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PD-AAA-132-B1

DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D. C. 20523

CAPITAL ASSISTANCE PAPER

Proposal and Recommendations
For the Review of the
Development Loan Committee

BOLIVIA - HIGHWAYS 1 AND 4

Project Number - 511-22-310-641
Loan Number - 511-L-021

AID-DLC/P-237

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AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D.C. 20523

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AID-DLC/P-237
May 18, 1964

MEMORANDUM FOR THE DEVELOPMENT LOAN COMMITTEE

SUBJECT: Bolivia - Highways 1 and 4

Attached for your review are the recommendations for authorization of a loan in an amount not to exceed $33,200,000 to the Government of the Republic of Bolivia to assist in financing the dollar and local currency costs (including final design and supervisory engineering) of constructing two related highways in Bolivia.

This loan proposal is scheduled for consideration by the Development Loan Staff Committee at its meeting on May 25, 1964 and a telephone poll of DLC members will be conducted on Tuesday, May 26th, to determine whether the DLC members approve without a DLC meeting or request a DLC meeting for the consideration of this proposal.

Rachel C. Rogers
Assistant Secretary
Development Loan Committee

Attachments:
Summary and Recommendations
Project Analysis
Annexes I-III

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BOLIVIA - PROJECTS 1 & 4 HIGHWAYS

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BOLIVIA - PROJECTS 1 & 4 HIGHWAYS

A. SUMMARY AND RECOMMENDATIONS

1. BORROWER: Government of Bolivia

2. AMOUNT OF THE LOAN: Up to $33,200,000.

3. TOTAL COST OF LOAN PROGRAM: Up to $33,400,000 distributed as follows:

SUMMARY OF COSTS OF PROJECTS Nos. 1 & 4

	TOTAL COST (Dollar Equivalent)		
	U.S.	Local	Total
a. Project I			
Total Construction Cost 1/	3,609,364	1,603,160	5,212,524
Contingencies (15% of Construction cost)	544,438	237,441	781,879
Total Construction Cost and Contingencies	4,153,802	1,840,601	5,994,403
Right-of-Way Costs		5,000	5,000
Engineering 2/			
Additional Surveys, Final Design and Preparation of Contract Documents (2.8% of Construction Cost and Contingencies 2/)	93,790*	72,210	166,000
Supervision of Construction (5.0% of Construction Cost and Contingencies) 2/	102,600**	197,400	300,000
Sub-TOTAL COST OF PROJECT	4,350,192	2,115,211	6,465,403
	Subtotal		6,500,000

	Total Cost (Dollar Equivalent)		
	U.S.	Local	Total
b. Project 4			
Total Construction Cost 1/	16,239,152	5,694,096	21,933,248
Contingencies (15% of Construction Cost)	2,343,987	855,000	3,289,987
Total Construction Cost and Contingencies	16,674,139	6,549,096	25,223,235
Right-Of-Way Costs #		180,000	180,000
Engineering 2/			
Additional Surveys, Final Design and Preparation of Contract Documents (1.7% of Construction Cost and Contingencies) 2/	250,860*	193,140	444,000
Supervision of Construction (4.1% of Construction Cost and Contingencies) 2/	351,496**	676,269	1,027,765
SUB-TOTAL COST PROJECT 4	19,276,495	7,598,505	26,875,000
	SUB-TOTAL		26,900,000
TOTAL PROJECTS 1 and 4	23,626,687	9,713,716	33,340,403
	ROUNDED TO		$33,400,000

1/ Gasoline is a local cost; diesel and lubricants are dollar costs.
2/ Does not include depreciation of vehicles or other equipment purchased under AID Loan 44.
* Based on design U.S. cost being 56.6% of total.
** Based on supervision U.S. costs being 34.2% of total.

\# Loan funds cannot be made available for purchase of right of way.

4. PURPOSE: To finance two highways which will give access to wide regions of highly fertile land, accelerate present and future colonization programs, provide a link between the highway system of Bolivia and navigation on the extensive Mamore River System, enhance economic development (through greater utilization of available land resources, increased farm unit size and income, establishment of related industries and increased demand for nationally produced goods and services) and achieve greater economic, social and political unification of the nation.

5. DESCRIPTION: This loan will provide for the construction of two all weather highways with a combined length of approximately 299 kilometers. The first fully paved highway is about 206 kilometers long and extends from the city of Cochabamba generally northeastward across the flank of the Cordillera Real to the heart of the Chapare region at Villa Tunari, and thence northwestward along the Piedmont belt to the Isiboro River near Puerto Patino. This project includes 31 bridges varying in length from 20 to 201 meters. The second all gravel highway is about 86 kilometers long, extending from the colonization center Villa Tunari eastward to the Ichilo River at Puerto Villarroel. This highway includes 16 bridges varying in length from 18.5 to 286 meters.

6. EXIMBANK: Eximbank has indicated disinterest in loans to Bolivia in view of the continuing GOB default on Eximbank loans.

7. VIEWS OF COUNTRY TEAM: Recommends and supports the project not only based on the project's economic justification but also as a major Alliance for Progress contribution to the future economic and social development of Bolivia and its political unification.

8. PROCUREMENT: Open bidding by contractors from approved sources. All dollar procurement will be made in the United States. Special letter of credit procedures will be used to assure that dollars used to finance local currency costs of the project are used only for U.S. procurement.

9. STATUTORY CRITERIA: All statutory criteria related to this loan have been satisfactorily met. (See Annex I for details)

10. OTHER FINANCING: No other sources are presently available on reasonable terms.

11. ISSUES:

A. Adequacy of integration and coordination of technical assistance agencies, planning, financing and staffing for the GOB colonization program. This program provides the support essential to achieving agricultural production schedules which provide the major economic justification for this project.

Available evidence indicates a need for substantial improvements in the IDB/GOB colonization program in order to carry out this project's goals.

B. Adequacy of GOB organization and financing for maintenance of new and existing roads. Maintenance jurisdiction for this project and some other roads has still not been assigned to the AID supported National Roads Service. GOB transfers of earmarked revenues to the Roads Service are inadequate to cover costs of the present maintenance program.

C. Whether AID should provide close to 100% financing for this project: GOB budgetary limitations and inflexibility probably would lead to indirect AID financing from S.A. or other sources if a larger GOB contribution should be requested.

12. RECOMMENDATIONS: Authorization of a loan not to exceed $33,200,000 to the Bolivian Government to finance the construction of highways 1 and 4 on the following terms and conditions:

a. Repayment to be within 40 years from the date of first disbursement including a ten year grace period;

b. Credit fee charged on the disbursed balance to be 3/4 of 1% per annum during the grace period and 2% thereafter;

c. Payment of credit fee and principal to be in U.S. dollars;

d. Supervising engineering and contracting firm to be satisfactory to AID.

e. Equipment, materials and services financed hereunder shall have their source and origin in Bolivia or in the United States;

f. United States dollars utilized under the loan to finance local currency costs shall be made available through Special Letter of Credit procedures;

g. Based on a study by U.S. experts of organizational and program improvements (which the GOB has requested) to make most efficient use of GOB resources for rural development, the GOB shall develop, prior to the first disbursement under the loan other than for engineering services, and subsequently implement, a plan satisfactory to AID to strengthen programs and staffs, and integrate or better coordinate agencies responsible for GOB rural development and colonization programs. First priority shall be given to developing and implementing such plans for areas served by roads 1, 3, 4 and 7.

h. GOB is to continue to centralize and consolidate road maintenance activities under the jurisdiction of the Servicio National de Caminos based on the recommendations of the Bureau of Public Roads; to consolidate the present revenue producing programs for highway maintenance and take into consideration any recommendations to be made by a U.S. Internal Revenue tax team that recently visited Bolivia to study the Bolivian tax structure; to provide the necessary budget support to the centralized highway maintenance organization to defray maintenance costs of existing roads, highways 1 and 4 and other highway projects financed by AID funds.

i. GOB is to assume right-of-way costs.

j. Such other terms and conditions as AID may deem appropriate.

Project Committee:

Chairman - John C. Eddison
Program Officer - Lawrence L. Peterson
Engineer - Sterling L. Hedgpeth
Loan Officer - Lewis Ortega
Economic Advisor - Robert R. Edminster
Asst. Econ. Advisor - Jacob P. Merrman
Agr. Econ. Advisor - Frederick H. Dahl

Drafting Officers: John Eddison, USAID/Bolivia;Lewis Ortega, LA/CD

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May 18, 1964

B. SUMMARY PROJECT DESCRIPTION AND DESCRIPTION FOR FINANCING

I. BACKGROUND:

On June 28, 1962 a development loan (AID Loan No. 44) in the amount of $6,000,000 was made to the GOB for feasibility studies. The GOB, in turn, on July 5, 1962, entered into a contract with the U.S. consulting firm of Tippets, Abbetts, McCarthy and Stratton (TAMS) for study of the feasibility of several major road projects. On August 1,1963 AID and the GOB signed a loan agreement in the amount of $7.2 million for the construction and engineering costs of TAMS roads 3 (Yapacani-Puerto Grether) and 7 (Improvements Guabira-Yapacani, Guabira-Chanes and Guabira Puerto Benegas). These roads extend north and northwest of Santa Cruz. At the same time TAMS undertook the feasibility study of projects 1 and 4, located northeast of Cochabamba, which were completed and submitted to AID by the GOB during the first part of 1964.

This project is consistent with the July 1962 AID/IDB Memorandum of Understanding with the GOB in which the U.S. agreed to consider financing sound economic development projects including roads. The IDB financed colonization program and the project are interdependent and reinforce each other.

II. DESCRIPTION:

On Bolivia's overpopulated Altiplano and high valleys, most of the population lives barely above the subsistence level. To the east of the Andean chain, lie lowlands of high agricultural potential, underpopulated and under-exploited, except for occasional isolated settlements. To open up these lands for development and to facilitate the transfer of population to the lowlands, the GOB proposes the construction of a new and important road complex. This complex, designated as Routes 1 and 4, will link Bolivia's central city of Cochabamba with the fertile Chapare region and the Mamore River system of the Beni Department. These roads are expected to play a major role in changing Bolivia from a country economically dependent on mineral production and subsistence agriculture to a country with extensive development of its highly fertile tropical provinces, with enhanced division of labor between uplands and lowlands, and with increased wealth for all.

At present, 25% of Bolivia's imports are foodstuffs; the productivity of its agriculture is among the lowest in Latin America; the amount of cultivated land per capita is estimated at 0.16 hectares, less than half the ratio for Brazil and one-fifth of the corresponding ratios in Mexico. Illustrative of the potential for development are the facts that, although 2% of the country is now in crops, and half of this in the highlands, an estimated 30% of the land of Bolivia is arable.

Using 1958 data, in 1961 the GOB established a target of resettling 100,000 low-income farm families by 1973. Due to the acceleration in migration to the lowlands in the last five years, it is probable that this goal will be exceeded. Nevertheless the realization of Projects 1 and 4 will greatly facilitate in attaining and surpassing this goal. To the extent that it is attained, the benefits from the projects will be increased.

Project 4 will provide a two-lane paved highway from the city of Cochabamba northeast through the mountain barrier down to the town of Villa Tunari in the Chapare district at the edge of the lowlands. This highway will replace an existing one-lane, gravel road which climbs over a pass 14,222 feet high and provides only a hazardous and high cost connection. The new road will have 2,000 fewer curves; considerably lower grades; will be 16 km. shorter; and will be located at a far lower average elevation. (It will be recalled that as elevation increases, engine efficiency decreases.) As a result of the new highway, the estimated vehicle operating costs of a medium truck making a oneway trip between Cochabamba and Villa Tunari will be reduced from the present $37.00 to $15.40. At Villa Tunari, the proposed highway will narrow to an all-weather, two-lane, gravel road 43.5 km. long, terminating at Puerto Patino on the Isoboro River.

Project 1 will provide an all-weather, 93 km., two-lane, gravel road from Villa Tunari east to Puerto Villarroel on the Ichilo River which is navigable throughout the year. Together with the last 43 km. of Project 4, Project 1 will open for colonization some of the most fertile land in Bolivia. In addition, these roads will connect to two places with the navigable waters of the Mamore River system--the main transportation artery for much of tropical Bolivia--providing transportation at greatly reduced costs between the towns of this large river basin and the rest of Bolivia. Current traffic between the highlands and these provinces is primarily by air.

III. COSTS:

		Costs in Millions of U.S. Dollars			
Route	Length	Dollar Cost	Local Currency Cost	Total Cost	Loan Cost
1	93 Km.	$ 4.4	$ 2.1	$ 6.5	-
4	206 Km.	19.3	7.6	26.9	-
TOTAL	299 Km.	$23.7	$ 9.7	$33.4	$33.2

The total cost of the Projects is estimated at $33.4 million; $26.9 million for Project 4 and $6.5 million for Project 1. Dollar costs are estimated at $23.7 million and local currency costs at $9.7 million. Projects 1 and 4 have been combined since substantial reductions in construction costs will result if both are undertaken simultaneously. The GOB has requested 100% external and local financing because of shortages of foreign exchange and budget deficits. USAID's policy of decreasing grant support and of requiring increased GOB financial participation in existing programs and projects will make it very difficult for the GOB to contribute to the financing of these roads. Consequently, USAID/B recommends 100% financing. Since right-of-way costs of $185,000 will be excluded from the loan, the loan will be about $33.2 million.

IV. JUSTIFICATION:

Financing this project is justified by: (1) the need for alleviating intense population pressure on the limited cultivable areas of the highlands; (2) the high tangible benefit-cost ratios which were computed in the feasibility studies, ratios which we believe to be on the cautious side; (3) the extremely high potential for development in the largely isolated tropical provinces; (4) the high priority given to this project by both the GOB and USAID/B; (5) a recent USAID analysis showing that, assuming only a continuation of present Bolivian growth rates, the GOB will be able to amortize its obligations.

V. PROJECT WITHIN AID STRATEGY IN BOLIVIA:

The major goal of AID in Bolivia is accelerated economic development. The specific USAID strategy is to utilize the whole program, component by component, in effort to assist the Government not only to achieve rapid economic growth, but also to realize its own self-help measures of governmental reform, which form the basis for the furtherance of its economic and social development program. This project will have the major political impact of geographic unification and the major macro-economic effect of providing an efficient surface transport link between two diverse but complimentary geographic areas. The Mission has carefully examined alternatives with the result that, in both political and economic terms, this loan is believed to be the best use of available resources. The benefits to be realized are so large, in absolute terms as well as in relation to the costs, that they will give the project an attractiveness greatly exceeding that of any other available to the Mission at this time.

Although the No. 1 priority within the major goal of economic development of the USAID has been in the mining sector, the development of the transportation sector has recently been given equal attention. The strategy in the development of this sector is basically the consolidation of Bolivia as a political and economic entity.

Inadequate or non-existing transportation facilities are an effective barrier to domestic commerce and international trade. Expansion of domestic and international markets can only be achieved by major improvement in transportation facilities. Elimination of transport barriers, sectoral or nationally, immediately opens up a host of agricultural, industrial and investment opportunities.

Politically, the project will not only unify two diverse geographic areas, but will also create a climate for political action in governmental affairs by the frontier sectors served by this project. Furthermore, the realization of this project will undoubtedly enhance U.S. prestige in Bolivia.

It will also encourage the campesino, particularly those existing on the crowded and inhospitable Altiplano, to move eastward to more productive, virgin land.

