NORTHEASTERN HONDURAS TRANSPORTATION PROGRAM

Economic Feasibility Study
Under Contract AID-522-91

Continental-Allied Co., Inc.

1319 F Street, N.W.

Washington 4, D. C., USA

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NATIONAL 8-4729 CABLE: "MONEY"

CONTINENTAL-ALLIED COMPANY, INC.
INTERNATIONAL BUILDING
1319 F STREET, N. W.
WASHINGTON 4, D. C., U.S.A.

22 February 1965

U.S. Aid Mission to Honduras
Tegucigalpa, Honduras

Gentlemen:

I have the honor to submit a report entitled "Northeastern Honduras Transportation Program" under Contract AID-522-91 dated August 27, 1964. This report is an economic feasibility study of a program for the construction of roads and a port to connect the Guayape, Agalta and Aguán valleys with each other, with the rest of the country, and with the outside world.

In general this report conforms to the outline given in "Feasibility Studies, Economic and Technical Soundness Analysis, Capital Projects," issued by the Office of Engineering, U.S. Agency for International Development, under date of 1 September 1962. Part I follows the outline of Chapter I (All types of capital Projects) and the rest follows the outline of Chapter IX (Highway Projects).

On the basis of our study, we recommend construction of a small dock for ocean-going vessels at Puerto Castilla, a 183 kilometer road from Puerto Castilla south through San Estéban to Dulce Nombre de Culmí (already connected by road to the rest of Honduras), and restoration of bridges to make a usable road of an abandoned railbed along the Aguán Valley to connect Puerto Castilla and Olanchito. The project in its entirety would require outside financing of approximately $5 million (in addition to an AID loan of $500,000 already granted for a fire trail along part of the route). Its economic desirability is suggested by an estimated cost-benefit ratio of 1 : 12.

The validity of this study depends on two key decisions as to resources use on the part of the Honduran Government. The first is a decision on use of national forest lands in the Department of Olancho for lumbering (as is assumed in this study) or alternatively for a pulp and paper industry (which would require generally similar road and port facilities).

The second involves making available national land in the Aguán Valley (presently reserved for future land reform colonization) on some basis that will encourage immediate economic development. This might take the form of renting limited areas for commercial plantations, or of organizing cooperatives of medium

and small growers to produce on a commercial basis. Since the Honduran Government may wish to handle the development of the Aguán Valley in other ways (e.g. by waiting until a comprehensive colonization project can be organized), this report presents alternative estimates including the Aguán Valley bridges, and leaving out the Aguán Valley bridges. Either program appears to be justifiable, but the latter will require only $3.9 million of external financing.

Material concerning engineering aspects of the program, prepared by others under arrangements made by the U.S. Aid Mission, is reproduced as a convenience in Part III of the Report. Our own terms of reference did not include engineering, we are not professionally qualified to engage in the practice of engineering, and we do not pretend that we have done so in this report. However, in order to make meaningful economic comparisons, it has been necessary for us to develop overall cost estimates on the basis of available information from various sources; these are presented for what they are worth.

This report reflects the best efforts of a team consisting of Messers. Erwin J. Sholton (tropical export crops expert), Robert Clark (economist), José Gonzales (economist), John Danzilo (lumberman), Gilbert Aguirre (cattle expert) and the undersigned. Since it involves the projection of new production or substantial increases in areas that are now partially unused, it necessarily involves a good deal of conjecture. We have tried to arrive at conservative and logical estimates, taking into account both favorable and unfavorable elements of Honduras' economy. Needless to say, we can make no pretence of ability to predict the future in detail, and we can only claim a reasonable degree of validity for overall totals (in which errors may be expected to cancel each other out to some extent).

As in the case of previous work in Honduras, we have benefitted by the willingness of many people to help us with their information and opinions. Among others, we have been privileged to obtain advice from Ing. Hector Molina García (Minister of Natural Resources), Ing. Alfredo Ynestroza (Director, General Administration for Agrarian Incorporation), Mr. W.C. Nickol (Brown & Root, S.A.), Mr. Newell F. Williams (Director, U.S. Aid Mission), Mr. Maxwell Becker (Forestry Consultant, AID), Maj. S.D. Falkenbury Jr. (U.S. Military Mission to Honduras), and Mr. Henry Randall and Mr. John Ammot (U.S. AID/Washington). Many other persons who helped us are listed in Appendix "A".

We very much appreciated the opportunity to conduct this economic feasibility study. If it helps to develop an area of Honduras whose potential importance has become clear to us, we will feel well rewarded for our efforts.

Sincerely yours,

Edward A. Tenenbaum

EDWARD A. TENENBAUM
President

PART I: SUMMARY

A. Applicant

1. Official Name: Republic of Honduras, Ministry of Natural Resources (República de Honduras, Ministerio de Recursos Naturales).

2. Type of Entity: Government Agency

3. Date of Establishment: The Republic of Honduras declared its independence from Spain in 1821.

4. Principal Purpose: Conservation, administration and development of agricultural, forest, mineral, fishery and other Honduran natural resources.

5. Organization Chart of: MINISTRY OF NATURAL RESOURCES

National Hydrometric Service

General Administration of Natural Resources

Department of Hunting and Fishing

Department of Soils Survey

Department of Vegetable Sanitation

Department of Animal Sanitation

General Administration for Agrarian Incorporation

Construction of Penetration Roads

Workshop Department

Design, Construction & Maintenance Department

General Administration for Rural Development

Use of Hydraulic Resources

Irrigation Department

Personnel of the Ministry include the Minister, the Sub-

Secretary, seven top-level administrators, 42 college-trained technicians, 139 other technicians, 62 clerks and 145 laborers for a total of 397.

The applicant proposes to administer the project through its General Administration for Agrarian Incorporation, using for actual construction one or more of the following: (a) foreign private contractors, (b) local private contractors, (c) the Military Construction Batallion of the Honduran Army.

B. Project

1. Relationship to the Country's Economic Development

The area covered by the proposed Northeastern Honduras Transportation Project is bounded by the Caribbean coast on the north, the Guayape Valley on the south, the Yoro-Progreso region on the West, and the Mosquitia on the east. It includes the Departments of Olancho and Colón, plus a small part of the Department of Yoro. It includes 26.8% of the total area of Honduras, with 9.2% of the total present population of the country.

Much of this area, particularly the Lower Aguán and Agalta Valleys, is entirely without roads. The southernmost portion, consisting of the Guayape Valley, is linked by road to the interior of the country, but does not have satisfactory direct access to the sea for present and potential export traffic.

At present the only crossing of Honduras from south to north is in the western third of the country, running from San Lorenzo (land terminus for the lighterage port of Amapala) on the Pacific Coast through Tegucigalpa and San Pedro Sula to Puerto Cortés. Plans are in an advanced stage for a new road between

Tegucigalpa and San Pedro Sula, but this will have only a limited effect on the Eastern two-thirds of the country.

The proposed Northeastern Honduras Transportation Program would connect Dulce Nombre de Culmí (at the eastern end of the Guayape Valley) by a new road running north to San Esteban in the Agalta Valley, and thence via Paso de la Esperanza to the south bank of the Aguán River at Corocito. Here it would be joined by a road to be opened along the old railbed on the south side of the Aguán, connecting Olanchito and Corocito. The main road would cross the Aguán by a bridge (using the foundations left by the railroad) and would then run to Honduras' North Coast at Puerto Castilla. A small pier would be built at Puerto Castilla, adequate to work one hatch of ocean-going vessels.

These facilities would provide a short route for meat and other possible exports from the Guayape Valley, and would open up the Agalta Valley for increased cattle-ranching and limited agriculture. At the same time, it would permit exploitation of the virtually unused pine and hardwood areas around Dulce Nombre de Culmí, between San Esteban and Paso de la Esperanza, and in the Cerros del Ocote (north wall of the Agalta Valley). Finally, it would open up the most valuable parts of the Lower Aguán Valley for production of exports and crops for the internal market. Thus, the project would integrate Northeastern Honduras into the national economy, while opening it up for trade with world markets as well.

Besides the economic benefits, the project will have no less important (if less measurable) social and political benefits.

It will permit the spread of primary schools, medical services, church services and other agencies for educational and social improvement, make possible more effective police and defense services and improve the operations of administration and politics.

At present, the national pine forest lands of Olancho are reserved by decree for the establishment of a pulp and paper industry. It is understood that a U.S. investor is presently negotiating with the Government of Honduras on the establishment of this enterprise near Puerto Castilla, to use pine from the Cerros del Ocote - Sierra de la Esperanza area.

If the pulp and paper project is implemented, it will require road and port facilities generally similar to those which are recommended here, but expanded to take care of greater traffic than is likely to develop without this new industry. In the following study we assume that the pulp and paper industry will <u>not</u> develop in the area, and our recommendations are limited accordingly. Facilities recommended in this report could be expanded as necessary to meet future increases in requirements, with little increase in overall cost of the larger infrastructure.

2. Relationship to other highways and other transportation facilities.

At the present time, the Northeast of Honduras entirely lacks through road communications between North and South. The Guayape Valley itself has a road from Dulce Nombre de Culmí through Catacamas and Juticalpa, then via Guaimaca and Talanga to Tegucigalpa. However, there is no road north to the Caribbean coast, and exports from the Catacamas area must move a total of 578 kilometers via Tegucigalpa to Puerto Cortés.

The Agalta Valley has no road or rail facilities at all, and relies entirely on animal trails and aircraft for contact with the outside world.

The middle Aguán Valley is served by a narrow-gauge railroad owned by the Standard Fruit Co. This runs from the Aguán Valley around Olanchito north to the Atlantic Coast at La Ceiba, then west along the coast to Tela. Although nominally a common carrier, in fact service is largely for the company's own requirements. There is limited access from the vicinity of Olanchito to the West by a dry-weather lumbering road to Yoro, and some possibility of road traffic at certain times of the year along abandoned railroad beds in the Middle and Lower Aguán. However, bridges are mostly gone or in bad repair, and these routes are unusable during the rainy season.

For the most part, the Middle and Lower Aguán remain isolated from the rest of the country, communicating by mule, airplane or small boat.

At La Ceiba, the Standard Fruit Company maintains a pier for

ocean-going vessels, running out into the unprotected Atlantic. Some general cargo moves over this pier, but priority naturally goes to the company's own imports of supplies and banana exports. Honduras' other Atlantic ports of Tela and Puerto Cortés, to the west, are not accessible for the Northeastern region. Puerto Cortés, the country's main port, is overcrowded at present.

At Puerto Castilla, near the mouth of the Aguán Valley, are the remains of what was once the finest port in the Caribbean. This continues to provide limited access for small vessels (up to 500 tons). This port was originally constructed to serve the Trujillo Railroad Co. (a United Fruit Co. subsidiary), along with 383 kilometers of railroad lines into the Aguán and Paulaya Valleys, where the company had extensive banana plantations. The onslaughts of Panama disease forced abandonment of banana operations in 1938. The rails and key bridges were pulled out, cutting off land communications for the area.

During World War II, Puerto Castilla was temporarily reprieved for use by the U.S. Navy as an important anti-submarine base. Since then, however, storms and lack of maintenance have caused most of the original pier to fall into the water.

In the dry season, it is possible to follow the old railbed along the North bank of the Aguan River to the vicinity of Sonaguera-Rio Guajinquilapa. A number of smaller bridges have been repaired by the plywood company operating at Puerto Castilla. In other areas tributaries must be forded. From Rio Guajinquilapa westward the road has been restored to a passable condition by the Standard Fruit Co., to connect with its railroad. The Standard

Fruit Co. is reluctant to establish through road communications to Olanchito on the north bank of the river, since that would make access to its banana plantations easier for unauthorized persons.

As Table 1 shows, Honduras has by far the lowest ratio of roads to area in Central America: 0.03 kilometers of road per square kilometer. Nicaragua, second lowest in Central America and close to Honduras in terms of per capita G.N.P. and other measures of economic progress, has 0.044 kilometers of roads per square kilometer, or roughly 50% more. The average for Central America as a whole, 0.109, is seven time the figure for Honduras alone. The Northeast Honduras Transportation Program alone would add 275 kilometers to the country's network of improved roads, or approximately 15% of the 1819 kilometers of main road existing in 1962.

By restoring bridges on the south bank of the river, and providing a crossing of the Aguan south of Puerto Castilla, the Northeast Honduras Transportation Program would make the existing railroad bed usable as a low-grade truck road between Olanchito (where an existing railroad bridge across the Aguan can be adapted to carry automobile traffic) and Puerto Castilla. This would permit economic development of the Aguán Valley to begin immediately.

The Honduran land reform agency (Instituto Nacional Agrario) has a long-term plan for the colonization of the Aguán Valley. This plan also requires reconstruction of the bridges along the south side of the Valley between Olanchito and Puerto Castilla. However, a formal loan application covering the overall program

Table 1

Roads in Central America, 1961
In kilometers

	Improved Roads				Unimproved Roads	Total	Kilometers of Roads per Square Kilometer
	Paved	Gravel	Improved Dirt	Subtotal			
Honduras	160	2,240	720	3,120	200	3,320	0.030
Nicaragua	830	702	1,054	2,586	3,578	6,164	0.044
Guatemala	1,278	5,074	-	6,352	5,648	12,000	0.110
Costa Rica	1,040	2,192	10,720	13,952	4,640	18,592	0.365
El Salvador	1,034	389	3,499	4,922	3,544	8,467	0.406
Total	4,343	10,597	15,993	30,933	17,610	48,543	0.199
Honduras as % of total	3.7	21.1	4.5	10.1	1.1	6.8	15.1

Source: Central American Bank of Economic Integration and Permanent Secretariat of the General Treaty of Economic Integration, "Regional Program of Central American Highways," Tegucigalpa, 1963 Volume, p. 24.

(with an estimated cost of $20 million) has not been presented as yet. If such a loan is requested and receives favorable consideration in the near future, the provisions of the present program concerning bridge reconstruction in the Aguán Valley may become superfluous. On the other hand, if the present program is implemented prior to the development of an overall colonization scheme, it will provide facilities that are required for the latter and should thereby make the colonization plan easier to implement. Relations between the present program and land reform are discussed in more detail in II-C-1, below.

3. References to other applicable reports and long-range development plans.

L.H. Bell and Associates, "República de Honduras, Ministerio de Comunicaciones y Obras Públicas, Sula Valley Feeder Roads, Economic Feasibility and Engineering Report," Phoenix, Arizona, 1962.

Brown & Root Inc., International Consultants, "Republic of Honduras, Ministry of Public Works, Report on the Extension of the Western Highway Between Santa Rosa de Copán and the Northern Highway of El Salvador," Tegucigalpa, 1960.

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Organización de los Estados Americanos, "Informe Oficial de la Misión 105 de Asistencia Técnica Directa a Honduras sobre Reforma Agraria y Desarrollo Agrícola," (3 volumes), Washington, D.C., 1964.

República de Honduras, Consejo Nacional de Economia, "Informe Preliminar, Carreteras Vecinales de Valle du Sula, preparado por Jose Angel Bobadilla," Tegucigalpa, July 1961.

----------, "Plan Bienal de Transportes, 1963-1964," Tegucigalpa, 1963.

----------, Instituto Nacional Agrario, Departamento de Programación, "Situación Socio-Agroeconómica del Valle del Rio Guayape, por Lic. Efraín Reconco Murillo and Ing. Agro. Fabio Gómez Romero," Tegucigalpa, November 1964.

Stanford Research Institute, "A Ten Year Highway Program for Honduras" (4 volumes), Menlo Park, California, 1962.

Tippetts-Abbett-McCarthy-Stratton Inter-American Corporation, "Development Plan, Ports of Honduras," December 1958.

United Nations, E/CN.12/356 - ST/TAA/Ser.C/8, "El Transporte en el Istmo Centroamericano," Mexico, September 1963.

Upham, Porter-Urquhart Associates, "Preliminary Engineering Report, The North and West Roads."

U.S. Department of Agriculture, Forest Service, "Southern Pine Beetle Epidemic in Honduras, Appraisal and Recommendations," Washington, April 1964.

Vie du Rail (La), Paris, 24 June 1962, No. 852, "Le Honduras et ses Transports".

C. Major Features and Funds Required

1. Major Design Features

The program is to be based on standards for a permanent unpaved all-weather road, capable of carrying traffic of approximately 80 vehicles a day. These standards are above Class II as defined by the Stanford Research Institute in its report entitled "A Ten Year Highway Program for Honduras". Proposed standards (developed by Brown & Root S.A., advisors to the General Administration for Roads) compare as follows with the Stanford Research Institute classifications:

	Brown & Root, S.A. recommendations	Stanford Research Institute Class II	Stanford Research Institute Class III
Cost, in Lempiras per kilometer			
Flat	25,000		
Rolling	40,000		
Mountainous	60,000		
Subgrade width, meters	7.3	7.0	5.4
Roadway width, meters	5.5	5.0	4.0
Width of structures, meters	n.a.	6.0	4.7
Vehicle speed, kilometers per hour			
Flat	70	50	40
Rolling	55	40	30
Mountainous	40	25	20
Vehicles per day	approx. 80	50-100	less than 50

Estimates have been made according to general experience in Honduras, and without the benefit of earthwork classification based on ground observations. Long-span bridges are assumed to be constructed in steel, medium-span bridges in reinforced concrete, and short-span bridges in the Aguán Valley are to be made of wood (pressure-treated if possible).

2. Location.

The chief problems in locating transportation facilities for northeastern Honduras are the crossing of three mountain ranges running more or less parallel to the coast: (a) the mountains along the coast, bearing a series of different names, (b) the Cerros del Ocote-Sierra de la Esperanza separating the Aguán and Agalta Valleys, and (c) the Agalta mountains separating the Agalta and Guayape Valleys. The location of a port permitting trade with the outside world is also of importance.

Possible routes across the mountains include:

a. Coastal Mountains

1. La Ceiba- Olanchito, following the Standard Fruit Co. railroad line, for a distance of approximately 91 kilometers. The cost of this road, according to the SRI road report, would be $3,754,900.

2. Puerto Castilla-Trujillo-Aguán River. In this area the mountains come down to the coast and end, leaving a wide gap through which the Aguán River flows to the sea. Consequently, this route requires no significant expenditure to cross the first range of mountains.

b. Cerros del Ocote-Sierra de la Esperanza

1. Paulaya Valley. This route follows the Atlantic coast eastward from Puerto Castilla to the mouth of the Paulaya Valley, runs up the Valley to the headwaters of the Paulaya River and crosses over the edge of the Agalta Mountains to Dulce Nombre de Culmí. This is a relatively long way, involving some construction in difficult and isolated terrain, and is no longer given much consideration as a short-term solution of the problem.

2. Esperanza Pass. This is the easiest crossing of the Cerros del Ocote-Sierra de la Esperanza. It lies almost directly south of Puerto Castilla. Starting on the south bank of the Aguán River near Durango, the route rises southward along the Rio Bonito for approximately 25 kilometers through easy terrain to the top of the Esperanza Pass, then drops through difficult terrain for around 15 kilometers to the Sico River near Paso Real. After crossing the Sico River, it follows a semi-circular pattern around the mountains that close off the east end of the Agalta Valley.

first running south through the village of Carbón and then turning east to San Esteban, chief economic center in the Agalta Valley.

3. Mamé River. This river flows into the Aguán from the Cerros del Ocote in the vicinity of Olanchito, through a narrow and winding gorge. Construction of a road would be very difficult, and would require the crossing of the coastal mountains from La Ceiba, and a continuation across the Cerros del Ocote and the Agalta Range to reach the Guayape Valley. The Mamé route was originally planned to serve a pulp and paper project recommended by the FAO for Pueblo Viejo, near the headquarters of the Mamé River. More recently, consideration has been given to location of a pulp and paper mill on the Aguán River (either upstream in the vicinity of Olanchito or Sabá, or downstream near Trujillo). These alternatives would not require the Mamé route, and consequently it has fallen into disfavor.

c. Agalta Range.

1. San Esteban-Dulce Nombre de Culmí. This route runs generally south from San Esteban. It involves a high and fairly difficult crossing of the Agalta Range. However, it is the shortest connection to existing roads and the least expensive.

2. San Esteban-Gualaco-San Francisco de la Paz.

This route runs west from San Esteban through moderately mountainous terrain of little agricultural value to Gualaco, and thence over a difficult stretch of mountains to San Francisco de la Paz. From there an easy route leads to Juticalpa. This route is longer and substantially more expensive than the San-

Esteban-Dulce Nombre de Culmí route. It runs south of the Sico River, and thus is inconvenient for the exploitation of the major pine resources lying north of that river, and in the Cerros del Ocote.

Weighing all these factors, the most logical route appears to be via the Esperanza Pass, and then to the Guayape Valley via either San Esteban-Dulce Nombre de Culmí or San Esteban-Gualaco-San Francisco de la Paz. Economically, as will be pointed out below, there is little to be gained by building the longer way through Gualaco, whereas the cost will be over $1,000,000 higher. Therefore San Esteban-Dulce Nombre de Culmí appears to be preferable.

Once the Esperanza Pass is chosen as the crossing of the Cerros del Ocote-Sierra de la Esperanza, the logical marine terminus for the road is Puerto Castilla. This is one of the best natural harbors on the Atlantic coast of Central America. It is usable 365 days a year, and is so well protected that shipping all along the Carribbean Coast uses it as a refuge from hurricanes.

Until 1938, Puerto Castilla was one of the best and largest banana export ports in Central America. Then the spread of the Panama disease led to the abandonment of the United Fruit Co.'s plantations in the lower Aguán and Paulaya Valleys, and the port was allowed to fall into disrepair. Small coastal vessels use the remains of the pier to load plywood and cattle, and petroleum products tanks have recently been installed to meet the needs of the plywood factory. There is a danger that the

remains of the pier will disappear completely. In 1961, a mere 3,755 tons moved through Puerto Castilla.

On the Puerto Castilla side the Bay of Trujillo is over 30 meters deep, with depths of 10 meters within 30-60 meters of the shore. The Trujillo side, on the other hand, is shallow and gradual, so that deep-draft vessels would have to be served over a 600-meter long pier. The Tippets-Abbott-McCarthy-Stratton report on Honduran ports recommends construction of a small wharf at Puerto Castilla, with 27.5 meters of berthing length, just sufficient to work one hatch of a larger ship. The present cost of this minimal wharf is estimated at $300,000 (see III-2). Shipping line representatives at Puerto Cortés have indicated that Puerto Castilla could easily be superior to other existing ports, and would probably be added to the regular list of calls if sufficient cargo offers.

3. Funds required

a. Estimated total cost of the project

The total cost of the project is estimated as follows:

	(In Lempiras)
1. New construction	
a. Reconstruction of Puerto Castilla (see III-2)	650,000
b. Road construction	
1. Puerto Castilla-San Esteban	5,645,000
2. Restoration of bridges, Corocito Olanchito	2,600,200
3. San Esteban-Guayape via Dulce Nombre de Culmí	2,480,000
Subtotal	11,375,200
2. Right of way, etc.	
a. Puerto Castilla, 200 hectares at L.2,000 per hectare	200,000

b. Road right of way, 30 meters x (183,000 meters from Puerto Castilla to Dulce Nombre, plus 92,000 meters from Corocito to Olanchito) = 8,250,000 square meters = 825 hectares @ L. 50	41,250
Subtotal	241,250

3. Existing works

a. Bridge across Chapagua River, 201 meters x L. 5,000	1,005,000
b. Railroad roadbeds, at L. 20,000 per kilometer for 120 kilometers	2,400,000
Subtotal	3,405,000
Total cost of project	15,021,450

b. Amount and source of resources to be supplied by applicant.

The applicant will provide items (2) and (3), right of way and existing works, with a value of L. 3,646,250. In addition, self-help labor has been offered by the inhabitants of the South Bank of Aguan River for the reconstruction of bridges, and might be valued at 15% of the estimated cost, or L. 390,030. The applicant will also provide annual maintenance, with an estimated value of L. 492,300 per year, and a value over 40 years (discounted to the present at 6% interest) of L. 7,262,705.

It is not believed that the Honduran Government will be able to make a substantial cash contribution to construction out of its ordinary budget resources.

c. Amount of financing requested from AID

AID is requested to lend up to $4,992,585 (in addition to $500,000 already lent.) Of this, approximately 60% or $2,995,551 will be for dollar expenditures and 40% or $1,997,034 will be to finance local currency expenditures.

4. Waiver of Direct Taxes or Import Duties

All taxes will be waived on machinery or supplies imported for government use. Taxes on fuel used by private contractors might be waived, but this will require negotiation with the Government of Honduras.

5. Currency Problems

Honduras' national monetary unit is the Lempira. The official par value is $0.50. The currency is convertible and stable.

D. Present Status of the Project

This economic feasibility study has been prepared as a first step in justifying a loan to finance the project. According to our contract, we are responsible for economic aspects of the study, but not for engineering. Continental-Allied Co., Inc. is a firm of economic consultants, not professionally qualified to practice engineering.

The U.S. Aid Mission to Honduras has made its own arrangements for engineering advice on this project, among others with Brown & Root, S.A., who are advisers to the Honduras Administration for Roads. According to a Memorandum prepared by Brown and Root, S.A., on 1 October 1964,

"Preliminary engineering investigations have been started for the San Esteban-Corocito portion of the route, which is 80 kilometers in length.

"The terrain between San Esteban and Corocito is generally mountainous and topographic maps for the region are not available. However, there are available aerial photos from flights that were made by the U.S. Army Map Service in 1954, 1956 and 1960 and it is from these photos that a topographic reconnaissance map will be prepared. This map work has been contracted for with Mark Hurd Aerial Service Inc. of Minneapolis, Minn. and their schedule calls for completion prior to December 11, 1964. These maps will have a scale of 1:12000, will show contours at

10 meters intervals, spot elevations, roads, building, drainage courses, shore lines, swamps and outlines of wooded areas to the extent of visibility of the aerial photos.

"It has been arranged in the interest of expediency that Mark Hurd will furnish positives for maps at periodic intervals in order that they will be available for use prior to December 11. In this manner, the work required for projecting the horizontal alignment and profile for the route can be done simultaneously with the mapping.

"This latter phase of the engineering work will be done by Brown and Root, S.A., for which there will be no charge to AID except for actual expenditures connected therewith.

"The San Esteban-Corocito reconnaissance maps assembled on 11" x 16" sheets, will show the proposed horizontal and vertical alignment from which data a preliminary estimate of construction cost can be developed. The topographic mapping is for a strip 2 kilometers wide. This, in general, in combination with the photos, will be adequate for the determination of drainage areas that are required for the calculation of structure requirements. A report based on the reconnaissance mapping should be sufficient to provide the engineering data required for the development of a loan that would cover the costs for engineering and construction of the project.

"Considerable time is needed for the field and office work required for preparation of plans adequate to cover the proposed construction on the basis of unit price contracts. In the interest of expediency, therefore, it is generally considered proper to establish single financing to cover both engineering and construction. In this manner, construction can commence as soon as plans are available for a section of the project. Further contracts can be made effective as rapidly as the engineering work progresses. Specifications covering unit price contracts (that is, where payment is made for earthwork on the basis of the number of cubic meters that are excavated, the number of lineal meters of culvert pipe of various sizes that are installed, the number of cubic meters of concrete that are placed, etc) are available at no cost, since copies of these specifications already have been prepared for the Ministry of Public Works by Brown and Root, S.A.

"The designs for this highway probably would be based on a criteria that would serve 100 vehicles per day.

"The only present access between Corocito and San Esteban is existing mule trails. It would be well, therefore, in connection with the proposed construction of this highway, to consider as a part thereof the building of a preliminary access road to follow the route projected on the reconnaissance maps. This could be done at minimum cost, would develop immediate access to the area, expedite the work, as well as reduce the cost for

engineering and serve as access for construction contractors. This access will permit savings in engineering and construction costs that should approximate the cost of developing the access road.

"This access road will be sufficient to permit the entry of fire fighting crews and can be completed prior to and in the early part of the forest fire season."

Material provided by Brown & Root, S.A. is reproduced below as Part III-1 of this report. A letter from Luis F. Santiago Echegaray of the Area Public Works, Tenth Naval District is reproduced as Part III-2 of this report.

In order to make approximate cost estimates for purposes of determining economic feasibility, we have undertaken to draw together some additional information obtained informally from Mr. William G. Nichol, Brown & Root, S.A.; Maj. S.A. Falkenbury, Jr. (Engineering Advisor, U.S. Army Mission to Honduras), Mr. Alfredo Ynestroza (Director, General Administration for Agrarian Incorporation) and certain other sources. This appears in Part IV of the report. None of the persons listed above can be considered responsible for our conclusions, since it was not possible to provide them with an opportunity for comment before publication.

Within the limits of our terms of reference, this report is intended to produce "financial and other plans" and a "reasonably firm estimate of costs," in accordance with Section 611 of the Foreign Assistance Act of 1961. It has involved eight man months of field investigation plus substantial editorial work and analysis in the home office.

If the recommendations are generally acceptable to the Government of Honduras, a loan application may be submitted to AID, possibly along the lines of the draft application which is attached as Annex "A".

E. Soundness of the Project

Insofar as we could ascertain, there is no serious obstacle to the construction of the proposed roads, provided that financing can be made available. As regards the economic soundness, this seems to be confirmed by the estimates of highly favorable cost-benefit ratios of 1 : 12.5 (with Aguán river bridges) and 1 : 10.3 (without Aguán River bridges).

Part II

ECONOMIC ASPECTS AND BENEFITS

A. Position of Project in Overall Program

The Northeastern Honduras Transportation Program would connect the present terminus of the Tegucigalpa-Guayape Valley Road, at Dulce Nombre de Culmí, with the Aguán Valley and the Atlantic Coast at Puerto Castilla, and would provide minimal port facilities at that location. Table 2 indicates the area that would be primarily benefitted, in terms of alternative kilometer distances to Puerto Cortés and Puerto Castilla. It is based on present distances via the existing road from Tegucigalpa to Puerto Castilla.

If a new North Coast road is built from Tegucigalpa, as seems probable, this would run from Tegucigalpa via Talanga, and should reduce the present total distance to Puerto Cortés by 110-120 kilometers for all points in the table (except Tegucigalpa itself). In addition, the new road would be built to much higher standards than are envisaged for the Northeastern Honduras Transportation Program. Consequently substantial diversion of traffic to Puerto Castilla from areas between Tegucigalpa and Campamento seems unlikely. (It is possible that the Northeastern road may be open for a year or two before the North road is completed, and would obtain much of the traffic for a short interim period.)

Therefore, the project will primarily benefit the isolated Guayape, Agalta and Aguán Valleys, the most important valleys of Northeastern Honduras. Benefits to areas that already have good alternative transportation to the seacoast will be minimal or

Table 2

Approximate Road Distances in Kilometers

To:	Tegucigalpa	Puerto Cortés	Puerto Castilla	Difference between Puerto Cortos and Puerto Castilla
From				
Tegucigalpa	x	341	466	-125
Talanga	57	398	409	-11
Guaimaca	100	441	366	75
Campamento	127	468	339	129
Juticalpa (Guayape)	195	536	271	265
Catacamas "	237	578	229	349
Dulce Nombre de Culmi "	283	624	183	441
San Esteban (Agalta)	329	x	137	x
Tocoa (Aguán)	449	x	69	x
Puerto Castilla	466	x	x	x

1. Present highway system.

The age of road transport dawned late in Central America, and particularly late in Honduras. Until relatively few years ago, the interior of Honduras relied largely on pack animals and oxcarts for overland transportation. Beginning in the early 1900's, a network of railroads was established along part of the North (Atlantic) Coast to serve the banana industry. These, however, penetrated only around 90 miles into the interior. The capital city of Tegucigalpa was connected to the South (Pacific) Coast by an all-weather road only in 1961, and to the North (Atlantic) Coast only in 1962.

Apart from bananas, Honduras could only market high-value products such as silver or coffee, or live cattle that could be driven to market on the hoof.

During the past several decades, however, a national network of main roads has been constructed (with substantial help from international lending agencies.) Today, serviceable roads cross the country from the North Coast (Puerto Cortés and San Pedro Sula) through Tegucigalpa to the South Coast. Near the South Coast this main artery crosses the Pan American Highway, providing access to markets in El Salvador and Guatemala to the west, and to potential markets in Nicaragua and Costa Rica to the south. Another important road, the recently-completed Western Highway, links San Pedro Sula directly with San Salvador (by way of Nueva Ocotepeque). Other main roads fan out from Tegucigalpa into the Guayape Valley (via Juticalpa to Catacamas), and the Jamastrán Valley (via Danlí). A group of national and logging roads connects

San Pedro Sula, Progreso and Yoro to Olanchito in the Guayape Valley. Major roads are shown in the following table.

Table 3

Honduran Highway System, 1962
in kilometers

	Secondary	Main	Total
Tegucigalpa-Puerto Cortés	365	341	706
Puerto Cortés-Cuyamelito		56	56
San Pedro Sula-La Ceiba	208	191	399
Masicales-Trujillo		147	147
Chamelecón-Santa Rosa de Copán	51	160	211
Santa Rosa de Copán-Gracias	14	48	62
La Arada-Santa Barbara	17	65	82
Copán Ruins-Guatemalan Frontier		12	12
Nueva Occtepeque-Guatemalan Frontier		23	23
-El Salvador Frontier		8	8
Tegucigalpa-Valle de Angeles	14	28	42
-San Juan de Flores	14	43	57
-Catacamas	278	235	513
Talanga-Minas de Oro	31	73	104
Tegucigalpa-Choluteca	352	145	497
Choluteca-El Triunfo		53	53
Tegucigalpa-Danlí	186	110	296
Danlí-Los Alanos		36	36
El Chupadero-Oropoli		45	45
	1,530	1,819	3,349

Source: República de Honduras, Secretaria de Economia y Hacienda, Dirección General de Estadistica y Censos, "Honduras en Cifras," Tegucigalpa, December 1963, pages 132-135.

For statistical purposes, roads are classified as follows (as of the end of 1962):

Table 4

Types of Roads (in kilometers)

	Paved	Unpaved	Total
Principal	329	479	808
Secondary	55	922	977
Tertiary	-	1,149	1,149
Penetration	-	476	476
	384	3,026	3,410

Table 5 gives recent traffic counts on representative main highways.

Table 5

24-Hour Traffic Counts on Main Highways
(approximately August 1964)

Highway	Station	Passenger Vehicles	Light Trucks	Heavy Trucks	Trailers	Total
Western Highway	Cofradia	64	189	109	6	368
	-Quimistan	49	84	98	7	238
	-La Entrada	37	67	52	7	163
W. Hwy. Extension	-Ocotepeque	TOTAL				43
La Entrada - Copán Ruins	-La Entrada	34	81	21	0	136
La Arada-Sta. Barbara	-La Arada	7	28	14	0	49
North Road						
Tegucigalpa-Comayagua	-Zambrano (K. 56)	91	45	154	5	295
Comayagua-San Pedro Sula	-Siguatepeque (K. 146)	86	73	157	5	321
Comayagua-San Pedro Sula	-Taulabé (K. 170)	75	49	155	9	288
San Pedro Sula - Pto. Cortés	-Choloma	315	237	152	19	723
South Road	-K. 18	571	86	203	41	901
	-K. 50	417	159	260	42	878
Inter-American Highway						
	-El Amatillo (KO)	TOTAL				191
	-Nacaome (K. 34)	302	107	188	49	646
	-Agua Caliente (K. 65)	350	133	153	25	661
	-San Marcos (K. 140)	118	87	111	27	343
	-El Espino (K. 149)	TOTAL				84
Tegucigalpa-Danli	-K. 26	98	73	17	0	188
	-K. 70	39	33	12	0	84
Tegucigalpa-Guayape	- K. 24	75	91	94	7	267
	- K. 165	59	73	74	4	210
Siguatepeque-La Esperanza	-Siguatepeque	83	47	37	0	167

Source: Brown & Root, S.A.

2. Water transport system

Most of Honduras' export and import trade is carried by ocean shipping through ports on the Atlantic Coast (a limited quantity passes through the lighterage port of Amapala on the Pacific Coast). Except for a small trade with the Bay Islands and the coast of the Mosquitia, cabotage is economically unimportant. River navigation consists of the use of canoes to reach points on the Lower Patuca River, and on certain lagoons and rivers of the Mosquitia.

The bulk of shipping services to and from Central America, and most sailings between Central American ports, are provided by foreign-owned lines. The major lines to the U.S. are the Honduran flag ships of the United Fruit Company (primarily to Caribbean ports) and the U.S. flag Grace Lines (mainly to Pacific ports). Dutch, French, Italian and other lines provide service to both coasts of Central America as a part of routes between Europe and the West Coast of the U.S. and Canada, and a Japanese line links Puerto Cortés with the Orient. Many foreign lines that pass close to the Caribbean avoid Honduras (and other Central American countries) because of the delays in ports.

In recent years, an increasing share of trade between Central America and the outside world, as well as the limited water-borne trade between Central American countries, has gone to several Central American carriers, particularly Marina Mercante Nicaraguense (MAMENIC), owned by the Somoza family, and a Guatemalan line. A cabotage law, restricting common-carrier service between Central American countries to Central American flag ships, probably will be passed under the common market agreements within the next few

years.

At present there are approximately 14 scheduled liner sailings a month between Puerto Cortés and North America, 9 for Europe and 2 for the Far East. These sailings occasionally also call at Tela and La Ceiba.

Only a very limited volume of intra-Central American trade moves by sea, because of high freight rates established by shipping conferences, and high charges established by governments, trade unions, railroads, and others involved in the handling of cargo through Central American ports. Persons with shipping experience in Central America usually advise that truck transportation will be cheaper, even for long hauls, and deprecate the possibility of using ocean shipping.

The type of vessels calling at Honduran Atlantic ports is indicated in Table 6.

Table 6

Characteristics of Vessels Arriving in Puerto Cortés in 1961

		General Cargo	Lumber boats	Banana boats
Total length (feet)	Maximum	498.0	338.7	493.1
	Minimum	72.2	86.6	124.3
	Average	340.6	185.5	433.1
Draft (feet)	Maximum	29.3	24.6	27.8
	Minimum	8.0	6.0	6.8
	Average	20.8	11.8	26.0
Net register tons (of 100 cubic feet)	Maximum	5,885	2,736	4,325
	Minimum	73	77	104
	Average	1,384	318	2,764
Displacement tons (of 2,240 pounds)	Maximum	13,196	6,358	9,000
	Minimum	215	300	800
	Average	4,433	850	5,008

Source: "Plan de Desarrollo, Puerto Cortés," 1962.

The number and size of small craft engaged in cabotage on the Atlantic Coast is indicated in the following table.

Table 7

Number and Size of Vessels in Cabotage Trade in 1962

Size	Number	Tonnage	
		Total	Average
Less than 10 tons	45	232.5	5.1
10 to 24.9 tons	43	693.0	16.1
25 to 49.9 tons	25	853.0	34.1
50 to 99.9 tons	7	461.0	65.8
100 tons and over	4	451.0	112.7
Total	124	2,690.5	21.6

In that year, the total cargo transported was 9,668.5 tons, or around 78 tons per boat-year.

Wooden boats up to 250 gross tons are constructed in the Bay Islands. There are an estimated 1,000 large canoes (cayucas), 15-35 feet long, in the Caratasca area of the Mosquitia, mostly used for fishing.

On the Atlantic Coast, the chief ports at present are Puerto Cortés, Tela, La Ceiba, and Puerto Castilla. The peak cargo movement, reached in 1934-35 when Puerto Castilla still was exporting bananas, is just beginning to be approached again today.

Puerto Cortés, owned and operated by the government, is the main port of the country, with a relatively well-protected harbor. It has two wharfs permitting ships to tie up alongside. Originally designed as a railroad port, Puerto Cortés has only limited direct access for motor vehicles, and most truck-borne cargo must be transshipped on railroad cars in order to be handled

at the port. Available depth at the port is 9.2 meters. Puerto Cortés has become increasingly congested and inadequate for the country's foreign trade. A plan for reconstruction has been discussed with the World Bank, and probably will be put into effect soon.

Tela is an unprotected railroad pier, running out into the ocean. From 1954 until 1962 there were no exports of bananas, and the port was used only to bring in supplies for the United Fruit Co., and for limited lumber exports. At present, bananas are again moving out through Tela, as a result of the expansion of production and the congestion of Puerto Cortés. The port has a usable depth of 9 meters. There are no facilities for truck traffic.

La Ceiba is also a railroad pier jutting out into the unprotected ocean. Storms interfere with port operations, particularly during the months November-February. The pier foundations are deteriorating and silting is reducing the usable depth (now only 6 meters or 20 feet). Banana exports and incoming petroleum and other supplies for the Standard Fruit Co. use most of the port's capacity, but small amounts of lumber have been exported. If substantial additional traffic were to be handled, the port would have to be expanded or rebuilt. La Ceiba is the chief port for small boats from the Bay Islands.

Ports on the Bay Islands include Roatan, French Harbor, Oak Ridge, Stan Creek, and Guanaja. Roatan and Guanaja handle small amounts of international trade. Small ports along the coast to the east of Castilla include Santa Rosa de Aguán, Limón, Plaplaya,

Brus Laguna, Caratasca and Puerto Lempira.

Each major port is under the direction of a local Customs Collector, assisted by the Military Delegate to the Port (seconded from the Army to the Ministry of Economy and Finance). The Military Delegate supervises the Dock or Guard Commander, who in turn supervises the dock guards or police.

Maintenance of port facilities is financed out of the budget of the Customs Administration. Expenditures on maintenance appear to be less than are required.

Loading and unloading of vessels (and lighterage services at Amapala) are provided by private firms. The customs service has its own labor for movement of goods into and through customs. The cost is approximately covered by a standard fee. (see II-B-4).

In connection with a proposed loan for rehabilitation and expansion of Puerto Cortés, the IBRD has recommended the establishment of an Autonomous Port Authority, and this recommendation has been accepted.

The average distance travelled by cabotage cargo in 1963 was 90 kilometers. Table 8 gives available data on origin and destination of coastal passenger and cargo traffic.

Table 8

Cabotage Traffic in 1963

	Passengers		Tons of cargo	
	Out going	In-coming	Outgoing	Incoming
Puerto Cortes - La Ceiba	100	103	602.3	2,232.5
- Trujillo	76	87	742.7	340.4
- Castilla	2	-	23.4	0.0
La Ceiba - Balfate	11	31	20.8	39.6
- Trujillo	324	443	162.7	312.8
- Castilla	23	57	49.2	21.1

Balfate	- Trujillo	21	12	2.6	6.2
Trujillo	- Castilla	97	36	70.2	0.9
Subtotal		654	769	1,673.9	2,953.5
Puerto Cortés	- Guanaja	-	8	55.5	79.4
	- Roatan	62	162	976.8	232.5
Tela	- Roatan	-	-	3.0	29.2
	- Stan Creek	16	1	44.6	9.5
	- Utila	86	91	138.9	-
La Ceiba	- Guanaja	542	287	341.2	493.2
	- French Harbor	100	74	239.4	22.6
	- Roatan	407	685	274.5	176.8
	- Utila	591	401	243.0	416.8
	- Cayos Cochinos	35	53	8.5	0.2
Balfate	- French Harbor	-	-	1.0	-
	- Roatan	2	-	26.7	6.8
	- Utila	-	-	2.1	-
Trujillo	- Guanaja	18	28	1.1	21.4
	- Roatan	5	8	5.5	10.0
	- Utila	7	2	1.5	3.0
Castilla	- Guanaja	2	16	22.0	35.2
Limón	- French Harbor	2	-	11.2	-
Subtotal		1,875	1,816	2,396.5	1,536.6
French Harbor	- Guanaja	-	-	-	3.3
Roatan	- Guanaja	2	21	-	64.8
Utila	- Roatan	99	158	3.9	26.6
Subtotal		101	179	3.9	94.7
Tela	- Rio Tinto	79	85	14.6	12.8
La Ceiba	- Limón	63	23	86.6	32.9
	- Brus Laguna	79	96	19.8	98.2
	- Caratasca	89	6	179.8	18.0
	- Plaplaya	121	28	124.5	27.0
	- J.S. Guardiola	9	41	24.7	5.0
Balfate	- J.S. Guardiola	6	-	17.6	-
Trujillo	- Santa Rosa de Aguán	53	19	27.7	0.3
	- Iriona	34	-	7.1	0.4
	- Limón	62	23	32.6	2.1
Castilla	- Santa Rosa de Aguán	16	14	1.4	3.2
	- Limón	6	16	4.5	0.7
Trujillo	- J.S. Guardiola	8	2	6.6	0.4
	- Brus Laguna	43	10	37.3	26.7
	- Caratasca	-	-	29.9	-
Subtotal		658	363	614.7	227.7
Guanaja	- Caratasca	14	17	96.7	18.6
	- J.S. Guardiola	16	-	1.1	-
Roatan	- J.S. Guardiola	4	7	2.0	20.0
Brus Laguna	- Plaplaya	13	13	8.3	0.3
Subtotal		47	37	108.1	38.9
Totals		3,335	3,164	4,797.1	4,851.4

Source: Consejo Nacional de Economía

These figures may be incomplete, but do give some idea of the relative magnitudes. Puerto Castilla is approximately 70 kilometers from the major Bay Island ports, while La Ceiba, presently the most important center for island trade, is around 90 kilometers away. Some part of the island trade, therefore, is likely to shift to Puerto Castilla after it becomes more active. Trade with the Mosquitia is quite small at present, but should increase as a result of the development of a port and processing facilities (e.g. a slaughterhouse) at Puerto Castilla.

3. Other present transportation systems

a. Railroads

Honduras has three railway systems:

(a) The National Railway, owned by the government, and running south from Puerto Cortés to Potrerillos on the road to Tegucigalpa, with a total length of 113 kilometers.

