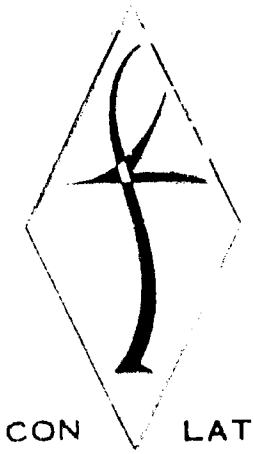

CONSULTORA LATINOAMERICANA, LTDA.
CONSULTING ECONOMISTS AND ENGINEERS
EDIFICIO BRAUN VALLE
GUATEMALA, GUATEMALA

FINAL REPORT OF TECHNICAL SERVICES PROVIDED TO THE PLANNING UNIT, DIRECCION GENERAL DE CAMINOS GUATEMALA, C. A.

PERIOD: OCT. 17, 1967 -- DEC. 31, 1968

Contract with U.S. AID/Guatemala
No. AID-520-222-T

(2)

FINAL REPORT OF
CONSULTORA LATINOAMERICANA, LTDA.
ON TECHNICAL SERVICES PROVIDED TO THE
PLANNING UNIT, DIRECCION GENERAL DE CAMINOS
GUATEMALA, C. A.

Contract No.

Contract No. AID-520-222T,
PIO/T 520-185-3-80038
(For the period October 17, 1967
through October 16, 1968.)
Extension until December 31, 1968.

December 1968

CONSULTORA LATINOAMERICANA, LTDA.
Consulting Economists and Engineers
Edificio Braun Valle - Office No. 218
6th. Ave. 12-21, Zone 1, Guatemala, C.A.

December 31, 1968

Mr. Deane R. Hinton,
Director
US AID/Guatemala
Edificio Cruz Azul,
Guatemala, Guatemala

Dear Mr. Hinton:

It is my privilege to transmit to you 25 copies in English and 25 copies in Spanish of the Final Report representing the accomplishments of the Consultants of Consultora Latinoamericana, Ltda. during the period October 17, 1967 through December 31, 1968 in which technical assistance was provided to the Planning Unit of the Department of Highways of Guatemala.

On behalf of Ingeniero Raúl Leclair and myself I wish to express our appreciation for the cooperation given us by members of your staff and yourself during the period of this contract.

We sincerely hope that the technical assistance provided during this contract will result in improved highway planning which in turn will be of very substantial benefit to the Government and the citizens of Guatemala.

Sincerely yours,

James R. Snitzler
Director

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A. SUMMARY AND RECOMMENDATIONS

1. This report covers the technical assistance provided to the Planning Unit of the Guatemalan Department of Highways by Consultora Latinoamericana, Ltda. for the period October 17, 1967 through December 31, 1968. This assistance was provided by the local U.S. AID Mission to Guatemala under the terms of a technical assistance agreement signed in 1954 between the Government of Guatemala and the Mission.

2. Personnel assigned to work under this contract by Consultora Latinoamericana were Dr. James R. Snitzler, Transport Economist; and, Ing. Raúl Leclair, Traffic Engineer. Dr. Snitzler was assigned one-third time and Ing. Leclair, full-time.

3. The major contribution by the Consultants during this second year of the contract was the development of a National Highway Plan for the period 1969-1974. They were assisted in this work by an engineer and analyst from Caminos, and an agronomist and two analysts from other institutions of the government.

4. In the development of the National Highway Plan, coordination was maintained with other planning agencies such as the National Planning Council, the Secretariat of Economic Integration for Central America (SIECA) and the Sectorial Planning Unit of the Ministry of Communications and Public Works.

5. In March 1968 a Highway Inventory was initiated by the Planning Section of the Highway Department with special financial assistance provided by AID in the form of funds for the purchase of equipment; the rental of vehicles; and per diem for the field people. The Consultants contributed a substantial amount of their time in the planning stages of this work and later in field checking the results.

6. The National Traffic Counting Program organized and supervised by the Consultants is illustrated by a 175-page report entitled "Tránsito por Carreteras de Guatemala, 1967".

7. An annual kilometer study by type of vehicles was orga-

nized by the Consultants with highway interviews in September 1967 and completed with visits to the homes of the drivers of those vehicles in September 1968.

8. Continued assistance was provided in the development of the National Traffic Program in 1968.

9. Assitance was provided in project evaluation of the Caminos Vecinales. The Consultants also participated in the development of a methodology for priority selection of projects for study within the Caminos Vecinales Plan.

10. Training was provided to the Planning Unit through personnel working deirectly with the Consultants; through individual and group discussions; and, through the preparation and distribution of training documents.

11. Assistance was given to the Statistical Section in improving the form and content of the DGC Annual Memoria, 1967.

12. Assistance was also provided to the same section in the preparation of Statistical Bulletin No. 2.

13. Efforts were made to implement the project for classification and numbering of Guatemala's highways proposed by Lloyd Morrison of the B.P.R.

14. Having in mind the problems encountered and the results achieved during the period of technical assistance the Consultants make the following recommendations:

a) That the key personnel of the Planning Unit place more stress upon training in traffic engineering, project evaluation and programming. There exists a need for continued improvement in techniques of planning, and good results can be obtained through having key personnel take special courses.

b) That the traffic Counting Program initiated by the Consultants be vigorously pursued each year and that the traffic counters be maintained in good operating condition.

c) That the system of numbering and classification of highways be put into effect.

d) That the National Highway Plan be complemented with evaluation of projects recommended for the period beyond 1974.

e) That in two years a review be made of the National Highway Plan to see whether or not substantial changes have occurred in the national economy which would require changes in the plan.

f) That vehicle operating costs used in evaluating the Caminos Vecinales projects be revised along the lines of Jan de Weille's data in his publication "Quantification of Road User Savings".

g) That an evaluation be made of the advantage of investing more in the construction of new penetration roads rather than paving projects within the Caminos Vecinales Plan.

h) That a typical project of the Caminos Vecinales be selected for intensive study in all phases including economic traffic and engineering. If the project demonstrates that is justifiable and is later constructed, then within a reasonable period of years, perhaps three, after the termination of the project, an appraisal should be made of the actual economic and traffic development by the project. This would then be compared with the earlier projections.

i) That studies of axel loads and speeds be undertaken with the portable scales and radar equipment donated by AID.