An essential condition of the loan will be GOB agreement and action to strengthen rural development agencies as well as the highway maintenance organization. This project will be closely related to USAID's general program in agriculture, mining, industry, banking, etc. More specifically, project 1 and 4 is related to USAID projects in crop and livestock production, agricultural demonstration centers, marketing facilities, cooperative marketing, colonization, civic action road construction, development of hydroelectric power. It complements AID loans to the GOB including:

Highway Maintenance AID Loan No. 26	2,400,000
Feasibility Studies AID Loan No. 44	6,000,000
Access Roads AID Loan No. 511-L-015	7,200,000
Banco Industrial AID Loan No. 511-L-018	2,400,000
Banco Agricola AID Loan No. 511-L-019	3,700,000

Transportation facilities to be made available by the project will increase the market for sugar produced in the Santa Cruz area and increase demand for loans from the Agricultural Bank and the Industrial Bank to support continued development of the area to be served by the project. In conjunction with the USAID program, the project will also accomplish the following:

1. It will accelerate the "second" GOB Agrarian Reform, the opening of new lands for settlement.

2. It may provide a route for additional investments in the petroleum field.

3. It will increase Government revenues as incomes rise and the tax base is broadened through the development and expansion of the area to be made accessible by the project.

4. It will facilitate development of hydroelectric power.

5. It will facilitate development of secondary roads to reach mineral deposits, including large deposits of high grade asbestos.

6. It will be the opening wedge that will be followed by the Civic Action Program in opening up even greater areas of the frontier.

7. It will provide and create additional employment. At present there are excess workers in nearly every mine, factory and government agency. Law and customs make it difficult to discharge workers, and these difficulties are reinforced if there are no alternatives for employment.

8. It will create incentives for the manufacture of construction materials. Anticipation of projects 1 and 4 has already induced a request for Cooley loan funds to expend cement production.

9. It will help to train engineering and construction personnel, and as a consequence, help to fill the vacuum that has resulted from the flight of professional and technical personnel in Bolivia. Thus, the proposed project is very much a part of the U.S., strategy to cooperate with the newly oriented Bolivian efforts to advance their economic development.

VI. COUNTRY IMPACT AND FEASIBILITY OF PROJECTS:

After an intensive feasibility study the consulting-engineering firm, TAMS, calculated the following benefit-cost ratios:

	5th year	20th year
Project 1	3.8	10.8
Project 4	2.0	5.3

These ratios were based on a 6% interest rate which is considered as a rate that would yield an equitable return on the investment.

USAID/B has evaluated the data on which these ratios are based and concludes that they are conservative. The expected output per potential farm in the Chapare does not deviate from output on recently settled farms in the Santa Cruz area. In calculating the cost-benefit ratios, the assumed increase in families in the Chapare is 5,000. This assumption is conservative in part since spontaneous colonization in Bolivia has been accelerating. According to Casto Farragut, Agricultural Official of the Food and Agricultural Organization in Bolivia, there were 10,000 families in the Chapare as of 1961. He estimates that 75% of these arrived in the period 1953-1961.

Substantial additional benefits would be realized from connecting Project 1 to Projects 3 and 7 (roads now being built northwest of Santa Cruz which will open new lands to cultivation) through an inexpensive additional 55 km. link. This would provide a direct route between Montero (a town 75 km. north of Santa Cruz) and Cochabamba and would substantially increase the benefits of Projects 4 and 1. Traffic from Projects 3 and 7 would find the Chapare route to Cochabamba about 300 km. shorter than the route through Santa Cruz. It would also cut the distance from the Chapare to Santa Cruz by about 400 km. In reducing transportation costs from the Chapare to Santa Cruz, this road-link would enhance the export possibilities to Argentina of Chapare produce.

User-savings on Route 4 will be substantial, according to the TAMS feasibility study. As noted above, the new route will be 16 km. shorter, two lanes (currently, traffic is one-way alternating in direction on successive days), will eliminate over two thousand curves, will be at a lower altitude, will have lower grade, and will cut the time enroute between Cochabamba and Villa Tunari by about two-thirds.

The costs of paving Project 4 from Cochabamba to Villa Tunari are less than $1.4 million. With paving comes not only a considerable decrease in user costs through higher running speeds and decreased depreciation, but also a decrease in maintenance costs. The marginal benefit-cost ratio for paving alone would be higher than for the project as a whole.

Because of the high total cost of the combined road projects, USAID has looked very carefully at various alternatives which might reduce these costs. The Mission investigated the possibility of cutting the average ratio of curvature, i.e., making the curves along the mountains sharper. The savings in construction costs were calculated to be nearly a million dollars, but the road became 4 km. longer. The resulting benefit-cost ratios showed that the suggestion was undesirable.

At the request of the Mission's engineers, increasing maximum grades to 9% was considered in three places between Cochabamba and Villa Tunari. These would shorten the road 5 km. and reduce construction costs about $1 million. (This 5 km. decrease would be in addition to the 16 km. difference in length between Route 4 and the current one-lane highway.) This change will probably be incorporated into TAMS' final design. However, no reduction in estimated total costs has been made, as it is believed that TAMS may have underestimated the costs of dealing with slide-terrain by about an equal amount.

USAID/B examined a proposal to eliminate the expensive, mountainous 165 km. of Project 4, southwest of Villa Tuneri, and merely connect the colonization highways in the Chapare with Projects 3 and 7. This would have provided a route to Cochabamba and the Altiplano via Santa Cruz. However, since most of the traffic to and from the Chapare would be with Cochabamba, the ensuing increase in user costs from following the round-about route, made the proposal untenable. Another alternative to Project 4 was also considered. This route from Cochabamba to Montepuncu, 116 km. east on the Santa Cruz highway, and then north to Project 1, might have been somewhat less costly to construct. However, the reduction in benefits far outweighed any possible reduction in costs. Shipping costs between any point in the Chapare and Cochabamba via this alternative would have been more expensive than via Route 4.

In 1963, Bolivia obtained a $9 million loan from BID to finance colonization in the tropical lowlands. In the process of approving the loan, detailed plans were formulated for the areas to be opened by Projects 1 and 4. The land was examined and found of high quality. Soils studies of the Chapare area to be served by the project indicate that about 40% is first class agricultural land, and about 45% requires minor drainage work to afford excellent growing

conditions. Additional surveying is in progress. Social overhead facilities are being planned. The Bolivian government is also developing a program of agricultural credit and extension.

USAID/B is aware of the increase in maintenance costs which the Projects imply. However, assuming that the recent growth rate of the Bolivian economy continues, the increasing burden of maintenance can be assumed without great stress. Moreover, following a recent survey of the Bolivian tax-system by experts of the U.S. Internal Revenue Service, USAID/B has agreed with the GOB to provide a team of tax experts for a minimum of two years to study means of improving Bolivia's tax-system. Further, USAID/B is helping to reorganize the various road-maintenance organizations into a single, efficient, centralized institution. The U.S. Bureau of Public Roads will assist in the reorganization.

The Mission believes that no competing use for the funds needed would be nearly as productive as these combined Projects. A USAID special project committee, selected to study all of the technical and economic aspects of Projects 1 and 4, has concluded that these Projects represent the optimum use that can be made of DL funds available to Bolivia at this time.

This opinion is partially founded on historical knowledge. No nation has developed without cutting transport costs. In Bolivia the lack of adequate transport facilities is a major barrier to economic growth. More broadly, it is indisputable that the Chapare and other tropical lowlands in Bolivia are areas where vast potential wealth will not materialize until cheap access is provided.

C. BORROWER

The G.O.B., through the Ministry of Economy, has requested a loan of $33.2 million to finance Roads 1 and 4. The request is very much in line with the GOB and the USAID's efforts to develop an adequate transportation system to accelerate the economic, social and political development of the nation. While the USAID believes that the GOB has the necessary administrative and technical capability to properly manage a road construction project of this order, it will be required that expert contractual services from the United States be retained on its behalf to supervise the construction.

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1. General Description of Project

The Highway project in question is located in the northeastern part of Bolivia, north and east of Cochabamba, and consists of the following two parts designated as Projects 1 and 4 respectively:

Villa Tunari - Puerto Villarroel, 86 kilometers

Cochabamba - Villa Tunari - Puerto Villarroel, 306 kilometers

The two projects will [illegible] a road system connecting the city of Cochabamba with the Chapare, which is the north-projecting to the east jungle-covered flood plains of the Amazon basin. In the Chapare plain, the roads would traverse an area of great agricultural potentialities, with their northern terminus on the bank of navigable rivers connecting with the Amazon and about the [illegible] River system.

Cochabamba, the southern terminus, is the second largest city in the country lying near the midpoint of the main projected highway that extends about 1,000 kilometers from [illegible] to Cobija. Cochabamba and other cities served by the extended highway are principal markets for agricultural products from the Chapare, and supply processed and manufactured goods for the Chapare. Thus, a good highway connection is of vital importance to further agricultural development in the region.

Hence the projects will serve two first purpose of opening new agricultural colonization areas and of providing a land or a combined road-river transportation system connecting the western, northern and eastern parts of the country with the north as well as providing an additional transportation link with Brazil.

Project 4, from Cochabamba (elevation 2,500 meters) to Villa Tunari (elevation 300 meters), traverses extremely rough mountainous terrain, reaching an elevation of 3,[illegible] meters 36 kilometers from Cochabamba. From that point to approximately [illegible], the project road gradually descends along the Tunari Valley to the [illegible] of the northern fork of the Cordillera Real. Hence the [illegible] project runs centrally to Villa Tunari, crossing two small drainage divides enroute.

Between Villa Tunari and Puerto Villarroel, Project 4 traverses the piedmont belt, never more than a few kilometers from the mountains providing access to a large area of underdeveloped but fertile land, and connecting with the [illegible] River at Puerto Villarroel. In the near future the population will [illegible] only local traffic, but in later years would form a link in the projected [illegible] of an interior arterial highway linking Bolivia, Peru, Paraguay and Argentina.

Project 1 begins at the colonization center of Villa Tunari in the flat, densely forested Chapare plain and extends eastward through relatively flat terrain to Puerto Villarroel (elevation 250 meters) on the Ichilo River. [illegible] 90 kilometers north of Puerto Villarroel, the Cordillera Real rises in a major mountain range reaching altitudes of over 5,000 meters and through which the length of Project 1 adds to the cost of the [illegible].

To further integrate Projects 1 and 4 with the existing highway network, a connection of approximately 78 kilometers is proposed between Aguirre and the Cochabamba-Santa Cruz highway through Sinaqui. Since road traffic can be expected between the Chapare and points east of Aguirre. A fair-weather road between Aguirre and Sinaqui is now under construction by Government forces. It is proposed under Project 4 to improve the road to a condition suitable for all-weather use.

The general location of Projects 1 and 4 is shown on the map at the end of Annex III.

The total construction cost of Project 1 is $5,[illegible],526 including $1,503,160 in local currency. Adding 15% for contingencies brings the total to $5,[illegible],[illegible]03, including $1,[illegible]0,[illegible] in local currency. Right-of-way costs ($5,000 in local currency), additional surveys, final design and preparation of contract documents ($[illegible],[illegible]0 of which 5[illegible]% are U.S. costs) and supervision of construction ($[illegible],[illegible] of which [illegible]% are U.S. costs) bring the total cost of the project to $[illegible], including $2,115,611 in local currency.

The total construction cost of Project 4 is $[illegible], including $5,694,096 in local currency. Adding 15% contingencies brings the total to $[illegible], including $[illegible] in local currency. Right-of-way costs ($[illegible],000 equivalent in local currency), additional surveys, final design and preparation of contract documents ($[illegible] of which [illegible]% are U.S. costs) and supervision of construction ($[illegible],[illegible] of which [illegible] are U.S. costs) bring the total cost of the project to $26,[illegible] including $7,599,905 in local currency.

Total costs of projects 1 and 4 are $[illegible]. This will be financed by the proposed loan with the exception of [illegible] costs which will be borne by the Government. Summary sheets of dollar and local currency costs are in Annex VIII.

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2. Implementing Plan

(a) Technical Feasibility

In accordance with the contract between the Government of the Republic of Bolivia and the consulting firm of [illegible] Group Stratton (HSG), and pursuant to Task Order N°1 which was issued to HSG by the Bolivian Government on October [illegible], 1962, HSG studied various alternate routes for Project 1 then were limited to the Cotapata route the most feasible route. Upon approval of the route route route by the Government, HSG, under the same Task Order, made detailed studies of the route and prepared an economic and technical [illegible] report. The following [illegible] reports were submitted by HSG in this connection on the dates indicated.

"Route Selection and Preliminary Engineering Studies, Project N°1, Highway to Villamontes" — April 12, 1963.

"Proposed Highway [illegible] Tarari to [illegible] Villamontes" — October 10, 1963.

Pursuant to Task Order N°4 issued to TAMS by the Government on November 7, 1962, TAMS studied various routes for Project 4 and recommended to the Government the most feasible route. Upon approval of the recommended route by the Government, TAMS, under the same Task Order, made detailed studies of the route and prepared an economic and technical feasibility report. The following titled reports were submitted by TAMS in this connection on the dates indicated:

"Route selection and Preliminary Economic appraisal, Project N°4, Highway from Cochabamba to Chipiriri (Puerto Patiño)" -- August 30, 1963

"Proposed Highway; Cochabamba to Villa Tunari and Isiboro River" -- January 29, 1964

From an engineering and construction standpoint, both Projects 1 and 4 are feasible. Project 1, in the lowlands, presents no engineering or construction problems except during the rainy season from November to March, when construction will be considerably hampered, particularly in earthwork operations which probably will have to be shut down. Project 4 has this difficulty only at its lower end in the Chapare.

The projects are economically justified. Tangible benefits from construction of Project 1, will consist of development benefits from new colonization along the highway and from linkage to navigation on the Ichilo-Mamoré River system. Project 4 will bring both development and road-user costs benefits.

The cost of Project 1 is estimated at $6.5 million while annual capital recovery cost is $412,000, at 6% interest. The annual average cost of maintenance over 50-yr. life is estimated at $81,000. The annual capital recovery cost of colonization associated with Project 1 is estimated at $79,000. Therefore, the total annual cost for the combined highway and colonization would be $572,000. The total tangible benefits for the years 1972 and 1987 have been estimated at $2.2 million and $6.2 million, respectively. Therefore, the benefit-cost ratios for 1972 and 1987 would be 3.8 and 10.8, respectively.

The cost of Project 4 is estimated at $26.9 million, for which, at 6% interest, the annual capital recovery cost is $1,737,000 until 1980, at which time it is estimated that $1.5 million will have to be expended to strengthen the asphalt pavement. The annual capital recovery cost

would therefore increase to $1,858,000 after 1980. The annual average cost of maintenance over costs on the current route is estimated at $41,000, based on an estimated cost per kilometer of $935. The annual capital recovery cost of the colonization associated with Project 4 is estimated at $75,000. Therefore, the total annual cost for the combined highway and colonization projects would be $1,843,000 prior to 1980 and $1,974,000 thereafter. Total tangible benefits are estimated at $3.75 million and $10.51 million for 1973 and 1988 respectively. Therefore, the benefit-cost ratios for 1973 and 1988 would be 2.0 and 5.3, respectively.

Concerning the reasonableness of the cost estimates, the unit prices shown in Annex III are estimated costs of labor, materials and equipment, plus a percentage for contractor's overhead and profit. In development unit prices it was assumed that equipment amortization will be charged to this project only to the extent that the normal useful life of the equipment is expended, hence these low amortization charges are contingent upon combining Project 1 and Project 4 in to a single construction contract, which would practically amortize the principal items of equipment, due to the fact that equipment will be switched between projects to make best use of the difference in rainfall condition between the two project areas. Were either project constructed under a separate contract, unit prices would probably be somewhat higher than those estimated, reflecting the additional amortization charges on the unexpended value of the equipment.

Escalation will be handled by including ing the specifications the clause used in Projects 3 and 7 as follows:

"If costs to the contractor should be increased because official action of the Government of the Republic of Bolivia in the exercise of its constituted authority, subsequent to execution of the contract, the Ministry will entertain a claim by the contractor for additional compensation, provided:

(a) The basis of the claim involves no other elements of cost except legal and unavoidable increases in the following:

1. Labor rates or legally required fringe benefits of the contractor's Bolivian employees, where such increases are granted pursuant to Government action raising the minimum wage of Bolivian workers.

2. The price of cement manufactured and purchased in Bolivia where such increases in price result from specific action of the Government.

3. The prices of fuels and lubricants manufactured and purchased in Bolivia, where such increases in price result from specific action of the Government".