(b) The Tela Railroad, owned by the United Fruit Co., and operated in combination with the National Railway, running west and south from the port of Tela to Puerto Cortés and the banana plantations in the Ulúa Valley, with a total length of 626 kilometers.

(c) The narrow-gauge lines of the Standard Fruit Co., running along the coast from Tela to La Ceiba, and thence across the mountains to the company's banana plantations in the Middle Aguán Valley near Olanchito, with a total length of 540 kilometers. The Trujillo Railroad, with 383 kilometers of track between Puerto Castilla and the Aguán and Paulaya Valleys, was dismantled in 1942.

The National Railway carries a certain amount of general

traffic (including imports for the San Pedro Sula area, and lumber for export). The other two systems, however, are mainly devoted to servicing the banana plantations of the two fruit companies. Roads now parallel the National and Tela railroads, and will be built along the coast between Tela and La Ceiba in the next few years. Freight is exchanged between the Tela Railroad and the Standard Fruit Co. railroad at Tela, but must be transferred between cars of the two lines because of the difference in gauge.

The railroad lines of the Standard Fruit Co., originally built to connect plantations along the Atlantic Coast with the port of La Ceiba, run between Tela and La Ceiba, and inland from La Ceiba to the newer banana areas near Olanchito in the Aguán Valley. Only the Aguán Valley line currently carries important traffic, since plantations along the coast have long since been abandoned. The line to the Aguán valley runs 111 kilometers between La Ceiba and Olanchito.

Traffic on Standard Fruit's railroad consists mainly of banana exports, and supplies (mostly imported) for the company's own operations. Possibly 10% of the total is commercial freight handled for others. Of this, roughly half moves between Tela and La Ceiba, while possibly 5,000 tons a year consists of lumber from the vicinity of Yoro for export through La Ceiba, and agricultural products from the Aguán Valley, moving to La Ceiba.

The line to Tela operates at a loss of around $250,000 a year. The company would like to abandon the line, but is unable to do so without government permission under the terms of its land concession. There has even been some talk of cutting down rail service from the Aguán Valley and shifting some shipments to trucks

if a road is built from Olanchito to La Ceiba (or to Puerto Castilla).

The company is a common carrier under Honduran law, but this has a somewhat different meaning than in the United States. According to the official freight tariff,

"The Company will fill requests for empty cars or other equipment provided these requests are made in due time (at least 12 hours in advance) but the Company is not in any way committed to provide these services when it does not have the requested equipment available and does not have facilities available to move it. The Railroad will not accept complaints on this subject"[1)]

Since the railroad is short of equipment, in effect this means that the rates only apply if the company wishes to accept the freight. While this has not presented much practical problem for small shippers, it could prevent some larger projects from relying on the railroad.

b. Air Transportation

A national airline (SAHSA) provides scheduled passenger and freight service to a number of interior points, the most important being Tegucigalpa, San Pedro Sula, Puerto Cortés, Tela, La Ceiba, Trujillo and Juticalpa. Within the Aguán-Olancho region the airline serves Juticalpa, Catacamas, Gualaco, San Estéban, Tocoa, Trujillo and Olanchito using DC-3's. Charter service is available to a number of other points with smaller aircraft.

For international traffic, Tegucigalpa is served by Pan American and Taca International Airways. A jet airport will be opened soon at San Pedro Sula, and will also be served by these lines. At present San Pedro Sula is served by international flights of TAN (non-IATA carrier) and SAHSA.

Chartered freight planes are occasionally used for exports

1) Standard Fruit Co., "Reglamento y Tarifes de Fletes, Pasajes y Otros Servicios Aprobados por Acuerdo No. 916 del Supremo Poder Ejecutivo de 13 de Mayo de 1960," La Ceiba, 1960. page 34.

of perishable products, but the cost is generally prohibitive.

Airports in the project area are all grass strips, usually adequate for DC-3 traffic, but unsuitable for larger aircraft. Fuel supplies and other service facilities are non-existent. Rehabilitation of the airport at Puerto Castilla to permit use by DC-6 type aircraft would be helpful in ensuring ability to meet emergency needs for spare parts, etc.

Table 9, based on a sample survey covering approximately 70% of SAHSA's total air freight movements in Northeastern Honduras during the second half of 1962 and first half of 1963, gives some idea of the type of traffic at present.

In round numbers, our estimates of major air traffic movements, and expected changes once the road is built, are as follows:

a. Guayape Valley

1. Meat to Tegucigalpa from Juticalpa (pork) and Catacamas (beef), (200,000 lb.) No change.

2. Meat from Juticalpa to La Ceiba (20,000 lb.) No change.

3. General cargo to Agalta Valley: manufactured goods (50,000 lbs.), salt (10,000 lbs.), beans (5,000 lbs.), seasonal movement of corn (5,000 lbs.). San Esteban's share - approximately 75% - should shift to road.

4. Onions to La Ceiba (10,000 lbs.). No change.

5. Manufactures from Tegucigalpa (130,000 lbs.) and La Ceiba (62,000 lbs.). Half of La Ceiba's share should shift to road and Puerto Castilla.

b. Agalta Valley

1. Manufactures, etc. from Tegucigalpa (45,000 lbs.) and

Table 9

Raw Data on Air Freight, July 1962 - June 1963
In pounds
Sample data and Statistics[1)]

Destination:	TGU	JUT	CAA	SFH[2)]	LAU	GCO	SET	OAN	LCE	TOC	TJI
Origin											
Tegucigalpa-TGU											
Statistical	x	76,095	48,271	-	11,363	28,333	21,151	122,298	161,223	706	19,408
Juticalpa-JUT											
Meat	110,077	x	-	-	-	-	-	-	9,378	-	-
Other	6,021	x	-	-	200	7,367[3)]	17,277[4)]	428	5,580[5)]	-	-
Sample total	116,098	x	-	-	200	7,367	17,277	428	14,958	-	-
Statistical total[1)]	175,440	x	270	-	2,673	18,884	42,168	3,040	60,118	-	-
Catacamas-CAA											
Coffee	700	-	x	-	-	-	-	-	5,500	-	-
Meat	78,912	-	x	-	-	-	-	-	288		
Other	1,489	220	x	-	-	7,709[6)]	13,751[7)]	665	7,620[8)]	-	-
Sample total	81,101	220	x	-	-	7,709	13,751	665	13,408	-	-
Statistical total[1)]	94,088	442	x	-	-	12,869	29,751	4,178	26,393	-	-
La Union-LAU											
Coffee	-	-	-	-	x	-	-	5,144	7,725	-	-
Other	42	-	-	-	x	-	-	8,065[9)]	1,700[10)]	-	-
Sample total	42	-	-	-	x	-	-	13,209	9,425	-	-
Statistical total[1)]	879	225	-	-	x	-	-	24,288	19,995	-	-
Gualaco-GCO											
Coffee	7,694	5,194	2,347	74,908	-	x	4,859	-	36,505	-	-
Other	-	203	340	-	-	x	613	-	79	33	-
Sample total	7,694	5,397	2,687	74,908	-	x	5,472	-	36,584	33	-
Statis. total[1)]	5,314	7,376	4,291	-	-	x	1,573	67	41,563	-	-
San Esteban-SET											
Coffee	-	100	1,000	-	-	5,675	x	375	111,244	-	-
Meat	1,282	-	-	-	-	11,759	x	-	21,166	-	-
Other	1,454	-	439	-	-	9,933[11)]	x	-	1,478	-	-
Sample total	2,736	-	1,439	-	-	27,367	x	375	133,888	-	-
Statis. total[1)]	42,325	6,059	7,242	-	-	1,834	x	454	95,455	-	-

Table 9 (cont.)

	TGU	JUT	CAA	SFH[2]	LAU	GCO	SET	OAN	LCE	TOC	TJI
La Ceiba-LCE											
Stat. total[1]	303,327	33,904	38,811	-	4,599	21,698	101,499	131,981	x	165,982	102,940
Tocoa											
Meat	3,144	-	-	-	-	-	200[12]	1,225	49,895	x	3,951
Other	-	-	-	-	-	-	-	-	66,435[13]	x	14,861[14]
Sample total	3,144	-	-	-	-	-	200	1,225	116,330	x	18,812
Statis. total[1]	1,908	-	-	-	-	-	-	1	88,494	x	54,240
Trujillo-TJI											
Meat	-	-	-	-	-	-	-	-	300	-	x
Other	7,485[15]	-	-	-	-	-	-	-	1,806	7,006[16]	x
Sample total	7,485	-	-	-	-	-	-	-	2,106	7,006	x
Statis. total[1]	8,145	-	-	-	-	-	-	342	91,641	12,861	x

1) Average of annual statistics for 1962 and 1963.
2) San Francisco de la Paz
3) Mostly miscellaneous manufactures; approximately 2,200 of beans
4) Miscellaneous manufactures (9,849), salt (6,328), corn (1100)
5) Includes 4,665 of onions
6) Miscellaneous manufactured goods, salt
7) Barbed wire (5,000), salt (4,000), other (4,751)
8) Includes onions (3,000), chickens and eggs (2,887), other foods (1,568)
9) Includes 6,765 of beans
10) Includes 1,600 of onions
11) Includes 3,600 of hides and skins
12) Corn
13) Includes 41,040 of corozco (wild oil palm); 12,419 of rice; 9,600 of flour, sugar, beans; 1,476 of hides
14) Includes rice (8,279), brown sugar (3,800), hides (922)
15) Includes hides (3,545), lobster and fish (1,181) and plywood (1,540)
16) Includes tobacco (1,100), insecticides (1,400) and plywood (540)

Sources: Sample from records of SAHSA; Statistics from Dirección General de Aeronautica

La Ceiba (145,000 lbs.). San Estéban's share - approximately 80% - of La Ceiba traffic should shift to road and Puerto Castilla.

2. Manufactures, etc. from Guayape (see 3 above). Should shift to road; manufacturers from Tegucigalpa, etc. would be shipped straight through.

3. Coffee to the interior from Gualaco (100,000 lbs.). Should go by air or mule to San Estéban, thence to Puerto Castilla.

4. Coffee to export via La Ceiba (37,000 lbs. from Gualaco and 110,000 lbs. from San Esteban). Should go by road to Puerto Castilla.

5. Meat from San Estéban to Gualaco (12,000 lbs.) and La Ceiba (20,000 lbs.). No change.

c. Aguan Valley

1. Meat from Tocoa to La Ceiba (50,000 lbs.). No change.

2. Corozco (wild oil palm) from Tocoa to La Ceiba (40,000 lbs.). Should shift to road and coastal vessels (or railroad).

3. Rice and beans from Tocoa to La Ceiba (20,000 lbs.). Should shift to road and coastal vessel (or railroad).

4. Rice (20,000 lbs.), brown sugar (10,000 lbs.) and other foods (30,000 lbs.) from Tocoa to Trujillo. Will move by road.

5. Meat from Trujillo to San Pedro Sula (15,000 lbs.). No change.

6. Manufactures from Tegucigalpa to Trujillo. (30,000 lbs.) Half may shift to road and Puerto Castilla.

. . .

c. Animal Transportation

In areas that lack roads, animal transportation is the alternative to air transportation. Mules normally carry 100 kilograms

while donkeys carry around 50 kilograms. The number of available cargo beasts is usually less than the seasonal peak demand, and lack of transport is a serious impediment to expansion of production. On-the-hoof movement of cattle - and even pigs - to market is important in some areas, even though serious losses of weight and strayed stock result.

4. Extent to Which Inadequacies of Transportation are Retarding Economic Growth.

Serious students of Honduras' economic and social problems are unanimous in pointing to the vital role of transportation. Transportation - or lack of it - has been a primary cause of human and material underdevelopment in all of Central America, and most of all in Honduras. Many populated and potentially productive areas have no roads at all. Goods and people may travel as much as 100 kilometers on mule-paths before reaching a road that will take automotive vehicles. These people are forced to limit themselves to subsistence agriculture, because they cannot economically move surpluses to market.

In northeastern Honduras, the isolation of the Guayape Valley has been broken in recent years by the construction of the main road from Juticalpa to Tegucigalpa, and of a system of feeder roads between Juticalpa and Catacamas. An appraisal of the effects of this development is attempted below (II-C-4-c). However, the present highway to Tegucigalpa leaves the valley almost 600 kilometers from the sea, making imports and exports expensive. The only export of any consequence is frozen meat. Valuable hardwood and pine resources are unused, because the cost of transportation to a port would be prohibitive.

The Agalta Valley continues to depend on animal transportation as in the times of the Spanish conquistadores, supplemented by air passenger and freight services. There is no road worthy of the name in the entire valley of 359 sq. kilom. Production is confined to high-value items - beef, pigs, coffee, allspice - that can walk out under their own power, or can stand the high cost of air freight. At present the valley appears to be declining economically.

The Aguán Valley is a case of an area that had a reasonably good transportation network, but lost it (when the facilities of the Trujillo Railroad Co. were pulled out in 1942). As a result, there has been a dramatic decline in economic activity in the entire area. Efforts to reverse this decline without providing the basic requirement of transportation (such as the government colonization scheme at "Colonia del Aguán") have not succeeded. The Aguán Valley is potentially the richest agricultural area of Honduras, comparable in many respects to the famous Imperial Valley of California. Lacking communications with the outside world, however, it must remain a backwater of small subsistence farms.

Regions without roads are necessarily deprived, economically, socially and even politically. Some 40.2% of Honduras' total population live in townships (Municipios) that have no roads. In Olancho, the percentage is 39.8, whereas in Colón 100% of the population lacks roads.[1] These people still use the transportation

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1) Continental-Allied Co., Inc., "Honduras Self-Help Feeder Road Program," Washington, D.C., 1964, p. 28.

technology of the horse and mule age as it was introduced by the Spanish Conquistadores, and are unable to participate in the economic and cultural changes that resulted from the invention of the wheel.

As in many tropical areas, Honduras' population has tended to move to mountainous interiors, so as to escape the discomfort and disease found in the low-lying humid areas along the coast.

The construction of railroads, and the public health measures and cash incomes associated with the banana industry helped to develop another area of dense population along the North (Atlantic) Coast. Otherwise, however, Honduras was characterized by scattered nuclei of population located in small interior valleys where pockets of fertile soil existed, plus a thin population engaged in shifting subsistence agriculture in mountainous areas of low fertility.

Historically, this scattering of population has made it difficult to develop effective national government and social institutions. It has been difficult or impossible to bring schools, health services and even church services to the widely scattered towns that had no roads.[1)]

Without roads, it is difficult or impossible to establish adequate schools, and difficult or impossible to obtain the attendance of school-age children. If school teachers are available at all for isolated communities, they are "empiric" (i.e. have only completed primary school themselves). If schoolhouses are available, they are rudimentary.

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1) For a review of social and political consequences of the lack of roads, see Ibid., pp 28.

Although an ambitious self-help school construction program has been launched under the auspices of SCIDE (the educational "servicio"), experience has shown that it is simply not possible to supply necessary supervision and building materials to communities that do not have roads. Several projects, among them Sabá, in the Aguán Valley, have had to be abandoned or delayed owing to lack of adequate roads.

In the past, lacking the means to transport bulky or low-value products, Honduras was only able to develop high-value minerals (such as silver), high-value agricultural products such as coffee, and cattle that could be driven to market. For the rest, Honduras was thrown back on subsistence agriculture and the small range of commercial and service activities that this limited economy could support. Only very recently has construction of roads made it possible for much of the country to seek markets for surplus products. Only recently, therefore, has it become desirable for farmers to try to produce more than they could eat.

According to the 1952 census of agriculture, the average agricultural worker cultivated only 1.1 hectares of crop land, although he could have worked three hectares without any substantial change in techniques. Unlike some other underdeveloped countries, the reason for the small area per worker was not a general shortage of land. On the contrary, land is comparatively so plentiful that Honduras has become a new frontier for many Salvadorans, a place to which they migrate to obtain work and find a farm.

To be sure, there are regions within Honduras where concentration of population has led to scarcity, over-exploitation and

eventual barrenness of land. However, there has always been empty land available for the taking, and in many comparatively well-populated parts of the country there is still substantial idle land today. In part this mal-distribution is due to social reasons: like anyone else, Hondurans are reluctant to leave their family and friends, particularly for isolated areas that lack communications with the outside world. In part it is due to unresolved health and safety problems.

However, the overriding reason is economic. Farmers choose to remain where they are if possible new areas have such poor access to markets that their production is valueless. Farmers choose to produce only for their own subsistence if any additional production is salable only at unremunerative prices, or is not salable at all. The insufficiency and high cost of transportation where roads do not exist is the chief cause of this condition.

The lack of roads not only makes transportation expensive, but also tends to keep competition away, and permits the development of local transportation and trade monopolies that take an unwarranted share of the farmer's possible return.

Since mules cannot be run on schedule, and their carrying capacity is limited, an entire region usually depends on the services of an intermediary with a storehouse (Bodega) located at a central point, who buys individual mule-loads of produce, and acts as a distributor for soft drinks, sugar, salt, building supplies and basic foodstuffs during the season of scarcity. The owner of the bodega usually has his own truck, or arranges for movement of commodities to the outside world by organized mule

trains.

Commercially, the people of the region are literally at his mercy. He sets the prices for all exchanges, without any competition that might provide a comparative yardstick. Needless to say, the resulting prices are often unfavorable to the farmer. For example, cases are not infrequent where the corn that a farmer harvested and sold for L. 0.05-0.06 a pound resold to him three months after the harvest at prices up to L . 0.18.

In isolated areas which depend on cash crops such as coffee, farmers frequently fall into debt to the local merchant. Often they must sell their crop before harvest ("en flor") in order to get money with which to buy food. The resulting price may be less than half what is offered at harvest time, three to five months later. The effective interest rate is 300-400% per year, and effectively discourages the expansion of production.

Once established, trade and transportation monopolists tend to use the normal tactics of monopolies. Rivals who might try to offer better prices to farmers are fought with unfair gossip, threats to farmers who patronize them, or withdrawal of credit. Similarly the transportation monopolist develops favorites among the farmers and gives them preferential treatment.

Transportation availability becomes at best inflexible to market demand, and at worst dependent on the personal whim of the monopolist. This makes it difficult or impossible to produce and market perishables at a profit. Finally, local monopolists usually transport only to the nearest market or major road, so that further handling delays and expenses are required to reach ultimate

markets.

At one or two roadless places in northeastern Honduras, modernization has occurred, and the role of transportation monopolist is played by the local airlines agent. He receives a large commission on outgoing freight, and thus is able to make it seem advantageous for farmers to sell all their products to him. In one case, the monopolist is also the town's only merchant, and its largest landowner. He pays for his purchases only in credit, good at his store.

Because of the lack of competition, and the paucity of facilities for storing and marketing crops, there are extreme seasonal fluctuations in prices. In some areas corn sells for as little as L. 2 per quintal ($0.01 per pound) at harvest time, but rises to L. 8 per quintal during the period of scarcity. San Estéban, where corn is extremely cheap during the harvest season, actually imports significant quantities by air during the dry season. Normal wholesale prices in Tegucigalpa average L. 6.25 per quintal in the main harvest period (September-January) and L. 8.37 per quintal in the season of scarcity (May-August.)[1)]

Since farmers without roads receive less for their products, and pay more for what they buy, the real return per unit of their labor and capital is substantially lower. It is not surprising therefore, that they have less incentive to produce, less economic possibility of using intensive agricultural methods (fertilizer, improved seed, etc.), and fewer opportunities to depart from

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4) Banco Nacional de Fomento, "Programa de Compra de Granos a Precios Minimos del Banco Nacional de Fomento para la Cosecha 1963-1964," Tegucigalpa, 1963.

the system of subsistence cropping limited to production of corn, beans and few other staples. In short, as a result of their isolation, they have every economic justification for producing very little, and little economic incentive to improve.

Once a road is opened, these conditions begin to change. New roads soon become part of the route of itinerant truckers, a highly competitive group which has become an important link in the Central American marketing system. Looking for cargo, independent truckers drive to the farms they can reach, or to convenient roadside areas where mule paths terminate, and pay cash for produce at reasonable competitive prices. Thus they act as active agents in breaking down the economic apathy of subsistence economies. In the words of one Honduran observer, the itinerant trucker "creates an appetite for planting among the farmers."

One other obvious consequence of the absence of roads is to make the exploitation of natural resources difficult or impossible. In northeastern Honduras the rich pine and hardwood forests have had virtually no economic use, since it has been almost impossible to bring lumber to market with a reasonable cost of transportation.

Under these conditions, the mere construction of roads tends to have a rapid stimulating effect on production during a medium-term period (of perhaps five years) when no improvement in techniques is likely to take place. In the longer, run, however, there may be an even more important effect as a result of the access provided for new methods of production.

In Honduras as in many other underdeveloped countries, isolation has led to in-breeding of animals, field crops and ideas.

The in-breeding of animals has caused the proud Andalusian strains imported by the Spaniards to regress into their original wild state, so that today's Honduran cattle closely resemble the pictures of European bisons as drawn by prehistoric man in the caves of the Pyrenees. The resulting cattle are hardy, successfully survive starvation and parasites that would kill purebred animals, but are relatively inefficient producers of meat (See II-C-2, below).

Similarly field crops like corn and beans have developed during centuries of localized re-planting of run-of-the-field seeds. They reflect the degree of genetic knowledge which developed among the Mayan Indians, with relatively little influence from the modern science of heredity.

Last, but by no means least, inbreeding of ideas as to agricultural techniques has led to the perpetuation - and also to the abuse and degeneration - of the "milpa" system of shifting agriculture which was developed by the Mayan Indians. This is the age-old system of burning down the forest growth to make cropland for a year or two, then moving on and allowing the forest cover to come back.

In areas of low labor cost, covered by tropical hardwoods, and with limited population density (so that land does not have to be re-used for a number of years) the system is economically efficient, and reasonably well adapted to ecological requirements. However, as population pressure increases, and as the "milpa" moves into unadapted land such as the pine forest areas of the Honduran highlands, it brings on declining yields, erosion, and

eventual destruction of the land as a source of wealth.

This destructive process is beginning to take place in Honduras. It is being accelerated by the spread of education and commerce, which are raising the Honduran people's expectations and cultural requirements. Today the milpa is expected to provide more than a mere subsistence: it is asked to buy an occasional bottle of beer, replacement batteries for a transistor radio, and perhaps even an occasional magazine as literacy spreads. What is more, it is expected to feed more mouths per family, as spreading health programs keep more children alive.

In the long run, the subsistence milpa must be supplemented by the development of diversified higher-value crops for cash markets, and must give way to modern techniques, including the use of fertilizers, mechanical clearing of bottom land, and continuous cultivation in rows. But these developments all depend on outside stimuli - market demand, technical assistance and credit facilities - which are largely inaccessible as long as roads do not exist.

Educational and financial resources of the Honduran Government agencies charged with fostering agriculture are all too limited, and naturally tend to be concentrated on the areas within easiest reach. The difficulties of travel, the poor living conditions and the isolation tend to discourage all but the most devoted public servants from visiting areas without roads. Even these find it hard to spare the inordinate amounts of time that are needed to reach communities on horse-back, when equally deserving communities with better marketing possibilities await

their services along existing roads.

Thus, Honduras' extension service - the General Administration of Rural Development or "Direccion General de Desarrollo Rural" - has only thirty trained agents at the present time. These cannot possibly hope to reach the many towns that have no roads, even with the simplest advice and supplies.

The National Development Bank (Banco Nacional de Fomento) is another important institution devoted to bringing modern methods to the Honduran farmer. Because of its shortage of personnel, and because of the extreme difficulty of supervising and checking credits where communications are difficult, the Bank follows a policy of lending money only to farmers who are located on a road. Thus, its programs cannot reach the large areas that lack roads.

These problems are particularly acute because - for the time being - Honduras must depend on foreign experts for some of her technical progress. In general, foreign experts are even less accustomed than Honduran counterparts to horse and mule travel, even less willing to stay in areas that lack hotels or other amenities, even more pressed to use their high-cost time efficiently.

Even the U.S. Peace Corps, whose volunteers are willing to undergo a certain degree of hardship, refuses to station them in villages that do not have roads. The chief reason for this decision is the difficulty of evacuating a volunteer in the event of a medical emergency. However, the difficulty of providing even the minimal administration and supervision that is envisaged by this streamlined agency is undoubtedly also a factor.

For all practical purposes, therefore, we must conclude that

improvements in technique as well as increases in output with present methods depend on the construction of roads,

In much of northeastern Honduras the lack of roads has not only inhibited the expansion of production but has contributed to an actual decline, particularly in cattle-raising. As other parts of Honduras have been opened up by road-building, and have been able to develop better schools, health facilities and amenities, there has been a tendency for younger and more able farmers to drift away from such isolated outposts as Gualaco and San Estéban in the Agalta Valley, either taking their cattle with them, or selling off herds without replacing them. The lack of roads plus the growth of population on subsistence farms, has also contributed to a breakdown of law and order in these areas, and in particular to an increase in theft of cattle.

The tendency towards economic decline is already being reversed in the Guayape and Aguán Valleys, though for different reasons. In the Guayape Valley, population and output are both increasing as a result of immigration, and output is rising under the stimulus of the opening of the new road to Tegucigalpa and the feeder roads in the valley (recently extended by the new road between Catacamas and Dulce Nombre de Culmí). Along these roads have come farmers from more crowded, less fertile or less well-watered regions of Honduras, as well as immigrants from overpopulated El Salvador.

In the Lower Aguán there has also been some increase in population. Here, however, the chief cause has been the mechanization and consequent decline of employment in the banana industry along

the North Coast. Unemployed former banana workers have moved into the Aguán as squatters to grow subsistence crops, even though there are no roads to facilitate production and sale for cash. In addition, there is some tendency for squatters to settle in the hopes that the various colonization schemes for the Aguán will confirm their rights to national lands that they occupy.

Thus, experience has shown that provision of roads is usually enough by itself to initiate the development of an isolated area. This development can be accelerated and increased by ancillary measures, such as cadastral surveys and certain land reform measures, technical assistance and credit. But roads alone will start development going.

5. National Program for Highway Development and Priority of This Project.

Honduras' overall national highway plan is still in preparation. In the interim, a tentative "Two Year Transportation Program"[1] has been published. This is based in part on the report of the Stanford Research Institute entitled "A Ten Year Highway Program for Honduras" which recommends expenditures of $134,442,500 over ten years. The major share of the total is to be spent on 1,296 kilometers of new main highways, and around $12,500,000 is provided for the construction of 600 kilometers of feeder roads.

Total expenditure on roads for the two-year period was estimated as follows (in dollars):

	Local	Foreign	Total
1963	2,146,250	6,940,000	9,986,250
1964	2,589,500	8,557,000	11,146,500

Since there is as yet no final highway plan, there is no

1) Consejo Nacional de Economia, "Plan Bienal de Transportes, 1963-1964," Tegucigalpa, 1963.

officially recognized priority for the proposed Northeastern Honduras Transportation Program. However, the Honduran Government probably will want to assign a fairly high priority, both for economic and for political reasons

B. Relation to other Transportation Systems

1. Present distribution of traffic among various types of transport in Project.Area.

The present distribution of traffic is somewhat different in the three major valleys of Northeastern Honduras. In the Guayape Valley, most traffic now moves by motor vehicles, along the new feeder roads in the valley, and the main road from Dulce Nombre de Culmí through Catacamas to Juticalpa and Tegucigalpa. Some cattle and pigs come in from surrounding farm areas on foot, but usually are transferred to motor vehicles at the first opportunity. Air freight remains important for beef and pork sales to the rest of the country because of the lack of reliable refrigerated road transport, and also is used to some extent for manufactured goods from the rest of the country.

For the Agalta Valley (San Esteban and Gualaco) the two chief means of transport are on-the-hoof movement of cattle and pigs, and air freight.

The Middle Aguán banana plantations of the Standard Fruit Co. move all their froight by the company's railroad to La Ceiba. However, motor vehicles are increasingly important in movement of bananas and other goods within the plantation (e.g. from the fields to the packing houses.) The rest of the Aguán moves limited amounts of agricultural surpluses to market via the Standard

Fruit Co. Railroad to La Ceiba. Another outlet of some importance is the small boat traffic via Puerto Castilla, Trujillo, etc. Coastal vessels move plywood from Puerto Castilla to Puerto Cortés, where it is loaded onto trucks for hauling to San Pedro Sula, Tegucigalpa, El Salvador, and other interior markets. Occasional cattle-boats call to take surplus live cattle away to Caribbean markets, and the new packing house at Puerto Castilla will ship its products by refrigerated boat.

Outside the banana areas, according to a sample survey conducted by the OAS, only around 10% of farm produce moves to market by ox-cart, 11% uses motor vehicles, and 0.2% goes on the railroad. The remainder must use mule-back.[1)]

2. Anticipated effect of project on economics of other transport systems.

Wherever roads penetrate, truck transport almost completely displaces present primitive means, and severely reduces the demand for air freight. Animal transport is inadequate even for current limited requirements, and is even more expensive than air transport in many cases. Air transport, particularly over the short distances that apply in the case of Honduras, is much more expensive than truck transport and will be largely displaced when roads are made available. While the effect on animal transport may be disregarded, the possible effect of the project on the national airline is a cause for some concern. Much of the airline's total traffic consists of passengers and freight for areas that cannot be reached by road, including northeastern Honduras. A large percentage of this traffic will be lost when the proposed

1) Organizacion de los Estados Americanos, "Informe Oficial de la Misión 105," Washington , [illegible] , Vol. I, page 69.

roads are built. To be sure there would be some increase in high-value passenger traffic, and possibly some compensating expansion elsewhere (e.g. it might again be profitable to fly rare hardwoods out of the Mosquitia, once a port is established at Castilla).

Probable shifts in air traffic have been discussed above (II-A-3-6). Our estimate of the loss of income for the airline as a result of projected shifts is L. 31,271 per annum. Our estimate of the net saving to residents of the area (after allowing for costs of alternative transportation, etc.) is L. 27,281. As these figures suggest, the net cost of bulk road transportation will be an average of perhaps 10% of the present cost of air transportation (depending on distance and area).

3. Relative availability of vehicles, operating personnel, fuel, servicing, etc.

Automotive vehicles are readily available in Honduras. There are no restrictions on imports, and a wide variety of U.S., German, French and other makes are available through established local dealers. There are a large number of independent truckers, both in Honduras and in El Salvador and other neighboring countries. These engage in cut-throat competition, resulting in ready availability of hauling services at relatively low prices.

Fuel is imported by a number of international oil companies, whose service stations are found in all large towns. A fuel handling facility has already been established at Puerto Castilla. Commercially available maintenance services generally are not excellent, but suffice to keep vehicles in running order for much of their normal economic service life. However, such facilities

are of course totally lacking in areas that do not now have roads or motor vehicles.

4. Estimated comparable transportation costs for the various systems.

a. Animal

The highest cost of transportation in Honduras is by human porterage. With the exception of family purchases by farmers living in isolated areas, this system is not of importance at present.

Ox-carts (usable only in flat valleys) are less expensive. The estimated cost is $0.55 per ton-kilometer. However, ox-carts can be used in swampy or rain-filled tracks that would stop other means of communication, and can carry heavy loads that could not be handled in other ways.

Pack-animal transport is the most expensive means of moving goods outside valleys. The estimated average cost is at least $0.50-1.00 per ton-kilometer. Even air freight is considered preferable at $0.70-0.80 per ton-kilometer ("deferred cargo" rate).

In areas that communicate only by mule or other beast of burden, production for market is confined to occasional surpluses of non-perishable staples such as corn or beans, or to high-value crops such as coffee. Production of vegetables or fruit for market is generally impossible because of losses in transit.

Adapting the method given in the Stanford Research Institute's road report[1], we estimate the cost of driving cattle on the hoof as follows:

1. It is assumed that animals can be driven 20 kilometers

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1) Stanford Research Institute Road Report, page 647.

per day. One cowboy (vaquero) is needed for every 20 head, at L. 5 per day. This amounts to L. 0.03 per animal kilometer or - at 275 kilograms live weight - L. 0.04 per ton-kilometer. Allowing for the return trip, and for the imputed rental of the cowboy's horse, the total cost is L. 0.12 per ton-kilometer.

2. In addition, an allowance must be made for the loss of live weight on the trail. On a 7-10 day drive between Catacamas and Tegucigalpa (235 kilometers) this would amount to 30-40 kilograms, or 0.13-0.17 kilograms per animal kilometer (0.55 kilograms per ton-kilometer). At L. 0.44 per kilogram, the loss amounts to L. 0.24 per ton-kilometer. Thus, the total cost of driving is L. 0.36 ($0.18) per ton-kilometer. This is substantially in excess of normal costs of truck transportation.

b. Rail

Railroad rates are comparatively high, as might be expected in view of the short distances, the low volume of traffic, and the concentration of most rail facilities on the needs of associated banana industries. On the Standard Fruit Co., railroad freight rates for carload shipment of major commodities are as follows:[1)]

Fuel and diesel oil (tank cars containing 8,000 gallons)	L. 1 per kilometer
Logs	L. 0.05 per metric ton-kilometer
Sawn wood	L. 0.07 " " " "
Honduran raw materials	L. 0.08 " " " "
Imported raw materials	L. 0.14 " " " "
Imported machinery	L. 0.18 " " " "

For the 111 kilometers between Olanchito and La Ceiba, Honduran raw materials would pay L. 8.88 per ton.

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1) Standard Fruit Co., "Reglamento y Tarifas de Fletes, Pasajes y Otros Servicios Aprobados por Acuerdo No. 916 del Supremo Poder Ejecutivo de 13 de Mayo de 1960," La Ceiba, Honduras, 1960.

c. Trucks

The cost of truck transportation varies considerably, depending on the nature of the terrain, the condition of the road, the possibility of obtaining return freight, the kind of cargo, etc. In general truck maintenance costs are much higher than in the U.S., partly because of the poor condition of the roads and partly because of the lack of proper preventive care. Truck tires give as little as one-tenth of the normal mileage attained in the U.S. Fuel consumption is also high. According to an SRI estimate, fuel consumption averages 8 kilometers per gallon for medium-size diesel trucks, and 5 kilometers per gallon for large diesels, or roughly 25% higher than the U.S. experience. Capital charges are also higher, but labor costs are lower. As a whole, however, truck transportation rates are not far different from those in the U.S.

Typical charges for transportation of grain in Honduras are as follows, in U.S. dollars per metric ton/kilometer:

Type of road	Paved	Mixed	Dirt
Over 60 kilometer haul	0.045	0.055	-
Under 60 kilometer haul	0.063	-	0.110

According to a Honduran road study, the average price of truck transportation on secondary dirt roads is $0.06-0.08 per ton-kilometer for two-axle vehicles, whose load limit is 14,000 pounds gross weight (of which useful load is 6-7,000 pounds).[1] The average fare for passenger transportation was $0.015 per

1) Ing. José Angel Bobadilla, "Informe sobre la construcción de carreteras vecinales en el Valle de Sula," Consejo Nacional de Economía, Tegucigalpa, July 1961.

passenger kilometer. Klabien Irmaõs & Cia., in a study entitled "Honduran Pulp and Paper Project; Preliminary Studies," (Rio de Janeiro, March 1962, pages 31-34) estimates the cost of pulpwood transportation from the forest to the mill as $0.055 per ton-kilometer.

d. Water freight

Liner rates for ocean freights are set by the so-called "Conferences". Rates vary depending on the origin, destination and commodity. Conference rates on lumber exports to Europe are as follows:

		Amapala	Puerto Cortés
Pine, thousand board feet	timbers	$62.30	$60.90
	boards	64.90	63.50
Mahogany, metric tons	timbers	47.60	39.90
	boards	49,00	41.30

Cabotage rates (e.g. for traffic to and from the Bay Islands) average around L. 0.20-0.25 per ton-kilometer and L. 0.08 per passenger-kilometer.

e. Port charges

Port charges in Central America are high. This is only partly because port facilities are generally inadequate and outdated. In addition, Central American governments have used port charges as a means of raising revenues. In some of the countries port charges have been looked upon as a form of extra tax on imports of consumer goods, and the tariff includes reduced rates for essential imports or certain politically sensitive export products. Finally, some of Central America's ports are still controlled by banana or railroad companies. These have used high port charges for various extraneous purposes such as to equalize

shipping costs through East and West coast ports, to choke off truck competition for railroads (high port charges offset by low rail rates), or to discourage use of the port by shippers other than the banana company itself.

Although part of the port charges fall on the vessel, the resulting burden is reflected in ocean freight rates, so that eventually all charges are in fact paid by Honduran importers and exporters.

Honduran government port charges include wharfage (per ton of cargo loaded or unloaded on nationally-owned docks or airports), a lighthouse tax (per ton of imported cargo), and a charge for stevedoring and loading services within customs warehouses (per ton of imported cargo).

The wharfage charge is as follows:

a. L. 0.01 (US$0.005) per gross kilogram for general cargo.

b. L. 0.005 ($0.0025) for grains, flour, beans, sugar in 100 lb. bags, heavy machinery, petroleum products, iron bars and sheets, fence wire, cement, animal feeds and concentrates, fertilizers and insecticides.

c. L. 0.20 ($0.10) per cubic meter of pulpwood, saw logs, and lumber (which would weigh approximately 1.3 metric tons per cubic meter or 3 metric tons per thousand board feet).

d. L. 1.50 ($0.75) for cattle of any description or size (possibly weighing 700 kilograms per head).

3. No charge for exports of coffee, bananas, plantains and other Honduran natural fruits.

f. L. 0.10 ($0.05) per 100 kilograms for <u>exported</u> cement (special rate granted to help the Bijao Cement plant in San Pedro Sula to seek orders in Belize).

Thus, the rate per ton ranges from

$0.00	for exports of coffee, bananas, etc.
0.08	for exports of lumber
0.50	for cement exports

$1.07	for cattle
2.50	for certain bulk cargos
5.00	for general merchandize

The lighthouse tax (applied even in ports that do not have a lighthouse) amounts to L. 2 per metric ton of imports.

Customs house, import stevedoring, and loading services, if provided by the government, are as follows:

a. L. 0.01 ($0.005) per gross kilogram for general cargo

b. L. 0.005 ($0.0025) for grains, flour, beans, sugar in 100 pound bags, salt, fertilizers and insecticides.

c. L. 0.20 ($0.10) per cubic meter of pulpwood, saw logs and lumber.

The rate per ton is approximately

$0.08	for for lumber
2.50	for certain bulk cargoes
5.00	for general merchandise

These charges are said to compensate for the actual cost of services performed. These rates may be compared with the <u>total</u> port charges of $2.40 per short ton ($2.65 per metric ton) for all cargo moved in or out through the port of Cristobal (Canal Zone).

Charges borne by the boat (based on conditions in Puerto Cortés) are as follows:

1. Anchorage service charge

1-50 tons	free
50-100 tons	L. 10
100-1,000 tons	15
1,000-5,000 tons	25

2. Dock fee: L. 0.05 per 12 hours and net register ton

3. Mooring and unmooring fee: L. 30

4. Official visit (health, immigration, military, Administrator and Chief of Wharf: each L. 20, or a total of L. 100, plus taxi fare of L. 4 and motorboat fare of L. 20.

5. Stevedoring
   (a) Extraordinary: L. 5-6 per metric ton
   (b) Ordinary: L. 2.50-3 " " "

6. Locomotives: L. 30 per hour

7. Water: L. 50 per boat of 500 tons or more requiring water (municipal charge)

8. Miscellaneous documentary services: L. 20

9. Ship's agent's commission: L. 100-200

In addition, the cost of transferring cargo from railroad cars to trucks, plus extra demurrage and other charges due to congestion may add around $7.50 per ton to the cost of using Puerto Cortés. The total is substantially more expensive than port costs in Nicaragua or Costa Rica, but still is cheaper than the inefficient double lighterage operation at Amapala on Honduras' Pacific Coast.

f. Air Transportation

Table 10 gives rates for freight traffic in northeastern Honduras on SAHSA, the Honduran local-service airline. The cargo rates are for shipments of over 100 lbs. (so-called "deferred cargo"). Rates for smaller shipments may be roughly 60% higher per pound, but very little traffic moves at the higher rate.

As is usual in airline tariffs, rates per kilometer go down as distance increases. For example, a shipment between San Esteban and Catacamas, 42 kilometers in a straight line, costs L. 0.045 per pound, or L. 2.36 per ton-kilometer. In contrast, a shipment between San Esteban and Tegucigalpa, a distance of around 200 kilometers, costs L. 0.065 per pound, or L. 0.72 per ton-kilometer. Similarly, a shipment between Tocoa and Trujillo

Table 10

Selected Air Freight Rates ("Deferred Cargo")

In Lempiras per Pound

Region:	Guayape		Agalta		Aguán and Atlantic			
Airport:	Juticalpa	Catacamas	Gualaco	San Esteban	Olanchito	La Ceiba	Tocoa	Trujillo
Tegucigalpa	0.035	0.045	0.06	0.065	0,065	0.07	0.08	0.085
Guayapo								
Juticalpa	-	0.03	0.045	0.05	0.065	0.07	0.10	0.11
Catacamas	0.03	-	0.04	0.045	0.06	0.065	0.09	0.10
Agalta								
Gualaco	0.045	0.04	-	0.03	0.08	0.055	0.075	0.085
San Esteban	0.05	0.045	0.03	-	0.07	0.05	0.07	0.08
Aguán and Atlantic								
Olanchito	0.065	0.06	0.08	0.07	-	0.07	0.045	0.05
La Ceiba	0.07	0.065	0.055	0.05	0.03	--	0.03	0.04
Tocoa	0.10	0.09	0.075	0.07	0.045	0.03	--	0.03
Trujillo	0.11	0.10	0.085	0.08	0.05	0.04	0.03	--
San Pedro Sula	0.13	0.125	0.11	0.09	0.06	0.05	0.065	0.07

Source: SAHSA

(a mere 30 kilometers as the crow flies) costs L. 0.03 per pound, or L. 2.20 per ton kilometer. On the other hand, freight between Tocoa and San Pedro Sula, approximately 167 kilometers apart, costs L. 0.065 or L. 0.86 per ton-kilometer.

Occasionally specially-chartered freight aircraft have been used to export or import cargo. An example is the movement of meat from San Pedro Sula (or any other Central American airport) to Puerto Rico, at $0.13 per pound, or $287 per metric ton. This, however, is too high for most products.

C. Effect of Development on Project Area

The chief purpose of the Northeastern Honduras Transportation Project is to open up (or re-open) areas that now have no road links to the outside world. It is hoped that construction of the road and port system will cause new activities to develop, or will expand existing ones manyfold. Consequently, present shipments (e.g. by pack animal or air freight) provide little or no basis for projection of future traffic volume.

To project future activities, two kinds of prognostications have to be combined:

1. The economic feasibility or attractiveness of new activities must be evaluated, in relation to conditions in northeastern Honduras.

2. The impact of non-economic problems (or of imperfect market condicions) must be weighed so as to project to what extent feasible developments will actually take place.

In seeking to meetthis requirement, we begin with production and marketing economics of a number of agricultural, animal

husbandry and forestry products that could be produced in northeastern Honduras. Our purpose is to determine whether production would be generally profitable, and how new output could be sold. Where appropriate, overall estimates of economically feasible and profitable output are made for the region as a whole.

The next step is to examine conditions in each of the three valleys - Aguán, Agalta and Guayape - that are part of the region. Overall estimates are allocated between the three valleys, and additional specific estimates of economically feasible output are made for each product and valley. The probability of attaining these estimates is then assessed, allowing for land tenure problems or other obstacles that might prevent realization even in cases where the economic justification seems to be clear. For example, the examination of lumber economics (II-C-3a) indicates that large pine lumber mills could be profitable in the area (on the assumption that the large pulp and paper mill project is not realized, since this would change the entire picture). However, most of the usable forests in the area are now legally reserved for the pulp and paper mill project. There is a slight possibility that the government may find it difficult to agree with private sawmill operators on stumpage, concession conditions, etc. To reflect this possibility, the estimated possible wood output is discounted by 20%.

Similarly, in the Aguán Valley, independent commercial plantations with perhaps 1,000 acres each of bananas appear to be attractive, and probably would be developed if land were available. However, most land that could be made available is controlled by

the Government land reform agency (INA), which may not be willing or able to lease or sell land for this purpose. Accordingly the projected tonnage of bananas is discounted by 50%.

Needless to say, we make no claim to be able to predict the future in detail. However, errors in individual estimates will tend to cancel out, the overestimations in some being compensated by the underestimates in others. By starting with conservative economic estimates, and discounting these to allow for non-economic obstacles, reasonably good total estimates should develop.

1. Agriculture

Table 11 gives latest available information about Honduras' output of agricultural crops. As will be seen, an important part of crops such as corn, beans, onions, oranges, bananas, coffee and cotton is exported. There appear to be increasing opportunities for exports to Central America. Taken as a whole, Central America needs increasing production of food, both to compensate for the increase in population and living standards, and to offset the decline in average fertility in many areas. This need is particularly pressing in El Salvador, with its shortage of land and heavy population pressure.

The long-term need is indicated by the tendency for population to increase by 2.7% per annum, while production of corn in Central America has been increasing by only 0.6% per annum, despite an increase in cultivated area by 1.8% per annum. Similarly, and even more regrettably from a nutritional point of view, production of beans is declining by 1.2% per annum, while the area under cultivation is increasing at the same annual rate. According

Table 11

1963/64 Agricultural Production and Areas Planted
In Manzanas and Quintals of 100 lbs.

