos debe ser coherente con los compromisos de la o las entidades financieras que respaldan la propuesta en términos de montos y programación de los desembolsos, tasas de interés, plazos y en general, con todas características de los sistemas de crédito ofrecidos. El estado de fuentes y usos debe ser compatible y consistente con todos los puntos contemplados en la propuesta financiera. Para su presentación puede usarse la presentacion que más se ajuste a los términos de cada propuesta. La información mínima requerida, por período mensual, debe discriminarse por origen de los fondos y rubros de aplicación, como se indica a continuación:

- Origen de los fondos :
  - Aportes de capital
  - Financiamiento local
  - Financiamiento externo
  - Otras fuentes
  - Total mensual
- Aplicación de los recursos
  - Legalización de los contratos
  - Elaboración de los diseños
  - Instalación y puesta en funcionamiento de la organización administrativa
  - Costos Fiduciarios

- Compra de predios
- Costos de construcción
- Costos administrativos
- Costos financieros locales
- Costos financieros externos
- Otro usos
- Total mensual

El estado de fuentes y usos debe acompañarse de toda la información necesaria para su correcta interpretación. La Dirección General de Caminos podrá solicitar información adicional, si lo considera necesario. Una vez verificada su consistencia, la propuesta se considerará como aceptable si los montos totales de los recursos aplicados son menores o iguales a los desembolsos financieros en cada período considerado.

- Etapa de Operación del Proyecto

El licitante deberá presentar la proyección anual del flujo efectivo del proyecto, calculado con una inflación semestral del 5%. El propósito de esta proyección es determinar el grado de factibilidad financiera durante el período operativo del contrato. Sirve como indicativo de la capacidad del proyecto para cubrir los costos de operación y mantenimiento, así como los costos financieros y los pagos de principal.

De igual forma, como se expuso en el numeral anterior, el flujo proyectado debe ser consistente con las características generales de la operación del proyecto, con el programa de conservación ofrecido para el mantenimiento de la obra y en general, con la estructura administrativa y técnica de la operación.

El flujo efectivo del proyecto debe ser coherente con los compromisos de la o las entidades financieras que respaldan la propuesta en términos de tasas de interés, pagos de principal y en general con todas las características de los sistemas de crédito ofrecidos. Debe ser compatible y coherente con todos los aspectos descritos en la propuesta financiera. Para su presentación puede usarse el formato que más se ajuste a los términos de cada propuesta. El formato anexo A-3 es ilustrativo y muestra la información mínima requerida.

El flujo efectivo del proyecto debe acompañarse con toda la información necesaria que permita su correcta interpretación. La Dirección General de Caminos podrá solicitar información adicional, si lo considera necesario.

Una vez verificada la coherencia y compatibilidad del flujo proyectado, la propuesta se considerará aceptable si el Margen Operacional que arroja como resultado para cada año de operación es igual o mayor que 1.20 (uno punto veinte).

El margen operacional se calcula de acuerdo con la siguiente fórmula :

$$MO = \frac{IN - EO - IMP}{GF + P} > 1.2$$

En donde :

MO	=	Margen operacional calculado de acuerdo con la formula anterior
IN	=	Ingreso Netos Totales,
EO	=	Egresos Operativos Totales
IMP	=	Impuestos Totales durante el año de operación respectivo
GF	=	Gastos Financieros
IP	=	Pagos de Principal

d. Evaluación de las ofertas

Las ofertas que hayan cumplido con las dos fases anteriores se evaluarán en términos de las condiciones económicas ofrecidas de acuerdo con la formula que se indica a continuación, de manera que aquella oferta que obtenga el menor puntaje, será la más conveniente para su adjudicación.

$$PUNTAJE = TP * PIMG + TP * SCA + TP * PC + TP * PO$$

La evaluación de las ofertas incluirá los siguientes parámetros como determinantes del puntaje :

1. Tarifas de peaje -TP-

TP es la tarifa ponderada que resulta de multiplicar la tarifa de peaje presentada en la oferta, para la carretera completa, para cada tipo de vehículo, por su composición porcentual del primer año de operación. Si en la carretera hay dos o más estaciones de peaje propuestas, la tarifa poderada de cada una se multiplicará por el índice de representatividad -IR- de cada estación, que es igual al cociente del volumen de tránsito total de la estación, dividido por el volumen de tránsito total que circulará a través de todas las estaciones de peaje de la carretera :

$$TP = TP_1 * IR_1 + TP_2 * IR_2 + \ldots + TP_N * IR_N$$

En donde :

$$TP_N = TA_N * A_N + TB_N * B_N N + TC2P_N * C2P_N + TC2G_N * C2G_N + TC3_N * C3_N + TC5_N * C5_N + T>C5_N * >C5_N$$

Siendo TA_N la tarifa para la categoría A en la estación de peaje N y A_N la participación porcentual de tráfico para la categoría A en esa misma estación y de igual forma, para todas las categorías vehiculares.

Los índices de representatividad se definen como :

$$IRN = TPD_N / TPD_{TOTAL}$$

Siendo TPD_N el volumen de tránsito total en la estación N y TPD_{TOTAL} la suma de los volúmenes de tránsito previstos en todas las estaciones localizadas en la carretera.

2. Porcentaje de ingresos mínimos garantizados. PIMG

Si los términos de la concesión preven garantías de tráfico para los concesionarios, el licitante podrá solicitar en su oferta que la Dirección General de Caminos le garantice un menor tránsito anual en la o las estaciones de peaje que localice en cada tramo. La calificación debe contemplar entonces los riesgos asumidos por el concesionario por esta causa. Al asumirlos, obtendrá menor puntaje en la medida que su propuesta disminuya el compromiso de la entidad contratante para cubrir posibles ingresos no recaudados por el concesionario por bajos niveles de tráfico.

El puntaje por PIMG se calcula así:

$$PIMG = P_1 * IR_1 + P_2 * IR_2 + \ldots P_n * IR_n$$

En donde :

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PIMG es el puntaje obtenido por el licitante de acuerdo con su propuesta en cuanto al volumen de tránsito garantizado.

$P_{1,2,\ldots,n}$ son los porcentajes de vehículos, para todas las categorías, que el licitante solicita se le garanticen con respecto a los volúmenes establecidos en el Pliego de Condiciones para los tramos en donde se localizan las estaciones de peaje 1,2,....,N.

$IR_{1,2,\ldots,n}$ son los índices de representatividad de las estaciones, ya definidos. Los porcentajes de ingresos mínimos garantizados, $P_{1,2,\ldots,n}$, para cada una de las casetas, en ningún caso puede ser inferior al 70%.

3. Sobrecostos de construcción asumidos -SCA-

El licitante podrá obtener un menor puntaje entre mayor riesgo asuma en cuanto a los sobrecostos de construcción. La entidad reconocerá al concesionario el 100% de los costos adicionales por cantidades de obra superiores hasta en un 30% sobre las establecidas en su propuesta y el 75% por cantidades en exceso entre el 30% y el 50%. Por excesos sobre el 50% no reconocerá ningún costo y estos serán de cargo del concesionario.

No obstante lo anterior, el licitante podrá proponer en su oferta disminuir los porcentajes topes de aumento en las cantidades de obra con respecto a las establecidas en su propuesta, a partir de los cuales asumirá las diferencias de costos. Esto le permitirá obtener una disminución en su puntaje,que se calculará de la siguiente manera :

$$SCA = \{1,0 - 1,5 * (50\% - P)\}$$

En donde :

SCA es el puntaje asignado por los sobrecostos de construcción asumidos por el licitante.

P es el porcentaje de aumento en las cantidades de obra, con respecto a las establecidas en su propuesta, a partir del cual el licitante asumirá el 100% de los sobrecostos, el cual deberá ser mayor o igual al 30% y menor o igual al 50%

$$30\% \leq P \leq 50\%$$

4. Plazo de construcción -PC-

El puntaje obtenido por el licitante por el plazo de construcción ofrecido en su propuesta se calculará de la siguiente manera:

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$$PC = 0.5 * \beta / 12$$

En donde :

PC es el puntaje obtenido por el licitante por el plazo de construcción ofrecido en su propuesta.

β es el plazo de construcción ofrecido por el licitante para cubrir el alcance físico establecido en el Pliego de Condiciones.

5. Plazo de operación de la concesión -PO-

El puntaje obtenido por el licitante por el plazo propuesto de operación de la concesión se calcula de la siguiente manera:

$$PO = 0.5 * \alpha / 144$$

En donde:

α es el plazo de operación de la concesión ofrecido por el licitante, en meses.

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ANNEX 3.10.13

EVALUATION AND CLASSIFICATION PROCEDURE OF THE MAINTENANCE CONDITION OF PAVED ROADS

En este Anexo se establecen las guías o lineamientos generales para calificar los diferentes elementos o parámetros de evaluación.

- Generalidades

- Es de cáracter obligatorio que el personal y los equipos que participen en la inspección de las carreteras con el fin de calificar su estado, porten elementos de seguridad y señalización, establecidos por la Dirección General de Caminos, con el objeto de proteger la integridad física de los evaluadores y los usuarios de las vías y minimizar los riesgos de accidentes fatales.

- La evaluación la deberán hacer en conjunto funcionarios de la interventoría y el contratista.

- Se deberá calificar solamente durante el día y cuando exista suficiente luz natural para poder apreciar debidamente el estado de la carretera. Como la inspección se dificulta cuando el recorrido se realiza con el sol a espaldas del calificador, especialmente cuando se trata de apreciar fisuras en la superficie de rodadura, las jornadas de evaluación deberán programarse de manera que se evite en lo posible esta situación.

- En caso de que se encuentre en reparación una sección o tramo de carretera, no se tomará en cuenta para la calificación y se anotará en las observaciones.

- Durante el recorrido el calificador deberá observar condiciones particulares que afecten la fluidez del tránsito o manifiesten la ocurrencia de problemas futuros en la vía que requieran atención. Por ejemplo: deslizamientos de taludes, daños en los puentes u obras de drenaje, deficiencias en las defensas metálicas, señales colocadas en forma inadecuada o que no cumplan con las normas establecidas, invasiones al derecho de vía y daños representativos de ahuellamientos y asentamientos longitudinales. Estas situaciones deberán reportarse al contratista, con el fin de que tome las medidas preventivas o correctivas necesarias para evitar daños mayores.

- Rugosidad

Para medir la rugosidad de las carreteras pavimentadas se utilizarán rugosímetros o analizadores de perfil longitudinal, de acuerdo con las instrucciones de los fabricantes.

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Las mediciones obtenidas para cada sector se clasificarán según los rangos definidos en el Cuadro 3.10.1. En caso de que se registren calificaciones por debajo de 3.8 para un sector determinado, el concesionario deberá adelantar la totalidad de las obras necesarias llevar la calificación del tramo a condiciones muy buenas dentro de los dos meses subsiguientes a la fecha del reporte del interventor. La rugosidad de la vía después de realizadas las obras no debe superar un valor de 2.2 m/km.

- Fisuras y Grietas

El procedimiento de calificación de este elemento consiste en la determinación, por comparación visual, del grado de fisuración de la calzada con respecto a patrones definidos mediante fotografías. Para ello se debe contar con catálogos de fotos de fallas que relacionen grupos de ellas con los niveles de deterioro a ser calificados. Como la calidad de las vías bajo contratos de concesión o gestión vial debe ser alta, los niveles de falla a ser calificados se relacionan con porcentajes bajos de fisuración. Estos se calificarán según una escala de 1 a 5 de acuerdo con el porcentaje de área afectada, como se indica a continuación:

Clasificación	Coeficiente F	% Area Afectada
Muy Bueno	5 - 4	0 < %A < 3%
Bueno	4 - 3	3 < %A < 6%
Regular	3 - 2	6 < %A < 10%
Malo	2 - 1	10< %A < 25%

Para calificar la fisuración se utilizará el Formato 1. Los calificadores delimitarán las secciones de la carretera que presenten fisuras, anotarán el abscisado de sus extremos, la longitud y ancho de las secciones, calcularán sus áreas y los productos de estas por los coeficientes F correspondientes. El coeficiente F ponderado se obtendrá de dividir la sumatoria de estos últimos por la sumatoria de áreas y se consignará en el formato.

- Ahuellamientos y Deformaciones

Para calificar la profundidad máxima de ahuellamientos y deformaciones en una carretera pavimentada, el Formato 1 presenta las calificaciones correspondientes a los diferentes rangos de valores de dicho daño.

La medición de la profundidad de los ahuellamientos y las deformaciones se efectuará con una regla de 3 m de longitud, colocada perpendicularmente al eje de la vía.

Para recolectar la información sobre profundidades de los ahuellamientos y las deformaciones, se empleará el Formato 2 para el tramo de carretera previamente identificado. En dicho formato se registrarán el abscisado, la profundidad máxima de ahuellamiento en milímetros, indicando el carril (derecho o izquierdo en el sentido del abscisado) y la huella (externa o interna) donde se presenta el daño y se relacionará la correspondiente longitud afectada en metros.

La columna 3, denominada PRODUCTO, se obtiene mediante la multiplicación de la profundidad máxima por la longitud del daño. Para cada sector se relizará la sumatoria de las columnas LONGITUD Y PRODUCTO y se obtendrá la profundidad máxima ponderada de ahuellamientos y deformaciones como el cociente de la sumatoria de los productos entre la sumatoria de las longitudes.

- Resistencia al Deslizamiento

Para calificar este elemento en las carreteras pavimentadas, en el Cuadro 3.10.1 se indican los rangos de calificación correspondientes a los valores de resistencia al deslizamiento.

Para efectos de la evaluación de este parámetro, la vía se dividirá en sectores de 5 kilómetros, a los cuales les realizarán mediciones de resistencia al deslizamiento cada 200 m y en curva, utilizando el péndulo del T.R.R.L. (Transport and Road Reseach Laboratory), siguiendo las normas y especificaciones establecidas por la Dirección General de Caminos y en particular la norma A.S.T.M. E303-69. La calificación de cada sector corresponderá al promedio de los ensayos realizados. En caso de presentarse una calificación por debajo de cuatro (4) para algún sector, el concesionario deberá mejorar la condición de resistencia en un plazo no mayor de dos meses a partir del reporte del interventor.

- Estado de los Hombros

Los daños en los hombros corresponden a pérdidas del recubrimiento asfáltico, asentamientos, ahuellamientos o deformaciones que superen los 3 centímetros al ser medidos con reglas de 3 metros, o a deterioro de los bordes.

En el Cuadro 3.10.1 se establecen los rangos de calificaciór correspondientes a la variación de los porcentajes de área de hombros cor daños u ocupados por maleza o escombros, con respecto al área total de la sección de hombros analizada.

CUADRO 3.10.1
Tabla de Calificacion de Estado de los Pavimentos

		RANGO DE CALIFICACIONES			
ELEMENTO	UNIDAD DE MEDIDA DE CALIFICACION	MUY BUENO 5 - 4	BUENO 4 - 3	REGULAR 3 - 2	MALO 2 - 1
RUGOSIDAD	I I R	2 - 3.5	3.5 - 4.5	4.5 - 6.5	6.5 - 12
AHUELLAMIENTO Y DEFORMACIONES	mm	0 - 25	25 - 40	40 - 60	60 - 100
FISURAS	Coeficiente F	5 -4	4 - 3	3 - 2	2 - 1
RESISTENCIA AL DESLIZAMIENTO	Coef Resistencia al deslizamiento	100 - 45	———	45 - 00	———
ESTADO DE BERMAS	% de daños	0 - 2	2 - 5	5 -10	10 - 20

CUADRO 3.10.2
Factor de Influencia

ELEMENTO	FACTOR DE INFLUENCIA
Rugosidad	0.35
Ahuellamientos y Deformaciones	0.20
Fisuras	0.20
Resistencia al Deslizamiento	0.20
Estado de Bermas	0.05

FORMATO 1
EVALUACION DE FISURAS

PAIS : _____

CONTRATISTA : _____

INTERVENTOR : _____

CARRETERA : _____

TRAMO : _____ SECTOR: _____

FECHA : _____ HOJA : _____ DE _____

ABSCISA	COEFICIENTE F	LONGITUD	ANCHO	AREA	AREA * F
SUMATORIAS					

COEFICIENTE F : Σ (AREA * F) / Σ AREA _____

CLASIFICACION : _____

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FORMATO 2
Evaluacion de Ahuellamientos

PAIS : _____

CONTRATISTA : _____

INTERVENTOR : _____

CARRETERA : _____

TRAMO : _____ SECTOR: _____

FECHA : _____ HOJA : _____ DE _____

ABSCISAS	CARRIL	HUELLA	PROFUNDIDAD MAXIMA (mm)	LONGITUD (m)	PROF * LONGITUD (P * L)
K + al K +	Derecho	Externa			
		Interna			
	Izquierdo	Externa			
		Interna			
K + al K +	Derecho	Externa			
		Interna			
	Izquierdo	Externa			
		Interna			
K + al K +	Derecho	Externa			
		Interna			
	Izquierdo	Externa			
		Interna			
S U M A T O R I A S					
PROFUNDIDAD MAXIMA DE AHUELLAMIENTO : $\frac{\Sigma (P * L)}{\Sigma L}$					

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ANNEX 3.12.1

ESTIMATES AND PROJECTIONS OF FISCAL INCOME AND DERIVATED TRANSPORT COST ON INTERURBAN PAVED ROADS

ANEXO 3.12.1

Estimados y Proyecciones de Ingresos Fiscales y Costos Derivados del Transporte por Carreteras Interurbanas Pavimentadas

Este Anexo describe la metodología utilizada para estimar los ingresos fiscales derivados del transporte por carreteras interurbanas pavimentadas por tipo de vehículo, así como los costos de mantener, rehabilitar y mejorar la red de carreteras, distribuidos por tipo de vehículo, utilizados para efectuar las proyecciones de ingresos y costos del sector carreteras. En la primera sección se presentan los ingresos fiscales, en la segunda sección los costos, y en la tercera se presentan los resultados de comparar los ingresos fiscales con los costos.

1. Ingresos Fiscales Derivados del Transporte por Carretera

Se incluyeron los siguientes cargos a usuarios para estimar los cargos a usuarios del sector carreteras y los ingresos fiscales derivados de los mismos:

- Impuesto por adquisición (transferencia y matrícula de vehículos).
- Impuestos a la importación de vehículos y registro de aduanas.
- Impuestos al valor agregado por la importación de vehículos.
- Impuestos a la importación de repuestos y accesorios para vehículos de transporte.
- Impuestos al valor agregado por la importación de repuestos y accesorios para vehículos de transporte.
- Sobrecargos a los combustibles (gasolinas y diesel) de transporte.
- Subsidios al consumo preferencial de combustibles (gasolinas y diesel) de transporte.
- Impuestos al valor agregado por el consumo de combustibles de transporte.
- Otros impuestos, cobros y multas.

A continuación se presentan las metodologías utilizadas para estimar los cargos a usuarios listados y en la última Sección se presentan los resultados de dichas estimaciones.

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1.1 Impuesto por Adquisición (Transferencia y Matrícula de Vehículos)

El Decreto No. 504 del 16 de Abril de 1993 tiene por objeto normar el establecimiento y aplicación de los derechos relacionados con la propiedad, transferencia, conducción y modificación de las características de los vehículos, que autorizan su circulación dentro de El salvador.

La administración de los derechos y materias conexas a que se refiere el decreto, le corresponde a la Dirección General de Impuestos Internos del Ministerio de Hacienda.

El Cuadro A.3.12.1 resume los derechos anuales por circulación de vehículos. La Tarjeta de Circulación es la especie fiscal extendida por la DGII, previo pago de los derechos respectivos.

Conforme al Artículo 11 del decreto, el propietario está en la obligación a entregar en la DGII la Tarjeta de Circulación y placas que le corresponden, una vez el vehículo quedare fuera de circulación definitivamente. Sin embargo, el decreto no establece penalidades si no lo hace.

Para la estimación de los ingresos percibidos por el Estado por concepto de transferencia y matrícula de vehículos, se calcula como la tasa promedio por tipo de vehículo i multiplicado por el número de vehículos tipo i:

$$TA_i = ta_i * VEH_i \qquad [2.1]$$

En donde :

TA_i: Ingresos por el registro de vehículos tipo i.
ta_i: Tasa promedio de impuesto por tipo de vehículo i registrado.
VEH_i: Número de vehículos tipo i.

Para la estimación de los ingresos por concepto de matrícula de vehículos, se recibió de la División de Informática de la Dirección General de Impuestos Internos la información correspondiente a número y cantidad percibida por el registro fiscal de vehículos, por clase de vehículo. El Cuadro A.3.12.2 presenta un resumen de dicha información. Se nota que los totales presentados en el Cuadro A.3.12.2 para los años 1991 a 1993 varían con aquellos presentados en Cuadro 3.3.6 del Informe Global, basado en el Informe de la Gestión Financiera del Estado. Para 1993, dicha variación es de 3.3 millones de colones sobre un total de 42.01 millones de colones presentado en el Cuadro 3.3.6. Para efectos del presente trabajo, se concidera que dicha variación, la cual es menos del 8 por ciento del total, es aceptable.

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CUADRO A.3.12.1

DERECHOS ANUALES DE CIRCULACION DE VEHICULOS

TIPO DE MATRICULA			DERECHO ANUAL A PAGAR (COLONES)
PARTICULARES			
	VALOR (COLONES)		
Hasta		50,000	100
de mas de	50,001 hasta	75,000	250
	75,001	100,000	500
	100,001	150,000	750
	150,001	200,000	1,500
	200,001	250,000	2,000
	250,001 en adelante		2,500

Reglas de aplicación:

1.- El 100% para vehículos cuyo modelo corresponda al año de expedición de la matrícula y al inmediato anterior;

2.- El 80% para vehículos con antiguedad de dos años;

3.- El 60% para vehículos con antiguedad de tres años;

4.- En los 5 años subsuguientes se reconocerá una reducción del 20% sobre el derecho básico, hasta un derecho de matrícula minimo de 100.

DE TRABAJO	
De alquiler	100
Autobuses	130
Páneles y vehículos de carga	
- Hasta 4 toneladas	100
- Por cada tonelada o fracción en exceso	80
- Por cada camión de llantas sólidas, hasta 3 toneladas	350
- Por cada tonelada o fracción en exceso	150
Cabezales y remolques	
- Automotores cabezales pagarán los derechos de camiones	
- Remolque sin motor, hasta 3 toneladas	100
- Por cada tonelada en exceso	80
Otras matrículas	
- Motocicletas, motonetas, motobicicletas, triciclos con motor, cuadrimotos y otros similares	50
- Vendedor para automovil	500
- Vendedor para motocicletas, motobicicletas, motonetas y similares	100
- Vehículo reparador	150
VEHICULOS CON MATRICULA EXTRANJERA	
Ingreso, tránsito y permanencia por 60 días	100

FUENTE: DECRETO LIGISLATIVO No. 504 DEL 16 DE ABRIL DE 1993.