In view of the preceding paragraphs, the proposed project meets all technical requirements of Section 611 of the Act for International Development in 1961.

(b) Engineering Plan for Implementation of Project

The schedule of engineering and construction requires prompt completion of the remaining engineering work, in order to permit construction to begin at the end of the 1964-1965 rainy season. The work that would be entirely or partially entrusted to the consulting engineers includes preparation of bidding plans, specifications, and other documents, pre-qualification of bidders, preparation of advertisement for bids, analysis of bids, award of construction contract, and preparation of final construction plans. The work associated with the principal items of preparation of bidding plans, specifications and construction plans is outlined below.

(1) Surveys

For final design, additional field survey work is needed to supplement the field location survey already accomplished. Although the band of surveys performed for this report was widened sufficiently to accommodate the various alternative alignments made in preliminary design, additional topographic survey work in a wider band is required for further investigation and study of the best alignment at several river crossings. Additional topographic surveys would be also made in areas where further study of minor drainage is considered essential, in several sections where slide may occur, and at the location of the proposed tunnel on Project 4.

(2) Soils and Materials

Additional borings and subgrade soil reconnaissance are required to complete studies of several possible line changes. Also, at most river crossings, further borings will be required to develop the final designs. All areas of potential or existing slide activities would be examined in detail.

The locations, quantities and quality of sand and gravel for select sub-base course and base course must be determined. Additional testing of aggregates for bituminous pavement and structural concrete and concrete cylinders is needed to develop suitable specifications.

(3) Horizontal Alignment

Several possible line changes must be studied concerning the most economical location and elimination of slide conditions, after which, if changes are made, horizontal alignment calculations will be altered, curve data assigned and final alignment referenced to points previously established in the field for final layout. Additional detailed study sould be given to the proposed tunnel at Km. 90.5 of Project 4.

(4) Vertical Alignment

In the design of the final vertical alignment, a general review of the grade line established during preliminary design will have to be made, taking into consideration subgrade soil properties, high water levels, bridge vertical clearances, cover over drainage structures, economical earthwork distribution, desirable maximum and minimum grades, and sight distances. Profile design work would also be entailed for comparative study of alternative alignments. Vertical curves would be designed to provide sight distances conforming with recommended design standards.

(5) Drainage

The drainage system will have to be reviewed in detail, investigating the feasibility of several possible channel changes to assure an efficient and economical design. Here small amount of field work will be required.

(6) Bridges

It will be necessary to inspect the structure sites to substantiate and supplement information obtained in the preliminary surveys, and to appraise possible alignment changes at several sites. Final structural

design calculations will have to be performed, as well as the preparation of detailed construction drawings in final form.

(7) Quantities Determination and Cost Estimate

Following design of the horizontal and vertical alignment, drainage and bridges, quantities of all construction items will be computed and a mass diagram plotted for those areas where economic balancing of earthwork can be effected. The analysis of unit prices will be reviewed and with quantities and unit prices a construction cost estimate can be calculated which will be used as a basis for evaluation of bids.

(8) Preparation of Contract Plans and Specifications

Plans and specifications for issuance with a call for bids will have to be prepared. Plans will consist of a title sheet, typical sections, standard plans for pipe and box culverts, roadway plan and profile sheets, and preliminary bridge drawings. Final specifications, which would be issued with the bid plans, would consist of the U.S. Bureau of Public Roads' 1961 edition of "Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects", supplemented by special provisions as required to meet local conditions. Final construction plans will be completed during the bidding and mobilization period.

The estimated time for performing the above final engineering work is 11 months as indicated on page 52 of Annex III. Bids will be invited 4 months prior to termination of this period.

With regard to the procedures for doing construction work, there is little precedent in Bolivia for the extensive program of highway construction now being planned. The most recent major construction project was the

highway from Cochabamba to Santa Cruz, completed about eight years ago. The major part of the work was accomplished under contracts providing for reimbursement of costs plus a fee. Several smaller highway projects have been performed in recent years by CBF (Corporation) and by local contractors, e.g., the 70-kilometer road from Carnavi to Santa Ana completed in early 1963 and built by a Bolivian construction company under a unit-price contract. A major airport is now under construction in the city of La Paz, under a unit-price contract as a joint venture of Bolivian and Peruvian construction firms. Bids were received January 21, 1964, on highway Projects 3 and 4, (AID loan N° 511-L-015), which will be constructed under a unit-price contract with AID financing similar to that expected for the present projects.

Many factors influence the type of contract to be selected for this project. Among these are the size and complexity of the work to be performed and the absence of construction firms in Bolivia capable of undertaking with their own equipment and staff the large scale specialized work required. Therefore the Mission proposes a unit-price contract with bids in both dollars and pesos bolivianos, the latter to be evaluated in equivalent dollars. U.S. contractors will be pre-qualified before being permitted to bid. The contractor will have full responsibility for all procurement: equipment, materials, manpower, etc. To adequately protect the interests of the Governments of Bolivia and the United States, the following bonding requirements are proposed: Bid Bond 20 percent, Performance Bond 100 percent and Payment Bond 50 percent of the bid or contract amount.

The construction time schedule is determined by the seasons. Since the principal items of construction -- excavation and grading, subbase, base, surfacing and structures -- can proceed at a normal rate only during the dry season, it is desirable to start construction at the end of a rainy season. Consideration is being given to constructing Projects 1 and 4 together as one contract. Page 52 under Bar Charts in Annex III presents a proposed schedule for these projects. As shown on the chart, it is expected that Project 1 will take 21 months to complete, and Project 4 [illegible] months. The schedule takes into account the limitations on construction activity during the rainy season. Page 53 under Bar Charts in Annex III is a schedule of engineering, construction and funding for Projects 1 and 4. (See page for a discussion of possible manpower shortage).

3. Maintenance

By Supreme Decree N° 06[illegible], signed February [illegible], 19[illegible], the National Roads Service of the Ministry of Public Works and Communications was made solely responsible for all functions related to highway maintenance in Bolivia and is currently preparing a program to reorganize maintenance on the national highway system. The National Roads Service has the best organization, equipment, and maintenance and repair facilities in Bolivia. Its central and district shops are well organized as [illegible] control of warehousing, operations and [illegible]. Payroll and cost accounting are standardized throughout the Service. Each District Office provides all necessary functions (management, administration, engineering, repairs, maintenance, stores and radio) required for highway maintenance work.

Covered garages are provided to protect equipment and to repair. Preventive and routine maintenance of equipment is accomplished at the work site. Minor and general repairs are executed in the district shops. Major repairs, overhaul and engine rebuilding, are done in the central shop at La Paz. The La Paz central shop and the Sucre, Cochabamba and Tarija District shops employ full time mechanical engineers. All district and resident engineers are college trained, some having graduated from U.S. universities. Most of the districts' chief mechanics have been trained in Mexico, as have many equipment operators. These men, in turn, have trained other mechanics and operators in Bolivia.

In Annex III, under "Maintenance Information" are found organization charts for the central headquarters and district offices. The location of the permanent work camps of the National Roads Service, the repair and maintenance equipment in the central and district shops, the road maintenance equipment of the Service, the equipment on order, and the personnel of the Service are also listed in Annex III.

The major source of funds for roadwork is the annual appropriation from the National Treasury. In addition, there are special taxes whose revenues are intended for road work. In Annex III under "Maintenance Information" will be found a description of the various special taxes contributing the road work funds.

It is believed advisable at this point to give a little background of the annual budget of the Servicio Nacional de Caminos. The 1964 budget is broken down into three main headings: Personal Services, General Expenditures and Investments. Under "Personal Services" are the items of basic salaries, Christmas and other bonuses, family support, dismissal indemnities, overtime and border bonus (a bonus for working in the "boondocks" near the frontiers). "General Expenditures" include the items of travel expenses, transportation of household effects, insurance, communications, public services, materials and expendibles, maintenance, food support, clothing, publications, rent, and miscellaneous and contingencies. The only item under "Investments" is "construction".

The budget situation of the Servicio Nacional de Caminos is a rather odd one since the Budget Bureau requests them to submit a budget only for the funds allotted to them from the Government's General Budget. For the past several years this figure has been $b 18,000,000. This, in reality, is not the actual expenditure situation of the Service, since they have several other sources of funds which, apparently, the Budget Bureau is not interested in as far as funds budgeting is concerned. Through the past few years these additional funds have amounted in [illegible] to $b [illegible],000,000. Other income, in addition to the allotment from the Government's General Budget, has consisted of payment for maintenance of [illegible] (usually N.S.'s responsibility), radio usage by other agencies, sale of equipment, sale of materials, rentals, interest, contract penalty [illegible], personnel fines, fines for lost property and miscellaneous. These extrabudgetary sources of funds amounted to about $b 4,429,600 in 1963 and $b [illegible] in 1964.

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The 1964 budget, as prepared, shows the following amounts in pesos bolivianos for the three main categories in each of the six districts and the central headquarters office:

District	Personal Services	General Expenditures	Investments	Total
La Paz Central Of.	2,60[illegible],[illegible]	[illegible]	4,[illegible]	3,49[illegible],[illegible]
La Paz District	1,69[illegible],[illegible]	[illegible]	1[illegible],[illegible]	3,658,613
Sucre District	2,078,[illegible]	[illegible],380	1[illegible],[illegible]	3,011,[illegible]
Tarija District	1,[illegible],[illegible]	[illegible],[illegible]	[illegible],[illegible]	2,869,[illegible]
Cochabamba Distr.	[illegible],[illegible]	346,[illegible]	[illegible],930	1,50[illegible],531
Oruro District	1,616,[illegible]	1,6[illegible],[illegible]	155,[illegible]	3,551,450
Potosi District	1,[illegible],[illegible]	[illegible]	[illegible],[illegible]	[illegible]
Total	14,078,[illegible]	5,[illegible],[illegible]	8[illegible],[illegible]	18,124,000

Unbudgeted sources of income [illegible] in calendar year 1963 amount to Bs 11,743,916.

Although not included in the 1964 budget, as a result of the Presidential Decree of January 21, 1963 issued by the Servicio Nacional de Caminos took over the functions of the Servicio Nacional de Caminos, the Servicio will receive, in addition to the [illegible] and Budget allotments, the following funds hitherto going to the Tesoro:

11% of tax on hydrocarbons, estimated at [illegible] per year	Bs [illegible],000,000
Road tax, estimated [illegible] per year	1,100,000
Miscellaneous [illegible] amount per year	[illegible],000,000
	Bs 7,100,000

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This amount should be reflected in the 1965 budget.

We have no particular comments to make on the budget as submitted by the Servicio. However, it may be [illegible]; that by reason of Government Decree during the past 4 years a considerable number of additional sources of income from taxes and tolls other than the three [illegible] have been assigned for road work.

Nevertheless, according to advice from the [illegible], [illegible] funds have not been received by this figure. We have requested the Servicio to investigate the reasons for the [illegible], particularly in view of the fact that by Supreme Decree [illegible] of January 21, 1963 all responsibilities for highway maintenance, [illegible] and construction have been assigned to the Servicio.

In view of the [illegible] the [illegible] that the [illegible] that the IDB will provide [illegible] the Servicio Nacional de Caminos [illegible] the [illegible] project as well as those other roads [illegible] the Servicio. Of [illegible] of this [illegible] maintenance [illegible] for [illegible] or a road [illegible]

approximately $b 1,450,000.

The National Roads Service receives both technical and financial assistance from USAID, the latter in the form of budgetary support to the Government of Bolivia. It is obvious that additional funds, and probably new sources of funds, must be developed if the roads of Bolivia are to be properly maintained. One of the responsibilities of the National Roads Service, specified in Supreme Decree [illegible], is a study to ascertain the net income from all existing sources of road revenues, to determine whether the existing laws are effective in producing their potential revenues, and to discover whether additional forms of taxation might be developed without adversely affecting the national economy.

From the above, it is obvious that an excellent organization is developing for road maintenance, but that financing is the main problem. Under AID Loan 26, the immediate equipment needs of the National Roads Service, under their old responsibilities, are being taken care of with the purchase of about $1.7 million worth of equipment, at a price ceiling of $400,000. Application for new equipment, [illegible] loan of about $[illegible] million, will be made so that the organization can meet its added responsibilities. In addition, the Government of Bolivia is negotiating with the U.S. Bureau of Public Roads for personnel to advise and assist in the establishment of an efficient maintenance program.

As far as the maintenance of these projects is concerned, the total estimated cost of equipment and plant to be purchased for Projects 1 and 4 is $423,000, of which $98,000 will be required for Project 1 and $325,000 for Project 4.

4. Manpower

In view of the considerable size of the 2 projects, and also because of the fact that their implementation may easily coincide with other road construction in Bolivia, the availability of skilled manpower may become a serious problem. This is true of trained equipment operators and mechanics as well as of personnel on the supervisory level, including foremen, surveyors, superintendents and similar. In order to overcome this possible bottleneck, the contract between GOB and the construction firm should specify an extensive training program for these categories of personnel to be undertaken by contractor at an early stage of his operations.

In addition, USAID/B will make the necessary provisions to intensify its participant program for the training of engineers, mechanics and operators so that they become available for the proposed projects.

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E. SOCIAL ASPECTS

I. INTRODUCTION

On Bolivia's overpopulated Altiplano and high valleys, most of the population lives barely above the subsistence level. To the east of the Andean chain, the lowlands of high agricultural potential, underpopulated and underexploited, except for scattered isolated settlements. To open up these lands for development and to facilitate the transfer of population to the lowlands, the [illegible] proposes the construction of a new and improved road complex. This complex, designated as Number 1 and 4, will link Bolivia's central city of Cochabamba, a major marketing center for agricultural produce, with the fertile Chapare region and with the Mamoré River system of the Beni Department. These roads are expected to play a key role in changing Bolivia from a country essentially dependent on mineral production and subsistence agriculture to a country with extensive development of the highly fertile tropical provinces, with enhanced division of labor between uplands and lowlands, and with improved wealth for all.

II. SUMMARY DESCRIPTION, JUSTIFICATIVES AND OBJECTIVES

a. Summary 1/

This project will contribute to the economic development of Bolivia, the highest priority in the approved USAID/B strategy, by greatly reducing transport costs between the overpopulated highlands and the region of considerable economic potential: (1) the [illegible] lowlands in the Chapare region immediately adjacent to the [illegible] and highways and hence accessible via inexpensive feeder roads, and (2) the lowlands of the Department of the Beni and Pando which are linked to the proposed highway by the navigable Mamoré River and Beni River systems.

b. Justification

1. Adjacent Settlement Areas

These lands consist of approximately 300,000 acres of tropical land of high fertility in a belt extending 5 kilometers from each side of the

1/ The institutional and analytical basis for the conclusions reached in this section is in the [illegible] which follows.

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highway. The are especially suitable for producing rice, bananas, corn, cassava and other tropical products. At present, their development is inhibited by high cost road transportation over a 14,200 foot pass between Villa Tunari and Cochabamba (the route to be served by Project 4) and by the lack of an all-weather road from Villa Tunari to Puerto Villarroel (the route of Project 1). The foothills can now support an estimated population of perhaps 20,000 families at relatively low levels of productivity.

With cheaper transport the region could support at a very conservative estimate 5,000 additional families within a few years of the completion of the project. Even areas, if these new settlers are given over a medium of technical assistance, their output per family may be expected to exceed substantially the per family output currently produced in the area. Within the relatively brief period of ten years from the completion of the projects, these settlements should have increased, at a minimum, the gross value of agricultural output of the area by 15-2 million. This increase will be achieved without any concentrated reduction in output in the overpopulated areas on the Altiplano and of the high valleys from which the settlers will come.

2. Mamoré Basin

Puerto Villarroel is at the head of all-year navigation on the Ichilo River, a major tributary of the Mamoré River. This river system flows north for approximately 900 miles through the sparsely populated Department of the Beni to the port of Guayaramerin on the Brazilian border. From Guayaramerin a proposed connecting road, now under construction, will connect the Mamoré River with the Beni River, the second major Amazon tributary crossing Bolivia.