B. BACKGROUND OF THE ADVISORY ASSISTANCE

This report covers the activities and accomplishments of the Consultants during the period October 17, 1967 through December 31, 1968. These activities relate to technical assistance provided to the Planning Section of Guatemala's Highway Department and are part of an overall program of technical assistance which the United States Agency for International Development Mission to Guatemala is providing to the Government of Guatemala. This specific assistance program dates from 1954 under the terms of an agreement drawn up at that time between the US AID and the GOG.

The technical assistance described within this report was provided under the terms of Contract No. AID-520-222-T dated December 4, 1967, between the U.S. AID Mission to Guatemala and Snitzler-Lottmann, Cía. Ltda. (Consultora Latinoamericana, Ltda.) of Guatemala.

The purpose of this assistance is fully explained in part C of this report, but in essence, it consisted in assisting and training the Planning Section personnel in all their activities, which are directly or indirectly related to highway planning. The emphasis here is upon training, since the Planning Section personnel lacked experience in this vital aspect of highway activity.

Personnel assigned to this work by the consulting firm were Dr. James R. Snitzler for four months and Ing. Raúl Leclair for 12 months. Dr. Snitzler is a Transport Economist with wide experience as a Consultant in various countries. Ing. Leclair is a specialist in Transport Programming and a Traffic Engineer.

C. CONSULTANT'S RESPONSIBILITIES

In general terms, the prime objective of these services is to provide technical assistance to the Planning Section of the D.G.C., and in so doing, train the personnel of the Planning Section so that the programs started by the Consultants can be carried on successfully upon termination of the technical assistance. The training phase was covered by direct

work contact and informal discussions by the Consultants, integrating part of the three working teams identifiable in the assisted section as: one with the responsibilities of gathering and analyzing transport statistics; the second, working on project evaluation; and a third, dedicated to planning. In these three aspects, all functions of the technical assistance program are covered.

The specific duties and responsibilities of the Consultants are detailed in the following terms of the contract:

1. Continue to review presently scheduled highway projects to determine whether they are the best ones for the country in terms of future as well as present needs and/or benefits, including consideration and definitive analysis of all reasonable alternatives; and

2. Formulate a five-year national highway plan for the period calendar year 1969 to 1974, and formulate criteria for a long-term plan through the end of calendar year 1984; and

3. Continue the review and analysis of presently scheduled projects as they relate to the first five year national highway plan and establish a schedule of project priorities as an integral part of the plan; and

4. Continue to assist the Planning Section in coordinating the national highway plan (CY 1969-1974) with the National Planning Office and with the proposed regional development plans of such agencies as SIECA, the Joint Planning Mission and the Central American Bank for Economic Integration; and

5. Continue to advise and assist in the implementation by the Planning Section of:

   a. Nation-wide inventory of highways.

   b. Inventory of motor vehicles and nation-wide traffic counting program.

   c. Traffic studies including ADT, travel speeds, distances and travel times between major

cities, ports and frontiers.

d. Development of traffic projections on all regional, primary and secondary highways and determination of highway capacities and estimates (in time) of when design capacities will be reached and improvement programs will be required.

6. Advise and through direct supervision assist the Planning Section in implementing the nation-wide traffic counting program and vehicle classification; and

7. Continue to advise and assist on economic and engineering feasibility studies under the "Caminos Vecinales" program and the formulation of a priority rating system for the selection of caminos vecinales projects.

8. Continue analysis of the nation-wide Transportation System with major emphasis upon highways.

9. Continue analysis of highway financing including sources, uses of funds and user charges and highway construction costs.

10. Continue training the personnel of the Planning Unit on the project evaluation, short and long-range planning, traffic engineering techniques, report preparation and other activities as necessary.

11. Review Statistical Sections organization, work load, and program and prepare recommendations for a revised organization and program of work utilizing to the fullest extent the available man-power. Among the activities to be covered under the work program are:

a) Review the Annual Memorium and make recommendations directed toward increasing its general effectiveness and appeal and to include cost data on maintenance of different types of highways and vehicles.

b) Continue assistance in development of improved procedures for collection and analysis of data to be used in a semi-annual statistical bulletin and special reports

as necessary.

c) Assist in the preparation of tables and text for the Second Highway Statistical Bulletin.

d) Review and advise on the utilization of traffic counting data gathered prior to 1967.

e) Make recommendations on assignment of personnel for the expanded traffic counting program.

12. Continue assistance on implementation of the highway numbering and classification system.

Although the Consultants carried out all of their duties and responsibilities according to the above enumerated list, they encountered obstacles which unnecessarily delayed them and resulted in expenses considerably above that contemplated in the contract.

One of these major obstacles was the considerable delay encountered in the receipt of equipment donated by U.S. AID to the Planning Section to be utilized in fundamental studies to fulfill other obligations. Such is the case of the equipment acquired for the Highway Inventory and the Traffic Study which was supposed to be delivered no later than December 1967 according to the order given by U.S. AID.