CUADRO 3.12.2
REGISTRO FISCAL DE VEHICULOS 1991 - 1994
NUMERO DE VEHICULOS E INGRESOS TOTALES Y PROMEDIO PERCIBIDOS POR TIPO DE VEHICULO

TIPO DE VEHICULO	1991			1992			1993			1994 (7)		
	No.	CANTIDAD PERCIBIDA COLONES		No	CANTIDAD PERCIBIDA COLONES		No.	CANTIDAD PERCIBIDA COLONES		No	CANTIDAD PERCIBIDA COLONES	
		TOTAL	PROMEDIO		TOTAL	PROMEDIO		TOTAL	PROMEDIO		TOTAL	PROMEDIO
AUTOMOVIL (1)	98,013	11,348,599	115.77	107,381	12,547,021	116.85	118,334	20,774,319	175.56	107,949	25,474,680	235.99
PICK-UP (2)	73,291	5,663,680	77.28	81,128	6,364,506	78.45	92,041	11,171,490	121.38	86,502	12,944,885	149.65
BUS (3)	6,821	809,072	118.61	7,170	871,958	121.61	7,878	1,532,185	194.49	7,189	1,955,238	271.98
CAMION C2 LIVIANO (4)	5,065	1,055,271	208.35	5,171	1,072,652	207.44	5,280	1,117,478	211.64	4,514	740,852	164.12
CAMION C2 PESADO (5)	10,238	4,514,572	440.95	11,651	5,161,888	443.04	13,154	5,482,558	416.81	12,065	5,282,082	437.82
CAMION C3 (6)	1,138	501,619	440.95	1,295	573,554	443.04	1,462	609,173	416.81	1,341	586,898	437.82
CAMION C3S2	1,623	1,449,603	893.16	1,986	1,782,668	897.62	2,284	3,706,625	1,622.87	2,206	3,729,694	1,690.70
SUB TOTAL	198,189	25,340,416	129.16	215,780	28,374,347	131.50	240,432	44,393,823	184.64	221,765	50,714,329	228.68
MOTOCICLETA	3,207	97,710	30.47	4,758	213,603	44.94	13,333	877,185	65.79	19,820	1,652,956	83.40
REMOLQUE	125	8,880	71.04	458	31,850	69.54	982	74,841	76.21	1,205	171,405	142.24
GRAN TOTAL	199,521	25,447,006	127.54	220,996	28,620,000	129.50	254,747	45,345,849	178.00	242,790	52,538,690	216.40

(1) INCLUYE AUTOMOVILES, RUSTICOS, MICROBUSES, AMBULANCIAS, VENDEDOR, REPARADOR Y ALQUILER.
(2) INCLUYE PICK-UPS Y PANELES.
(3) INCLUYE BUSES PARTICULARES Y COMERCIALES.
(4) INCLUYE CAMIONES DE MENOS DE 3.5 TONS.
(5) INCLUYE EL 90% DE CAMIONES DE ENTRE 3.5 TONS Y 15 TONS.
(6) INCLUYE EL 10% DE CAMIONES ENTRE 3.5 TONS Y 15 TONS.
(7) LA INFORMACION PARA 1994 NO ESTA COMPLETA.

Fuente : Direccion General de Impuestos Internos, Ministerio de Hacienda

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Tomando la información referente a 1994, la tasa promedio por tipo de vehículo i (ta_i) que se utilizó en la estimación de ingresos del estado por este concepto son las siguientes:

Tipo de Vehículo	Tasa (colones)
Automóvil	235
Pick ups	150
Buses	270
Camión C2 liviano	165
Camión C2 pesado	440
Camión C3	440
Camión C3S2	1,690

1.2 Impuestos a la Importación de Vehículos y Registro de Aduanas

El Decreto Legislativo No. 647 del 19 de diciembre de 1990, publicado en el Diario Oficial Tomo No. 309 del 20 de diciembre de 1990, modificado según el Decreto publicado en el Diario Oficial Tomo No. 318 del 19 de febrero de 1993, tiene por objeto normar el establecimiento y aplicación de los impuestos que se aplicarán a la importación de mercaderías al territorio nacional. En particular, el Capítulo 87 del Diario Oficial No. 318 contiene los niveles arancelarios aplicables a los vehículos automóviles, tractores, ciclos y demás vehículos terrestres, sus partes y accesorios.

La administración de los impuestos a la importación de mercadería y materias conexas a que se refiere el decreto, le corresponde a la Dirección General de Rentas de Aduana del Ministerio de Hacienda.

En general, los aranceles para vehículos de turismo varían entre un 20% y 30% del valor CIF del vehículo, dependiendo del tamaño de motor del mismo, tiempo de combustible y características tractivas. Los arancelos para los vehículos para el transporte de personal (diez o mas personas) y de mercancías, así como para repuestos y accesorios, es del 5% del valor CIF.

Para la estimación de los ingresos percibidos por el Estado por concepto de impuestos de importación de vehículos, se calcula como la tasa promedio por tipo de vehículo i multiplicado la tasa promedio de importación del vehículo i multiplicado por el número de vehículos tipo i:

$$TI_i = ti_i * (IMP_i/VEH_i) * VEH_i \qquad [2.2]$$

En donde :

TI_i: Ingresos fiscales por impuestos a la importación de vehículos tipo i.

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ti_i : Tasa promedio de impuesto por vehículo importado tipo i.
IMPi: Importación de vehículos tipo i.

Para la estimación de los ingresos por concepto de impuestos a la importación de vehículos, se recibió de la Dirección General de Rentas de Aduana la información correspondiente a número vehículos, valor CIF, derechos de aduana e impuesto al valor agregado (IVA) percibidos durante 1993 y hasta agosto de 1994. El Cuadro A.3.12.3 presenta un resumen de dicha información. Se nota que los totales presentados en el Cuadro A.3.12.3 para 1993 (161.01 millones de colones) varía con aquellos presentados en Cuadro 3.3.6 (204.22 millones de colones) del Informe Global, basado en el Informe de la Gestión Financiera del Estado. Dicha variación, de 43.21 millones de colones, corresponde a respuestos y accesorios de vehículos de transporte y a la importación de otros vehículos y materiales de transporte.

Debido a la forma de clasificar la importación de vehículos, la cual difiere de los tipos de vehículos matriculados, no es posible relacionar directamente los vehículos importados con los vehículos registrados. En su defecto, en base a la información del Cuadro A.3.12.2, se evaluó la tendencia observada de los vehículos registrados y en base a esa tendencia, se utilizó la información sobre número de vehículos importados, valores CIF, y derechos de importación promedios por tipo de vehículo.

El Cuadro A.3.12.4 resume la información sobre vehículos registrados y participación por tipo de vehículo, para los años 1991 a 1993. Se observa que los cambios en los porcentajes de participación no son muy acentuados, aunque se nota una leve tendencia a la disminución de la participación de los automóviles, buses y camiones livianos, y a un aumento de los pick-ups y camiones con mas capacidad de carga.

El Cuadro A.3.12.5 muestra el aumento de los vehículos registrados en 1992 y 1993. Se observa que para 1993 el total del aumento de vehículos registrados, 24,652 unidades, es inferior al total de vehículos importados, incluyendo vehículos importados libre de franquicia, unidades (véase Cuadro No. 3.12.3). Parte de esta diferencia se puede deber al retiro natural de vehículos, incluyendo el retiro forzado de vehículos por hurto de los mismos. Otra parte se puede deber a discrepancias en el registro de vehículos. Sin embargo, no hay un registro confiable de retiro de vehículos que pueda identificar exactamente el motivo de la diferencia indicada.

El Cuadro A.3.12.5 muestra tasas de crecimiento en el registro de vehículos relativamente altas para todos los tipos de vehículos, con excepción de los camiones livianos, particularmente para los pick-ups y camiones con mas capacidad de carga. Parte de este crecimiento acelerado en la flota vehicular se debe a la reposición de los vehículos que no habían podido ser repuestos durante el período de conflicto. Otra parte se debe a la necesidad de adecuarse al crecimiento de la demanda de transporte surgida despues del período de conflicto.

CUADRO A.3.12.3
IMPORTACION DE VEHICULOS - 1993

CODIGO	DESCRIPCION	% VALOR CIF	# DE VEH.	VALOR CIF (US DOLARES)	DERECHOS (US DOLARES)
TRANSPORTE DE TURISMO					
87032291	Turismo gas 1000<cc<=1500 hasta 1300 cc	20%	720	4,677,998	936,108
87033191	Turismo diesel cc<=1500 hasta 1300 cc	20%	11	49,653	90,510
87020101	Cualquier motor cc<1300	20%	271	1,655,300	329,922
87032110	Turismo gas cc<=1000. Traccion 4 ruedas	25%	23	143,067	35,767
87032210	Turismo gas 1000<cc<=1500. Tracc 4 ruedas	25%	143	679,710	164,966
87032299	Turismo gas 1000<cc<=1500. Otros - Los demas	25%	1,143	4,631,819	1,152,562
87032391	Turismo gas 1500<cc<=3000. Hasta 2000 cc	25%	3,794	23,612,072	5,855,031
87032410	Turismo gas cc>3000. Tracc 4 ruedas	25%	99	1,651,120	414,289
87033110	Turismo diesel cc<=1500. Tracc 4 ruedas	25%	13	285,998	71,499
87033199	Turismo diesel cc<=1500. Otros - Los demas	25%	25	125,074	31,269
87033210	Turismo diesel 1500<cc<=2500. Tracc 4 ruedas	25%	56	382,257	95,564
87033291	Turismo diesel 1500<cc<=2500. Hasta 2000 cc	25%	300	1,285,505	320,703
87033310	Turismo diesel cc>2500. Tracc 4 ruedas	25%	93	1,483,855	368,508
87020103	Cualquier motor 1300<cc<=2000	25%	1,676	7,978,099	1,999,651
87031000	Turismo. En nieve, golf y similares	30%	4	8,571	2,571
87032399	Turismo gas 1500<cc<=3000. Otros - Los demas	30%	367	3,029,408	896,557
87032480	Turismo gas cc>3000. Otros - Los demas	30%	62	579,807	165,121
87033299	Turismo diesel 1500<cc<=2500. Otros - Los demas	30%	42	277,558	82,680
87033390	Turismo diesel cc>2500. Otros - Los demas	30%	25	194,027	58,208
87039000	Turismo - los demas	30%	10	104,804	29,536
87020199	Los demas	30%	161	1,284,266	417,949
TOTAL TRANSPORTE DE TURISMO			9,038	54,119,966	13,516,991
TRANSPORTE DE PERSONAL					
87021000	Diez o mas personas. Diesel	5%	786	8,695,754	434,301
87029000	Diez o mas personas. Los demas	5%	682	3,998,411	200,244
87020200	Diez o mas personas. Microbuses y autobuses	5%	563	3,974,045	199,792
TOTAL TRANSPORTE DE PERSONAL			2,031	16,368,211	834,337
TRANSPORTE DE MERCANCIA					
87041000	Volquetas	5%	24	341,160	17,058
87042100	Diesel tons<=5	5%	3,606	21,179,082	1,068,367
87042200	Diesel 5<tons<=20	5%	1,742	15,903,462	796,973
87042300	Diesel tons>20	5%	24	195,607	9,780
87043100	Gas tons<=5	5%	6,807	28,315,621	1,435,342
87043200	Gas 5>tons	5%	47	324,162	16,208
87049000	Los demas	5%	15	90,185	4,509
87020300	Incluyendo mixtos (pick-ups)	5%	3,448	16,134,040	807,486
TOTAL TRANSPORTE DE MERCANCIA			15,713	82,483,298	4,155,724
TOTAL 1993			26,782	152,971,475	18,507,052

CONTINUA CUADRO A.3.12.3...

IMPORTACION DE VEHICULOS - 1994

(VALORES MONETARIOS EN US DOLARES)

CODIGO	DESCRIPCION	% VALOR CIF	# DE VEH.	VALOR CIF US DOLARES	DERECHOS US DOLARES
TRANSPORTE DE TURISMO					
87032291	Turismo gas 1000<cc<=1500 hasta 1300 cc	20%	684	4,529,755	1,436,619
87033191	Turismo diesel cc<=1500 hasta 1300 cc	20%	51	281,222	56,244
87032110	Turismo gas cc<=1000. Traccion 4 ruedas	25%	39	278,187	69,547
87032210	Turismo gas 1000<cc<=1500. Tracc 4 ruedas	25%	122	654,020	163,505
87032299	Turismo gas 1000<cc<=1500. Otros - Los demas	25%	1,023	4,797,446	1,189,308
87032391	Turismo gas 1500<cc<=3000. Hasta 2000 cc	25%	3,649	26,510,758	7,048,917
87032410	Turismo gas cc>3000. Tracc 4 ruedas	25%	137	2,891,240	776,973
87033110	Turismo diesel cc<=1500. Tracc 4 ruedas	25%	4	19,672	4,918
87033199	Turismo diesel cc<=1500. Otros - Los demas	25%	14	76,007	19,002
87033210	Turismo diesel 1500<cc<=2500. Tracc 4 ruedas	25%	39	359,949	88,187
87033291	Turismo diesel 1500<cc<=2500. Hasta 2000 cc	25%	168	796,320	181,580
87033310	Turismo diesel cc>2500. Tracc 4 ruedas	25%	119	2,197,495	545,709
87020103	Cualquier motor 1300<cc<=2000	25%	1	5,984	1,496
87032399	Turismo gas 1500<cc<=3000. Otros - Los demas	30%	425	4,403,985	1,364,771
87032490	Turismo gas cc>3000. Otros - Los demas	30%	68	1,377,389	403,183
87033299	Turismo diesel 1500<cc<=2500. Otros - Los demas	30%	24	176,544	51,974
87033390	Turismo diesel cc>2500. Otros - Los demas	30%	5	28,028	8,408
87039000	Turismo - los demas	30%	3	18,679	3,817
87020199	Los demas	30%	2	28,007	15,986
87031000	Turismo. En nieve, golf y similares	30%	4	12,747	2,394
TOTAL TRANSPORTE DE TURISMO			6,581	49,443,435	13,432,539
TRANSPORTE DE PERSONAL					
87021000	Diez o mas personas. Diesel	5%	905	15,499,188	770,020
87029000	Diez o mas personas. Los demas	5%	569	4,039,619	204,829
TOTAL TRANSPORTE DE PERSONAL			1,474	19,538,807	974,849
TRANSPORTE DE MERCANCIA					
87041000	Volquetas	5%	27	445,861	22,302
87042100	Diesel tons<=5	5%	2,976	20,870,409	1,043,802
87042200	Diesel 5<tons<=20	5%	1,148	11,625,524	576,579
87042300	Diesel tons>20	5%	8	53,638	2,682
87043100	Gas tons<=5	5%	6,041	30,230,205	1,529,322
87043200	Gas 5>tons	5%	28	228,695	11,435
87049000	Los demas	5%	7	129,894	6,490
TOTAL TRANSPORTE DE MERCANCIA			10,235	63,584,326	3,192,611
TOTAL 1994			18,290	132,566,567	17,599,999

CONTINUA CUADRO A.3.12.3...

FRANQUICIA DE VEHICULOS - 1993

(VALORES MONETARIOS EN US DOLARES)

CODIGO	DESCRIPCION	% VALOR CIF	# DE VEH.	VALOR CIF US DOLARES	DERECHOS US DOLARES
	REGIMEN ADMINISTRACION PUBLICA				
TRANSPORTE DE PERSONAL					
87020200	Diez o mas personas. Microbuses y autobuses	5%	5	30,835	1,542
87021000	Diez o mas personas. Diesel	5%	1	10,921	546
87029000	Diez o mas personas. Los demas	5%	3	33,640	1,682
TOTAL TRANSPORTE DE PERSONAL			9	75,396	3,770
TRANSPORTE DE MERCANCIA					
87020300	Incluyendo mixtos (pick-ups)	5%	9	128,983	6,449
87042100	Diesel tons<=5	5%	28	1,650,858	82,543
87042200	Diesel 5<tons<=20	5%	5	245,263	12,263
87043100	Gas tons<=5	5%	56	562,120	27,999
TOTAL TRANSPORTE DE MERCANCIA			98	2,587,224	129,254
TRANSPORTE DE TURISMO					
87032291	Turismo gas 1000<cc<=1500 hasta 1300 cc	20%	8	139,714	9,943
87020103	Cualquier motor 1300<cc<=2000	25%	42	270,739	67,085
87032110	Turismo gas cc<=1000. Traccion 4 ruedas	25%	3	25,839	6,460
87032210	Turismo gas 1000<cc<=1500. Tracc 4 ruedas	25%	137	1,303,816	325,954
87032299	Turismo gas 1000<cc<=1500. Otros - Los demas	25%	63	301,523	75,520
87032391	Turismo gas 1500<cc<=3000. Hasta 2000 cc	25%	176	1,042,122	258,449
87032410	Turismo gas cc>3000. Tracc 4 ruedas	25%	15	303,063	73,766
87033210	Turismo diesel 1500<cc<=2500. Tracc 4 ruedas	25%	6	76,019	19,005
87033291	Turismo diesel 1500<cc<=2500. Hasta 2000 cc	25%	10	42,869	10,717
87033310	Turismo diesel cc>2500. Tracc 4 ruedas	25%	24	386,243	96,561
87020199	Los demas	30%	10	90,969	27,291
87032399	Turismo gas 1500<cc<=3000. Otros - Los demas	30%	68	539,357	161,591
87032490	Turismo gas cc>3000. Otros - Los demas	30%	1	27,664	8,299
87033299	Turismo diesel 1500<cc<=2500. Otros - Los demas	30%	3	25,334	7,600
87033390	Turismo diesel cc>2500. Otros - Los demas	30%	10	72,059	21,618
TOTAL TRANSPORTE DE TURISMO			576	4,647,329	1,169,857
TOTAL REGIMEN ADMINISTRACION PUBLICA			683	7,309,949	1,302,881
	REGIMEN INSTITUCION BENEFICA				
TRANSPORTE DE MERCANCIA					
87042200	Diesel 5<tons<=20	5%	1	13,278	664
	REGIMEN DE DIPLOMATICOS Y CONSULTORES				
TRANSPORTE DE MERCANCIA					
87020300	Incluyendo mixtos (pick-ups)	5%	9	104,553	5,228
TOTAL FRANQUICIA PARA 1993			693	7,427,780	1,308,772

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CUADRO A.3.12.4
REGISTRO FISCAL DE VEHICULOS 1991-1993
NUMERO Y PARTICIPACION POR TIPO DE VEHICULO

TIPO DE VEHICULO	1991		1992		1993	
	No.	%	No.	%	No.	%
AUTOS (1)	98,013	50.0%	107,381	49.8%	118,334	49.2%
PICK-UPS (2)	73,291	37.4%	81,126	37.6%	92,041	38.3%
BUSES (3)	6,821	3.5%	7,170	3.3%	7,878	3.3%
CAMION C2 LIVIANO (4)	5,065	2.6%	5,171	2.4%	5,280	2.2%
CAMION C2 PESADO (5)	10,238	5.2%	11,651	5.4%	13,154	5.5%
CAMION C3 (6)	1,138	0.6%	1,295	0.6%	1,462	0.6%
CAMION C3S2	1,623	0.8%	1,986	0.9%	2,284	0.9%
TOTAL	196,189	100.0%	215,780	100.0%	240,432	100.0%

(1) INCLUYE AUTOMOVILES, RUSTICOS, MICROBUSES, AMBULANCIAS, VENDEDOR, REPARADOR Y ALQUILER.
(2) INCLUYE PICK-UPS Y PANELES.
(3) INCLUYE BUSES PARTICULARES Y COMERCIALES.
(4) INCLUYE CAMIONES DE MENOS DE 3.5 TONS.
(5) INCLUYE EL 90% DE CAMIONES DE ENTRE 3.5 TONS Y 15 TONS.
(6) INCLUYE EL 10% DE CAMIONES ENTRE 3.5 TONS Y 15 TONS.

FUENTE: FREDERIC R. HARRIS, INC.

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CUADRO A.3.12.5

REGISTRO FISCAL DE VEHICULOS 1992 - 1993

NUMERO Y PORCENTAJE DE AUMENTO POR TIPO DE VEHICULO

TIPO DE VEHICULO	1992		1993	
	No.	% (7)	No.	% (7)
AUTOS (1)	9,368	9.6%	10,953	10.2%
PICK-UPS (2)	7,835	10.7%	10,915	13.5%
BUSES (3)	349	5.1%	708	9.9%
CAMION C2 LIVIANO (4)	106	2.1%	109	2.1%
CAMION C2 PESADO (5)	1,413	13.8%	1,502	12.9%
CAMION C3 (6)	157	13.8%	167	12.9%
CAMION C3S2	363	22.4%	298	15.0%
TOTAL	19,591	10.0%	24,652	11.4%

(1) INCLUYE AUTOMOVILES, RUSTICOS, MICROBUSES, AMBULANCIAS, VENDEDOR, REPARADOR Y ALQUILER.

(2) INCLUYE PICK-UPS Y PANELES.

(3) INCLUYE BUSES PARTICULARES Y COMERCIALES.

(4) INCLUYE CAMIONES DE MENOS DE 3.5 TONS.

(5) INCLUYE EL 90% DE CAMIONES DE ENTRE 3.5 TONS Y 15 TONS.

(6) INCLUYE EL 10% DE CAMIONES ENTRE 3.5 TONS Y 15 TONS.

(7) PORCENTAJE SOBRE EL AÑO ANTERIOR.

FUENTE: FREDERIC R. HARRIS, INC.

Se considera que las tasas de crecimiento en el registro de vehículos observadas en el Cuadro A.3.12.5 obedecen a situaciones coyunturales y no son aplicables en el largo plazo.

En su defecto, para los buses y caminones, se tomaron las tasas de crecimiento anual del tráfico vehicular proyectadas por tipo de vehículo, conforme al Escenario A de los pronósticos de demanda, como equivalentes a las tasas de crecimiento de registro de vehículos. Para los automóviles y pick ups, se tomó la tasa de crecimiento ponderada de los dos tipos de vehículo (7.5%), pero se modificaron las tasas individuales de crecimiento a fin de que las participaciones relativas do los automóviles y pick ups pasen del 56% y 44% observadas en 1993 a 70% y 30% en el año 2015. Este cambio en las participaciones relativas de los automóviles y pick ups refleja la disminución esperada en la utilización de de pick ups para el transporte de pasajeros.

Para las tasas de importación de vehículos, se tomaron las tasas de crecimiento de registro de vehículos, aumentados en un 20% para tomar en cuenta el retiro natural de vehículos. Las de crecimiento anuales resultantes son las siguientes:

	Tasa de Crecimiento	
Tipo de Vehículo	Registro	Importación
Automóvil	8.7%	10.4%
Pick-up	5.5%	6.6%
Bus	4.1%	4.9%
Camión C2 liviano	5.2%	6.2%
Camión C2 pesado	5.2%	6.2%
Camión C3	5.2%	6.2%
Camión C3S2	7.1%	8.5%

Para la estimación de los valores CIF promedios por tipo de vehículo, se utilizaron los valores CIF promedios de los vehículos importados de enero a agosto de 1994 (véase el Cuadro A.3.12.6).

Para los automóviles, pick-ups, buses y camiones C2 livianos, los resultados corresponden a valores acordes con los de unidades nuevas, variando el valor CIF promedio de los vehículos importados entre un 75% del valor de unidades nuevas para automóviles, 50%-60% para pick-ups y camiones C2 livianos, y 45% para buses. Sin embargo, para los camiones de mayor capacidad (C2 pesado, C3 y C3S2), dichos porcentajes son inferiores al 30%, reflejando una alta proporción de vehículos usados en la importación de dichos tipos de vehículos.