By tying the highway system into these river systems, an area roughly equal to the state of Colorado (304,152 sq. miles) and comprising 25% of the national territory, is brought into the national economy. The two Departments of the Beni and Pando have hitherto been connected to the more densely populated highlands solely by airplane. As a result, the Brazilian grasslands have enjoyed a fraction of the livestock which they can support and the forest and farm economies have had very limited local markets.

Initially the Mamoré basin would cap the mainly beef trade the river and Settlers 1 and 4 (estimated at 1 million in value at the 10th year). This is the only increase in production estimated in the tangible benefits calculations. However, because of the expected increase in population in the area and of the greatly reduced costs of supplies and equipment

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brought in from other parts of Bolivia, it is anticipated that there will be considerable diversification in production which, though difficult to quantify today, could lead to the development of many other products of greater economic value in 10-20 years time.

There have already been several dramatic illustrations of how improved transportation into the Beni will reduce costs.

In one of the northern cities of Bolivia, Tarija, there is a mountain of rock salt used as milk licks for cattle. This salt currently sells for Bs 4,000 per hundred weight. By the time it is transported to Santa Cruz the price is Bs 23,000 per hundred weight. Until recently the additional transportation costs to the Beni made this hundred weight of rock salt sell for Bs 100,000. Recently, with most very small improvements in one of the subsidiary rivers of the Mamoré, which reduced transportation costs, the price of rock salt in the Beni has dropped to Bs --- 60,000.

c. General Benefits

It is expected that the Project will accelerate economic growth in Bolivia for the following reasons:

(1) Agricultural Productivity. The agricultural lands of the high valleys are overcrowded so that output per man is very low. Even output per acre is low since the [illegible] relatively small plots of [illegible] technological advances, and much of the land is depleted or eroded. In the lowlands - the areas to be served by the new roads and in the river communities - fertile land is abundant and [illegible] available. Already low, Cuba apart from social and political considerations, simple economic sense requires a redistribution of labor to this underutilized natural resource - provided, of course, that the costs of migration and accelerated investment costs are not excessive. In the presence of the high benefit-cost ratios indicate that they are not. The estimated increase of $9.0 million in gross output attributable to this project in the tenth year, will not result in a decrease in output in any other sector. In the contrary, a decrease in the rural population of the Altos overall highland areas will make increases in output much easier to achieve.

(2) Reduced Transport Costs. It is estimated that in Bolivia, transport then costs amounts from 35 percent of the market value of agricultural products, as against 4 to 10 percent in the U.S.A., where the average distance to market is much greater than in Bolivia. Thus, if the variable operating costs of shipping and for cargo (valued at $100 in Cochabamba) between Cochabamba and Villa Tunari are reduced from their current $37.40 to $15.[illegible] ($[illegible] additional) the price of the good to

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the consumer can be reduced by 16% (from $137.40 to $115.40) and his net income raised correspondingly. (Actually, since the benefits of the project accrue directly to the private sector, the price system will distribute the gains among consumers, farmers, and transport operators).

(3) Expanded Markets. Reduction in the costs of moving products not only increases the real income of their purchasers and/or suppliers, but greatly extends the market for any given product: The campesino spending $120 a year may now find 10 of those dollars paying transport costs on his city produced products; improvements in transport could cut this sum to $5 or less; as a result his effective demand for products can be increased 20 to 30 percent. Since this would be true for all purchasers of goods, effective demand for all desirable goods probably increases considerably. This means larger markets, and larger markets mean that modern methods of large scale production become increasingly practical. Adam Smith summed it up with his statement that "the division of labor is limited by the extent of the market." Without the transport revolution, the industrial revolution would not have been possible. The same is true in Bolivia today.

(4) Increased Political Stability. An increase in social and political stability, although not easily measurable, will have considerable economic importance. Private investment in all sectors of the economy is discouraged by the unrest inherent in an overcrowded agricultural sector yielding low incomes for the campesinos. In the regions in which settlement is encouraged by this highway, the agricultural system will be characterized by individual freeholds of an adequate size to support a family, with rising family income as the parcels are developed (20 to 45 acres, at least 15 times as large as average holdings in Bolivia today). Taken by itself the present project does not necessarily assure social stability and a basically private enterprise economy in Bolivia but it can make a contribution to that end that should not be ignored.

d. Conclusion

The annual, estimated, total, tangible benefits are $3,730,000 in 1973, $5,730,000 in 1978, and $7,690,000 in 1983. On completing a detailed analysis, the USAID/B, concluded that no competing uses for the funds needed would be as productive as these projects. Because of uncertainty, inadequate data, and lack of information on the development process, a precise answer to the question are projects 1 and 4 the best uses in Bolivia for $24 million in scarce resources is impossible.

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The benefit-cost ratios are both high and conservative. But this is not a sufficient reply. We can only state that, on reviewing alternatives, we know of no other large scale investment which will at this stage yield as high returns to the economy as the proposed projects. This conclusion is partially founded on historical knowledge. No nation had developed without cutting transport costs enormously. Relatively cheap transport is a necessary, although not a sufficient condition for development. The existing deficiency on this score is glaring in Bolivia.

To reiterate, the benefit-cost ratios are conservative, even when remaining within the framework of measurable benefits. For example, the increased benefits which would result from connecting Routes 1 and 4 with a direct route to Santa Cruz were not included.* In calculating these benefits, no consideration was given to long-run dynamics: The highways open a fertile agricultural area where settlement over time will probably give impetus not only to the development of agriculture, but also to food processing industries, farm input industries (e.g., machinery, fertilizer, insecticides, concomitant transportation, communication and service industries) as well as to commerce and urbanization. To what extent the new industries would locate in the lowlands and to what extent there would be enhanced division of labor between the lowlands and the high plane is a moot question. What is indisputable, is that enhanced agricultural wealth will stimulate industrial growth and that the vast potential wealth in these tropical areas will not materialize until access is provided.

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* See page E-D for detailed analysis

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III DETAILED ECONOMIC ANALYSIS

a. Method of Analysis and Conclusions

As TAMS made separate studies of Project 4 and Project 1, it is difficult to combine data for the two. Four is more costly than One, $ 26.9 million as opposed to $ 6.5 million. Detailed analysis is made of Four. This analysis is in large part directly applicable to One. Moreover the method of calculating benefits and costs in One is identical with that of Four. Hence a briefer analysis will be made of One.

The conclusions reached in the economic analysis of benefits and costs is that the TAMS estimates are honestly and efficiently made. They are conservative. Taking the cost estimates as datum, the probability is far greater that the estimated benefit-cost ratios will be exceeded than the contrary.

b. Benefits of Project 4

1. Expected Traffic and User Savings

In estimating future flows of traffic, TAMS broke the aggregate flow into components, projected future traffic densities for each component, then added the partial flows together. There are three components: (1) Normal traffic growth over the entire route of 7 percent per annum is assumed. This is conservative as traffic over the existing Cochabamba-Chapare highway increased 12.9 percent annually between 1957 and 1962. (2) Generated traffic is assumed at 15 percent of 1963's density between Cochabamba and Aguirre, and 20 percent between Aguirre and Villa Tunari. Generated traffic is those motor vehicle trips made which would not have occurred without the highway improvement. This extrapolation is based on U.S. experience, and appears conservative.

A more important component is (3) development traffic. It is assumed that soon after completion of the project 2,500 additional families will have settled in the Project 1 area of the Chapare with the assistance of the CBF (Corporación Boliviana de Fomento). The produce shipped by these farms is estimated. For example, the average farm is expected to ship 3.8 medium truck loads in 1975, and 5 such truck loads in 1980. (1 truck load = 6 metric tons). In this fashion, future outbound truck movements of agricultural products are estimated. To estimate associated traffic increases the resulting figures are multiplied by a factor of 3 for 1975, increasing to 5 by 1985. The rationale for this procedure is that road traffic

between Cochabamba and the Chapare "ranges between 2.1 and 7.8 times" outbound movement of farm products and lumber. In similar fashion, the Project 1 traffic expected to feed into the Project 4 highway is estimated. The partial flows are then totaled. For example, the ADT (Average Daily Traffic) from the Yungas of Corani to Villa Tunari is estimated at 390 in 1973, as opposed to 65 in 1963.

TABLE I

PROJECT 4, CUMULATIVE DISTRIBUTION OF ADT+ COMPONENTS IN 1978, AND TOTAL ADT IN 1983 AND 1988°

SEGMENT	TOTALS 1	2	3	4	5	6
Cochabamba-Sacaba	350	1015	1127	1350	1850	2600
Sacaba-Aguirre	85	245	357	580	790	1120
Tiraque-Aguirre	5	15	23	50	70	100
Aguirre-Colomi	85	250	370	620	850	1190
Colomi-Yungas of Corani	70	205	325	580	790	1110
Y. of Corani-Villa Tunari	65	190	295	550	750	1050
V.Tunari-Isiboro River	-	-	na	70	100	140

Average ADT Cochabamba-V.Tunari 96

1) Hypothetical Distribution in 1963.
2) Increased by projected normal and generated traffic between Cochabamba and Villa Tunari.
3) Increased by Estimated development traffic.
4) Increased by Project 1 traffic using Project 4 road.
5) Total ADT in 1983.
6) Total ADT in 1988.
+ Average Daily Traffic
° Totals rounded down to nearest zero.

User savings will be substantial. The decrease of 16 Km. in road length from Cochabamba to Villa Tunari, the higher running speeds, the paved surface, the elimination of over two thousand curves, as well as of long segments of road at high elevations are expected to result in average savings in vehicle operating costs between Cochabamba and Villa Tunari of about 5 cents per kilometer for light vehicles, 11 cents for medium vehicles and nearly 30 cents for heavy vehicles. Given the expected decrease in user costs and expected traffic flows, the new highway between Cochabamba and Villa Tunari as well as the connection between

Aguirre and the Cochabamba-Santa Cruz highway near Tiraque - of very minor weight in the calculation - would result in annual savings in user operating costs of $ 3.1 million in 1973 increasing to $ 7.7 million in 1983.

2. Development Benefits

The other element in TAMS' "tangible benefit" calculation is "development benefits". In calculating this figure, average gross farm income is estimated and costs of labor, capital, and marketing subtracted. The net figure arrived at is $ 280 per farm in 1973, and $ 570 per farm in 1978, after ten years. (Note: This implies low per capita incomes but this calculation is based solely on marketed output and does not include produce consumed on the farm). Total colonization benefits were calculated by multiplying this net figure times the 2,500 estimated families ($ 700,000 in 1973 and $ 1,420,000 in 1978). In making this estimate, TAMS implicitly assumed that labor transferred to the Chapare brings with it a decrease in output equal in value to that of home produced and consumed goods. This assumption is very conservative: Marginal labor on the Altiplano and associated valleys is not productive; labor is underemployed in agriculture, mining and elsewhere. TAMS' assumed constant market prices in this calculation. It should be pointed out that, at this stage in its development, increasing incomes in the non-agricultural sectors should bring an increased demand for food. Hence a rapid rate of development elsewhere in Bolivia might be accompanied by increased agricultural prices to the farmer.

If, however, the price of Chapare produce should decrease, this would not imply decreased monetary benefits to Bolivia. Those purchasing Chapare produce would receive an increase in the value of their money income in the amount of the price-reduction times the quantity purchased. The monetary benefits Chapare farmers lose would be passed on in increased income to the rest of the community.

The "estimated total tangible benefits" are $ 3,750,000 in 1973, $ 5,730,000 in 1978, and $ 7,590,000 in 1983.

3. Evaluation of the Benefit Calculation

It is desirable to note that the estimated income per farm - the basic element in the benefit calculation - is based on current prices received by Chapare farmers. As TAMS put it, "no allowance is made for the favorable marketing effect from reduced vehicle operating costs over the improved highway to Cochabamba". (Appendix IV.) In other words, although the reduction in transportation costs implies some increase in produce prices at the farm, and hence higher farm incomes, TAMS assumed that the entire savings

would accrue to vehicle operators. Needless to say, this simplifies the benefit calculation and is probably superior to alternative approaches.

As concerns settlement, 2,500 families moving in over a ten year period is probably conservative. Prior to the revolution of 1952, it was more difficult to migrate than today, as much of the land in the Oriente was held by a few wealthy families opposed to colonization. With the revolution, this situation changed and today migration is far easier. For example, after the road from La Paz to Caranavi was completed in 1959, it is estimated that about 15 thousand people moved into the Caranavi region in four years. This colonization was largely spontaneous, i.e., unsupervised. Similarly in 1961, the estimated number of families in the Chapare was 20 thousand. Nearly all of these are from Cochabamba valley where the man-land ratio is extremely high. It is estimated that about three-quarters of these settlers arrived in the eight years preceding 1961 although the road they moved in on was finished in 1937. These experiences suggest high future spontaneous colonization rates.

Both the projected rate of settlement and output per family are fundamental in estimating benefits from Projects 4 and 1. Estimated shipments out of the Chapare depend upon these two variables. TAMS estimates the value of average farm sales in the fifth year of colonization as $ 600 and in the tenth year of colonization as $ 995. How likely is this prognosis? In the Aroma settlement of the Santa Cruz area, sponsored by the CBF (Corporación Boliviana de Fomento) in 1954, the average value of marketed output per family was $ 563 in 1960. For the Huayto settlement of the CBF started in 1957, and consisting of 165 families in 1961, marketed output per family in 1960 was $ 497. In both of these colonies in 1960 or 1961, the average size of the family was 5.3 persons. Most of the allotted land per family was not cultivated. Hence further output per family should increase inter alia due to increased labor available per family and hence more land being brought into production. The Okinawan Colony in the Santa Cruz area, founded in 1954, with 245 families in 1961, had an average marketed family output of $ 1,195 in 1960. Here average family size in 1961 was 6 persons. These comparisons imply that the TAMS estimates of average new farm output in the Chapare are more than warranted, and are not optimistic.

The net annual income per family of $ 570 in the tenth year of farming is low; if we assume four in the family, less than $ 150 per capita. One reason for this low estimate is TAMS' exclusion from their benefit calculation of that income which does not enter into the market process: home produced and home consumed shelter, clothing, and above all food. It can be argued that the shelter and probably the clothing produced by colonists (if any) is offset by diminished production of these goods elsewhere. However, due to surplus labor on land in Bolivia's settled areas, it is probable

that with increased colonization, there is no concomitant decrease in agricultural output.

Substantial additional benefits would be realised from connecting the proposed Routes to Projects 3 and 7 (roads now being built northwest of Santa Cruz, which will open new lands to cultivation), through an inexpensive additional 55 km. link. This would provide a direct route between Montero (a town 75 km. north of Santa Cruz) and Cochabamba and would substantially increase the benefits of Projects 4 and 1. Traffic from Projects 3 and 7 would find the Chapare route to Cochabamba about 300 km. shorter than the route through Santa Cruz. It would also cut the distance from the Chapare to Santa Cruz by about 400 km.

c. Costs of Project 4

1. Costs and Benefit Cost Ratios

The cost of Project 4 is estimated at $26.9 million. This excludes colonization investments of about $2.2 million. TAMS estimate that in 1980, $1.5 million would be needed to improve the pavement where the highway is heavily travelled. They assume a fifty year life of both the highway and the colonies. They then calculate what annual payments would be needed to amortize the entire investment of $29.1 million, plus the additional $1.5 million planned for 1980. Maintenance costs in excess of these needed on the existing route are estimated at $41,000 per year.

The results:

> Total annual cost for the combined highway and colonization project thus would be $1,737,000 prior to 1980 and $1,858,000 thereafter.

The resulting benefit cost ratios:

TABLE 2

Year	6% Return C/B Ratio
1973	2.0
1978	3.1
1983	3.8
1988	5.3

Needless to say. both road and colonies can be expected to have lives exceeding 50 years.