Crop	Production (Quintals)	Area (Manzanas)	Average Production (Quintals/Manzana)
Corn	6,652,130	578,450	11.33
Sorghum	1,303,290	104,260	12.50
Beans	969,450	145,780	6.65
Rice[1)]	492,960	19,720	25.00
Potatoes	36,820	1,220	30.18
Cassava	346,500	6,560	52.82
Onions	40,290	1,410	28.57
Tomatoes	48,190	1,610	29.93
Melons	62,730	1,630	38.48
Oranges	289,230	5,680	50.92
Bananas & Plantains	19,501,630	97,510	200.00
Pineapples	55,450	1,290	43.00
Sugar Cane[2)]	14,321,340	37,220	384.78
Coffee	630,570	157,640	4.00
Cacao	4,310	360	12.00
Cotton[3)]	440,758	12,300	35.83
Henequen	3,000	660	4.55
African Palm	346,776	2,787	124.43
Tobacco	92,900	12,110	7.68

1) Unshelled. 1 quintal shelled rice = 1.6 quintals unshelled rice

2) Production of "Plantation white" sugar = 575,105 quintals

3) 1 Quintal ginned cotton = 2.85 quintals raw cotton.

Source: Annuario Estadisticos, 1963.

to a study sponsored by the Central American development banks,

> "The decline in corn production per hectare is the result of the low fertility of some of the new areas planted to this crop, and the continuous erosion and leaching of the soil in which corn has been cultivated for many years. This has occurred despite the fact that some of the crop is being produced in fertile areas, and/or with modern methods of production, resulting in rising yields in a few areas at present."[1)]

These tendencies are accelerating in Honduras also with the shift of better land and farmers with better knowledge into cash crops such as cotton, sesame seed and sugar cane. There will be a continuing tendency in this direction as self-sufficient agriculture gives way to a cash economy.

Furthermore, with the rise in employment and incomes in Honduras, the gradual spread of nutritional knowledge, the improvement in communications and distribution, and the displacement of subsistence agriculture by cash crops, there is a growing market within Honduras as well. Although average caloric intake is good compared to the rest of Central America, protein consumption of the average Honduran is far below optimum standards.

Another potential market, particularly for low-lying areas close to the coast, consists of the demand for certain tropical products in world markets, including bananas, citrus, African oil palm, off season vegetables and melons, etc. However, most of these crops require an important improvement in the level of technical and organizational skill over what is required for subsistence agriculture. Unfortunately, the highly complex problems

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1) SIECA/IFE-IV/DT 1, Reunion de Institutos de Fomento y Estabilización de Precios, "Los Granos Basicos en Centroamerica y Panama," Vol. I, pages 5-6.

of land tenure in Honduras tend to impede the development of higher levels of technique.

It is difficult to describe the land tenure problems of Honduras, because there are so many of them. However, there are three general types: maldistribution, uncertainty as to ownership rights, and lack of clarity as to management responsibility. In many cases, a single piece of land may have all three kinds of problems.

Maldistribution is less of a problem in Honduras than in countries with a higher population density. Nevertheless, there is much idle land, while many farmers seeking land cannot find it. Thus the phenomenon has arisen of land hunger in a country that has a vast surplus of land. In the Guayape Valley, for example, surrounded by tens of thousands of idle hectares, far from the areas of high population density, landless farmers still undertake the heroic labor of clearing tropical jungle <u>by hand</u>, in return for the right to one or two corn crops from the cleared area.

There is no doubt that the resulting tensions must be exorcised, and the Agrarian Reform Law of 1 September 1962 is a notable first step in bringing them under control. However, this law has turned out to be difficult to administer. In particular, the primary cause of idle land undoubtedly is the absence of an effective tax on wealth held in the form of real estate. This makes it possible for landowners to hold their property in idleness for generations, neither exploiting it themselves nor selling or renting it to others for exploitation.

To meet this problem - a general problem of the real estate tax structure - the law provides for a specific confiscatory tax on idle land, rising to a peak of 20% of the value per year. So far, it has been impossible to enforce this confiscatory tax. Results might have been more rapid if a more reasonable tax had been applied to all land - idle or not - in the first place.

Similarly, the law provides for rather loose procedures for the expropriation of large properties. These may include properties which are already being cultivated efficiently, and decisions may be taken by a government committee without reference to a court of law. On the other hand, the law also requires full cash payment for all expropriated properties. In practice, this means that no significant amount of expropriation can take place. If expropriation had been more carefully limited to start with, it might have been possible to authorize payment in long-term bonds, or some other more practical form.

Finally, as is perhaps inevitable, INA has allowed its energies to be diverted into the provision of roads, houses, drainage, schools and other physical facilities for limited numbers of "colonies". Provision of such complete facilities has raised the cost of ordinary land reform projects to perhaps L. 5,000 per family, so that the cost for a program affecting 20-40,000 families might have been L. 100-200 million, or more than the total foreign debt of L. 85 million at the end of 1964. The effort to provide ready-made homes, instead of homesteads, not only has been very expensive, but also has not been understood by the beneficiaries, and several of the land reform "colonies"

have been failures.

In areas that were settled by the Spanish, notably San Esteban in the Agalta Valley and the Guayape Valley, many land tenure difficulties have their origin in the imprecise nature of the original land grants. These grants sometimes contained a description of the physical boundaries of the land included in the grant; but often stated only the area of the grant. The confusion wrought by this omission was relatively small and unimportant as long as the number of land owners in the area was small. However, as the original owners passed away and the land passed into the hands of generations removed, the problem multiplied. After ten or so generations, one can imagine the land ownership confusion which results. Only within the last year or so has the government begun to try to redefine property lines in modern terms, as part of a "cadastral survey".

A cadastral survey is planned for the Departments of Choluteca, Cortés, Atlántida and Olancho, to begin in January 1965. The survey itself should require about two years, and the Instituto National Agrario (INA), which will administer the survey, hopes to have the ownership map completed by the end of 1968.

The survey will be carried out as much as possible by the land owners themselves. INA will require all holders of land titles to measure their land, establish their own boundaries, and mark the boundaries with some type of permanent markers, such as stone pillars. All those title holders who have not surveyed their land since 1945 will be included in this requirement. INA will perform this function for the national and ejidal lands.

If the private owners do not accept the responsibility for this survey, then INA will measure their land for them, and the land owners will have to accept any arbitrary decisions that may be made.

In case of conflicting land titles which come to light as a result of this cadastral survey, INA will be the deciding agency, in accordance with the Agrarian Reform Law.

The problem of unclear management responsibility results from several traditional forms of land occupancy that fail to meet modern requirements: "joint ownership" and "possession through use" ("mancomunidad" and "dominio util"). Under the former, a single piece of property may be passed on to a number of heirs as a unit to be owned and managed jointly. With succeeding generations, each "share" may be subdivided again, until many tens or hundreds of persons have a legal joint right to a given piece of property. In one case, a sawmill owner bought timber cutting right from a dozen known "joint owners" of a forest property, and then had to make additional payments to over 1000 "joint owners", who declared their status when the news got around that they could make money by asserting their claim. With such multiple ownership, it is increasingly difficult to obtain unanimous consent for any constructive use of the property. More often than not, the eventual result is to force the property into idleness, for lack of agreement among the joint owners.

Much of Honduras' territory is owned by the national government or municipalities. These have given out, sold or rented rights to work the land, conveying possession through use

(dominio util) to the occupant and to his heirs. However, sale of such rights is legally difficult, and it is impossible to mortgage land held on these terms.

Finally, much government or municipal land - and some private land - is occupied by squatters, with no legal rights. Squatting has been a safety-valve for land hunger, allowing for a continuous migration of increasing population into unoccupied areas. However, it does not provide the secure basis of ownership that would encourage improvements or facilitate the granting of credit. Squatting is particularly prevalent in northeastern Honduras, whose isolation from markets caused legal owners to lose interest in their property, and in many cases to abandon the area for Tegucigalpa or other more centrally located towns. These people took their land titles with them, and will almost certainly try to reassert ownership as roads open up the area. However, the very existence of their claims appears to be forgotton in many cases. In the Guayape, the seriousness of the problem became evident after the road was opened through to Catacamas. Those eager to expand production to send to markets in Tegucigalpa and San Pedro were uncertain about their rights. People in Tegucigalpa began dusting off old titles which now had value. And the government, previously also uninterested and without sufficiently active representation in the area, also began to extend its authority into the region (only to find that much government land was occupied by small farmers who had a moral claim to their property, if not a legal one). The result has been a reluctance of all concerned to take advantage of the new road

facilities. People are refraining from committing themselves and their capital to a program of expanded production as long as ownership of the land is still in doubt.

In the Lower and Middle Aguán there is less doubt as to who owns the land, but no less squatting. Theoretically, most of the land in the Aguán Valley belongs to one of three owners: the national government, the municipal governments, or the Standard Fruit Company. The national government has titles for all the land that was turned back to it by United Fruit Co. in the late 1930's. The Standard Fruit Co. still holds the land on much of the left bank of the river. However, both the fruit company and the government are plagued with squatters. A few "squatters" have taken over fairly large cattle-ranching areas, but most have drifted into the area to establish subsistence homesteads. Under these circumstances, according to one resident of the area, "the best title is three strands of barbed wire and a .38 revolver."

INA has developed an ambitious proposal to settle approximately six thousand families in the Aguán Valley. This plan is based on the recommendations of an OAS Mission,[1] and discussions are under way with the Inter-American Development Bank on the possibility of meeting a financial requirement of perhaps $20,000,000.

The families will be settled on plots varying from 10 to 20 hectares. As experience in Honduras and other countries has shown, there will be an initial tendency for production of traditional subsistence crops, and a substantial effort will be required

1) Organización de los Estados Americanos, "Informe Oficial de la Misión 105 de asistencia técnica directa a Honduras sobre reforma agraria y desarrollo agrícola, Tomo III, Proyecto de Colonización del Bajo Aguán.

over a period of time to introduce cash crops on small farms of this type. Whether or not this is economically feasible, however, it is socially necessary, and most usable land of the Aguán Valley has been reserved by decree for family farms.

On the other hand, the 70,000 hectare scheme will only use around one-third of the agriculturally desirable land in the Lower and Middle Aguán. It would therefore be possible to develop some larger-scale agricultural enterprises in the area, providing processing facilities and demonstrations of new techniques that would help to introduce cash crops to the smaller farms as well. However, this would require some change in present policies, so as to permit long-term enterprises to operate. Such a change of policy might involve political problems, and may not be feasible. However, it would be the most effective way to begin the development of the Aguán Valley, and would also facilitate "colonization" with small settlers.

Apart from pointing to the opportunities that exist, it is not our province to recommend an agricultural development policy for the Aguán Valley. If political considerations permit the realization of these possibilities, on a limited scale that will not interfere with the colonization program, the resulting increase in production could justify the proposed expenditure on reconstruction of bridges along the south bank of the Aguán River. It would also help to justify the construction of port facilities as Puerto Castilla. If, on the other hand, it will be impossible to provide any land for commercial agriculture or cattle-raising

in the Aguán Valley, reconstruction of bridges along the Valley could perhaps best be justified as part of a long-range land reform "colonization" scheme, and financing as part of the present project might not be appropriate. Because of the uncertainty as to future government decisions on this issue, commercial agricultural possibilities in the Aguán will be discounted by 50%. Cattle-raising possibilities, on the other hand, appear to be more likely to go ahead in one form or another, and will be discounted by only 20%.

To estimate the feasibility of commercial development, it is necessary to analyze and compare the profitability of alternative crops. This is difficult to do. Agronomic information is scarce in Honduras, and much of the limited experimental work that has been done deals with physical results rather than costs and economic returns. The imperfection of the marketing system and the wide seasonal swings in prices make it difficult to determine a standard price for products. Furthermore, great differences in soil fertility, climate, altitude and other factors influence agricultural production. For all these reasons any estimates of comparative profitability must be treated with a great deal of reserve.

The following are efforts to arrive at representative figures, not necessarily reflecting the conditions of any specific locality. Material used includes standard estimates developed by the Banco Nacional de Fomento as a basis for crop loans.

Since there are wide variations in land values, capital investment at different levels of techniques, etc., the estimates are stated as "gross profit per Manzana", without trying to estimate interest or depreciation. Comparability of figures may be particularly difficult in the case of the fiber crops, which involve relatively large investments for processing facilities.

Table 12 summarizes the results, and permits some interesting general conclusions.

Table 12

Estimated Gross Profit per Manzana from Agricultural Crops (Including Profit on Processing Installations where Required) In Lempiras

a.	Corn - local, hand labor	15
	- local, mechanized	85
	- hybrid, mechanized	140
b.	Beans - hand labor	45
	- mechanized	140
c.	Rice - hand labor	120
	- mechanized	437
d.	Cassava and sorghum	Not estimated
e.	Winter vegetables (large scale)	615
f.	Bananas (large scale)	505
g.	Citrus	1,660
h.	Pineapples - present methods	504
	- improved methods	1,132
i.	Cacao	262[a)]
j.	African oilpalm	849
k.	Sisal and henequen	144-194
l.	Abacá	322
m.	Rubber	Not estimated[a)]

a) Does not appear to be reasonably profitable at present world market prices.

Some interesting general conclusions may be drawn from these estimates. Corn, by far the most important crop in Honduras, and the chief dietary grain, is the least "profitable" (although gross profit can be increased substantially by mechanization and use of improved seed). Corn production is part of Honduras'

pattern of subsistence agriculture, a way of life rather than a money-making proposition. However, without effective technical help and other assistance, there is not much hope for a rapid shift of small farmers to other crops.

On the other hand, crops that seem to promise the highest relative returns - bananas, pineapples, palm oil, citrus fruit - all require special processing or marketing facilities in order to reach export markets. These facilities are only likely to be installed when reasonable assurances exist that there will be a steady high-quality supply of raw materials. While it is not impossible to organize such a supply from a large number of very small farms, it will certainly be difficult, and take much time for training and development.

Another interesting conclusion concerns the superior profitability of mechanized farming methods. In many parts of Honduras, and particularly in the isolated areas of northeastern Honduras, there is a definite shortage of labor at planting and harvest time. Consequently, some mechanization is necessary if a rapid expansion of output is to take place. Furthermore, scanty available data suggests that mechanized operations can be significantly cheaper than present hand labor and use of oxen or other draft animals.

For example, experimental plantings of beans showed that one hour of tractor work was equivalent to 19 hours of hand labor plus the use of oxen. The cost per manzana amounted to L. 25.28 for mechanized cultivation and 36.75 for traditional hand labor plus oxen. Yields on land prepared with the help of a tractor

were 16.05 quintals per hectare, while traditional yields were 13.46 quintals. Total cost per quintal, accordingly, was L. 5 for tractor-cultivated beans, and L. 6.52 per quintal for traditional methods.

In some countries, the conflict between small farming and the need to introduce more modern methods has been resolved by the introduction of the "central farm" and "outside farmer" system. The "central farm" is established by large companies with the necessary capital and experience, to produce superior seed, serve as an experiment station, supply fertilizers and know-how, and as a location for a central processing station. Most or all of the crops are then grown under contract by small farmers. A variation of this system has been introduced by the banana companies in some areas: medium-size independent growers do the planting, cultivation and harvesting, while the banana company undertakes spraying and other complex tasks, provides technical assistance and coordination (e.g. to ensure harvesting at the proper time), and runs the central boxing plant.

Table 13 gives somewhat outdated statistics (taken from the 1952 census of agriculture) on production of major cash crops in northeastern Honduras. As these figures show, northeastern Honduras is generally more fertile than the rest of the country, producing a share of total output which is greater than its share of area planted (except for coffee). Thus, output of corn averaged 25.5 quintals per hectare in the Aguán Valley, 20.2 in the Agalta Valley, 26.1 in the Guayape Valley, and 16.4 for Honduras as a whole.

Table 13

Major Cash Crops in Project Area 1952 Census of Agriculture
In hectares and quintals of 100 lbs.

		Corn[1]		Beans[1]		Rice		Coffee	
		Area	Production	Area	Production	Area	Production	Area	Production
a. Coast line									
Iriona	(Colón)	477	10,929	332	7,602	1,163	40,883	8	23
Aguán	"	8	n.a.	1	n.a.	2	n.a.	2	n.a.
Santa Fé	"	2	n.a.	1	n.a.	-	-	19	115
Balfate	"	18	278	5	45	1	n.a.	-	-
Subtotal		50	11,207	339	7,647	1,166	40,883	29	138
b. Aguán Valley									
Trujillo	"	999	30,874	95	1,192	19	332	27	73
Limón	"	60	1,455	5	67	7	212	13	84
Tocoa	"	733	16,675	114	2,052	30	932	13	114
Sonaguera	"	1,059	27,224	164	3,164	121	3,241	41	230
Olanchito	(Yoro)	2,798	70,152	814	10,332	458	12,180	163	685
Arenal	"	162	1,731	46	268	-	-	43	182
Subtotal		5,811	148,111	1,238	17,075	635	16,897	300	1,268
c. Aguán Uplands									
Esquipulas del N.	(Olancho)	221	6,288	111	1,631	-	-	119	577
Guata	"	307	6,486	182	2,293	1	n.a.	214	1,782
Subtotal		528	12,774	293	3,924	1	n.a.	333	2,359
d. Agalta Valley									
San Estéban	"	505	10,157	171	1,413	7	56	225	786
Gualaco	"	977	19,865	250	2,384	1	n.a.	1,205	4,815
Subtotal		1,482	30,022	421	3,797	8	56	1,430	5,601
e. Guayape Valley									
Dulce Nombre de Culmi	"	90	1,528	2	39	10	164	38	349
Catacamas	"	1,466	44,125	221	2,629	143	2,838	647	1,973
El Real	"	469	16,784	105	1,189	51	717	139	455

Table 13 (cont.)

		Corn[1]		Beans[1]		Rice		Coffee	
		Area	Production	Area	Production	Area	Production	Area	Production
San Francisco de Becerra	(Clancho)	230	5,880	23	402	7	130	22	92
Juticalpa	"	3,300	82,290	772	10,341	337	7,527	329	1,814
Subtotal		5,555	150,609	1,123	14,600	546	11,370	1,175	4,683
f. Guayape Uplands									
San Francisco de la Paz	"	897	19,564	167	1,536	4	127	575	1,680
Guarizama	"	571	8,665	259	2,805	21	422	70	322
Manto	"	598	10,553	271	1,783	8	80	150	612
Jano	"	204	3,291	101	646	2	27	213	353
Silca	"	321	9,918	83	1,323	1	n.a.	139	822
Salamá	"	419	7,059	403	3,476	50	1,415	78	243
Guayape	"	769	18,717	297	4,007	-	-	398	2,181
Concordia	"	203	2,670	132	1,123	6	71	250	1,653
Campamento	"	1,175	17,[illegible]75	18	151	38	295	743	3,472
Subtotal		5,157	98,112	1,731	16,850	130	2,427	2,616	11,538
Total for project		19,038	450,835	3,587	63,893	2,486	71,639	5,883	25,587
Total for Honduras		253,510	4,169,679	50,086	483,343	10,905	247,351	68,118	309,419
Project as % of Honduras		7.5	10.8	7.1	11.2	22.8	28.1	8.7	8.3

1) First and second harvests combined

Source: Republic of Honduras, Ministerio de Gobernación, Dirección General de Censos y Estadisticas, "Primer Censo Agropecuario, 1952," Tegucigalpa, 1954

a. Corn

Corn is Honduras' chief subsistence crop, and is also an important export. Sales to the chief market in El Salvador totalled 22,704 tons in 1963, at an average price of L. 148 per metric ton. This is higher than the world market price: U.S. exports of corn in 1963 amounted to 437.7 million bushels of 56 pounds, valued at $588.3 million, or approximately L. 106 per metric ton.

In Central America as a whole during recent years population has increased at 2.7% per annum, while corn production has been increasing at a mere 0.6% per annum.[1] This low rate of increase is in spite of a rise in the area planted by approximately 1.8% per annum. Throughout Central America, there has been a decline in fertility of established producing areas, and some displacement of corn (and other subsistence crops) from better land by cash crops such as cotton.

According to 1963 estimates, some 580,000 manzanas were planted to corn. The average yield per manzana was 1,133 pounds. In some areas, only one crop is grown, while in others a second crop ("postrera") is planted to take advantage of the late rains.

In Honduras, corn is generally used for human consumption. Some corn is fed to chickens and hogs at harvest time, especially in isolated areas (such as the Agalta Valley) where no adequate storage or transportation facilities exist. Corn plantings have been increased in some areas as a result of the installation of drying and storage facilities by the National Development Bank.

Most of the corn in Honduras is planted on land with the

1) SIECA/IFE/DT 1, Reunion de Institutos de Fomento y Establización de Precios, "Los Granos Basicos en Centroamerica y Panamá, Vol. I, page 5-6.

lowest yield and the highest population concentration, since in the absence of mechanization corn production requires a considerable amount of manual labor.

During the coming decade, Honduras hopes to increase corn production by around 70,000 tons per annum. Of this, 42,000 tons is to come from better yields in ostablished corn-growing regions, while 28,000 tons is to be produced on newly-cultivated areas on the Pacific Coast (around Choluteca) and on the Atlantic. Table 14 shows the normal price and transportation cost structure of the Honduran corn market.

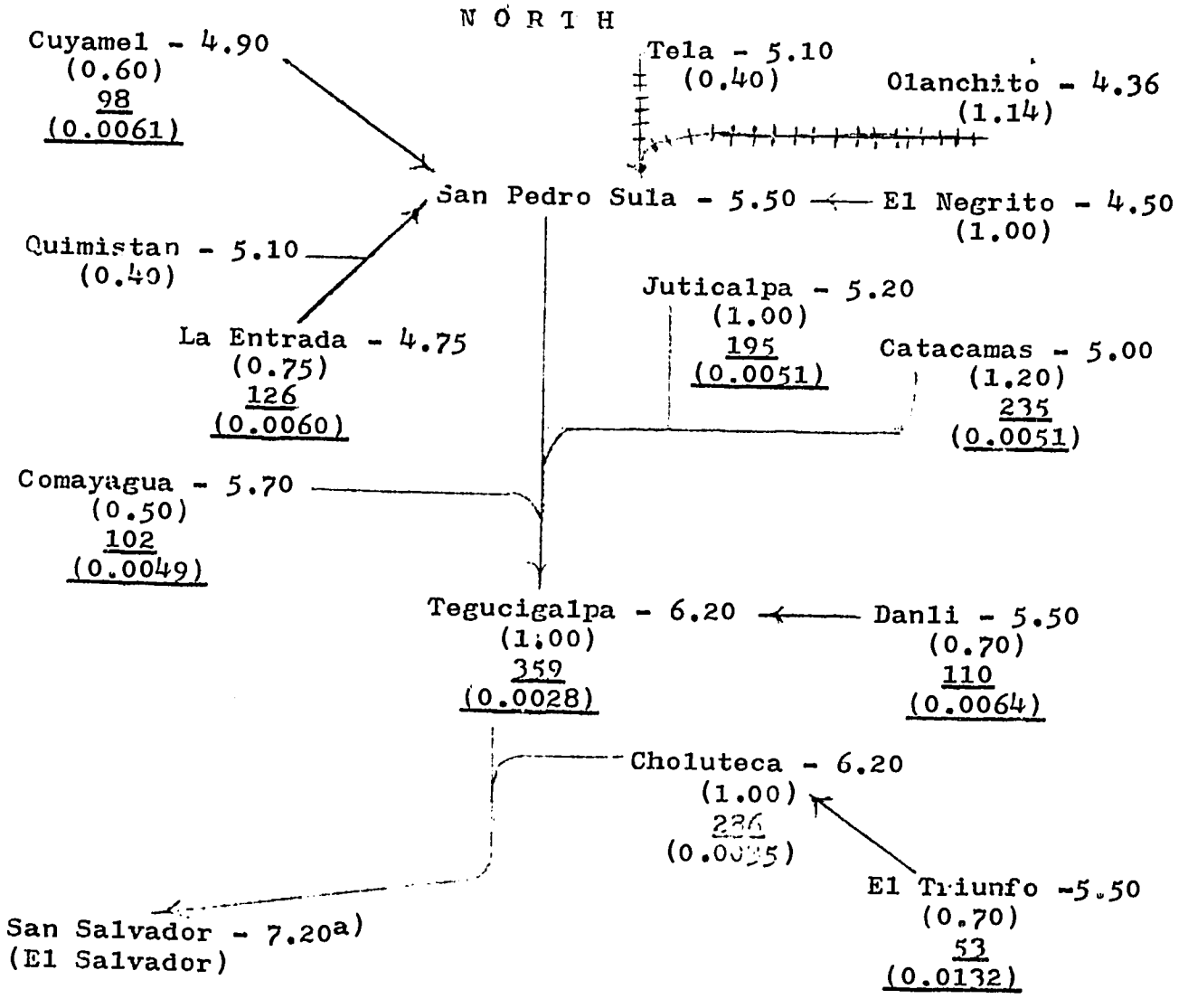
As regards the Southern section of the country (south of a line running through Catacamas-Juticalpa-Comayagua-Tegucigalpa-El Salvador) this is based on the price of corn in El Salvador, less costs of transportation, since the marginal demand for Honduras' corn comes from El Salvador. For example, when the wholesale price in El Salvador was L. 7.20 per quintal of 100 Spanish pounds, the price in Tegucigalpa tended to be L. 7.20 less transportation costs of L. 1, or L. 6.20.

In the area to the north of this line, local demand tends to be in balance with local supply, and the price has been somewhat higher than the El Salvador base less costs of transportation. Thus, in the past, the price at San Pedro Sula has been L. 5.50 per quintal. The price for shipments to Tegucigalpa, on the other hand, would have been L. 6.20 less freight of L. 1.70, or only L. 4.50. This situation will change as a result of the construction of the Western Highway, drastically reducing costs of transportation from Northern Honduras to El Salvador. However, results

Table 14

Normal Pattern of Corn Prices in Honduras
(in Lempiras per Quintal)

Price shown next to town name; transportation costs are in parentheses; distance in kilometers underlined, cost per quintal-kilometer in parentheses and underlined



a) Normal price in previous years; this year El Salvador has reduced price to L.6.40

Source: Banco Nacional de Fomento, "Programa de Compra de Granos a Precios Minimos del Banco Nacional de Fomento para la Cosecha 1963-64," Tegucigalpa, 1963.

are not yet clear enough to be taken into account in this report.

Production costs in different parts of the country vary in a manner that tends to offset part of the differences in transportation costs to market centers. While transportation costs rise from south to north, annual rainfall also tends to rise, helping to reduce production costs. Similarly, population density - with its attendant soil exhaustion and erosion and high land values - tends to be lower towards the north and east, again tending towards lower production costs. However, production costs seem to fall less rapidly than costs of transportation to market rise, and there is therefore a marginal boundary beyond which production of corn for market becomes unprofitable.

Very generally, cash sales cease and subsistence economy reigns where total transportation costs from the three market centers of San Salvador, Tegucigalpa and San Pedro Sula begin to exceed something like L. 1.30-1.50 per quintal. For example the Aguán Valley usually does not supply corn to the national market.

Transportation costs shown in Table 14 refer only to main centers on highway or railway lines. When the heavy costs of transportation from roadless producing areas to highways or railways are taken into account, the area that can participate in the national corn market is of course severely restricted. For example, if mule transport is estimated at $0.50 per ton-kilometer or $0.0227 per quintal-kilometer (against $0.0051, say for truck transport on the Catacamas-Juticalpa road), the marginal boundary must be withdrawn around 4.4 kilometers along the main road for every kilometer of mule transport required to reach

that road. For a 9 kilometer mule trip, it must be withdrawn around 40 kilometers, the entire length of the Guayape Valley between Catacamas and Juticalpa. Thus, until feeder roads were built in the Guayape Valley, obviating the need to rely on expensive animal transport, there was little production of corn for outside markets.

Once this relationship becomes clear, it is also clear why so much of Honduras is given over to subsistence farming, or is left to extensive pursuits such as cattle-ranching: because of high transportation costs to market, it is unprofitable for many farmers to harvest anything beyond their own needs.

Typical production costs may be estimated as follows:

	Lempiras per Manzana
a. Local corn variety, current system	
Land preparation	L. 20.00
Seed cost and planting	9.00
Cultivation	16.00
Doubling	10.00
Harvest, transport and stripping	20.00
Total estimated production costs	75.00
Estimated production = 15 quintals at L. 6.00 (1 ton per hectare)	90.00
Estimated gross profit	L. 15.00
b. Local corn variety, mechanized	
Land preparation	L. 10.00
Seed cost and planting	5.50
Cultivation	6.00
Doubling	6.00
Harvest, transport and stripping	37.50
Total estimated production costs	65.00
Estimated production = 25 quintals at L. 6.00 (1.3 tons per hectare)	150.00
Estimated gross profit	L. 85.00

c. Hybrid corn, mechanized

Land preparation	L. 10.00
Cost of seed (25 pounds)	8.00
Cost of fertilizer	30.00
Cost of insecticide	30.00
Planting	3.00
First fertilizer application	2.00
First two cultivations	5.00
Insecticide application	5.00
Second fertilizer application	2.00
Third cultivation	3.00
Irrigation	10.00
Harvest, transport and stripping	52.00
Total estimated production costs	160.00
Estimated production = 50 quintals at L. 6.00 (2.6 tons per hectare)	300.00
Estimated gross profit	L. 140.00

As these figures suggest, it is doubtful whether traditional subsistence farm production of corn is profitable in a commercial sense (particularly since prices at harvest time may fall as low as L. 2 per quintal in isolated areas). In effect, it is a way of life rather than a profit-making activity. The farmer grows corn to feed his family, and for this purpose it is invaluable. Any surplus is sold on the market for what it will bring, without regard to its economic cost of production.

Experiments have shown that yields can be increased dramatically by the use of improved seed and limited amounts of fertilizer. Typical results are as follows:

Yields of corn, pounds per Manzana[1)]

	Check plot (no fertilizer)	75 lb. NPK fertilizer components	150 lb. NPK fertilizer components
Local variety	2,298	3,662	4,135
Improved seed:			
Open pollinated	4,854	6,220	5,613
Hybrid	4,273	6,867	6,745

1) Jorge Diaz A. and Julio Romero F., "Maices para Honduras, Resultados Experimentales en Siembras de Primera, 1963," STICA, Tegucigalpa, 1964.

Throughout Central America, a tendency is beginning to develop to mechanize corn production, and to move into wet lowlands along the coast where costs of production are lower. This will gradually bring pressure on the price of corn for a reduction, and will thus tend to discourage subsistence producers. At the same time, corn will increasingly be treated as a commercial crop, required to produce a profit and grown with the latest techniques in order to reduce costs.

In the Aguán - Olancho region, we may expect corn production to increase in the Guayape Valley (using land which is now idle or used marginally for pasture) and in the Aguán Valley, primarily for movement to interior markets and export markets in El Salvador. There is also likely to be some increase in the Agalta Valley, but this will be limited by the general poverty of the soil.

b. Beans

Beans are normally grown in symbiosis with corn, as part of the traditional subsistence "milpa". They are the staple protein for most of Central America's population. In 1963, Honduras grew 145,730 manzanas , with a total production of 969,450 quintals or 44,013 metric tons, or an overall average of 6.65 quintals per manzana. Most of the beans are grown in the southern part of the country where the yields are lowest, but the population is highest. Beans require good drainage, but will grow on relatively poor soil.

Traditionally, the population prefers a small, red, kidney-shaped bean. Recently, however, a considerable area has been planted to higher-yielding black beans, for export to El Salvador and Guatemala.

Honduras' total exports in 1963 amounted to 14,951 tons, with an average value of L. 294 per ton. This is close to being a competitive price by world market standards, equivalent to $0.067 per pound whereas U.S. exports in 1963 amounted to 3 million pounds of small red beans valued at $180,453, or $0.06 per pound. Other types of beans brought higher prices. Given the fact that Honduras' present export price is valued at the land frontier with El Salvador, it should be possible to develop an overseas export trade in beans, particularly from areas with limited rainfall close to the North or South Coast.

Bean production is being encouraged by the National Development Bank through the installation of drying and storage facilities. Since the unit value is greater than that of corn, beans

can better support transportation costs, and therefore are frequently produced in relatively remote areas. For market, most beans are produced as a second crop ("postrera") where there is sufficient late rainfall for the seed to germinate and for the plants to establish themselves. Beans have deeper roots than corn, and the crop matures in only two months with less rain than is required for a second crop of corn. Dry weather at harvest time is most important for good yields.

Usually, the vines are pulled by hand and hung on the corn stalks to dry. The pods are then flailed by hand. The threshed beans are spread in the sun for further drying and then stored or marketed.

Taking Central America as a whole, the area devoted to beans has been falling. The price of beans has been rising, and per capita consumption is declining, to the serious detriment of health standards (since protein is deficient to start with). Pushed by more profitable cash crops, traditional cultivation is moving to poorer soils, with a consequent lowering of yields. However, a few large growers, using mechanization and irrigation to raise yields, are beginning to be attracted by the rising price.

Honduras hopes to increase her bean output by 6,000 tons through use of better seed in areas such as Danli, Copán, Quimistan, Olanchito and Cedros. In addition, she hopes to produce an additional 1,800 tons on 1,500 Manzanas of new bean area near Olanchito, Catacamas and Choluteca.

Estimated production costs are as follows:

	Lempiras per Manzana
a. Current system	
Land preparation	13.00
Seed cost and planting	12.00
Cultivation	16.00
Harvest and shelling	18.00
Transport	16.00
Total estimated production costs	75.00
Estimated production = 10 quintals at L. 12.00	120.00
Estimated gross profit	45.00
b. Mechanized and irrigated	
Land preparation	10.00
Cost of seed	4.00
Cost of fertilizer	25.00
Cost of insecticide	30.00
Planting	3.00
First fertilizer application	3.00
3 cultivations	13.00
Second fertilizer application	3.00
Insecticide application	5.00
Irrigation	15.00
Harvest and shelling	25.00
Transport	24.00
Total estimated production costs	160.00
Estimated production = 25 quintals at L.12.00	300.00
Estimated gross profit	L.140.00

Bean production should increase in the upper Aguán (Olanchito), to some extent in the Agalta Valley, and possibly in the Guayape. However, there will be a tendency to meet local requirements in the lower Aguán Valley by moving beans from the interior, displacing the present high-cost production on unsuitable wet soils.

c. Rice

Rice is a good crop for poor soils, and particularly soils with insufficient drainage or swampy conditions. Honduras presently imports rice, and the government is anxious to increase production. Rice requirements will probably increase as the standard of living rises. In 1963, Honduras imported 1,683 tons of hulled rice (mostly from El Salvador) at a cost of L. 696,569 or L. 414 per metric ton. However, the appearance of the "hoja blanca" disease, and the development of more profitable cash crops such as cotton is tending to reduce El Salvador's rice surplus. Net imports of Central America amount to around 8,000 tons a year at present. U.S. exports of milled rice to Central America totalled 5,853.7 metric tons in 1963, with a value of $878,594, or $150 per ton (f.o.b.). The two largest importers were Nicaragua and El Salvador.

Rice is grown in all parts of Honduras. The best yields are obtained in the Department of Colón, particularly the lower Aguán Valley and in Gracias á Dios (Mosquitia). Only upland rice varieties are grown; flooded or paddy rice is only produced on a few trial plots at research stations. According to data reported for 1963, 19,720 manzanas were planted to rice with a production of 492,960 quintals, and an average production of 25 quintals per manzana (1.6 tons per hectare). However, this seems quite high under present conditions.

A good yield for upland rice would be 2.5 tons per harvest per hectare; paddy rice should yield 3 tons per harvest under good conditions. Two harvests a year are possible where water is

available. With the appearance of "hoja blanca" in Honduras, it will be necessary to introduce resistant seed varieties if rice production is to continue.

At present, most of the rice is planted with a digging stick, like corn, is cut by hand, threshed by flail, and then sent to a power mill for hulling. Local seed is a mixture of various strains, and the grain ripens unevenly. As a result, kernels are of varying size, and there is much breakage in milling.

Estimated costs for unmechanized and mechanized upland rice production are as follows:

	Lempiras per Manzana
a. Current system, unmechanized	
Land preparation	L. 20.00
Seed cost (100 lbs.)	30.00
Planting	5.00
Cultivations	32.00
Harvesting, threshing, storage & transport	33.00
Total estimated production costs	120.00
Estimated production - 12 quintals per manzana at L. 20.00 (0.76 tons per hectare)	240.00
Estimated gross profit	120.00
b. Mechanized	
Land preparation	15.00
Seed Cost	30.00
Planting	3.00
Cost of insecticide	10.00
Cost of fertilizer	24.00
Cultivations	6.00
2 fertilizer applications	4.00
Insecticide application	3.00
Irrigation (twice)	30.00
Harvesting, threshing, storage & transport	52.00
Total estimated production costs	177.00
Estimated production = 30 quintals at L. 20.00 (1.94 tons per hectare)	600.00
Estimated gross profit	437.00

In view of the relatively good profit to be expected, an

expansion of the rice cultivation is anticipated in all parts of the Aguán - Olancho region. Most of the production should move to interior markets.

d. Cassava and sorghum

Cassava is a native crop of Central America, and was a part of the pre-Columbian diet. It is still a staple food, particularly in Northern Honduras, and demand is increasing. However, it is not easily transported over long distances in its raw form. Therefore, movement of a large volume out of the Aguan-Olanchito region is not anticipated, although there should be some increase in production for local consumption.

Sorghum is a substitute for corn, planted in areas with limited rainfall, particularly as a second ("postrero") crop. Sorghum is also a more certain crop on the poor soils on the sides of mountains. At present, it is grown mainly in Southern Honduras, around Choluteca, with small plantings in the Guayape Valley. Since rainfall is generally more abundant in the Aguán-Olancho region, we do not expect much increase in sorghum production, and especially not for movement out of the area. However, there may be some increase for feeding of hogs (and possibly even cattle).

c. Winter vegetables

Honduras' North Coast is well located to supply winter vegetables and melons to the U.S. market. As Table 15 shows, in 1963 U.S. imports of cucumbers, squash, eggplant, tomatoes, cantaloupes and melons totalled 443 million pounds, valued at $30.2 million. Most of these were imported during the months of December-February, when the United States' own production is very limited.

There have been two attempts in the past to establish large-scale winter vegetable enterprises in Honduras. Both failed, mainly because of lack of adequate financing, and in part for lack of sufficiently experienced management. However, the basic idea was sound, and is succeeding on a smaller scale in several other Central American countries.

It would be difficult to produce winter vegetables for export on small farms, since irrigation, pest control, packing, shipping and sales must all be coordinated. The following is a conservative estimate of profitability, assuming production of 6 million pounds of vegetables on approximately 500 acres. No allowance is made for possible off-season crops on the same area.

	In Lempiras
Wages and salaries	175,000
Fuel	20,000
Seed, insecticide, fertilizer	85,000
Packing materials	12,000
Spare parts	10,000
Depreciation of equipment (total value: L. 200,000)	40,000
Depreciation of irrigation installations	2,000
Stevedoring at port	30,000
Total cost of production	424,000
Price, f.o.b. port at L. 0.10/lb.	600,000
Gross profit	176,000

We assume that at least one such enterprise will develop in the lower Aguan Valley.

Table 15

U.S. Imports of Winter Vegetables in 1963

	Weight in pounds	Value in Dollars (fob)	Average value U.S. cents per pound (fob)
Cucumbers			
Mexico	6,985,642	541,453	7.8
Honduras	5,936,180	311,891	5.3
Bahamas	25,626,798	1,469,999	5.7
Haiti	7,231,424	327,542	4.5
British Honduras	128,602	5,744	4.5
Total	45,908,646	2,656,629	5.8
Squash			
Mexico	1,823,240	171,497	9.4
Bahamas	831,190	49,819	6.0
Dominican Republic	13,840	346	2.5
Total	2,668,270	221,662	8.3
Eggplant			
Mexico	2,671,132	182,483	6.8
Honduras	213,839	13,752	6.4
Bahamas	976,693	64,552	6.6
Haiti	801,350	51,589	6.4
Total	4,663,014	312,376	6.7
Tomatoes			
Mexico	239,965,022	20,705,769	8.6
Guatemala	65,760	2,830	4.3
Honduras	4,100	687	16.8
Bahamas	86,295	4,418	5.1
Dominican Republic	47,004	2,482	5.3
Venezuela	51,520	5,633	10.9
Canary Islands	92,368	8,501	9.2
Italy	52,457	5,429	10.3
Total	240,364,526	20,735,749	8.6
Cantaloupes and melons (except watermelons)			
Mexico	114,844,868	5,001,354	4.4
El Salvador	273,691	16,425	6.0
Panama	11,712	1,331	11.4
Haiti	427,106	17,812	4.2
Dominican Republic	9,648	492	5.1
Peru	188,286	6,799	3.6
Ecuador	35,973	3,036	8.4
Chile	22,506,678	737,908	3.3
Argentina	311,329	14,124	4.5
Spain	10,412,733	478,958	4.6
Italy	127,700	4,107	3.2
Total	149,149,724	6,282,346	4.2
Total	442,754,180	30,208,762	-

f. Bananas

Bananas are Honduras' largest single export product. At present, virtually all bananas are produced and shipped by one of the two major fruit companies. Once the world's largest banana exporter, Honduras' production fell drastically during and after World War II. Among the reasons for this decline were (1) the onslaughts of the "Panama disease", an incurable and fatal malady for the standard "Gros Michel" variety, (2) the increase in labor costs in Honduras after the introduction of a complex labor code (with over 1,000 articles), and (3) expansion of low-cost production in Ecuador.

Within recent years, however, the industry has adjusted to these changes, and banana production is again expanding in Honduras. Disease-resistant but more easily bruised varieties (Giant Cavendish and Valery) have been substituted for the Gros Michel, and the entire handling system has been changed to permit shipment of the resistant varieties in corrugated boxes. The plantations have been mechanized so as to increase labor productivity in line with the increase in wage cssts. Finally, in Ecuador Panama disease has begun to spread, initial fertility of newly-cleared ground is diminishing, and labor and other costs are rising.

At present both major companies are increasing their acreage in Honduras, to around 30,000 acres for the United Fruit Company and at least 12,000 acres for the Standard Fruit Company. The United Fruit Co. is leasing some of its plantations to independent growers, while the Standard Fruit Co. is considering a

program to develop 2-5,000 acres of independent production in the Middle Aguán Valley, adjacent to its present plantations. In both cases, the major companies would continue to transport and market the fruit through their own facilities. Independent growers would probably have lower labor costs than the major companies, but would require technical assistance in such matters as irrigation and disease control.

In addition, it would be possible for banana growing to develop in the Lower Aguán Valley, with or without the participation of the major companies. The distribution system in the United States is changing, partly as a result of an anti-trust decision which requires the United Fruit Co. to divest itself of its wholesaling affiliates, partly because of the impact of boxing and pre-cooling (which reduces the need for experienced and well-equipped ripening establishments in the U.S.). Consequently, independent market outlets can now be found, and the major companies themselves are more willing to market for independent producers.

In 1963, Honduras' exports of bananas totalled 9,951,077 stems, valued at L. 66,065,200, or L. 6.64 per stem. A box contains approximately 41 pounds of bananas, or roughly seven-tenths of an average stem. Thus, the average value per box (if all fruit had been boxed) might have been $2.32. However, the price that is actually likely to be paid to independent producers is in the vicinity of $1.50 per box. Even at this price, independent producers could expect to make substantial profits.

The following estimate is based on the assumption of a self-contained banana producing and boxing unit, covering 1,000 acres.

This may be divided into a number of medium-size farms (e.g. 200 acres each) provided all units are operated together, with adequate coordination and management. The estimate is based on yields of 700 boxes per acre per year; present yields of typical small growers might be 250 boxes per year, and quality sometimes is not adequate to meet export demands.

	In U.S. dollars
a. Total investment (exclusive of purchase of land)	
Seed, 600 per acre at $0.20	120,000
Land preparation & road construction	90,000
Buildings	50,000
Equipment	100,000
Initial planting, cultivation, spraying, fertilizer	42,000
	402,000
b. Annual cost	
Supervision and management	30,000
Depreciation	60,000
Maintenance	15,000
Cultivation	50,000
Harvesting	50,000
Fertilizer	40,000
Spraying	25,000
Miscellaneous	10,000
Cost of growing	280,000
Packing: Labor @ 0.05	
Box @ 0.48	
0.53 x 700,000	371,000
Trucking to port	40,000
Stevedoring and export duties	70,000
Total cost, f.o.b.	761,000
c. Sales proceeds: 700,000 boxes at $1.50	1,050,000
Gross profit	289,000

The annual tonnage to be moved may be estimated as follows:

Bananas:	700,000 x 41 lbs. x 0.000454	13,030 tons
Packaging:	10%	1,303
Gross weight:		14,333

A logical location for a banana enterprise would be in the Lower Aguán, in the vicinity of Puerto Castilla. We assume one such unit as part of our overall estimate.

g. Citrus

Citrus is the most widely grown fruit in Honduras, next to bananas and plantains. It is grown in all parts of the country. The favorite citrus fruits are swoet oranges and tangerines. A large lime is the most common acid citrus. The season for oranges is very long and they can be found in the larger markets during most of the year. The two principal varieties are Valencia and Washington Navel. Grapefruit is not popular in Honduras. However, good quality fruit is produced in the north where rainfall is adequate and the temperature is high during the ripening period. Much of this is exported to Europe.

A number of areas of Honduras are eminently suitable for citrus production. In addition to fresh fruit markets, local processing into fruit juices and concentrates is a possibility.

Honduran export statistics show the following sales for 1963:

		Weight Kilograms	Value Lempiras
a. Oranges and tangerines			
Guatemala		7,428	1,156
El Salvador		3,722,484	421,987
Nicaragua		17,440	850
Western Germany		26,160	200
Total		3,773,512	424,193
Lempiras per Kg:	0.113		
U.S. dollars per pound:	0.026		
b. Grapefruit			
U.S.A.		286,747	30,200
El Salvador		96	18
Western Germany		3,595,428	377,653
Total		3,882,271	407,871
Lempiras per Kg.	0.105		
U.S. dollars per pound:	0.024		

For orange groves in the vicinity of San Pedro Sula, the local market absorbs limited quantities, at a price of around L. 25-30 per thousand oranges (weighing around ½ lb. each), or

roughly $0.03 per pound. The surplus is exported to El Salvador at a price on the farm of roughly L. 15 per thousand ($0.014 per pound). However, El Salvador has been planting oranges also, and new markets will be needed.