The nine traffic counters and the "Fifth Wheel" were not received till the middle of May 1968. In the case of the traffic counters, the first six months of data for 1968 which were expected from the expanded traffic program, were thus lost. Similarly, in the case of the "Fifth Wheel", which is used to measure distances for the Highway Inventory, six months of time was lost.

The radar to be used for speed studies and the gyroscopes for use in the Highway Inventory, were not received till July 1968. The late delivery of these items prevented their use by the Consultants.

The other major obstacle was the lack of sufficient

adding machines and calculators. Although these machines were supposed to have been furnished by Caminos, never during the two consecutive years of the contract were there ever sufficient machines in the Planning Section for the Consultants and the Planning Section personnel to accomplish their work with dispatch. Although AID contributed a calculator and an adding machine during the last year's contract, this only partially alleviated the problem.

The following pages of this report contain a complete description of the Consultant's work. To make the evaluation easier, the outline followed is in the same order as the above stated specific responsibilities of the Consultants. Also, comments and recommendations are provided whenever necessary in the development of this report.

1. Review of Presently Scheduled Highway Projects

The Consultants considered that those projects which were under construction or whose construction had been contracted were not subject to change in terms of whether or not such projects were actually feasible; thus, no evaluation of these projects were made by the Consultants.

The projects included within this category and which fall within the Five-year National Highway Plan, 1969-1974 are:

	PROJECT	Length	Type of Improvement	Investment (1000's of Q's)
a.	Morales-Modesto Méndez	64 Kms.	Earthwork & Drainage	3,500
b.	Pte. Arroyo-La Mesilla	69 Kms.	Asphalt	3,104
c.	Pte. Selegua II - Pte. Selegua III	11 Kms.	Earthwork & Asphalt	1,146
d.	El Rancho-Sta. Elena	49 Kms.	Earthwork & Drainage	4,119
e.	Sta. Elena-Salamá	17 Kms.	Earthwork & Drainage	1,879
f.	Sta. Elena-Cobán	80 Kms.	Earthwork & Drainage	8,268
g.	Padre Miguel-Anguiatú	91 Kms.	Earthwork, Drainage & Asphalt	3,568
h.	Los Encuentros-Quiché	36 Kms.	Asphalt	360
i.	San Mateo-San Juan Cot.	36 Kms.	Asphalt	360
	TOTAL	383 Kms.		26,304

As of December 31, 1968, Q.10.8 million, or about 40 per cent of the total had been invested in the nine projects listed above.

A second category of projects within the National Highway Plan are those for which economic and technical feasibility studies have been contracted and are currently underway.

These include the four northern highways study under contract with Louis Berger, Inc. of East Orange, New Jersey, and the Morales-Modesto Méndez-San Julián-El Estor-San Felipe highway study (approximately 241 kilometers) under contract with the concortium of Frederick R. Harris of New York City and Consuldeca of Guatemala.

The northern highways study includes the following roads:

Vértice de Santiago-Chisec (approx. 210 Kms.)
Chisec-Puerto Modesto Méndez (approx. 140 Kms.)
Huehuetenango-Intersect with Cobán Road (approx. 170 Kms.)
Cobán-Flores (approx. 215 Kms.)

Completion of this study is scheduled for February 1970, while the Harris-Consuldeca contract calls for submission of a draft feasibility report on February 15, 1969, and a final report in May 1969.

Because these two sets of feasibility studies were well underway with personnel availability much greater than that for the entire National Highway Plan, the Consultants did not attempt to make an independent evaluation of these projects. They felt it was far better from the standpoint of their very limited manpower resources to evaluate a series of projects which had not yet been scheduled for study.

There are seven projects included within this group which were evaluated by the Consultants

using the method known as the Internal Rate of Return, the rate which equalizes discounted benefits and costs. These projects are listed below:

	PROJECT	Length	Type of Improvement	Investment (1000's of Q's)
a.	Autopista Guatemala-Escuintla	47 Kms.	Earthwork, Drainage & Asphalt	19,160
b.	Escuintla-Texisco	50 Kms.	Earthwork, Drainage & Asphalt	3,500
c.	El Rancho-Sta. Elena	49 Kms.	Asphalt	1,470
d.	Sta. Elena-Cobán	80 Kms.	Asphalt	2,400
e.	Sta. Elena-Salamá	17 Kms.	Asphalt	510
f.				
f.	Sanarate-Jalapa	45 Kms.	Earthwork, Drainage & Asphalt	4,950
g.	Entre Ríos - Front. Honduras	21 Kms.	Earthwork, Drainage & Asphalt	2,940
	TOTAL	309 Kms.		38,930

2. Formulate a Five-Year National Highway Plan

Under the direction of the Consultants, a small working group was formed to prepare a National

Highway Plan for the period 1969-1974. This working group consisted of:

Ing. F. Javier Godoy - Dirección General de Caminos
Br. Hugo Rivera (Analyst) - Dir. Gen. de Caminos
Br. René Orellana - Consejo Nacional de Planificación
Br. Rolando Chávez - Consejo Nac. de Planificación
Ing. Humberto Ortiz - Ministerio de Agricultura

Messrs. Godoy and Rivera worked with the Consultants on a full-time basis since May 1968. Mr. Orellana worked approximately one week and Mr. Chávez on a part-time basis from the middle of July until the end of October. Ing. Ortiz worked with the Consultants for approximately one month. None of these persons had had previous experience in highway planning or in projet evaluation.

The integration of this working group was the final result of a series of conferences which the Consultants conducted with the Director, the Sub-director and the departmental heads of Caminos. For these meetings the Consultants had prepared a detailed outline of the procedures and methodology to be followed and the content anticipated in the National Highway Plan.