2. Possible Cost Reductions Through Lowering Design Standards

Certain questions come to the fore. Why pave 165 kilometers of Project 4? In their preliminary study of August 1963, TAMS estimated the costs of the "bituminous surface treatment" as $1,036,538. Studies of user costs of the past have shown that paving of roads bring user-benefits, which increase with traffic density. Were a benefit-cost ratio computed for the asphalting costs alone the ratio would be higher than for the project as a whole. (See Wilfred Owen, Automotive Transportation, Brookings, 1949 and Appendix I.)

At the request of the Mission TAMS considered cutting costs through decreasing the average radius of curvature, i.e., making the curves along the mountains sharper. The savings in construction costs were calculated at nearly a million dollars, but the road became 4 km longer. The resulting

benefit-cost ratios showed that the suggestion was completely undesirable.

At the request of the Mission's engineers, increasing grades to 9% was considered in three places between Cochabamba and Villa Tunari. These would shorten the road 5 km. and reduce construction costs about $1 million. (The 5 km. decrease would be in addition to the 16 km. difference in length between Route 4 and the current one-lane highway.) This change will probably be incorporated into TAMS' final design. However, no reduction in estimated total costs has been made, as it is believed that TAMS may have understated the costs of dealing with slide-terrain by about an equal amount.

3. Possible Cost Reductions Through Alternative Routes

Two alternatives to Project 4 were considered, one was a route from Cochabamba east via the present Cochabamba-Santa Cruz highway for 116 km. to Montepuncu; the alternative would then move north through a mountain pass and continue for 136 km. to connect with Project 1. The costs of this alternative might have been below that of the proposed route from Cochabamba to Villa Tunari. However, there would have been considerable increases in distances from Cochabamba to the Chapare via this Montepuncu alternative. For example, the distance from Villa Tunari to Cochabamba via the Project 4 route would be 163 km., via the Montepuncu alternative it would be 318 km. As about 90 per cent of Chapare produce is expected to go to or through Cochabamba, the alternative implied greatly reduced benefits, far more than those offset by any probable reduction in costs. The estimated annual reduction in benefits if the Montepuncu alternative were built is 1.3 million dollars in 1973 and 3.5 million dollars in 1988. These estimates are based on the assumptions made by TAMS as concerns colonization and traffic flows in calculating their benefits for Project 4. Moreover, assuming construction of the alternative, because Route 4 would be the cheaper mode of shipping produce from the Chapare, at some future date when traffic-density justified it, Project 4 would probably be built and the Montepuncu route abandoned. The alternative was dropped.

A second alternative to the costly mountainous part of Project 4 was to build Project 1, plus the Puerto Patiño-Villa Tunari leg of Project 4; then connect these roads to Project 3 (a road being built northwest of and connecting with Santa Cruz), and Santa Cruz with a leg from Puerto Villarroel to Puerto Grether. Colonization could then proceed and the produce and purchases of the new area could move into and out of Santa Cruz.

However, most population and income in Bolivia are in and about the region Cochabamba-Oruro-La Paz. Hence, the produce of the Chapare, and much of the purchases of those in the Chapare, would have to move through Santa Cruz into and beyond Cochabamba. This view is supported by the following TAMS statement concerning current traffic from the Chapare proceeding to points south and east of Aguirre via the Tiraque-Aguirre road and connecting with the Cochabamba-Santa Cruz highway:

> Traffic on the existing road between Tiraque and Aguirre probably amounts to one or two vehicles per day during the dry season, and none at other times.

This is one or two vehicles daily in the dry season only, although TAMS estimates an ADT of 70 on the current Aguirre-Villa Tunari one lane road. These and other considerations lead TAMS to estimate that 90 per cent of the traffic on the Project 4, Villa Tunari-Aguirre road, will proceed to Cochabamba. Even stronger evidence for the view that most Chapare produce would move into or beyond Cochabamba is the current movement of produce out of the Santa Cruz area: From December 1961 to September 1962, 8.6 thousand vehicles left Santa Cruz carrying either food products or raw materials; of these 7.6 thousand had as destination either : La Paz (1.5), Oruro (.3) or Cochabamba (5.8). (Appendix IV.)

Hence, if the Chapare were opened to Santa Cruz, most of the output would still move to or through Cochabamba. The costs per metric ton per kilometer (T/km) on the 500 km. Cochabamba-Santa Cruz highway are given as US $.02 in the Plan Bienal 1963-64. (This is a freight rate, or total cost figure. Vehicle operating costs per T/km. are but a part of this). Estimate the distance from the Chapare to Santa Cruz as on average 300 km., and assume the same freight rate of $.02 per T/km in moving to Santa Cruz. The total costs, then of moving a ton of produce from the Chapare to Cochabamba via Santa Cruz is $ 16. The Two-Year Plan 1963-1964, gives the cost of moving a T/km on the current 150 km Cochabamba-Villa Tunari road as $.043. Add another 50 km as the average distance from within the Chapare to Villa Tunari. Estimate costs per T/km at $.05 over these 200 km Then total costs of moving one metric ton out of the Chapare to Cochabamba on the current highway come to $ 11.50. The route via Santa Cruz costs $ 16. These calculations exaggerate the costs of moving produce out of the Chapare. Actually the difference in costs between the two routes is greater than $ 4.50 per ton. Hence, at this stage, from the user-benefits perspective, connecting the Chapare with Santa Cruz would be senseless.

In addition, colonizing the Chapare via Santa Cruz is equally undesirable. A map of the excess farm population in Bolivia would show heavy concentrations in the Altiplano from Lake Titicaca to Oruro and in and about Cochabamba. Hence, opening the Chapare via Santa Cruz would bring little advantage. The overwhelming majority of colonists moving into the Chapare would find the current one-lane route the cheaper one.

d. Benefits and Costs of Project 1

1. Benefits

In calculating expected traffic on this gravel road, two components are relevant. As the current road is a mule trail, present traffic is insignificant; The number of families assumed settling along the highway is 2,500. TAMS estimated average farm income in Project 1 is slightly less than that of Project 4, by assuming that agricultural prices in the project area would be slightly less than those now prevailing in the Chapare, because of additional transportation costs due to greater distance from farm to market. In the tenth colonization year, average net farm-income is estimated at $510 and consequently total colonization benefits are estimated at $1,275,000.

Over the first twenty years of the project the majority of estimated benefits is derived from transhipments of river traffic at Puerto Villarroel for shipment to Cochabamba. Most of these benefits consist of increased income of cattle-raisers: For example, in 1977 the projected increments in net income in the Mamore Basin due to the road are $2,108,000. Of these, $2,070,000 will be due to shipments of cattle, the remainder due to lumber.

In reaching this $2,070,000 figure, TAMS projected expected cattle shipments for 1977 at 230,000 head. This is based upon projections of cattle output in Bolivia's Ten Year Economic Development Plan, 1962-71. According to Sr. Percival Buno of the FAO, this number represents only a small fraction of the potential for cattle development in the Beni, given adequate access to markets. TAMS assumed that but 75 percent of the Plan's projection for 1971 would be realized in 1972 and that the full amount projected for 1971 would not be attained until 1977. According to TAMS, the possibility of moving cattle via the river and the connecting highway system would mean that the "rancher's profits would be markedly improved by elimination of most of the current average wastage of 47 percent of the weight and by increased efficiencies resulting from much larger volume; it is conservatively estimated that his net income per head of cattle would be ten dollars, shipping on the hoof via the superior river and highway route." Hence we have the figure (230,000) ($10) or $2,300,000. TAMS assume that 10 percent of the cattle would be shipped to the Cochabamba-Chapare road via Puerto San Francisco, a small port now functioning in the Chapare, and cut benefits from $2,300,000 to $2,070,000. In all probability this figure of $10 per head increased net income is far too low, since 47 percent of the weight of cattle is currently dissipated in moving to market. (Note: currently meat is flown in from the Beni to La Paz and the Altiplano). TAMS considers solely cattle and lumber shipments in their calculations of benefits from "linkage to navigation." Undoubtedly other products will move up the Mamore to Puerto Villarroel, not to mention the possibility of products moving from Cochabamba via Puerto Villarroel to points north.

A problem is the allocation of the transhipment benefits of river traffic at Puerto Villarroel. Most of this traffic will travel the full route to Cocha-Bamba. Hence it can be argued that part of such benefits should be allocated to Project 4. TAMS ascribe the benefits entirely to Project 1. The ideal procedure would be to calculate benefits for Project 4 and 1 combined, since the full benefits from Project 1 presume the existence of Project 4. However in lieu of Project 4, Project 1 would still connect with the current rough road at Villa Tunari and presumably both colonization and transhipment benefits would still exist at least in the amounts TAMS calculate; for these calculations are conservative. Consequently we let TAMS benefit calculations for Project 1 stand.

TABLE 3

Estimated Total Annual Tangible Benefits of Project 1
(Thousands of Dollars)

Year	Benefits from Colonization	Benefits from Linkage to Navigation	Total Tangible Benefits
1972	620	1,580	2,200
1977	1,280	2,110	3,390
1982	1,720	2,750	4,470
1987	2,600	3,600	6,200

"Intangible benefits" such as the stimulation to production of new products which the reduction in transport cost makes possible do not enter into the benefits calculation. Nor are reductions in cost of the current mule traffic considered.

2. Costs and Benefit-Cost Ratios

The highway is estimated at total cost of $6,500,000. Colonization costs for Project 1, largely financed by a loan from the BID for the entire Chapare region, are estimated at about half of the total loan or some $2.4 million. Annual maintenance costs are estimated at $81,000, "including extraordinary maintenance costs of periodic replenishment of the gravel in the base course."

Total annual cost for the combined highway and colonization projects thus would be $572,000 considering on interest rate of 6% as yielding an equitable return on the highway investment.

The benefit cost ratios which result from these data are, assuming road funds at 6%, 3.8 in 1972, increasing to 10.8 in 1987.

e. Agricultural Potential of the Area to be Served by the Highways

The area which would be served by these highways has the greatest agricultural potential of any area studied to date by the soild section of the Interamerican Agricultural Service. Soil studies of the area to be served by the project indicate that about 40% is first class agricultural land and about 45% requires minor drainage work to afford excellent growing conditions. Additional surveying is in progress.

An experiment station has been established in the area to conduct trials and to distribute improved seeds and plants. Early results show excellent potential for bananas, cocoa, rice, citrus fruits and hard fibers such as kenaf and jute. Private plantings of rubber are giving excellent results.

f. The Economic Problems of Maintenance

TAMS suggest that maintenance of the Project 1 and 4 highways be carried out by Servicio Nacional de Caminos, and estimate that the Servicio will need $626,000 in additonal equipment to do so adequately. TAMS estimate annual maintenance costs for the two projects as follows:

TABLE 4

	Project 4	Project 1	Totals
Local Currency	$ 132,000	$ 50,685	$ 183,485
US$ for Equipment and Material	175,300	29,915	205,215
TOTALS	$ 308,100	$ 80,600	$ 388,700

In the past efficient road maintenance has been hindered by the confusion resulting from a large number of separate organizations in this field. Furthermore, the total amount of money provided by the government for maintenance has been inadequate. If the present road is to be maintained these defects must be corrected. USAID/B has encouraged the GOB to centralize the administration of road maintenance and under a recent decree the Servicio Nacional de Caminos (SNC) was given exclusive jurisdiction. To further strengthen SNC a team of experts from the U.S. Bureau of Public Roads has been arranged for. They will come to Bolivia this year for a two-year stay as advisors to SNC.

The financial problem of adequate road maintenance is a part of the more general fiscal problem of the Bolivian Government. It must raise revenues sharply in the next few years through better administration and a reform of the tax structure. USAID/B with the enthusiastic cooperation of the Minister of Finance has arranged for tax advisors from the U.S. Internal Revenue Service. They will be working in the Ministry of Finance for the next few years. Two other groups of tax experts from private American consulting firms will be brought to Bolivia during the latter part of 1964 to deal with other aspects of the revenue system.

Given the projected increases in national income in Bolivia during the next few years, the fiscal problem should not be intractable. It would be wise, however, in the case of these projects to have as a condition precedent of the loan the GOB's commitment to spend a stated minimum amount per kilometer on the maintenance of these roads.

IV. BALANCE OF PAYMENTS

a. Balance of Payments Impact

The net annual balance of payments savings as a result of these projects will be, by conservative estimate, $2 to $3 million ten years after completion. Of this $2 million will be in import replacement (including PL 480 commodities) and from $0.5 million to $1.0 will be increased exports. At a more distant date, say 20 years, these savings may be several times greater.

In a sense, the primary impact of the proposed highway will be in increasing and cheapening the supply of food for domestic consumption. It will thus aid in decreasing Bolivia's dependence on imported foods. In 1961, the latest year for which complete import figures are available, food and beverage imports amounted to $20 million or 25.7% of the total value of imports. The continuing importance of these food imports, and more specifically of agricultural products, is shown by the following table:

IMPORTS OF SELECTED FOODSTUFFS, JANUARY 1-JUNE 30, 1963

(Annual rates in millions of dollars)

Meat and Animal Products	1.6
Milk and Milk Products	2.5
Fresh Vegetables	0.2
Fruits	0.2
Coffee, Tea	0.4
Cereals	2.0
Flour	9.2
Fats and Oils	3.8
Sugar	1.7
TOTAL	21.6

Given a rate of growth of population of around 2.3% per year the demand for imported foodstuffs will probably steadily increase in the future, if new producing areas are not opened up and if costs are not significantly reduced on the transport of agricultural products from the Mamoré Basin.

It is estimated that the agricultural areas along the proposed highway and the rivers with which they connect will annually produce the following foodstuffs ten years after completion of the highways:

(Prices at Farm, 1963)

Rice	$ 837,500
Bananas	957,500
Corn	117,500
Peanuts	137,500
Yucca	457,500
Livestock and Poultry	2,667,500
Coffee	370,000
Citrus	450,000
Avocado	620,000
TOTAL	$6,614,500

At least $2 million worth of these products are either directly import-replacing or close substitutes for imported foodstuffs.

With the proposed highway but without other major changes in Bolivia's transport system a minimum of half a million dollars worth of the tropical fruits can be marketed abroad each year. Obviously these proportions are subject to change as relative prices change. Thus, for example, with good export possibilities the banana output can be increased rapidly; if processing and marketing facilities are created, peanut and livestock production can be increased.

The market areas for Bolivian tropical fruits will be in temperate Argentina and Uruguay and possibly in Chile. The most important outlet in the near future is the interior of Argentina -- the provinces of Salta, Córdoba, San Juan, Tucumán, and Mendoza - with total population greater than 4 million; i.e., about that of Bolivia. In these provinces the Brazilian competition is at a transport-cost disadvantage. Shipments of bananas from the Chapare have already been sold at good prices in Salta and Córdoba. Buyers have been, however, reluctant to depend on this source of supply as long as transport difficulties and low level of production make deliveries uncertain.

Access to the world market for rice, bananas, and citrus-concentrates is a strong possibility. It depends on the construction of a road connecting the present Projects 1 and 4 with Projects 3 and 7 (already approved). Although this road is not at present listed in the schedule of proposed construction, the GOB is contemplating a TAMS feasibility and route selection study. It seems virtually certain that it will be built in the course of the next 10 or 15 years. In addition to this road, an outlet for Chapare-Mamoré products on the ocean will require either improved Santa Cruz-Santos rail connections or the development of transport on the Paraguay River. In other words, important as this possibility is for the region to be served by the new road and for Bolivia, it lies somewhat further in the future.

b. Local Cost Financing

The local costs of these two projects are given by TAMS as $9,528,716 (exclusive of right-of-way costs of $185,000). Assuming that local costs are disbursed on the same schedule as all costs they will be disbursed as follows:

1964	$ 209,632
1965	1,696,111
1966	2,286,892
1967	2,286,892
1968	3,001,546
1969	47,643

The indirect foreign exchange drain associated with the expenditure of these local costs is estimated at 65 to 75% of total local costs. This figure is higher than the AID rule-of-thumb which calculates indirect foreign exchange costs at 50% of local costs (M.O. 1011.6). This higher estimate rests on the belief that the marginal propensity to import is very high in Bolivia (for a more detailed discussion see Appendix II). If, then, the indirect foreign exchange costs are estimated at 70% of local costs, it would leave 30% of $2.9 million of local costs to be financed by the GOB from its own resources. It is recommended, however, that in this case, the United States finance 100% of the local costs exclusive of the costs of right-of-way acquisition. There are two principal reasons for this recommended departure from normal policy. These are (1) the fiscal situation of the GOB and (2) the maintenance costs associated with the road program.