One producer has already begun to export to Canada, and the possibility of exporting to other countries is being explored by others. U.S. imports of oranges in 1963, mostly from Mexico, were purchased at $0.031 per pound, f.o.b. U.S. exports of oranges, on the other hand, averaged $0.10 per pound. U.S. exports of grapefruit sold for $0.06 per pound, while imports, mostly from Mexico, averaged $0.05 per pound.

It will be seen that these prices are three to four times what is presently realized for Honduran exports. To obtain prices on this order, however, Honduran producers would have to improve the quality of their fruit. In particular, some 12 to 15 sprayings would be necessary whereas at present only a few growers spray at all and usually make only one or two applications of chemicals per season. It would be desirable to grow oranges in a dryer climate (such as the Guayape or Upper Aguán Valley), both in order to produce a yellower color and to make possible timing of the crop to hit peak market demands by control of irrigation. (However, the color problem could also be solved by dyeing the fruit.)

A long growing season can also be obtained by planting different varieties, as follows:

Variety	Harvest period
Pineapple orange	October - December/January
Valencia "	October - December/January

Washington Navel Orange	July - August/September
Victoria "	October - November
Pomelo (a form of grapefruit)	grows all year around

Sweet orange trees enter into production after five years and continue to produce for some 30 years. Profit potential is estimated as follows:

1. Production estimate for 13 year period assuming overhead or gravity irrigation

Plant, June 1964		
Harvest - November 1967	200	oranges per tree
June-Nov. 1968	1,000	" " "
8th-13th year	1,600	" " "

- or 1, 00 oranges for sixth and seventh year, plus 1,600 oranges a year for eigth through thirteenth year, or a total of 10,800 fruits per tree.

2. Investment (other than land)

	Lempiras per Manzana	
1st year:		
Cultivation and disking	L. 100.00	
Marking (L. 0.04 per tree)	7.00	
Hole digging	9.00	
Transplanting	10.00	
Cultivation (6 at L. 30)	180.00	
Pruning	15.00	
Cost of budded seedlings (169 at L.2.00)	338.00	
Irrigation system	400.00	
Fertilizer (400 lbs. of 12-24-12)	42.00	1,101.00
2nd year:		
Cultivation (6 at L. 30)	180.00	
Irrigation - operation & amortization	74.00	
Fertilizer (400 lbs. urea)	56.00	310.00
3rd year: Repeat		310.00
4th year: Repeat		310.00
Total estimated cost until first harvest		2,031.00

3. Revenue estimate

169 trees per manzana (23' x 23') = 169 x 10,800
= 1,825,200 fruits/manzana in 10 years (to 13th year level)
1,825,200 at L. 15.00 per 1,000 (export price)
= L. 27,378 per Manzana

4. Profit and Loss Estimate

Initial investment to 4th year		L. 2,031.00	
Cultivation 5th to 13th year (9 years)			
= 6 cultivations at L. 30.00	180.00/yr.		
Fertilizer: 400 lbs. 12-24-12	42.00 "		
	222.00 x 9=	1,998.00	
Irrigation = L. 74.00 x 9		666.00	
Harvesting (3,000 fruits per day at L.5.00 = L. 0.60 per 1,000 x 1,825.2 thousands		1,095.00	
Total estimated costs (including investment)			5,790.00
Estimated Revenue			27,378.00
Estimated gross profit to 13th year			21,588.00
Average per annum			1,660.00

The above estimates do not include fumigation costs. A minimum of 2 applications annually are essential. The necessary equipment is valued at L. 1,200 to L. 3,000, plus the tractor. However, farmers who would fumigate would also do the cultivating by rotary hoe rather than by hand and the economies thus effected would offset the cost of fumigation.

With around 12 to 15 applications annually, the fruit could be exported overseas. The additional revenue to be obtained at the higher export price would more than cover the cost of spraying and packing, and the profit per Manzana would increase substantially.

h. Pineapple

Pineapples grow well in many parts of Honduras. They require well drained and well aerated soils with a reasonable quantity of organic matter. They thrive under a wide variety of rainfall conditions (20 to 80 inches annually, provided they are well distributed). Artificial irrigation could be employed during prolonged dry spells.

At present, the best quality fruit comes from an area around San Pedro Sula on the North Coast. A pineapple boom is now in progress in this area, with over 500 Manzanas already planted. Unfortunately, this boom will probably collapse, with serious consequences for many growers, unless processing facilities are established soon.

The pineapple boom began in response to an export demand developed by one of the banana companies, and the provision of an improved variety called "Montufar". This is a form of the standard "Spanish Red" shipping pineapple. Compared to the Spanish Red, Montufar has a better flavor, but contains more noticeable seed when ripe, and is more subject to the development of brown spots in the flesh around the seed. "Spanish Red" as such has not done well in the area, possibly because efforts were made to grow it on hillsides at altitudes up to 1,200 feet.

Unfortunately, local suppliers of the banana company did not take precautions against fruit borers (which can be controlled with one or two sprayings of toxaphene during the 30 day flowering period.) In addition, they failed to dry the cut bases properly, so that the fruit was subject to rot. Some of them also sought to

pass off underripe and overripe fruit. In many cases, harvested fruit was brought to the road by rolling it down steep hillsides, with consequent serious internal bruising.

Faced with these difficulties, the banana company stopped buying pineapples, and the market collapsed. At present, fruit in excess of the limited local demand is exported at low prices, primarily to El Salvador where it is processed into canned pineapple juice. A large grower who tried to ship his own fruit to the United States found that he was unable to solve transportation, storage and other distribution problems on his own.

A typical good price is L. 5 per "load" (cargo), containing approximately fifty pineapples and weighing approximately 125 pounds. This works out to roughly $0.01 per pound at the farm. At this price, processing would be profitable, and it probably would be possible to organize fresh fruit exports, provided the growers are willing to control their quality.

In 1963, Honduras' exports of pineapples were as follows:

	Weight, Kilogram	Value		
		Lempiras	Lempiras per kilogram	U.S. dollars per pound
USA	111,196	5,421	0.049	0.011
El Salvador	145,549	9,754	0.067	0.015
Western Germany	32,802	No value declared		

U.S. imports in 1963 consisted mainly of pineapples in bulk from Mexico. These amounted to 14,389,802 pineapples, valued at $914,374, or $0.063 each. If each pineapple weighed four pounds, the average value would have been $0.016 per pound, f.o.b. Mexico.

Neither Montufar nor Spanish Red are considered sufficiently high in quality for canning as slices (although they could be

processed into certain juice products). The standard canning variety is the "Smooth Cayenne", whose better flavor, higher citric acid content, and greater production per planted area are offset by inability to stand rough handling in shipment as fresh fruit. Very little if any "Smooth Cayenne" is grown in Honduras (apart from carefully-guarded experimental plantings made by Hawaiian pineapple interests in cooperation with the banana companies). If grown, this variety probably would not be accepted on the local fresh fruit market.

As a pineapple producer, Honduras enjoys potential advantages over Hawaii, the largest supplier of the United States market: (a) geographical proximity and (b) cheap labor. It is understood that certain Hawaiian producers are interested in organizing production, and their connections and marketing experience could be of substantial advantage to Honduras.

The usual harvesting procedure employed in Honduras is to harvest one fruit from the mother plant after two years, and thereafter two fruits from shoots each year for five years. This makes a total of nine fruits per mother plant during a planting cycle. This is excessive, and as a result quality and weight decrease progressively. Average weight under this system is 2-2½ pounds per fruit.

An improved cultivation procedure would work as follows:

Each plant or shoot produces two shoots in turn. One shoot should be cut and lifted for planting elsewhere, and the second should be left for fruit production. For example, the mother plant might be put in January 1965. Between November and February

1967, one fruit would be harvested from the mother plant. From November to February 1968, one fruit would be harvested from one first generation shoot. Between November and February 1969, one fruit would be harvested from a second generation shoot. To compensate for the fact that only one shoot is used each year, initial planting would be at a rate of 16,000 per Manzana. Each pineapple would weigh around three pounds, and total production would be 48,000 x 3 lb., or 144,000 pounds in four years. Smooth Cayenne would weigh four to five pounds each, and could be planted somewhat more densely (17,400 per Manzana). If fertilizer were used, production could be extended for another two years or so.

At present pineapple production is highly seasonal, with peak production in the San Pedro Sula area during the months of June, July and November. However, fruit formation can be triggered at will by spraying the plant with a hormone-like chemical (calcium carbide). Fruit is produced 21-22 weeks later. This procedure may reduce the average size of fruit somewhat, but will ensure supplies when the market requires them.

Estimated profitability under present and proposed new methods of cultivation is as follows:

	Lempiras per Manzana
1. Variety "Montufar", current procedure	
Initial cultivation	L. 32.00
Planting material (6,000 plants)	60.00
Planting (L. 5.00 per 1,000)	30.00
Re-planting (5%)	4.50
6 cultivations per year at L. 32 each for 4 yrs.	768.00
Harvesting, 3 x L. 30	90.00
Total estimated production costs	984.50

Estimated revenue:

Production:	2nd year	6,000	fruits
	3rd year	12,000	"
	4th year	12,000	"
		30,000	

At 50 fruits per load = 600 loads	
Sales price per load = L. 5.00	
Total revenue through fourth year, 600 x L.5	3,000.00
Estimated gross profit over 4-year period	2,015.50
Gross profit per year	L. 504.00

2. Variety "Montufar", improved procedure

Initial cultivation	32.00
Planting material (16,000 plants)	160.00
Planting (L. 5.00 per 1,000)	80.00
Re-planting (5%)	12.00
24 cultivations (6 per year)	768.00
Harvesting, 3 x L. 45	135.00
Total estimated production costs	1,187.00
Estimated revenue:	
3 x 16,000 = 48,000 fruits	
At 42 fruit per load = 1,143 loads	
Total revenue through fourth year, 1,143 x 5	5,715.00
Estimated profit over 4-year period	4,528.00
Average profit per year	1,132.00

Since this is a relatively profitable use of available resources, we assume that a pineapple operation will be developed in the Aguán Valley using a minimum of 300 Manzanas, each producing an average of 17.25 metric tons a year, or a total of 5,160 tons per annum. If one-third (1,720 tons) is exported as first-grade fresh fruit, while the remainder is processed into juice concentrate with a gross weight of 400 tons, the total outgoing traffic would be 2,120 tons a year. Since industrial processing is not considered within our terms of reference, subsequent cost-benefit calculations will consider only the income of the pineapple growers.

i. Cacao

Various areas of Honduras offer favorable conditions for the production of cacao. Since agricultural wages are fairly low, Honduras could be in a good competitive position, particularly if new high-yielding varieties are planted.

As a permanent tree crop, cacao is suitable for areas where short-term crops should be abandoned in the interest of erosion control and for conservation. It could be processed locally to substitute for present imports, or could be exported to other Central American countries and to world markets.

Cacao grows best at high temperatures and with high and nearly continuous rainfall. The lower limit of temperature is 15°C. and optimimum temperature is between 30 and 32°C. Cacao seldom grows satisfactorily at altitudes above 1,500 feet.

Average monthly rainfall should exceed four inches (48" a year, although 60-100" is better), and should not fall below 2.5 inches.

Cacao is best produced in rich, moist, porous and deep soils approximately neutral in pH. The optimum pH lies between 6.0 and 6.5 and the upper and lower limits are 5.5 and 7.0 respectively. Although the majority of the roots are located within 12 inches of the surface, they require well drained and porous soil to a depth of 40 inches or more (the maximum extent of root penetration). Cacao soils should be inherently rich in nutrients and organic matter, or these must be added by means of fertilizer.

The majority of cacao is produced under some type of shade. Young plants grow best under about 50% of shade whereas older

plants require less shade. In areas with mature trees, the shade should be opened up so that the sun shines directly onto the plants at some time of the day. Adequate shade lowers the temperature in the plantation, increases the relative humidity and reduces fertilizer requirements. Cacao is usually planted as seed. Seed may come from solid blocks of grafted trees, or may be artificially pollinated to produce desired hybrid varieties.

Blocks of two good varieties, totalling 80 hectares, were established some years ago by the United Fruit Company, and are now rented out to independent growers who are willing to provide seed to others. Individual specimens of other varieties are available in the country for the production of hybrids. Cacao trees start producing after 3½ to 5 years and usually reach an age of 50 to 60 years.

The cacao pods ripen in about five months. They do not drop from the trees, but must be carefully cut off. They may be harvested within a three week period without serious loss of quality It is often possible to increase the production of a cacao plantation by up to 25% by simply instituting a regular two to three weeks cutting cycle.

The harvested pods are collected in heaps and then opened, usually by means of a machete. Care is taken not to damage the nuts. A worker can open some 350 pods per hour, producing approximately 70 lbs. (32 kilograms) of moist nuts. These are placed into boxes, tins or jute bags for transport to the fermentation plant.

Fermentation of the nuts takes place in wooden boxes, usually

stacked in frames, one above the other. The relative position of the boxes is changed periodically in order to equalize the fermentation process. This lasts from three to six days. After fermentation, the nuts are dried to a moisture content of 6 to 8%, either by the sun or in artificial dryers. At present, almost all Honduran cacao is sun-dried, without proper fermentation, and consequently is of low quality. The sales price on the farm is around L. 0.25 per pound, or somewhat over half the present world market price. There are no central drying plants. A small drying plant, processing perhaps 5,000 pounds in 30 hours, would cost around $4,500.

There is a limited market for cacao within Central America, at a premium above world market prices. In 1963, Honduras exported 52.2 tons to El Salvador and Guatemala, at an average price of L. 0.63 per kilogram, or L. 0.29 per pound. Other Central American cacao producers, whose quality meets world market standards, obtained substantially higher prices from these markets. Production of up to 3,000 lbs. per hectare (2,100 lbs. per manzana) of dry cacao per year can be obtained from improved varieties.

Cacao is attacked by a number of diseases and insects. Their control requires both equipment and technical know-how. Therefore, planting of cacao by widely dispersed small farmers is usually uneconomical, and either reasonably sized commercial plantations or properly organized cooperatives are recommended.

In recent years there has been much interest in the possibility of expanding cacao production in Honduras. However, this developed mainly during 1958 and 1959, when the U.S. price of cacao

rose to 34-44 cents per pound. The price has since dropped to 29 cents in 1960, 23 cents in 1961, 20 cents in 1962 and around 25 cents at present.

According to the following estimate, cacao would be barely profitable at the present price, if grown in such a way as to produce a good yield of 2,500 pounds per hectare. It would lose money for farmers who produced a mediocre yield of 1,500 pounds per hectare. Yields of present small growers working with DESARRURAL vary between 15 and 30 quintals per Manzana (2,140-4,280 pounds per hectare).

Estimated Production Cost per Pound of
Dry Cacao Beans
in U.S. cents per pound

	Yield per Hectare	
	1,500 lbs.	2,500 lbs.
Maintenance, including shade, pruning, cultivation, spraying and drainage	8.0	6.5
Harvest and transport to fermentation plant	6.0	4.5
Fermentation and drying	2.0	1.5
Packing material	0.6	0.5
Storing and handling	1.0	0.9
Transport to port of export	2.0	1.0
Shipping costs to New York	1.3	1.0
Administration	3.0	2.0
Amortization and new plantings (30 years)	2.6	2.1
Interest on capital (8%)	6.5	5.0
Total	33.0	25.0

Some sources claim that Honduran production costs do not exceed 18 U.S. cents (L. 0.36) per pound. However, it is suspected that these sources do not take into account such items as administration, amortization and interest on capital.

It is, of course, possible that cacao prices will again rise to their prior level of 30 to 35 US cents per pound. However, this is not expected by cacao market experts. Accordingly we assume

only a limited development of cacao production in the Aguán Valley, covering perhaps 100 Manzanas, and producing possibly 100 tons a year for sale to El Salvador and Guatemala.

j. African oilpalm

This crop is already being grown in Central America by the United Fruit Company, both in Honduras (near Tela) and in Costa Rica. It seems to offer good possibilities for further development and expansion.

The oil palm is a major world source of hard vegetable oil for soap and other industrial uses, ranking next to coconut in importance. It also makes a fairly good edible oil. The chief production areas are Nigeria, the Congo, some of the other West African countries, Indonesia and Malaya.. The palm is a stout single-stemmed upright-growing tree, reaching a height of 20 meters or more at maturity. Low-growing varieties have also been developed. The trunk is characterized by persistent, spirally-arranged leaf bases. The male and female flowers are borne in separate spadices arising from the axils of the leaves.

The oil palm requires a moist and warm climate. Best results with highest yields, regularity of bearing and oil content of the fruits are obtained in areas with an annual rainfall of about 120 inches, distributed as evenly as possible over the year, and with the continuous high temperatures found near sea level. The trees grow less rapidly in regions with uneven rainfall distribution. A marked periodicity of fruiting and smaller crops result when there is a more or less sharply defined dry season. This situation is also undesirable for economic reasons, since full use cannot be made of processing plants and labor.

Oil palms require nearly neutral soils, with good drainage and aeration. They must be grown from seeds. Like most palms,

these are slow and often erratic in germination. The seeds are planted in nursery boxes and the young seedlings transplanted into nursery beds. Usually, a second transplanting is made into nursery beds at wider spacing. The plants are moved to the field when they have about ten leaves. Usual planting distances are 8 x 8 or 9 x 9 meters.

Oil palms require comparatively little attention, except for regular pruning of dead or diseased leaves. Care must be taken not to prune excessively as this will reduce yields.

Yields vary widely according to soil and climate conditions and agricultural practices employed. It is usually considered that during the fifth year after planting, when commercial production begins, one hectare will produce 1,350 kilograms of palm oil and 450 kilograms of kernels. Mature plants in full bearing will average around 2,200 kilograms of palm oil and 600 kilograms of kernels per hectare per year. However, more than twice that much can be obtained under exceptionally favorable conditions and with improved varieties.

Oil palms ripen their fruit throughout the year in most areas so that harvesting is continuous. As long as the trees are small, the bunches of fully ripe fruit can be cut from the ground, but ladders must be used after a few years unless one of the new low-growing varieties is planted. Some large producers employ tractor-drawn or tractor-mounted hydraulic platforms for harvesting tall palms.

Unlike most oilseeds, the oil-bearing kernel is surrounded by a fleshy fruit portion which also contains oil. The latter must

be quickly processed after harvest, in order to forestall enzymatic action which would develop rancidity or unwanted free fatty acids.

Processing begins with the care taken in harvesting bunches of fruit to avoid bruising, and the consequent entry of oxygen into contact with the flesh. Then the fruit must be transported as quickly as possible to a processing plant. Most plantations establish a series of narrow-gauge rail lines. Laborers carry the bunches to the cars for hauling to the factory as rapidly and without bruising the fruit.

Upon arrival at the factory, the bunches are heated to 55°C. in vats with steam to destroy the enzymes and halt further formation of free fatty acids. The next process is to separate the fruit from the bunches. This is usually done by machine. In some factories, the fruits are then kneaded to separate the kernels from the pericarp. This increases the efficiency of extraction, and oil from pericarp handled in this way has a free fatty acid content of less than 5%. However, the more usual procedure consists of extraction of the oil from whole fruits by hydraulic presses.

After the oil is pressed out from the pericarp, it is clarified and filtered to remove impurities. The kernels are separated from the press cake by a combination separator-dryer. They must be dried to a moisture content of about 10% to be easily cracked.

Two types of crackers are in use, a centrifugal type and a roller type. The kernels are usually separated from the broken

pieces of shell by pouring them into vats of water. The shells are heavier than water, while the kernels float so that they can be taken off as a continuous process. The kernels are dried to a moisture content of 6 to 7 per cent and bagged for export.

Palm oil containing 4 to 5% free fatty acids, such as the better grades from Malaya and Indonesia, is used mainly in the manufacture of margarine. Oils with a higher fatty acid content are utilized mainly in soap and tin-plating. Dried kernels, comprising about 60 per cent of the total export tonnage of oil palm products, are used like copra in soap and oil factories. Oil palm press cake is marketed as dairy feed, but does not possess as high a fat and protein content as copra press cake.

A study prepared for the Bank of Guatemala gives the following production cost figures in Dollars per manzana (agricultural operations only):

Direct costs to 6th year	$774.83
Indirect costs to 6th year	188.58
Total costs per manzana, to 6th year	963.41

Assuming a 20 year optimum production period (6th to 25th year), the profit and loss estimate per manzana would be as follows:

Amortization of costs to 6th year ($963.41/20)	$ 48.17	
Production costs per year (agricultural)	177.81	
Factory costs: unavailable, but roughly estimated at $0.01 per pound x 4928 lbs	49.28	
Total estimated production costs per Manzana		$275.26
Estimated revenue:		
0.7 x 2.2 tons palm oil per hectare at $280/ton c.i.f.[1], less $30/ton estimated ocean frighht	550.00	
0.7 x 0.6 tons palm kernels per hectare at $280/ton c.i.f.[1] less $30/ton estimated ocean freight	150.00	700.00
Estimated yearly profit per manzana		424.74

1) FAO, 1963 Prices, Rome (prices have recently decreased to about $235/ton c.i.f.).

This would be an excellent crop for the Lower Aguan Valley. With proper organization, based on central processing plants, it might be possible to develop small producing units. However, it will probably be difficult to persuade small farmers to invest labor and other resources for six years until production is established, unless medium-term financing can be provided (possibly in the form of surplus foods.)

k. Sisal and Henequen

Sisal and henequen fiber production offer good possibilities for development in Honduras, both for local consumption and for export. Honduras is the only Central American country that lacks its own cordage industry, and still imports substantial quantities of twine and cordage (1,625 tons in 1962). These imports could easily be substituted by local production based on local raw material supplies.

Outside Central America, world market prices for both henequen and sisal have maintained high levels during the last several years. Although prices have decreased recently, they still offer very attractive profit margins to efficient producers. Sisal and henequen are closely related plants. Under favorable conditions, sisal produces more profit per unit of area because of the higher quality of its fiber. Therefore sisal is to be preferred wherever it will grow well. However, on marginal soils and under poor rainfall conditions, the somewhat more demanding sisal crop must give way to henequen, which grows under poor soil and climatic conditions that will not support any other commercial crop.

Sisal is by far the most widely-produced hard fiber in the world. As a cordage fiber, it is second only to abacá in quality and is closely followed by henequen. All these fibers are relatively coarse in texture, and therefore are less suited to the manufacture of bag textiles than the soft fibers like jute and kenaf. In the international market, sisal and henequen are used primarily for the manufacture of binder, baler and tying twine. There is some threat from plastics in these markets. Substantial

quantities of sisal are also used in ropes, including marine cordage, the centers of wire rope and for rugs. Waste from processing is used in automobile pads and upholstery, paper manufacture, etc. Both sisal and henequen are employed as jute substitutes for bag manufacture in some producing countries. However, the resulting bag is coarser and otherwise less desirable than a soft fiber bag.

A mature sisal plant is about five feet tall. It has a short trunk extending a few inches above the ground, some 6 to 9 inches in diameter. From this radiate a number of 3 to 6 foot long soft, green, fleshy leaves. New leaves are continuously emerging from the heart of the plant, as it grows older. The stem widens to some 4 to 6 inches and fans out in a circular pattern.

Strands of sisal fiber run the length of the leaves. The fibers are recovered by scraping away the flesh and washing and drying the fiber.

The henequen plant is very similar to the sisal plant. Its leaves are shorter and heavier, and have sharp thorns running along both edges. The fiber is coarser and weaker, and usually sells at a lower price. At present, sisal sells for around $0.17 per pound for the best grades, while henequen brings around $0.13 per pound.

Both sisal and henequen are hardy plants and adapt themselves to a wide variety of soil and climatic conditions. Henequen, in particular, can be grown in arid areas where little else will grow. However, the highest yields are produced when conditions are more

favorable. Both sisal and henequen can be grown on large commercial plantations by groups of small farmers. However, central processing facilities must be provided in either case if the product is to be sold on world markets.

Production costs on commercial plantations in the established producing countries presently range between $0.08-0.11 per pound for sisal, and are somewhat lower for henequen. However, sisal plantations usually have about twice the annual output per unit area compared to henequen plantations.

In Central America henequen grown by small farmers is estimated to cost $0.10 per pound to produce, and is sold to the factories at $0.13 per pound. The same applies to the plantation-grown henequen in El Salvador. In Guatemala where henequen is mostly collected from wild, spontaneous growth, it is purchased at $0.10 per pound delivered at small purchasing stations. These have been established by the factories in a number of villages in the producing areas.

An efficient modern sisal decorticating installation requires the output of 3,750 acres (1,500 hectares) of a fully-mechanized sisal plantation; this figure includes unusable areas, land reserves for nurseries, roads, buildings, etc. Annual production should amount to 1,350 tons. Total production costs would be around $302,000, gross revenues would amount to $514,000, and profit before taxes would be approximately $212,000. The profit per manzana (including the profit on the processing facility) would be $97.

For a 7,500 acre (3,000 hectare) henequen plantation - with

2,000 hectares under mature henequen - annual production should amount to 2,000 tons. Total production costs would be $360,000, gross revenues are estimated at $670,000 and profit before taxes might be $312,000. The profit per manzana (including the profit on the processing facility) would be $72.

Total investment required to establish a sisal or henequen plantation is estimated at $150-175 per acre, including all machinery and equipment, but exclusive of land purchasing costs. This amounts to $560,000-660,000 for a 3,750 acre plantation.

In view of the very wide adaptability of henequen to comparatively poor soil and climatic conditions, there appears to be little doubt that a suitable area could be located in the Aguán - Olancho region, possibly in the Agalta Valley. Production - under less than optimum conditions - is estimated at one ton per hectare (0.70 tons per manzana - 0.40 tons per acre). To meet the Honduran requirements, estimated at 2,000 tons annually at the most, some 3,000 hectares should be planted to henequen (with an estimated 2,000 hectares in the cutting stage at any one time).

Sisal is more demanding, and would require better soils and more rainfall. The upper Aguán or Guayape Valleys might be suitable areas. Because of its higher price on world markets, sisal would logically go mainly into exports.

1. Abacá (Manila hemp)

Abacá is another fiber crop that offers good possibilities for Honduras. Abacá was grown in Honduras during and after the second World War, under an arrangement between the United States Government and the United Fruit Company. Production was only abandoned when the Philippines, as the world's largest abacá producer, objected against U.S. government competition with their best dollar earner. A new abacá industry in Mexico is doing exceptionally well.

Because of its lightness, strength and resistance to seawater, abacá is recognized as the best available natural cordage fiber. The highest grades of commercial rope are made from abacá and it is used almost exclusively in marine cordage. The better grades of the fiber are mostly shipped to the United States. The United Kingdom imports somewhat lower grades for cordage purposes, and Japan buys substantial quantities of lowest-quality fiber for paper manufacture, building boards, shoes, etc.

Abacá is very similar in appearance and growth habits to the banana plant, and is botanically related. When mature, abacá consists of 12 to 30 stalks radiating from a central root system; each of these stalks is usually 12 to 25 feet high with a trunk 5 to 10 inches in diameter at the base. The stalk is bare of foliage but opens out into a leaf toward the top. The fiber is stripped from the stalk of the plant, mechanically or by hand.

Abacá requires a warm climate, abundant moisture and good drainage. It does not grow well at over 3,000 feet elevation. The areas suitable for this crop in Honduras are limited to the

Caribbean coast.

As in the case of sisal and henequen, abacá can either be grown on a large plantation scale or by a number of small farmers, provided central processing facilities are made available. When abacá was grown on large commercial plantations in Central America, production costs were said to have been $0.08 per pound. At present, production costs for mechanized plantations in Central America would probably fall within the range of $0.10-0.12 per pound.

A mature abacá plantation is estimated to yield some 1,000 pounds of fiber per acre per year (2,500 pounds per hectare). About 5,000 acres of plantation would be required to fully utilize a modern abacá processing plant. Yearly production should then amount to 2,000 tons, with some US $540,000 of production costs, US $985,000 of gross revenue, and US $445,000 of profit before taxes. The profit per manzana (including the profit on the processing facility) would be $153.

m. Rubber

Basic conditions in the Aguán - Olancho region are suitable for rubber production. The trees are grown from seeds or cuttings, and 450 to 500 trees are planted per hectare. Production begins in the fourth or fifth year and continues for 20 to 25 years. Some rubber has been planted between Tela and La Ceiba for sale to Central American markets. However, in the world market rubber faces strong and ever increasing competition from synthetics, and the price is expected to decline. Consequently, a careful study of the market would be required before any definite recommendation could be made.

2. Animal husbandry

Table 16 gives data on cattle and pig population, taken from the agricultural census of 1952. In general, this seems to overestimate the number of animals presently in the Aguán - Olancho region, and somewhat lower figures will be used in subsequent calculations. However, the figures do suggest the importance of animal husbandry for the economic development of the area.

Table 16

Animal Population in 1952

	Number of cattle			Number of pigs
	Total	Milking cows	Of which, milked yesterday	
a. Coast line				
Iriona (Colón)[1]	9,201	1,732	1,141	5,886
Aguán "	734	201	154	259
Santa Fé "	399	142	97	184
Balfate "	175	38	38	260
Subtotal	10,509	2,113	1,330	6,585
b. Aguán Valley				
Trujillo (Colón)	5,731	1,274	670	5,329
Limon "	453	84	55	517
Tocoa "	2,724	522	403	3,760
Sonaguera "	4,183	1,019	578	4,550
Olanchito (Yoro)	23,073	6,625	3,423	13,083
Arenal "	3,055	292	180	849
Subtotal	39,219	9,816	5,309	28,088
c. Aguán Uplands				
Esquipulas del N. (Olancho)	565	181	102	1,373
Guata "	1,545	276	19	2,075
Subtotal	2,110	457	121	3,448
d. Agalta Valley				
San Esteban "	11,923	3,322	120	4,087
Gualaco "	11,329	3,632	1,043	6,201
Subtotal	23,252	6,954	1,163	10,288

1) Includes Mosquitia

e. Guayape Valley					
Dulce Nombre de Culmi	(Olancho)	138	43	8	563
Catacamas	"	15,767	3,475	1,176	6,298
El Real	"	3,325	842	658	2,741
San Francisco de Becerra	"	3,976	875	416	1,239
Juticalpa	"	36,178	10,377	2,802	13,321
Subtotal		59,384	15,612	5,060	24,162
F. Guayape Uplands					
San Francisco de la Paz	(Olancho)	6,596	1,842	220	5,423
Guarizama	"	4,075	1,106	18	3,079
[illegible]nto	"	7,335	1,053	24	4,245
Jano	"	1,712	498	156	894
Silca	"	4,082	925	510	1,782
Salamá	"	5,167	770	58	1,909
Guayape	"	4,066	706	58	2,476
Concordia	"	2,264	68	14	1,204
Campamento	"	3,125	953	361	2,898
Subtotal		38,422	8,533	1,419	23,911
Total for project area		172,896	43,485	14,402	96,482
Total for Honduras		1,146,801	310,697	144,669	525,277
Project area as % of Honduras		15.1	14.0	10.0	18.4

a. Cattle

Like many isolated areas with a relatively low population density, large parts of Honduras are devoted to cattle grazing. This applies particularly to areas that lack roads. In some of these areas, high-value crops like coffee are produced, since these can stand the cost of mule-back transportation. In others, the chief product is live cattle, which can be driven on the hoof to market.

However, cattle-raising continues to be important in many areas where truck transportation has become available. In some places soils are too poor or rainfall is too sparse for agriculture. In other places, the human population is not dense enough to cultivate all available land with present labor-intensive techniques, and the spread of cultivated crops must await the introduction of mechanization.

To be sure, the continued predominance of cattle-raising is also a social or historical phenomenon, rather than merely the product of economic forces. Many landholdings are kept in pasture even though intensive uses would be more profitable. Absentee ownership and land tenure problems tend to keep land in cattle - and cattle in neglect - when economic considerations would suggest otherwise. In some cases, cattle have been put on land primarily to keep squatters out. Recently this reason for cattle ownership has gained strength from the new land reform law which places confiscatory taxes on idle land. There is some doubt as to whether the law will ever be enforced in its present drastic form. However, many absentee landowners are clearing and fencing their land,

and are putting a few cattle on to graze as a token use to forestall implementation of the law. This practice is known as "playing chess", since the cattle are sometimes moved from pasture to pasture merely to show use of a maximum area. In these cases the value of cattle is negative: their economic function is to occupy land, rather than to produce meat or milk.

To an important extent, the neglect of cattle is the effect of traditional attitudes which have not had time to change. These may be traced back to the traditions of the Spanish conquistadores.

In Spanish cattle are called "ganado", and the word also has the meaning of "winnings" or profit. Many cattle-owners still treat their cattle like exploitable gold mines, or herds of wild game, rather than as an investment requiring care and maintenance expenditures. Cows that live despite neglect are profit, and cows that die are considered no loss. Particularly in areas where there is still open rangeland, cows feed and water themselves, if they can, and the survivors are rounded up periodically for branding and driving on the hoof to market.

These attitudes made economic sense when the value of cattle was little greater than the value of their hides. Indeed, the same attitudes have prevailed in many parts of the world whenever or wherever the value of cattle is low. In particular, present conditions in the Honduran cattle industry are quite similar to conditions in remote parts of the United States during the "Wild West" era of the 1870's and 1880's.

As in Texas, Montana, and the other open range areas of that time, in almost all areas of Honduras today the only provision for

watering is access to a river. Cattle are expected to graze as much as three miles away from the river, and to walk between the pasture area and the watering place at least once a day. This undoubtedly leads to a serious loss of weight. Frequently, ground water is within a reasonable distance of the surface (e.g. 80 feet under most of the Guayape and Agalta Valleys) and could be raised with an inexpensive windmill pump.

The need for daily access to the river keeps much of the area in the status of open range, with little fencing to control breeding. Under these conditions, parasite control is difficult, and pasture rotation virtually unknown.

As a consequence, normal stocking rates are extremely low, approximating one cow (and calf) for every ten manzanas in parts of the Guayape Valley. This rate could be at least quintupled by controlled grazing alone (fencing for rotation of pastures), so as to permit grass to develop its maximum output.

In many areas, there are large areas of common pasture (owned by the municipality or "ejido"), as in medieval Europe. These common pastures are invariably overcrowded, with as many as ten animals per acre, as each member of the community tries to profit as much as possible from the common area. Consequently, the grass is kept eaten down to the roots, and has little or no chance to produce any reasonable volume of nutrition.

In most of Honduras, there is a surplus of pasture during the rainy season, but grass ceases to grow during the dry season (usually up to six months). The only food for animals is the dried standing grass remaining in pastures at the end of the

rainy season. As feed, this has numerous deficiencies. In the first place, rapid growth during the rainy season usually gets out of control, and the grasses normally found in tropical countries become tall and woody. In this stage they are low in nutrients, unappetizing, and high in lignin and fiber (reducing the digestibility of the little food they contain).

Furthermore, standing dried grass is very low in Vitamin A (in the form of carotene). Cattle can store Vitamin A in their livers for as much as 100 days, but that does not suffice to carry them over a dry season of as much as 180 days. Because of the lack of water, nutrients, and Vitamin A, there is often a heavy death toll during the dry season, and usually a severe loss of weight gained during the rainy season. To make matters worse, Honduran soils are generally deficient in phosphorus.

Vitamin A could be supplied by green grass, from irrigated or river-bottom land, green hay (harvested with the leaves and dried after cutting), silage, yellow corn, or a number of other sources. Necessary phosphates could be supplied by fertilizing pastures, or in the form of bone meal or mineralized salt. However, with very few exceptions there is no supplemental feeding of range cattle during the dry season, or at any other time for that matter. Two animal feed mills have been established within recent years, but so far sell almost entirely to chicken, hog and some milk producers.

Partly because of their low level of nutrition, cattle fall prey to a wide variety of diseases and parasites. Many of these are more prevalent under tropical conditions than in temperate

climates. A few simple veterinary practices have taken hold, including vaccination for blackleg fever. However, little or nothing is done by most cattlemen to combat ticks, torsalo flies, screw-worms, and intestinal parasites. A common remedy for screw-worms is to plaster fresh manure on the wound, in the generally vain hope of suffocating the worm. Many animals have lost so much of their digestive system as a result of parasite infestation that they are unable to gain weight even when placed in a feedlot.

The torsalo fly, a fairly recent arrival in Honduras, has caused a severe deterioration in cattle health during the last fifteen years or so. Insofar as is known, it first appeared in Honduras from Nicaragua, via San Marcos de Colón on the Pacific Coast in the late 1940's. It then spread through Danlí to Olancho. As late as 1949 the Tela Railroad Co. found only 98 animals with torsalo out of a purchase of 4,047 feeder steers.[1] By now, torsalo has become endemic over a wide area of the country.

A famous U.S. historian, J. Frank Dobie, describes the early treatment of cattle in Texas in terms that almost exactly fit many parts of Honduras today:

> "Feeding them, sheltering them, salting them, doctoring them, doing anything for them in any way was unthought of. As the range was all free and as the cattle were worth little, their survival was left entirely to the wholesome winnowing process of nature. 'It will cost more to raise a brood of chickens in Texas than an equal number of cattle', an agent for immigration wrote."[2]

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1) Jorge de Alba, "Informe sobre la producción ganadera en Honduras," Tegucigalpa, Banco Nacional de Fomento, 1951, page 41.

2) J. Frank Dobie, "The Longhorns," New York, 1941, page 36.

Not only are animal husbandry methods similar to those of the U.S. "Wild West", but the cattle are similar: the "criollo" or "native" cow found in Honduras looks very much like the famous "Texas longhorn". Basically this is a reversion, caused by uncontrolled breeding, neglect and hardship, to the European wild bison or buffalo. The latter is the original source of all recognized Western cattle breeds.(Brahma or Zebu cattle are derived from the Asiatic-African buffalo; the American plains buffalo never bred in captivity, and therefore never produced a domesticated "cow".) The "criollo" or "longhorn" developed - or more properly, regressed - from the Andalusian cattle brought over by the Spanish conquistadores, which escaped or were allowed to breed indiscriminately. According to Dobie,

> "Any kind of cattle turned loose in a big country will revert to wildness...Left for a hundred years in such a country to breed and fend for themselves, with bears, panthers and lobos (...wolves...) allowed to thrive and help nature to select her survivors, the shortest-legged Herefords would become highly potent in maintaining their wildness. Yet in the end they would resemble only distantly the prize-ring whitefaces."[1]

In much of Honduras, man has intervened to a greater extent than in the wilds of Texas. In particular, the castration of surplus males is a fairly general practice. However, as in many underdeveloped countries, the practice of castration is influenced by folklore. For example, many Honduran cowboys refuse to assist in castration while their wives are pregnant.

More serious is the effect of the widespread belief that early castration will set back growth. This belief leads to postponement of castration until the third or fourth year of the

1) Ibid, page 288-9.

animal's life. By that time, the animal may have serviced a number of females, and one major purpose of castration - selective control of breeding - will have been defeated.

Like many long-established beliefs, recent investigations have shown that there is some validity to the idea that early castration retards growth. Young bulls, up to the age of perhaps two years, grow as much as 25% faster than steers of the same breed. Thereafter, the rate of growth of steers rises, while the rate of growth of bulls falls. On the other hand, as presently performed in Honduras with crude methods, late castration may cause a serious setback to growth. It leaves a large open wound that heals only with difficulty, and provides a ready entry for screw worms and infections. In advanced countries, early castration is practiced because cattle mature early, and the percentage of usable caracass and choice cuts is lower for bulls than for steers. This difference is reflected in a lower price per pound for bulls, making production of steers more profitable. However, at present cattle are bought by the pound in Honduras, with no penalty for failure to castrate. Therefore, if breeding could be controlled by provision of adequate fencing and separation of the sexes, it might make sense to skip castration entirely.

To the extent that breeding is effectively controlled, there is a tendency to go to the opposite extreme, and provide too few bulls. It is normal to provide only one bull for every 50 or 60 cows (compared to one bull for at most 30 cows in normal U.S. practice). In one case, an expensive purebred Brahma was assigned

to a pasture with 150 females, and literally killed himself trying to meet the demand for his services. The "saving" on bulls is false economy, since the low ratio of males to females results in a calf crop of perhaps 35-45%, while a normal figure might be 60-80%. The rate of fertility is also reduced by dietary deficiencies, including lack of phosphates, proteins and Vitamin A (particularly during the dry season).

The low percentage of calvings, of course, means that only a small part of the total breeding herd is economically productive, in terms of feeder calves or milk supply. To make matters worse, production in terms of pounds of meat or bottles of milk is extremely low. An eight to ten month old calf, ready to be weaned, weighs 150-200 pounds, compared to 350-400 pounds for comparable animals in countries with better animal husbandry practices.

Gains continue to be slow after weaning, and in general the annual rate is at the phenomenally low figure of 100-150 pounds. According to the records of the slaughterhouse in Catacamas (one of the least progressive cattle-raising areas of Honduras) the average animal is killed when four years old, with a weight of only 564 pounds, or an average daily gain of one-third pounds per day. At this light weight, it is largely skin, bone and digestive organs, and the yield of usuable carcass is only 181 pounds, or 32.1% of live weight.[1] To be sure, there are some larger "criollo" animals brought in for slaughter. However, a

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1) Slaughterhouses operating in better areas report higher average weights, and yields in the vicinity of 38%.

1,200 pound ox usually is at least eight to ten years old. (In the U.S., steers are usually slaughtered with a weight of around 1,000 pounds, attained in perhaps 18 months, at an average gain of almost two pounds a day. The normal yield may be around 55%.)

Although weights are abnormally low as a result of poor nutrition, slow growth is a characteristic of the type of animal. As Dobie points out,

> "The Longhorn was exceedingly slow in development, not reaching the maximum of weight until eight or ten years old. He was not considered mature until past four years old. Steers from four to eight years old averaged around eight hundred pounds, while ten-year olds and up weighed a thousand pounds or better..."[1)]

It is interesting to note that English cattle developed similarly low weights until the great English beef breeders began their work in the eighteenth century:

> "In 1710 beeves sold in Smithfield market weighed on the average 370 pounds, in 1795, 800 pounds... Scientific methods have so developed milk production in cows, and meat down to the hock on beeves, that some modern cattle, as compared with their progeniture, look as if they belonged to a different species."[2)]

Possibly in response to some deliberate selection, but also - as recent research has shown - in response to poor nutrition during the growing stages, the "criollo" cow is comparatively better as a milk producer than as a source of the better cuts of meat. The calf, undersized as a result of the cow's lack of feed during gestation as well as generations of inbreeding, usually is unable to consume all her milk. To prevent damage to

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1) Dobie, Op. cit., page 34.

2) Ibid., pages 70, 289.

the cow's udders, and to produce a maximum of valuable dairy products, the practice has developed in some areas of milking the cow as completely as possible every morning, before the calf has a chance to suckle. The result is to leave many calves in a semi-starved condition during the critical early months of their lives. In isolated areas where the demand for milk and cheese is limited we have observed farmers throwing away their surplus milk, instead of feeding it to the hungry calves.

Although better as a dairy cow than as a beef animal, under prevailing conditions the "criollo" may provide pitifully small yields of milk. Production may be as low as 3-5 "bottles" (0.7 liters each) or roughly 2.4-3.9 quarts a day.

In many areas, there is little incentive for cattlemen to seek to improve their practices, because cattle rustling takes such a large part of their possible profit. Cattle theft is a particularly serious problem in those areas where a recent influx of population has disturbed traditions of the open range. That has happened within the last several decades in the Guayape and Upper Aguán Valleys, where average losses to rustlers may amount to 10% of the total herd per annum. This has caused a serious decline in the industry, and the number of cattle in the area may have fallen by 50-80% in the last fifty years. Rustling is less severe in the Agalta and Lower Aguán Valleys, for the simple reason that the population is smaller, and cattle-owners' reprisals are more drastic.

Usually, stolen cattle are slaughtered on the spot for local consumption. In trying to prevent live sale of stolen cattle,

Honduran law imposes strict branding rules. New-born calves are branded with the owner's mark on one side. When the calf is sold (or mortgaged to a bank) this brand is cancelled by repeating it on the calf's other side. The new owner's mark is then added on the original side. When the animal is sold to a slaughterhouse, the law requires cancellation of the last brand (by repetition on the cow's other side), and then branding with the slaughterhouse's own brand before slaughter. Brands frequently are scrawled on with a hot poker, and with little or no thought for the damage done to hides.

Despite a recent rise in cattle prices, in its present underdeveloped state much of the Honduran cattle industry is marginal. Generalizations about the investment required and cost of production are difficult, since conditions vary substantially between different parts of the country. However, the following figures, based largely on a sample survey undertaken by the Ministry of Natural Resources for the torsalo fly control program, do give some indication of the low rate of return.

a. Land purchase. The value of land varies with its location and fertility. As a rough generalization, however, the value of raw, uncleared land might be estimated at L. 35-50 per Manzana. The total land investment for a reasonable-size cattle ranch of 400 Manzanas could be L. 16,000.

b. Land clearing is usually done by hand, under the traditional "milpa" system: trees and brush are chopped down with machetes, are bunched and then are burned. The approximate cash cost of this operation would be L. 30 per Manzana. Corn

is usually planted among the cut-over stumps by hand, with a digging stick. The next year, sprouts from the stumps are re-chopped and burned; the cash cost would be around L. 10 per Manzana. Again, corn is interplanted, and usually grass seed is sown in the corn towards the end of the growing season. In areas near roads, landless farmers do all the clearing in return for most of the two corn crops (even if the farmer has to clear off tropical rain forest!). A typical yield might be 15 quintals per Manzana, with a gross value of L. 30-90, depending on the remoteness of the area from consuming centers. Accordingly, it is reasonable to assume the cost of initial clearing to be zero, and there may even be a small profit. (However, there are large areas where overgrazing has led to the development of thorny tree growth, whose cost of clearing may be prohibitive.)