The Consultants had also investigated the possibility of using the computer at the University of San Carlos. The University has a Transport Model Program which has not yet been utilized or tested for Guatemala. With the data which the Consultants and the working group had gathered and analyzed, the use of the computer could have been very beneficial to the study. Unfortunately, however, Caminos had no funds for this purpose, nor were there funds in the contract for this use. The Consultants strongly recommend that in revisions of the National Highway Plan use be made of the University's computer to evaluate further prospective highway projects.

The steps developed by the Consultants for the

execution of the National Highway Plan with the assistance of the working group were as follows:

1. Investigation of all sources of economic and technical data and the compilation of the same.

2. The planning and execution of field studies, particularly those of traffic.

3. Analysis of the information obtained.

4. Projections of economic and demographic information for 1974, 1984 and general trends through 1994.

5. Projections of traffic movement measured in relation to the present and projected economic activity.

6. Determination of the needs of highway investments and presentation of the plan.

All possible sources of information were contacted for the large amount of economic, financial and technical data required in the National Highway Plan. These included among others most of the Ministries of the Government; autonomous agencies such as the Port Authorities of Matías de Gálvez and Champerico and the National Institute of Electrification; regional agencies such as SIECA, CABEI and ICAITI; international agencies including U.S. AID locally and the regional mission (ROCAP); the United National Mineral Survey Team and FAO-FYDEP Forestry Group; and a large number of local producers, business organizations, motor carrier operators, airline and railroad officials and many others too numerous to mention here.

All of the economic information was analyzed at the national and departmental level including production and apparent consumption estimates for 26 products or product groups representing the bulk of the economic activity of the country.

The Central American Transportation Study of 1964-1965 was an extremely valuable reference work in this economic analysis. The Consultants, however, expanded the list of agricultural products contained in the CATS Study to more clearly fit the Guatemalan economy. For example, to the CATS list was added: wheat, grain sorghum, potatoes, vegetables and fruits.

The complete list of products and product groups analyzed in the study were:

1. Cotton
2. Rice
3. Sugar
4. Bananas
5. Coffee
6. Beans
7. Fruits, Citrus and Deciduous
8. Cattle
9. Meat
10. Milk
11. Corn
12. Potatoes
13. Plantain
14. Grain Sorghum
15. Wheat
16. Vegetables
17. Other Agricultural Products
18. Food products, beverages and tobacco, oils and fats of animal and vegetable origin
19. Fuels, lubricants and similar products
20. Chemical products
21. Machinery and material of transport
22. Non-edible raw materials, exluding petroleum
23. Manufactured articles, classified primarily according to material
24. Other manufactured items and miscellaneous
25. Forest Products
26. Minerals

All of this production and consumption data were put on a 1966 basis with projections then made by product and department for 1974 and 1984.

Each of the major sectors, agriculture, manufacturing, forestry and minerals were then projected through 1994. This long term projection was necessary in order to have 20 years of traffic data for the recommended road projects on the assumption that construction would be terminated by 1974.

Demographic projections were also made including urban, rural, total population and economically active. These data were used for estimating passenger traffic.

The complete report of the National Highway Plan contains the following chapters:

I. Purpose and Scope of Study
II. Economic Resource Base
III. The Transportation System
IV. Transport Investment and Financing
V. Highways and Transportation by Highways
VI. The National Highway Plan
Appendix B - Detailed Economic and Traffic Data

3. Review and Analysis of Presently Scheduled Projects with Relation to the National Highway Plan

The results of the economic evaluation of projects were not the only criteria taken into account in the National Highway Plan. Consideration was also given to projects which had already been scheduled for construction and, as indicated previously, it was not practicable to introduce changes. An example is CA-13 which will extend from Entre Ríos to the Honduras frontier, a length of 21 kilometers. Although the results of the Consultant's evaluation of this project were not very favorable, and agreement has already been reached between the Guatemalan and Honduras governments for completion of this highway on both sides of the border. In view of this and the forthcoming financing by CABEI, it is the Consultant's opinion that it is now too late to consider postponing the project.

4. Coordination of the National Highway Plan

Throughout the development of the National Highway Plan studies, the Consultants took special note of investment policies and recommendations already given concerning projects determined by other agencies which work in planning, so that they could be evaluated accordingly and integrated into the Plan whenever justified. This coordination of the National Highway Plan with regional and national planning agencies was carried out in the following manner:

Central American Bank for Economic Integration: The programming and execution of the highways were analyzed insofar as Guatemala was concerned. The Central American Transportation Study completed by the T.S.C. Consortium for CABEI was consulted continuously.

SIECA. Preliminary reports by the Infrastructure Division on Central America's natural regions were consulted. Various interviews were conducted with personnel of this agency.

National Council of Economic Planning. The reports on the 1965-69 plan were carefully studied and appraised, both from the standpoint of transport projects and overall economic development. Members of the Council were also interviewed on various occasions and were kept abreast of progress. In addition, the participation of an employee of the Council as part of the working group on the National Highway Plan facilitated this coordination.

Sectorial Unit of Urban and Regional Planning of the Ministry of Communications and Public Works: Documents published by this section concerning national planning through economic regions were reviewed by the Consultants. Interviews were also held with personnel of this agency on the National Highway Plan.

FYDEP: Interviews were conducted with officials of FYDEP, the autonomous agency in charge of development of the Petén. Information was

obtained on FYDEP's investment plans in this very important zone of the country, where it is anticipated that considerable funds will be used in the construction of new highways during the next several years.

Ministry of Agriculture: It was considered important that the Ministry of Agriculture be included in the participating working group of the National Highway Plan because of necessary coordination between agricultural development plans and proposed new highways. As it will be shown in another part of this report, the agronomist designated by this entity only collaborated with the Consultants for a short period of time, due to the heavy work load in his own office.