CUADRO A.3.3.6
ESTIMATIVO DE VALOR CIF PROMEDIO POR CLASE DE VEHICULO Y ARANCEL DE IMPORTACION PROMEDIO ACTUAL Y PROYECTADO

ITEM	VALOR CIF PROMEDIO COLONES	% DE VEH POR CLASE DE VEH	ARANCEL PROMEDIO ACTUAL	ARANCEL PROMEDIO PROYECTADO
AUTOMOVIL				
TURISMO	65,350	88.0%	27.2%	9.0%
BUSES (MICRO) GASOLINA	61,800	7.0%	5.0%	0.0%
BUSES (MICRO) DIESEL (35%)	71,100	5.0%	5.0%	0.0%
PROMEDIO PONDERADO	65,400		25.0%	8.0%
VALOR NUEVO	86,875			
PROPORCION CIF/NUEVO	75%			
BUS (65% DE BUSES DIESEL)	190,000	100.0%	5.0%	0.0%
VALOR NUEVO	422,500			
PROPORCION CIF/NUEVO	45%			
PICK-UP				
GAS DE TONS<=5	43,500	72.0%	5.0%	0.0%
DIESEL DE TONS <=5 (80%)	55,500	28.0%	5.0%	0.0%
PROMEDIO PONDERADO	46,900		5.0%	0.0%
VALOR NUEVO	88,725			
PROPORCION CIF/NUEVO	53%			
CAMION C2 LIVIANO (20% DE DIESEL DE TONS <=5)	83,000	100.0%	5.0%	0.0%
VALOR NUEVO				
PROPORCION CIF/NUEVO				
CAMION C2 PESADO				
GAS DE TONS > 5	71,100	3.0%	5.0%	0.0%
DIESEL 5 <TONS <=20 (78%)	83,700	97.0%	5.0%	0.0%
PROMEDIO PONDERADO			5.0%	0.0%
VALOR NUEVO				
PROPORCION CIF/NUEVO				
CAMION C3 (8% DE DIESEL DE 5<TONS <=20	88,100	100.0%	5.0%	0.0%
VALOR NUEVO	325,325			
PROPORCION CIF/NUEVO	27%			
CAMION C3S2				
DIESEL TONS > 20	90,950	4.0%	5.0%	0.0%
DIESEL 5 <TONS <=20 (14%)	92,500	92.0%	5.0%	0.0%
DEMAS	161,450	4.0%	5.0%	0.0%
PROMEDIO PONDERADO	95,200		5.0%	0.0%
VALOR NUEVO	464,750			
PROPORCION CIF/NUEVO	20%			

FUENTE: FREDERIC R. HARRIS, INC.

En general, se considera que, conforme se reduzcan los aranceles a la importación y se aumente la capacidad de adquisición de unidades nuevas, los valores CIF promedios de los vehículos importados tenderá a aumentar, acercándose al valor CIF de unidades nuevas. Por tanto, para propósitos de proyección de ingresos por concepto de aranceles a la importación, se utilizaron los siguientes valores CIF de los vehículos y los siguientes aranceles:

VALOR CIF PROMEDIO						
	1994		1995-1999		2000-2015	
	VALOR		VALOR		VALOR	
Tipo de Vehiculo	% Nuevo	Colones	% Nuevo	Colones	% Nuevo	Colones
Automóvil	75.0%	65,400	77.5%	67,300	80.0%	69,500
Pick up	53.0%	46,900	57.5%	51,000	60.0%	53,200
Bus	45.0%	190,000	47.5%	200,000	50.0%	211,300
Camión C2 liviano	58.0%	83,000	60.0%	86,200	60.0%	86,200
Camión C2 pesado	37.0%	83,000	42.0%	94,000	45.0%	100,800
Camión C3	27.0%	88,000	37.0%	120,400	45.0%	146,400
Camión C3S2	20.0%	95,200	35%	162,700	45.0%	209,100

TASA DE ARANCEL SOBRE VALOR CIF			
Tipo de Vehículo	1994	1995	Proyectado
Automóvil	25.0%	24.0%	8.0%
Pick up	5.0%	1.0%	0.0%
Bus	5.0%	1.0%	0.0%
Camión C2 liviano	5.0%	1.0%	0.0%
Camión C2 pesado	5.0%	1.0%	0.0%
Camión C3	5.0%	1.0%	0.0%
Camión C3S2	5.0%	1.0%	0.0%

1.3 Impuestos al Valor Agregado por la Importación de Vehículos

Para la estimación de los ingresos percibidos por el Estado por concepto de impuestos al valor agregado (IVA) por importación de vehículos, se calcula como la tasa promedio de IVA por tipo de vehículo i multiplicado la tasa promedio de importación del vehículo i multiplicado por el número de vehículos tipo i:

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$$TIVA_i = tiva_i * (IMP_i/VEH_i) * VEH_i \quad [2.3]$$

donde,

$TIVA_i$: Ingresos fiscales por IVA a la importación de vehículos tipo i.

$tiva_i$: Tasa promedio de IVA por vehículo importado tipo i.

El IVA por la importación de vehículos se estima como el 10% del valor CIF del vehículo mas los correspondientes aranceles de importación. Se considera que en un futuro, conforme los ingresos del Estado por otros conceptos disminuyan, como los aranceles a la importación de vehículos, el IVA podría aumentar. Sin embargo, para propósitos del presente estudio se consideró que este permanece en su nivel actual, según los siguientes valores:

	IVA Sobre Valor CIF		
Tipo de Vehículo	1994	1995	Proyectado
Automóvil	12.7%	12.4%	10.8%
Pick up	10.5%	10.1%	10.0%
Bus	10.5%	10.1%	10.0%
Camión C2 liviano	10.5%	10.1%	10.0%
Camión C2 pesado	10.5%	10.1%	10.0%
Camión C3	10.5%	10.1%	10.0%
Camión C3S2	10.5%	10.1%	10.0%

1.4 Impuestos a la Importación de Repuestos y Accesorios de Vehículos para Transporte

Conforme se indicó anteriormente, los impuestos de importación de respuestos y accesorios de vehículos de transporte para 1993 corresponden al 5% del valor CIF de las importaciones. En 1993, el valor CIF de las importaciones de partes y accesorios para vehículos fue de 212,558 miles de colones (Revista Trimestral, Abril-Mayo-Junio de 1994, del Banco Central de Reserva). Por tanto, el estimativo de impuestos por este concepto es de 10.63 millones de colones para dicho año.

Para la estimación de los ingresos percibidos por el Estado por concepto de impuestos de repuestos y accesorios de vehículos, se calcula como la tasa promedio de impuestos por tipo de vehículo i multiplicado la tasa promedio de importación de repuestos y accesorios del vehículo i multiplicado por el número de vehículos tipo i:

$$TR_i = tr_i * (RE_i/VEH_i) * VEH_i \quad [2.4]$$

donde,

TR_i: Ingresos fiscales por concepto de impuestos a la importación de repuestos y accesorios para de vehículos tipo i.

tr_i: Tasa promedio de impuestos a la importación de repuestos y accesorios para vehículos tipo i.

RE_i: Valor CIF de la importación de repuestos y accesorios para vehículos tipo i.

En 1993, los aranceles para para repuestos y accesorios era del 5% del valor CIF de los repuestos y accesorios. Como parte del programa económico del presente gobierno, dicho arancel se redujo al 1% del valor CIF de las importaciones a partir del 1 de abril de 1995 y espera reducirse a 0% a partir del 1 de enero de 1996.

Para la estimación de los valores CIF promedios de importación de repuestos y accesorios por tipo de vehículo, se utilizaron los registros de vehículos para 1993, los valores CIF promedios de los vehículos importados anteriormente enumerados, el valor promedio de mercado estimado por tipo de vehículo y proporciones de gasto anual en respuestos y accesorios sobre el valor promedio de mercado asumidos por tipo de vehículo, y el valor total de ingresos del Estado en concepto de aranceles a la importación de repuestos y accesorios para 1993 anteriormente citado como valor de referencia (véase el Cuadro A.3.12.7).

En base a dichas estimaciones, para propósitos de proyección de ingresos del estado por concepto de aranceles a la importación de repuestos y accesorios, se utilizaron los siguientes valores:

Tipo de Vehículo	Valor CIF Repuestos Promedio Importados (colones)	Arancel 1994	1995	Proyectado
Automóvil	695	5.0%	1.0%	0.0%
Pick up	640	5.0%	1.0%	0.0%
Bus	3,700	5.0%	1.0%	0.0%
Camión C2 liviano	1,360	5.0%	1.0%	0.0%
Camión C2 pesado	1,765	5.0%	1.0%	0.0%
Camión C3	2,560	5.0%	1.0%	0.0%
Camión C3S2	3,660	5.0%	1.0%	0.0%

1.5 Impuestos al Valor Agregado por la Importación de Repuestos y Accesorios de Vehículos

CUADRO A.3.12.7

ESTIMATIVO DEL GASTO ANUAL EN REPUESTOS Y ACCESORIOS POR TIPO DE VEHICULO

TIPO DE VEHICULO	VEHICULOS (1993)	VALOR CIF POR VEHICULO COLONES	VALOR PROMEDIO DE MERCADO			GASTO EN REPUESTOS			ARANCELES	
			% VALOR CIF (1)	POR VEHICULO COLONES	VALOR TOTAL COLONES	% (2)	VALOR TOTAL COLONES	POR VEHICULO COLONES	VALOR TOTAL (3) COLONES	POR VEHICULO COLONES
AUTOMOVIL	118,334	69,500	50%	34,750	4,112,106,500	2.0%	82,242,130	695	4,112,107	35
PICK-UP	92,041	53,200	40%	21,280	1,958,632,480	3.0%	58,758,974	638	2,937,949	32
BUS	7,878	211,300	35%	73,955	582,617,490	5.0%	29,130,875	3,698	1,456,544	185
CAMION C2 LIVIANO	5,280	88,200	35%	30,170	159,297,600	4.5%	7,168,392	1,358	358,420	68
CAMION C2 PESADO	13,154	100,800	35%	35,280	464,055,480	5.0%	23,202,774	1,764	1,160,139	88
CAMION C3	1,462	146,400	35%	51,240	74,887,260	5.0%	3,744,363	2,562	187,218	128
CAMION C3S2	2,284	208,100	35%	73,185	167,154,540	5.0%	8,357,727	3,659	417,886	183
TOTAL	240,432				7,518,751,350		212,605,235		10,630,262	

5.00%

(1) VALORES ASUMIDOS, EN BASE A LA APRECIACION SOBRE LA EDAD PROMEDIO DE LOS VEHICULOS

(2) PORCENTAJE SOBRE EL VALOR TOTAL ASUMIDOS, EN BASE A LA UTILIZACION ANUAL DE LOS VEHICULOS

(3) ESTIMADO EN BASE A UNA TASA DEL 5% SOBRE EL VALOR CIF DE LAS IMPORTACIONES DE REPUESTOS Y ACCESORIOS.

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Para la estimación de los ingresos percibidos por el Estado por concepto de IVA por importación de repuestos y accesorios para vehículos, se calcula como la tasa promedio de IVA por tipo de vehículo i, multiplicado la tasa promedio de importación de repuestos y accesorios del vehículo i, multiplicado por el número de vehículos tipo i:

$$TRIVA_i = triva_i * (RE_i/VEH_i) * VEH_i \qquad [2.5]$$

donde,

$TRIVA_i$: Ingresos fiscales por IVA a la importación de repuestos y accesorios para vehículos tipo i.

$triva_i$: Tasa promedio de IVA a la importación de repuestos y accesorios para vehículo tipo i.

El impuesto al valor agragao (IVA) por la importación de repuestos y accesorios de vehículos se estima como el 10% del valor CIF de los repuestos y accesorios mas los correspondientes aranceles de importación, según los siguientes valores:

	IVA sobre Valor CIF		
Tipo de Vehículo	1994	1995	Proyectado
Automóvil	10.5%	10.1%	10.0%
Pick up	10.5%	10.1%	10.0%
Bus	10.5%	10.1%	10.0%
Camión C2 liviano	10.5%	10.1%	10.0%
Camión C2 pesado	10.5%	10.1%	10.0%
Camión C3	10.5%	10.1%	10.0%
Camión C3S2	10.5%	10.1%	10.0%

1.6 Impuestos a los Combustibles (gasolinas y diesel)

Los combustibles para el transporte, gasolinas y diesel, tienen tres tipos de sobrecargo:

- El Fondo de Estabilización y Fomento Económico (FEFE), establecido en el Decreto No. 762 del 24 de Julio de 1981, publicado en el Diario Oficial No. 150, Tomo 272 del 18 de Agosto del mismo año, con el propósito expreso de generar recursos al Estado para asistir en la reactivación económica y mantenimiento de un nivel adecuado de desarrollo. Para tal efecto, se creó una Cuenta Especial de Estabilización y Fomento Económico, integrado por un recargo de 1.3921

colones por cada galón de gasolina facturada por la Refinería Petrolera Acajutla, S.A (RASA).

El Decreto No. 762 se complementó con el Decreto No. 847 del 4 de noviembre de 1981, publicado en el Diario Oficial 202, Tomo 273 del 4 de noviembre de 1981, en el cual se define el propósito expreso del FEFE para regularizar los precios del petróleo y los de sus derivados, con transferencias a favor de quienes efectúan la prestación del servicio de transporte colectivo público, y los mecanismos presupuestales para la operación de dicho fondo.

El Decreto No. 399 del 3 de diciembre de 1992, publicado en el Diario Oficial No. 231, Tomo 317 del 15 de diciembre de 1992, modificó el Decreto No. 762 para incluir mezclas de gasolinas o gasohol y gasolinas importadas y comercializadas por personas autorizadas por el Ministerio de Economía, en adición a las gasolinas facturads por RASA.

- El Margen de Financiamiento de Subsidios (MFS), el cual según Acuerdo Ejecutivo No. 46 del 26 de enero de 1994 y publicado en el Diario Oficial No. 19, Tomo 322 del 27 de enero de 1994, se utiliza exclusivamente para subsidiar el precio preferencial de un volumen de hasta 2,900,000 galones mensuales de diesel destinado para el transporte público de pasajeros por medio de autobuses[1], y para subsidiar el precio de venta del gas licuado.

- El Margen Especial de Financiamiento (MEF), el cual según Acuerdo Ejecutivo No. 46 del 26 de enero de 1994 y publicado en el Diario Oficial No. 19, Tomo 322 del 27 de enero de 1994, se utiliza para subsidiar el precio preferencial del las gasolinas y diesel utilizado por por el Gobierno Central, municipalidades y otras entidades.

La administración de los sobrecargos, subsidios y materias conexas a que se refieren los decretos Legislativos y Acuerdos Ejecutivos arriba mencionados, le corresponde a la Dirección de Energía, Minas e Hidrocarburos del Ministerio de Economía.

El Cuadro No. A.3.12.8 presenta los montos de los recursos de dichos recargos para 1993 y 1994, los cuales son recaudados principalmente de los recargos a las gasolinas (95% del total). La mayor parte de dichos fondos son utilizados para subsidiar el precio preferencial del diesel utilizado para el transporte público, el cual, en base al volumen máximo subsidiado según el Acuerdo No. 46, podría llegar a casi 200 millones de colones al año.

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[1] El Tomo III del presente estudio presenta un análisis y recomendaciones sobre la problemática del subsidio al combustible diesel utilizado para el transporte de pasajeros por medio de autobuses.

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CUADRO A.3.12.8

RECUROS EN CONCEPTO DE SUBSIDIO, MFS, MEF Y FEFE (COLONES)

RECURSOS	1993	1994
MARGEN DE FINANCIAMIENTO DE SUBSIDIOS (MFS)	175,143,537.73	54,856,090.33
MARGEN ESPECIAL DE FINANCIAMIENTO (MEF)	59,383,368.32	66,224,354.82
FONDO DE ESTABILIZACION Y FOMENTO ECONOMICO (FEFE)	115,137,735.51	126,314,327.59
TOTAL ANUAL	349,664,641.56	247,394,772.74

Fuente: Ministerio de Economía, Dirección de Energía, Minas e Hidrocarburos, Liquidaciones Mensuales por RASA de C.V. y Compañías petroleras.

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Para efectos de estimación de los recursos del Estado disponible para el sector transporte, se estimaron los recursos provenientes de los tres tipos de recargo, aplicados a las gasolinas. Los ingresos percibidos por el Estado por concepto de recargos a las gasolinas, se calcularon como el recargo anual promedio por tipo de vehículo i (calculada como el recargo por galón de gasolina de 2.73 colones, multiplicado por el consumo anual de gasolina por tipo de vehículo i) multiplicado por el número de vehículos tipo i que utilizan gasolinas:

$$TG_i = tg_i * VEH_i \qquad [2.6]$$

donde,

TG: Total de ingresos por regargos a las gsolinas.

TG_i: Ingresos por recargos a las gasolinas por vehículos tipo i.

tg_i: Recargo anual promedio por tipo de vehículo i:
$tg_i = 2.73 * GAL_i$, donde GAL_i : Consumo anual promedio de gasolinas por tipo de vehículo i.

Tomando como base los recargos de 1994 y el total de gasolinas vendidas en 1994 (véase Cuadro No. A.3.12.9), se estima un recargo total por FEFE, MFS y MEF de 2.73 colones por galón de gasolina vendida. En base a dicho recargo y al consumo anual de gasolinas estimado por tipo de vehículo (véase Cuadro No. A.3.12.10), se estimaron los siguientes valores:

Tipo de Vehículo	Gal/Año	Recargo/Año (colones)
Automóvil (gasolina: 90%)	460 1,260	
Automóvil (diesel: 10%)	460	N/A
Pick-up (gasolina: 72%)	502	1,370
Pick-up (diesel: 28%)	502	N/A
Bus (diesel 100%)	5,333	N/A
Camión C2 liviano (diesel: 100%)	1,514	N/A
Camión C2 pesado (diesel: 100%)	2,038	N/A
Camión C3 (diesel: 100%)	3,000	N/A
Camión C3S2 (diesel: 100%)	5,000	N/A

1.7 Subsidios al Consumo Preferencial de Gasolinas y Diesel

Se estimaron los subsidios considerando el límite máximo del subsidio al diesel para el transporte de pasajeros (200 millones de colones anuales) y la utilización total del MEF. Considerando que los vehículos del sector público guardan la misma distribución por tipo de vehículo que la totalidad de vehículos, sin incluir camiones tipo C3S2, el subsidio MEF se estima en 250 colones al año por vehículo.

1.8 Impuestos al Valor Agregado por el Consumo de Combustibles (Gasolinas y Diesel)

Los ingresos percibidos por el Estado por concepto de IVA al consumo de gasolinas y diesel de transporte, se calcularon como el IVA promedio anual por tipo de vehículo i (calculada como el IVA por galón de gasolina o diesel, multiplicado por el consumo anual de gasolina por tipo de vehículo i) multiplicado por el número de vehículos tipo i que utilizan gasolinas:

$$TGIVA_i = tgiva_i * VEH_i \qquad [2.7]$$

donde,

$TGIVA_i$: Ingresos por IVA al consumo de combustibles (gasolinas y diesel) de transporte por vehículos tipo i.

$tgiva_i$: Recargo anual promedio por tipo de vehículo i:
$tgiva_i = giva_i * GAL_i$, donde $giva_i$: IVA promedio por galón de combustible consumido por el vehículo tipo i y GAL_i : Consumo anual promedio de gasolinas por tipo de vehículo i.

Los precios e IVA promedios de los combustibles para 1994 fueron los siguientes:

Tipo de Combustible	Precio Promedio por Galón (colones)	IVA Promedio por Galón (colones)
Gasolinas	12.98	1.18
Diesel al público	8.40	0.76
Diesel preferencial	1.87	0.17

Considerando los consumos promedios de combustible por tipo de vehículo presentados anteriormente, y el IVA promedio por galón, los IVA estimados por el

CUADRO A.3.12.9

VENTAS DE COMBUSTIBLES
(VOLUMEN EN GALONES AMERICANOS)

PRODUCTOS	1993	1994
GASOLINA ESPECIAL CON PLOMO	22,216,785	29,647,753
GASOLINA ESPECIAL SIN PLOMO	1,393,037	2,643,725
GASOLINA REGULAR CON PLOMO	58,744,772	58,329,559
DIESEL PUBLICO	75,341,037	87,871,733
DIESEL DESTINADO AL TRANSPORTE DE PASAJEROS POR MEDIO DE AUTOBUSES	34,624,871	34,406,929

Fuente: Ministerio de Economía, Dirección de Energía, Minas e Hidrocarburos, RASA de C.V. y Compañías Distribuidoras.

CUADRO A.3.3.10

ESTIMATIVO DE CONSUMO DE COMBUSTIBLE POR TIPO DE VEHICULO

TIPO DE VEHICULO	VEHICULOS (1993)	PARAMETROS POR VEHICULO (1)			TOTAL GALONES POR AÑO
		KM POR AÑO	KM POR GALON	GALONES POR AÑO	
GASOLINAS					
AUTOS (90%) (1)	106,501	14,500	31.5	460	48,990,276
PICK-UPS (72%) (2)	66,270	12,050	24.0	502	33,267,299
TOTAL GASOLINAS	172,770				82,257,575
DIESEL					
AUTOS (10%) (1)	11,833	14,500	31.5	460	5,443,364
PICK-UPS (28%) (2)	25,771	12,050	24.0	502	12,937,283
BUSES (3)	7,878	64,000	12.0	5,333	42,013,374
CAMION C2 LIVIANO (4)	5,280	26,500	17.5	1,514	7,993,920
CAMION C2 PESADO (5)	13,154	26,500	13.0	2,038	26,806,833
CAMION C3 (6)	1,462	30,000	10.0	3,000	4,384,500
CAMION C3S2	2,284	30,000	6.0	5,000	11,420,000
TOTAL DIESEL	67,662				110,999,274

(1) PARAMETROS SEGUN MODELO HDM III, AUMENTANDO EN UN 15% LOS KM POR GALON, PARA REPRESENTAR AUMENTOS EN LA EFICIENCIA.

FUENTE: FREDERIC R.HARRIS, INC.

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cosumo de combustibles por tipo de vehículo son los siguientes:

Tipo de Vehículo	Gal/Año	IVA/Año (colones)
Automóvil (gasolina: 90%)	460 545	
Automóvil (diesel: 10%)	460 350	
Buses preferencial(diesel 100%)	34.8 millones	5.92 millones
Buses otros (diesel 100%)	5,333	4,050
Pick-ups (gasolina: 72%)	502 590	
Pick-ups (gasolina: 28%)	502 380	
Camión C2 liviano (diesel: 100%)	1,514	1,150
Camión C2 pesado (diesel: 100%)	2,038	1,550
Camión C3 (diesel: 100%)	3,000	2,280
Camión C3S2 (diesel: (100%)	5,000	3,800

1.9 Otros impuestos, Cobros y Multas

Otros impuestos, cobros y multas venta de placas de vehículos, derechos de licencias de conducir, multas de tránsito y policía, impuestos por propiedad de vehículos automotores, y multas por propiedad y venta de decomisos relacionados con vehículos automotores.