Hand-cleared pastures are full of stumps, and cannot be plowed or mowed for hay with machinery. However, an annual chopping with machetes usually serves to keep the stumps from developing new tops, and they rot away over a period of years.

c. Fencing. A normal large cattle ranch may contain four pastures, each with 50 Manzanas, or a total of 400 Manzanas, requiring 12,000 "varas" (Spanish yards; 0.835 meters) of fence-line. The cost is estimated as follows:

1.	6,000 line posts, set in place @ L. 0.10	600
2.	185 corner posts, set in place @ L. 0.30	55
3.	133 rolls of barbed wire, each 360 Varas @ L. 17	2,261
4.	295 pounds of barbed wire staples @ L. 0.35	103
5.	Stretching, 133 x L. 1	133
		3,152

In the more humid sections of the country posts consist of

poles cut from a fast-growing local tree (usually "Madriago"). These take root after they are set, forming a living hedge that is virtually immune to termites and other natural enemies. In dryer parts of the country local wood is set in the ground without treatment, and must be replaced frequently. Posts are usually set around 5-6 feet apart, compared to the normal distance of 14 feet in the U.S. Corner and gate posts are made of heavier wood than line posts, but only rarely are braced properly. Barbed wire is usually strung loosely, without mechanical stretching. Frequently as many as six or seven strands of expensive wire will be used in order to make up for the deficiences in construction; four strands are normal for well-built fences in the U.S.

d. Seed. 4,000 lb. of "jaragua" grass seed, at L. 0.30 — L. 1,200

e. Purchase of cattle

1.	200 Native heifers, at L. 100	20,000
2.	4 part-Brahman bulls, at L. 300	1,200
3.	4 oxen at L. 150	600
4.	2 ordinary horses at L. 100	200
5.	1 saddle horse at L. 150	150
		22,150

f. Housing and structures

1.	Owner-manager's house	3,000
2.	Cowboys' houses	1,000
3.	Shed for young calves	500
4.	2 corrals, at L. 250	500
		5,000

g. Equipment

Oxcart, yoke and harness	273
Total investment	42,775

Annual receipts and profit are estimated as follows:

a. Receipts

The annual calf crop is assumed to be 35%, or 70 calves (compared to a figure of 61% attained at the Pan American Agricultural School with "criollo" cattle, and a figure of 80% considered normal in the United States.) Half will be male and half will be female. Each year the male calves will be sold at weaning time, along with 35 of the least productive cows (to be replaced by the 35 female calves). Under good conditions, each cow will give possibly 1,000 "bottles" of milk a year (739 liters, or 2.8 quarts per day during nine months), for a total milk output of 7,000 "bottles" from 70 producing cows.

The sales price will vary according to the locality. For deliveries to the Sula Valley milk plant, it amounts to L. 0.16 per liter, or L. 0.12 per "bottle". In very remote parts of the country it may fall as low as L. 0.07 per "bottle". However, there is a floor under the price of milk, because the farmer has the alternative of making cheese or butter. Cheese requires 5 "bottles" of fluid milk per pound, and usually sells in consuming areas at L. 0.40-0.50 per pound. In areas where there is a good market for fluid milk, the price on the farm may be L. 0.15 -0.20 per "bottle".

In accordance with these estimates, annual receipts might be calculated as follows:

1.	35 weaned calves, at L. 60	2,100
2.	35 cows, at L. 100	3,500
3.	70,000 "bottles" of milk, at L. 0.12	8,400
		14,000

b. Profit

14,000 - 9,804	4,196
Profit as percent of investment	8.8%

The normal interest rate of the National Development Bank is 9%, and interest on private loans amounts to 12-24% per annum. Consequently, the estimated return of 8.8% on invested capital can hardly be considered favorable. In some areas, the cattlegrower's entire profit may be wiped out by rustling. Under these circumstances, it is little wonder that the cattle industry has stagnated wherever law and order have broken down.

As even these rough figures show, there is ample room for improvements that would make the cattle industry much more profitable. To cite only one example, if the death rate is reduced from 10% per annum to a normal 2.5% per annum, some L. 1,661 would be added to the net annual profit. If the calving rate is raised from 35% to 50% (as compared with a reasonable rate of at least 60% for "criollo" cattle), annual income will increase in value from L. 14,000 to perhaps L. 20,000. There would, of course, be some increase in expenses (e.g. the number of bulls would probably have to be increased to seven, some additional fencing would be needed to control breeding, and some silage or other supplemental feed would have to be provided in the dry season.) However, the net additional annual profit might be roughly estimated at L. 4,000.

Experience in the U.S., Argentina and many other beef-producing countries has shown that such improvements are likely only when new marketing opportunities develop to disturb the

equilibrium of the cattle industry. Until around five years ago, Honduras' cattle industry produced milk (one-fourth for fluid sale and three fourths for sale in the form of cheese and butter) and meat for local consumption. A surplus of feeder steers was also produced, for sale on the hoof to other Central American countries. These sales have increased during the last decade by around 20%.

Much of the annual calf surplus still is exported on the hoof or by truck to Guatemala and El Salvador. (See Table 17). However, an increasing share is now exported to the U.S. in the form of frozen beef, from five slaughterhouses that have been established during recent years. As Table 18 shows, exports of frozen beef totalled 4,870,221 kilograms in 1963. Most of this was shipped as boneless meat (weighing around 70% of the carcass weight) and the equivalent live weight may be roughly estimated at 19,500 tons, or 2.6 times the weight of that year's live cattle exports.

Honduran grass-fed beef is leaner than most U.S. beef. However, this is an advantage in sales to Puerto Rican, Cuban or other Latin American consumers, as well as to manufacturers of frankfurters and similar products.

Today there are slaughterhouses in Tegucigalpa, Choluteca, Catacamas, San Pedro Sula and Tela. Another slaughterhouse is under construction at Puerto Castilla.

By now, the capacity of existing slaughterhouses exceeds the supply of cattle for slaughter. There is intense competition between the different slaughtering groups for available

Table 17

Exports of Cattle in 1963

Country	Number	Weight, Kilograms	Value, Lempiras	Average Weight, Kilograms	Average value per head, Lempiras
Guatemala	32,538	5,284,002	2,744,413	162	84.34
El Salvador	8,385	1,204,540	689,693	144	82.25
Peru	1,255	444,750	186,795	354	148.77
Neth. West Indies	890	378,636	135,750	425	152.53
Panama	100	54,432	35,000	544	350.00
Nicaragua	1	150	327	150	327.00
Total	43,169	7,366,510	3,791,978	171	87.84

Source: República du Honduras, Secretaria de Economia y Hacienda, "Comercio Exterior de Honduras, 1963, Tomo 1," Tegucigalpa, May 1964.

Table 18

Honduran Exports of Frozen Beef in 1963

Country	Weight, kilograms	Value, Lempiras	Average value Lempiras per kilogram	$ per pound
a. Honduran exports (f.o.b.)				
USA	4,258,286	5,782,191	1.35	0.31
Puerto Rico	603,362	684,547	1.13	0.26
Belize ("British Honduras")	6,352	5,298	0.83	0.19
El Salvador	1,317	1,785	1.35	0.31
Colombia	723	569	0.79	0.18
Guatemala	181	114	0.63	0.14
Total	4,870,221	5,784,755	1.19	0.27

	Weight, pounds	Value, dollars	Average value, $ per pound
b. U.S. Imports from Honduras (f.o.b.)			
Frozen beef, bone in	123,393	33,341	0.27
" " , boneless	5,910,480	1,823,843	0.31
Frozen beef total	6,033,873	1,857,184	0.31

Source: Honduran and U.S. official trade statistics.

cattle, and the number of cattle in the country is declining. The result has been a dramatic increase in the value of cattle. At Catacamas, for example, the live-weight price per pound has risen within the past two years from L. 0.07 to L. 0.17 in 1963, and up to L. 0.22 for the highest grades (rarely found in this area) in 1964. A typical steer that brought L. 50 in 1960 now brings L. 150 or more.

In response to rising prices, the existing cattle industry has been selling large numbers of female cows (up to 46% of the cattle that are slaughtered), and has been selling cattle at lower weights and younger ages (the average weight of exported cattle has declined 20% in the past decade). Seeking to correct these abuses, the government recently issued two decrees prohibiting the slaughter of healthy breeding-age females and the export (on the hoof or as meat) of animals with a live weight of less than 300 kilograms.[1] So far, however, enforcement has been difficult.

Thus, Honduras has reached the stage in her cattle development that was reached by the U.S. in the 1870's (when the transcontinental railroads opened up markets for the cattle of the "Wild West") and by Argentina in the 1890's (when packing plants and refrigerated vessels made possible sales of beef to Europe.)

In indicating what is likely to happen in Honduras (and indeed, is already happening to some extent), we quote again from J. Frank Dobie's description of what happened in Texas:

1) Acuerdos No 224 and 233, of 11 and 17 August 1964.

"Circumstances forced the changes from open to fenced ranges, from common to blooded stock...Push of population and economic popularity of the ranching industry drove every man who would maintain a range to get individual title to it and wall off all contenders. Land and taxes went up so that a cowman could no longer keep a steer until he was 'aged' to market him. He had to have a quick-maturing animal that would convert pasturage into choice cuts of meat instead of into locomotory energy. With the trails to walk up all cut off, the cattle instead of providing their own freight now had cars to ride in. They became worth so much that an owner could no longer allow them to die if they were unable to rustle their own living. Cowmen quickly learned...If you are going to the expense of feeding and nursing animals, practice on the kind worth saving and, by stopping the breed, get rid of the other kind.

"The Longhorn...was bred away, not only in horn but in other characteristics. Before the close of the last century, all the livestock papers and magazines and all the talkers to cattle raisers harped without ceasing on the necessity of breeding up herds and getting rid of 'scrub cattle'...

"The pesky fever ticks did more to extirpate the lingering remnants of Longhorns than any other agency. Compulsory dipping of cattle against ticks began in southern Texas in 1922. By law, every owner had to dip all of his cattle every fourteen days. There was one alternative for cleaning a pasture: to take every hoof out of it and keep it vacant for from seven to eighteen months. Without hosts to feed upon, the ticks dropped from animals on the ground would during that time die without issue. The tick laws forced the big ranches to cut up and cross-fence their pastures and brought every animal in the land under control and frequent inspection. Cattle that could not be worked were shot as nuisances."[1)]

History helps us to understand the past, and to foretell the future, but history never repeats itself exactly. A complete parallel between development of the U.S. and Honduran cattle industries is particularly unlikely because: (1) much more scientific knowledge is available about animal husbandry today than was known at the time of the passing of the "Wild West" in the United States; the mistakes made in the U.S. do not have to be repeated in Honduras; (2) the tropical climate of Honduras

1) In Honduras, the proposed campaign against the torsalo fly may have some analgous effects to Texas' program to exterminate the fever-bearing tick. Dobie, op. cit., pages 341-3.

creates more severe problems of adaptation for European cattle than existed in the temperate and sub-tropical areas of Texas; (3) the U.S. is able to produce corn and other grains cheaply for feeding to cattle, whereas corn probably will remain high in price in Honduras as long as it continues to be a staple of the human diet,

It is particularly important to look for possible variations from the historical pattern because Honduras' present system of animal husbandry, with all its faults, has certain economic advantages:

1. It produces beef cheaply, making a profit at less than $0.10 per pound of live weight, while cattlemen in the United States lose money despite their much more modern methods at $0.20-.25 per pound of live weight.

2. Being grass fed, Honduran cattle are lean, whereas grain-fed cattle in the U.S. tend to run to fat. For sausages and other prepared meats, for Latin American customers in Puerto Rico and elsewhere, and eventually for sale to Europe, leanness is an advantage.

3. Since Honduran cattle are older at slaughter, their meat is naturally more palatable (or would be if proper nutrition had been available throughout their lives). The "marbling" or fat deposits that are required to make U.S. meat tender are not necessary. Even in the United States, there is now a tendency for consumers to require less "marbling".

4. Whatever the disadvantages of the "criollo" breed, it survives better under tropical conditions, is more resistant to

disease and parasites; and better able to withstand seasonal shortages of feed and water.

Despite these acknowledged advantages, there is sometimes a tendency to substitute foreign breeds uncritically, and at great expense. In part, this follows the example set by the United States and Argentina. To some extent it reflects the fact that it is easier to import a few foreign bulls than to improve the basic conditions for existence of the large number of native cattle. In part, however, it may reflect some misunderstanding of the origins and purposes of the internationally-recognized beef breeds, and particularly the ones of English origin (Shorthorn, Hereford, Angus).[1)]

The English breeds were developed during the eighteenth century, in order to make use of new supplies of concentrated feedstuffs. At first these consisted of root crops (turnips, etc.) and clovers introduced in the new system of rotations, and later they included imported oilcake and other protein by-products of industry. The availability of high-protein and high-energy foodstuffs made it possible to breed for a reduction in the length of time required to reach maturity. As a result, farmers were able to use expensive land and capital more intensively, and to reduce the time spent under the severe winter conditions of Northern Europe (when much of the feed goes into

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1) The following discussion is derived largely from:

Jorge de Alba, "Alimentación del Ganado en America Latina," Mexico, 1958.
Allan Fraser, "Beef Cattle Husbandry," rev. ed., London, 1959.
Roscoe R. Snapp, "Beef Cattle," 3rd ed., New York, 1939.

mere maintenence of body temperature). Furthermore, with growing population pressure and a rising standard of living, there was a desire to maximize the production of choice cuts of meat, located in the hind quarters, while producing a minimum of low-value fore-parts, belly, legs and offal. Finally, beef breeds were developed to make the biggest possible gains per pound of concentrated feedstuffs. In other words, they were - and are - the most efficient consumers of a specialized and artificial diet.

In the 1880's and 1890's English breeds were exported to overseas areas that were beginning to produce for the English market, particularly the U.S. and Argentina. There they found similar temperate climatic conditions and an ample supply of legumes (alfalfa pasture in Argentina) and high-energy foods (corn in the U.S.). In Argentina, the U.S. and many other areas, "criollo" types of cattle were almost completely displaced by the English breeds. For example, the "Texas Longhorn" has become almost extinct; it is maintained in small numbers on a government reservation, like the wild buffalo.

Only in comparatively recent years have attempts been made to analyze the reasons for the success of the English beef breeds, and to evaluate their true economic significance. These have shown that the chief difference between the English breeds and other types of cattle is in the ability to grow rapidly.

Undifferentiated cows - such as the Honduran "criollo" - pass through several distinct stages of growth, approximately in the following order:

1. Nervous tissue

2. Bone
   a. Head
   b. Extremities
   c. Lumbar region
   d. Hips

3. Muscles

4. Fat

Usually, a later stage does not begin until the preceeding stages have finished. In the case of the "criollo", the first three stages take almost four years. In the case of the Brahman (Zebu), the bony structure of the body begins to broaden only after the second birthday. The European beef breeds, on the other hand, follow a foreshortened and telescoped growth schedule, with several stages going on at once. Always provided that sufficient concentrated feed is made available, a steer may be ready for slaughter as "baby beef" in as little as 18 months.

However, rapid growth involves certain disadvantages. Slower-growing breeds are better able to adjust to interim periods of malnutrition (or even to actual starvation) simply by interrupting growth at whatever stage it has reached. English breeds are therefore less able to fend for themselves in underdeveloped countries.

Furthermore, if not given an adequate and continuous supply of food, the inherited growth characteristics of the English breeds tend to be severely modified by the unfavorable environment. In effect, the animal's growth pattern reverts partially to the "criollo" or undifferentiated type. The percentage of valuable hind quarters goes down, and the percentage of offal,

legs and other low-value parts rises. Under such conditions, even the most expensive and purebred beef animal begins to resemble an ordinary dairy cow, or even a "criollo."

Unfortunately, almost all beef research has been on English breeds, and practically no data are available on the nutritional response of "criollo" cattle. However, experiments have shown what happens to English beef breeds when they revert to a staged growth pattern as a result of a restricted diet. These make possible some hypotheses about the effects of better nutrition on "criollo" cattle.

A group of "beef-type" cattle was divided into three lots. The first lot received full feed, the second lot was put on a restricted diet, and the third lot was forced to live on a very restricted diet. The results may be summarized as follows:

Number of days	30-360	360-720	720-1080	1080-1440
a. Daily gain in grams				
1. Full feed	833	708	493	326
2. Restricted diet	564	401	327	340
3. Very restricted diet	331	295	154	390
b. Kilograms dry feed per kilogram of gain				
1. Full feed	5.08	11.26	17.02	23.43
2. Restricted diet	4.71	11.74	28.95	15.74
3. Very restricted diet	5.24	10.27	23.20	11.45

Source: P.F. Trowbridge, C.R. Moulton and L.D. Haigh, Missouri Agricultural Experiment Station Research Bulletin No. 43, 1921, cited in Jorge de Alba, "Alimentación del Ganado en America Latina," Mexico, 1958, page 202.

As these data show, animals on full feed showed their highest daily gain and lowest feed consumption per kilogram of gain during their first year of life. By the fourth year, their daily

rate of gain fell behind less-favored animals. Animals on restricted diets showed a decline in daily gains through the third year, followed by an increase. Feed required per kilogram of gain went up during the first three years, and fell during the fourth year.

To the extent that these conclusions can be applied to Honduran "criollo" cattle, they suggest that the present practice of slaughter in the fourth year without prior feeding may be killing off animals just as they become able to use feed most efficiently. Other investigations have also shown that animals that start on very restricted diets, with small gains, can gain at a rapid rate if more adequate feed is provided later.

While hereditary characteristics undoubtedly are important and deserve to be improved, it has been shown repeatedly that even the present "criollo" can gain much more rapidly if reasonably well fed and watered. In one experiment, a Honduran slaughterhouse fed cattle for sixty days, starting with a vermifuge treatment, followed in thirty days by a hormone (silbestrol) implant. The result was a gain of 63 pounds, or 1.05 pounds per day.[1] Although not very impressive compared to rates of gain of English breeds, this represented almost 12% of the average weight attained by the cattle in the previous four years, and was three times the average daily rate of gain under typical conditions. At the Pan American Agricultural School, under good conditions, "criollo" cattle gain an average of 1.38 pounds a

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1) Some studies suggest that silbestrol is ineffective (but harmless) if the ration is not enough to sustain a gain of around 2 pounds per day.

day on pasture, with limited supplemental feedings of silage and hay during the dry season, and no grain.

With some infusion of new blood, markedly better results are possible. In the Lower Aguán Valley an uncontrolled cross of Red Poll (by no means the best of the European meat breeds) and "criollo" cattle developed after the withdrawal of the United Fruit Company. Under the favorable conditions found in that area, these cows now attain a weight of over 1,000 pounds in around two years, on pasture alone. Similarly, on the United Fruit Company ranch near San Pedro Sula, 1,000 pound steers are produced in 2½ years, from Brahma-"criollo" crosses. One of the best-run privately-owned ranches, on the Pacific Coast, runs 8,000 Brahma and Brahma-"criollo" cows, and obtains a slaughter-weight of 1,000 pounds in as little as 2 years. This ranch pastures jaragua and pangola grass, adding silage and cottonseed-corn supplement for maintenance during the dry season.

Even more startling are the possible improvements in milk production. "Criollo" cows near Cacacamas give an average of three "bottles" (2.2 liters) of milk per day. At the adjacent El Sembrador mission school, Holstein-"Criollo" crossed cattle, fed well, give 22 "bottles" per day or over seven times as much. These are among the relatively few cows in Honduras that are fed ground corn (with the cob), rice hulls, cottonseed meal, etc. During the dry season, they also receive fresh cut grass (soilage) harvested from river-bottom fields that have a sufficiently high water table to provide growth all year round.

Indian cattle - Brahman or Zebu - play an increasingly

important part in the upgrading of "criollo" cattle, because of their resistance to heat and sunshine.[1] The Zebu is not as precocious as the European breeds, and therefore is less adapted to high-level nutrition with concentrates. However, it is almost as good in terms of high percentage of carcass to live weight. Crosses of Zebu with English breeds have resulted in several new recognized breeds, including the famous Santa Gertrudis (Zebu-Shorthorn). Crosses with milk breeds have also been undertaken with some success in Nicaragua (Suindico: Brown Swiss-Zebu) and other countries. In Honduras, and in the other Central American countries as well, Brahman bulls have been imported in large numbers by national development banks and similar agencies for crossing with "criollo" cows.

Two fairly simple conclusions seems to be indicated by the above analysis: (1) improvement of the breed will do only a limited amount of good, unless it is accompanied by improvement in nutrition, and (2) improvement in nutrition alone will produce some of the benefits normally attributed to the introduction of specialized beef blood lines.

Honduras has traditionally served as a breeding ground for cattle that were driven to Guatemala and El Salvador for final feeding. Only with the development of local slaughterhouses and an export market for meat has there been much pressure to improve the availability of feed within the country. Recently,

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1) Like the "criollo", the Brahman has a dark pigment in its hide, whereas English breeds have a light-colored skin. This may be the chief reason why it is difficult to acclimatize English breeds in countries with annual isotherms exceeding 18-22°C.

Honduran farmers have begun to plant improved grasses, such as Pangola and Jaragua. These tropical grasses require controlled grazing (e.g. by pasture rotation) in order to keep their rank growth below 10", since otherwise they become woody and unpalatable. Furthermore, they are only productive during the rainy season, and hay or silage need to be made if animals are to be prevented from suffering weight loss during the dry season. Finally, they are low in protein, and bulky, so that the ordinary cow can only eat enough to supply perhaps two thirds of its total digestible nutrient requirement and one half of its protein needs.

On the other hand, very high yields are possible, compared to ordinary grasses or temperate climate forage crops, as is shown in Table 19.

Table 19

Typical Yields of Tropical Grasses

Type	Tons per hectare	Forage Units per 100 kilograms	Forage Units per hectare
Elephant grass	120-150	12.2	14,640-18,300
Guinea	90	14.1	12,600
Para	70	16.7	11,690
Alfalfa	25-40	12.1-16.3	3,025-6,520
Irrigated ordinary pasture	22	14.3	3,146

Source: Italconsult, "Elementos para la programación agropecuaria del Ecuador, V. Desarrollo de la producción forajera", Rome, 1963, page 76.

With close control to prevent the development of woody growth (by rotation grazing and mechanical clipping) elephant grass pastures could support 2.8 animals per Manzana per year. A rate of 1.1 head per Manzana of pasture is maintained at the Pan American

Agricultural School at Zamorano, with very little supplemental feeding.

One possible program for feeding would be to put three and four year old range cattle on good grass pasture for around 200-300 days. This should produce daily gains of perhaps 0.3 kilograms (0.7 pounds). According to experiments in Puerto Rico, that rate could be increased by growing kudzu or some other tropical legume together with the grass, so as to provide more protein. Another possibility would be to supplement grass pasture with protein and carbohydrate concentrates, so as to increase the rate of daily gain.

In addition, there is a great need for fodder during the dry season, which can be met with hay, silage or soiling. It is difficult to make hay in a tropical climate, because of the high rainfall. However, a crop can usually be made at the end of the rainy season, particularly in areas where this can be predicted with some certainty. It is usually necessary to clip the field some weeks before the end, in order to have nutritious low-growing grass at the time when hay is made.

Silage can be made during most of the year, from almost any vegetable material that animals can eat. In advanced countries, material to be ensiled is handled by special machinery, and is mechanically chopped so as to make compacting and exclusion of oxygen easier. This method is used at the Pan American Agricultural School. Some experts argue that silage is unpractical for most of Latin America because small farmers would find it difficult to acquire the necessary machinery. However, in

small farming areas of Europe (such as certain parts of Italy), good silage is made by piling green forage (not previously chopped, crimped, or crushed) into a simple wooden frame. The forage is compressed either by trampling by foot, or by rolling with an oil drum filled with concrete, so as to exclude excess air. The oil drum may slide along a steel bar, revolving around a central pole, and mechanization with a small motor is possible. This method has been used in high rainfall districts, with easily-spoiled materials such as legumes. It would be necessary to adapt the technique to Honduran conditions, and to sell it to farmers by demonstrations.

Soiling is the practice of cutting fresh grass daily from a limited area under irrigation, or located on wet river-bottom ground, and feeding it to cattle in a feedlot. This is practiced at the "Sembrador" mission school near Catacamas. In some localities sugar cane tops, otherwise valueless, would be available during much of the dry season. Another possibility, requiring more labor, would be to grow root crops such as cassava or fodder beets for harvest as needed for supplemental feed. This practice has been abandoned in advanced countries with high labor costs, but might still be economical in Honduras.

Finally, there are a number of possible sources of dry feed, including sun-dried bananas, food processing wastes (banana peels, dried citrus pulp and peel, pineapple and tomato cannery wastes) rice and wheat bran, oilcake and slaughterhouse wastes. In many Latin American countries, including El Salvador and Guatemala, feedlots operate profitably on a 60 to 90 day cycle, feeding a

mixture of molasses, cottonseed meal, sugar cane tops and cottonseed hulls to mature steers before slaughter. Usually this diet is supplemented with a few pounds per day of green alfalfa or some other source of Vitamin A.

Although pure-bred "beef-type" animals may be able to use this kind of feeding more efficiently, it has been demonstrated to be profitable with "criollo" cattle also. Practical experience in Nicaragua and Honduras indicates that a small minority of "criollo" animals do lose the power to gain on better feed, possibly as a result of severe intestinal parasite attacks. However, these can be sent to slaughter after a trial period, leaving the majority to profit from additional feed.

For the Aguán-Olancho region as a whole, we may expect a substantial expansion and improvement of cattle production during the next decade or so. At present, dairy prices are relatively high in the Aguán Valley, primarily because of high costs of transportation. There may therefore be some purchase of surplus cheese from the Agalta or even the Guayape Valley.

The isolated Agalta Valley, with its relatively infertile soils and wide areas of rangeland will probably develop as a breeding area for cattle, along with the Upper Aguán. The lush pasture of the Lower Aguán would then be a logical area for fattening of yearlings. In the Guayape and associated valleys, there is room for both breeding and feeding operations.

Meat from the slaughterhouses at Catacamas and Puerto Castilla would move almost entirely to overseas markets. With

lower transportation costs to the port, both slaughterhouses should be able to compete more effectively for available cattle supplies, and the movement of live animals from the Guayape Valley towards Tegucigalpa should be reduced. The operation of the slaughterhouse at Puerto Castilla will tend to stimulate cattle raising in the Mosquitia and along the Atlantic Coast, with movement to Puerto Castilla by land and by barge along the coast.

b. Pigs

Development of pork production is another promising field. As Table 20 shows, Honduras exports around 35,000 hogs a year, mostly to El Salvador. These are sold live, primarily because butchers in El Salvador refuse to handle slaughtered pork in order to protect their own activities. Export sales are increasing, while there is also a growing local demand as a result of the increase in beef prices.

Table 20

Honduran Exports of Pigs in 1963

Destination	Number	Kilograms (live weight)	Value in Lempiras	Price	
				Lempiras per kilogram	Dollars per pound
El Salvador	32,939	3,[illegible],667	2,053,071	0.67	0.15
Guatemala	1,766	111,360	63,230	0.57	0.13
USA	10	73	200	-	-
Total	34,715	3,195,100	2,116,501	0.66	0.15

Until recently, pork was more expensive than beef in the local market. However, the prices are now about the same. In San Pedro Sula, pigs now sell for around L. 0.30 per pound of live weight. The retail price of ordinary pork is L. 0.90 per pound, and hams sell for roughly L. 1.75 per pound. The farm price of fresh pork meat is approximately L. 0.45 ($0.22) per pound, while lard sells for around L. 0.25 per pound. At these prices exports of pork to overseas markets might be possible, if processing facilities are established. U.S. exports of fresh and frozen pork totalled 105.7 million pounds in 1963, with a value of $29.2 million, or an average of $0.28 per pound (f.o.b.).

With the exception of two small smoking and sausage-making plants in Catacamas and San Pedro Sula, at present pork is only processed by local artisanal butchers.

The agricultural extension service (Desarrural) has initiated a breeding program to supply Duroc pigs to Honduran farmers. This is still on a very small scale, producing only a few hundred sows a year, and potential demand far exceeds the supply. An expansion of the program will become increasingly necessary, because the shift of consumer demand to vegetable shortening is causing a decline in the demand for lard.

At present there are only a few large-scale pig-growers in Honduras. Perhaps the largest is a farmer of Swiss-Argentine extraction in Comayagua, who produces around 300 pigs every six months. He buys corn at harvest time for approximately L. 4 per 100 pounds, and also feeds plantains, pumpkins and sorghum.

Small farmers usually allow pigs to run loose and forage for themselves. Sometimes supplementary feedings of camote, cut grass and corn are made. Mixed feed is now being produced, but the price of L. 5 per 100 pounds seems high to Honduran farmers. There is no official control of feed quality, and some sub-standard feed may have appeared on the market in the past. Lately, however the quality has been improved.

Any increase in pig production in the Guayape and Agalta Valleys would probably be sold to interior markets or El Salvador. A large pork enterprise in the Lower Aguán Valley, producing for export through Puerto Castilla, is a possibility.

3. Forest Resources

Honduras' forest resources are the most important in Central America, and among the notable wooded areas of the world. However, after millenia of uncontrolled burning and several decades of improvident lumbering, the seemingly inexhaustible forests are showing signs of decline. Some 78% of Honduras' total land area is in mountains and forests, in areas with thin soil and steep slopes that are not suited for agriculture. By now, however, almost one-half of these areas has been cleared of pine and other native growth, by shifting subsistence agriculture and forest fires. Much of this cleared area is grown up into economically worthless broadleaf brush.

Around 5 million hectares (5,000 square kilometers) or roughly 44% of Honduras' national territory are still covered with forest. Of this, around 1.9 million hectares are pine, 2.6 million hectares are mixed tropical hardwood (rain-forest) areas, and 0.5 million hectares are predominantly dry hardwoods.

Pine is the most important forest resource, although many parts of the country have large areas of potentially valuable hardwoods. Hardwoods usually are found in mixed stands with up to 100 different species per hectare. Only around 5% are of recognized commercial value as lumber. Presently valuable hardwoods include Honduras mahogany, Spanish cedar, Santa Maria, San Juan, palo de rosa, and granadillo. Valuable varieties usually are found as single trees, or as small clumps, with one or two each to the hectare. In areas accessible to roads, the valuable

trees have usually been cut down, leaving only the lesser species.

Pine, on the other hand, is usually found in relatively pure stands, and all Honduras' varieties are of commercial value. The two of greatest important are "ocote", similar to the longleaf yellow pine of the United States, and pinus caribensis, equivalent to slash pine. Under Honduran conditions, these develop relatively dense woods, with a high resin content.

The division between pine and hardwood areas is largely a function of rainfall. Altitude also has an important influence, but largely through its effect on rainfall. Tropical rain forests are found at altitudes of up to 800 meters, with annual rainfall of 170-290 centimeters (69-118"). During the rainy season, moisture-laden clouds are blown in from the ocean by prevailing winds (coming from the Northeast in the vicinity of Trujillo). Part of the precipitation is discharged when the clouds first reach land, and more is wrung out of the clouds as they pass each successive mountain slope or increase in average elevation. Thus the climate tends to become dryer as the distance increases from the coast.

Within the Aguán Valley (which runs generally from Northeast to Southwest) annual rainfall at the end nearest the sea (adjacent to Trujillo) is more than twice as great as it is some 100 kilometers into the interior (e.g. at Olanchito).

A more or less extensive area of transition usually is found between pine and hardwood forests. In this area, there is a constant battle for predominance between the two types of trees.

In nature, the cycle may begin when the broadleaves capture available light and drive out the pines. When a cycle of drought years occurs, forest fires set by lightning tend to kill off the broadleaf species. The fires also sweep the ground bare of organic debris, and make minerals available to new pine seedlings in the form of ashes. The pine seedlings take over immediately and completely dominate the area. If there is a long period without fires, however, pine needles and other organic debris accumulate, changing the nature of the soil until it is again attractive for broadleaf species. Again the pine is shaded out, and the cycle starts over.

One of the most significant facts about this cycle is the importance of fire in the establishment and maintenance of pine forests. Indeed, the effect of annual rainfall on fires may be the chief determinant of the boundary between pine and hardwoods, over much of the area of Honduras. Without fire, hardwood forests would represent the ecological climax in many areas that are now covered with pine.

When the hand of man interferes in this natural cycle, he tips the balance towards one side or the other. He favors pine by setting frequent fires, and by using land as cattle range. On the other hand, he favors broadleaves by clearing fields to plant crops, then abandoning them after a few years when the initial fertility is exhausted.

In moderation, man-made fires have little effect on the dense and damp hardwood forests, and are not the pine forest's enemy, but its friend. Modern forestry recognizes this fact, and uses

planned fire as one of its tools for pine cultivation. However, where man encroaches on a natural pine forest without controlling his use of fire, and particularly where he appears as a shifting cultivator who uses fire to clear his subsistence patch, fires become much more frequent than in undisturbed nature. New seedlings are destroyed by fire during the five or so years before they can reach a size that will provide them with some natural resistance, and in consequence the forest becomes "over-aged" (populated mainly by trees that have passed their prime).

This has been the result for many decades over almost all the pine areas of Honduras. Even in areas with very limited populations, there have been enough cattle-raisers or subsistence farmers to set some fires every year, either to clear croplands or to encourage the growth of young grass at the beginning of the rainy season. In the absence of roads or many natural firebreaks, with no incentive for subsistence farmers to try to limit their fires to the areas they want to burn, and with no government fire-fighting service, fires often spread over hundreds of miles during the dry season. Fires are such a regular occurrence that heavy concentrations of inflammable debris do not accumulate on the ground. Consequently, it is rare for fires to get into the tree tops (except where an occasional old tree flares up when its shaggy bark catches fire), and in general the fires are not dangerous to man.

In the past, the chief apparent damage has been to young seedlings, and old grasses, which are so thoroughly destroyed that the forest floor appears as if it had been mowed in many areas.

The spread of annual forest fires is so great that the smoke interferes with aerial navigation over much of Honduras. Small planes that do not carry blind flying equipment may have to go as high as 20,000 feet in order to reach clear skies.

Over-aged forests have reduced ability to resist the natural enemies - insects and fungus - which lie in wait for dying trees. One of these is the Southern pine beetle, which eats around the tree inside the bark and thereby destroys the vital cambium layer. Young trees can resist this attack, since their sap pours down into the beetles' tunnels and tends to drown them or wash them out of the tree.

Where a forest consists largely of over-age trees, however, the beetle may find conditions ripe for an explosive increase in population. Once this increase in population begins, the hordes of beetles are able to swarm over healthy trees as well, overcoming by sheer weight of numbers any natural resistance.

About two years ago, such a population explosion began somewhere between the isolated farming communities of San Estoban and Gualaco in the Agalta Valley. Lacking road communications to the outside world, the area has never been a significant producer of lumber. Consequently, it is not surprising that local farmers and cattle-ranchers paid little attention to the plague which began to destroy the pine trees of the area.

The rest of Honduras, having little contact with Agalta Valley, became alarmed only as the beetle swarms spilled over the mountains, blown by prevailing winds in a generally Westerly and Southerly direction into the rest of the country. By then, however,

it was too late for preventive measures to do much good. Today, the epidemic of pine beetles has spread inland to Tegucigalpa and beyond, engulfing the entire pine area of the country, and is beginning to move into neighboring Nicaragua.

Fortunately, as the beetle plague grew, so did its natural enemies (such as the bird population). Thus the speed and extent of the epidemic seems to have become increasingly limited. Furthermore, in the areas which have been attacked first, there now seems to be little or no new beetle activity, and it seems safe to assume that the remaining timber supply will not be decimated by a return of the beetles (at least for another decade or so).

Accurate estimates are not available, and experts differ widely among themselves. However, a rough concensus of opinion might be as follows:

1. In the limited pine area to the East and North of San Esteban (towards El Carbón and Paso de la Esperanza). there seems to be only limited damage (possibly as low as 20%).

2. In the area to the North and West of San Esteban, on the Southern slopes of the Cerros del Ocote-Sierra de la Esperznza, damage amounts to approximately 30-40%.

3. In the original outbreak area, running West from San Esteban to Gualaco, some 50-90% of the live pine trees have been killed.

8. To the east and south of San Esteban, in the areas of the Guayape and Lopaguare Valleys, beetle kill is in the range of 50%.

5. In the area running further east and south to Tegucigalpa, the beetle is still active, but indications are that it is running into greater natural opposition and increasingly unfavorable

conditions due to greater stretches of cultivated areas. Ultimate damage might possibly be in the range of 30-40% of existing timber.

If left alone, the pine forests would sooner or later restore themselves. Seeds already in the ground - possibly a two to three year supply - would sprout and grow, particularly where the killing of large trees opens up the forest floor to more light and precipitation. New seedlings might reach pulpwood sizes (4"-12") within perhaps twelve years, and would become mature timber ready for the sawmill in around thirty years.

However, the recurrent man-made forest fires that must be expected under present conditions will kill off most of the seedlings as they sprout, and during their first five to ten years of life. Since the beetle-killed trees cannot produce seed, this means that if uncontrolled burning continues there will be large areas where nature may not be able to restore forest cover for a long time, if at all.

Partly because of its past isolation, the Aguán-Olancho region is now the most important remaining forest area of Honduras. Olancho alone has roughly 480,000 hectares of pine forest, or 26% of Honduras' total pine area. Before the beetle epidemic, the pine forests of Olancho contained around 3.5 million cubic meters of standing timber, or around 44% of the total for the country. As this figure suggests, the density of pine in Olancho is roughly twice the density in more populated and exploited forest areas of Honduras. Even so, it is perhaps one-third of the densities found in well-managed forests under similar climatic

conditions. Given reasonable control of fires for perhaps fifteen to thirty years, potential annual output in Olancho should be around 1.5 cords per acre-year, or 10 cubic meters per hectare. This would produce a total of 4,800,000 cubic meters of round timber or (at 4.71 cubic meters per 1,000 board feet) over 1,000,000 thousand board feet a year.

The chief pine areas of Olancho are along the south slope of the Cerros del Ocote-Sierra de la Esperanza, and in the mountains at the east (San Estoban) and west (Pueblo Viejo-La Union) ends of the Agalta Valley. Another area of importance is at the east end of the Guayape Valley, around Dulce Nombre de Culmi.

As a result of the onslaughts of the pine beetle, there is a serious danger of severe forest fires in the Agalta Valley areas. Beetle-killed pine trees are already beginning to fall over, forming potential bonfires. These can bake out the moisture in live timber, and lead to top fires that are far more destructive and difficult to control than the ground fires normally found in Honduras.

To meet this immediate threat, the Government of Honduras has committed itself to an ambitious fire control and forest service program. (See "Honduras Fire Fighting Road"). A loan of $500,000 has been obtained from AID to finance emergency construction of a jeep trail from the Aguán Valley near Durango to San Esteban, as a means of communication designed primarily for fire control. It is understood that construction of this road is already under way, and will be completed by the Spring of 1965.

Despite the damage done by the beetle, the forests along the

western, northern and eastern edges of the Agalta Valley are still the most important forest resource of Honduras. Since 1956 they have been reserved by decree for the establishment of a future pulp and paper industry. Such an industry would almost certainly include some provision for an associated sawmill. In the event that the pulp and paper mill project is realized, of course, there would be a need for a larger (and possibly somewhat different) infrastructure system than is discussed in this report. However, a pulp and paper industry would almost certainly include some provision for a sawmill to produce lumber from part of the available forest resources. If for some reason the pulp and paper project cannot be realized, there would be every reason to encourage reasonable use of the forest for production of lumber alone (particularly since rational exploitation is the only practical way to restore a normal age distribution and prevent the recurrence of the pine beetle epidemic).

Olancho also has approximately 800,000 hectares of tropical hardwood forest, or 31% of the total for the country as a whole. These contain perhaps 4 million cubic meters of commercially valuable hardwoods. Other important hardwood areas are found in much of the Mosquitia (to the East of Puerto Castilla), on both walls of the Aguán Valley, along the Atlantic Coast, and on both sides of the Sierra del Agalta, particularly between Dulce Nombre de Culmí and Desacualpa. Fine woods include cedar, mahogany and nogal. Some years ago an attempt was made to float hardwoods down the Patuca River to the sea, but spring floods left the timbers high and dry on the valley walls, and the venture

failed. Once roads are built into the area, production of hardwood lumber for export will become economically feasible.

a. Lumber

In 1963, timber exports accounted for 10.3% of total exports, or $8.5 million. Wood products - chiefly sawn pine timber - are the largest single manufactured product in Honduras, with a value greater than that of all other manufactured goods. Present production is 200 million board feet per annum. This, however, could be doubled over five years if less wasteful lumbering and silvicultural practices were introduced. The result would be to increase annual growth rates substantially, improve the quality of timber, reduce wastes in logging and sawmill operation, and cut down on unnecessary mortality of standing trees.

According to the latest available information, there are 111 operating sawmills in Honduras, with a total output of around 575,000 cubic meters (243,600 thousand board feet) a year. Only seven mills, with a combined output of less than 15,000 cubic meters, are presently located in Olancho. There are also a few small mills in the Department of Gracias a Dios (Mosquitia) and Colón. Most presently-operating mills are in Francisco Morazán (particularly around Tegucigalpa, Talanga and Guaimaca) and Yoro (Yoro-Progreso area).

At present, lumber operations in the Lepaguare Valley around Guaimaca appear to be at the extreme margin permitted by transportation costs to the Atlantic port of Puerto Cortés or to the Pacific port of San Lorenzo. Present output in the Guaimaca area has reached the not inconsiderable figure of 80,000 thousand

board feet a year. Transportation is by way of Tegucigalpa, and total distances are 459 kilometers to Puerto Cortés and 230 kilometers to San Lorenzo. Potential lumber areas further to the east, such as Dulce Nombre de Culmí would have to ship west through Guaimaca and Tegucigalpa, and cannot economically reach export or local markets. On the other hand, construction of the new road would put Guaimaca within 366 kilometers of Puerto Castilla, while Dulce Nombre de Culmí would be at a distance of 183 kilometers, and the pine reserves of the Cerros del Ocote - Sierra de la Esperanze would be within 100 - 150 kilometers of the sea.

Although there has been a rapid increase in logging activity since the end of World War II, the chief use of Honduras' timber wealth has been to burn it down as a temporary source of mineral ashes to fertilize shifting cultivation of subsistence crops. In recent years, some of the less far-sighted logging operators only compounded this folly by "high-grading" or "creaming" the forest to remove only the very best logs, leaving the rest to rot or burn. Such lumber operators, however, had the excuse that any other method of exploitation was uneconomic as long as transportation costs remain high.

High transportation costs (exacerbated by inefficient methods in some cases) have forced the industry to try to produce only the highest grados for export, leaving potentially lower-grade logs to rot in the forest. High transportation costs also encouraged the practice of rough-hewing logs into squares in the forest. While this increases the volume that can be loaded onto a truck, it wastes much of the high-grade outer portion of the

tree. Given the opportunity, Honduran lumbermen might or might not have followed less wasteful practices; in fact they did not have the economic choice.

As it is organized at present, the Honduran pine lumber industry is a marginal operation. Sawmills and lumber operators do moderately well when the international market for lumber is high, and suffer a wave of bankruptcies and near-bankruptcies whenever foreign demand slacks off. Many Honduran sawmills are small, averaging 2,500-4,800 cubic meters per annum. Only a few produce as much as 20-50,000 cubic meters per annum. The industry is chronically short of capital, and consequently depends heavily on a few export intermediaries for the financing of its sales. A high price must be paid for their services.

Trees are usually felled and limbed by two man crews using cross-cut saws. The logs are skidded to a landing with crawler tractors. The "landing" usually consists of a pit dug into the earth, with sloping ends. A flat-bed truck is driven into the pit, and logs are man-handled on. The truck is then driven out of the pit, with some help from one of the logging tractors if necessary.

Construction and maintenance of forest-to-mill roads is one of the major items of expense in Honduran lumber operations. In general, the industry probably spends too little on initial construction, much too little for road maintenance, and consequently spends too much for truck operation (including maintenance). Very few lumber operators use a motor patrol or similar grading equipment to maintain the road crown and ditches. Consequently,

forest roads become partially impassable and production slumps during the rainy season.

Trucks normally available for contract hauling of logs are operator-owned 100-horsepower flatbed trucks, usually with gasoline engines and friction brakes. The trucks lack stakes, and generally carry only around seven logs, regardless of size (unless the logs are squared in the forest). The normal length of logs is 16 feet, and poletrailers (permitting lengths of 30-60 feet) are only infrequently used. The normal load is 800 Doyle board feet, equivalent to roughly 1,000-1,100 board feet of lumber under Honduran conditions.

Most sawmills are still equipped with circular saws, but there is an increasing trend to the more modern bandsaw. Most pine sawmills produce around 0.5-0.75 cubic meters per man-day (although output ranges as low as 0.33 and as high as 1.1 cubic meters per man-day). This is roughly one-sixth of the figure for modern mills in the Western United States. Even under present conditions, according to the Stanford Research Institute road report, output per man-day could be tripled, and overall production costs could be reduced by as much as two-thirds. Insofar as is known, no mill has adequate sheds and working capital to stockpile logs. Therefore, operations slow down or sto during the rainy season when logging becomes difficult.

During the last few years, improvements in national roads have reduced freight costs substantially, particularly on the main north-south road from the Pacific port of Amapala/San Lorenzo by way of Tegucigalpa and San Pedro Sula to the Caribbean at Puerto

Cortés. This has made possible an expansion of production in the center of the country, at a time when pine resources closer to the North Coast were beginning to show signs of exhaustion.