5. Assistance on Specific Programs of the Planning Section

The Consultants' assistance in this aspect was divided into the following activities:

a) Highway Inventory

U.S. AID Mission/Guatemala provided the equipment and funds for Guatemala's first Highway Inventory, now in progress under the direction of Ing. Juan A. López of the Planning Section. The equipment for this program consisted of the following: 9 pocket compasses with their accesories, 9 odometers, 1 "Fifth Wheel" and 2 gyroscopes. The funds were also used for field personnel (salaries and viaticos), rent of equipment and map preparation. The latter has not yet started.

The work was formally initiated during the first days of March. Although progress was slow at first, close supervision solved many of the problems so that within two months the work was being accomplished at a very satisfactory rate. By October 1968 the achivements were as follows:

1. Paved Highways (1,770 Kms.)

General Characteristics	100%
Visibility	100%
Grades	80%
Curves	20%
Calculations	10%
Drafting	0%

2. Unpaved Highways (10,000 Kms. Approx.)

General Characteristics	100%
Grades	0%
Calculations	0%
Drafting	0%

3. Use of Funds Available 40%

The Consultants participated in all of the first discussions on the Highway Inventory, when there was a need to draw up a workable program and to solve the initial problems. The Consultants also participated in the meeting with Mr. William Campbell of U.S. AID, and the chiefs of the Planning and Financial Sections of the Highway Department, to clear up the procedures to be followed in the use of U.S. AID funds.

Once the work was started, the Consultants visited the field and checked the progress and completeness of information being obtained. They also checked the use of the equipment.

The Consultants recommended that the drafting work be initiated immediately, so that it may be possible to check with the field personnel on any questions which might arise in interpretation of the data prior to completion of the field work.

b) National Vehicle Inventory and National Traffic Counts

The National Vehicle Inventory for Highways was completed. From original data of the Statistics and Census Department the following

information was compiled: place of vehicle registration; type; make; and model year. When these data were processed and adjusted, tabulations were prepared on vehicle registration by departments; curves of vehicle registration by age and type; tables of predominant makes, etc. This is valuable information for planning and is found in a preliminary report entitled: "Vehicles Being Used 1966". It has not been published in a final report, because it is intended to have all data included in one of the Statistical Bulletins of the Highway Department. The Consultants recommend that similar work be done for the year 1967 and for the following years.

Upon completion of the Traffic Counting Program last year, the Consultants prepared a report which included not only the results obtained during 1967, but also all data accumulated since 1962. Partial information for these earlier years had been gathered by Caminos, but it had not been analyzed nor prepared for publication. The results of this work were published in a 170-page report entitled: TRANSITO POR CARRETERAS DE GUATEMALA, 1967. This work was of great importance to the Consultants and Caminos, since it was the first document in which the structure and variation of highway vehicle movements were examined; an analysis which is essential for planning. A careful programming of the stages to be covered, from data tabulation to report presentation, permitted the Consultants to have everything ready for March 1968, but difficulties from the Highway Department delayed its publication until two months later.

The information in this report will be useful for various purposes from regulation of traffic flow to planning, design, construction and maintenance of highways.

c) Additional Traffic Studies

Once the volumes of average vehicle flows are obtained, known as ADTA (Annual Daily Traffic Average), additional traffic investigations

are necessary whether on a specific project basis or general studies in order to know the proper characteristics of the movement by highway.

From the 1967 traffic data a perspective was obtained of the large flow on the Guatemala-Escuintla Highway. As a step towards eveluating the need for expanding this highway into a four-lane road, speed studies were carried out at various critical points. For example, the Cuesta de Villalobos and the intersection at Villanueva. The method utilized was that of "common plates" which consists in locating enumerators at the extremes of a known road segment. These individuals must register the precise crossing time for each vehicle. The relation between the known distance and travel time of the vehicle that goes by the two stations will give the actual speed.

The Consultants supervised the development of this study which took about one week. Later on this same study was done on the Interamerican Highway to the West, at the Guatemala-San Lucas road. The conclusions of both studies are shown in tabulations and figures of a preliminary study. Also, various Origin-Destination surveys were carried out for the National Highway Plan. These surveys were developed as follows:

i. At the six land frontier customs stations during 48 hours on working days during the months of February and June.

ii. A 12-hour survey (0600 - 1800) at six selected stations where highways cross departmental limits, during the months of March and April.

iii. A 12-hour survey (0600 - 1800) for a traffic analysis using the plates method. This took place in May 1968 and was concerned with a possible Guatemala City by-pass.

iv. A 6-hour survey (0700 - 1300) for a traffic analysis of a possible Escuintla by-pass using the plates method, during the month of May.

v. A 6-hour survey (0700 - 1300) for a traffic analysis of a possible by-pass of Mazatenango, using the plates method, during the month of June.

The last three surveys were made for the purpose of evaluating the traffic volumes that would use possible by-passes of those cities, by which traffic congestion could be avoided. Some interesting conclusions were obtained. For example, from the traffic stand point, the Guatemala City study indicated there was no need for peripheral ring around the city. It was discovered that the construction of the north-west peripheral ring at Escuintla can be justified with a first priority.

d) Traffic Projections and Capacity

In the 1967 Highway Traffic Study, a relation between capacities and actual or projected traffic volumes was established. From the relation of capacity-projected volumes, some highway segments indicated the need for expansion from two lanes to four lanes. In priority they are:

Guatemala-Escuintla (CA-9)
Guatemala-San Lucas (CA-1)
Guatemala-Deviation San José Pinula (CA-1)
Guatemala-Toll Station (CA-9)
Escuintla-Muluá (CA-2)

e) Other Studies

In September 1968, the second stage of the survey on annual mileage by highway and type of vehicle was started. This study originally begun in September 1967, when at various stations located at exit sites of Guatemala City, vehicles were stopped and general data as well as

odometer readings were obtained. To obtain the second reading of the odometer is a more difficult process, because visits were made to the homes of each of the vehicle owners. This procedure gives a better result than sending cards by mail, but nevertheless about a 20% loss of data occurred, because many of the owners had changed their address or sold their vehicles.