In spite of substantially increased tax collections in the last two years, the GOB will face difficult budgetary problem over the next few years. In 1963 the Government was forced to borrow roughly $4 million from the Central Bank at the end of the year. It also received direct budget support from the U.S. of $5.4 million, and assumed, incorrectly, that it would receive the same level of budget support in 1964. In 1964 the level of normal expenditures will probably rise by about $4 million (or 9%). Thus if the GOB were to avoid borrowing at the Central Bank and were to receive the same level of budget support, it would have to increase its tax collections by $8 million or nearly 20%. In fact it must do much better than this. In the first place direct budget support provided by the U.S. is being reduced sharply in 1964 and thereafter. The anticipated levels of direct budget support are as follows:

1963	$5.4 million
1964	3.6 "
1965	1.8 "
1966	-0-

Secondly, the implementation by USAID of the Solomon-Bureau of the Budget strategy will increase further the budgetary strain. A large number of current operations which have been financed in the past by USAID will be

transferred to the GOB in 1964. The GOB will be required to provide 20% of the financing of these projects in 1964, as much as 50% in 1965 and progressively higher fractions thereafter. This added burden amounts to $600,000 in 1964 and about $1.2 million in 1965.

These various elements of Bolivia's fiscal situation in 1964 and 1965 can be summarized in the following table:

Increased Revenue Needs of the GOB
Compared with 1963 1/
(in millions of dollars)

	1964	1965
Deficit Covered by Central Bank Borrowing, 1963	4.0	4.0
Increase in Normal Expenditures over 1963	4.0	9.0
Decrease in U.S. Budget Support since 1963	1.8	3.6
Increase in Extra-budgetary Expenditures 2/	0.5	1.2
Total	10.3	17.8

1/ On the assumption that the GOB will avoid internal borrowing

2/ Expenditures resulting from the GOB assuming a portion of the financing of projects previously financed by USAID.

Compared with 1963, the needed increase in revenues is approximately 25% in 1964 and 44% in 1965. Bolivia has done a remarkably good job of increasing its revenues through better administration, and some further increase can be expected from this source. USAID has arranged for a team of experts in administration from the Internal Revenue Service to help the GOB. In addition, contract advisors will be brought in before the end of CY 1964 to assist strengthening the system of rural and urban property taxes. The GOB has enthusiastycally endorsed these proposals. Nonetheless it will be very difficult to achieve gains of the mentioned magnitudes within a short period of time. This is particularly true since a major overhaul of the tax structure cannot be achieved until late in 1964 or early 1965, i.e., after the national elections.

Internal borrowing to meet local costs. At the present time the Bolivian Government can only borrow internally from the Central Bank. Under its Standby Agreement with the IMF, the Central Bank is limited to an expansion of Central Bank credit of $5 million per year. Two factors limit the full utilization of this possibility. In the first place, the Government should have some reserve against unfavorable contingencies, e.g., a shortfall of revenues below budgeted levels, the necessity for unplanned expenditures as in the case of political disorders. Secondly,

to the extent that the Government utilizes the full expansion potential of central bank credit, the private sector is unable to increase much-needed commercial bank loans. In the light of this fiscal situation it is not advisable to require the GOB to undertake the additional expenditures involved in meeting the local costs of the present project.

Road Maintenance Costs. Requiring the Government to contribute between 25 and 50% of local costs ($2.9 to $4.8 million) would serve the very useful purpose of creating a stronger sense of participation in the road program. This same purpose might be better served by having it devote attention and resources to the creation of an efficient road maintenance system. This would fit in well with the present USAID plans to bring a Bureau of Public Roads team to Bolivia for a period of two or more years. The team's purpose will be to create a strong and financially sound highway maintenance organization. As to Routes 1 and 4, the estimated annual local costs of their maintenance will be $183,485 and the annual dollar costs will be $205,215. In addition, there will be the costs of constructing and maintaining an extensive network of small feeder roads if the agricultural production objectives of the main roads are to be achieved.

The work of creating the proper institutions, recruiting personnel, and purchasing equipment will proceed during the construction period. In a sense this does not represent a genuine alternative since it must be done in any case, however the local costs financing problem is handled. It may, however, be accomplished with greater dispatch if the GOB is not simultaneously making heavy investment expenditures on the construction of roads 1 and 4.

V RECOMMENDATION

On the basis of the above analysis, the Economic Branch of USAID/B recommends that USAID makes funds available to Finance Projects 1 and 4.

VI APPENDICES

Appendix 1 Letter from Thaddeus C. Johnson, Project Manager, Project 1 & 4, TAMS, to Sr. Alfonso Gumucio Reyes, Minister of National Economy, La Paz, March 9, 1964. Subject matter: Possible economies in highway design.

Appendix 2 Financing of Local Costs

Appendix 3 Bolivia's External Debt as of December 31, 1963

Appendix I

Tippetts-Abbett-McCarthy-Stratton

COPY March 9, 1964 TRANSLATION

Mr. Alfonso Gumucio Reyes
Minister of National Economy
La Paz

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Dear Mr. Minister:

In conversations today with representatives of the USAID Mission I was asked to comment on the possible advisability of reducing the standards of Project 4 to effect a decrease in the total cost of the project. In particular their question related to a possible reduction in the geometric standards of curvature, grade and width, and to the relative advantage of reducing the cost of the project by deletion of the bituminous pavement.

I responded in general terms approximately as outlined below, and I was asked to provide written confirmation of these general concepts.

A reduction in design standards would imply that the highway would be under-designed in one or more of its elements, with the thought of adopting a stage construction procedure, improving the road to a higher design standard at a later date. It is important to consider the later cost of such improvement. With regard to the geometric standards of alignment, grade and curvature, a stage construction procedure cannot reasonably be adopted since subsequent improvement of standards would require partial or even complete reconstruction of the highway. Similarly, for a highway in mountainous terrain constructed initially with sub-standard width, the subsequent cost of widening deep cuts and high fills by an increment of say one or two meters would be disproportionately high.

Consequently, as a general concept for highway design in mountainous terrain, stage construction would not be readily adaptable to such elements of the design as width and geometric standards of the alignment.

Turning to the pavement structure itself, the subbase and lower base courses cannot be strengthened readily subsequent to construction of the project, because such strengthening would require destruction of the pavement surface and upper base course. Evidently, stage construction could be applied most readily to the paved surface, providing initially only the minimum pavement thickness required to serve adequately present traffic and traffic projected a few years into the future. This concept has been applied in the preliminary design developed for the feasibility studies for Project 4.

The representatives of the USAID Mission inquired whether consideration should be given to constructing Project 4 with only a stone or gravel surface, leaving the pavement to be added at a later date. This procedure obviously would carry stage construction of the pavement to its extreme limit, and I was asked to comment upon the possible advantage of such a procedure.

In carrying out economic studies of highway projects in Bolivia and in other countries, I have found that vehicle operating costs are greatly dependent upon the type of running surface. In particular, the operating costs are substantially lower if some kind of pavement surface is provided. I have found in general that even though present traffic may be light, if predicted traffic growth over a 10 to 20-year period is substantial, then a bituminous pavement is one of the most highly justifiable elements of the highway, with an incremental benefit-cost ratio usually higher than that of the remainder of the project. I would expect this to be true for Project 4, although an arithmetic analysis has not been made as yet.

A further factor in support of construction of a pavement for the proposed new road of Project 4 is that a gravel-surfaced road on the relatively steep grades that are proposed would be subject to excessive erosion under the heavy rainfall conditions prevailing in the region.

Summarizing the general concepts expressed above, and relating them to Projects 1 and 4, I believe that the stage construction of the paved surface, as already proposed for Project 4, is the practical limit of the application of the concept of stage construction for Projects 1 and 4, and that the design standards proposed for the project should not be reduced.

Very truly yours,
Tippetts-Abbett-McCarthy-Stratton

Thaddeus C. Johnson
Project Manager

Appendix II

Financing of Local Costs

The proposition, that the direct foreign exchange of local expenditures of Projects 1 and 4 are between 65% and 75% of those costs, rests on estimates of savings and import propensities. It is estimated that the marginal propensity to save (including all non-consumption uses of income (e.g., taxes) is .15 and the marginal propensity to import is .5. Admittedly this latter figure is very high, but, as will be shown, it could be substantially lower without putting the results outside the 65 to 75% range asserted in the text. In addition, it is very likely that during the next few years Bolivia will experience price level increases on the order of 5% per annum. This will be the result of the very high level of investment, internally and externally-financed, that is projected. The high marginal import propensity is not then a pure income phenomenon but is meant to take into account both income and substitution effects. As long as the marginal propensity to import falls roughly between .5 and .3, the indirect use of foreign exchange will be in the ranges indicated.

Bolivia can, of course, take measures to hold the import response at a lower level and in fact may have to do so if the levels of gross capital formation anticipated over the next five years are forthcoming. The cost, however, of constraints here are greater pressures on the domestic price level from a given volume of investment. Dollar financing of the local costs provides a margin of protection for the domestic price level in situations where it is difficult to increase rapidly the level of domestic savings, taxation, and industrial output.

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Appendix III

Bolivia's External Debt as of Dec.31, 1963 *

(in thousands of US$)

I.	Old Bonded Debt		$ 55,349.-
II.	EXIMBANK		33,941.-
III.	Railroad Debt:		38,864.- 1/
	a) La Paz-Guaqui Ry.	$ 751.-	
	b) La Paz-Arica Ry.	1,513.-	
	c) Yacuiba-Santa Cruz Ry.	36,600.-	
IV.	AID Loans in dollars		10,751.- 2/
V.	I.D.B. Loans		5,606.- 3/
VI.	Commercial Debt 4/		17,349.-
	a) Arpic (COMIBOL)	$ 23.-	
	b) Markus (Min. Finance)	95.-	
	c) L.M. Ericcson (Municipalidad Oruro)	216.-	
	d) Ferrostal	36.-	
	e) British Moratorium	3,262.-	
	f) German Moratorium	949.-	
	g) French Moratorium	3,698.-	
	h) T.P.F.B.	12,042.-	
	i) Other agreements	611.-	
	j) L.A.B.	569.-	
VII.	Others:		33,927.-
	a) Triangular Plan (AID excluded)	7,605.-	
	b) Y.P.F.B.	11,000.-	
	c) Bermejo (C.B.F.)	170.-	
	d) Supplier's Credit	11,000.-	
	T O T A L		$195,787.-

* Estimated figures.

1/ Does not include $47 million of the Corumba-Santa Cruz Railroad because the agreement has not been signed as yet between the governments of Brazil and Bolivia.

2/ This amount represents actual disbursements on total AID loans that amount to $43.3 millions. Also, $4.4 millions disbursed for private industrial loans are not included.

3/ This amount represents actual disbursements on total I.D.B. loans that amount to $23.1 million.

4/ Loans guaranteed by the Central Bank.

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Estimate of Number of Vehicles Leaving Santa Cruz, by Type of Cargo and Destination, December 1961 - September 1962

Item	Cocha-bamba	La Paz	Oruro	Sucre	Potosí	Tarija	Area North of S.Cruz	Area So.West of S.Cruz	Others	Total
Food Products	4,992	958	179	484	243	22	70	79	33	7,060
Raw Materials	855	546	91	12	-	-	1	2	1	1,508
Manufactured Goods	225	348	189	4	17	-	184	10	14	991
Other	829	341	43	144	22	9	6,073	252	150	7,863
Grand Total	6,901	2,193	502	644	282	31	6,328	343	198	17,422

Source: Jefatura Departamental de Tránsito de Santa Cruz (Registro de Salida de Vehículos), compiled by: Junta Nacional de Planeamiento.

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F. FINANCIAL ANALYSIS

The total financing required is approximately $33,200,000. The Export-Import Bank has stated that they are not interested in considering this loan in view of the continuing GOB default on an Eximbank loan. The Inter-American Bank cannot consider the loan in view of other priority projects being considered for Bolivia in the fields of electric power, irrigation and mining. Other free world financing sources are not available for this project. U. S. financing is desirable as an Alliance For Progress continued contribution to the future economic and social development of Bolivia and its political unification.

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G. REPAYMENT PROSPECTS

EXPANDED OUTPUT

As long as Bolivia can continue to increase greatly its productive capacity with the assistance of external borrowing, there is no reason why repayment will become unduly burdensome. Since the country has enormous unused resources and a considerable amount of unemployed labor, the possibilities of sharply diminishing returns to external assistance are remote. This assumes, of course, that the correct balance of technical assistance and capital assistance is maintained. The main questions then concern the willingness of the Bolivians to abstain from consuming all of their output increments and their ability to use the resources thus released for exports and import replacement, since repayment will be in foreign currency.

EXTERNAL DEBT

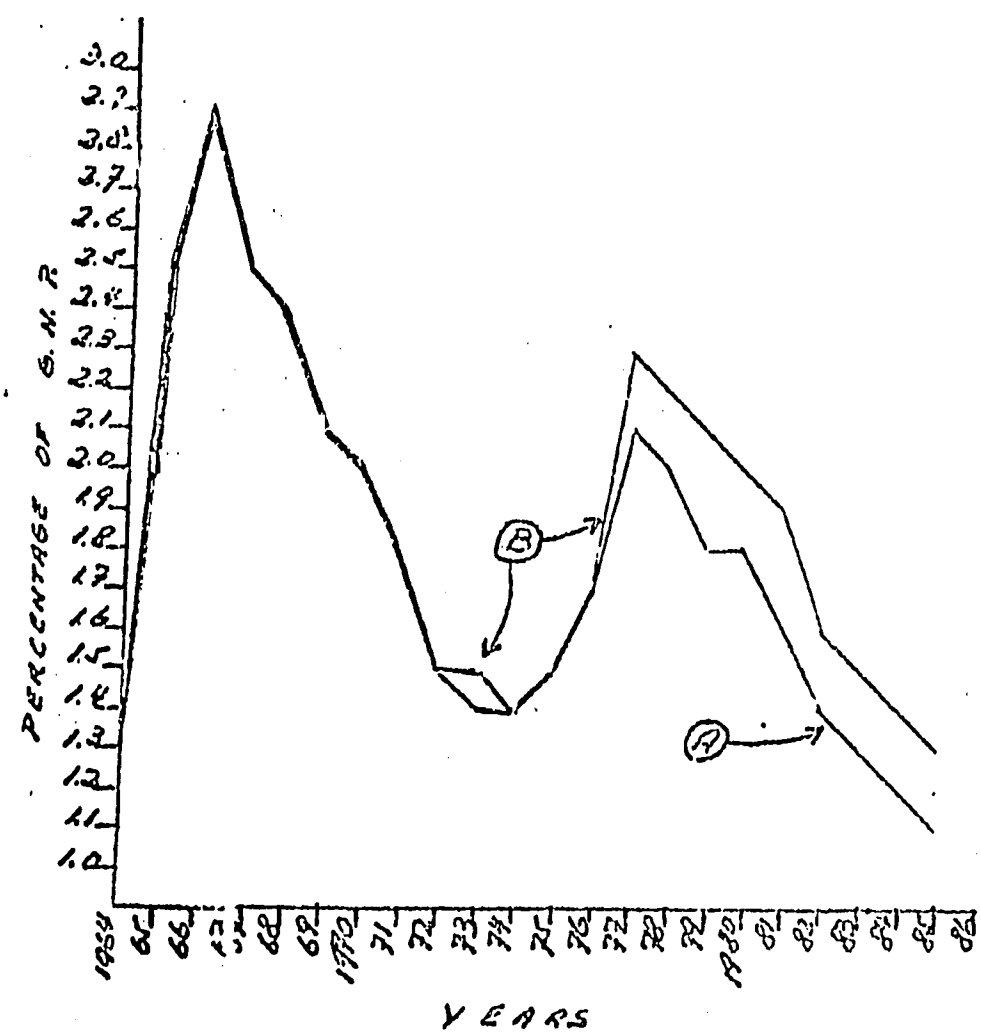
By the end of 1964 the total external debt of Bolivia will be on the order of $250 million. No precise amortization schedule can be drawn up for this debt over the life of the proposed highway loan. More than half of this total is in various stages of negotiations as to the amount actually owing or as to amortization*. Nevertheless, the graph below on interest and principal payments is presented so that at least a rough idea of amounts can be gained. In this graph two alternative assumptions are made as to the increase in the Bolivian external debt from the end of CY 1964 through CY 1970. Assumption A, is that Bolivia will borrow from the U. S. and other official sources about $100 million. Assumption B, is that Bolivia will borrow $150 million during the same period. In both cases a growth rate of 3.5% per year is assumed after 1969.