At first, the improvement in the road to the Pacific did not greatly benefit the industry, because archaic make-work practices at the port of Amapala were a costly burden. During the last several years however, the government has permitted direct lighterage of lumber from the mainland at San Lorenzo to ships anchored in the Gulf of Fonseca (by-passing the transhipment operations at Amapala), and this has helped to reduce exporting costs.

Because of the high percentage of pitch, Honduran pine lumber is relatively heavy. Rough boards weigh perhaps 6 pounds per board foot, while dressed boards weigh one-third less. Because of this, and because dressed lumber takes less space, a truck that hauls 5,000 board feet of rough lumber can haul 8-9,000 board feet of planed lumber.

Table 21 gives the cost of truck movement of lumber from sawmill areas to the port. These data are also shown on a scatter chart (Table 22). As is to be expected, the cost per thousand board feet per kilometer goes down as the total distance increases. For a relatively short average distance of 100 kilometers (likely to apply to much of the lumber produced in the Agualn-Olancho region) the graph indicates approximate freight rates of L. 0.09 for dressed lumber and L. 0.17 for rough lumber.

An alternative estimate may be made from the daily cost of vehicle operation, the number of round trips a day, and the average

Table 21

Cost of Road Transportation of Lumber
In Lempiras

Origin	Destination	Distance Kilometers[1]	Cost per 1000 Board Feet			Rate, 1000 BF/Kilometer			Surface
			Timber	Rough Lumber	Dressed Lumber	Timber	Rough Lumber	Dressed Lumber	
Zambrano	-San Lorenzo	164	22	24	17	0.134	0.146	0.104	Dirt/paved
	-Potrerillos	175	24	27	18	0.137	0.154	0.103	Dirt
	-Puerto Cortés	296	33	35	20	0.111	0.118	0.067	Dirt/paved
Tegucigalpa	-San Lorenzo	114	18	20	14	0.158	0.175	0.123	Paved
	-Potrerillos	225	27	30	20	0.120	0.133	0.089	Dirt
	-Puerto Cortés	345	33	35	24	0.096	0.101	0.070	Dirt/paved
Talanga	-Tegucigalpa	62	10	12	8	0.161	0.194	0.129	Dirt
	-San Lorenzo	176	20	22	15	0.114	0.125	0.085	Dirt/paved
	-Potrerillos	287	30	33	22	0.105	0.115	0.077	Dirt
	-Puerto Cortés	407	36	40	26	0.088	0.098	0.064	Dirt/paved
Guaimaca	-Tegucigalpa	114	17	18	12	0.149	0.158	0.105	Dirt
	-San Lorenzo	230	27	30	20	0.117	0.130	0.087	Dirt/paved
	-Potrerillos	339	36	40	28	0.106	0.118	0.083	Dirt
	-Puerto Cortés	459	42	45	30	0.092	0.098	0.065	Dirt/paved
Simple average						0.121	0.133	0.089	

1) Average distance from mills in the area to port

Source: Interviews with sawmill operators

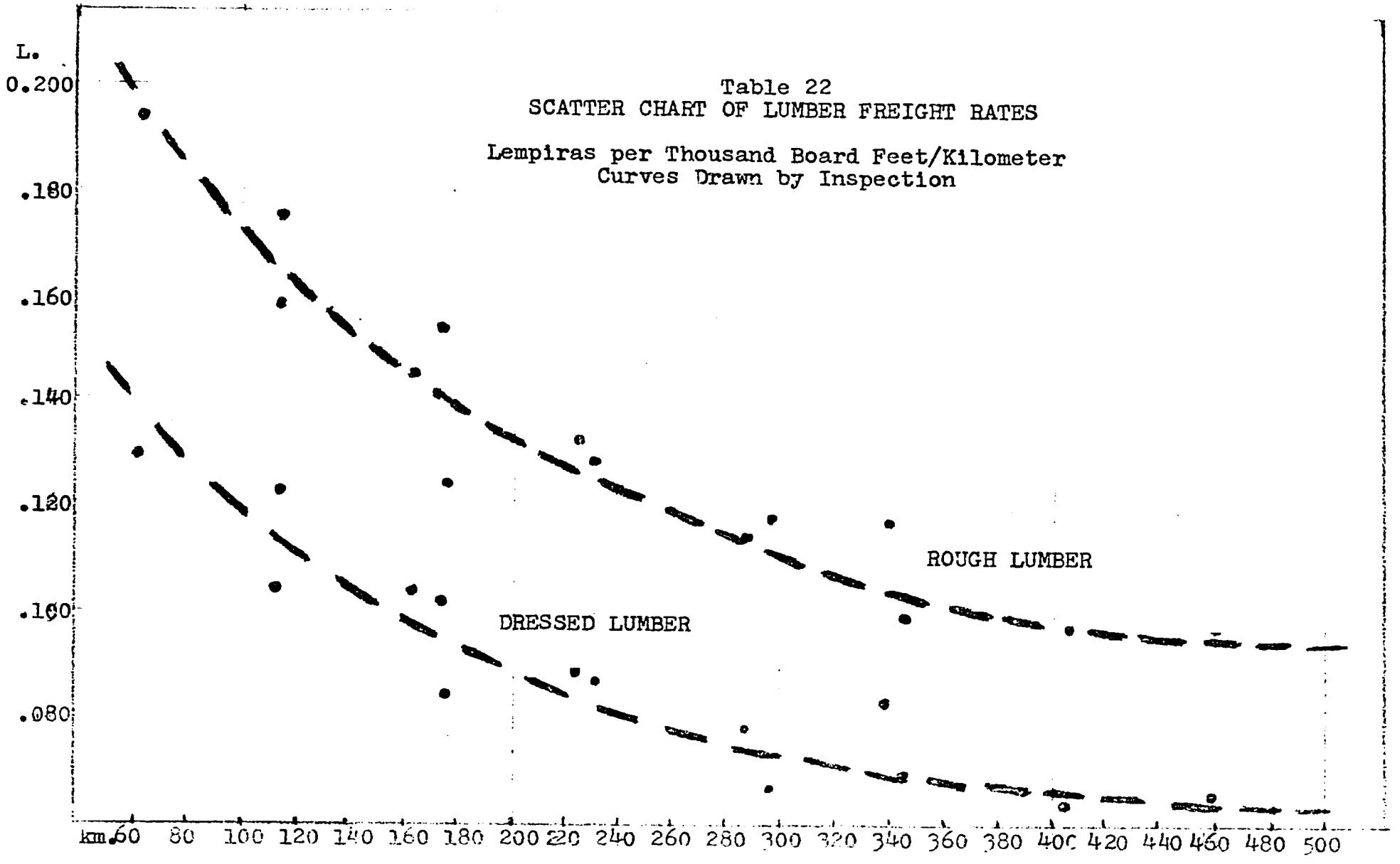
Table 22
SCATTER CHART OF LUMBER FREIGHT RATES
Lempiras per Thousand Board Feet/Kilometer
Curves Drawn by Inspection
L.
0.200
.180
.160
.140
.120
.100
.080
ROUGH LUMBER
DRESSED LUMBER
km.60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360 380 400 420 440 460 480 500

load per trip. The cost of a new flat-bed truck is L. 35,000, and the useful life may be estimated at five years. Monthly expenses would be approximately as follows (in Lempiras):

Depreciation	600
Insurance	100
Tires	400
Fuel and oil	300
Maintenance (labor and materials)	250
Labor (driver and helper)	400
Owner's profit[1]	450
	2,500

1) Plus residual value of truck at end of 5 years, estimated at 20%.

Operating 25 days a month, at 200 kilometers or 1 round trip per day (including loading and unloading), the approximate cost is L. 100 per day and round trip. The rate for rough lumber would be (100/5.5 thousand board feet) L. 18, or L. 0.18 per kilometer. Similarly, the rate for dressed lumber would be (100/8) L. 12.5, or L. 0.125 per thousand board feet per kilometer. Some allowance might be made for possible return cargo, or for more trips per month. Assuming an average rate of L. 0.13, the cost would be L. 13 per thousand board feet to Puerto Castilla. This compares favorably with present costs to Puerto Cortés of such centers as Talanga (L. 40 and 26, or an arithmetical average of L. 33) and Guaimaca (L. 45 and 30, or an average of L. 37.5)

Honduras' domestic market generally takes low-grade lumber, and demand is saturated by existing mills close to consuming centers. Lumber production in the Aguán-Olancho region therefore would have to go mainly for export. Tables 23 and 24show Honduras' wood exports for 1963, a year of comparatively high international prices. The average for sawn pine lumber was L. 170

Table 23

Pitch Pine Exports, 1963

	Cubic meters	Thousand board feet	Lempiras	Lempiras per thousand board feet
Timber and squared logs	34,322	14,542	2,853,224	196
Of which,				
Venezuela	8,702	3,687	546,584	149
United Kingdom	8,001	3,390	760,964	224
Barbados	5,175	2,193	394,077	180
Netherlands	4,508	1,910	500,004	262
United States	2,568	1,088	227,337	215
Western Germany	2,319	983	234,527	239
Railway ties	1,252	531	185,520	349
Of which,				
Panama	1,150	487	107,500	221
Sawn boards,	181,647	76,949	13,098,024	170
Of which				
El Salvador	41,884	17,746	1,653,148	93
Jamaica	39,830	15,877	2,619,142	165
Western Germany	22,308	9,453	2,718,718	288
Netherlands	21,486	9,106	2,190,888	241
Puerto Rico	17,704	7,500	1,217,028	162
Leeward/Windward Is.	8,246	3,494	484,650	139
Trinidad & Tobago	7,232	3,064	432,507	141
Guadaloupe/Martinique	5,862	2,484	221,558	89
Netherlands Antilles	4,393	1,861	263,905	142
Panamá	4,292	1,819	472,086	260
United Kingdom	3,252,	1,378	278,165	202
Venezuela	2,200	932	128,830	138

Source: Dirección General de Estadistica y Censos, "Comercio Exterior de Honduras, 1963, Tomo I," Tegucigalpa, May 1964.

Table 24

Other Wood Exports, 1963

	Cubic meters	Thousand board feet	Lempiras	Lempiras per thousand board feet
Cedar				
Timbers & squared logs	123	52	14,154	272
Sawn boards	1,272	539	140,960	262
Other coniferous				
Timbers & squared logs	149	63	16,358	260
Sawn boards	397	168	44,812	267
Mahogany, ebony & nogal				
Timbers & squared logs	369	156	42,081	270
Sawn boares	1,094	464	157,844	340
Granadillo, "palo de rosa", "palo de sangre"				
Timbers & squared logs	713	302	59,245	196
Sawn boards	141	60	11,464	191
Other non-coniferous				
Timbers & squared logs	647	274	85,563	312
Sawn boards	2,017	855	250,879	293

Source: Dirección General de Estadistica y Censos, "Comercio Exterior de Honduras, 1963, Tome I," Tegucigalpa, May 1964.

per thousand board feet. However, this covered three different types of markets.

Oversimplifying somewhat, the three types of export markets for Honduran lumber may be described as follows: (1) low grade lumber - generally equivalent to No. 3 and No. 4 common - was sold to El Salvador and to some Caribbean markets for L. 89-93 per thousand. (2) Standard construction grades - similar to No. 2 common - were sold to certain Caribbean markets for approximately L. 140-165 per thousand. (3) Highest-quality pitch pine - No. 1, select or better - sell for around L. 200-288 per thousand, primarily to Western Germany and the Netherlands.

The market for highest-quality pine is at present practically unlimited, and would absorb substantially larger quantities than Honduras is likely to be able to produce in the future. Likely Honduran production of standard construction grades is only a small fraction of the total moving in world commerce, and should be readily salable if the price meets competition. However, Honduran quality control and merchandising methods will need to be improved if sales outside the Caribbean are to be encouraged. Present markets for low-grade lumber, on the other hand, are largely saturated. The Aguán-Olancho region would be in a somewhat better position than present Honduran producers, because of its lower freight costs. However, the only constructive long-run solution of the marketing problem is to reduce output of low-grade lumber to an absolute minimum, by better operating practices.

Some 20-25% of the average mill's output is in the higher

grades (Genoa prime, No. 1, etc.) while roughly 80% is usually in construction grades (e.g. No. 2 common) or lower. According to one lumber operator, roughly half o. the output could be grade No. 1 or better. However, well over half this potential higher-grade output is damaged by stain, rot or drying damage, for lack of proper storage, drying kilns or other facilities. Most Honduran mills try to produce highest grades as their main product, and treat lower grades as a by-product to be dumped on local or near-by markets for whatever they will bring. This is to some extent a hangover from the days when internal transportation costs were so high that only the highest grades could stand the freight to export markets.

Compared to pine, hardwood exports are relatively insignificant at present. While exports of pitch pine totalled 217,211 cubic meters in 1963, exports of all other woods amounted to only 6,922 cubic meters, or a mere 3%. Honduras' prewar position as an important world supplier of hardwoods has been lost as a result of the exhaustion of readily accesible reserves of the most valuable trees.

A rough estimate of cost of production of pine lumber in the Aguán-Olancho Region might be as follows (in Lempiras):

	Per cubic meters of round logs	Per thousand board feet sawn timber
Logging operations	5.00	23.50
Stumpage (national forests)	5.00	23.50
Hauling to mill	3.20	15.00
	13.20	62.00
Sawmill operation		36.00
Transportation to port (L.0.13 x 100 kilometers)		13.00
Stevedoring		10.00
Export tax and wharfage		6.60
Miscellaneous		2.00
		129.60

The value of lumber depends on the grade, the destination, and the ups and downs of the international lumber market. However, an average of L. 170 per thousand board feet seems reasonable in the light of recent experience. This would give a gross profit of L. 40.40 per thousand board feet, or L. 444,400 a year for 11,000 thousand board feet a year. The approximate investment required to establish a mill of this size is L. 600,000.

Since the sawmill industry seems likely to return a good profit, and since lumber resources in other parts of Honduras are becoming scarcer, we assume it will develop in the Aguán-Olancho region as soon as adequate road and port facilities become available. If a large pulp and paper project does not develop to upset present conditions, development might take the form of two large pine mills, each producing 50,000 board feet a day or a total of 22,000 thousand board feet a year. These might be located in the Sierra de la Esperanza area, or in the vicinity of San Esteban. In addition, two smaller mills, producing perhaps half that much, might locate in other pine areas, such as the vicinity of Dulce Nombre de Culmí. The total output of 33,000 thousand board feet a year would represent 43% of Honduras' pine lumber exports in 1963.

In addition, two medium-size hardwood mills, each producing 15,000 board feet a day, or a total of 7,200 thousand board feet a year, might locate in the Dulce Nombre de Culmí and Sabá (Aguán) areas. Finally, a large hardwood mill is planned in conjunction with the plywood complex at Puerto Castilla (discussed below), with a capacity of 50,000 board feet a day, or 11,000 thousand

board feet a year. The total hardwood production of the Aguán-Olancho region would then be 18,200 thousand board feet a year.

If all pine comes from national forests, total stumpage revenue for the government would be L. 665,500 per annum, at the present rate of L. 5 per cubic meter of log (equivalent to L. 23.50 per thousand board feet of sawn lumber). Stumpage on hardwoods varies with the species, but most commercially valuable species pay L. 15 per cubic meter of log, or roughly L.47.50 per thousand board feet of lumber. (The percentage of waste is smaller with hardwoods because of their generally greater diameter).

In addition, export taxes of L. 3 per thousand would apply, producing revenues of approximately L. 156,600.

b. Naval stores (turpentine and rosin)

Naval stores are produced by cutting through the bark of pine trees, and collecting the oxuded gum. This gum is distilled to separate it into volatile turpentine and non-volatile rosin. Normally, 28 pounds of rosin and one gallon of turpentine (weighing approximately 7.2 pounds) are produced from gum weighing around 36 pounds. This proportion is not attained in Honduras, largely because much of the turpentine evaporates as a result of inefficient collection methods.

Trees are tapped and gum is collected by men on foot or horseback. The approximate cost of collection in Honduras, using primitive methods, is L. 15 per "barrel" of roughly 320 pounds of gum. Costs of transportation and barrels amount to L. 3, while the royalty charged by private forest owners amounts to L. 1-2.

Because of the seasonal nature of the gum flow in the pine tree, turpentine plants operate only for approximately six months of the year. Most of Honduras' naval stores plants are located in the vicinity of Sabanagrande, between Tegucigalpa and the South Coast, and have to draw gum from forest areas located some distance away. The supply of gum is limited, and the profit to entrepreneurs or intermediaries raises the delivered price to approximately L. 30 per barrel, or L. 0.10 per pound. Although the pay is comparatively good, relatively few persons produce gum, and these cling stubbornly to antiquated methods. Therefore, existing plants are unable to obtain adequate supplies of raw material.

If the naval stores industry is introduced into an area where it does not now exist, such as Olancho, it should be possible to

start afresh with more modern methods, including the use of sulfuric acid as a stimulant, shallower cutting, metal or clay cups, etc. With these improvements, a delivered price of L. 0.08 per pound of gum should be very profitable for the harvestors.

Table 25 shows Honduran exports of naval stores during 1963. Turpentine is sold almost entirely within Central America, at a price of approximately L. 0.26 per kilogram, or L. 0.85 ($0.42) per gallon. This exceeds the world market price for similar grades. For example, Mexican turpentine imported into the U.S. during the period January-August 1963 averaged $0.26 per gallon, f.o.b. If new plants in Olancho produce important quantities of turpentine, they might well exceed the absorptive capacity of the Central American market, and drive the price down to world market levels.

Rosin exports also go mainly to other Central American countries. However, supply exceeds Central American demand, and consequently the price is close to the world market level. There are important sales of rosin to the U.K. and West Germany. The present average price is around L. 0.31 per kilogram. During the period January-August 1963, U.S. imports from Mexico and Belize were made at an average price of $0.07 per pound (f.o.b.) or roughly L. 0.32 per kilogram.

A plant to produce roughly 400 gallons of turpentine and 12,000 pounds of rosin a day would involve an investment of approximately L. 100,000. Costs of production might be estimated as follows (in Lempiras):

Table 25

Honduran Exports of Naval Stores in 1963

In Kilograms and Lempiras

	Kilograms	Lempiras	Lempiras per kilogram
a. Turpentine	111,382	28,779	0.258
Of which, to:			
El Salvador	43,222	11,580	0.268
Nicaragua	29,282	7,878	0.269
Guatemala	23,911	7,050	0.295
Costa Rica	14,967	2,271	0.152
b. Rosin	867,589	272,111	0.314
Of which, to:			
Guatemala	141,527	41,585	0.294
Nicaragua	138,576	34,741	0.251
Panamá	131,976	59,447	0.450
U.K.	118,800	34,027	0.286
El Salvador	113,847	35,633	0.313
Western Germany	82,800	25,180	0.304

Raw materials: (400 x 7.2 + 12,000) x 150 days = 2,232,000 lb.; 2,232,000 lb x 0.08	178,560
Fuel: 15 gallons diesel/day x 150 days x L. 0.40	900
Power: 5 kW x 24 hours x 150 days x L. 0.10	1,700
Labor and management	20,000
Depreciation	10,000
Repairs, etc.	5,000
	216,160
Miscellaneous & packaging, 15%	32,544
	248,704

Approximate gross proceeds might be as follows:

60,000 gallons of turpentine at L. 0.52	31,200
1,800,000 lbs. of rosin, at L. 0.31	558,000
	589,200
Cost of transport to port/inland market	
1,800,000 lb. rosin	
432,000 lb. turpentine	
2,232,000	
223,200 packaging (10%)	
2,455,200 lb = 1,115 tons; at L. 25	-27,875
Net proceeds	561,325
Net profit might be (561,125 - 248,704)	312,421

Present methods of turpentine collection in Honduras are relatively destructive. However, using more modern methods, it should be possible to combine gum turpentine production and other forms of forest utilization without any serious conflict. With the most modern methods (acid stimulation, shallow incisions, and cutting and collection once every three weeks instead of once a week) some 210 producing trees will provide roughly 67,200 lb. of raw material a year, and will maintain this yield for many years. As a guess, we may estimate a minimum of 20 producing trees per acre. Accordingly, a plant of the proposed size would operate on only 345 acres, an insignificant part of the total available pine forest.

In addition to turpentine produced by tapping, there will

be virtually unlimited supplies of butt logs and stumps from beetle-killed timber. After allowing the sapwood to rot away (a matter of 3-8 years after death) the resin content of the remaining heartwood may be estimated at 15% for butt logs and 25% for the stump. The cost of transportation to a plant would be higher than for tappers' gum, but the cost of harvesting would be much smaller. The resin from butt logs and stumps is expelled by heating, and the gum is then distilled in the usual manner.

For purposes of the present estimate, we assume the equivalent of six plants of the general size described above, to operate partly on new tappings and partly on salvaged beetle-killed trees. The total annual tonnage to be moved from the plants would be approximately 6,700 tons, destined mostly for export. The tonnage of raw materials moving into the plants is estimated at 37,500 tons.

c. Plywood

Honduras' only plywood factory is located at Puerto Castilla, using hardwoods as its raw materials. During the last few years, an experienced U.S. producer has invested in this enterprise, and production is increasing. The annual output likely to be reached during the next year or two is 6 million square feet, provided the proposed road is built to ensure access to hardwood forests in the Esperanza Pass area.

To produce 6 million square feet of plywood, some 2.5 million board feet of logs will be needed. At 2,000 feet per truck (substantially higher than for pine), operating over 10 months, this will require 125 truckloads a month. The weight of the plywood produced may be estimated at 726 pounds per 1,000 square feet, or 1,978 metric tons a year. Around half the expanded output would go to Honduran, Salvadoran or other Central American markets by road, while the remainder would be shipped to Puerto Rico or other overseas markets.

In addition, the company probably will undertake to produce particle board or hardboard on a small scale, using plywood waste or low-value hardwood species, at a rate of 25 tons per day or 6,250 tons per annum. This should sell mainly in Central America.

Finally, if the proposed road is built, the company probably will put in a hardwood sawmill, to process plywood cores and the most valuable hardwoods into lumber. Estimated output is 50,000 board feet a day, weighing approximately 112 tons. Raw material

would weigh perhaps twice as much as the finished lumber.

Fuel oil requirements for the combined operation would be 150-200,000 gallons per month. A wood materials balance for these three activities might be as follows:

a. Raw material needs (tons per annum)

Sawmill	56,000
Plywood	7,000
	63,000
Processing losses (sawdust, etc.)	6,300
Net available for finished products	56,700

b. Finished products

Plywood		1,978	
Less:	glue	50	
	extender	100	
			1,828
Particle board		6,250	
Less:	resin, etc.	625	
			5,625
Lumber			26,880
			34,433

At present, all plywood moves by small boat from Puerto Castilla to Puerto Cortés. Costs of transportation are approximately as follows:

Loading	L.0.02 per 100 pounds
Shipping	0.23
Unloading	0.02
Trucking to San Pedro Sula	0.08
	0.35

When output is expanded, around half of the total plywood production will be for inland markets (primarily San Pedro Sula, Tegucigalpa, and El Salvador), while the remainder will be exported to Caribbean markets. We assume that three-fourths of the particle board will be for inland sales, and one-fourth for export. Virtually all the hardwood lumber will be for export.

d. Charcoal

A U.S. investor is understood to be considering the establishment of a charcoal briquetting plant at Puerto Castilla, to produce 10-15 tons of charcoal a day. At 200 days a year, this would amount to 2-3,000 tons of product, requiring 10-15,000 tons of wood. According to the material balance shown above, this could be provided from scrap wood of the plywood-particle board - sawmill complex.

If the presently interested group does not go through with the project, it is likely to be undertaken by others in the near future. Details on industrial costs fall outside the terms of reference of this report, but we have made estimates which indicate excellent profit prospects.

4. General description of area served

Honduras is the least prosperous and least-developed of the countries of Central America. She shares with the rest of Central America a highly-accidented terrain with numerous mountain ranges running generally from East to West, parallel with the Atlantic and Pacific Coasts. However, the recent volcanic chain forming a belt of rich agricultural soil for the other Central American countries is interrupted in Honduras (lying mostly in the Gulf of Fonseca region off the Pacific Coast). The soil, therefore, is gnnerally poorer than in the rest of Central America.

Around 85% of the country's area is so mountainous as to make agriculture impractical. In the interior, much of this mountainous area is given over to pine forests, forming the basis for an important lumbering industry.

Over most of the area, rainfall is concentrated in a rainy season lasting 5-7 months, and over much of this area total rainfall is scanty. Bananas, accounting for 40% of total exports, are grown commercially under irrigation, even in the relatively high rainfall areas of the North Coast. In the dry southern part of the country (around Choluteca) sorgo tends to replace corn as a staple grain because of the shortage of water.

Partly because of her general poverty, Honduras is one of the least-densely populated areas in Central America. Settlement is largely by small subsistence farmers, and there are no great social pressures arising from scarcity of farmland. However, there is an important variation in population density in different parts of the country. Population is heaviest on the North Coast near

the banana and industrial center of San Pedro Sula, along the western border with El Salvador, and in the south near the Pacific Ocean. There is also a minor concentration around the capital city of Tegucigalpa (originally founded by the Spaniards as a silver mining center.)

However, the largest part of the national territory is underpopulated, including potentially rich agricultural regions such as the Jamastran and Guayambre Valleys (east of Danli), the Guayape Valley (between Juticalpa and Catacamas), the Agalta Valley (around San Esteban) and much of the Aguán Valley (running to the sea near Trujillo/Puerto Castilla). Also included in the area with minimal population is the vast tropical rain-forest and savannah area known as the Mosquitia, whose potential resources are barely known. Some of these areas are used for cattle-grazing, at a level of technique little different from that of the open range in the U.S. "wild west" days after the Civil War.

Apart from sawmills and maintenance establishments connected with banana plantations and railways, industrial development is relatively recent. A few factories - including a soap factory, a vegetable oil mill, and several breweries, have been established for several decades. Many important industries - including a cement mill, a flour mill, textile mills, a detergent factory - are barely five years old. The chief industrial center is San Pedro Sula, but there is also some industrial development around Tegucigalpa and La Ceiba.

Honduras' population is growing at the very rapid rate of 3.3-3.5% per annum. To keep up with this increase, while providing

for the 2.5% annual increase in average living standards that was recommended at the Punta del Este Conference, requires the not inconsiderable rate of increase in gross national product of 5.8-6.0% per annum.

At present, agriculture and forestry provide around 72% of all employment, generate half of the gross domestic product, and produce some 90% of total exports. These branches of the economy have been expanding in recent years.

Table 26 gives population data on the project area. At present, the area is underpopulated compared to the country as a whole, and consequently offers opportunities for agricultural expansion that would be difficult to provide in other areas. Taken as a whole, the area covers 26.8% of Honduras' national territory, but contains only 9.2% of the national population. The rate of population growth during the last decade has been the same as for the country as a whole, but the biggest proportionate increase has been in the Guayape Valley (linked to the national road system during this period.)

In the following analysis, an attempt is made to project possible developments in the three main valleys that form Northeast Honduras. These projections are deliberately conservative, intended as a minimal economic justification of the proposed road, and they are not intended to be exhaustive.

As has already been discussed above, the projections are based on two key assumptions concerning national resources policy of Honduras: (1) Limited amounts of land will be made available

Table 26

Population of Northeastern Honduras

		Area in square kilometers	Population 1950	Population 1961	Population density per square km. 1950	Population density per square km. 1961	Population over 9 yrs. 1961	Of whom, literate 1961	Percent Literate
a. Coast line									
Iriona	(Colón)	4,459.0	2,854[1)]	4,615	0.6	1.0	2,837	1,385	
Aguán	"	80.2	1,432	1,839	17.9	22.9	1,210	631	
Santa Fe	"	116.1	1,631	1,961	14.0	16.9	1,294	748	
Balfate	"	607.3	1,105	1,712	1.8	2.8	1,081	660	
Subtotal		5,262.6	7,022	10,127	1.3	1.9	6,422	3,424	53.3
b. Aguán Valley	(Colon)								
Trujillo	(Colon)	1,385.0	13,125	9,781	9.5	7.1	6,286	4,139	
Limón	"	562.0	1,075	1,776	1.9	3.2	1,156	584	
Tocoa	"	736.0	2,523	5,480	3.4	7.4	3,429	1,882	
Sonaguera	"	929.2	4,975	14,740	5.4	15.9	9,105	5,453	
Olanchito	(Yoro)	1,931.0	24,301	29,890	12.6	15.5	18,659	12,097	
Arenal	"	157.0	3,457	3,092	22.0	19.7	1,945	1,294	
Subtotal		5,700.2	49,456	64,759	8.7	11.4	40,580	25,454	62.7
c. Aguán Uplands									
Esquipulas del No.	(Olancho)	350.1	2,745	1,646	7.8	4.7	982	223	
Guata	"	220.0	2,305	3,769	10.5	3.8	2,329	544	
Subtotal		570.1	5,050	5,415	8.9	9.5	3,311	767	23.1
d. Agalta Valley									
San Esteban	"	1,782.0	3,576	4,566	2.0	2.6	2,797	1,378	
Gualaco	"	1,808.0	4,460	7,032	2.5	3.9	4,383	1,160	
Subtotal		3,590.0	8,036	11,598	2.2	3.2	7,179	2,538	35.4
e. Guayape Valley									
Dulce Nombre de Culmi	"	3,593.0	794	1,054	0.2	0.3	654	276	
Catacamas	"	6,438.0	7,023	15,000	1.1	2.3	9,633	4,814	
El Real	"	342.2	2,527	2,839	7.4	8.3	1,863	1,029	

Table 26 (cont.)

		Area in square kilometers	Population 1950	Population 1961	Population density per square km. 1950	Population density per square km. 1961	Population over 9 yrs. 1961	Of whom, literate 1961	Per cent literate
San Francisco de	(Olancho)								
Becerra	"	743.0	2,588	2,071	2.8	2.8	1,289	650	
Juticalpa	"	4,795.0	14,468	25,965	8.4	8.4	16,772	7,462	
Subtotal		12,318.2	24,812	46,929	2.0	3.8	30,211	14,455	47.8
F. Guayape Uplands									
San Francisco de la Paz	"	395.0	5,487	7,083	13.9	17.9	4,539	1,662	
Guarizama	"	220.0	3,164	3,155	14.4	14.3	1,978	701	
Manto	"	238.0	5,953	5,305	25.0	22.3	3,358	1,215	
Jano	"	322.0	1,569	1,404	4.9	4.4	860	304	
Silca	"	111.3	2,213	2,357	19.9	21.2	1,417	537	
Salamá	"	98.0	3,261	3,616	33.3	36.9	2,275	1,216	
Guayape	"	444.0	4,004	4,794	9.0	10.8	3,007	753	
Concordia	"	332.0	2,781	3,116	8.4	9.4	1,961	607	
Campamento	"	448.0	3,084	4,170	6.9	9.3	2,536	1,100	
Subtotal		2,608.3	31,516	35,000	12.1	13.4	21,931	8,095	36.9
Total for project area		30,049.4	125,892	173,823	4.2	5.8	106,323	54,733	51.5
Total for Honduras		112,088.0	1,368,605	1,884,765	12.2	16.8	1,219,288	577,266	47.3
Project area as % of Honduras		26.8	9.2	9.2	34.4	34.5	8.7	9.5	108.9

1) Estimated in accordance with present boundaries

in the Aguán Valley, either for commercial farming ventures or for well-organized cooperatives of small growers, so as to permit the development of certain export crops, and of more modern cattle-raising enterprises. If this assumption is not realistic, or for some reason conflicts with the government plans for large-scale colonization of the Aguán Valley, the present proposal to finance reconstruction of bridges along the Aguán Valley would not be appropriate. It would, of course, still be possible for the Government to apply for a separate loan to finance a comprehensive program of colonization in the Lower Aguán Valley, along the lines recommended in the OAS Report,[1] including a substantial expenditure on roads and bridges. In any event, the proposed port development and road from Puerto Castilla to Dulce Nombre de Culmí appears to be justifiable without regard to the intensive development of the Aguán Valley.

(2) Government controlled forests in the Agalta Valley and in the vicinity of Dulce Nombre de Culmí will be made available for production of timber, with reasonable stumpage charges and cutting regulations. If these forests are not made available for lumbering, the justification for the construction of the road between the Esperanza Pass and Dulce Nombre de Culmí will be reduced, and may no longer be adequate. Alternatively, the government may arrange for the development of a large pulp and paper plant, drawing on these forest reserves, In that case, the justification for

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1) Organización de los Estados Americanos, "Informe Oficial de la Misión 105 de asistencia técnica directa a Honduras sobre Reforma Agraria y Desarrollo Agrícola." Washington, D.C., 1964.

the project will be at least as great as is projected here, and possibly greater.

a. Aguán Valley

The Aguán Valley is one of the most promising agricultural areas in all Honduras, provided that communications facilities can be restored, and effective arrangements for production and marketing of crops can be made.

A careful study has been made of the valley's soils and other resources by the OAS Mission 105. The Lower Aguán Valley extends from the point where the Mamé River flows into the Aguán River - just below Olanchito - to the sea. The division between Lower Aguán and Middle Aguán thus coincides with the change-over from dry tropical forest to tropical rain forest. The Lower Aguán is the area most suited for agriculture. It includes the villages of Sabá, Tocoa, Sonaguera, Japón and Masicales. There are some 60,000 hectares of well drained alluvial soils of excellent qualtiy along both sides of the river. There are an additional 34,000 hectares of badly drained alluvial soils, generally located in depressions, between natural dikes and at the foot of the hills and mountains surrounding the valley. These have a high productivity potential, but are frequently flooded by the rivers, and large areas often remain inundated for weeks during the rainy season. Drainage would be necessary before crops could be grown, but much of this area could be used for pasture.

Finally, there are some 23,000 hectares of mixed alluvial soils in the extreme south of the valley, many of which offer good agricultural opportunities.

The remainder of the flat or undulating areas are composed of swamps, coastal dunes, etc. with no agricultural potential other than coconut production, and possibly some pasture. The Middle and Upper Aguán contain approximately 50-75,000 hectares of land usable for agriculture and pasture.

Much of the Middle Aguán Valley, and some of the lands on the north bank of the river in the Lower Aguán Valley are owned by the Standard Fruit Co., which operates extensive banana plantations. Most of the land on the south bank of the river is owned (or claimed) by INA. This area was once part of a system of banana farms operated by the Trujillo Railroad Co. (United Fruit Co.), and the original irrigation and drainage ditches still exist (although they have fallen into disrepair). Much of the former banana land has grown up into brush, but would still be relatively easy to clear. At present, a relatively thin population of squatters makes some use of the land. The chief present population center is the town of Tocoa. The land around the town of Tocoa is supposedly municipal (ejidal), but the title is unclear.

Because of the difficulty of transportation, most of the farmers now in the area grow subsistence crops. A few large cattle ranches also operate. The value of the gross product of the area under present conditions, has been estimated at L. 5 million. INA has a plan to settle 6,000 families on 70,000 hectares, at a cost of approximately L. 52 million, which is expected to increase annual output to L. 42 million a year

Annual rainfall in the Lower Aguán varies from an average of

about 33 inches at Olanchito to 108 inches at Puerto Castilla, the increase being quite uniform as one progresses from west to east. Temperatures range between 21 and 32°C. In general, the climate is favorable for most tropical and temperate crops, yields are high, and costs of production are low in comparison with the rest of Honduras.

Present population is approximately 32,000 in the Lower Aguán Valley and 36,500 in the Middle Aguán and Aguán highlands. Almost half consists of independent farmers (mostly squatters). The other half of the population is directly or indirectly associated with the Standard Fruit Co. operations, and is unlikely to increase as a result of construction of better roads. However, a doubling of the independent portion or an increase by roughly 35,000 (to a total of 100,000) seems probable in the decade following establishment of road communication. This would increase the average population density to roughly 18 per square kilometer, not much more than the present average for Honduras as a whole. In addition, population of surrounding upland areas might be expected to increase to perhaps 7,000, while the coastal areas might increase to 15,000 once a port is developed at Puerto Castilla. The total population of the area therefore, might be 122,000 as compared to roughly 80,000 today.

An even greater increase is feasible if a large colonization project were to be financed and implemented by the government land reform agency.

The present lack of transportation is stifling possible economic

growth, as is shown by the experience of two adjacent towns in the Aguán Valley, Sabá and Tocoa. Both lie on the southern bank of the Aguán and are only thirty-six kilometers apart. At one time a United Fruit Company railroad connected the two areas. But all that remains today is a surprisingly good road bed which, if bridges were added, would serve quite well as the base of an all-weather road between the two points and beyond. During the dry season, Tocoa is able to ship products to Sabá by ox-cart along this road. Products such as rice may also be sent across the river for shipment by rail to La Ceiba. During the rainy season, however, such shipments become impossible. Tocoa must either rely on air freight, or move goods directly across the river (a relatively risky trip) to be loaded on the railroad at El Olvido for La Ceiba. The cost of this method is L. 1.25-1.50 per quintal to El Olvido, and L. 0.86 per quintal by rail to La Ceiba, for typical exports such as rice.

The Tocoa region contains a population of roughly 4,000. Many of these are individualistic farmers who remained in the area when United Fruit Company moved out its operations. Owing to Tocoa's extremely propitious climate (the Lower Aguan is graced, unlike almost all other Honduran regions, with year-round rainfall) almost any crop tried has prospered in small quantity. Tomatoes, cucumbers, peppers, cabbage, along with cacao have recently been grown with considerable success. In addition, natural pasture is far more abundant than in almost any other Honduran region. Consequently, significant quantities of swine (5,000 cwt live weight) and beef cattle are sent on foot to Sabá and then

shipped by railroad to La Ceiba. However, effective transportation costs for vegetables are prohibitive. Air shipping of cucumbers - which has been tried - costs 1.5¢ a pound, that is, roughly their market price in La Ceiba. The Tocoa region is producing about 8,000-10,000 quintals of rice per year; 2,000 quintals of beans, and 8,000 quintals of corn. About 75% of the available land in the immediate Tocoa area is under cultivation.

Sabá's population is supported by the Standard Fruit Co.'s banana plantations in the area. Daily wages for banana workers are some three to four times the national average. Since almost all males are hired by Standard Fruit and most of the nearby land is owned by that company, very little private farming exists. Consequently even basic staples are not readily available.

Price differentials between corn and bean sales in Sabá and Tocoa reflect their economic isolation despite their geographical proximity. During harvest, corn sells at L. 0.03 per pound wholesale in Tocoa. Prices in Sabá range around L. 0.20 a pound, and corn is brought from La Ceiba by rail, rather than from nearby farms. Similarly, beans sell in Tocoa at around L. 0.10 per pound,,whereas the Sabá price fluctuates between L. 0.10 and L.030.

Consequently, both areas might solve their inter-related economic problems jointly. Tocoans have little incentive presently to increase their production, since any increases without market access merely disrupt price stability in the region. Farm methods, therefore, remain quite stagnant, with the sole exception of large landholdings, some of which are attempting to recreate

plantation production of pineapples, bananas, oranges and cacao, all of which are well-suited to the area. In the main, then, little agricultural improvement can be expected before basic market forces can be restructured so as to accomodate and stimulate it.

1. Agriculture, a. Corn

Table 27 gives available information on present corn prices in the Aguán Valley (with some comparable data from other areas of Honduras.) Although the price is fairly high in the immediate vicinity of the isolated Trujillo consuming area, it is well below the national average in the interior of the Aguán Valley, and on the coast near La Ceiba. Pronounced seasonal differences will also be noted. Thus, in April 1963, the price at Sonaguera was L. 8 per quintal, whereas the price at Trujillo - a mere 47 air kilometers away - was L. 4. Conversely, in October the price rose to L. 6 at Trujillo, but fell to L. 3 at Sonaguera.

With the opening up of transportation, there should be an increase in the average price available within the valley, an expansion of production, and a tendency for corn to flow towards the interior of the country in limited quantities (particularly during the second harvest season). The approximate cost of moving corn from the Corocito/Durango area to Juticalpa by truck would be L. 0.65 per quintal. Assuming a standard market price of L. 5.20 at Juticalpa, the price in the Lower Aguán would be L. 4.55. Compared to harvest prices of L. 3, this is obviously quite favorable.

For present purposes, we estimate existing production (including production by subsistence farmers) at 10,000 tons a year in the Aguán Valley as a whole. The additional amount that might be

Table 27

Price of Corn on Farm, April 1963 - March 1964
In Lempiras per Quintal (100 lbs)

	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	Annual Average
a. Aguán Region													
Trujillo	4.00	5.00	5.00	6.00	6.00	6.00	6.00	6.00	5.00	6.00	6.00	6.00	5.58
Sonaguera	8.00	6.00	6.00	5.00	5.00	4.00	3.00	3.00	3.00	3.00	4.00	4.00	4.50
Jutiapa	5.00	6.00	5.00	7.00	6.00	4.00	4.00	3.00	3.00	5.00	5.00	6.00	4.92
b. Cortés Region													
Choloma	6.25	5.00	7.50	7.00	7.00	7.00	5.00	4.00	4.00	5.00	5.50	5. 0	5.73
c. Pacific Region													
Sabanagrande	8.00	10.00	10.00	13.00	8.00	6.00	4.50	5.50	6.00	6.00	6.00	6.00	7.42
Choluteca	n.a.	n.a.	n.a.	9.00	9.00	6.00	4.50	4.00	4.50	4.50	6.00	5.50	n.a.
National average	6.66	6.58	6.73	7.51	7.31	5.91	5.13	4.45	4.60	5.27	5.69	5.83	5.97

Source: Dirección General de Estadistica y Censos, "Información Agropecuaria, Precios Recibidos por el Productor e Indices de Precios," 2nd, 3rd & 4th Quarters of 1963, 1st Quarter of 1964, Tegucigalpa, 1963 and 1964.

shipped to the interior of the country might be estimated at another 5,000 tons. It will also be necessary to feed the increased population, estimated to require another 6,000 tons. Total corn output would then be 21,000 tons. Yields of up to two tons per hectare are attainable in the Aguán Valley. However, to be conservative, we assume yields of 1.5 tons per hectare per crop. Since a second crop can be grown over much of the area, the area required might be estimated at a total of 9,000 hectares.

b. Beans

Beans have been comparatively high-priced in the Aguán Valley, and in general seem likely to expand less rapidly than other cash crops. To be sure, some expansion may occur in the dry areas with poorer soil (possibly including the Upper Aguán) where beans have a greater comparative advantage (or what amounts to the same thing, less comparative disadvantage.) In the Lower Aguán beans would have to be planted in well-drained alluvial soils, to avoid fusarium wilt. The Valley's present production might be estimated at 2,000 tons. Of this, 1,000 tons is consumed locally, and perhaps 1,000 tons is shipped to La Ceiba, Trujillo and other markets. Requirements for the expanded population (an additional 600 tons) and for a possible improvement in the protein-deficient diet (e.g. another 400 tons) might leave room for production of perhaps 1,000 tons for export. Total additional area required for beans would be approximately 2,670 hectares. However, some of this could grow two crops a year.

c. Rice

Rice is well adapted to the poorly drained soils of the Lower

Aguán Valley. Rice yields in the area are the highest in Honduras, running up to 2.5 tons per hectare per crop. A rice mill already exists in the area, but does not operate at full capacity due to lack of local production. A group of U.S. investors is considering the establishment of a large rice plantation on land belonging to the Standard Fruit Co., since all other suitable land is controlled by INA.

Present production amounts to perhaps 1,500 tons, at an average of 1 ton per hectare. A goal of 3,000 additional crop-hectares, producing at least 6,000 tons a year seems conservative. The increased population of the valley would consume around 375 tons, leaving 5,625 tons for shipment to the interior.

d. Winter vegetables and melons

We project two 500-acre commerical farms in the Aguán Valley, each exporting 2,700 tons of product, or a total of 5,400 tons.

e. Bananas

A reasonable estimate, in accordance with II-C-1-f above, would be one producing unit (commercial, or a well-organized cooperative of medium-size growers) of 1,000 acres (400 hectares) exporting 14,333 gross tons (including packaging).

f. Citrus

A conservative target for the Aguán Valley would be 250 hectares of commercial citrus, exporting 386,000 fruit per hectare during peak production years, at one-half pound per fruit or 88 tons per hectare. This figure is higher than present yields in the area of San Pedro Sula, being based on denser plantings per hectare than are presently considered normal. Of the total output,

perhaps one-third might be shipped as high-quality fresh fruit, while the rest would be processed. For estimating purposes, we assume that the processing would consist entirely of concentrating to one-fourth of the fresh juice weight, and the total exported weight (including packaging) would be 13,750 tons.

g. Pineapples

In accordance with II C-1-h above, we assume 210 hectares of pineapples, producing 5,160 tons of fruit a year. One third would be exported as fresh fruit, and two-thirds as manufactured concentrate, for a total export weight of 2,120 tons.

h. Cacao

Production of an additional 100 tons a year for sale to Central American markets seems reasonable. This would require a mere 90 hectares.

i. African oilpalm

This crop appears to offer large possibilities and has a ready export market. However, we confine our estimate to the establishment of one reasonable producing area, with 2,000 hectares and an output of 2,200 kilograms of oil and 600 kilograms of palm kernel per hectare, or a total of 5,600 tons per annum.

j. Sisal

This is a possible crop for the Middle or Upper Aguán, or alternatively for the Guayape Valley. A balanced producing unit would require 1,500 hectares, and would produce around 1,350 tons of fiber a year, primarily for export.

k. Abacá

This crop should do well in the Lower Aguán. Production

might amount to 2,500 pounds per hectare, on a 2,000 hectare producing unit, or roughly 2,270 tons of fiber a year. We assume that this would all be exported, although there is a limited Honduran demand.

A number of other crops can be grown in the area primarily for local consumption, such as cassava, sugar cane (for brown sugar), vegetables, etc. These, however, would not substantially affect the demand for transportation, and have therefore been omitted from consideration.