6. Assistance in the Establishment of the National Highway Traffic Counting Program

The Consultants had prepared an automatic traffic counting program for 1968 which had to be changed almost completely because the equipment needed, consisting of nine automatic traffic counters, was to be received not later than December 1967; actually it was not delivered until May 1968. This delay provoked a total revamping of the 1968 program, known as Cycle 2, since it was not possible to acquire full-year data from the five permanent stations of the system. Nor was it possible to complete the desired area coverage of the program. One of the consequences of this program revision is the inability to complete the design volume schedules which require more complete information than that now available.

Major activities of the 1968 Traffic Program consist of field checking the personnel; adjusting the monthly programs; and, at the same time, proceeding with the analysis process. A fact of concern to the Consultants is the continued loss of data, because the apparatus in the permanent stations have not received the necessary attention and stop when the battery is out; or when they are harmed; or because of mechanical troubles, etc. Greater care, organized in a continuous systematic manner, would eliminate some of these problems. Such measures have been strongly urged by the Consultants.

There also have been delays in the classified counting program. Those delays occurred whenever personnel are used for other programs. In any case, in the planning of these programs these eventualities have been considered, and only at the end will it be possible to measure the level of effective accomplishment.

The Consultants recommed that for the program of 1969 the counting system be extended and include, besides the one already established, new summary stations in the Caminos Vecinales Plan financed by BID and the Government. Summary stations are ones where 48-hour counts take place on regular working days.

The Statistical Unit of the Planning Section provided 8 enumerators, 1 analyst, and 2 chauffeuers on a full-time basis for the 1968 traffic program. When the Consultants first began their duties with the Planning Section in October 1966, there was no such program.

7. Project Evaluation

Because of the limited capacity of the Planning Section to make economic justification studies of more than 100 proposed projects of Caminos Vecinales, and establish priorities, there was need to determine an empirical method for selecting for study the many different investment possibilities. The Consultants participated very actively in the discussions with the professionals of the Planning Section in establishing the criteria to be used. For each project, three aspects were considered: 1) Financial aspects such as project costs and user benefits; 2) Social aspects evaluated on the basis of population and different types of beneficiaries; and 3) Economic aspects classified according to the zones of influence and the potential land use. The scores obtained for each of the 100 projects determined the order in which the studies are to be done.

Once the project study had been given a priority, the economical evaluation of the same, followed the procedure established by the Consultants in their report: ANALYSIS OF PROJECT EVALUATION FOR THE CAMINOS VECINALES PLAN, RECOMMENDATIONS, June 1967. During the period of the contract, the Consultants continued assisting in the evaluation studies, by direct participation in the following projects:

Alotenango - El Rodeo - Siquinalá
Mazatenango - La Dicha
Patulul - Pochuta
Berberena - Casillas

It is appropriate to mention here that improvement in project evaluation, and as a consequence, transportation planning can come about only through a continuous desire to use better techniques, the adoption of new concepts and the revision of new criteria in the selection of programs of public investment. Although there is no formal educational program with scholarships at the postgraduate level or intensive courses, personnel of the Planning Section can obtain additional technical assistance through reviewing documents listed in the extensive bibliography cited below. 1/ It is essential that the Planning Section, as well as other sections of the DGC, have budgeting resources for the acquisition of documents on matters of interest.

The Consultants have been very concerned about the use of so much of the funds of the Caminos Vecinales Plan for paving projects rather than the construction of new access roads into potentially valuable agricultural or forest lands. The Consultants do not oppose road paving, but the argument mainly centers upon the question of whether in the light of limited financial resources, it is more beneficial to pave existing all-weather roads or to construct new ones where there aren't any.

In the analysis of a project that consisted in the betterment and paving of an existing road, the overall benefit-cost ratio was found to be satisfactory and justified the project investment. But the betterment investment only, gave a greater benefit-cost ratio. This is a clear case for applying stage construction with paving to be done only when traffic has reached adequate levels.

The Consultants also recommended two studies on project evaluation:

a) To revise the highway operating cost tables, following the orientation of Jan De Weille's book Quantification of Road User Savings, published by the John Hopkins Press, 1965. This revision is necessary because the AASHO document (used by Caminos) is now outmoded

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1/ See bibliography compiled on Transportation and Economical Development by Katherine D. Warden, in the publication by Gary Fromm Transport Investment and Economic Development, The Brookings Institution, 1965.

in terms of cost criteria for project evaluation.

b) Since it is contemplated that investments in the Caminos Vecinales Plan will probably be continued, the Planning Section should capitalize on its experience acquired to date in economic evaluation. It is recommended that projects be selected for complete study including analysis of travel habits and desires through personal interviews. From such activity new and better techniques for studies can be derived.

8. Continue Analysis of a Nation Wide Transport System with Major Emphasis Upon Highways

The information assembled, analyzed and reproduced under this section is a necessary adjunct to the National Highway Plan since in order to develop the plan, one must take into consideration the competitive situation with other modes of transport.

For the base year 1966, the Consultants have distributed tonnage data on exports and imports of their 26 products and product groups among the four national ports of Champerico, San José, Matías de Gálvez and Puerto Barrios; the international airport of La Aurora; the railroad points of entry and exit for El Salvador and Mexico at Angiatú and Tecún Umán; and the highway frontier points at Pedro de Alvarado, Melchor de Mencos, San Cristóbal and Valle Nuevo.