Para la estimación de los ingresos percibidos por el Estado por estos conceptos, se calculó como la tasa promedio por tipo de vehículo i multiplicado por el número de vehículos tipo i:

$$TO_i = to_i * VEH_i \qquad [2.8]$$

donde,

TO_i: Ingresos por otros impuestos, cobros y multas por vehículos tipo i.

to_i: Tasa promedio por tipo de vehículo i.

En base a los ingresos anuales del Estado por utilización de carreteras para 1993 presentados en los Cuadros 3.3.6 y 3.3.7 del Informe Global, se calculan los siguientes montos:

Item	Monto (millones de colones)
Venta de placas de vehículos	2.46
Derechos de licencias de conducir	7.05
Multas de tránsito y policía	3.64
Impuestos por propiedad[1]	43.27
Multas por propiedad y venta de decomisos[1]	4.46
Total	60.88

[1] Basado en los valores de 1992, aumentados en un 20%, según la tasa de aumento del total de items del Cuadro 3.3.6.

Tomando el total de vehículos matriculados en 1993, 240,432 vehículos, resulta en una tasa promedio por vehículo de 250 colones al año.

1.10 Ingresos fiscales Totales Derivados del Transporte por Carretera

El Cuadro A.3.12.11 presenta el estimativo para 1994 y proyecciones 1995-2014 de ingresos fiscales derivados del transporte por carretera resultantes, desglosadas por tipo de vehículo y cargo a usuario. Los Cuadros A.3.12.12, A.3.12.13 y A.3.12.14 presentan resúmenes de dichas proyeccciones, el primero desglosados por tipo de cargo al usuario, el segundo por tipo de vehículo, y el tercero presenta el valor promedio por vehículo desglosado por tipo de vehiculo.

1.11 Ingresos Fiscales Derivados del transporte por Carreteras Interurbanas Pavimentadas

A fin de estimar los ingresos fiscales derivados del transporte por carreteras interurbanas pavimentadas únicamente, se distribuyeron los ingresos fiscales estimados para la totalidad de la red de transporte estimada en la sección anterior a la red de carreteras interurbanas pavimentadas en base a la proporción de vehículos-kilómetro por tipo de vehículo recorridos en las carreteras interurbanas pavimentadas y el total de vehículos-kilómetro. Dicha proporción varía por tipo de vehículo y por año de proyección.

El Cuadro A.3.12.15 presenta los vehículo-kilómetros por tipo de vehículo estimados para las carreteras pavimentadas interurbanas, según los informes de salida del modelo HDM III, utilizado para determinar la estrategia de mantenimiento de dichas carreteras. El Cuadro A.3.12.16 presenta los vehículo-kilómetros por tipo de vehículo

CUADRO A.3.3.11
ESTIMATIVOS Y PROYECCIONES DE INGRESOS FISCALES DERIVADOS DEL TRANSPORTE POR CARRETERA - 1994 - 2014

ITEM	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
AUTOMOVIL																					
VEHICULOS	128,629	139,820	151,984	165,207	179,580	195,203	212,186	230,646	250,712	272,524	296,234	322,006	350,021	380,473	413,574	449,555	488,666	531 180	577,393	627,626	682,229
VALOR CIF UNITARIO	65,400	67,300	67,300	67,300	67,300	67,300	69,500	69,500	69,500	69,500	69,500	69,500	69,500	69,500	69,500	69,500	69 500	69 500	69,500	69,500	69,500
CARGOS (MILLONES DE COLONES)																					
MATRICULA DE VEHICULOS	30.23	32.88	35.72	38 82	42.20	45 87	49 88	54 20	58.92	64 04	69 61	75 67	82 25	89 41	97 19	105 65	114 84	124 83	135 69	147 49	160 32
IMPUESTO IMPORT VEHICULOS	201.22	218.07	78.29	85.10	92.51	100.55	112.87	122.69	133.37	144 97	157 58	171 29	186 20	202 40	220.00	239 15	259 95	282 57	307 15	333 87	362.92
IVA IMPORTACION VEHICULOS	100.61	111.84	105.89	114 89	124.88	135.75	152.38	165.64	180.05	195 71	212 74	231 25	251 37	273 23	297 01	322 85	350 93	381 46	414 65	450 73	489 94
IMPUESTO IMPORT REPUESTO	4.47	0.97	0.00	0 00	0.00	0.00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0.00	0 00
IVA IMPORT REPUESTOS	9.39	9.81	10.58	11 48	12.48	13 57	14 75	16 03	17 42	18 94	20 59	22.38	24 33	26.44	28.74	31 24	33 96	36 92	40 13	43.62	47.41
RECARGOS A GASOLINAS	145 87	158.58	172.35	187 34	203.64	221 36	240.62	261 55	284 31	309 04	335 93	365 15	396 92	431 46	468.99	509 80	554 15	602 36	654 76	711 73	773 85
SUBSIDIO MEF	(32.16)	(34 98)	(38.00)	(41 30)	(44.90)	(48.80)	(53 05)	(57 66)	(62.68)	(68 13)	(74 06)	(80 50)	(87 51)	(95 12)	(103 39)	(112 39)	(122.17)	(132.80)	(144 35)	(156.91)	(170 56)
SUBSIDIO DIESEL	0.00	0 00	0.00	0 00	0.00	0.00	0 00	0.00	0 00	0 00	0.00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
IVA GASOLINAS	63.09	68.58	74.55	81 03	88.08	95.75	104 08	113.13	122.97	133 67	145 30	157 94	171 69	186.62	202.86	220 51	239 69	260 54	283.21	307 85	334 63
IVA DIESEL	4 50	4.89	5.32	5.78	6.29	6.83	7 43	8 07	8.77	9 54	10 37	11 27	12.25	13 32	14 48	15 73	17 10	18 59	20 21	21 97	23.88
OTROS CARGOS Y MULTAS	32.16	34 96	38.00	41 30	44 90	48 80	53 05	57 66	62.68	68 13	74 06	80 50	87 51	95 12	103 39	112 39	122 17	132 80	144 35	156 91	170 56
TOTAL CARGOS	559.38	603.38	482 48	524 44	570.08	619 68	681 99	741 31	805 81	875 91	952.12	1 034 95	1,125 01	1,222.88	1,329 27	1,444 93	1,570 62	1,707 27	1,855 80	2,017 26	2,192.75
CARGO PROMEDIO POR VEHICUL	4,349	4 315	3,175	3,174	3,175	3,175	3,214	3 214	3,214	3 214	3 214	3,214	3,214	3,214	3,214	3 214	3 214	3 214	3,214	3 214	3,214
PICK-UP																					
VEHICULOS	97,103	102,444	108,078	114,022	120,293	126,909	133,889	141,253	149,022	157,218	165,865	174,988	184,612	194,766	205,478	216,779	228,702	241,281	254,551	268,551	283,321
VALOR CIF UNITARIO	48,900	51,000	51,000	51,000	51,000	51,000	53,200	53,200	53,200	53,200	53,200	53,200	53,200	53,200	53,200	53,200	53,200	53,200	53,200	53,200	53,200
CARGOS (MILLONES DE COLONES)																					
MATRICULA DE VEHICULOS	14.57	15 37	16.21	17.10	18.04	19 04	20.08	21 19	22.35	23 58	24 88	26 25	27 69	29 21	30 82	32.52	34 31	36 19	38 18	40.28	42.50
IMPUESTO IMPORT VEHICULOS	14 25	3.27	0.00	0 00	0.00	0 00	0 00	0 00	0.00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0.00
IVA IMPORTACION VEHICULOS	29 91	33.01	34.48	36 38	38 38	40.49	44 56	47 01	49 60	52.32	55 20	58 24	61 44	64 82	68 39	72 15	76 12	80 30	84 72	89 38	94.29
IMPUESTO IMPORT REPUESTO	3 11	0 66	0.00	0 00	0.00	0.00	0.00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
IVA IMPORT REPUESTOS	6 53	6 62	6.92	7 30	7.70	8 12	8 57	9.04	9 54	10 06	10 62	11 20	11 82	12 47	13 15	13 87	14 64	15 44	16 29	17 19	18 13
RECARGOS A GASOLINAS	95 78	101 05	106 61	112.47	118 66	125.18	132.07	139 33	147 00	155 08	163 61	172 61	182 10	192 12	202 68	213 83	225 59	238 00	251 09	264 90	279 47
SUBSIDIO MEF	(24 28)	(25.61)	(27 02)	(28 51)	(30 07)	(31.73)	(33.47)	(35.31)	(37.26)	(39 30)	(41 47)	(43 75)	(46 15)	(48 69)	(51 37)	(54 19)	(57 18)	(60 32)	(63 64)	(67 14)	(70 83)
SUBSIDIO DIESEL	0 00	0 00	0 00	0 00	0.00	0.00	0.00	0 00	0.00	0 00	0.00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
IVA GASOLINAS	41.25	43.52	45 91	48.44	51.10	53.91	56 88	60.00	63.30	66.79	70 48	74 33	78.42	82 74	87.29	92 09	97 15	102 50	108 13	114 08	120.35
IVA DIESEL	10.33	10 90	11.50	12.13	12.80	13.50	14 25	15.03	15.86	16 73	17 65	18 62	19 64	20 72	21 86	23.07	24 33	25 67	27 08	28 57	30.15
OTROS CARGOS Y MULTAS	24 28	25 61	27 02	28 51	30 07	31 73	33 47	35 31	37.28	39 30	41 47	43.75	46 15	48 69	51.37	54 19	57 18	60 32	63 64	67 14	70.83
TOTAL CARGOS	215 73	214 40	221 63	233 82	246.68	260.24	276 41	291.60	307 65	324 58	342.42	361 25	381 11	402 08	424 19	447 53	472 14	498 10	525 49	554 40	584 89
CARGO PROMEDIO POR VEHICUL	2,222	2,093	2,051	2,051	2,051	2,051	2,064	2,064	2,064	2,064	2,064	2,064	2,064	2,064	2,064	2,064	2,064	2,064	2,064	2,064	2,064
BUS																					
VEHICULOS	8,201	8,537	8,887	9,251	9,630	10,025	10,436	10,864	11,309	11,773	12,256	12,758	13,281	13,826	14,393	14,983	15,597	16,236	16,902	17,595	18,316
VALOR CIF UNITARIO	190,000	200,000	200,000	200,000	200,000	200,000	211,300	211,300	211,300	211,300	211,300	211,300	211,300	211,300	211,300	211,300	211,300	211,300	211,300	211,300	211,300
CARGOS (MILLONES DE COLONES)																					
MATRICULA DE VEHICULOS	2.21	2.30	2.40	2.50	2.60	2.71	2.82	2.93	3.05	3.18	3 31	3.44	3.59	3 73	3 89	4 05	4 21	4 38	4 56	4.75	4 95
IMPUESTO IMPORT VEHICULOS	3.67	0 80	0.00	0 00	0.00	0.00	0 00	0 00	0 00	0.00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
IVA IMPORTACION VEHICULOS	7 70	8.12	8.37	8 71	9.07	9.44	10 38	10.81	11 25	11 71	12.19	12.69	13.21	13 75	14 32	14 90	15.51	16 15	16 81	17 50	18 22
IMPUESTO IMPORT REPUESTO	1 52	0 32	0.00	0.00	0.00	0 00	0 00	0 00	0 00	0 00	0.00	0 00	0.00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
IVA IMPORT REPUESTOS	3 19	3 19	3.29	3.42	3.56	3.71	3.86	4.02	4 18	4 36	4 53	4 72	4 91	5.12	5 33	5 54	5 77	6 01	6 25	6 51	6 78
RECARGOS A GASOLINAS	0.00	0.00	0.00	0 00	0 00	0.00	0.00	0.00	0.00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
SUBSIDIO MEF	(2 05)	(2 13)	(2 22)	(2.31)	(2.41)	(2.51)	(2 61)	(2.72)	(2 83)	(2 94)	(3 06)	(3 19)	(3 32)	(3 46)	(3 60)	(3 75)	(3 90)	(4 06)	(4 23)	(4 40)	(4 58)
SUBSIDIO DIESEL	(200 00)	(200 00)	(200.00)	(200 00)	(200 00)	(200 00)	(200 00)	(200 00)	(200 00)	(200 00)	(200 00)	(200 00)	(200 00)	(200 00)	(200 00)	(200 00)	(200 00)	(200 00)	(200 00)	(200 00)	(200 00)
IVA GASOLINAS	0 00	0 00	0 00	0 00	0 00	0 00	0.00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
IVA DIESEL	12.71	14 07	15 49	16 96	18 50	20 10	21 76	23 49	25 30	27 17	29 13	31 16	33 28	35 49	37 79	40 17	42 66	45 25	47 95	50 75	53 67
OTROS CARGOS Y MULTAS	2 05	2 13	2 22	2 31	2 41	2 51	2 61	2 72	2 83	2 94	3 06	3 19	3 32	3 46	3 60	3 75	3 90	4 06	4 23	4 40	4 58
TOTAL CARGOS	(169 00)	(171 20)	(170 45)	(168 41)	(166 27)	(164 04)	(161 18)	(158 75)	(156 22)	(153 58)	(150 84)	(147 99)	(145 01)	(141 91)	(138 67)	(135 34)	(131 85)	(128 21)	(124 43)	(120 49)	(116 38)
CARGO PROMEDIO POR VEHICUL	(20 607)	(20,054)	(19 180)	(18,205)	(17,266)	(16,363)	(15,445)	(14 612)	(13,814)	(13 045)	(12,307)	(11 600)	(10 919)	(10 264)	(9 635)	(9 033)	(8 454)	(7 897)	(7 362)	(6 848)	(6 354)

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CONTINUACION CUADRO A.3.3.11 ...

CAMION C2 LIVIANO																					
VEHICULOS	5,555	5,844	6,148	6,468	6,804	7,158	7,530	7,922	8,334	8,767	9,223	9,703	10,208	10,739	11,297	11,884	12,502	13,152	13,836	14,555	15,312
VALOR CIF UNITARIO	83,000	86,200	86,200	86,200	86,200	86,200	86,200	86,200	86,200	86,200	86,200	86,200	86,200	86,200	86,200	86,200	86,200	86,200	86,200	86,200	86,200
CARGOS (MILLONES DE COLONES)																					
MATRICULA DE VEHICULOS	0.92	0.96	1.01	1.07	1.12	1.18	1.24	1.31	1.38	1.45	1.52	1.60	1.68	1.77	1.86	1.96	2.06	2.17	2.28	2.40	2.53
IMPUESTO IMPORT VEHICULOS	1.36	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IVA IMPORTACION VEHICULOS	2.85	3.00	3.12	3.29	3.46	3.64	3.83	4.02	4.23	4.45	4.69	4.93	5.19	5.46	5.74	6.04	6.35	6.68	7.02	7.39	7.78
IMPUESTO IMPORT REPUESTO	0.38	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IVA IMPORT REPUESTOS	0.79	0.80	0.84	0.88	0.93	0.97	1.02	1.08	1.13	1.19	1.25	1.32	1.39	1.46	1.54	1.62	1.70	1.79	1.88	1.98	2.08
RECARGOS A GASOLINAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUBSIDIO MEF	(1.39)	(1.46)	(1.54)	(1.62)	(1.70)	(1.79)	(1.88)	(1.98)	(2.08)	(2.19)	(2.31)	(2.43)	(2.55)	(2.68)	(2.82)	(2.97)	(3.13)	(3.29)	(3.46)	(3.64)	(3.83)
SUBSIDIO DIESEL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IVA GASOLINAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IVA DIESEL	6.39	6.72	7.07	7.44	7.82	8.23	8.66	9.11	9.58	10.08	10.61	11.16	11.74	12.35	12.99	13.67	14.38	15.12	15.91	16.74	17.61
OTROS CARGOS Y MULTAS	1.39	1.46	1.54	1.62	1.70	1.79	1.88	1.98	2.08	2.19	2.31	2.43	2.55	2.68	2.82	2.97	3.13	3.29	3.46	3.64	3.83
TOTAL CARGOS	12.69	11.86	12.04	12.68	13.33	14.02	14.75	15.52	16.32	17.17	18.07	19.01	20.00	21.04	22.13	23.29	24.49	25.76	27.10	28.51	30.00
CARGO PROMEDIO POR VEHICUL	2.284	2.029	1.958	1.960	1.959	1.959	1.959	1.959	1.958	1.958	1.959	1.959	1.959	1.959	1.959	1.960	1.959	1.959	1.959	1.959	1.959
CAMION C2 PESADO																					
VEHICULOS	13,838	14,558	15,315	16,111	16,949	17,830	18,757	19,732	20,758	21,837	22,973	24,168	25,425	26,747	28,138	29,601	31,140	32,759	34,462	36,254	38,139
VALOR CIF UNITARIO	83,000	94,000	94,000	94,000	94,000	94,000	100,800	100,800	100,800	100,800	100,800	100,800	100,800	100,800	100,800	100,800	100,800	100,800	100,800	100,800	100,800
CARGOS (MILLONES DE COLONES)																					
MATRICULA DE VEHICULOS	6.09	6.41	6.74	7.09	7.43	7.85	8.25	8.68	9.13	9.61	10.11	10.63	11.19	11.77	12.38	13.02	13.70	14.41	15.16	15.95	16.78
IMPUESTO IMPORT VEHICULOS	3.38	0.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IVA IMPORTACION VEHICULOS	7.11	8.15	8.48	8.93	9.39	9.88	11.14	11.72	12.33	12.97	13.65	14.36	15.10	15.89	16.72	17.59	18.50	19.46	20.47	21.54	22.66
IMPUESTO IMPORT REPUESTO	1.22	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IVA IMPORT REPUESTOS	2.56	2.60	2.70	2.84	2.99	3.15	3.31	3.48	3.66	3.85	4.05	4.27	4.49	4.72	4.97	5.22	5.50	5.78	6.08	6.40	6.73
RECARGOS A GASOLINAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUBSIDIO MEF	(3.46)	(3.64)	(3.83)	(4.03)	(4.24)	(4.46)	(4.69)	(4.93)	(5.19)	(5.46)	(5.74)	(6.04)	(6.35)	(6.69)	(7.03)	(7.40)	(7.79)	(8.19)	(8.62)	(9.06)	(9.53)
SUBSIDIO DIESEL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IVA GASOLINAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IVA DIESEL	21.45	22.56	23.74	24.97	26.27	27.64	29.07	30.58	32.17	33.85	35.61	37.46	39.41	41.46	43.61	45.88	48.27	50.78	53.42	56.19	59.12
OTROS CARGOS Y MULTAS	3.46	3.64	3.83	4.03	4.24	4.46	4.69	4.93	5.19	5.46	5.74	6.04	6.35	6.69	7.03	7.40	7.79	8.19	8.62	9.06	9.53
TOTAL CARGOS	41.51	40.79	41.66	43.53	46.11	48.52	51.77	54.46	57.29	60.28	63.42	66.72	70.19	73.84	77.68	81.71	85.97	90.42	95.13	100.09	105.33
CARGO PROMEDIO POR VEHICUL	3.021	2.802	2.720	2.721	2.721	2.721	2.760	2.760	2.760	2.760	2.761	2.761	2.761	2.761	2.761	2.760	2.761	2.760	2.760	2.761	2.761
CAMION C3																					
VEHICULOS	1,538	1,618	1,702	1,791	1,884	1,982	2,085	2,193	2,307	2,427	2,553	2,686	2,826	2,973	3,128	3,291	3,462	3,642	3,831	4,030	4,240
VALOR CIF UNITARIO	88,100	120,400	120,400	120,400	120,400	120,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400	146,400
CARGOS (MILLONES DE COLONES)																					
MATRICULA DE VEHICULOS	0.68	0.71	0.75	0.79	0.83	0.87	0.92	0.96	1.02	1.07	1.12	1.18	1.24	1.31	1.38	1.45	1.52	1.60	1.69	1.77	1.87
IMPUESTO IMPORT VEHICULOS	0.40	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IVA IMPORTACION VEHICULOS	0.84	1.16	1.21	1.27	1.34	1.41	1.80	1.89	1.99	2.09	2.20	2.32	2.44	2.57	2.70	2.84	2.99	3.14	3.31	3.48	3.66
IMPUESTO IMPORT REPUESTO	0.20	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IVA IMPORT REPUESTOS	0.41	0.42	0.44	0.46	0.48	0.51	0.53	0.56	0.59	0.62	0.65	0.69	0.72	0.76	0.80	0.84	0.89	0.93	0.98	1.03	1.09
RECARGOS A GASOLINAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUBSIDIO MEF	(0.38)	(0.40)	(0.43)	(0.45)	(0.47)	(0.50)	(0.52)	(0.55)	(0.58)	(0.61)	(0.64)	(0.67)	(0.71)	(0.74)	(0.78)	(0.82)	(0.87)	(0.91)	(0.96)	(1.01)	(1.06)
SUBSIDIO DIESEL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IVA GASOLINAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IVA DIESEL	3.51	3.69	3.88	4.08	4.30	4.52	4.75	5.00	5.26	5.53	5.82	6.12	6.44	6.78	7.13	7.50	7.89	8.30	8.73	9.19	9.67
OTROS CARGOS Y MULTAS	0.38	0.40	0.43	0.45	0.47	0.50	0.52	0.55	0.58	0.61	0.64	0.67	0.71	0.74	0.78	0.82	0.87	0.91	0.96	1.01	1.06
TOTAL CARGOS	6.04	6.13	6.28	6.60	6.95	7.31	8.00	8.41	8.86	9.31	9.79	10.31	10.84	11.42	12.01	12.63	13.29	13.97	14.71	15.47	16.29
CARGO PROMEDIO POR VEHICUL	3.927	3.789	3.690	3.685	3.689	3.688	3.837	3.835	3.840	3.835	3.835	3.838	3.838	3.841	3.840	3.838	3.839	3.836	3.840	3.839	3.842