2. Livestock

a. Cattle

The Lower Aguán Valley has some of the best natural conditions for cattle-raising in Honduras. The heavy rainfall and high water table make it possible to carry as many as 2.5 head per acre on Pangola grass pasture, while guinea grass safely supports one head per acre. Furthermore, the high humidity and frequent rains tend to kill off ticks and torsalo flies. Finally, there has been a significant improvement in the breed, as a result of crossing of Red Poll (brought in by the United Fruit Co.) and - more recently - Brahma cattle with the native stock.

Under these ideal conditions, steers presently in the area average around 1150 pounds at less than four years of age, and dress out to a 55% yield. This, of course, is far superior to the 550-750 pounds with a yield of 32-37% attained at four years of age in the Guayape and Agalta Valleys.

In the past, cattle from the Aguan Valley could only be moved on foot to La Ceiba, or were sold to small cattle-boats from the

Caribbean area, arriving at Puerto Castilla irregularly and without notice. A slaughterhouse is now being installed at Puerto Castilla by Puerto Rican investors. This enterprise hopes to draw cattle not only from the Aguán, but also from the Agalta Valley, the North Coast between Tela and Trujillo, and the savannah regions of the Mosquitia (to be transported by barge or coastal vessel).

This plant's operations would be facilitated if a road is built along the Aguán Valley. At present, the loss on a 150 kilometer trail drive (e.g. from the Upper Aguán) may be as high as 12-15%, including a 4-6% head loss and an 8-10% weight loss. To compensate for such losses, the plant proposes to pay $0.0875-0.09 per pound live weight at Olanchito, as against $0.10 at the plant. If a road is built, the cost of transportation would amount to only $0.004-0.005 per pound, and it would be possible to pay around $0.095 at Olanchito.

The Middle and Upper Aguán Valley are less favorable for cattle-ranching, since they are dryer, and there is some loss of cattle to torsalo fly attacks and drought. Furthermore, cattle-rustling is more prevalent, with losses of up to 10% of the herds per annum.

Economically, the dryer cattle area at the upper end of the valley might best be used to produce feeder calves (yearlings, or perhaps two year olds under Honduran conditions). These would be brought to the more valuable Lower Aguán areas with higher rainfalls for finishing before slaughter.

The slaughterhouse at Puerto Castilla hopes to establish its own holding and feeding stations in Lower Aguán, for the dual

purpose of finishing young cattle from the interior, and to provide a buffer stock to smooth out slaughterhouse operations. The company will also provide veterinary services and medicines for cooperative cattle-growers. INA has been asked to make land available for cattle feeding operations.

The Puerto Castilla slaughterhouse is designed to handle 15 animals an hour, and will produce boned frozen meat for export to Puerto Rico, the U.S., and European markets.

As a result of the improvement in marketing facilities, an increase in the number of cattle may be expected for the valley as a whole. If better police protection can be provided, the number of cattle in the Upper Aguán Valley should increase by perhaps 50%, to 30,000. This total should produce at least 5,000 three-year-old feeder steers a year. The present cattle population of the Lower Aguán should also increase by 50%, to around 12,000 head producing perhaps 3,000 two-year-old feeder cattle a year.

Feeding stations in the Lower Aguán should be expected to hold the 8,000 feeder cattle from the valley for 6-12 months on perhaps 3,000 hectares of pasture. The cattle would be slaughtered at an average live weight of perhaps 1,100 pounds, providing possibly 1,526 tons of boned meat and other products.

In addition, the Puerto Castilla slaughterhouse might draw some 3,000 head a year from the Mosquitia, Atlantida, etc, and perhaps 4,000 head from the Agalta Valley. In terms of boned

meat exports this might amount to 700 tons, making a total export of 2,400 tons a year. The total number of animals slaughtered would be 15,000, or roughly half the plant's maximum capacity.

Dairy production is another possibility for the Lower Aguán, either as a joint product of beef cattle raising, or as a separate industry. At present, the prices of dairy products are relatively low in the Aguán Valley (except for the isolated consuming area of Trujillo). A bottle of milk averages L. 0.138 in Sonaguera and L. 0.12 in Jutiapa against a national average of L. 0.177 (April 1963-March 1964). Similarly, cheese averages L. 0.50 per pound at Sonaguera and L. 0.352 at Jutiapa, against a national average of L. 0.548.

In order to export fluid milk to the interior of the country, the Aguán Valley would need a milk processing plant (similar to the one at San Pedro Sula). However, cheese and clarified butter could be exported without much new investment. As a rough estimate, we assume shipments of 500 tons of cheese a year to the interior of the country. This might consume the milk of 1,500-1,800 cows.

b. Pigs.

With relatively cheap corn available, the Middle and Lower Aguán areas have the basis for expansion of pig-raising. At present, pork prices are somewhat higher than might be expected, possibly because of the comparatively high consumption of the prosperous banana workers, and the limited number of pig producers in the area. However, production should increase and prices should decline, permitting sales to the interior of the country, and also

exports to Puerto Rico and other parts of the Caribbean (particularly if the new slaughterhouse at Puerto Castilla expands into hog processing). We assume a 100% increase in production, turning out an additional 20,000 pigs a year with a live weight of 200 lbs. or a total live weight of 1,800 tons. Export products might weigh a total of 1,300 tons.

3. Forest resources

a. Lumber

If bridges are restored along the Aguán Valley, the development of a medium-size hardwood lumber mill in the vicinity of Sabá, with an output of 15,000 board feet a day (3,600 thousand board feet a year) seem feasible. Annual exports would be 8,134 tons. In addition, a large hardwood mill is planned for the Puerto Castilla plywood complex. This is described below in connection with the Agalta Valley from which most of the raw materials would come.

. . . .

b. Agalta Valley

The Agalta Valley is the second most isolated area in Honduras (exceeded in remoteness only by the tropical rainforests of the Mosquitia area to the east.) Since there are no roads in the area, all traffic moves by mule and cattle trail, or by air.

On the south, the Agalta is enclosed by the Sierra de Agalta which cuts off access to the Guayape Valley. On the north and west the Agalta Valley is bordered by a mountain chain consisting of the Cerros del Ocote and the Sierra de la Esperanza, cutting off access to the Aguan Valley. To the east, the valley runs into

a narrow gorge formed by its Sico River, so accidented that it is avoided even by mule traffic. After leaving this gorge, the Sico River joins the Paulaya River, and flows into the Atlantic.

The two towns of some importance in the Agalta area are San Estéban to the east, and Gualaco to the west. Gualaco is located near the headwaters of the Sico in an area of poor soil, producing mainly subsistence crops and coffee for export. The population is partly settled on municipal (ejidal) land, and partly consists of squatters on national lands. Coffee is shipped to the outside world by air, and by mule to San Francisco de la Paz to the west. However, the latter town itself is handicapped by high transportation costs due to the poor condition of its road to Juticalpa.

Possibilities of agricultural or animal husbandry expansion in the Gualaco area are limited because of the paucity of good soil. Pine forests, once an important potential resource of the area, have been largely destroyed by the epidemic of Southern pine beetle. Even if fire protection is provided to allow regeneration of the forests, it will take some 25 or more years to produce sawmill timber. For these reasons any substantial extra expenditure to provide access to the Gualaco area as part of the Northeastern Honduras Transportation Program does not appear to be justified. Needs of the area might perhaps justify a penetration road from San Francisco to Gualaco, and improvement of the road from Juticalpa to San Francisco. However, that might best be handled without reference to the present program (e.g. as part of the self-help feeder road program which is also under

consideration).

Although Gualaco has most of the present population of the valley (7,032 persons in 1961, compared to 4,555 for San Estéban), San Esteban gives every indication of being more important economically, at least in terms of cash income. This is suggested not only by available information about air freight movements (see Table 9) but also by the comparative appearance of the two towns. In particular, San Estéban has the only reasonably large general store in the entire valley.

At present, San Estéban also produces some coffee, and supports some subsistence farming. It is also a moderately important center of cattle-raising, and produces some hogs (using local surpluses of corn). San Estéban's land appears to be mostly privately owned. Some of it is in large tracts that tend to be neglected by absentee owners, while much of the rest is in the form of "jointly-owned" properties, making economic utilization difficult.

Although the soil is somewhat better at the San Estéban end of the valley, it is generally poor (particularly in comparison with the resources of the Guayape or Aguán Valleys). However, there is a narrow flood plain along part of the Sico River, offering some promise as an area for corn and similar demanding crops. The natural vegetation over much of the valley floor is pine forest, most of which has been destroyed by the pine beetle epidemic. As a result of excessive burning and grazing, large areas have been converted into thin hardwood brush. Rainfall averages around 42 inches a year, with a relatively short dry season.

During the last year or two the San Esteban area has also shipped out important quantities of allspice (used as a substitute for pepper in Honduras), collected from wild growth in the mountains. However, the process of collection consists of chopping down the trees in order to reach the berries, and this resource should soon be exhausted.

Even though the area's resources are limited, the present population is so small that a substantial proportionate increase should take place once road communications are established. A tripling of population, to approximately 13,700 seems probable during the first decade after a road is built. This would bring the population of the San Estèban area to around 8 per square kilometer, or half the present national average.

1. Agriculture

a. Corn

The increased population would require approximately 1,600 tons of corn for its own use. Assuming an additional 3,500 hectares can be used for corn production, with a yield of one ton per hectare, there would be an annual surplus of 1,900 tons. However, some 500 tons might be required for pig-feeding, leaving a net of 1,400 tons for shipment to the interior of the country.

b. Beans

Beans should do comparatively well in the dry, poor soil of the San Estèban area. We estimate production on 3,000 hectares, at 0.7 tons per hectare, or 2,100 tons. Additional local consumption might amount to 225 tons, leaving 1,875 tons for sale. It is assumed that all of this would go to Puerto Castilla for export.

c. Rice

Past efforts to establish commercial rice-growing in the San Esteban region failed because of the lack of transportation for the product. However, rice should be a good crop for the area, since it grows on poor soil, and the abundant streams of the area could be used for irrigation without much difficulty. Assuming 500 hectares are planted to rice, with an average annual output of 5 tons per hectare (two crops a year), some 2,500 tons a year would be available for shipment to interior markets.

g/h. Citrus/pineapple

Some development of fruit production for export seems possible. As a guess, we assume 100 hectares, with an annual output of perhaps 50 tons per hectare (averaging pineapples and citrus). This might be processed into concentrate at Puerto Castilla, making 1,250 tons of exportable product.

i. Henequen

Henequen would be a good crop for the dry, poor soils of the Agalta Valley. A balanced economic unit would produce perhaps 2,000 tons a year on 3,000 acres. This would probably be shipped inland to meet Honduras' cordage requirements.

j. Coffee

San Estéban's present coffee production might be roughly estimated at 100 tons. An increase to perhaps 250 tons may be expected if additional population is attracted to the area by the construction of a road. Coffee from the Gualaco area would also tend to move to San Estéban, either by air or by mule, for truck shipment to Puerto Castilla. A figure of 100 tons is assumed.

2. Animal husbandry

a. Cattle

According to cattlemen in the San Estéban area, the number of cattle is now a small fraction of the peak reached around fifty years ago; one old-timer states (not necessarily correctly) that the present herds are only 10% of the number that used to graze in the valley. Reasons for the decline include some increase in rustling, and the tendency for more wealthy and more enterprising families to send their children out of the valley for education and subsequent careers. Since around 1959, the situation has been made much worse by the onslaught of the torsalo fly. The combination of torsalo fly attacks and a bad drought may cause a loss of up to 10% of an average herd.

The present cattle population of the valley may be roughly estimated at 20,000 (mostly at the San Estéban end ; cattle from the Gualaco area can move on foot without much difficulty to the San Estéban area.) In quality, these are midway between the relatively good cattle of the Lower Aguán and the poor cattle of the Guayape.

At present, cattle for market are usually walked to Gualaco and then across a moderate mountain range to San Francisco de la Paz. The weight loss in this movement is perhaps 10-12%. Representatives of the slaughterhouses at Catacamas and Tegucigalpa make regular buying trips into the valley, generally paying L. 0.01 per pound less than the posted price at the slaughterhouse in Catacamas.

Present annual production may be estimated at 3,000 steers,

3½ years old and weighing some 750 pounds. Availability of a road should encourage an increase in output of perhaps 60%, to 4,800 steers. Of these, 4,000 might go to Puerto Castilla while 800 go to Catacamas. The steers for Puerto Castilla would produce perhaps 400 tons of boned meat for export.

b. Pigs

San Estéban has become a fairly important producer of pork. Corn, worth as little as L. 2 per quintal at harvest time (compared to a minimum of L. 3-3.50 in the Guayape Valley) is fed to hogs in order to produce a higher-value product. Some meat is exported by air, using the twice-weekly services of SAHSA, and paying approximately L. 0.05 per pound to reach a market. In addition, approximately 500 live pigs a year are herded across the mountains to Dulce Nombre de Culmí, where truck transportation is available to complete the journey to market.

We estimate additional output of 1,000 pigs a year, weighing roughly 90 tons. Half of these would be shipped to Puerto Castilla for export (product weight: 35 tons) and half might be shipped live to inland markets.

3. Forest products

a. Lumber

Pine lumber is the most important natural resource in the Agalta Valley. Major pine areas are found on high ground along the Agalta Valley side of the Cerros del Ocoto-Sierra de la Esperanza, ending in the vicinity of the Esperanza Pass. Another important area is along the route San Estéban - El Carbón - Paso Real. Access from the valley floor to the edge of the pine areas

is generally easy, but the areas themselves lie in difficult to very difficult mountain terrain.

The two logical starting points for lumbering operations would be from the top of the Esperanza Pass, running west into the mountains along the north of the Agalta Valley, and from the vicinity of El Carbón, between the Sico River and San Estéban, going west into the mountains at the east end of the Agalta Valley. It seems reasonable to project one large mill (or equivalent) in each of these locations, producing 50,000 board feet a day each, 220 days a year. Each mill would have an annual output of 11,000 thousand board feet, weighing approximately 1.8 tons per thousand, or 19,800 tons per mill.

b. Naval stores

In accordance with II-C-3-b above, naval stores output of the Agalta Valley is estimated at 6,700 tons of products. Operations might be divided between the El Carbón area (tapping live pine) and San Esteban (processing beetle-killed butt logs and stumps).

c. Plywood, etc.

The plywood factory at Puerto Castilla is physically within the general area of the Aguán Valley, and at present draws most of its raw material from the mountains on the north bank of the Aguán. However, if the proposed road to the Esperanza Pass area is built, the factory will be able to expand, and plans to do so. In that case, the bulk of its raw materials will come from its concessions in the Esperanza Pass region, or the hardwood forests at the east end of the Agalta Valley. For this reason, the plywood

factory and possible associated industries are treated for our purposes as part of the Agalta Valley.

As is discussed in II-B-3-c above, the factory not only plans to expand output of plywood, but also to establish a particle board plant and a large hardwood lumber mill, producing 50,000 board feet a day. Total incoming hardwood raw materials would weigh 63,000 tons a year, while outgoing finished products would be approximately as follows:

Product	Total weight	To Interior	To port for export
Plywood	1,978	989	989
Particle board	6,250	4,688	1,562
Hardwood lumber	26,880	-	26,880

Incoming oil requirements would be 175,000 gallons a month, or roughly 8,000 tons a year, while chemical requirements would amount to perhpas 1,000 tons a year.

d. Charcoal

A charcoal plant would use the residue from lumber and plywood operations to produce perhaps 2,500 tons of charcoal for export.

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c. Guayape Valley

The Guayape Valley is often described as Honduras' "Wild West". The background is described as follows in a recent report by the National Agrarian Institute,

> "The history of the Department of Olancho has always been bloody, from the time of General Francisco Morazán, our Central American Paladin, to the present. The valley of the Guayape River is geographically located approximately in the center of this Department, and through its immense plain, roads, paths and ravines parade criminals

in flight from the law, savage hordes of revolutionaries, the interminable herds of cattle stolen by rustlers, while its mountains serve as a refuge for murdering bandits, and hear the cries of women exposed to profanation and rape."[1])

However, even this troubled area is now becoming civilized. Until a few years ago, cattle was a declining industry in the Guayape. Law and order had been declining during a period of fifty years or so, as population increased and the old days of the open range came to an end (a similar development took place in the "Wild West" of the United States). Cattle rustling made ranching unprofitable, and herds became smaller. The problem was so great that several years ago the government extension agency (STICA) decided to concentrate on pig-raising and to neglect the cattle industry in the valley, merely because it is more difficult to steal pigs than to steal cattle.

When the meat-packing plant was first opened in Catacamas a few years ago, buying both live animals and slaughtered carcasses, there was an immediate upsurge of rustling. In response to pressure from local cattle-growers, the packing plant then undertook to buy only live cattle, and strict precautions were taken to ensure purchase only from the actual owner. Rustling has now declined again, since it is limited to cattle that can be slaughtered for local sale.

With the improvement in prices that has resulted from the establishment of a slaughterhouse and construction of a road to

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1) Instituto Nacional Agrario, Departamento de Programación, "Situación Socio-Agroeconómica del Valle del Rio Guayape, por. Lic. Efraín Reconco Murillo & Ing. Agro. Fabio Gómez Romero," Tegucigalpa, November 1964.

the outside world, cattleowners are fencing their land, and taking greater precautions to prevent thievery. In addition, the Army has introduced some vigorous police measures, which have resulted in a visible improvement in law and order. Pistols, once a normal part of the male costume, have completely disappeared from public view.

The effect of the feeder road program in the valley on economic conditions has been discussed in detail in a previous report.[1] Despite some increase in production, only around 25% of the valley's total area is actually being used with reasonable intensity at present. The valley has a total area usable for agriculture of around 100,000 hectares, two-thirds flat and one-third rolling. For much of this area the logical future use is to grow corn, beans, rice and other staple foods to meet the growing needs of Honduras and El Salvador. However, such crops would move along the existing highway to Tegucigalpa, and would not be effected much by the proposed Northeastern Road.

To be sure, the Guayape area would benefit by a reduction in the cost of transportation of imports, but this seems unlikely to be an important stimulus for development.

On the other hand, the construction of the Northeastern Road will have a significant effect on production of beef, which is primarily for export, will make possible development of certain agricultural export crops, and will open up lumbering in the area of Dulce Nombre de Culmi.

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1) Continental-Allied Co., Inc., "Honduras Self-Help Feeder Road Program," Washington, 1964, pages 117 ff.

Rainfall in the Guayape is around 52" a year. The valley contains very fertile soils in a belt approximately 3 kilometers wide around the Guayape River , with average corn crops of 25 "cargas" (5,000 lbs.) of unshelled corn per manzana. Areas uphill from this belt are less fertile, and have less ground water available. They also seem to be affected by a seasonal unbalance between availability of nitrogen (which tends to encourage vegetative growth) and of potassium and phosphates (needed for the production of seed). During the season of heavy rains (first crop) minerals tend to be leached down into the subsoil, while microbiological activity and a consequent release of nitrates is encouraged. As a result corn develops vegetatively, but produces only small ears, and the crop (unshelled) amounts to 15 "cargas" (3,000 lbs.) of ears. On the other hand, during the season of less rain (second harvest) minerals seem to be brought to the root zone by capillary action, while the nitrate supply is reduced. Many plants fail to grow at all, and vegetative growth is small, but ears are large. The average crop may amount to 10 "cargas" (2,000 lbs) of ears per manzana.

The valley also contains large areas of flat clay soil, with poor natural drainage, suitable only for pasture.

There are ample opportunities for expansion of production by introduction of better methods. In particular, the Guayape Valley probably would benefit from some mechanization. At present, there are probably less than a dozen tractors in the entire valley (several of them at the World Gospel Mission's Agricultural School, "El Sembrador", near Catacamas.) Drainage and irrigation could

also produce important improvements, as could the construction of farm storage ponds and wells for cattle-watering.

The valley's population of 47,000 in 1961 is almost twice the population of 1950. As much as one-fourth of the present total, or half the increase, may consist of recent immigrants from other parts of Honduras and from El Salvador, attracted by the development of roads in the area. The present population could double again in a decade, for an estimated total of 94,000. Even with this increase, population would amount to only 7.6 per square kilometer, less than half the present average density for Honduras as a whole. The population of the tributary Guayape uplands, presently 35,000, is not expected to increase as rapidly. We estimate an increase by perhaps 10,000 during the next deacde, for a total of 45,000. To this may be added the population of Gualaco, which would communicate with the outside world primarily by way of the San Francisco de la Paz and the Guayape Valley if our recommendations are followed as to the route of the Northeastern road. That population now stands as 7,000 and might increase to perhaps 10,000. The grand total of population of the area would then be 149,000.

1. Agriculture

g/h. Citrus/pineapple

With the establishment of direct access to the sea, development of citrus and/or pineapple production should become feasible in the Guayape Valley. Assuming 50 tons of fruit per hectare as a rough average of citrus and pineapple output, and some 500 hectares, the total output per annum would be 25,000 tons a year.

Under these circumstances, the Guayape would be likely to develop its own processing industry. If this produces a mixture of full-weight products (such as pineapple slices) and concentrates, the annual export tonnage might be 12,500 a year.

k. Sisal

Particularly if land does not become available in the Middle or Lower Aguán, a sisal enterprise would be feasible in the Guayape. A balanced unit would produce 1,350 tons a year, all for export.

l. Coffee

Present coffee output of the Guayape area might be estimated at 300 tons a year, and a doubling of output seems a reasonable expectation once transportation costs to an ocean port are reduced.

m. Cotton

Some 200 manzanas of cotton have been planted in the vicinity of Catacamas, mostly in rented land by entrepreneurs from El Salvador. Initial results were very promising, and have led to plans for a rapid expansion of production. However, except in favorable years, rainfall in this area is likely to last into the cotton harvest season, with consequent spoilage of a part of the crop. It therefore seems doubtful that a large area will continue to be devoted to cotton.

2. Animal husbandry

a. Cattle

Cattle population in the Guayape Valley is estimated at around 15,000 head. As in the Agalta Valley, it is down to a

fraction (possibly one-third) of what it was fifty years ago, when a cattle boom was stimulated by the growing demand of the banana areas for meat. The decline is partly due to the breakdown of law and order, and partly to economic reasons: the price of a steer went down from L. 20-30 to L. 10 towards the end of World War II. However, the development of meat exports has resulted in a powerful stimulus for increased production: at present the price of a steer has risen above L. 70, or above its prewar peak in terms of purchasing power. At Catacamas, the price per pound of live weight has risen from L. 0.075 in 1962 to L. 0.175 today. If the valley obtains a direct outlet to the sea, this price should go up even more; at present frozen meat is shipped 600 kilometers from Catacamas to Puerto Cortés by way of Tegucigalpa, at a cost of $0.037 per pound (dressed weight). This would be reduced by more than one-half once direct access to Puerto Castilla becomes available. In terms of live weight, that would permit an increase of perhaps L. 0.01 per pound in the price paid to the cattleman.

At present the annual output of the Guayape area may be estimated at around 4,000 animals a year (four years old or older). The slaughterhouse at Catacamas is killing approximately 4,500 a year, drawing from both the Guayape and the Agalta Valleys, and from the Guayambre Valley to the south. In addition, a slaughterhouse at Tegucigalpa draws important supplies from the valley. The total offtake appears to be exceeding the annual production, and cattle population is going down (at least temporarily). On the other hand, the stimulus of higher prices is beginning to lead

to improvements (e.g. fencing of additional pasture and purchase of Brahmin bulls) which should help to increase production in the future.

According to the records of one cattle-buyer in the area, the average animal is killed at a weight of 564 pounds, with a yield of 181 pounds, or only 32.1%. Other slaughterhouses in more favored areas report yields of up to 38%. The low yield on light-weight cattle is reflected in the slaughterhouse's price schedule, which allows L. 0.135 per pound for an animal between 551 and 600 lbs., and L. 0.185 per pound for an animal with 951-1,000 pounds of live weight.

To reach a weight of 550-600 pounds in the Guayape Valley under present conditions requires around four years, with an annaul rate of gain of perhaps 100-150 pounds a year. A 1,200 pound animal (normal slaughter weight in the U.S. after around two years) is usually eight years or more old.

With relatively minor improvements in methods, it should be possible to double the cattle population, to increase the annual crop to perhaps 10,000 per year, and to increase the average slaughter weight to 750 pounds. This would permit the Catacamas slaughterhouse to produce 1,200 tons of frozen boned meat from the Guayape Valley alone. The superior access to the sea via the new Northeastern road would tend to eliminate competition from Tegucigalpa or other interior slaughterhouses. In addition, the Catacamas slaughterhouse might draw some 800 cattle from the Agalta Valley, and another 2,000 a year from the Guayambre, Patuco, Guampú, and other interior valleys, producing possibly 336 tons of

boned meat for export.

b. Hogs

Although an increase in pig production is likely, this would probably go to interior markets.

3. Forest products

The Guayape Valley contains pine forests along the southern and western mountain walls, and at the eastern end running up towards Dulce Nombre de Culmi. Particularly in the Dulce Nombre area, grazing and annual burning have largely eliminated reproduction, so that the parts of the area look more like pine-studded pasture than forest. The north wall of the valley (up to and across the summit of the Sierra del Agalta) is covered with a dense growth of tropical rain forest. This includes valuable hardwoods, such as Honduras mahogany and guanacaste, as well as less valuable species. Until direct access to the sea is constructed, these forests will remain economically beyond the reach of export markets.

We assume that the new road will permit the development of two pine lumber mills in the Dulce Nombre area, each producing 25,000 board feet a day or a total of 11,000 thousand board feet a year, with a total weight of 19,800 tons. In addition, at least one hardwood mill might be supplied from the Sierra del Agalta, producing 15,000 board feet a day (3,600 thousand board feet a year), with a total weight of 8,134 tons (hardwood is expected to weigh somewhat more per thousand board feet than pine.)

D. Recapitulation and overall Traffic Estimates

In the following table, estimates made in previous sections of the report are brought together to provide an overall estimate of traffic volume and value added in production of additional output. An allowance is also made for incoming freight (consumer goods, petroleum products, building materials, farm supplies, etc.). This is estimated at 75 pounds per capita of imported products, plus 75 pounds per person of locally-manufactured goods for the Aguán Valley (which will continue to draw some of these supplies via the Standard Fruit Co. railroad from La Ceiba), and 125 pounds per person of locally-manufactured goods for the San Estéban area. It is assumed that local manufactures will continue to move via the existing road from Tegucigalpa to supply the Guayape Valley.

To cover the possibility that restoration of bridges along the Aguán Valley will not form part of the project, an alternative total is developed excluding that part of the estimated development in the Aguán which seems to depend on restoration of land communications and on the development of commercial agriculture. Limited development (including cattle, corn, beans, rice, etc.) is expected to take place solely as a result of the construction of the road between Puerto Castilla and Dulce Nombre de Culmí, plus the port at Castilla.

Table 28
Estimate of Major Traffic Generated by Northeastern Road
In Lempiras and Metric Tons

	Present Shipments (Tons)	Transport Cost Saving (L.)	Additional Production: Quantity (Tons)	Additional Production: Gross Value (L.)	Additional Production: Net Added (L.)	Traffic: To Port[1] (Tons)	Traffic: Ocean Oceight (Tons)	Traffic: To Interior (Tons)	Ton-kilometers: To Castilla[1] ('000)	Ton-kilometers: To Dulce Nombre ('000)	Suggested Discount (%)
A. Aguán											
1. Agriculture											
a. Corn	1,000	33,000	11,000	1,089,000	816,750	12,000	-	5,000	600	720	0
b. Beans	1,000	33,000	2,000	528,000	396,000	3,000	1,000	-	150	-	0
c. Rice	750	24,750	6,000	2,640,000	1,760,000	6,750	-	5,625	337	810	20
e. Winter vege.	-[2]	-[2]	5,400	1,200,000	900,000	5,400	5,400	-	270	-	50
f. Bananas	-[2]	-[2]	14,333	2,100,000	1,400,000	14,333	14,333	-	717	-	50
g. Citrus	-[2]	-[2]	22,000	2,904,000	2,323,200	22,000	13,750	-	1,100	-	50
h. Pineapples	-[2]	-[2]	5,160	451,500	361,200	5,160	2,120	-	258	-	30
i. Cacao	20	660	100	110,000	88,000	120	120	-	6	-	0
j. African oil palm	0	0	5,600	2,800,000	1,960,000	5,600	5,600	-	280	-	50
k. Sisal	0	0	1,350	1,012,500	607,500	1,350	1,350	-	135	-	50
l. Manila hemp	0	0	2,270	2,156,500	1,509,550	2,270	2,270	-	114	-	50
Subtotal	2,770	91,410	75,713	16,991,500	12,122,200	77,983	57,233	10,625	3,967	1,530	
Discounted subtotal	2,770	91,410	46,989	10,241,550	7,311,715	49,609	23,956	9,500	2,514	1,368	
2. Livestock											
a. Cattle											
1) Upper Aguán	1,200	26,400	600	240,000	216,000	1,800	-	-	180	-	0
2) Lower Aguán	825	17,600	412	181,280	163,152	1,237	-	-	62	-	0
3) Feedlots	0	0	4,360	701,190[3]	631,071	4,360	1,526	-	44	-	30
4) Cheese	-[2]	-[2]	500	550,000	440,000	500	-	500	25	72	0
b. Pigs	450	14,850	1,800	1,200,000	600,000	2,250	1,300	-	112	-	0
Subtotal	2,475	58,850	7,672	2,872,470	2,050,223	10,147	2,826	500	423	72	
Discounted subtotal	2,475	58,850	6,364	2,662,113	1,860,902	8,839	2,368	500	410	72	

Table 28

	Present Shipments (Tons)	Transport Cost Saving (L.)	Additional Production: Quantity (Tons)	Additional Production: Gross Value (L.)	Additional Production: Net Added (L.)	Traffic: To Port[1] (Tons)	Traffic: Ocean Freight (Tons)	Traffic: To Interior (Tons)	Ton-kilometers: To Castilla[1] ('000)	Ton-kilometers: To Dulce Nombre ('000)	Suggested Discount (%)
3. Forest products											
Hardwood lumber (Sabá)	0	0	8,134	1,080,000	648,000	8,134	8,134	-	569	-	20
Discounted subtotal	0	0	6,507	864,000	518,400	6,507	6,507	-	455	-	
4. Incoming traffic											
Per capita	5,720	126,000	2,580			8,300	4,150	4,150	415	598	
Industrial supplies[4]	-	-	1,000			-	1,000	-	-	-	
Total incoming	5,720	126,000	3,580			8,300	5,150	4,150	415	598	
Discounted outgoing	5,245	150,260	59,860	13,767,663	9,691,017	64,955	32,831	10,000	3,379	1,440	
Total traffic	10,965	276,260	63,440			73,255	37,981	14,150	3,794	2,038	
B. Agalta											
1. Agriculture											
a. Corn	-[2]	-[2]	3,500	367,500	275,625	-	-	1,400	-	64	0
b. Beans	-[2]	-[2]	2,700	702,000	526,500	1,875	1,875	-	257	-	30
c. Rice	-[2]	-[2]	2,500	1,117,500	745,000	-	-	2,500	-	115	40
g/h Citrus/pineapple	0	0	5,000	475,000	380,000	5,000	1,250	-	685	-	50
k. Henequen	0	0	2,000	1,028,000	616,800	-	-	2,000	-	92	50
l. Coffee	150	10,500	200	220,000	176,000	350	350	-	48	-	0
Subtotal	150	10,500	15,900	3,910,000	2,719,925	7,225	3,475	5,900	990	271	
Discounted subtotal			10,590	2,480,900	1,770,575	3,987	2,287	3,900	570	179	
2. Livestock											
a. Cattle	1,022	30,000	613	216,550	194,895	1,308	400	327	179	15	0
b. Pigs	50	7,000	91	60,000	30,000	45	30	45	6	2	0
Subtotal	1,072	37,000	704	276,550	224,895	1,353	430	372	185	17	
3. Forest products											
a. Lumber (pine)											
1) Esperanza Pass, etc.	0	0	19,800	1,903,000	1,046,650	19,800	19,800	-	1,485	-	20
2) El Carbón, etc.	0	0	19,800	1,859,000	1,022,450	19,800	19,800	-	2,178	-	20
b. Naval stores											
1) Esperanza Pass, etc.	0	0	3,350	1,740,000	1,392,000	3,350	3,350	-	251	-	20

Table 28

	Present Shipments (Tons)	Transport Cost Saving (L.)	Additional Production: Quantity (Tons)	Additional Production: Gross Value (L.)	Additional Production: Net Added (L.)	Traffic: To Port[1] (Tons)	Traffic: Ocean Freight (Tons)	Traffic: To Interior (Tons)	Ton-kilometers: To Castilla[1] ('000)	Ton-kilometers: To Dulce Nombre ('000)	Suggested Discount (%)
2) San Estéban, etc.	0	0	3,350	1,700,000	1,392,000	3,350	3,350	-	459	-	20
c. Plywood Complex (Puerto Castilla)											
1) Raw material	3,500	0	59,500	-[6]	-[6]	63,000	-	-	4,410	-	20
2) Plywood	495	0[7]	1,483[8]	1,112,250	667,350	989	989	989	0	181	0
3) Particle board	0	0	6,250[8]	2,187,500	1,312,300	1,562	1,562	-	0	858	0
4) Hardwood lumber	0	0	26,880[8]	3,125,600	1,875,360	26,880	26,880	-	0	-	20
5) Charcoal	0	0	2,500[8]	300,000	210,000	2,500	2,500	-	0	-	20
Subtotal	3,995	0	105,800	13,927,350	8,896,110	141,231	78,231	5,677	8,783	1,039	
Discounted subtotal			84,640	11,801,830	7,510,818	113,495	63,095	5,677	7,026	1,039	
4. Incoming traffic											
Per capita	300	19,800	943			466	466	777	36	36	
Industrial supplies[5]	100	0	10,650			3,000	10,650	-	300	-	
Total incoming	400	19,800	11,593			3,466	11,116	777	336	36	
Discounted outgoing	5,217	47,500	95,934	14,559,280	9,508,288	118,835	65,812	9,949	7,781	1,235	
Total traffic	5,617	67,300	107,527			122,301	76,928	10,726	8,117	1,271	
C. Guayape											
1. Agriculture											
g/h. Citrus/pineapple	0	0	25,000	2,500,000	2,000,000	12,500	12,500	-	2,287	-	30
k. Sisal	0	0	1,350	992,000	595,200	1,350	1,350	-	247	-	50
l. Coffee	300	21,000	300	330,000	264,000	600	600	-	110	-	0
Subtotal	300	21,000	26,650	3,822,000	2,859,200	14,450	14,450	-	2,644	-	
Discounted subtotal	300	21,000	18,475	2,576,000	1,961,600	10,025	10,025	-	1,834	-	
2. Livestock											
a. Cattle[9]	400	35,200	1,136	1,250,000	875,000	1,536	1,536	-	281	-	0
3. Forest products											
a. Lumber											
1) Pine	0	0	19,800	1,683,000	925,650	19,800	19,800	-	3,623	-	20

Table 28

	Present Shipments (Tons)	Transport Cost Saving (L.)	Additional Production: Quantity (Tons)	Additional Production: Gross Value (L.)	Additional Production: Net Added (L.)	Traffic: To Port (Tons)	Traffic: Ocean Freight (Tons)	Traffic: To Interior (Tons)	Ton-kilometers: To Castilla ('000)	Ton-kilometers: To Dulce Nombre ('000)	Suggested Discount (%)
2) Hardwood	0	0	8,134	1,016,750	610,050	8,134	8,134	-	1,489	-	20
Subtotal	0	0	27,934	2,699,750	1,535,700	27,934	27,934	-	5,112	-	
Discounted subtotal	0	0	22,347	2,159,800	1,228,560	22,347	22,347	-	4,090	-	
4. Incoming traffic											
Per capita	3,030	106,050	2,043			5,073	5,073	-	928	-	
Industrial supplies	-	-	2,000			2,000	2,000	-	366	-	
Total incoming	3,030	106,050	4,043			7,073	7,073	-	1,294	-	
Discounted outgoing	700	56,200	41,958	5.985,800	4,065,160	33,908	33,908	-	6,205	-	
Total traffic	3,730	162,250	46.001			40,981	40,981	-	7,499	-	
D. Grand total (3 valleys)	20,312	505,810	216,968	34,312,743	23,262,465	236,537	155,890	24,876	19,410	3,309	
E. Less: Roadbound Aguán traffic[10]	8,805	196,275	36,460	6,941,000	4,852,925	41,180	32,906	4,150	2,222	598	
Total (2 valleys)	11,507	309,535	180,508	27,371,743	18,409,540	195,357	122,984	20,726	17,188	2,711	

1) Or within Aguán Valley
2) Subsistence production not estimated
3) Value of additional weight
4) Banana boxes (1303 tons)and other packaging materials discounted 50%
5) Plywood mill requirements (9000)tons), discounted 15%, plus allowance for sawmills, etc.
6) Included in finished product
7) Chief saving is in convenience and reduced damage; not readily measurable
8) Omitted from total to avoid double counting
9) Boned meat from Catacamas slaughterhouse
10) 1 e, f, 80% of g and h, j, k, l, 3 and 4, plus half of remaining transport cost saving.

E. Anticipated Economic Benefits

1. Increase in special tax receipts (gasoline, customs duties, etc.

According to the Stanford Research Institute Report[1)] special taxes per ton-kilometer of freight average L. 0.03. However, this average would probably be high for the bulk cargo movements expected for the Northeastern Road as a whole, and a figure of L. 0.02 will be used. No special projection is made for passenger traffic, which in general amounts to 20% of typical vehicle counts in Honduras. However, as a conservative estimate we add 20% to the figure for taxes per ton-kilometer of freight, making the latter L. 0.022.

Table 28 shows estimated total freight ton-kilometers of 22,719,000 if the Aguán Valley bridges are included in the program, and 19,899,000 without that part of the program. Reducing these figures by one-half, we arrive at revenue estimates of L. 249,909 and 218,889 respectively.

In addition the Northeastern Honduras Transportation Program might claim some part of the increase in special tax revenues from additional traffic on the road from Dulce Nombre de Culmí to the interior. However, this will be omitted from the present estimate.

The government would also receive stumpage and export taxes on lumber. Stumpage is estimated at L.. 532,400 for pine and L. 259,200 for hardwood cut from national lands (excluding plywood mill hardwood cut from their own concession). The export tax on pine is estimated at L. 156,400, and the total amounts to L.948,000.

If the Aguán bridges are not built this estimate might fall to L. 818,400.

Finally, port charges at Puerto Castilla would also go to the government. These are difficult to estimate, since decisions will have to be made as to the rates that will apply to certain commodities which are not now produced. However, as a guess, we assume that lumber will bring in L. 21,380, manufactured export products will be charged at L. 275,000, and import cargo will yield L. 76,700 wharfage charges. In addition, charges on vessels (docking fees, etc.) might be estimated at L. 30,000 a year for a total of L. 403,080. This figure is arbitrarily reduced by 50%, making an estimate of L. 201,540. If the Aguán bridges are not built, the figure might be reduced to L. 150,000. The grand total of special tax receipts would thus be L. 1,300,449 and L. 1,187,289 respectively.

2. Increase in general tax receipts resulting from increased economic activity.

The increase in value added as a result of the project is estimated (in 4, below) at L. 22,209,605 and L. 12,529,182, depending on whether the Aguán bridges are built. In addition, of course, there will be some "multiplier effect", or increase in other incomes resulting from the initial increase in incomes. In general, the "multiplier" under Honduran conditions is likely to be fairly low since much of any additional national income is siphoned off to pay for imports, before it has a chance to stimulate much additional local activity. On the other hand, an important part of the increase in production will be for export (e.g. lumber,

winter vegetables,palm oil) thereby tending to increase the "multiplier" resulting from this project.

As a conservative estimate, we assume that the multiplier will be only 1.5, so that gross domestic income will increase by L. 33,314,407 and L. 18,993,773 a year. In 1962, the average tax burden on the gross national product was as follows:

Indirect taxes	L. 64.0 million
Direct taxes on corporations	7.4
Direct taxes on individuals	4.2
Other current transfers	0.5
	76.1

This amounted to 8.9% of the gross domestic product of L. 852.2 million. It might be argued that the marginal tax rate collected from additional income might be higher. However, as a conservative estimate we assume that general tax receipts will increase by 8.9% of the above figures, or L. 2,964,982 and L. 1,690,446 respectively.

3. Reduction in transportation costs.

According to Table 28, the reduction in transportation costs is estimated at L. 505,810, if the Aguán Valley bridges are included, and L. 309,535 if they are not. These figures seem sufficiently probable so that they may be allowed to stand without further reduction.

4. Increased income effect.

In order to estimate the income effect of the projected increase in rural population, we have made an independent estimate of rural per capita income, based on unpublished raw data on consumption prepared by the Department of Economic Studies of the Central Bank of Honduras. In order to make this estimate, a number of arbitrary divisions of global figures were undertaken by

our own staff, and the Central Bank should not be held responsible for any defects in the results.

Table 29 gives these results. The total of L. 259.07 per capita is only around 60% of the estimated per capita gross national product at market prices for the country as a whole, and this proportion seems to be in line with the known fact that living standards are higher in urban areas.

As has been indicated above, population is expected to increase by 38,000 in the Aguán region, and by 9,140 in the San Esteban area; the projected increase in the Guayape area is likely to take place as a result of existing roads, and cannot be attributed to the Northeastern program. If the bridges are not restored in the Aguán Valley, the population increase in that area might be limited to 10,000. These increases appear so likely that they will not be reduced. The corresponding increases in income may be estimated as L. 12,212,560 with the Aguán Valley bridges and L. 4,958,600 without that part of the program.

Increases estimated on the basis of per capita rural income and total population would largely reflect subsistence production. In addition, there will be an important value added by commercial agriculture, forestry and manufacture (fruit for export, African oil palm, lumber, naval stores, etc.). As a rough adjustment to avoid double counting, we deduct the estimated discounted value added for subsistence-type crops (corn, beans and rice in the Aguán; corn and beans in the Agalta), totalling L. 3,268,375, from the value added totals in Table 28. The remainders, L. 19,994,090 with the Aguán bridges and L. 15,141,165 without them, are then

Table 29

Estimated Rural Per Capita Annual Income
at Normal Market Prices,
in Lempiras

	Pounds per Capita	Price or Value per pound	Total Value
a. Consumption			
Corn	392.8	0.08	31.44
Bread	31.1	0.18	5.58
Rice	20.5	0.20	4.00
Sorghum	28.8	0.06	1.69
Subtotal			42.91
Beans	39.6	0.12	4.95
Beef	12.1	0.45	5.40
Pork	3.0	0.61	1.83
Poultry, fish, etc.	-	-	5.57
Subtotal			17.75
Cheese	16.2	0.65	10.53
Butter, lard, etc.	10.6	0.85	9.01
Eggs (dozen)	9.4	0.80	7.52
Milk (liters)	26.8	0.18	4.82
Subtotal			21.88
Other vegetables	77.7	0.07	5.19
Bananas & plantains	713.3	0.04	27.66
Other fruits	51.1	0.09	4.60
Subtotal			37.45
Sugar & honey	35.4	0.15	5.45
Coffee	17.3	0.63	10.90
Salt, vinegar			1.47
Imported foodstuffs			2.46
Subtotal			20.28
Soft drinks			5.00
Liquor			10.00
Beer			5.00
Cigarettes			7.00
Subtotal			27.00
Clothing			12.00
Furniture & household goods			7.00
Housing			14.92
Firewood			11.33
Subtotal			45.25
Miscellaneous family expenses			6.00
Personal care & health			8.00
Transportation & communications			6.00
Recreation & amusement			3.00
Subtotal			23.00
Total consumption			235.52
b. Savings, errors & omissions, 10%			23.55
Estimated Total Net Income		L.	259.07
		$	129.54

Source: Our estimate, based on raw data supplied by the Department of Economic Studies of the Central Bank of Honduras

divided in half. The overall totals of national income resulting directly from the project are then estimated at L. 22,209,605 and L. 12,529,182 respectively.

5. Lower costs of other planned development projects.

The two development projects most likely to be affected by the proposed Northeastern Honduras transportation program are a pulp and paper industry and the colonization (agrarian reform) of the Aguán Valley. A large pulp and paper industry, if it is located to draw raw materials from the eastern end of the Agalta Valley, probably would use the road between San Estéban and Puerto Castilla, and the port facilities at Castilla. However, the volume of traffic would be substantially larger than is projected in the present report, and might be roughly estimated as follows:

a. Port traffic

25,000	metric tons of	chemicals
120,000	" " "	fuel oil
7,500	" " "	mixed cargo
150,000	" " "	pulp and paper
45,000	" " "	(25 million board feet) pine lumber
347,500		

b. Road Traffic

400,000	metric tons of pulpwood
120,000	metric tons of sawwood
520,000	

It would therefore be necessary to expand the port and upgrade the proposed road. However, none of the proposed investment is likely to become a net loss in the process.

The proposed colonization project in the Lower Aguán would utilize the bridges along the Aguán (if built as part of the present program), the bridge across the Aguán, and the port at Castilla. Construction of these facilities as part of the North-

eastern Honduras Transportation Program would also make it possible to begin the colonization effort on a small scale, without waiting for development of a comprehensive plan for the valley as a whole.

6. Gains by opening new land for settlement by unemployed or underemployed.

Assuming an average of five members per family, the increase in population by 47,140 and 19,140 respectively should reflect full-time direct employment of 9,428 and 3,823 farmers or industrial workers.

PART III

ENGINEERING ASPECTS AND TECHNICAL SOUNDNESS

A. Present and Future Traffic Generating Activities.

This topic has been covered in Part II, above.