The allocations of tonnage among the ports were made by obtaining as much data as were available directly from the port authorities, and then making adjustments in those instances where the port classifications of the commodities did not correspond to those of the Consultants. Information was also utilized from the Pacific Port Pre-feasibility Study recently completed by Consultora Latinoamericana, Ltda.

Data for Angiatú and Tecún Umán were obtained directly from the IRCA Railroad. Air transport data were

obtained from the national and international airlines serving Guatemala, while data for the highway frontier points were obtained from the Bank of Guatemala with allocations among products based upon origin-destination surveys conducted by the Consultants.

The Consultants also obtained information from the railroad on estimated departmental origins and destinations of their export, import and local traffic.

Data from the Bank of Guatemala were obtained which show the monthly variation in total tons of export and import among the various ports and other customs points of entry and exit. These data were adjusted by the Consultants to correspond with the data previously refered to in the tables of exports and imports by commodities.

Listed below are the tonnages of exports and imports by major ports and frontier points for the base year 1966, and the total tonnage of export, import and local traffic by rail, highway, air and other, also for 1966.

Customs Points of Entry and Exit	Metric Tons		
	Export	Import	Total
Deep-Water Ports			
Champerico	73,804	27,531	101,335
San José	82,099	403,968	486,067
Matías de Gálvez	80,012	392,883	472,895
Puerto Barrios	160,285	125,800	286,085
International Airport			
La Aurora	2,790	3,856	6,646
Railroads			
Angiatú	6,680	8,290	14,970
Tecún Umán	---	12,234	12,234
Highways			
Pedro de Alvarado	115,317	75,299	190,616
San Cristóbal	12,483	5,065	17,548
Melchor de Mencos	1,394	283	1,677
Valle Nuevo	33,811	7,413	41,224
El Carmen	---	5,235	5,235
TOTAL	568,675	1,067,857	1,636,532

	METRIC TONS			
	Export	Import	Local	Total
Rail	192,191	206,806	185,686	584,683
Highway	373,694	219,811	4,583,877 1/	5,177,382
Air	2,790	3,856	4,477	11,123
Other	---	637,384	---	637,384 2/
TOTAL	568,675	1,067,857	4,774,040	6,410,572

1/ Includes 1,339,000 M.T. of Sugar Cane, 217,900 T.M. of Raw Cotton and 116,838 M.T. of Coffee in the Bean.

2/ Movement of crude petroleum by pipeline from shipside to storage tanks near the ports of San José and Barrios.

9. Highway Financing, User Taxes and Construction Costs

The Consultants prepared a section for the National Highway Plan entitled: INVERSIONES EN TRANSPORTE Y SU FINANCIAMIENTO, which contains an analysis of highway financing. It is complemented with a critical examination of income generated by users, in which is measured the degree of recovery of highway investment by the Government. The most important results are summarized below:

From July 1957 to December 1967, Highway Department expenditures were Q.172.7 million of which Q.98.5 million were invested in highway construction or betterment; Q.53.4 million were assigned to maintenance; and, Q.20.8 million were used for administration and new project studies. In terms of funding sources, Q.116.9 million were from internal resources; Q.27.5 million from loans; and, Q.28.3 million, donations from international agencies.

Since external resources were used almost exclusively for construction projects, these resources accounted for over half the total investments during the 10 1/2 year period. Future highway investment is expected to be funded in large part by external loans for two fundamental reasons: a) the donations are nearly finished. The principal source of these donations was the U.S. Government, which financed two thirds of the total cost of the Interamerican Highway. There is only Q.4.5 million still to be invested between 1968 and 1970 to finish the project; and, b) the critical fiscal situation of the National Government is manifested by the limited availability of internal savings. One analysis of the present debt capacity indicates that in 1968 the National Government could obtain $100 million of external loans without disturbing the national economy.

In the second part of the study, an analysis is made of highway user taxes. The Consultants determined that for each vehicle-kilometer traveled 1.9 cents is obtained from such user taxes as those on fuels, license plates, tolls, fines, etc. In the 1964-1967 period, Q.42 million was collected in highway user taxes. This compares with annual amortization costs of the highway investment of Q.62.5 million (25 years at 6 per cent) for the period 1955-1967. To this must be added maintenance and administrative costs.

It is clear from the above analysis that automobile, bus and motor carrier transport is being subsidized rather substantially. One way of partially reducing this subsidy in the future is to design the more heavily traveled sections (Guatemala-Escuintla) as toll roads. Of course, indiscriminate use of toll roads would solve no financial problems. To the contrary it would create new ones.

An analysis was made of construction costs for the purpose of obtaining as realistic as possible investment costs for the next five years. This analysis showed that construction costs per kilometer averaged Q.100,000 on flat terrain; Q.140,000 per kilometer in mountainous terrain; and, Q.30,000 per kilometer for asphalt paving. These costs are based upon Camino's experience on highway construction projects over a period of more than ten years.

10. Training

The training supplied by the Consultants to the Planning Unit took the form of individual and group discussions; the assignment of planning personnel to work directly with the Consultants on the National Highway Plan and the Traffic Counting Program for examples; and the preparation and distribution of documents for use by the planning personnel. On one occasion, Ing. Raúl Leclair was invited by the Engineering Faculty of the University of San Carlos to present a paper on "Highway Traffic Engineering" for a seminar. Professional engineers including Caminos personnel, faculty members and students attended the seminar.