CONTINUACION CUADRO A.3.3.11

CAMION C3S2																					
VEHICULOS	2,446	2 620	2,806	3,005	3,218	3,446	3,691	3,953	4,234	4,535	4,857	5,202	5,571	5,967	6,391	6,845	7,331	7,852	8,409	9 006	9 645
VALOR CIF UNITARIO	95,200	162,700	162,700	162,700	162,700	162,700	209,100	209,100	209,100	209,100	209,100	209,100	209,100	209,100	209,100	209,100	209,100	209,100	209,100	209 100	209,100
CARGOS (MILLONES DE COLONES)																					
MATRICULA DE VEHICULOS	4.13	4 43	4.74	5 08	5.44	5.82	6.24	6.68	7 16	7.66	8.21	8 79	9 41	10.08	10 80	11 57	12 39	13.27	14.21	15 22	16 30
IMPUESTO IMPORT VEHICULOS	0 92	0 34	0.00	0 00	0.00	0.00	0 00	0.00	0.00	0.00	0.00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
IVA IMPORTACION VEHICULOS	1.94	3 42	3.62	3.88	4.16	4 45	6 12	6.56	7 03	7 53	8 03	8 63	9 25	9 90	10 61	11 36	12 17	13.03	13 96	14 95	16 01
IMPUESTO IMPORT REPUESTO	0 45	0 10	0 00	0 00	0.00	0 00	0 00	0 00	0 00	0 00	0.00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
IVA IMPORT REPUESTOS	0.94	0.97	1.03	1.10	1 18	1.28	1.35	1.45	1.55	1 66	1.78	1.90	2 04	2 18	2 34	2 51	2 68	2.87	3 08	3 30	3 53
RECARGOS A GASOLINAS	0.00	0 00	0.00	0 00	0.00	0.00	0.00	0 00	0.00	0 00	0.00	0 00	0 00	0.00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
SUBSIDIO MEF	(0.61)	(0 66)	(0 70)	(0 75)	(0.80)	(0 86)	(0.92)	(0.99)	(1 06)	(1 13)	(1 21)	(1.30)	(1 39)	(1 49)	(1 60)	(1 71)	(1 83)	(1 96)	(2 10)	(2.25)	(2 41)
SUBSIDIO DIESEL	0.00	0 00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0 00	0 00	0.00	0 00	0 00	0 00	0.00	0 00	0 00	0 00	0 00	0 00
IVA GASOLINAS	0.00	0.00	0.00	0 00	0.00	0.00	0.00	0.00	0.00	0 00	0 00	0.00	0 00	0 00	0.00	0 00	0 00	0.00	0 00	0 00	0 00
IVA DIESEL	9.29	9 96	10.66	11 42	12.23	13.09	14.03	15.02	16 09	17.23	18 46	19 77	21 17	22 67	24.29	26 01	27 86	29 84	31 95	34 22	36 6[illegible]
OTROS CARGOS Y MULTAS	0.61	0 66	0.70	0 75	0 80	0.86	0.92	0.99	1.06	1 13	1.21	1 30	1 39	1 49	1 60	1 71	1 83	1 96	2 10	2 25	2 4[illegible]
TOTAL CARGOS	17 67	19.22	20.05	21 48	23 01	24 62	27 74	29 71	31 83	34 08	36 51	39 09	41 87	44 83	48 04	51 45	55 10	59 01	63.20	67 69	72 45
CARGO PROMEDIO POR VEHICUL	7.224	7.338	7.145	7.148	7.150	7.145	7.516	7.516	7.518	7.515	7 517	7.514	7 516	7.513	7 517	7.51[illegible]	7.516	7.515	7 516	7 516	7 516
TOTAL																					
VEHICULOS	257,310	275 441	294,920	315,855	338,358	362,553	388,574	416,563	446,676	479,081	513,961	551,511	591,944	635,491	682,399	732,938	787,400	846 102	909 384	977 617	1 051 20[illegible]
VALOR CIF PROMEDIO	64,135	68,382	68,320	68,260	68,202	68,147	71,285	71,201	71,139	71,079	71,021	70,965	70,911	70,860	70,810	70,762	70,715	70,671	70 628	70 587	70 54[illegible]
CARGOS (MILLONES DE COLONES)																					
MATRICULA DE VEHICULOS	58 83	63 04	67.57	72 45	77.69	83.34	89 41	95.95	103 01	110 59	118.78	127.58	137 05	147 28	158 32	170.22	183 03	196 85	211 77	227 86	245 2[illegible]
IMPUESTO IMPORT VEHICULOS	225.20	221 70	76.29	85 10	92.51	100.55	112 87	122 69	133.37	144.97	157.58	171.29	186 20	202 40	220 00	239 15	259 95	282 57	307 15	333 87	362 9[illegible]
IVA IMPORTACION VEHICULOS	150 96	168 50	164.97	177 35	190.68	205.06	230.21	247.65	266 48	286 78	308 73	332 42	358 00	385 62	415 49	447 73	482 57	520 22	560 95	604 97	652 5[illegible]
IMPUESTO IMPORT REPUESTO	11.35	2.43	0 00	0 00	0.00	0.00	0.00	0.00	0 00	0.00	0 00	0.00	0 00	0.00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
IVA IMPORT REPUESTOS	23.81	24 41	25 78	27 48	29.32	31.29	33.39	35.66	38 07	40 68	43 47	46 48	49 70	53 15	56 87	60 84	65 14	69 74	74 69	80 03	85 [illegible]
RECARGOS A GASOLINAS	241 65	259 61	278.96	299 81	322.30	346.54	372 69	400.88	431.31	464 12	499 54	537 76	579 02	623 58	671 67	723 63	779 74	840 38	905 85	976 63	1 052 [illegible]
SUBSIDIO MEF	(64 33)	(68 86)	(73.74)	(78 97)	(84.59)	(90.65)	(97.14)	(104.14)	(111.63)	(119 76)	(128 49)	(137.88)	(147 99)	(158 87)	(170 59)	(183.23)	(196 87)	(211 53)	(227 36)	(244 41)	(262 8[illegible]
SUBSIDIO DIESEL	(200.00)	(200.00)	(200.00)	(200 00)	(200.00)	(200.00)	(200.00)	(200 00)	(200.00)	(200.00)	(200 00)	(200.00)	(200 00)	(200 00)	(200 00)	(200 00)	(200 00)	(200 00)	(200 00)	(200 00)	(200 0[illegible]
IVA GASOLINAS	104 34	112 10	120 48	129 47	139.18	149 66	160 96	173 13	186 27	200 46	215 76	232.27	250 11	269.36	290 15	312 60	336 84	363 04	391 34	421 93	454 9[illegible]
IVA DIESEL	68 18	72 79	77 66	82 78	88.21	93.91	99 95	106.30	113 03	120 13	127 65	135 56	143 93	152 79	162 15	172 03	182 49	193 55	205 25	217 63	230 7[illegible]
OTROS CARGOS Y MULTAS	64.33	68 86	73.74	78 97	84.59	90.65	97.14	104.14	111 60	119.76	128 49	137.88	147 99	158 87	170.59	183.23	196 87	211.53	227 36	244 41	262 8[illegible]
TOTAL CARGOS	684.32	724 58	813.69	674 44	739 89	810.35	899 48	982.28	1,071.54	1,167 73	1,271 49	1,383.34	1,504 01	1,634 18	1,774 65	1,926 20	2,089 76	2,266 33	2,457 00	2,662 92	2 885 3[illegible]
CARGO PROMEDIO POR VEHICUL	2.660	2.631	2,081	2.135	2,187	2.235	2.315	2.358	2.399	2.437	2 474	2,508	2.541	2,572	2 601	2.628	2.654	2.679	2 702	2 724	2 74[illegible]

FUENTE FREDERIC HARRIS, INC.

CUADRO 3.12.12
PROYECCIONES DE INGRESOS FISCALES DERIVADOS DEL TRANSPORTE POR CARRETERA POR TIPO DE CARGO AL USUARIO 1994 - 2014
(VALORES EN MILLONES DE COLONES A PRECIOS DE 1994)

AÑO	MATRICULA DE VEHICULOS	IMPUESTO DE IMPORT VEHICULOS	IVA IMPORT DE VEHICULOS	IMPUESTO IMPORT REPUESTOS	IVA IMPORT REPUESTOS	RECARGOS A GASOLINAS	SUBSIDIO MEF	SUBSIDIO DIESEL	IVA CONSUMO GASOLINAS	IVA CONSUMO DIESEL	OTROS CARGOS Y MULTAS	TOTAL CARGOS
1994	58.83	225.20	150.96	11.35	23.81	241.65	(64.33)	(200.00)	104.34	68.18	64.33	684.32
1995	63.04	221.70	168.50	2.43	24.41	259.61	(68.86)	(200.00)	112.10	72.79	68.86	724.58
1996	67.57	78.29	164.97	0.00	25.78	278.96	(73.74)	(200.00)	120.46	77.66	73.74	613.69
1997	72.45	85.10	177.35	0.00	27.48	299.81	(78.97)	(200.00)	129.47	82.78	78.97	674.41
1998	77.69	92.51	190.68	0.00	29.32	322.30	(84.59)	(200.00)	139.18	88.21	84.59	739.89
1999	83.34	100.55	205.06	0.00	31.29	346.54	(90.65)	(200.00)	149.66	93.91	90.65	810.35
2000	89.41	112.87	230.21	0.00	33.39	372.69	(97.14)	(200.00)	160.96	99.95	97.14	899.48
2001	95.95	122.69	247.65	0.00	35.66	400.89	(104.14)	(200.00)	173.13	106.30	104.14	982.26
2002	103.01	133.37	266.48	0.00	38.07	431.31	(111.68)	(200.00)	186.27	113.03	111.68	1,071.54
2003	110.59	144.97	286.78	0.00	40.68	464.12	(119.76)	(200.00)	200.46	120.13	119.76	1,167.73
2004	118.76	157.58	308.73	0.00	43.47	499.54	(128.49)	(200.00)	215.76	127.65	128.49	1,271.49
2005	127.56	171.29	332.42	0.00	46.48	537.76	(137.88)	(200.00)	232.27	135.56	137.88	1,383.34
2006	137.05	186.20	358.00	0.00	49.70	579.02	(147.99)	(200.00)	250.11	143.93	147.99	1,504.01
2007	147.28	202.40	385.62	0.00	53.15	623.58	(158.87)	(200.00)	269.36	152.79	158.87	1,634.18
2008	158.32	220.00	415.49	0.00	56.87	671.67	(170.59)	(200.00)	290.15	162.15	170.59	1,774.65
2009	170.22	239.15	447.73	0.00	60.84	723.63	(183.23)	(200.00)	312.60	172.03	183.23	1,926.20
2010	183.03	259.95	482.57	0.00	65.14	779.74	(196.87)	(200.00)	336.84	182.49	196.87	2,089.76
2011	196.85	282.57	520.22	0.00	69.74	840.36	(211.53)	(200.00)	363.04	193.55	211.53	2,266.33
2012	211.77	307.15	560.95	0.00	74.69	905.85	(227.36)	(200.00)	391.34	205.25	227.36	2,457.00
2013	227.86	333.87	604.97	0.00	80.03	976.63	(244.41)	(200.00)	421.93	217.63	244.41	2,662.92
2014	245.25	362.92	652.56	0.00	85.75	1,053.12	(262.80)	(200.00)	454.98	230.75	262.80	2,885.33

FUENTE: FREDERIC HARRIS, INC.

CUADRO A.3.3.13
Proyecciones de Ingresos Fiscales Derivados del Transporte por Carretera por tipo de Vehículo 1994 - 2014 (Valores en Millones de Colones)

AÑO	AUTOMOVIL	PICK-UP	BUS	CAMION C-2 LIVIANO	CAMION C-2 PESADO	CAMION C-3	CAMION C3S2	TOTAL
1994	559.38	215.73	(169.00)	12.69	41.81	6.04	17.67	684.32
1995	603.38	214.40	(171.20)	11.86	40.79	6.13	19.22	724.58
1996	482.48	221.63	(170.45)	12.04	41.66	6.28	20.05	613.69
1997	524.44	233.82	(168.41)	12.68	43.83	6.60	21.48	674.44
1998	570.08	246.68	(166.27)	13.33	46.11	6.95	23.01	739.89
1999	619.68	260.24	(164.04)	14.02	48.52	7.31	24.62	810.35
2000	681.99	276.41	(161.18)	14.75	51.77	8.00	27.74	899.48
2001	741.31	291.60	(158.75)	15.52	54.46	8.41	29.71	982.26
2002	805.81	307.65	(156.22)	16.32	57.29	8.86	31.83	1,071.54
2003	875.91	324.56	(153.58)	17.17	60.28	9.31	34.08	1,167.73
2004	952.12	342.42	(150.84)	18.07	63.42	9.79	36.51	1,271.49
2005	1,034.95	361.25	(147.99)	19.01	66.72	10.31	39.09	1,383.34
2006	1,125.01	381.11	(145.01)	20.00	70.19	10.84	41.87	1,504.01
2007	1,222.88	402.08	(141.91)	21.04	73.84	11.42	44.83	1,634.18
2008	1,329.27	424.19	(138.67)	22.13	77.68	12.01	48.04	1,774.65
2009	1,444.93	447.53	(135.34)	23.29	81.71	12.63	51.45	1,926.20
2010	1,570.62	472.14	(131.85)	24.49	85.97	13.29	55.10	2,089.76
2011	1,707.27	498.10	(128.21)	25.76	90.43	13.97	59.01	2,266.33
2012	1,855.80	525.49	(124.43)	27.10	95.13	14.71	63.20	2,457.00
2013	2,017.26	554.40	(120.49)	28.51	100.08	15.47	67.69	2,662.92
2014	2,192.75	584.89	((116.38)	30.00	105.29	16.29	72.49	2,885.33

CUADRO 3.12.14

PROYECCIONES DE INGRESOS FISCALES POR VEHICULO DERIVADOS DEL TRANSPORTE POR CARRETERA POR TIPO DE VEHICULO 1994 - 2014

(VALORES EN COLONES A PRECIOS DE 1994)

AÑO	AUTOMOVIL	PICK-UP	BUS	CAMION C2 LIVIANO	CAMION C2 PESADO	CAMION C3	CAMION C3S2	TOTAL
1994	4,349	2,222	(20,607)	2,284	3,021	3,927	7,224	2,660
1995	4,315	2,093	(20,054)	2,029	2,802	3,789	7,335	2,613
1996	3,175	2,051	(19,180)	1,958	2,720	3,690	7,145	2,081
1997	3,174	2,051	(18,205)	1,960	2,721	3,685	7,148	2,135
1998	3,175	2,051	(17,268)	1,959	2,721	3,689	7,150	2,187
1999	3,175	2,051	(16,363)	1,959	2,721	3,688	7,145	2,235
2000	3,214	2,064	(15,445)	1,959	2,760	3,837	7,516	2,315
2001	3,214	2,064	(14,612)	1,959	2,760	3,835	7,516	2,358
2002	3,214	2,064	(13,814)	1,958	2,760	3,840	7,518	2,399
2003	3,214	2,064	(13,045)	1,958	2,760	3,836	7,515	2,437
2004	3,214	2,064	(12,307)	1,959	2,761	3,835	7,517	2,474
2005	3,214	2,064	(11,600)	1,959	2,761	3,838	7,514	2,508
2006	3,214	2,064	(10,919)	1,959	2,761	3,836	7,516	2,541
2007	3,214	2,064	(10,264)	1,959	2,761	3,841	7,513	2,572
2008	3,214	2,064	(9,635)	1,959	2,761	3,840	7,517	2,601
2009	3,214	2,064	(9,033)	1,960	2,760	3,838	7,516	2,628
2010	3,214	2,064	(8,454)	1,959	2,761	3,839	7,516	2,654
2011	3,214	2,064	(7,897)	1,959	2,760	3,836	7,515	2,679
2012	3,214	2,064	(7,362)	1,959	2,760	3,840	7,516	2,702
2013	3,214	2,064	(6,848)	1,959	2,761	3,839	7,516	2,724
2014	3,214	2,064	(6,354)	1,959	2,761	3,842	7,516	2,745

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FUENTE: FREDERICK HARIS, INC.

CUADRO A.3.12.15

PROYECCIONES DE VEHICULOS-KILOMETROS EN CARRETERAS INTERURBANAS PAVIMENTADAS POR TIPO DE VEHICULO 1994 - 2014

(VALORES EN MILES DE VEHICULOS-KILOMETROS)

AÑO	AUTOMOVIL	PICK-UP	BUS	CAMION C2 LIVIANO	CAMION C2 PESADO	CAMION C3	CAMION C3S2	TOTAL
1995	658,454	898,118	217,432	95,487	284,061	32,432	53,947	29,119,103
1996	725,992	933,739	22[illegible]40	100,603	298,656	34,410	58,145	28,534,632
1997	800,481	970,814	2[illegible]9	105,959	313,973	36,478	62,609	30,310,968
1998	882,646	1,009,397	245,223	111,579	330,084	38,623	67,350	32,218,812
1999	973,272	1,049,544	255,228	117,475	347,006	40,866	72,388	34,269,336
2000	1,073,244	1,091,332	265,632	123,650	364,791	43,207	77,755	36,475,320
2001	1,183,537	1,134,813	276,452	130,146	383,486	45,655	83,463	38,850,612
2002	1,305,225	1,180,068	287,704	136,943	403,133	48,206	89,553	41,409,972
2003	1,439,496	1,227,168	299,399	144,065	423,772	50,862	96,026	44,169,468
2004	1,587,649	1,276,196	311,574	151,549	445,473	53,649	102,930	47,148,240
2005	1,751,129	1,327,213	324,226	159,416	468,285	56,558	110,286	50,365,356
2006	1,931,550	1,330,300	337,386	167,656	492,258	59,599	118,124	53,842,476
2007	2,130,639	1,435,571	351,074	176,312	517,461	62,780	126,503	57,604,068
2008	2,350,367	1,493,090	365,307	185,399	543,957	66,120	135,424	61,675,968
2009	2,592,870	1,552,948	380,118	194,931	571,811	69,596	144,951	66,086,700
2010	2,860,516	1,615,260	395,522	204,950	601,088	73,245	155,114	70,868,328
2011	3,155,908	1,680,099	411,548	215,478	631,886	77,062	165,963	76,055,316
2012	3,481,957	1,747,601	428,209	226,517	664,253	81,044	177,547	81,685,536
2013	3,841,834	1,817,846	445,558	238,121	698,285	85,236	189,911	87,801,504
2014	4,239,060	1,890,962	463,593	250,298	734,060	89,624	203,132	94,448,760

FUENTE: FREDERIC R. HARRIS, INC.

CUADRO A.3.12.16

PROYECCIONES DE VEHICULOS-KILOMETROS EN EL TOTAL DE CARRETERAS POR TIPO DE VEHICULO 1994 - 2014

(VALORES EN MILES DE VEHICULOS-KILOMETROS)

AÑO	AUTOMOVIL	PICK-UP	BUS	CAMION C2 LIVIANO	CAMION C2 PESADO	CAMION C3	CAMION C3S2	TOTAL
1995	2,027,390	1,234,450	546,368	154,866	385,787	48,540	78,600	78,378,280
1996	2,203,768	1,302,340	568,768	162,922	405,848	51,060	84,180	80,963,694
1997	2,395,502	1,373,965	592,064	171,402	426,942	53,730	90,150	86,140,711
1998	2,603,910	1,449,531	616,320	180,305	449,149	56,520	96,540	91,699,004
1999	2,830,444	1,529,253	641,600	189,687	472,495	59,460	103,380	97,670,267
2000	3,076,697	1,613,352	667,904	199,545	497,061	62,550	110,730	104,089,885
2001	3,344,367	1,702,099	695,296	209,933	522,898	65,790	118,590	110,996,089
2002	3,635,324	1,795,715	723,776	220,851	550,087	69,210	127,020	118,429,859
2003	3,951,598	1,894,477	753,472	232,326	578,681	72,810	136,050	126,436,006
2004	4,295,393	1,998,673	784,384	244,410	608,785	76,590	145,710	135,066,205
2005	4,669,087	2,108,605	816,512	257,130	640,452	80,580	156,060	144,372,842
2006	5,075,305	2,224,575	849,984	270,512	673,763	84,780	167,130	154,415,197
2007	5,516,859	2,346,930	884,864	284,584	708,796	89,190	179,010	165,259,301
2008	5,996,823	2,476,010	921,152	299,371	745,657	93,840	191,730	176,974,851
2009	6,518,548	2,612,187	958,912	314,926	784,427	98,730	205,350	189,638,800
2010	7,085,657	2,755,859	998,208	331,303	825,210	103,860	219,930	203,336,791
2011	7,702,110	2,907,436	1,039,104	348,528	868,114	109,260	235,560	218,161,192
2012	8,372,199	3,067,340	1,081,728	366,654	913,243	114,930	252,270	234,212,892
2013	9,100,577	3,236,040	1,126,080	385,708	960,731	120,900	270,180	251,604,088
2014	9,892,321	3,414,018	1,172,224	405,768	1,010,684	127,200	289,350	270,455,345

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estimados para el total de carreteras, según las estimaciones efectuadas en la sección anterior. El Cuadro A.3.12.17 presenta el estimativo para 1994 y proyecciones 1995-2014 de ingresos fiscales derivados del transporte por carreteras interurbanas pavimentadas. El Cuadro A.3.12.18 resume dichas proyecciones por tipo de vehículo y año.

2 Costos Derivados de las Carreteras Interurbanas Pavimentadas

2.1 Costos Totales

Para la estimación de los flujos de costos anuales de los gastos corrientes y gastos de capital (servicio de la deuda y aportes GOES de obras realizadas y en proceso de carreteras interurbans pavimentadas y obras propuestas), se utilizaron las proyecciones desarrolladas para la estimación de gastos del sector vial.

En la Sección 3.8 se presentaron los flujos de costos anuales para el período 1995-2014, requeridos para efectuar estrategia recomendada de mantenimiento rutinario y periódico de las carreteras interurbanas. Dicha estrategia presenta la mejor alternativa de mantenimiento tanto para la entidad encargada de proveer el mantenimiento de las carreteras, como para los usuarios de las mismas. Se considera que dichos fujos anuales de costos de mantenimiento rutinario y periódico son aplicables para el análisis desarrollado en este Anexo..

Los Cuadros A.3.12.19 y A.2.12.20 presentan las proyecciones de los flujos anuales de costos para el periodo 1995-2014 para el sector vial en su conjunto y para las carreteras interurbanas pavimentadas respectivamente. Dichas proyecciones se basan en los siguientes consideraciones:

- Para los costos corrientes, se utilizaron los valores de los dos últimos Informe de la Gestion Financiera del Estado (1992 y 1993) y se incrementaron en un 10% para estimar un valor anual a precios de 1994, y las proyecciones financieras de la DGC, aplicable a cada rubro, según los siguientes criterios:

  - Para 1995, se utilizaron los valores estimados según se detalla a continuación. Para los siguientes años, se consideró una tasa de crecimiento anual del 5%.