As can be seen from the graph, Bolivia is more likely to have some problems in meeting debt payment schedules in the near future - the grace period of the present loan - than in the longer run. Even the short run problem may be less than indicated since it assumes that the existing volume of short-term debt will be liquidated rather than kept at a more-or-less constant level. In any event, during the period of amortization of the proposed loan the total debt burden should be well within the capacity of the economy to handle.

* For a more detailed explanation see Annexe VIII

BOLIVIAN DEBT SERVICE AS PERCENTAGE OF G.N.P.

1964-1985



EXPORT GROWTH

The key to Bolivia's ability to transfer abroad large payments on its external obligations during the next three decades is its ability to develop a growing export sector. The other elements of the future balance of payments problem, terms-of-trade, income elasticity of demand for imports, import component of domestic capital formation, etc., are either unpredictable over a long span of time or not amenable to present planning. Adopting the highly adverse assumption that Bolivia will become a mature debtor in the early 70's, i.e., that then repayments will exceed new borrowings, we can say that if Bolivia is to meet its external obligations, exports must grow at an annual rate of from 6 to 8 per cent.

It is the belief of the Mission that Bolivia does have the necessary export potential to service and repay an external debt much larger than it will have at the end of 1964 if the present loan is granted. In the short run it can expand greatly its mineral exports. Private mineral products grew by 10% in 1963. The recoverable reserves of alluvial gold alone have been estimated at $2 billion. Petroleum exports should become very substantial starting in 1965. It is extimated that the early return to the government in taxes and royalties from exports will be $3 million. Useful reserves of natural gas have been discovered; their future export to Brazil is considered probable. The Gulf Oil Company has drilled and capped 27 wells capable of producing oil and gas*. In the longer run it should be able to develop very considerable exports of agricultural products both raw and processed, from the enormous natural resources of the Oriente. To do this will take considerable planning and the development of the transportation system, the latter being, of course, one of the objectives of the present loan.

FISCAL MECHANISMS

This discussion of ability to pay, leaves unanswered the question of willingness to pay. Although the GOB's record in this respect is certainly not very good, the Mission believes that it is creating the mechanisms which will make it possible to solve the fiscal problems of debt repayment. Assuming that the economic development which this and other AID programs are designed to create does take place, the probability of repayment is good.

*According to a speech given in San Francisco, Jan. 16, 1964, by N. Dorsey, Security Analyst.

TABLE

PROJECTION OF BOLIVIA'S EXTERNAL DEBT SERVICE, 1964-1965

	G N P (1) (In Millions of U.S.$)	DEBT PAYMENTS (4) (In Millions of U S.$)		PAYMENTS AS A PERCENTAGE OF GNP	
		A(2)	B(3)	A	B
1964	529.7	6.9	6.9	1.3%	1.3%
1965	563.3	14.0	14.0	2.5	2.5
1966	603.0	17.3	17.3	2.9	2.9
1967	647.1	16.0	16.0	2.5	2.5
1968	693.7	16.4	16.4	2.4	2.4
1969	737.4	15.4	15.4	2.1	2.1
1970	763.2	15.0	15.0	2.0	2.0
1971	789.9	14.0	14.1	1.8	1.8
1972	817.5	12.3	12.6	1.5	1.5
1973	846.1	12.0	12.3	1.4	1.5
1974	875.7	11.9	12.2	1.4	1.4
1975	906.3	13.4	13.7	1.5	1.5
1976	938.0	15.5	15.8	1.7	1.7
1977	970.8	20.0	22.7	2.1	2.3
1978	1,004.8	19.8	22.5	2.0	2.2
1979	1,040.0	19.0	21.7	1.8	2.1
1980	1,076.4	19.0	21.6	1.8	2.0
1981	1,114.1	18.3	20.9	1.6	1.9
1982	1,153.1	15.8	18.3	1.4	1.6
1983	1,193.5	15.1	17.6	1.3	1.5
1984	1,235.3	14.6	17.1	1.2	1.4
1985	1,278.5	14.4	16.8	1.1	1.3

(1) Rate of growth assumptions: 64-65 = 6.4%; 65-66 = 7.0%; 66-67 = 7.3%; 67-68 = 7.2%; 68-69 = 6.3%; 69-85 = 3.5%

(2) Assuming a $100 million debt increase. Repayment in 30 years starting in 1969.

(3) Assuming a $150 million debt increase. Repayment in 30 years starting in 1971.

(4) Interest and amortization.

H. IMPACT ON THE U. S. ECONOMY

The major effects of this loan on the U. S. economy will come through the purchase of materials and the payment of wages and profits to U. S. technicians and to the contractor. All imported equipment will be procured in the U. S.

For the local costs of the project, dollars will be converted to local currency through the AID Special Letter of Credit procedure. Under these procedures, dollars will be made available to the GOB to be used only for procurement in the U. S. Local currency made available under these procedures will be deposited in a U. S. Treasury Account for payment to the contractor for local costs of the project.

There will not be significant displacement of U. S. exports either in Bolivia or in third markets by the commodities produced as a result of the project. The major exceptions to this statement are the PL 480 commodities. In the long-run this project's contributions to self-sufficiency in food will help to make PL 480 assistance unnecessary.

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CHECK LIST OF STATUTORY CRITERIA (ALLIANCE FOR PROGRESS)

* 1. Foreign Assistance Act of 1961, as amended (hereinafter FAA), Section 102. The loan will further the policy of the Act, as stated in this Section. Every possible precaution will be taken to assure that loan proceeds are not diverted to short-term emergency purposes (such as budgetary purposes, balance of payments purposes, or military purposes) or any other purpose not essential to the long-range economic development of Bolivia.

* 2. FAA Section 201(d). Loan funds are not to be loaned or re-loaned at rates of interest which are excessive or unreasonable for the Borrower, or higher than the applicable legal rate of interest in Bolivia of 18-30 per cent.

* 3. FAA Section 202(c), Foreign Aid and Related Agencies Appropriation Act of 1964 (hereinafter "App."), Section 117. Funds have been appropriated by Congress for this loan.

* 4. FAA Section 204. The terms and conditions of the loan are in accordance with standards and criteria established by the Development Loan Committee.

* 5. FAA Section 251(a). The loan will promote economic development in Bolivia and will contribute to the welfare of its people. See "Development Benefits" Page E-8

6. **FAA Section 251(b)(1). Account has been taken of the extent to which** Bolivia **is adhering to the principles of the Act of Bogota and Charter of Punta del Este and is showing a responsiveness to the vital economic, political, and social concerns of its people, and of the extent to which** Bolivia **has demonstrated a clear determination to take effective self-help measures.**

7. **FAA Section 251(b)(2). The activity to be financed is economically and technically sound.** See "Costs and Benefit Cost Ratios" Page E-11

8. **FAA Section 251(b)(3). The activity is consistent with and is related to other development activities being undertaken or planned and will contribute to realizable long-range objectives.** See "Project Within AID Strategy in Bolivia" Page B-3

9. **FAA Section 251(b)(4). The loan will have no foreseeable adverse effect on the U. S. economy.** See "Impact on the U. S. Economy" Page H-1

10. **FAA Section 251(b). Financing from other free world sources (including private sources within the United States) on reasonable terms for the project is not available.** See "Financial Analysis" Sec. F-1

11. **FAA Section 251(b). The terms of the loan (interest, year amortization) are reasonable under circumstances affecting the loan and the capacity of Borrower to repay.** See "Repayment Prospects" Page G-1

12. FAA Section 251(b). Account has been taken of the extent to which Bolivia is making reasonable efforts to encourage repatriation of capital invested in other countries by its own citizens.

* 13. FAA Section 251(b). There are reasonable prospects that the loan will be repaid. See "Repayment Prospects" Page G-1

* 14. FAA Section 251(e). An application has been received for this loan which gives sufficient information and assurances to indicate reasonably that the funds will be used in an economically and technically sound manner.

15. FAA Section 251(g). In view of the nature of the project, it is not appropriate to utilize the loan to assist in promoting the cooperative movement in Latin America.

* 16. FAA Sections 601(b); 621. The loan will be administered in such a manner as to encourage and facilitate participation by private enterprise to the maximum extent practicable. United States private engineering services, and other services of United States private enterprise will be employed whenever practicable. The facilities of other Federal agencies will be utilized only if they are particularly suitable, are not competitive with private enterprise, and can be made available without undue interference with domestic programs. U. S. engineering and contracting services to be utilized on project. At request of GOB the Bureau of Public Roads will provide recommendations that will assist in the development of a nationally centralized Highway Maintenance organization.

17. FAA Section 602. American small business shall be assisted to the maximum extent practicable to participate equitably in the furnishing of goods and services for the project, in accordance with the procedures described in this section of the Act.

* 18. FAA Section 604(a). Equipment, materials, and services (except Marine Insurance) financed for the project under the loan shall be procured from the United States or Bolivia . Dollars utilized under the loan to finance procurement in Bolivia shall be made available through appropriate procedures and, except for Marine Incurance, shall be used only for procurement in the United States. See "Other terms and conditions under Loan Authorization".

* 19. FAA Section 604(b). Any commodities financed by the loan and purchased in bulk will be purchased at prices no higher than prevailing U. S. market prices.

* 20. FAA Section 604(d). Loan funds shall be available for Marine Insurance on commodities shipped when such insurance is placed on a competitive basis, as specified in this section of the Act. In the event that Bolivia discriminates against any U. S. marine insurance company, commodities purchased with loan funds shall be insured against marine risk with a U. S. company, as required by this section.

* 21. FAA Section 611(a)(1). Necessary substantive technical and financial planning for the project has been completed, and a reasonably firm estimate of cost of the project to the United States has been obtained. See "Index of Annex III"

* 22. FAA Section 611(a)(2). No further legislative action in Bolivia in required for implementation of the project. It may be necessary to issue a supreme decree to procure right of way. This can be accomplished within a reasonable period of time and will not adversely effect implementation of project.

* 23. FAA Section 611(b), App. Section 101. The project does not involve water or related land resource construction.

* 24. FAA Section 611(c). Construction contracts to be financed by the loan shall to the maximum extent practicable be let on a competitive basis. Contracts to be let on a competitive bid basis.

* 25. FAA Section 619. Not applicable. Bolivia is not a newly independent country.

* 26. FAA Section 620([illegible]), App. Sections 109(a), 109(b). No assistance will be furnished under this loan to the present government of Cuba, nor does Bolivia furnish assistance to the present government of Cuba. Bolivia has taken appropriate steps to prevent ships or aircraft under its registry from engaging in any Cuba trade.

* 27. FAA Section 620(b). The Secretary of State has determined that Bolivia is not controlled by the International Communist Movement.

* 28. FAA Section 620(c). Bolivia is not indebted to any U. S. citizen for goods or services furnished or ordered, where such a citizen has exhausted available legal remedies or where the debt is not denied or contested by or the indebtedness arises under an unconditional guaranty of payment given by Bolivia.

* 29. FAA Section 620(d). Loan funds will not finance construction or operation of any productive enterprise which will compete with United States enterprise.

* 30. FAA Section 620(e). Neither the government of Bolivia nor any governmental agency or subdivision thereof has, on or after January 1, 1962, nationalized, expropriated, or seized ownership or control of property of any U. S. citizen or firm, taken steps to repudiate or nullify existing contracts with such citizens or firms, or imposed or enforced discriminatory taxation or other exactions or restrictive conditions, or taken other actions having the effect of nationalizing, expropriating or otherwise seizing ownership or control of property owned by U. S. citizens or firms, as specified in this section of the Act, without taking appropriate steps to discharge its obligations, as specified in this section of the Act.

* 31. FAA Section 620(f), App. Sections 109(a), 109(b). Assistance provided by this loan will not be furnished to any Communist country.

* 32. FAA Section 620(g). Assistance provided by this loan will not be used to compensate for expropriated or nationalized property.

* 33. FAA Section 620(h). Assistance provided by this loan will not be used in a manner which promotes or assists foreign aid projects or activities of the Communist bloc countries.

* 34. FAA Section 620(i). The President has not determined that Bolivia is engaging in or preparing for aggressive military efforts directed against the United States, or any country receiving assistance from the United States, or against any country to which sales are made under PL 480, nor is any basis for such determination known to A.I.D.

* 35. FAA Section 636(h). Bolivia will contribute local currency in the amount of $185,000 to meet the cost of contractual and other services to be rendered in conjunction with the project. Foreign currency owned by the United States will, to the maximum extent possible, be utilized to meet the costs of contractual and other services for the project. Due to budget deficits Bolivia will not contribute local currency other than $185,000 for right of way costs to the project. See "Local Cost Financing" Page E-20

* 36. App. Section 102. Obligations of funds in excess of $25,000 for engineering fees to any firms or group of firms financed under the loan will be reported to the committees on appropriations of the Senate and House.

* 37. App. Section 104. Funds obligated by the loan, and local currency generated thereby, will not be used to pay pensions, annunities, etc., as prohibited in this section.

* 38. App. Section 111. U. S. personnel to serve under contracts for services financed by the loan shall have security clearance.

* 39. App. Section 112. Firms which provide engineering, procurement, and construction services financed by the loan for the project, and the terms of their contracts, shall be approved by A.I.D.

* 40. App. Section 114. Loan funds will not be used to make any payment to the U. N.

* 41. App. Section 118. Construction work financed by the loan shall be performed by qualified persons, in accordance with A.I.D. regulations promulgated pursuant to this section.

* 42. App. Section 601. Loan funds will not be used for publicity or propaganda purposes within the United States.

John C. Eddison D. D.
Chairman, Project Committee

CLEARANCE:
Counsel David Lazar
Desk Lawrence L. Peterson
Engineer Sterling L. Hedgpeth
Other (Specify)
Economist Robert R. Edminster
Asst. Economist Jacob P. Meerman
Agri. Economist Frederick H. Dahl
Loan Officer Lewis Ortega

LOAN AUTHORIZATION

BOLIVIA: Highways 1 and 4
PROVIDED FROM: Alliance for Progress Funds

Pursuant to the authority vested in me as Administrator, Agency for International Development ("A.I.D.") by the Foreign Assistance Act of 1961, as amended, and the delegations of authority issued thereunder and following consultation with the Development Loan Committee, I hereby authorize the establishment of a loan to the Government of the Republic of Bolivia ("GOB") of not to exceed thirty three million two hundred thousand dollars ($33,200,000) to assist in financing the dollar and local currency costs (including final design and supervisory engineering) of constructing two related highways in Bolivia, one approximately 206 kms., from Cochabamba to the Isiboro River near Puerto Patino, (paved approximately 183 kilometers from Cochabamba to Villa Tunari), and the second, all gravel, of approximately 93 kms., from Villa Tunari to Puerto Villarroel. The loan shall be subject to the following terms and conditions:

1. Interest and Terms of Repayment

Borrower shall repay the loan to A.I.D. in United States dollars within forty (40) years from the first disbursement of the loan including a grace period of not to exceed ten (10) years. Borrower shall pay to A.I.D. in United States dollars on the disbursed balance of the loan interest of three-quarters of one (3/4 of 1) percent per annum during the grace period and two (2) percent per annum thereafter.