As mentioned previously, the Consultants have worked closely with the Agronomist and Economist assigned to evaluate the individual Caminos Vecinales Projects. To assist these two professionals in their work the Consultants translated into Spanish and edited Hans Adler's chapter on "Economic Evaluation of Transport Projects". This chapter was from the book edited by Gary Fromm, Transport Investment and Economic Development, Brookings Institution, 1965. Copies of this translation were given wide distribution in Caminos.

The working group organized by the Consultants, with the approval of the Director of Caminos, to work on the National Highway Plan provided a good opportunity for these less experienced personnel to obtain practical training in the techniques of planning, traffic analysis and project evaluation.

Caminos provided two persons, full-time, one engineer and one statistical assistant. In addition an economist was furnished by the National Planning Council and an agronomist by the Ministry of Agriculture. Unfortunately these two individuals were able to participate on a very limited basis only.

In the course of the activities of the working group, Ing. Godoy of Caminos assisted Ing. Leclair in the preparation of a report entitled: "Methods of Distribution and of Transport". The report contained a discussion of the techniques of linear programming applicable to a transport model.

A further aspect of the training program was the grant of funds by AID to finance a three months course in Traffic Engineering for the head of the Statistical Section, Ing. Hurtarte. The Consultants have worked very closely with Ing. Hurtarte to insure that he would be capable of operating the Traffic Program with the termination of the Consultants' contract. The Consultants have also trained the field personnel in this work.

11. Assistance to the Statistical Section

In addition to the above training, primarily in Traffic Analysis provided by the Consultants to the Statistical Section, they also worked very closely with Statistical Section personnel and especially Ing. Hurtarte in the following activeities:

(a) Annual Memoria

The Consultants discussed with the head of the Statistical Section the need for modifying the annual memoria of the D.G.C. in order to make it more functional. A preliminary examination of the memoria for 1966 indicated the following:

1. The volume contained a large quantity of data which was of little use.

2. More information was necessary on construction projects.

3. The memoria should include figures and photographs illustrating the various projects undertaken during the year.

4. The general presentation of the memoria could be greatly improved.

At the request of the chief of the Planning Section and the Head of the Statistical Section, the Consultants reviewed the data being prepared for the 1967 Annual Memoria and made many suggestions about its presentation, degree of completeness, the use of graphics, etc.

Upon completion of this review, the Consultants actually prepared a draft of the 1967 report. And after review by the Planning Chief it was reproduced with few modifications. Many favorable comments were received from the Division Heads of Caminos and the Director on the improved appearance, readibility and worthwhileness of the revised Annual Memoria.

(b) Compilation and Analysis of Data for the Statistical Bulletins

The first Highway Statistical Bulletin ever published in Guatemala was released in August 1967. This work was initiated by the Consultants with assistance provided by the Statistical Section. It was contemplated that this bulletin would be issued at least on an annual basis and thus in the matter of a few years a valuable quantity of series data would have been accumulated.

To carry out this objective, the Consultants discussed with the head of the Statistical Section in June 1968 the need for completing the data and stencils for this second bulletin. The Consultants had already compiled and prepared statistical tables for the bulk of the report and had completed a good part of the text. Unfortunately the Statistical Section has just begun now (December 1968) to complete the stencils for the first part of the bulletin. Perhaps within 6 weeks to two months the work will be completed.

(c) Utilization of Traffic Data Obtained Prior to 1967

Reference has been made previously to the analysis and incorporation within the Consultants Traffic Report of data gathered prior to 1967. This information permitted the determination of historical tendencies.

(d) Reorganization of the Statistical Section

The Consultants have discussed with the chief of the Planning Section and the Head of the Statistical Section the urgent need to reorganize and redefine the functions of this latter Section in order that the personnel be utilized more effectively. The Statistical Section should concentrate on the operation of the National Traffic Counting Program, including the compilation, processing, analysis and publication in report form of all pertinent traffic data. Though it may not be possible to add to the staff of the Statistical Section because of budget limitations, this is all the more reason for a definition of functions and assignment of personnel with definite responsibilities so that a minimum traffic program can be continued including special studies of transport costs, traffic flows and vehicle utilization.

The Consultants recommend that the Statistical Section use as a guide the program of Transport Statistics approved by the Subcommittee of Statistical Coordination of the Central American Isthmus.

12. Highway Classification and Numbering

In a report by Lloyd Morrison, a U.S. Bureau of Public Roads engineer, published in January 1967, a new system of classification and numbering of Guatemala's highways was proposed. On a number of occasions, the deficiency of this system in terms of highway identification had been noted. It was necessary to establish an orderly system, functional for the present and future development of the highway system and this was proposed in Mr. Morrison's report. The numbering system was patterned after that of the United States.

The implementation of Mr. Morrison's project has been impossible, even though the engineers of the DGC have agreed that its adoption would bring multiple benefits. During a meeting held in February

1968 in which the chief engineers of the DGC, Mr. Morrison and the Consultants from CONLAT attended, it was concluded that the discussion stage on the classification and numbering of highways was over. The next step was to take a look at the procedures to be followed for its implementation. A committee was organized to take charge of the preparation of a brief memorandum showing the project justifications. This memorandum was later sent to the Minister of Communications and Public Works for his acknowledgement and approval.

The memorandum was approved, and it was then recommended that an executive decree be drawn up for presentation to the President so that the new system could be implemented. The legal attorney of DGC was requested to prepare the decree, but this individual has never done so despite urgings by the Consultants.

In a report of May 17, 1968 presented by CONLAT to the Chief of the Planning Section, the Consultants stated:

> "Knowing the need and effectiveness of the proposed highway numbering and classification system for Guatemala, the Consultants recommend that immediate steps be taken for its implementation either through a meeting of the departmental heads, the Director and Sub-Director of Caminos or by any other valid means."