  - Administración y planificación superior. Está basado el promedio de gastos reportados en 1992 y 1993, aumentados en un 10% para precentarlo a precios de 1994. Para la porción aplicable a carreteras interurbanas pavimentadas, se consideró el 60% del total de costos en administración y planificación superior, porcentaje que corresponde a la

CUADRO A.3.12.17

PROYECCIONES DE INGRESOS FISCALES DERIVADOS DEL TRANSPORTE POR CARRETERAS INTERURBANAS PAVIMENTADAS - 1996-2014

(VALORES MONETARIOS EN MILLONES DE COLONES A PRECIOS DE 1994)

ITEM	1996	1998	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
AUTOMOVIL																				
VEHICULOS	139 820	151,884	165,207	179,580	195,203	212,186	230 646	250 712	272,524	296,234	322 006	350 021	380 473	413 574	449 555	488 666	531 180	577 393	627 626	682 229
VEHICULOS-KILOMETRO (MILLONES)																				
TOTAL	2,027 39	2,203 77	2,395 60	2,603 91	2,830 44	3,076 70	3 344 37	3,635 32	3,951 60	4,296 39	4,669 09	5 075 30	5 516 86	5 998 82	6 518 55	7 085 66	7 702 11	8 372 20	9,100 58	9 892 32
RED INTERURBANA PAVIMENTADA	658 45	725 69	800 48	882 65	973 27	1,073 24	1 183 54	1 305 22	1,439 50	1,587 65	1 751 13	1 931 55	2 130 64	2 350 37	2 592 87	2 860 52	3 155 91	3 481 98	3,841 83	4,239 06
RESTO DE RED DE CARRETERAS	1,368 94	1,477 78	1,595 02	1,721 26	1,857 17	2,003 46	2,160 83	2,330 10	2,512 10	2,707 74	2,917 96	3,143 75	3,386 22	3,646 45	3,925 68	4,225 14	4 546 20	4 890 24	5,258 75	5 653 26
PORCENTAJE INTERURBANA/TOTAL	32 5%	32 9%	33 4%	33 9%	34 4%	34 8%	35 4%	35 9%	36 4%	37 0%	37 5%	38 1%	38 6%	39 2%	39 8%	40 4%	41 0%	41 6%	42 2%	42 9%
CARGOS TOTALES	603 38	482 48	524 44	570 08	619 68	681 99	741 31	805 81	875 91	952 12	1,034 95	1,125 01	1,222 68	1 329 27	1 444 93	1,570 62	1 707 27	1,855 80	2 017 26	2,192 73
CARGOS RED INTERURBANA	196 10	158 74	175 16	193 28	213 17	238 01	262 42	289 29	318 83	352 28	388 11	428 63	472 03	521 07	575 08	634 53	699 98	772 01	851 28	940 69

ITEM	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
PICK-UP																			
VEHICULOS	102,444	108,078	114,022	120,293	126,909	133,889	141,253	149,022	157,218	166,865	174,988	184 612	194 788	205 478	216 779	228 702	241,281	254,551	268 551	283 321
VEHICULOS-KILOMETRO (MILLONES)																				
TOTAL	1,234 45	1,302 34	1,373 97	1,449 53	1,529 25	1,613 36	1,702 10	1,795 72	1,894 48	1,998 67	2 108 61	2,224 57	2 346 93	2 476 01	2,612 19	2 755 83	2 907 44	3 067 34	3,236 04	3 414 02
RED INTERURBANA PAVIMENTADA	898 12	933 74	970 81	1,009 40	1,049 54	1,091 33	1 134 81	1 180 07	1,227 17	1,276 29	1 327 21	1 380 30	1 435 57	1 493 09	1 552 95	1 615 26	1 680 10	1 747 60	1 817 85	1 890 96
RESTO DE RED DE CARRETERAS	336 33	368 60	403 16	440 13	479 71	522 03	567 29	615 65	667 31	722 47	781 40	844 27	911 36	982 92	1,059 24	1 140 60	1,227 34	1,319 74	1,418 19	1,523 06
PORCENTAJE INTERURBANA/TOTAL	72 8%	71 7%	70 7%	69 6%	68 6%	67 6%	66 7%	65 7%	64 8%	63 9%	62 9%	62 0%	61 2%	60 3%	59 5%	58 6%	57 8%	57 0%	56 2%	55 4%
CARGOS TOTALES	214 40	221 63	233 82	246 68	260 24	278 41	291 80	307 65	324 56	342 42	361 25	381 11	402 08	424 19	447 53	472 14	498 10	525 49	554 40	584 89
CARGOS RED INTERURBANA	156 08	158 91	165 31	171 69	178 52	186 85	194 50	202 13	210 31	218 81	227 23	236 29	246 07	255 79	266 28	276 67	287 90	299 53	311 57	324 03

ITEM	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
BUSES																			
VEHICULOS	8,537	8,887	9,251	9,630	10,025	10,436	10,864	11,309	11,773	12,256	12,758	13,281	13,826	14,393	14,983	15,597	16,236	16,902	17,595	18,316
VEHICULOS-KILOMETRO (MILLONES)																				
TOTAL	546 37	568 77	592 06	616 32	641 60	667 90	695 30	723 78	753 47	784 38	816 51	849 93	884 85	921 15	958 91	998 21	1 039 10	1 081 73	1,120 08	1 172 22
RED INTERURBANA PAVIMENTADA	217 43	226 34	235 60	245 22	255 23	265 63	276 45	287 70	299 40	311 57	324 23	337 39	351 07	365 31	380 12	395 52	411 55	428 21	445 56	463 59
RESTO DE RED DE CARRETERAS	328 94	342 43	356 46	371 10	386 37	402 27	418 85	436 08	454 07	472 81	492 28	512 59	533 79	555 84	578 79	602 69	627 55	653 52	6 0 52	708 63
PORCENTAJE INTERURBANA/TOTAL	39 8%	39 8%	39 8%	39 8%	39 8%	39 8%	39 8%	39 7%	39 7%	39 7%	39 7%	39 7%	39 7%	39 7%	39 6%	39 6%	39 6%	39 6%	39 6%	39 5%
CARGOS TOTALES	(171 20)	(170 45)	(168 41)	(166 27)	(164 04)	(161 18)	(158 75)	(156 22)	(153 58)	(150 84)	(147 89)	(145 01)	(141 91)	(138 67)	(135 34)	(131 85)	(128 21)	(124 43)	(120 49)	(116 38)
CARGOS RED INTERURBANA	(68 14)	(67 84)	(67 03)	(66 18)	(65 29)	(64 15)	(63 18)	(62 02)	(60 97)	(59 88)	(58 75)	(57 57)	(56 34)	(55 05)	(53 59)	(52 21)	(50 77)	(49 27)	(47 71)	(45 97)

ITEM	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CAMION C2 LIVIANO																			
VEHICULOS	5,844	6,148	6,468	6,804	7,158	7,530	7,922	8 334	8 767	9,223	9,703	10,208	10 730	11,297	11 884	12 502	13 152	13 836	14 555	15 312
VEHICULOS-KILOMETRO (MILLONES)																				
TOTAL	154 87	162 92	171 40	180 31	189 69	199 55	209 93	220 85	232 33	244 41	257 13	270 51	284 58	299 37	314 93	331 30	348 53	366 66	385 71	406 77
RED INTERURBANA PAVIMENTADA	95 49	100 60	105 96	111 58	117 48	123 65	130 15	136 94	144 07	151 55	159 42	167 66	176 31	185 40	194 93	204 95	215 48	226 52	238 12	250 30
RESTO DE RED DE CARRETERAS	59 38	62 32	65 44	68 73	72 21	75 90	79 78	83 91	88 26	92 86	97 71	102 85	108 27	113 97	120 00	126 35	133 05	140 13	147 59	155 47
PORCENTAJE INTERURBANA/TOTAL	61 7%	61 7%	61 8%	61 9%	61 9%	62 0%	62 0%	62 0%	62 0%	62 0%	62 0%	62 0%	62 0%	61 9%	61 9%	61 9%	61 8%	61 8%	61 7%	61 7%
CARGOS TOTALES	11 88	12 04	12 68	13 33	14 02	14 75	15 52	16 32	17 17	18 07	19 01	20 00	21 04	22 13	23 29	24 49	25 76	27 10	28 51	30 00
CARGOS RED INTERURBANA	7 32	7 43	7 84	8 25	8 68	9 15	9 62	10 12	10 65	11 20	11 79	12 40	13 04	13 70	14 42	15 16	15 92	16 75	17 59	18 51

3 10

CONTINUA CUADRO A 3 12 17

ITEM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CAMION C2 PESADO																				
VEHICULOS	14,568	15 315	16 111	16 949	17 830	18,757	19,732	20 758	21 837	22,973	24 168	25 425	26,747	28 138	29 601	31 140	32 759	34 462	36,254	38 139
VEHICULOS-KILOMETRO (MILLONES)																				
TOTAL	385 79	405 85	426 94	449 15	472 50	497 06	522 90	550 09	578 68	608 78	640 45	673 78	708 80	745 66	784 43	825 21	868 11	913 24	960 73	1 010 68
RED INTERURBANA PAVIMENTADA	284 06	298 86	313 97	330 08	347 01	364 79	383 49	403 13	423 77	445 47	468 28	492 26	517 46	543 96	571 81	601 09	631 89	664 25	698 28	734 06
RESTO DE RED DE CARRETERAS	101 73	107 19	112 97	119 07	125 49	132.27	139 41	146 88	154 91	163 31	172 17	181 50	191 34	201 70	212 62	224 12	236 22	248 99	262 45	276 62
PORCENTAJE INTERURBANA/TOTAL	73 6%	73 6%	73 5%	73 5%	73 4%	73 4%	73 3%	73 3%	73 2%	73 2%	73 1%	73 1%	73 0%	73 0%	72 9%	72 8%	72 8%	72 7%	72 7%	72 6%
CARGOS TOTALES	40 79	41 68	43 83	46 11	48 52	51 77	54 46	57 28	60 26	63 42	66 72	70 19	73 84	77 66	81 71	85 97	90 43	95 13	100 08	105 29
CARGOS RED INTERURBANA	30 02	30 66	32 22	33 89	35 61	38 00	39 92	41 99	44 12	46 42	48 77	51 31	53 90	56 71	59 57	62 59	65 83	69 16	72 76	76 44

ITEM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CAMION C3																				
VEHICULOS	1,618	1,702	1,791	1,884	1,982	2,085	2,193	2,307	2,427	2,553	2,685	2,826	2,973	3,128	3,291	3,462	3,642	3,831	4,030	4,240
VEHICULOS-KILOMETRO (MILLONES)																				
TOTAL	48 54	51 06	53 73	56 52	59 46	62 56	65 76	69 21	72 81	76 59	80 56	84 78	89 19	93 84	98 73	103 86	109 26	114 93	120 90	127 20
RED INTERURBANA PAVIMENTADA	32 43	34 41	36 48	38 62	40 87	43 21	45 65	48 21	50 86	53 65	56 56	59 60	62 78	66 12	69 60	73 25	77 06	81 04	85 24	89 62
RESTO DE RED DE CARRETERAS	16 11	16 65	17 25	17 90	18 59	19 34	20 14	21 00	21 95	22 94	24 02	25 18	26 41	27 72	29 13	30 61	32 20	33 89	35 68	37 58
PORCENTAJE INTERURBANA/TOTAL	66 8%	67 4%	67 9%	68 3%	68 7%	69 1%	69 4%	69 7%	69 9%	70 0%	70 2%	70 3%	70 4%	70 5%	70 5%	70 5%	70 5%	70 5%	70 5%	70 5%
CARGOS TOTALES	6 13	6 28	6 60	6 95	7 31	8 00	8 41	8 86	9 31	9 79	10 31	10 84	11 42	12 01	12 63	13 29	13 97	14 71	15 47	16 29
CARGOS RED INTERURBANA	4 09	4 23	4 48	4 75	5 02	5 53	5 84	6 18	6 51	6 35	7 24	7 62	8 04	8 47	8 90	9 37	9 85	10 37	10 91	11 48

ITEM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CAMION C3S2																				
VEHICULOS	2,620	2,008	3 005	3,218	3 446	3,691	3,953	4,234	4 535	4,857	5,202	5 571	5,967	6 391	6 845	7 331	7 852	8 409	9 008	9 645
VEHICULOS-KILOMETRO (MILLONES)																				
TOTAL	78 60	84 18	90 15	96 54	103 38	110 73	118 59	127 02	136 05	145 71	156 06	167 13	179 01	191 73	205 35	219 93	235 56	252 27	270 18	289 35
RED INTERURBANA PAVIMENTADA	53 95	58 14	62 61	67 35	72 39	77 75	83 46	89 55	95 03	102 93	110 29	118 12	126 50	135 42	144 95	155 11	165 96	177 55	189 91	203 13
RESTO DE RED DE CARRETERAS	24 65	26 04	27 54	29 19	30 99	32 98	35 13	37 47	40 02	42 78	45 77	49 01	52 51	56 31	60 40	64 82	69 60	74 72	80 27	86 22
PORCENTAJE INTERURBANA/TOTAL	68 6%	69 1%	69 5%	69 8%	70 0%	70 2%	70 4%	70 5%	70 6%	70 0%	70 7%	70 7%	70 7%	70 6%	70 6%	70 5%	70 5%	70 4%	70 3%	70 2%
CARGOS TOTALES	19 22	20 05	21 48	23 01	24 62	27 74	29 71	31 83	34 08	36 51	39 09	41 87	44 83	48 04	51 45	55 10	59 01	63 20	67 69	72 49
CARGOS RED INTERURBANA	13 18	13 85	14 93	16 06	17 23	19 47	20 92	22 44	24 06	25 78	27 64	29 60	31 69	33 92	36 32	38 85	41 60	44 49	4 59	50 88

ITEM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TOTAL																				
VEHICULOS	275,441	294 920	315 856	338,358	362,553	388 574	416,563	446 676	479 061	513 881	551 511	591 944	635 491	682 399	732 938	787 400	845 102	909 384	977 617	1 051,202
VEHICULOS-KILOMETRO (MILLONES)																				
TOTAL	4,476 01	4,778 89	5,103 75	5,452 28	5,828 [illegible]	6,227 85	6,658 98	7,121 89	7,619 42	8,153 83	8,728 43	9,346 03	10,010 23	10,724 58	11,493 09	12 320 03	13,210 11	14 168 36	15,200 22	16 311 56
RED INTERURBANA PAVIMENTADA	2,239 83	2,377 88	2,525 91	2,684 60	2,856 79	3,038 60	3,237 66	3,450 82	3,680 80	3,928 02	4,197 12	4,488 68	4,800 33	5,139 67	5,507 23	5,905 70	6 337 95	6 807 13	7,316 78	7 870 72
RESTO DE RED DE CARRETERAS	2,236 06	2,401 01	2,577 84	2,767 38	2,970 53	3,188 25	3,421 43	3,671 17	3,938 62	4,224 81	4,531 31	4,859 15	5,208 90	5,584 91	5,985 86	6,414 33	6 872 16	7,361 23	7,883 43	8 440 84
PORCENTAJE INTERURBANA/TOTAL	50 0%	49 8%	49 5%	49 2%	49 0%	48 8%	48 6%	48 5%	48 3%	48 2%	48 1%	48 0%	48 0%	47 9%	47 9%	47 9%	48 0%	48 0%	48 1%	48 3%
CARGOS TOTALES	724 58	613 69	674 44	739 89	810 35	829 48	982 26	1,071 54	1,167 73	1,271 49	1,383 34	1,504 01	1,634 18	1,774 85	1,928 20	2,069 76	2,268 33	2 457 00	2,662 82	2 885 33
CARGOS RED INTERURBANA	338 66	305 98	332 81	361 72	392 94	432 86	470 04	510 13	553 51	601 46	652 03	708 28	768 43	834 61	906 98	984 98	1 070 31	1 163 04	1,263 89	1 378 07

FUENTE FREDERI R. HARRIS INC

CUADRO A.3.12.18

PROYECCIONES DE INGRESOS FISCALES DERIVADOS DEL TRANSPORTE POR CARRETERAS INTERURBANAS PAVIMENTADAS POR TIPO DE VEHICULO - 1994 - 2014

(VALORES EN MILLONES DE COLONES A PRECIOS DE 1994)

AÑO	AUTOMOVIL	PICK-UP	BUS	CAMION C2 LIVIANO	CAMION C2 PESADO	CAMION C3	CAMION C3S2	TOTAL
1994	196.10	156.08	(68.14)	7.32	30.02	4.09	13.18	338.65
1995	158.74	158.91	(67.84)	7.43	30.66	4.23	13.85	305.98
1996	175.16	165.31	(67.03)	7.64	32.22	4.48	14.93	332.91
1997	193.26	171.69	(66.18)	8.25	33.89	4.75	16.06	361.72
1998	213.17	178.52	(65.29)	8.68	35.61	5.02	17.23	392.94
1999	238.01	186.85	(64.15)	9.15	38.00	5.53	19.47	432.86
2000	262.42	194.50	(63.18)	9.62	39.92	5.84	20.92	470.04
2001	289.29	202.13	(62.02)	10.12	41.99	6.18	22.44	510.13
2002	318.83	210.31	(60.97)	10.65	44.12	6.51	24.06	553.51
2003	352.28	218.81	(59.88)	11.20	46.42	6.85	25.78	601.46
2004	388.11	227.23	(58.75)	11.79	48.77	7.24	27.64	652.03
2005	428.63	236.29	(57.57)	12.40	51.31	7.62	29.60	708.28
2006	472.03	246.07	(56.34)	13.04	53.90	8.04	31.69	768.43
2007	521.07	255.79	(55.05)	13.70	56.71	8.47	33.92	834.61
2008	575.08	266.28	(53.59)	14.42	59.57	8.90	36.32	906.98
2009	634.53	276.67	(52.21)	15.16	62.59	9.37	38.85	984.96
2010	699.98	287.90	(50.77)	15.92	65.83	9.85	41.60	1,070.31
2011	772.01	299.53	(49.27)	16.75	69.16	10.37	44.49	1,163.04
2012	851.28	311.57	(47.71)	17.59	72.76	10.91	47.59	1,263.99
2013	940.69	324.03	(45.97)	18.51	76.44	11.48	50.89	1,376.07
2014	2,192.75	584.89	(116.38)	30.00	105.29	16.29	72.49	2,885.33

FUENTE: FREDERIC R. HARRIS, INC.

CUADRO A.3.12.10

PROYECCIONES DE COSTOS ANUALES DEL SECTOR VIAL - 1996 - 2014

(VALORES EN MILLONES DE COLONES A PRECIOS DE 1994)

ITEM	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
COSTOS CORRIENTES (1)																			
ADMON Y PLANIF SUPERIOR (2)	30.00	31.59	33.06	34.73	36.47	38.29	40.20	42.21	44.32	46.54	48.87	51.31	53.88	56.57	59.40	62.37	65.49	68.76	72.20	75.81
DIRECCION/COORDINACION DGC (3)	53.90	56.59	59.43	61.35	64.42	67.64	71.02	74.07	78.30	82.22	86.33	90.65	95.18	99.94	104.94	110.18	115.70	121.49	127.56	133.94
MTO DE EMERGENCIA (4)	27.00	28.35	29.77	31.26	32.82	34.46	36.18	37.99	38.69	41.88	43.97	46.17	48.48	50.90	53.45	56.12	58.93	61.88	64.97	68.22
DIRECCION/COORDINACION DUA (5)	35.00	37.80	39.69	41.67	43.75	45.94	48.24	50.65	53.18	55.84	58.63	61.56	64.64	67.87	71.26	74.82	78.56	82.49	86.61	90.94
MTO OBRAS URBANAS (5)	44.00	46.20	48.51	50.94	53.49	56.16	58.97	61.92	65.02	68.27	71.68	75.28	79.02	82.97	87.12	91.48	96.05	100.85	105.89	111.18
AME (6)	14.50	15.23	15.99	16.79	17.63	18.51	19.44	20.41	21.43	22.50	23.63	24.81	26.05	27.35	28.72	30.16	31.67	33.25	34.91	36.66
TOTAL COSTOS CORRIENTES	204.50	214.73	225.47	236.74	248.58	261.00	274.05	287.75	302.14	317.25	333.11	349.76	367.25	385.60	404.89	425.14	446.40	468.72	492.14	516.75
COSTOS DE CAPITAL																			
OBRAS DE URBANIZACION (7)	100.00	105.00	110.25	115.76	121.55	127.63	134.01	140.71	147.75	155.14	162.90	171.05	179.60	188.58	198.01	207.91	218.31	229.23	240.69	252.72
MTO OBRAS NO PAVIMENTADAS																			
RUTINARIO	62.43	62.71	62.72	62.71	57.62	56.07	54.04	56.07	56.07	56.07	56.07	56.07	54.04	56.07	56.07	56.07	56.07	56.07	54.04	56.07
PERIODICO	0.00	0.00	0.00	0.00	0.00	85.32	135.69	85.32	85.32	85.32	85.32	85.32	135.69	85.32	85.32	85.32	85.32	85.32	135.69	85.32
MTO OBRAS PAVIMENTADAS																			
RUTINARIO	83.03	81.88	91.89	91.69	51.71	52.13	52.20	52.05	52.11	52.00	52.01	51.97	51.83	51.86	52.08	52.02	52.15	52.04	51.85	52.02
PERIODICO	212.32	197.83	94.97	54.24	27.34	59.25	94.44	180.81	73.86	106.50	103.37	138.11	124.28	123.94	133.83	134.61	87.43	115.27	78.55	83.70
SERVICIO DEUDA OBRAS REALIZADAS	132.45	129.28	125.72	119.44	119.44	119.44	119.44	119.44	99.19	99.19	99.19	99.19	99.19	99.19	99.19	99.19	99.19	99.19	90.96	90.96
SERVICIO DEUDA OBRAS EN PROCESO	0.00	54.39	128.90	210.40	275.08	327.49	327.49	327.49	327.49	327.49	327.49	327.49	327.49	327.49	327.49	327.49	327.49	327.49	327.49	327.49
APORTE GOES OBRAS EN PROCESO	189.96	297.16	239.34	204.22	189.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OBRAS PROPUESTAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.00	25.00	687.00	305.00	305.00	305.00	305.00	586.00	377.00	503.00	449.00	449.00
TOTAL COSTOS DE CAPITAL	750.21	767.68	772.29	822.47	852.19	827.33	917.31	861.68	860.79	906.71	1.573.35	1.234.20	1.277.13	1.237.45	1.236.79	1.548.62	1.312.96	1.467.61	1.428.27	1.377.28
TOTAL COSTOS	954.71	982.38	997.67	1.059.21	1.100.77	1.088.33	1.191.36	1.249.44	1.188.93	1.223.96	1.906.46	1.583.96	1.644.38	1.623.05	1.641.68	1.973.76	1.759.36	1.936.33	1.920.41	1.894.03

(1) TODOS LOS GASTOS CORRIENTES SE SUPONEN CRECIENDO A UNA TASA ANUAL REAL DEL 5%
(2) BASADO EN EL PROMEDIO DE GASTOS EN 1992 Y 1993 (SEGUN INFORME DE LA GESTION FINANCIERA DEL ESTADO) INCREMENTADO A PRECIOS DE 1994 EN UN 10%
(3) TOMADO DE LAS PROYECCIONES FINANCIERAS REALIZADAS POR LA DGC
(4) ESTE ITEM ES PARA CUBRIR OBRAS DE MANTENIMIENTO DE EMERGENCIA NO CUBIERTAS EN MANTENIMIENTO POR CONTRATO TOMADO DE LAS PROYECCIONES FINANCIERAS REALIZADAS POR LA DGC REDUCIDAS EN UN 50%
(5) BASADO EN LOS GASTOS DE 1993 (SEGUN INFORME DE LA GESTION FINANCIERA DEL ESTADO), INCREMENTADO A PRECIOS DE 1994 EN UN 10%
(6) BASADO EN LOS GASTOS DE 1993 (SEGUN INFORME DE LA GESTION FINANCIERA DEL ESTADO), INCREMENTADO A PRECIOS DE 1994 EN UN 10% Y REDUCIDOS EN UN 50%
(7) PARA 1995, BASADO EN EL PROMEDIO DE GASTOS EN 1992 Y 1993 (SEGUN INFORME DE LA GESTION FINANCIERA DEL ESTADO) INCREMENTADO A PRECIOS DE 1994 EN UN 10%, Y CON UN CRECIMIENTO ANUAL DEL 5% PARA LOS SIGUIENTES AÑOS

FUENTE FREDERIC R HARRIS INC

CUADRO A.3.12.39

PROYECCIONES DE COSTOS ANUALES DE LAS CARRETERAS INTERURBANAS PAVIMENTADAS - 1996 - 2014

(VALORES EN MILLONES DE COLONES A PRECIOS 03 1994)