B. Traffic Capacities

The ton-kilometer estimates made in Part II suggest vehicle counts of as high as 250-300 per day on the more heavily travelled sections of the road However, since the purpose of the road is developmental, and since traffic will not immediately reach any such intensity even under very favorable circumstances, we recommend design to much lower criteria, with the expectation that heavy maintenance or up-grading programs can be undertaken to raise standards as traffic actually materializes.

C. Justification of the Scope of Improvement.

See Part II, above.

III-1. Report on Road Engineering by
Brown & Root, S.A.

SAN ESTEBAN-COROCITO HIGHWAY PROJECT

D - Design Criteria

Average daily traffic (ADT), pavement and bridge loadings, and design speed.

Average Daily Traffic	80 vehicles per day
Pavement and bridge loadings	H15S12
Design Speed - Flat	70 Kms.p.h. (45 m.p.h.)
Rolling	55 Kms.p.h. (35 m.p.h.)
Mountain	40 Kms.p.h. (25 m.p.h.)

Maximum grade, minimum radius of curvature, minimum sight distance and minimum length of vertical curve.

Maximum grade	10%
Minimum radius of curvature	12° (10 meters arch.)
Minimum sight distance	50 meters
Minimum length of vertical curve	80 meters

Number of traffic lanes. 2

Width of lanes	5.50 m. (18')
Shoulders width	0.90 m. (3')
Right-of-way	30.00 m. (100')

Maximum height of embankment. 15 m. (50')

Criteria used to determine types of stream crossings.

In view of availability of materials along the project, and local familiarity with masonry work, it is recommended that abutments and headwalls be constructed of stone masonry.

Inasmuch as the road is to be constructed on permanent alignment, it is believed desirable to construct all bridge superstructure of concrete or steel, giving preference to concrete in view of maintenance problems.

Culverts will be corrugated metal or concrete pipes, taking into consideration the local conditions as aggregate availability, salt air due to the proximity of the sea, etc. Metal pipe with bituminous coating.

Minimum and maximum side slopes for cuts.

Minimum side slope	1:1
Maximum side slope	$\frac{1}{4}$:1

Minimum and maximum side slopes for fills.

Minimum	3:1
Maximum	$1\frac{1}{2}$:1

Unit stresses for structural design.

According to AASHO specifications for Highway Bridges eight edition (1961)

E. Surveys and Preliminary Plans

Description of extent of preliminary studies and surveys used to arrive at proposed location.

The preliminary alignment was traced on photogrammetric sheets with a scale of 1:12,000, and contour lines at 10 meter intervals. These sheets were obtained from aerial photographs taken by the U.S. Army Map Service, at an altitude of 30,000 feet, and the horizontal and vertical controls were established by the Cartographic Office of the Republic of Honduras.

Preliminary alignment map.

Exists.

Preliminary plan-profile drawings.

Exist, and will be definitely determined by Mark Hurd.

Rainfall and runoff data.

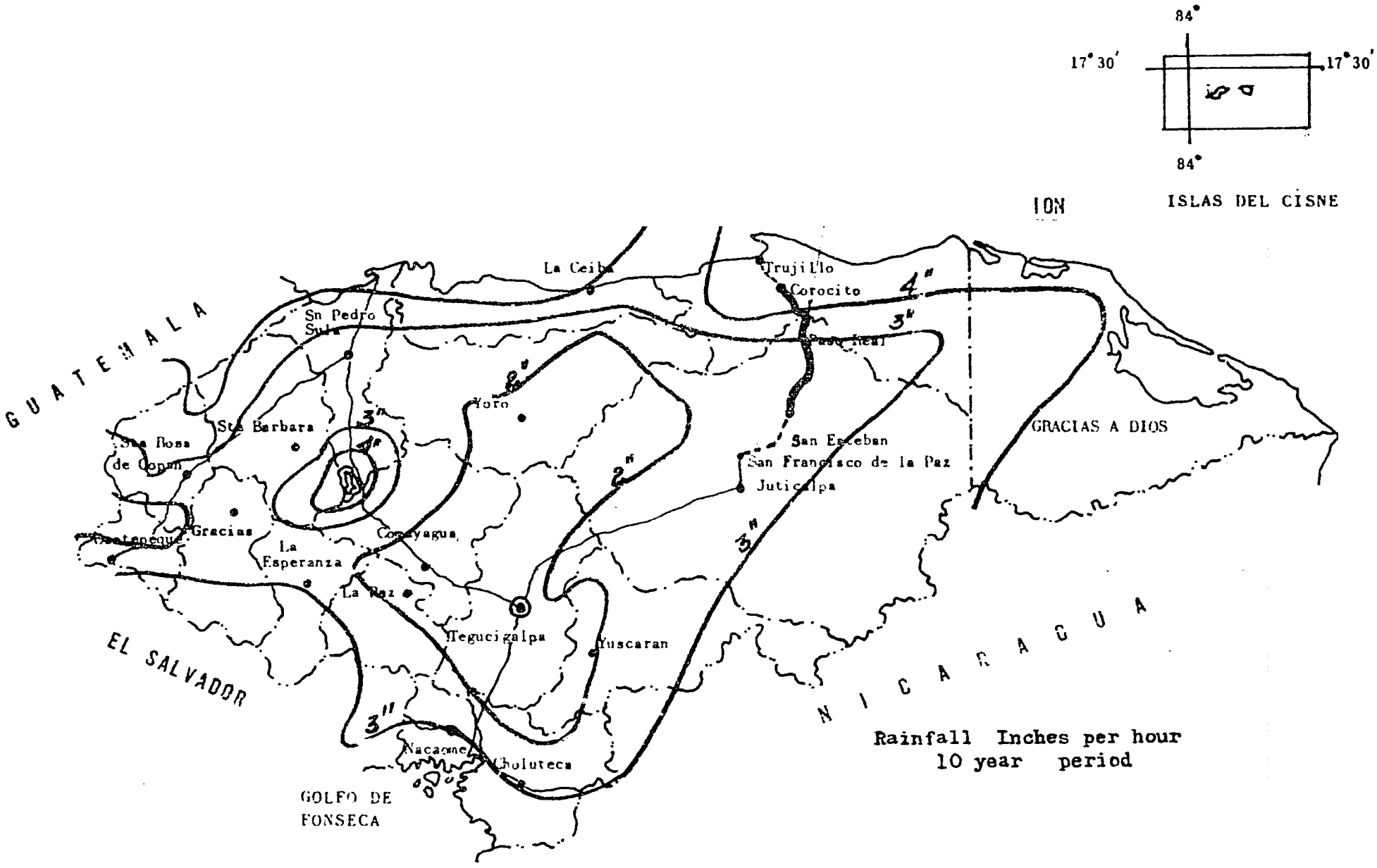
A map of annual isohyetes and another of isohyetes of intensity have been prepared, and are attached.

Location sketches for major new structures.

It will be necessary to construct eight major structures across the following rivers: Grande, Sinuape, Coronado, Tonjagua, Conquire, Sico, Bonito and Aguan. These structures will have the following lengths respectively: 50, 70, 50, 50, 50, 100, 40 and 180 meters. The piers of a former railroad bridge exist in the Aguan River.

Reconnaissance mapping for route selection has been developed and there are no preliminary plans for modification of existing structures, construction of new structures and miscellaneous drainage. Soils investigations have not been made and the project would not require any major safety features.

MAPA DE LA REPUBLICA DE HONDURAS



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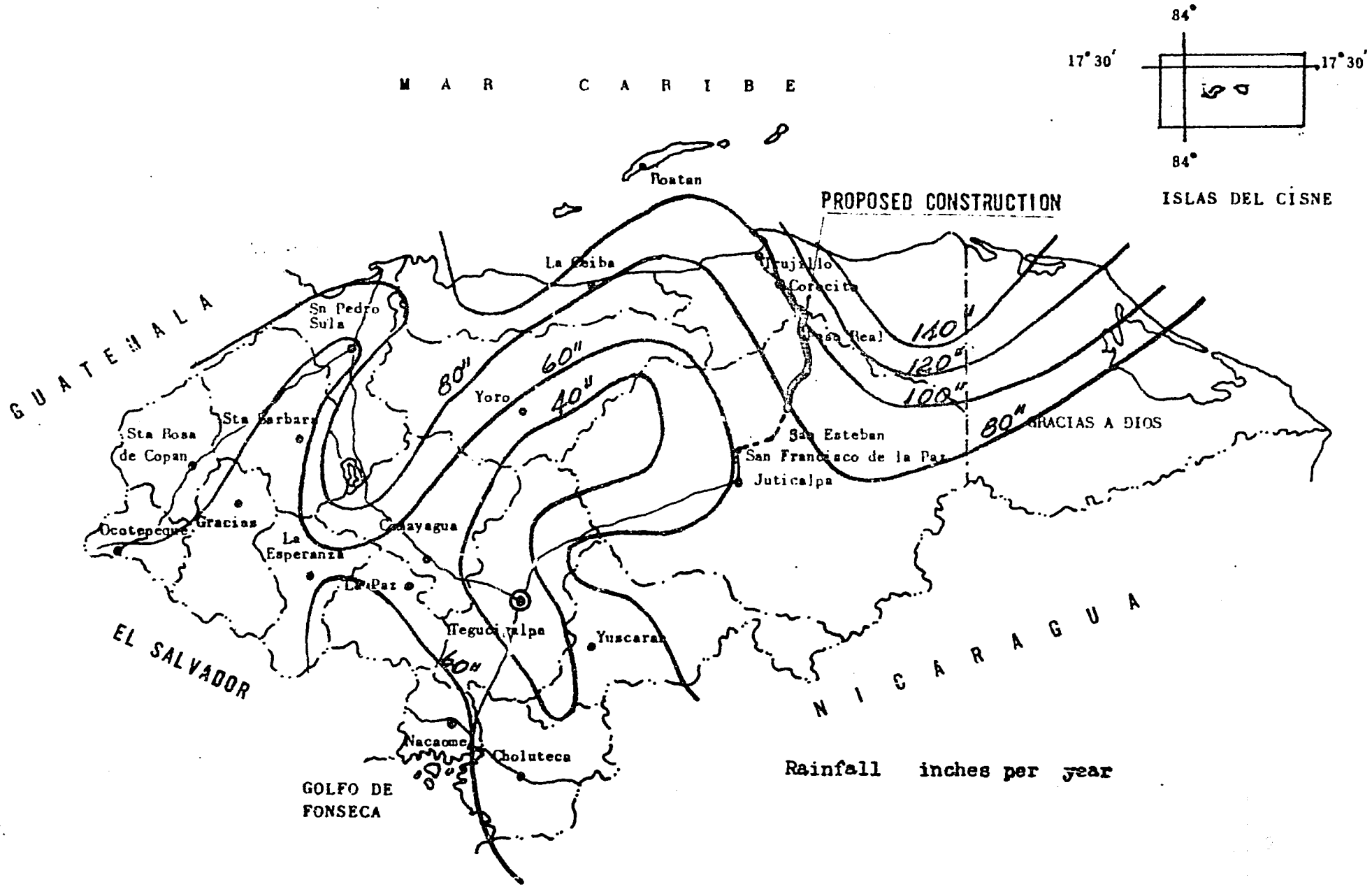
MAR CARIBE
Roatan
PROPOSED CONSTRUCTION
ISLAS DEL CISNE
84°
17°30'
17°30'
84°
La Ceiba
Trujillo
Corecita
Sn Pedro Sula
GUATEMALA
Sta Rosa de Copan
Sta Barbara
Yoro
80"
60"
40"
140"
120"
100"
80"
GRACIAS A DIOS
San Esteban
San Francisco de la Paz
Juticalpa
Ocotepeque
Gracias
La Esperanza
Comayagua
La Paz
Tegucigalpa
Yuscaran
EL SALVADOR
NICARAGUA
60"
Nacaome
Choluteca
GOLFO DE FONSECA
Rainfall inches per year

F - Construction Standards

No unusual specification standards will be required.

G - Availability of Local Resources and Equipment

Skilled and unskilled labor, as well as technical supervisory personnel is available in Honduras. Contractors and subcontractors, both foreign and local, are now continuing operating in the country. For this project, there are no existing housing facilities, but there are numerous locations where suitable housing can be developed. Aggregate, water and base course materials are available in the vicinity of the project and cement is manufactured in the Department of Cortés. Steel pipe and foreign imports that could be received at Puerto Castilla. Construction equipment would, in part, be from local sources and, in part, from foreign imports. There would be no special training required to develop maintenance and the local Government budget and laws are adequate for maintenance and continued operations of this facility.

H - Special Construction Problems Foreseen

The rainy season extends through nine months of the year and only the months of February, March and April are considered dry months. The average annual rainfall is 100 inches and the maximum intensity of the rainfall is 4 inches per hour. The periods of daylight are normal for 15° of latitude and, therefore, would have no particular effect on construction schedules, equipment use and the labor forces. The route is through virgin country and there are no traffic problems. Imports of equipment and material are mainly from the U.S. with a shipping time of approximately one week and this does not develop long load-time. The region would be subject to slides and floods, but not to earthquakes. Labor troubles and political disturbances could cause delays. This is not a plant that would require special tools for continued operation.

I - Plan for Execution of Project

General plans for construction operation, grading operation, surfacing and paving operations, construction methods, etc. have not been developed. Contracting for engineering services is proposed as is the contracting for construction. The construction will be covered by public bidding and contractors will be covered by the normal bond requirements.

J - Maintenance Organization

The Government of Honduras has a satisfactory maintenance organization with trained personnel, equipment and finances that are provided for in each yearly budget.

III-2. Report on Puerto Castilla from U.S. Navy Engineer

MEMORANDUM

September 21, 1964

TO: Mr. Newell F. Williams, Director USAID/W

FROM: Luis F. Santiago Echegaray
Civil Engineer
Area Public Works - CARIB
10th Naval Dist. - San Juan, Puerto Rico

This report is concerned with the need for development of Puerto Castilla.

At this port, once existed a large pier. To date what is left is a section of 22 meters long with a concrete deck badly damaged by weather action and by hurricane Ana in 1962. The Texaco Co. still uses this section and had installed 2" pipes for fuel and another line for potable water which this last is always leaking. The physical conditions of the pier offered no security and its repairs are worthless. Records indicate that this pier has been abandoned since 1938.

This country is in a long-range development and after contacting the following companies representatives and members of the Honduran Government it is imperative to provide port facilities in this cape Honduras site. It is estimated that the annual general cargo would amount to about 20,000 metric tons in 1966. Presently the "North Packing Co." "Empacadora del Norte", is remodeling and adapting existing building providing refrigerating rooms. The theoretical exporting figure of 100 tons per month is expected to start with by the end of this current year.

The Honduras Plywood Co. is another factory within this site, and actually is working under its design capacity due to port facilities. Its monthly production should be around 1,000,000 feet - $\frac{1}{4}$" thick plywood.

The Minister of Natural Resources and Customs are very interested on the re-establishment of port facilities in this area as it will benefit the existing and the proposed industries and also the development of the rich agricultural lands in the valleys of Aguan and Paulaya Rivers.

Access road to this port is under study by a continental U.S. firm hired on a contract by the AID office. The Honduras Public Works are given paramount assistance as they also will be favored. This proposal access road is around 240 kilometers and will be a third-class road.

The proposed new pier will be as the one projected by Tippets-Abbett-McCarthy-Stranton Corp. on their report for Development Plan - Ports of Honduras of December 1958.

The estimated cost for the wharf at Puerto Castilla is as follows:

1. Wharf and approach causeway	L. 290,000
2. Dolphine and connecting roadway	38,000
Subtotal	L. 328,000
Engineering (field work, design, drawings, specifications and estimates)	100,000
Estimated total cost	L. 428,000
Demolition of existing portion or pier, and removal of all debris, piles, etc., under water	160,000
Total Project Cost	L. 588,000

Say - L. 600,000

PUERTO CASTILLA

Sr. Rubén Santiago, Manager
Empacadora del Norte, S.A.

Sr. Jesús Valenzuela Fiallos, Manager
Honduras Plywood Co.

TEGUCIGALPA

Sr. Héctor Molina García
Minister of Natural Resources

Sr. Ricardo Alduvín
Technical Advisor of Banco Central de Honduras

Sr. Roberto López, Dirección General de Caminos
Obras Públicas - Public Works

PART IV

FINANCIAL ASPECTS

A. Estimated Capital Cost

1. Estimated cost of engineering and construction.

The following estimate includes only engineering and construction.

a. Road from Puerto Castilla to Guayape Valley

The estimated cost of alternative routes between Puerto Castilla and the Guayape Valley are as follows (in Lempiras):

Kilometers from Puerto Castilla	Point	Type of terrain	Cost per kilometer	Total cost
	1. Common line (Puerto Castilla-San Estéban)			
0	Puerto Castilla			
39	Bridge across Aguán River (182 meters: replace superstructure			400,000
43	Corocito			
48	Existing road or railbed ends	Flat	10,000	480,000
69		Flat	25,000	525,000
	(Bridge: 40 meters			100,000
72	Top of Esperanza Pass			
128		Mountain	60,000	3,540,000
	(Two bridges: 150 meters)			375,000
137	San Estéban	Flat	25,000	225,000
	Total			5,645,000
	2. San Estéban-Gualaco-San Francisco alternative			
137	San Estéban			
161		Flat	25,000	600,000
	(Two bridges: 100 meters)			250,000
170		Mountain	60,000	540,000
183	Gualaco			
187		Rolling	40,000	680,000
	(Two bridges: 120 meters)			300,000
222	San Francisco de la Paz	Mountain	60,000	2,100,000
247	Jutiquile (existing road)	Flat	10,000	250,000
262	Juticalpa	Flat	-	-
or				
287	Catacamas	Flat	-	-
	Total			4,720,000

3. San Estéban-Dulce Nombre de Culmí alternative

137	San Estéban			
146		Rolling	40,000	360,000
	(Bridge: 30 meters)			75,000
178		Mountain	60,000	1,920,000
183	Dulce Nombre de Culmí	Flat	25,000	125,000
	Total			2,480,000

For reasons which are discussed in Part V, below, the extra L. 2,240,000 of cost for the route via Gualaco does not seem to be economically justified. We therefore recommend the route via Dulce Nombre de Culmí, with a total cost of L. 8,125,000. This route has been partially surveyed by the Engineer Batallion of the Honduran Army. It might be desirable to arrange for the Engineer Batallion to complete a penetration road from Dulce Nombre de Culmí to San Estéban as part of the "Civic Action" program, to facilitate construction of the main road.

A penetration road from the Aguán Valley to San Estéban is already under construction, financed by a $500,000 loan from AID as part of a forest fire control program. We assume that the total cost of this project can be deducted from the estimated cost of building the main road, since both engineering and construction will be made much simpler by the availability of the penetration road.

b. Bridges along the Aguán Valley

The cost of bridge construction may be roughly estimated as follows (in Lempiras per meter)

Steel: complete bridge	L. 5,000
Steel: replace superstructure only	2,200
Reinforced concrete	2,500
Wooden truss: untreated	1,000

Wooden truss:	treated	L. 1,250
Wooden trestle:	untreated	600
Wooden trestle:	treated	750

Steel must be used for ordinary long-span bridges. For medium-span bridges reinforced concrete or wooden trusses (up to 18 meter openings) may be used. For shorter spans, and particularly for trestle bridges over streams that do not have swift currents, wooden trestles are appropriate.

Most of the original railroad bridges in the Aguán Valley were made of wood, and most of the original abutments are still in existence. If these bridges were replaced with treated wood, they would give satisfactory service for at least 20 years. If replaced with untreated wood, severe maintenance problems might arise in as little as 3-5 years.

Unfortunately, at present no treatment plant is readily available to supply highway construction needs in Honduras. The banana companies maintain plants for their own use, where they use water-borne chemicals (copper salts) which are not entirely satisfactory for highway construction. A plant in Guatemala is equipped for creosote treatment, but freight from this plant would be expensive.

However, creosote-treated lumber probably could be obtained within the above budget figure in any one of the following ways: (a) by importing from the U.S. or other world market suppliers, (b) by importing from Guatemala, (c) by compensating one of the fruit companies for the extra expense of using creosote, or (d) by building a small treatment plant at Puerto Castilla. Given these possibilities, we assume that all but the longest-span

bridges along the Aguán Valley can be built of wood. In the absence of detailed engineering, we assume an average cost for treated wood bridges of L. 1,000 per meter.

A temporary alternative to construction of bridges (particularly for the expensive longer spans) would be the installation of ferries. The approximate initial cost of a ferry in Honduras is L. 10,000. Operating costs consist mainly of the wages of two attendants, totalling L. 6 per day.

According to the OAS Report[1)] the total length of bridges to be replaced in order to restore communications along the south bank of the river between Corocito and Olanchito (assuming that the existing railroad bridge across the Aguán near Olanchito can be converted for joint use by automobile traffic) would be:

985 meters of wooden bridges, at L. 1,000	985,000
316 meters of steel bridges (replace superstructure only), at L. 2,200	695,200

In addition, some limited rehabilitation may be necessary for the old roadbed from Corocito to Olanchito. We arbitrarily estimate the cost at L. 10,000 per kilometer for approximately 92 kilometers, or 920,000

Total cost 2,600,200

c. Puerto Castilla

According to III-2 above, the cost of rehabilitating Puerto Castilla is estimated at L. 600,000 However, this makes no allowance for new sheds or other buildings. Since our cargo estimate is substantially higher than that of the original Tippets-Abbett-McCarthy-

1) "Informe Oficial de la Misión 105, Tomo III, Proyecto de Colonización del Bajo Aguán".

-Stratton report (which did not envisage a road into the interior), we recommend an additional building allowance of at least 50,000

Total cost 650,000

d. Grand total

1. With bridges along Aguán 11,375,200
2. Without bridges along Aguán 8,775,000

As is indicated in I-3, above, the total value including right of way and existing works may be estimated as follows (in Lempiras):

	With Aguán Valley Bridges	Without Aguán Valley Bridges
a. Construction & engineering	11,375,200	8,775,000
b. Right of way	241,250	227,450
c. Existing works	3,405,000	1,551,200
	15,021,450	10,553,650

2. Total estimated capital cost in U.S. dollars and local currency (a) to be financed by applicant, (b) to be financed by loan.

	With Aguán Valley Bridges	Without Aguán Valley Bridges
a. To be financed by applicant		
1. Right of way and existing works	3,646,250	1,778,650
2. Self-help labor	390,030	-
b. Financed by previous AID loan	1,000,000	1,000,000
Subtotal	5,036,280	2,778,650
c. To be financed by proposed loan	9,985,170	7,775,000
Total cost of project	15,021,450	10,553,650
Dollar equivalent of proposed loan		
1. Foreign exchange (approx. 60%)	2,995,551	2,332,500
2. Local currency (approx. 40%)	1,997,034	1,555,000
Total	4,992,585	3,887,500

B. Maintenance and operation costs

1. Main road maintenance: Puerto Castilla - Dulce Nombre de Culmí, 183 kilometers at

L. 1,600	292,800
2. Aguán road maintenance	
a. Wooden bridges at 7% of 985,000	68,950
b. Steel bridges at 1% of 695,000	6,950
c. Roadbed, 92 kilometers at L. 800	73,600
Total	149,500
3. Puerto Castilla	
a. Maintenance	10,000
b. Operation	30,000
c. Electricity and water	10,000
	50,000
Total including Aguán bridges	492,300
Total excluding Aguán bridges	342,800

PART V

COMPARISON OF BENEFITS AND COSTS

A. Alternative Routes from Puerto Castilla to Guayape

Possible additional benefits to be obtained by routing the main road through Gualaco to San Francisco de la Paz seem to be outweighed by benefits to be obtained by routing to Dulce Nombre de Culmí. Traffic likely to be generated in the Gualaco area itself is small, and a part (cattle) can move by trail without much loss. Little or no lumber could move from the Gualaco area itself, since this has been hard hit by the beetle epidemic. Important pine areas in the mountains to the north and west are 25-50 kilometers away from Gualaco itself, and even more inaccessible from most of the route that has been selected between Gualaco and San Estéban. Soil conditions in the area are too poor to support much production of cash crops for movement out of the area.

The Dulce Nombre de Culmí area, on the other hand, has important traffic generating potential in its pine and hardwood forests. Its agricultural potential is limited, but seems to be roughly equal to the agricultural potential of the Gualaco area. If the Dulce Nombre de Culmí area has to ship via Jutiquile, San Francisco de la Paz and Gualaco, the total distance to the Puerto Castilla would be 318 kilometers, as against 183 kilometers directly via San Estéban. The approximate cost per thousand board feet would be L. 18.26 via Gualaco and L. 11.71 directly via San Estéban. At 14,600 thousand board feet a year, the extra freight

cost would amount to L. 95,630 per year.

Similarly, the bulk of other traffic from the Guayape Valley probably would be generated in the vicinity of Catacamas (the site of the slaughterhouse, for example). The distance from Catacamas to Puerto Castilla would be 229 kilometers via Dulce Nombre de Culmi, and 287 kilometers via Gualaco. As regards traffic to the interior along the road to Tegucigalpa, there is little difference between the two routes; the total estimated distance from Puerto Castilla to Juticalpa would be 262 kilometers via Gualaco and 269 kilometers via Dulce Nombre de Culmi.

For these reasons, the additional cost of L. 2,240,000 ($1,120,000) for construction via Gualaco does not appear to be justified, and the route via Dulce Nombre de Culmi is recommended. In the opinion of the Engineering Advisor of the U.S. Military Mission, construction of this route is feasible.

B. Basis for Discounting

In order to compare costs and benefits it is necessary to reduce them to a common denominator in terms of time. This may be done by discounting both costs and benefits to the present, using a normal interest rate of 6%. However, cost of construction will be spread out over a period of time (possibly two years) while benefits will only develop with some lag. On the basis of past experience, it may be estimated that full benefits will not be realized for ten years after the completion of the road project.

Approximate allowance for these variables is made in Table 30. This shows:

Table 30

Present Value of Benefits and Costs

End of Year	Construction Year 1	2	Total	Discounted to present at 6%
a. Costs Starting from Cinstruction				
1	0.5	-	0.5	0.4717
2	0.5	0.5	1.0	0.8900
3-43			1.0	
40 year uniform series at 1.0 per annum = 15.046; discounted from second year to present				=13.3909
Total				14.7526
b. Benefits rising uniformly over ten years after construction				
1			0	0
2			0	0
3			1	0.8396
4			2	1.5842
5			3	2.2419
6			4	2.8200
7			5	3.3255
8			6	3.7644
9			7	4.1433
10			8	4.4672
11			9	4.7412
12			10	4.9700
13 - 43			10	
30 year uniform series at 10 per annum = 137.65; discounted from twelfth year to present =				68.4120
Total				101.3093

If benefit is 1, discounted present value is 10.1309

(a) the present value of benefits that rise uniformly over a period of ten years after completion, and continue at their peak for thirty years, and

(b) the present value of costs that begin with construction and continue for a period of 40 years after completion of the project. It is assumed that in this time the entire cost of the road is amortized, and the project is considered to have no value and no continuing maintenance cost.

According to this table, the present value of benefits that reach a peak of 1 per annum is 10.13, and the present value of costs of 1 per annum is 14.75

C. Summary of Annual Benefits

No effort will be made to assign a monetary value to educational, social and political benefits of the program.

Tangible benefits described in II-E may be summarized as follows:

	With Aguán Bridges	Without Aguán bridges
1. Annual benefits		
a. Increase in special tax receipts	1,399,449	1,187,289
b. Increase in general tax receipts	2,964,982	1,690,446
c. Reduction in transportation costs	505,810	309,535
d. Increased income in area	22,079,846	15,716,452
	27,079,846	15,716,452
2. Present discounted value (x 10.13)	274,318,840	159,207,659

4. Summary of Annual Costs

Annual capital costs are figured as the capital recovery factor (uniform payment covering both amortization/depreciation

and interest at 6% over a 40 year period) on the cost of construction plus the value of the right of way and existing works, or a total of L. 15,021,450 with the Aguán bridges and L. 10,553,650 without the Aguán bridges (See IV-A-2). Annual maintenance and operating costs have been estimated above (IV-B).

Total annual costs are estimated as follows:

	With Aguán Bridges	Without Aguán Bridges
Capital costs (x 0.06646 capital recovery factor)	998,322	701,392
Maintenance and operation	492,300	342,800
Total	1,490,622	1,044,192
Present discounted value (x 14.75)	21,986,674	15,401,832

4. Cost-benefit ratio

1. With Aguán River Bridges

21,986,674 : 274,318,840 or 1 : 12.5

2. Without Aguán River Bridges

15,401,832 : 159,207,659 or 1 : 10.3

Appendix A

LIST OF PERSONS INTERVIEWED

1. Honduran Government

Ministry of Natural Resources	
Ing. Hector Molina Garcia	Minister
Ing. Salomón Ordoñez	Sub-Secretary
General Administration for Agrarian Incorporation	
Ing. Alfredo Ynestroza	Director
Wilfredo Sierra-Piñeda	Hydrometric Investigation Service
General Administration for Rural Development	
Felipe Antonio Peraza	Director
Carlos M. Zacaría	Deputy Director
Manuel Cáceres	Chief, Information Department
Baudilio Barahona	Progreso
Mario Daccarrat	Juticalpa
William Harlan	Seed Advisor
Dr. Matamoros	Veterinary
Mario Ordoñez	San Pedro Sula
Fernando Padgett	" " "
Luis Romero	Danli
Antonio Tavel	Catacamas
Juan Diaz Vasquez	Danli
Miguel Velasquez	San Pedro Sula
Willy Villena (FAO)	San Pedro Sula (seed geneticist)
General Administration for Natural Resources	
Ing. Bill O. Santos	Director
General Administration for Agriculture	
Ing. Mario Morillo	Director
Ing. Miguel Angel Barahona	
Dr. Hector Chacon	
Dr. Roberto Metzgen	
Thomas Sanchez	
Demonstration Farm School of Catacamas	
Ing. Rafael Mercado	Director
F.A. Roberto Salas Posas	Chief, Horticultural Department
Ministry of Communications	
L. Bogran	Minister
General Administration for Roads	
Hector Cerna	Director
William G. Nickol	Advisor, Brown & Root, S.A.)

Ministry of Economy and Finance

General Administration of Statistics and Census
Sr. Matamoros

Honduran Army Engineer Batallion
Captain Turcios
Captain Duron Medina
Lt. Omar Zelaya Reyes
Staff Sgt. Miller (US Army)
Tech. Sgt. Kelly (" ")

Department of Colón
Captain José J. García — Governor

National Economic Council
Ing. Miguel Rivera — Director
Ing. Norberto Torres — Chief, Dept. of Transport Planning
Lic. Virgilio Cáceres — Chief, Dept. of Public Sector Planning
José Gomez Robelo

Central Bank of Honduras
Lic. Guillermo Bueso — Chief, Dept. of Economic Studies
Ing. Ricardo Alduvin
Ing. Humberto Leon

National Agrarian Institute
Lic. Angel Araujo Nieto
K. Dienes
Rodolfo Luna Moran
Ing. Pablo Pastor
Silvio Larios Zuñiga

National Development Bank
José Hernandez Fiallos — Vice President
Ricardo Reyes — Chief, Development Department
Lic. Oscar Martinez — Industrial Development Division
Lic. Eduardo Mendieta — Chief, Technical Div.
Lic. Arturo Sheib Piñeda — Chief, Credit Analysis Committee
Dr. Reyes — Veterinary, Guayape Valley

Centro Cooperativo Técnico Industrial
Benjamin Membreño — Director
Walter Huppke

SCIDE (Education "Servicio")

Dr. Steven Youngberg	Director
John Cook	Business Manager
Jose Gradiz	
Jorge Matute	
1st Lt. Paul Hay	U.S. Special Forces (engineer and architect for school construction program)
2nd Lt. Peter Zettel	

2. Foreign Missions, etc.

American Embassy

Mr. Thomas Killoren	Economic Officer
Mr. Jack O'Grady	Labor Attache

CARE

Allen Turnbull	Director, Honduras Mission

Central American Bank for Economic Integration

Jose Angel Bobadilla	

"El Sembrador" Agricultural School, Catacamas, (World Gospel Mission)

Donald Hawk	Director

Servicio Volontario Menonita (Tocoa)

George Zimmerman	
Robert Lehman	

U.S. Aid Mission

Newell F. Williams	Director
Edward Brooks	Executive Officer
Ben Mayfield	Director, Agriculture Division
Alfons Chable	Acting Director," "
Dr. Maxwell E. Becker	Forestry Advisor
John Maris	International Development Services

U.S. Army Mission

Maj. S.D. Falkenbury, Jr.	Engineer Adviser

U.S. Peace Corps

Edwin P. Astle	Director
Gerald MacMahon	Deputy Director
Tom Asmus	
Bill Farren	
Jane and Glen Grant	
Holger Jorgensen	
John Logsdon	
Jay Lynch	

UN Food and Agriculture Organization

Charles Simmons	Director, Soils Inventory

Emil Zacar	Food for Peace Program
Ing. Betancourt Cohen	

3. Honduran farmers, etc.

Caires	
Jose Olivia Rodriguez M.	
Victor Vargas	
Catacamas	
Alberto Bu Castellon	Empacadora Nacional de Carnes Preparados (pork processing)
Antonio Tavel	Catacamas Industrial S.A. (beef packing)
Choluteca	
Baltazar Alegría	Cattle
Sr. Ochoa	Slaughterhouse
G. Pierrefeu	Shipping agent
Danlí	
Constantino Argeñal	
Arturo Gallerdo	Mayor of Danlí
Salvador Paz	
Marco Sevilla A.	
Gonzalo Lobo Sevilla	
Gualaco	
Ramón Escobar	Mayor
James Sereder	U.S. Missionary
Juticalpa	
Dr. J. Younger	
La Ceiba	
Gerhard Fehling	Manager, Standard Fruit Co.
La Lima	
Mr. Cappell	Manager, Livestock Div., Tela Railroad Co.
Roger Bornavaca	Cattle
Columbia Echevarri	
Mario Fajardo	Farmer
Lanzatilla	
Guillermo Carranza	
Ricardo Gomez	
Mezcales	
Marco Antonio Amador	Mayor
Felix Pedro Aplicano	
Cruz Hernandez L.	

Valentin Rodriguez	
Olanchito	
Mr. Steiner	La Curaçao
Petoa	
Juan Piñeda Cruz	Mayor
Progreso	
Amadeo Avila	
Puerto Castilla	
Fausto Fortín	Slaughterhouse technician
George Knie	Foreman, Honduras Plywood
Eugene Nemes	Manager, Honduras Plywood
Tomas Ramirez	Empacadora del Nortè
Ruben Santiago	Empacadora del Nortè
San Esteban	
Miguel Angel Sarmiento	Mayor
Tomas Guillen	Cattleman
Miguel Mendez	Cattleman
Rafael Mendez	Merchant
San Francisco de la Paz	
Isais Durón	Municipal Secretary
San Pedro Sula	
Roberto Bográn	
Don Bridwell	
F. Cacecede	Sugar cane
Ed. Gatlin	Lumber
Boris Goldstein	Alimentos Concentrados S.A.
Viriate Gutierrez	Slaughterhouse
Fred Nachman	
Tegucigalpa	
Jack Agurcia	
Nick Agurcia	
H. Carraccoli	Dairy farm
F. Lardizabel	Cattle
Horton Kivet	Chief pilot, SAHSA
Osmund Maduro	Lumber
Jose Membreño	Dairy farm
T. Reyes	Dairy farm
A. Sansone	Lumber
J. Suarez	Dairy farm

Tocoa

Juan Barrientos	Mayor
Carlos Oliva	Military Commander
Carlos E. Bascha	
Carlos Polanco	

Trujillo

Chester Smith	Cattle
Sr. Lobo	Cattle
Adolfo Midence	Cattle

Zamorano (Panamerican Agricultural School)

Dr. Moeller	Director
R. Armour	Assistant Director
Abdul Bari Awan	
George Freytag	
Candelario Reyes	

Lumber and trucking industries (Various locations)

A. Arceiri
L. Barahona
J. Echaverri
A. Garcia
G. Ilma
M. Magee
A. Memeli
Pavan y Molina
O. Snyder
F. Walker

ANNEX A

DRAFT LOAN APPLICATION

Ministry of Natural Resources
Republic of Honduras

Tegucigalpa, D.C., Honduras, C.A.
_____, 1965

U.S. Aid Mission
Tegucigalpa, Honduras

Gentlemen:

I have the honor to submit a capital projects loan application in accordance with AID Manual Order No. 1232.1, requesting a loan of $_____to finance a road and port for Northeastern Honduras.

A. Nature and Location of the Project

The project is described in detail in the enclosed Economic Feasibility Study entitled "Northeastern Honduras Transportation Program", prepared under Contract AID 522-91 by Continental-Allied Co., Inc. It provides for:

1. Construction of 275 kilometers of roads, linking Puerto Castilla, the Aguán, Agalta and Guayape Valleys;

2. Construction of a dock and other facilities at Puerto Castilla.

The Ministry of Natural Resources, through its General Administration for Agrarian Incorporation, has been engaged in the construction of feeder and penetration roads for a number of years.

B. General Purpose of Project

1. Anticipated end product

The project is intended to stimulate new production of agricultural, livestock and wood products for export and local markets, with a net annual value added of L 22.2 million. (Note: with Aguán bridges). It will provide a second through route between Central Honduras and the North (Atlantic) Coast in an area that now lacks communication between South and North.

2. Charge for services

Normal taxes will be applied to highway users and normal port charges will be assessed on traffic through the port. The

estimated annual revenue is L. 1.4 million (NOTE: With Aguán bridges; L. 1.2 million without .

3. Anticipated demand and location of markets to be supplied.

The project will open up:

a. Access to the rich agricultural areas of the Aguán Valley, which are expected to produce tropical export crops (bananas citrus, pineapple, palm oil) and meat for world markets, and some surpluses of food grains (corn and rice for domestic consumption and markets in other Central American countries.

b. Access to the forest areas of the Agalta Valley, to produce lumber and naval stores for world markets; access to cattle raising areas that will produce meat for export; access to limited agricultural areas that will produce corn and rice for internal and other Central American markets.

c. Access to the rich agricultural areas of the Guayape Valley, producing meat for export, and expected to develop other crops for world markets (citrus, sisal, etc.)

According to available market information, demand will be more than adequate to absorb estimated increases in production.

4. Sources of raw materials

Construction machinery, motor fuel, culvert, bridge steel and reinforcing rods would be imported. Cement is manufactured near San Pedro Sula, and aggregate and selected materials are available locally in most parts of the country.

5. Competition and 6. Transportation available

At present areas without roads usually move goods in and out on mule-back or by air. These are extremely expensive methods compared to the cost of truck transport.

C. Total Cost

Detailed cost estimates are given in the attached feasibility study. The totals are as follows: (NOTE: Figures including Aguán Valley bridges.)

Total cost of program		$7,510,725
Borrowed		
Local currency	2,197,034	
Foreign exchange	3,295,551	
		5,492,585
Local contribution		2,018,140

D. Amount Requested from AID and Specific Use of AID Funds

The amount requested from AID is $4,992,585 (in addition to $500,000 previously lent).

E. Plans for Maintenance

The new roads will be maintained by the General Administration for Agrarian Incorporation until such time as the increase in traffic and betterment maintenance bring them within the scope of the national through highway program (administered and maintained by the General Administration for Roads of the Ministry of Communications).

F. Proposed Terms and Repayment Schedule

It is proposed to borrow for a period of forty years, at 1½% interest for the first ten years, and 2½% interest for the remaining 30 years on the unpaid balance. A ten year initial grace period for amortization payments is requested, the principal to be repaid in equal installments over the next thirty years.

G. Efforts to Obtain Capital Elsewhere

This loan application has been discussed by the Government of the Republic of Honduras with the following institutions (Note: suggested list):

U.S. Export-Import Bank
International Bank for Reconstruction and Development
Inter-American Development Bank
Central American Bank for Economic Integration
Chase Manhattan Bank
Bank of America

None of these institutions is willing to finance the program on terms that might reasonably be afforded by the Honduran Government.

I. Status of Government Agency

1. Name and legal status

Ministry of Natural Resources, authorized to borrow by decision _____ of the _____ , dated _____.

2. Persons responsible for the undertaking

Ing. Hector Molina Garcia, Minister
Ing. Alfredo Ynestroza, Director

Biographical data are included in _____.

3. Guarantee

This loan is guaranteed by the general credit of the Government of the Republic of Honduras. Attached to this letter are the following tables, giving information about the financial condition of the Republic of Honduras:

A. National Investment and Savings, 1958-1962.
B. Estimated Long-Term External Debt as of end of 1964.
C. Projected Public Sector Obligations on Present Debt, 1965-1974.

Hoping that this application will meet with your early and favorable consideration, I am,

Sincerely yours,

HECTOR MOLINA GARCIA
Minister of Natural Resources

Table A

Investment and Savings, 1958-1962
In millions of Lempiras, at Current Prices

	1958	1959	1960	1961	1962
Composition of gross domestic product					
Private Consumption	565.8	586.8	594.5	616.9	650.5
Government consumption	71.9	70.4	73.2	78.1	76.6
Total consumption	637.7	657.2	667.7	695.0	727.1
Private & "Mixed"[1] gross domestic investment	81.8	83.8	89.5	84.7	107.2
General government gross domestic investment	14.9	10.7	15.3	11.1	12.9
Total gross domestic investment	96.0	94.5	104.8	95.8	120.1
Exports	149.6	147.7	136.1	157.2	173.9
Minus imports	158.4	148.3	152.8	152.8	168.9
Gross domestic product	724.9	751.1	755.8	795.2	852.2
Government net investment					
General government gross domestic investment	14.9	10.7	15.3	11.1	12.9
Depreciation of government investment	4.6	4.7	4.8	4.9	5.1
General government net investment	10.3	6.0	10.5	6.2	7.8
Total net investment					
Gross domestic investment	96.0	94.5	104.8	95.8	120.1
Less: depreciation	40.0	40.4	44.4	45.7	39.6
Net domestic investment	56.0	54.1	60.4	50.1	80.5
Financed by:					
Domestic private saving	39.4	48.8	64.1	54.3	70.7
General government saving	-1.3	3.0	2.8	-1.8	-0.6
Foreign balance	17.9	2.3	-6.5	-2.4	10.4

1) Includes government-owned enterprises.

Source: Banco Central de Honduras, Departamento de Estudios Económicos, "Cuentas Nacionales de Honduras, 1948, 1953-1962", Tegucigalpa, December 1963, Tables 1a, 4, 5a.

Table B

Estimated Long-Term External Government Debt
as of End of 1964
In thousands of Lempiras

Creditor	Number	Purpose	Balance due
(a) Central Government			
IBRD	IB-195-HO	Repair & maintenance of roads	9,302.0
DLF	DLF-1	Plans, specifications and construction of roads & bridges	8,606.4
ICA	ICA-X22-1	Development of Guayape Valley (feeder roads) and improvement of national sanitary conditions	5,267.1
Ex-Im Bank	EIB-879	Construction of roads	2,650.0
IDB	12-SF-BID	Study of roads and aerial transport	1,728.0
	5-SF-BID	Study and construction of roads	4,000.0
	AID-1-BID	School construction	385.0
IDA	IDA-1-HO	Design and construction of roads	13,207.3
Marine Midland Trust Co.	-	Consolidation of floating debt	791.1
Subtotal			45,937.5
(b) National Electric Power Enterprise (ENALUF)			
IBRD			2,478.0
"			17,182.0
DLF			5,560.0
Subtotal			24,220.0
(c) National Development Bank (BNF)			
Ex-Im Bank			1,025.0
IDB			7,000.0
"			3,250.0
Subtotal			11,275.0
(d) National Aqueduct & Sewer Service (SANAA)			
IDB			2,399.0
AID			378.
Subtotal			2,777.0
Total			85,209.5

Table C

Projected Public Sec or Obligations on Present Debt, 1965-1974
in Thousands of Lempiras

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
Internal Debt										
Amortization	8,538.8	7,734.7	6,727.0	5,783.6	4,973.9	4,476.9	3,880.5	3,191.0	2,322.4	1,304.6
Interest	2,405.4	1,966.9	1,594.3	1,592.8	950.1	705.1	492.8	309.5	160.3	56.1
Subtotal	10,944.2	9,701.6	8,321.3	7,376.4	5,924.0	5,176.0	4,373.3	3,500.5	2,482.7	1,360.7
External Debt										
Amortization	3,116.4	3,694.1	3,900.2	4,126.1	4,221.6	4,389.2	4,840.4	5,184.4	5,358.2	5,714.6
Interest	3,200.4	3,091.8	3,009.7	2,935.0	2,747.7	2,609.1	2,459.4	2,366.4	2,034.6	1,803.6
Subtotal	6,316.8	6,785.9	6,909.9	7,061.1	6,969.3	6,998.3	7,299.8	7,550.8	7,392.8	7,518.2
Total Debt										
Amortization	11,655.2	11,428.8	10,627.2	9,909.7	9,195.5	8,860.1	8,720.9	8,375.4	7,680.6	7,019.2
Interest	5,605.8	5,058.7	4,604.0	4,527.8	3,697.8	3,314.2	2,988.2	2,675.9	2,194.9	1,859.7
Total	17,261.0	16,487.5	15,231.2	14,437.5	12,893.3	12,174.3	11,673.1	11,051.3	9,875.5	8,878.9
Balance due										
Internal	47.505.7	39,870.8	33,343.8	27,660.2	22,886.3	18,615.4	14,934.9	11,843.9	9,721.5	8,616.9
External	97,762.9	95,709.6	91,799.3	87,673.2	83,451.5	79,062.6	74,221.8	69,037.5	63,679.2	57,964.6
Total	145,268.6	135,580.4	125,143.1	115,333.4	106,337.8	97,678.0	89,156.7	80,881.4	73,400.7	66,581.5

Source: Consejo Nacional de Economia, using data from Ministerio de Economia y Hacienda and autonomous institutions.