ITEM	1996	1998	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
COSTOS CORRIENTES (1)																				
ADMON Y PLANIF. SUPERIOR (2)	18.00	18.90	19.85	20.84	21.88	22.97	24.12	25.33	26.60	27.93	29.33	30.80	32.34	33.96	35.66	37.44	39.31	41.28	43.34	45.
DIRECCION/COORDINACION DGC (3)	39.75	41.74	43.83	46.02	48.32	50.74	53.28	55.94	58.74	61.68	64.76	68.00	71.40	74.97	78.72	82.65	86.78	91.13	95.69	100.
MTO. DE EMERGENCIA (4)	20.28	21.28	22.32	23.44	24.61	25.84	27.13	28.49	29.91	31.41	32.98	34.63	36.36	38.18	40.09	42.09	44.19	46.40	48.72	51.
AME (5)	8.79	9.14	9.89	10.88	10.56	11.11	11.67	12.25	12.86	13.50	14.18	14.88	15.63	16.41	17.23	18.09	18.98	19.94	20.94	21.
TOTAL COSTOS CORRIENTES	88.70	91.04	95.69	100.38	105.39	110.66	116.20	122.01	128.11	134.52	141.25	148.32	155.73	163.52	171.70	180.28	189.28	198.75	208.69	219
COSTOS DE CAPITAL																				
MTO. OBRAS PAVIMENTADAS																				
RUTINARIO	53.03	51.66	51.59	51.69	51.71	52.13	52.20	52.06	52.11	52.00	52.01	51.97	51.83	51.89	52.08	52.03	52.15	52.04	51.85	52.
PERIODICO	212.32	197.53	84.67	54.24	27.34	59.29	84.44	180.91	73.88	108.53	103.37	138.11	124.28	123.94	133.63	134.61	97.43	115.27	78.55	63
SERVICIO DEUDA OBRAS REALIZADAS	106.68	103.61	99.95	93.67	93.67	93.67	93.67	93.67	73.42	73.42	73.42	73.42	73.42	73.42	73.42	73.42	73.42	73.42	70.59	70
SERVICIO DEUDA OBRAS EN PROCES	0.00	39.40	109.78	172.88	228.48	275.16	275.16	275.16	275.16	275.16	275.16	275.16	275.16	275.16	275.16	275.16	275.16	275.16	275.16	275
APORTE GOES OBRAS EN PROCESO	98.27	139.49	149.82	135.09	127.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
OBRAS PROPUESTAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.30	25.00	687.00	305.00	305.00	305.00	305.00	586.00	377.00	503.00	448.00	449
TOTAL COSTOS DE CAPITAL	470.30	482.61	496.02	507.30	528.53	480.21	515.47	601.48	498.56	532.08	1,190.98	843.66	829.78	829.38	839.29	1,121.22	875.16	1,018.89	925.15	910
TOTAL COSTOS	557.00	573.65	591.62	607.68	633.92	590.87	631.67	723.50	627.68	666.60	1,332.21	991.98	985.43	992.90	1,010.99	1,301.50	1,064.44	1,217.64	1,133.84	1,129.6

(1) TODOS LOS GASTOS CORRIENTES SE SUPONEN CRECIENDO A UNA TASA ANUAL REAL DEL 5%

(2) BASADO EN EL PROMEDIO DE GASTOS EN 1992 Y 1993 (SEGUN INFORME DE LA GESTION FINANCIERA DEL ESTADO) INCREMENTADO A PRECIOS DE 1994 EN UN 10%

(3) TOMADO DE LAS PROYECCIONES FINANCIERAS REALIZADAS POR LA DGC

(4) ESTE ITEM ES PARA CUBRIR OBRAS DE MANTENIMIENTO DE EMERGENCIA NO CUBIERTAS EN MANTENIMIENTO POR CONTRATO TOMADO DE LAS PROYECCIONES FINANCIERAS REALIZADAS POR LA DGC REDUCIDAS EN UN 80%

(5) BASADO EN LOS GASTOS DE 1993 (SEGUN INFORME DE LA GESTION FINANCIERA DEL ESTADO) INCREMENTADO A PRECIOS DE 1994 EN UN 10% Y REDUCIDOS EN UN 50%

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participación del los costos en dichas carreteras sobre el total de costos para 1995 y 1996.

- Dirección y coordinación DGC. Está basado en las proyecciones de la DGC. Para la porción aplicable a carreteras interurbanas pavimentadas, se consideró el 75% del total de costos de la DGC.

- Mantenimiento de emergencia. Este item es para cubrir obras de mantenimiento de emergencia, no cubiertas por el mantenimiento por contrato asumido en las proyecciones. Está basado en las proyecciones financieras realizadas por la DGC, reducidas en un 80%, para tomar en cuenta la introducción de mantenimiento por contrato. Para la porción aplicable a carreteras interurbanas pavimentadas, se consideró el 75% de los mismos.

- Dirección y coordinación DUA. Está basado en los gastos reportados para 1993, aumentados en un 10% para presentarlo a precios de 1994. Este item no se consideró aplicable a las carreteras interurbanas.

- AME. Está basado en los gastos reportados para 1993, aumentados en un 10% para presentarlo a precios de 1994, y reducido en un 50%, para tomar en cuenta la introducción de mantenimiento por contrato. Para la porción aplicable a carreteras interurbanas pavimentadas, se consideró el 60% de los mismos.

- Para los costos de capital, se utilizaron los valores de los dos últimos Informe de la Gestion Financiera del Estado (1992 y 1993) y las proyecciones financieras de la DGC, aplicable a cada rubro, según los siguientes criterios:

  - Obras de urbanización. Para 1995, está basado el promedio de gastos reportados en 1992 y 1993, aumentados en un 10% para precentarlo a precios de 1994. Para los siguientes años, se consideró una tasa de crecimiento anual del 5%. Este item no se consideró aplicable a las carreteras interurbanas.

  - Mantenimiento de obras no pavimentadas. Para el mantenimiento rutinario, se utilizaron las proyecciones realizadas por la DGC para el periodo 1995-1999 y las estimadas por el estudio para los siguientes años, reducidas en la misma proporción dada por la razón entre las proyecciones realizadas por la DGC y las estimadas por el estudio para el periodo 1995-1999. Para el mantenimiento periódico, para el periodo 1995-1999, está siendo cubierto por las obras en proceso, y para los siguientes años se utilizaron las proyecciones realizadas por el estudio.

Este item no se consideró aplicable a las carreteras interurbanas pavimentadas.

Mantenimiento de obras pavimentadas. Se utilizaron las proyecciones realizadas por el estudio. Este item no se consideró 100% aplicable a las carreteras interurbanas pavimentadas.

Servicio deuda obras realizadas. Está basado en los condiciones de financiamiento de las obras realizadas. Los Cuadros A.3.12.21 y A.3.12.22 presentan los flujos anuales de servicio a la deuda de obras realizadas, estimadas para toda la red vial y para las carreteras interurbanas pavimentadas respectivamente.

Servicio deuda obras en proceso. Está basado en las de inversiones por fuente de financiamiento programadas por la DGC para el periodo 1995-1999. Los Cuadros A.3.12.23 y A.3.12.24 presentan los flujos anuales de inversión de las obras en proceso (periodo 1995-1999), estimadas para toda la red vial y para las carreteras interurbanas pavimentadas respectivamente, y los Cuadros A.3.12.21 y A.3.12.22 presentan los flujos anuales de servicio a la deuda de obras en proceso, estimadas para toda la red vial y para las carreteras interurbanas pavimentadas respectivamente. Las condiciones de financiamiento asumidas por fuente de financiamiento son las siguientes:

BID: Para 1995, 142.6 millones de colones no utilizados de préstamos existentes a una tasa de servicio (intereses y comisiones) del 2.5% anual y un periodo de pago de 25 años. El remanente para dicho año y restantes años, a una tasa de servicio del 8.0% anual y un periodo de pago de 25 años.

BCIE: A una tasa de servicio del 9.75% anual y un periodo de pago de 20 años.

AID: Donaciones.

JAPON: Para 1995, donación. Para los restantes años, a una tasa de servicio mas ajuste por cambios en las tasas de cambio de la divisa del 9.75% y un periodo de pago de 25 años.

BIRF: A una tasa de servicio del 7.97% aunual y un periodo de pago de 25 años.

Aportes GOES para obras en proceso. Está basado en las de

CUADRO A.3.12.21

PROYECCIONES DE SERVICIO DE LA DEUDA DE OBRAS REALIZADAS Y EN PROCESO DEL SECTOR VIAL - 1995 - 2014

(VALORES EN MILLONES DE COLONES A PRECIOS DE 1994)

PROGRAMAS	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
PROGRAMAS FINALIZADOS																				
MTO Y MEJORAS RED VIAL 321-ES	4.76	4.76	4.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FINANCIA VIAS URBANAS 427-ES	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	0.00	0.00
PROG REH EMERGENCIA 453/OC-ES	4.16	4.16	4.16	4.16	4.16	4.16	4.16	4.16	4.16	4.16	4.16	4.16	4.16	4.16	4.16	4.16	4.16	4.16	4.16	4.16
CAMINOS RURALES 472-ES	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91
CAMINOS RURALES II ETAPA 665-ES	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
TRAMOS INTERAMERICANA 2-003-0-1-2-3-4	5.08	5.08	1.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S SALVADOR-S MIGUEL 2-0112-01 ETAPA	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LA HERRADURA COSTA DEL SOL 2-0148-0	3.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
COMPLETAR LA HERRAD -COSTA/SOL 2-0148-	2.51	2.51	2.51	2.51	2.51	2.51	2.51	2.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
REH LA HACHADURA CA-12 2-0213-0	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74
REH S ANA-ANGUIATU CA-12 2-0219-0	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25
MEJORA S SALV-SAN MIGUEL II ETAPA 2-0225-	11.10	11.10	11.10	11.10	11.10	11.10	11.10	11.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INTERCOONEC CA-1 Y CA-12 S ANA 2-0136-1	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61
PROG NACIONAL DE CARRETERAS 31-ES	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	0.00	0.00
CAMINOS RURALES III ETAPA 844-SF-ES (2)	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80
CARRETERAS TRONCALES 653-CS-ES (3)	37.87	37.87	37.87	37.87	37.87	37.87	37.87	37.87	37.87	37.87	37.87	37.87	37.87	37.87	37.87	37.87	37.87	37.87	37.87	37.87
CARRETERAS TRONCALES 870-SF-ES (3)	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97
CARRETERA S SALVADOR-APOPA 2873-ES (4)	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15
TOTAL PROGRAMAS FINALIZADOS	132.45	129.28	125.72	119.44	119.44	119.44	119.44	119.44	99.19	99.19	99.19	99.19	99.19	99.19	99.19	99.19	99.19	99.19	90.96	90.96
PROGRAMAS EN PROCESO																				
BID	0.00	36.35	81.27	127.97	163.17	186.10	186.10	186.10	186.10	186.10	186.10	186.10	186.10	186.10	186.10	186.10	186.10	186.10	186.10	186.10
BCIE	0.00	17.29	24.83	32.15	32.15	32.15	32.15	32.15	32.15	32.15	32.15	32.15	32.15	32.15	32.15	32.15	32.15	32.15	32.15	32.15
JAPON	0.00	0.00	18.47	47.95	77.43	106.91	106.91	106.91	106.91	106.91	106.91	106.91	106.91	106.91	106.91	106.91	106.91	106.91	106.91	106.91
BIRF	0.00	0.65	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33
TOTAL PROGRAMAS EN PROCESO	0.00	54.29	126.90	210.40	275.08	327.49	327.49	327.49	327.49	327.49	327.49	327.49	327.49	327.49	327.49	327.49	327.49	327.49	327.49	327.49

(1) SE CONSIDERA FINALIZADO EN UN 40% AL 31 DE DICIEMBRE DE 1994
(2) SE CONSIDERA FINALIZADO EN UN 60% AL 31 DE DICIEMBRE DE 1994
(3) SE CONSIDERA FINALIZADO EN UN 90% AL 31 DE DICIEMBRE DE 1994
(4) SE CONSIDERA FINALIZADO EN UN 75% AL 31 DE DICIEMBRE DE 1994

FUENTE FREDERIC R HARRIS INC

CUADRO A.3.12.22

PROYECCIONES DE SERVICIO DE LA DEUDA DE OBRAS REALIZADAS Y EN PROCESO DE CARRETERAS INTERURBANAS PAVIMENTADAS - 1995 - 2014

(VALORES EN MILLONES DE COLONES A PRECIOS DE 1994)

PROGRAMAS	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
PROGRAMAS FINALIZADOS																				
MTO Y MEJORAS RED VIAL 321-ES	4.76	4.76	4.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRAMOS INTERAMERICANA 2-003-0-1-2-3-4	5.08	5.08	1.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S. SALVADOR-S MIGUEL 2-0112-0 I ETAPA	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LA HERRADURA COSTA DEL SOL 2-0148-0	3.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
COMPLETAR LA HERRA.-COSTA/SOL 2-0148-1	2.51	2.51	2.51	2.51	2.51	2.51	2.51	2.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
REH LA HACHADURA CA-12 2-0213-0	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74
REH S ANA-ANGUIATU CA-12 2-0219-0	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25
MEJORA S SALV-S MIGUEL II ETAPA 2-0225-0	11.10	11.10	11.10	11.10	11.10	11.10	11.10	11.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INTERCONEC CA-1 Y CA-12 S ANA 2-0136-1	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61
PROG NACIONAL DE CARRETERAS 31-ES	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	0.00	0.00
CARRETERAS TRONCALES 653-OS-ES (1)	37.37	37.37	37.37	37.37	37.37	37.37	37.37	37.37	37.37	37.37	37.37	37.37	37.37	37.37	37.37	37.37	37.37	37.37	37.37	37.37
CARRETERAS TRONCALES 870-SF-ES (1)	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97	9.97
CARRETERA S SALV-APOPA 2373-ES (2)	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15
TOTAL PROGRAMAS FINALIZADOS	106.68	103.51	99.95	93.67	93.67	93.67	93.67	93.67	73.42	73.42	73.42	73.42	73.42	73.42	73.42	73.42	73.42	73.42	70.59	70.59
PROGRAMAS EN PROCESO																				
BID	0.00	21.46	55.15	90.17	116.57	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77
BCIE	0.00	17.29	24.33	32.15	32.15	32.15	32.15	32.15	32.15	32.15	32.15	32.15	32.15	32.15	32.15	32.15	32.15	32.15	32.15	32.15
JAPON	0.00	0.00	18.47	47.95	77.43	106.91	106.91	106.91	106.91	106.91	106.91	106.91	106.91	106.91	106.91	106.91	106.91	106.91	106.91	106.91
BIRF	0.00	0.65	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33
TOTAL PROGRAMAS EN PROCESO	0.00	39.40	100.78	172.60	228.48	275.16	275.16	275.16	275.16	275.16	275.16	275.16	275.16	275.16	275.16	275.16	275.16	275.16	275.16	275.16

1) SE CONSIDERA FINALIZADO EN UN 60% AL 31 DE DICIEMBRE DE 1994
2) SE CONSIDERA FINALIZADO EN UN 75% AL 31 DE DICIEMBRE DE 1994

FUENTE: FREDERIC R. HARRIS, INC.

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CUADRO A.3.12.23

INVERSIONES PROGRAMADAS PARA EL SECTOR VIAL POR FUENTE DE FINANCIAMIENTO - 1995 - 1999

(VALORES EN MILLONES DE COLONES)

FUENTE	1995	1996	1997	1998	1999
BID	464.70	505.66	525.73	396.29	258.13
BCIE	149.77	65.33	63.40	0.00	0.00
AID	20.68	39.15	36.39	0.00	0.00
JAPON	67.37	170.93	272.80	272.80	272.80
BIRF	7.00	17.94	0.00	0.00	0.00
TOTAL INVERSION EXTERNA	702.52	781.07	898.32	669.09	530.93
INVERSION INTERNA (GOES)	189.96	207.16	230.34	208.22	199.45
TOTAL INVERSION	892.48	988.23	1,128.66	877.31	730.38

FUENTE: DIRECCION GENERAL DE CAMINOS.

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CUADRO A.3.12.24

INVERSIONES PROGRAMADAS PARA LAS CARRETERAS INTERURBANAS PAVIMENTADAS POR FUENTE DE FINANCIAMIENTO - 1995 - 1999

(VALORES EN MILLONES DE COLONES)

FUENTE	1995	1996	1997	1998	1999
BID	241.58	379.25	394.30	297.22	193.60
BCIE	149.77	65.33	63.40	0.00	0.00
JAPON	67.37	170.93	272.80	272.80	272.80
BIRF	7.00	17.94	0.00	0.00	0.00
TOTAL INVERSION EXTERNA	458.72	615.51	730.50	570.02	466.40
INVERSION INTERNA (GOES)	98.27	130.49	149.02	135.09	127.33
TOTAL INVERSION	556.99	746.00	879.52	705.11	593.73

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inversiones por fuente de financiamiento programadas por la DGC para el periodo 1995-1999. Los Cuadros A.3.12.23 y A.3.12.24 presentan los flujos anuales de los aportes GOES para obras en proceso, estimadas para toda la red vial y para las carreteras interurbanas pavimentadas respectivamente.

- Obras propuestas. Está basado en las obras propuestas por el estudio. Este item no se consideró 100% aplicable a las carreteras interurbanas pavimentadas.

2.2 Costos por Tipo de Vehículo

A efectos de estimar los costos de mantenimiento derivados del transporte por carreteras interurbanas pavimentadas por tipo de vehículo, se efectuaron las siguientes operaciones:

- Los costos corrientes y de mantenimiento rutinario se distribuyeron entre los tipos de vehículos en base a los vehículos-kilómetro estimados por tipo de vehículo.

- Los costos de mantenimiento periódico se distribuyeron entre los tipos de vehículos en bas a los ejes equivalentes-kilómetro estimados por tipo de vehículo.

- Otrs costos de capital (servicio de la deuda de obras realizadas y en proceso, aportes GOES de obras en proceso y nuevas obras propuestas) se distribuyeron en base a los incrementos en vehículos-kilómetro estimados por tipo de vehículo.

El Cuadro A.3.12.25 resume los resultados de las operaciones arriba indicadas y presenta los costos estimados por tipo de vehículo.

3. Comparasion de Ingresos Fiscales y Costos de las Carreteras Interurbanas Pavimentadas

El Cuadro A.3.12.26 presenta el resultado final de comparar los ingresos fiscales derivados de la utilización de las carreteras interurbanas pavimentadas y los costos de las mismas, desglosados por tipo de vehículo.

CUADRO A.3.12.25

ESTIMATIVOS Y PROYECCIONES DE COSTOS DE LAS CARRETERAS INTERURBANAS PAVIMENTADAS POR TIPO DE VEHICULO - 1994 - 2015

ITEM	1996	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
AUTOMOVIL																				
VEHICULOS	139 820	151.864	165 207	179 580	195 203	212.186	230 646	250 712	272.524	298 234	322 006	350 021	380 473	413 574	449 555	488 866	531 180	577 393	627 626	682 229
VEHICULOS-KM (MILES)	658 454	725.992	800 481	882 646	973 272	1 073 244	1 183 537	1 305 225	1 439 496	1 587 649	1 751 129	1 931 550	2 130 639	2 350 387	2 592 870	2 860 516	3 155 908	3 481 957	3 841 834	4 239 080
AUMENTO VEH-KM (MILES)	60.589	67.538	74.488	82 165	90 626	99 972	110.293	121 688	134 271	148.153	163.480	180 421	199 089	219 728	242.503	267 645	295 392	326 050	359 877	397 226
EJES EQUIVAL-KM (MILES)	159	188	225	231	276	297	308	342	371	439	452	505	512	641	689	732	849	900	994	1 124
GASTOS CTES (MILLONES)	25 48	27 81	30 28	33 01	35 91	39 07	42 49	46 20	50 09	54 30	59 01	63 93	69 03	74 74	80 90	87 25	94 36	101 67	109 48	117 85
GASTOS CAPITAL (MILLONES)	97 11	133 85	175 99	207 43	238 38	200 57	205 51	210 43	218 14	222 97	631 49	406 98	415 10	423 22	431 22	627 74	495 84	591 78	561 19	569 90
MTO RUTINARIO (MILLONES)	15 61	15 75	16 41	17 04	17 62	18 35	19 05	19 71	20 44	20 98	21 71	22 41	23 01	23 74	24 63	25 17	25 88	26 46	27 28	27 98
MTO PERIODICO (MILLONES)	0 03	0 02	0 01	0 01	0 01	0 01	0 02	0 04	0 02	0 03	0 03	0 04	0 03	0 04	0 04	0 04	0 03	0 04	0 03	0 03
MTO RUTINARIO POR VEH	112	104	98	95	90	88	83	79	75	71	67	64	60	57	55	52	49	46	43	41
MTO PERIODICO POR VEH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL COSTOS	138 22	177 43	222 87	257 48	291 92	258 00	267 07	275 39	288 89	296 25	712 24	493 33	507 15	521 74	536 79	740 20	616 12	719 38	697 99	715 75
PICK-UP																				
VEHICULOS	102 444	108 078	114 022	120 293	126 909	133 889	141 253	149 022	157 218	165 865	174 988	184 612	194 766	205 478	216 779	228 702	241 281	254 551	268 551	283 321
VEHICULOS-KM (MILES)	898,118	933.739	970 814	1 009 357	1 049 544	1 091 332	1 134 813	1 180 068	1 227 168	1 276 198	1 327 213	1 380 300	1 435 571	1 493 090	1 552 948	1 615 260	1 680 099	1 747 601	1 817 846	1 890 982
AUMENTO VEH-KM (MILES)	34,185	35.620	37 076	38 583	40 147	41 789	43 481	45 255	47 101	49 027	51 018	53 087	55 271	57 519	59 858	62 312	64 839	67 502	70 245	73 117
EJES EQUIVAL-KM (MILES)	1 601	1 655	1 782	1 785	1 817	1 974	1 950	2 041	2 098	2 177	2 265	2 432	2 522	2 678	2 781	3 013	3 214	3 440	3 787	4 120
GASTOS CTES (MILLONES)	34 78	35 78	36 70	37 75	38 73	39 72	40 74	41 77	42 71	43 85	44 73	45 89	46 51	47 48	48 45	49 27	50 23	51 33	51 81	52 57
GASTOS CAPITAL (MILLONES)	54 78	70 59	87 60	97 [illegible]	105 60	83 84	81 02	78 28	78 52	73 79	197 07	119 74	115 24	110 79	106 44	146 15	108 54	122 52	109 54	104 90
MTO RUTINARIO (MILLONES)	21 29	20 26	19 90	19 46	19 00	18 66	18 27	17 82	17 43	16 85	16 46	15 01	15 50	15 08	14 75	14 21	13 78	13 29	12 91	12 48
MTO PERIODICO (MILLONES)	0 31	0 23	0 10	0 08	0 04	0 06	0 13	0 24	0 09	0 13	0 13	0 13	0 16	0 16	0 17	0 17	0 13	0 15	0 11	0 09
MTO RUTINARIO POR VEH	208	187	175	162	150	139	129	120	111	102	94	87	80	73	68	62	57	52	48	44
MTO PERIODICO POR VEH	3	2	1	1	0	1	1	2	1	1	1	1	1	1	1	1	1	1	0	0
TOTAL COSTOS	111 11	128 84	144 29	154 71	163 36	142 31	140 15	138 29	138 75	134 41	258 38	191 82	177 41	173 51	169 81	209 80	172 98	186 98	174 37	170 04
BUS																				
VEHICULOS	8 537	8 887	9 251	9 630	10 025	10 436	10 864	11 309	11 773	12 256	12 758	13 281	13 828	14 393	14 983	15 597	16 236	16 902	17 595	18 316
VEHICULOS-KM (MILES)	217,432	226 340	235 599	245 223	255 229	265 632	276 452	287 704	299 389	311 574	324 226	337 356	351 074	365 307	380 118	395 522	411 548	428 228	445 558	463 593
AUMENTO VEH-KM (MILES)	8 558	8 909	9 259	9 624	10 005	10 405	10 819	11 252	11 698	12,175	12 652	13 190	13 688	14 233	14 811	15 403	16 027	16 681	17 348	18 035
EJES EQUIVAL-KM (MILES)	257 577	268 210	279 153	290 542	302 425	314 778	327 608	340 901	354 843	369 239	384 289	399 325	418 011	432 978	450 592	468 513	487 906	507 842	528 205	549 682
GASTOS CTES (MILLONES)	8 41	9 67	9 91	9 17	9 42	9 67	9 92	10 15	10 42	10 66	10 93	[illegible]	[illegible]	[illegible]	[illegible]	12 06	12 31	12 50	12 70	12 89
GASTOS CAPITAL (MILLONES)	13 72	17 66	21 88	24 30	28 32	20 87	20 16	19 46	19 00	18 32	46 87	29 68	28 54	27 41	26 34	38 13	25 90	26 24	27 05	25 87
MTO RUTINARIO (MILLONES)	5 15	4 91	4 83	4 73	4 62	4 54	4 45	4 34	4 25	4 11	4 02	3 91	3 79	3 69	3 61	3 48	3 37	3 25	3 16	3 06
MTO PERIODICO (MILLONES)	50 38	38 96	14 99	12 46	3 20	13 [illegible]	21 00	39 68	16 07	22 89	21 98	29 [illegible]	26 88	25 50	[illegible]	27 10	19 42	22 39	15 32	12 28
MTO RUTINARIO POR VEH	604	553	522	491	461	435	410	384	361	338	315	295	274	256	241	223	203	193	180	167
MTO PERIODICO POR VEH	5 902	4 159	1 620	1 294	318	1 278	1 933	3 509	1 365	1 868	1 723	2 139	1 972	1 772	1 316	1 737	1 196	1 343	871	669
TOTAL COSTOS	27 67	68 20	50 60	50 68	46 55	48 40	55 53	72 67	49 75	55 39	85 30	73 53	89 53	88 22	89 02	78 07	52 00	88 59	58 23	54 08
CAMION C2 LIVIANO																				
VEHICULOS	5,844	6,148	6 468	6 804	7,158	7 530	7,922	8 334	8 767	9 223	9 703	10 208	10 739	11 297	11 884	12,502	13 152	13 838	14 556	15 312
VEHICULOS-KM (MILES)	95 487	100 603	105 959	111 579	117 475	123 650	130 146	138 943	144 085	151 549	159 418	167 658	176 312	185 399	194 931	204 950	215 478	226 517	238 121	250,298
AUMENTO VEH-KM (MILES)	4 876	5,116	5 356	5 620	5 896	6,175	6,496	5 757	7 122	7 484	7 867	8 240	8 656	9 087	9 532	10 019	10 527	11 039	11 605	12 177
EJES EQUIVAL-KM (MILES)	10,838	11 488	12,084	12 683	13,384	14 048	14 878	15 560	16 451	17 289	18 068	19 039	19 944	20 841	21 948	22 990	24 198	25 331	26 710	27 989
GASTOS CTES (MILLONES)	3.70	3 83	4 01	4 17	4 33	4 50	4 67	4 85	5 01	5 18	5 37	5 55	5 71	5 90	6 08	6 25	6 44	6 61	6 79	6 98
GASTOS CAPITAL (MILLONES)	7 81	10 14	12 65	14 19	15 51	12 39	12 10	11 75	11 57	11 28	30 39	18 59	18 05	17 50	16 95	23 50	17 67	20 04	18 10	17 47
MTO RUTINARIO (MILLONES)	2.28	2 18	2.17	2 15	2 13	2 11	2.10	2 07	2 05	2 00	1 98	1 94	1 90	1 87	1 85	1 80	1 77	1 72	1 69	1 65
MTO PERIODICO (MILLONES)	2 12	1 58	0 65	0 54	0 27	0 59	0 95	1 81	0 75	1 07	1 03	1 38	1 24	1 23	1 33	1 33	0 96	1 13	0 77	0 62
MTO RUTINARIO POR VEH	387	355	336	317	297	281	264	248	233	217	204	191	177	166	156	144	134	124	116	108
MTO PERIODICO POR VEH	383	257	100	80	38	79	120	217	85	116	107	138	116	109	112	106	73	32	53	41
TOTAL COSTOS	15 89	17 76	19 48	21 08	22 24	19 60	19 83	25 48	19 38	19 52	38 77	27 46	28 90	28 50	28 21	32 88	26 84	29 50	27 35	26 70

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CONTINUA CUADRO A 3.12.25

ITEM	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CAMION C2 PESADO																				
VEHICULOS	14 558	15 215	16 111	16 949	17 830	18 757	19 732	20 758	21 837	22 973	24 168	25 425	26 747	28 138	29 601	31 140	32 759	34 462	36 254	38 139
VEHICULOS-KM (MILES)	284 061	298 656	313 973	330 054	347 006	364 791	383 486	403 133	423 772	445 473	463 285	492 255	517 461	543 957	571 811	601 088	631 866	664 253	698 285	734 060
AUMENTO VEH-KM (MILES)	13 872	14 595	15 317	16 111	16 952	17 785	18 696	19 647	20 639	21 701	22 812	23 973	25 203	25 496	27 854	29 277	30 798	32 367	34 031	35 776
EJES EQUIVAL-KM (MILES)	617 770	649 510	682 322	717 353	754 713	793 437	834 080	876 761	921 720	968 912	1 018 477	1 070 617	1 125 403	1 182 992	1 243 554	1 307 291	1 374 143	1 444 514	1 519 465	1 596 227
GASTOS CTES (MILLONES)	10 99	11 44	11 87	12 35	12 80	13 28	13 77	14 27	14 75	15 24	15 78	16 29	16 77	17 30	17 84	18 33	18 89	19 40	19 90	20 41
GASTOS CAPITAL (MILLONES)	22 23	29 92	36 19	40 67	44 51	35 68	34 84	33 98	33 53	32 66	88 12	54 07	52 55	51 03	49 53	68 67	51 70	58 75	53 07	51 33
MTO RUTINARIO (MILLONES)	6 73	6 48	6 44	6 37	6 28	6 24	6 17	6 09	6 02	5 88	5 81	5 71	5 59	5 49	5 43	5 29	5 18	5 05	4 96	4 84
MTO PERIODICO (MILLONES)	120 84	89 50	38 67	20 80	15 47	33 56	53 46	102 05	41 75	60 07	58 26	77 83	70 00	69 68	75 11	75 56	54 69	64 57	44 04	35 60
MTO RUTINARIO POR VEH	462	423	400	376	352	333	313	293	276	256	240	225	209	195	184	170	158	146	137	127
MTO PERIODICO POR VEH	8 300	5 844	2 276	1 217	868	1 789	2 710	4 916	1 912	2 615	2 410	3 061	2 617	2 476	2 537	2 426	1 669	1 574	1 215	933
TOTAL COSTOS	160 79	136 25	91 16	90 19	79 07	88 76	102 24	156 39	96 05	113 85	167 96	153 91	144 90	143 50	147 91	167 35	130 46	147 76	121 96	112 47
CAMION C3																				
VEHICULOS	1 618	1 702	1 791	1 884	1 982	2 085	2 193	2 307	2 427	2 553	2 686	2 826	2 973	3 128	3 291	3 462	3 642	3 831	4 030	4 240
VEHICULOS-KM (MILES)	32 432	34 410	36 478	38 623	40 866	43 207	45 655	48 206	50 862	53 249	56 559	59 599	62 780	66 120	69 596	73 245	77 062	81 044	85 236	89 624
AUMENTO VEH-KM (MILES)	1 969	1 978	2 068	2 145	2 243	2 341	2 448	2 552	2 656	2 737	2 908	3 042	3 180	3 340	3 476	3 649	3 816	3 982	4 190	4 388
EJES EQUIVAL-KM (MILES)	70 248	74 617	78 991	83 644	88 467	93 521	98 778	104 433	110 138	116 155	122 381	129 055	135 995	143 205	150 745	158 609	166 968	175 638	184 745	194 227
GASTOS CTES (MILLONES)	1 28	1 32	1 38	1 44	1 51	1 57	1 64	1 71	1 77	1 83	1 91	1 97	2 03	2 10	2 17	2 23	2 30	2 37	2 43	2 49
GASTOS CAPITAL (MILLONES)	3 03	3 92	4 89	5 41	5 90	4 70	4 56	4 41	4 31	4 20	11 23	6 86	6 63	6 43	6 18	8 56	6 41	7 23	6 54	6 30
MTO RUTINARIO (MILLONES)	0 77	0 75	0 75	0 75	0 74	0 74	0 74	0 73	0 72	0 71	0 70	0 69	0 68	0 67	0 66	0 64	0 63	0 62	0 61	0 59
MTO PERIODICO (MILLONES)	13 74	10 25	4 24	3 59	1 81	3 96	6 33	12 16	4 99	7 20	7 00	9 28	8 46	8 43	9 10	9 17	6 65	7 35	5 36	4 03
MTO RUTINARIO POR VEH	475	439	418	396	373	354	335	316	298	277	261	245	228	213	201	186	174	161	150	140
MTO PERIODICO POR VEH	8 492	6 041	2 368	1 905	915	1 897	2 887	5 269	2 056	2 821	2 606	3 320	2 845	2 697	2 767	2 643	1 825	2 049	1 329	1 022
TOTAL COSTOS	15 79	15 27	11 25	11 19	9 96	10 96	13 07	19 00	11 30	13 94	20 34	18 91	17 30	17 64	18 12	20 61	15 93	19 06	14 93	13 71
CAMION C2S2																				
VEHICULOS	2 620	2 806	3 005	3 218	3 446	3 691	3 953	4 234	4 535	4 857	5 202	5 571	5 967	6 391	6 845	7 331	7 852	8 409	9 006	9 645
VEHICULOS-KM (MILES)	53 947	58 145	62 609	67 350	72 385	77 755	83 463	89 553	96 025	102 930	110 286	118 124	126 503	135 424	144 951	155 114	165 963	177 547	189 911	203 132
AUMENTO VEH-KM (MILES)	3 932	4 195	4 465	4 740	5 035	5 367	5 708	6 090	6 473	6 904	7 356	7 837	8 379	8 921	9 527	10 163	10 849	11 584	12 365	13 221
EJES EQUIVAL-KM (MILES)	127 271	137 193	147 752	158 385	170 754	183 401	196 330	211 195	225 434	242 732	260 222	278 623	298 358	319 414	341 915	365 871	391 463	418 385	447 964	479 133
GASTOS CTES (MILLONES)	2 09	2 23	2 37	2 52	2 67	2 83	3 00	3 17	3 34	3 52	3 72	3 91	4 10	4 31	4 52	4 73	4 96	5 19	5 41	5 65
GASTOS CAPITAL (MILLONES)	8 30	9 32	10 55	11 97	13 25	10 77	10 64	10 52	10 50	10 39	28 42	17 68	17 47	17 18	16 94	23 64	19 21	21 02	19 28	18 97
MTO RUTINARIO (MILLONES)	1 28	1 29	1 29	1 30	1 31	1 33	1 34	1 35	1 36	1 36	1 37	1 37	1 37	1 37	1 38	1 37	1 36	1 35	1 35	1 34
MTO PERIODICO (MILLONES)	24 39	18 91	7 93	6 82	3 50	7 78	12 62	24 55	10 29	15 05	14 83	20 26	18 56	18 81	20 65	21 15	15 58	18 72	12 99	10 63
MTO RUTINARIO POR VEH	488	450	427	404	380	360	340	319	301	280	263	246	229	214	201	186	173	160	150	139
MTO PERIODICO POR VEH	9 502	6 727	2 640	2 118	1 016	2 102	3 192	5 508	2 262	3 099	2 861	3 636	3 110	2 944	3 017	2 885	1 984	2 227	1 443	1 108
TOTAL COSTOS	34 56	30 71	22 13	22 60	20 72	22 89	27 59	39 64	25 45	30 32	48 38	43 21	41 49	41 67	43 49	51 08	40 11	46 29	39 03	36 54
TOTAL																				
VEHICULOS	275 441	294 920	315 855	338 358	362 553	388 574	416 563	446 676	479 091	513 961	551 511	591 944	635 491	682 399	732 938	787 400	846 102	909 384	977 617	1 051 202
VEHICULOS-KM (MILES)	2 239 931	2 377 858	2 525 914	2 684 901	2 855 778	3 039 610	3 237 551	3 450 831	3 680 739	3 929 022	4 197 113	4 486 373	4 800 339	5 139 664	5 507 225	5 905 694	6 337 943	6 807 128	7 316 792	7 870 730
AUMENTO VEHICULOS-KM (MIL	127 881	137 955	148 029	158 987	170 877	183 832	197 941	213 280	229 953	248 222	268 093	289 760	313 466	339 325	367 562	398 469	432 249	469 185	509 664	553 938
EJES EQUIVAL-KM (MILES)	1 085 464	1 142 840	1 202 819	1 265 713	1 331 835	1 401 344	1 474 442	1 551 233	1 632 052	1 717 005	1 806 154	1 900 096	1 998 745	2 102 746	2 212 183	2 327 309	2 448 748	2 576 350	2 710 913	2 852 483
GASTOS CTES (MILLONES)	86 70	91 04	95 60	100 38	105 39	110 66	116 20	122 01	128 11	134 52	141 25	148 32	155 73	163 52	171 70	180 28	189 29	198 75	208 69	219 13
GASTOS CAPITAL (MILLONES)	204 95	273 40	349 75	401 36	449 48	368 83	368 83	368 83	372 58	373 53	1 035 58	653 58	653 58	653 58	653 58	934 58	725 58	851 58	794 75	794 75
MTO RUTINARIO (MILLONES)	53 03	51 68	51 69	51 69	51 71	52 13	52 20	52 05	52 11	52 00	52 01	51 97	51 83	51 86	52 08	52 03	52 15	52 04	51 85	52 02
MTO PERIODICO (MILLONES)	212 32	157 53	84 57	54 24	27 34	59 25	94 44	180 61	73 86	106 50	103 37	138 11	124 28	123 94	133 63	134 61	97 43	115 27	78 55	63 70
GASTOS CTS POR VEH-KM	0 0387	0 0383	0 0378	0 0374	0 0369	0 0364	0 0359	0 0354	0 0348	0 0342	0 0337	0 0331	0 0324	0 0318	0 0312	0 0305	0 0299	0 0292	0 0285	0 0278
GASTO CAPITAL POR AUVEH-K	1 6027	1 9818	2 3627	2 5245	2 6304	2 0063	1 8633	1 7293	1 6248	1 5050	3 8628	2 2556	2 0850	1 9261	1 7782	2 3454	1 6786	1 8150	1 5594	1 4347
MTO RUTINARIO POR VEH-KM	0 0237	0 0217	0 0205	0 0193	0 0181	0 0171	0 0161	0 0151	0 0142	0 0132	0 0124	0 0116	0 0108	0 0101	0 0095	0 0088	0 0082	0 0076	0 0071	0 0066
MTO PERIODICO POR EE-KM	0 1956	0 1378	0 0537	0 0429	0 0205	0 0423	0 0641	0 1164	0 0453	0 0620	0 0572	0 0727	0 0622	0 0589	0 0604	0 0578	0 0398	0 0447	0 0290	0 0223
GASTO CTS POR VEH	315	309	303	297	291	285	279	273	267	262	256	251	245	240	234	229	224	219	213	208
GASTO CAPITAL POR VEH	91	115	138	149	157	121	114	107	101	95	247	146	136	127	119	158	114	125	109	101
MTO RUTINARIO POR VEH	193	175	164	153	143	134	125	117	109	101	94	88	82	76	71	66	62	57	53	49
MTO PERIODICO POR VEH	771	534	204	160	76	152	227	404	154	207	187	233	196	182	182	171	115	127	80	61
TOTAL COSTOS	557 00	573 65	581 22	607 68	633 92	590 27	631 27	723 50	627 36	666 60	1 332 21	991 98	985 43	992 90	1 010 99	1 301 50	1 064 44	1 217 84	1 133 84	1 129 60

FUENTE FREDERIC R HARRIS INC

CUADRO A.3.12.28

PROYECCIONES DE INGRESOS FISCALES Y COSTOS DE LAS CARRETERAS INTERURBANAS PAVIMENTADAS POR TIPO DE VEHICULO - 1984 - 2015

(VALORES EN MILLONES DE COLONES A PRECIOS DE 1984)

ITEM	1985	1986	1987	1988	1989	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
AUTOMOVIL																				
INGRESOS	198.10	158.74	175.18	193.28	213.17	238.01	262.42	289.29	318.83	352.28	388.11	428.63	472.03	521.07	575.06	634.53	699.98	772.01	851.28	940.69
COSTOS	138.22	177.43	222.67	257.48	291.92	258.00	287.07	276.38	288.69	298.25	712.24	493.33	507.18	521.74	538.79	740.20	616.12	718.98	697.99	715.75
SUPERAVIT (DEFICIT)	57.68	(18.69)	(47.51)	(64.22)	(78.75)	(19.99)	(4.65)	12.90	30.14	54.03	(324.13)	(64.70)	(35.15)	(0.67)	38.29	(105.67)	83.86	52.05	153.29	224.94
PICK-UP																				
INGRESOS	158.08	158.91	165.31	171.68	178.52	186.85	194.50	202.13	210.31	218.81	227.23	236.29	246.07	255.79	266.28	276.67	287.90	299.53	311.57	324.03
TOTAL COSTOS	111.11	126.84	144.29	154.71	163.38	142.31	140.15	138.09	136.25	134.41	258.38	181.62	177.41	173.51	169.81	209.50	172.98	186.38	174.37	170.04
SUPERAVIT (DEFICIT)	44.97	32.07	21.02	18.98	15.16	44.54	54.35	64.04	73.56	84.40	(31.15)	54.67	68.66	82.28	96.47	66.87	114.92	112.55	137.20	153.99
BUS																				
INGRESOS	(68.14)	(67.84)	(67.03)	(66.18)	(65.29)	(64.15)	(63.18)	(62.18)	(60.97)	(59.88)	(58.75)	(57.57)	(56.24)	(55.05)	(53.59)	(52.21)	(50.77)	(49.27)	(47.71)	(45.97)
TOTAL COSTOS	77.67	88.20	50.60	50.66	48.55	48.40	55.53	73.67	49.75	55.99	35.60	73.53	59.55	48.22	49.02	73.77	62.00	58.69	58.23	54.08
SUPERAVIT (DEFICIT)	(145.81)	(138.04)	(117.63)	(116.84)	(111.84)	(112.55)	(118.71)	(135.85)	(110.72)	(115.87)	(144.55)	(131.40)	(125.02)	(123.27)	(122.61)	(130.98)	(112.77)	(117.96)	(105.94)	(100.05)
CAMION C2 LIVIANO																				
INGRESOS	7.32	7.43	7.84	8.25	8.68	9.15	9.62	10.12	10.65	11.20	11.79	12.40	13.04	13.70	14.42	15.16	15.92	16.75	17.59	18.51
TOTAL COSTOS	15.89	17.78	19.48	21.08	22.24	19.60	19.83	[illegible]	19.38	19.52	38.77	27.46	26.90	26.50	26.21	32.58	25.84	29.50	27.35	26.70
SUPERAVIT (DEFICIT)	(8.57)	(10.35)	(11.64)	(12.83)	(13.56)	(10.45)	(10.21)	[illegible]	(8.73)	8.33	(26.98)	(15.06)	(13.86)	(12.80)	(11.79)	(17.42)	(10.92)	(12.75)	(9.76)	(8.19)
CAMION C2 PESADO																				
INGRESOS	30.02	30.66	32.22	33.89	35.61	38.00	39.92	41.99	44.12	46.42	48.77	51.31	53.90	56.71	59.57	62.59	65.83	69.18	72.78	76.44
TOTAL COSTOS	160.79	136.35	91.18	90.19	79.07	88.78	108.24	156.39	96.05	113.85	167.98	153.91	144.90	143.50	147.91	167.35	130.46	147.78	121.98	112.17
SUPERAVIT (DEFICIT)	(130.77)	(105.69)	(58.96)	(56.30)	(43.46)	(50.78)	(68.32)	(114.40)	(51.93)	(67.43)	(119.19)	(102.60)	(91.00)	(86.79)	(88.34)	(105.25)	(64.63)	(73.60)	(49.20)	(35.73)
CAMION C3																				
INGRESOS	4.09	4.23	4.48	4.75	5.02	5.53	5.84	6.18	6.51	6.85	7.24	7.62	8.04	8.47	8.90	9.37	9.85	10.37	10.91	11.48
TOTAL COSTOS	18.79	16.27	11.25	11.19	9.98	10.98	13.27	19.00	11.50	13.94	26.64	18.91	17.30	17.64	18.12	20.81	15.99	18.08	14.93	13.71
SUPERAVIT (DEFICIT)	(14.70)	(12.04)	(6.77)	(6.44)	(4.94)	(5.43)	(7.43)	(12.82)	(5.29)	(7.09)	(19.60)	(11.29)	(9.26)	(9.17)	(9.22)	(11.44)	(6.14)	(7.69)	(4.02)	(2.23)
CAMION C3S2																				
INGRESOS	13.18	13.85	14.83	16.06	17.23	19.47	20.82	22.44	24.06	25.78	27.64	29.60	31.69	33.92	36.32	38.85	41.60	44.49	47.59	50.89
TOTAL COSTOS	34.56	30.71	22.13	22.60	20.73	22.09	27.59	39.64	25.48	30.32	48.38	43.21	41.49	41.67	43.49	51.08	40.11	46.28	39.03	36.64
SUPERAVIT (DEFICIT)	(21.38)	(16.86)	(7.29)	(6.54)	(3.50)	(3.22)	(6.87)	(17.20)	(1.42)	(4.54)	(20.74)	(13.61)	(9.80)	(7.75)	(7.17)	(12.23)	1.49	(1.79)	8.56	14.25
TOTAL																				
INGRESOS	338.65	305.98	332.91	361.72	392.94	432.86	470.04	509.97	553.51	601.46	652.03	708.28	768.43	834.61	906.98	984.98	1.070.31	1.163.04	1.263.99	1.376.07
TOTAL COSTOS	557.00	573.65	561.62	667.68	833.92	590.87	631.87	723.50	627.66	668.60	1.332.21	991.98	985.43	992.90	1.010.99	1.301.50	1.064.44	1.217.64	1.133.84	1.129.60
SUPERAVIT (DEFICIT)	(218.35)	(267.67)	(228.71)	(245.96)	(249.98)	(158.01)	(161.83)	(213.53)	(74.15)	(65.14)	(680.18)	(283.70)	(217.00)	(158.29)	(104.01)	(316.54)	5.87	(54.60)	130.15	246.47

FUENTE. FREDERIC R. HARRIS, INC