2. Other Terms and Conditions

(a) Equipment, materials and services financed hereunder shall have their source and origin in Bolivia or in the United States.

(b) United States dollars utilized under the loan to finance local currency costs shall be made available through Special Letter of Credit procedures and, except for the purchase of marine insurance, shall be used only for procurement in the United States.

(c) The supervising engineering and contracting firms shall be approved by A.I.D.

(d) Based on a study by U.S. experts of Bolivia's rural development program and agencies, and prior to the first disbursement under this loan except for engineering services, the Government of Bolivia will furnish a schedule plan satisfactory to A.I.D. for:

(i) Strengthening programs and staffs, and integrating or better coordinating agencies responsible for GOB rural development and colonization programs; and

(ii) Colonization and rural development in the areas that surround and are adjacent to projects 1 and 4.

(e) The Government of Bolivia will accept the services of U.S. experts to advise and assist in completing the integration of road maintenance organizations and programs within the national roads service and in the development of an adequate nation-wide maintenance program.

(f) The Government of Bolivia will accept the services of U.S. experts to advise and assist in developing any necessary new revenue sources and in consolidating the various present revenue producing sources for highway maintenance.

(g) Prior to disbursement of any funds under this loan, except for engineering services, the Government of Bolivia will furnish A.I.D. with a plan, including a specific schedule, satisfactory to A.I.D., for carrying out the following:

(i) Completing the program to integrate highway maintenance organizations and programs within the National Roads Service.

(ii) Developing an expanded maintenance program and allocating budget resources adequate for Bolivia's growing road system.

(iii) Establishing load limits and an enforcement system for projects 1 and 4.

(h) Such other terms and conditions as A.I.D. may deem appropriate.

_____
Administrator

_____
Date

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DETAILED TECHNICAL PROJECT DESCRIPTION

Bolivia is the fifth largest nation in South America, encompassing over one million square kilometers, and is situated in the west central part of the continent between 10° and 23° south latitude and 58° and 69° west longitude. The Republic is completely landlocked, although access to seaports is provided by railroads through Chile, Peru and Brazil. The Pan American Highway enters from Peru on the west and passes through Bolivia and into Argentina on the south, and air transportation is available to all neighboring countries.

Bolivia possesses extremes in topography from the high and rugged peaks of the Andes to the vast jungle-covered flood plains of the Amazon basin. Physiographically, the country is devided into three distinct regions: the "altiplano", a high and almost level plateau whose median altitude is 13,000 feet, located between two massive cordilleras of the Andes; the Valleys and "yungas", temperate and semi-tropical areas located within the eastern cordillera and on the lower Andean slopes; and the "llanos" or lowlands, flat and rolling tropical country east of the Andes and comprising about 70% of the nation's land area.

The Republic of Bolivia is divided into nine departments, which are further subdivided into 96 provinces, each containing numerous cantons and municipalities. Project 1 is located entirely within the Department of Cochabamba, near the geographic center of the Republic of Bolivia at about 17° south latitude. The Department has an area of approximately 56,000 square kilometers, or about 5% of the nation's total land area. Near the center of the department lies a flat, densely forested area known as the Chapare. Navigable rivers link the Department of Cochabamba with the Beni Department to the north, which is much larger, with approximately 214,000 square kilometers, 20% of the nation's total.

Project 1 extends about 86 kilometers from the vicinity of the colonization center of Villa Tunari eastward to Puerto Villarroel on the Ichilo River. On the west it connects with TAMS Project 4, a proposed paved highway, linking the Chapare region with Cochabamba and the Santa Cruz highway. The land is relatively flat from Villa Tunari (elevation about 300 meters above sea level) eastward to Puerto Villarroel (elevation about 240 meters). Some 50 kilometers south of Puerto Villarroel, the Cordillera Real rises in a major mountain range reaching heights of over 5,000 meters and the road throughout more than half its length would be located at the foot of this range.

At the west end of Project 1 an all-weather road connects Villa Tunari with Cochabamba, but within the project area itself there are

no roads suitable for uninterrupted vehicular traffic. A fair-weather road extends from the east side of the Chapare River as far as Colonia Busch. From there a clearing and foot-path have been cut through the jungle by the Bolivian Development Corporation (CBF) eastward to Puerto Grether on the Ichilo River. Joining this trail is a similar one extending northward 42 kilometers to Puerto Villarroel. Most of the area is uninhabited, except for some colonists who have settled between Villa Tunari and Colonia Busch.

The highway proposed for Project 1 would start at its junction with Project 4 immediately north of Villa Tunari and would trend in an easterly direction across the Chapare River and about 59 kilometers beyond; after crossing the Ivivigarsama River the route would turn northward and continue some 27 kilometers to Puerto Villarroel. The land over the entire length of the route is flat and heavily forested, and presents excellent prospects for agricultural development and colonization. For about 20 kilometers eastward from the Villa Tunari area there is some agricultural development where colonization has already occurred. Along the rest of the route to Puerto Villarroel the road follows approximately the 50-meter-wide clearing through the jungle opened by CBF, where virtually no development has taken place. Existing development at Puerto Villarroel is limited to a small encampment of the Bolivian Army.

The project would serve both as a penetration road through undeveloped jungle terrain, and as a vital transportation link to a major river navigation system.

Project 4 also is located in the Department of Cochabamba. It consists of a proposed highway about 206 kilometers long between the city of Cochabamba and the central part of the Chapare Province. Cochabamba, the southern terminus, is the second largest city in the country and lies near the midpoint of the main arterial highway that extends about 1,000 kilometers from La Paz to Guabirá. Cochabamba and other cities served by the arterial highway are principal marketing areas for agricultural products from the Chapare, and they are sources of supply for processed and manufactured goods for the Chapare. Thus a good highway connection is of vital importance to further agricultural development in the region.

Not far from Cochabamba (elevation 2,570 meters) the proposed highway would pass through or near the population centers of Sacaba and Aguirre. In this segment the alignment closely follows the existing route, utilizing portions of the existing roadbed where practical. The highest point of the proposed highway is reached at an elevation of 3,690 meters, some 36 kilometers from the beginning of the project. From this point the road generally descends

along the Corani Valley, passing near Aguirre at about km 45 and Colomi at km 50. At approximately km 64 the valley ends abruptly at the scarp of the northeastern flank of the Cordillera Real. From km 64 northward the proposed route continually descends, crossing a drainage divide and passing into the Paracti Valley. From here, location studies proved that the most economical route crosses over another small drainage divide into the valley of the Espiritu Santo River and follows the river downstream to Villa Tunari (elevation 300 meters), the commercial center of the Chapare region.

The proposed alignment between Aguirre and Villa Tunari, about 120 kilometers long, and on an almost continuously descending grade, would replace an existing road that is about 18 kilometers longer, rises from Aguirre almost 1,000 meters to an elevation of 4,335 meters, and is limited to one-way traffic through barren and precipitous terrain.

At Villa Tunari the proposed highway would connect with the proposed new highway of Project 1. It can be expected that virtually all products transported on the project 1 highway also would traverse the proposed new Cochabamba-Villa Tunari highway.

Project 4 also includes the construction of a penetration road 43 kilometers northwest from Villa Tunari to the Isiboro River. The road would traverse the piedmont belt, never more than a few kilometers from the adjacent mountains, with the immediate purpose of penetrating and providing access to a large area of undeveloped, potentially productive land. While in the near future the penetration road would be expected to carry only local traffic, in later years it could form a link in a new arterial highway.

To integrate the proposed projects with the existing highway network, an additional connection approximately 18 kilometers long is proposed between Aguirre and the Cochabamba-Santa Cruz highway near Tiraque, since some traffic can be expected between the Chapare and points east of Aguirre. A fair-weather road between Aguirre and Tiraque is now under construction by the Local Roads Headquarters of the Department of Cochabamba; it is proposed under Project 4 to improve the road to a condition suitable for all-weather use.

Project 1 will be a class 1 road with a 9-meter, shoulder to shoulder width, with bridge widths varying from 6.5 to 9 meters, depending on the length of the bridge (see Design Criteria in Annex III). It will have a crushed gravel surfacing full width, shoulder to shoulder. Bridges, generally, will be prestressed concrete superstructures on open-end concrete abutments founded on cast-in-place concrete tubular piles, and concrete piers on spread footings.

Grouted rip-rap will be provided at all abutments. Major bridges vary in length from 90 to 286 meters with span lengths varying from 30 to 39 meters.

Project 4 will be a class 1 road from Cochabamba to Villa Tunari, with shoulder to shoulder widths varying from 8 to 10 meters. From Villa Tunari to the Isiboro River (Puerto Patiño) the road will be only 6 meters wide, shoulder to shoulder. The Cochabamba-Villa Tunari section will have a double bituminous surface treatment 7 meters wide from Cochabamba to km 19, and 6 meters wide from there to Villa Tunari. The Villa Tunari-Isiboro River section will have a full width (6 meters) pit-run gravel surfacing. Bridge widths vary from 6.5 to 9 meters on the flat and rolling terrain and from 6.5 to 8 meters in the mountainous terrain, the variations depending on the length of the bridges. (See Design Criteria in Annex III). The same type of bridges will be constructed as indicated above on Project 1, except that three types of piers will be constructed: twin circular columns, solid walls and hollow piers.

SUMMARY OF COSTS OF PROJECTS Nos. 1 & 4

	Total Cost (Dollar Equivalent)			
	U.S.	Local	Total	
a.- Project 1				
Total Construction Cost 1/	3,609,364	1,603.260	5.212,524	
Contingencies (25% of Construction Cost)	544,438	237,441	781,879	
Total Construction Cost and Contingencies	4,153,802	1,840,601	5.994.403	
Right-Of-Way Costs#		5.000	5.000	
Engineering 2/				
Additional Surveys, Final Design and Preparation of Contract Documents (2.8% of Construction Cost and Contingencies 2/	93,790*	72.210	166,000	
Supervision of Construction (5.0% of Construction Cost and Contingencies 2/	102,600**	197.400	300,000	
SUB-TOTAL COST OF PROJECT 1	4,850,192	2,115.211	6,465.403	
SUB-TOTAL				6.500,000
b.- Project 4				
Total Construction Cost 1/	16,239,152	5,694,096	21.933.248	
Contingencies (15% of Construction Cost)	2,343,987	855.000	3.289,987	
Total Construction Cost and Contingencies	16,674,139	6,549.096	25.223.235	
Right-Of-Way Costs#			180,000	
Engineering 2/				
Additional Surveys, Final Design and Preparation of Contract Documents (1.7% of Construction Cost and Contingencies) 2/	250.860*	193,140	444,000	
Supervision of Construction (4.1% of Construction Cost and Contingencies)2/	351,496**	676.269	1,027,765	
SUB-TOTAL COST PROJECT 4	19,276,495	7,598,505	26,875.000	
SUB-TOTAL				26.900.000
TOTAL PROJECTS 1 and 4	23,626,687	9,713,716	33,340,403	
ROUNDED TO			$ 33,400,000	

1/ Gasoline is a local cost; diesel and lubricants are dollar costs
2/ Does not include depreciation of vehicles or other equipment purchased under AID Loan 44
* Based on design U.S. cost being 56.6% of total
** Based on supervision U.S. Costs being 34.2% of total
Loan funds can not be made available for purchase of right of way.

SUMMARY OF QUANTITIES AND COSTS OF HIGHWAY AND STRUCTURES

Project 1

ITEM	Quantities Highway	Quantities Structures	Unit	Unit Price (dollars)	Total Cost (Dollar Equivalent) Highway	Total Cost (Dollar Equivalent) Structures
Clearing and Grubbing	344		Hect.	606.00	208,464	
Roadway, Borrow, and Channel Excavation	1,450,000		C.M.	0.83	1,203,500	
Selected Sand (Compacted)	34,000		C.M.	1.39	47,260	
15 Cm. Crushed Gravel Course (compacted)	129,000		C.M.	4.23	545,670	
Structural Concrete		9,500	C.M.	128.00		1,216,000
Prestressed Concrete		3,025	C.M.	290.00		877,250
Cast-inPlace Concrete Piles		2,800	L.M.	30.00		84,000
Miscellaneous Iron and Steel		53,000	Kg.	0.92		48,760
Steel Sheeting		7,500	Sq. M.	24.00		180,000
Structure Excavation (Aquecus)		10,400	C.M.	11.00		114,400
Structure Excavation (Semi-Aquecus)		1,600	C.M.	8.00		12,800
Structure Excavation (Box Culvert)		2,000	C.M.	3.25		6,500
Tremie Concrete		1,200	C.M.	67.00		80,400
Rip-Rap (grouted)		1,500	C.M.	28.00		42,000
Heavy Rip-Rap		600	C.M.	5.50		3,300
Concrete Railing		3,100	L.M.	16.00		49,600
Timber Sheeting		350	Sq.M.	8.00		2,800
Concrete Guide Posts		390	Each	8.00		3,120
30" Pipe		950	L.M.	28.00		26,600
36" Pipe		2,000	L.M.	36.00		72,000
48" Pipe		1,750	L.M.	67.00		117,250
60" Pipe		1,225	L.M.	100.00		122,500
72" Pipe		1,075	L.M.	138.00		148,350
Sub-totals					2,004,894	3,207,630
Total Construction Cost						5,212,524
Contigencies (15% of Construction Cost)						781,879
Total Construction Cost and Contigencies						5,994,403
Right-of-way Costs						5,000
Engineering for Final Design and Supervision of Construction (7-8% of Construction Cost and Contigencies) 1/						466,000
TOTAL COST OF PROJECT 1						$6,465,403
ROUNDED TO						6,500,000

1/ Does not include depreciation of vehicles or other equipment purchased under AID Loan No. 44.

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RECAPITULATION AND DISTRIBUTION OF CONSTRUCTION COSTS

Project No. 1

	Unit	Quantity	Unit Cost (Dollars)	Total Cost (Dollar Equivalent) U.S.	Local	Total
Materials						
Reinforcing Steel	Lb.	3,261,000	0.1315	428,822		
Tension Wires	Lb.	423,500	0.30	127,050		
Miscellaneous Steel	Lb.	117,000	0.19	22,230		
Tubular Steel Piles	Lb.	252,000	0.18	45,360		
Sheet Piling	Lb.	308,000	0.105	32,340		
Nails	Lb.	13,000	0.30	3,900		
Miscellaneous Hardware	Lb.	17,000	0.30	5,100		
Cement	Sacks	152,600	1.73		263,998	
Lumber	MBF	1,760	100.00		170,000	
		Sub-Total		664,802	433,998	1,098,800
Fuel and Lubricants 1/						
Structures				7,670	235,303	
Grading and Base				112,360	96,150	
	Sub Total			120,030	331,453	451,483
Equipment and Rental (Excluding Fuel)						
Structures				913,792		
Grading and Base				1,135,654		
	Sub-Total			2,049,446		2,049.446
Labor						
Structures					400,6[illegible]	
Grading and Base				20,118	116,40[illegible]	
	Sub-Total			20,118	517,077	537,195
Contractor's Administration Costs						
Performance Bond				52,125		
Overhead and Other Indirect Expenses				417,404	192,379	
	Sub-Total			469,529	192,379	661,908
Contractor's Profit						
Structures				158,626	106,998	
Grading and Base				126,813	21,255	
	Sub-Total			285,439	128,253	413,692
Total Construction Cost				3,609,364	1,603,160	5,212,524
Contigencies (15% of Construction Cost)				544,438	237,441	781,879
Total Construction Cost and Contigencies				4,153,802	1,840,601	5,994,403
Right-Of-Way Costs				5,000		5,000
Engineering 2/ Additional Surveys, Final Design and Preparation of Contract Documents (2-8% of Constructiin Cost and Contigencies) 2/						166,000
Supervision of Construction (5-10% of Construction Cost and Contigencies) 2/						300,000
SUB-TOTAL COST OF PROJECT 1						$ 6,465,403
ROUNDED TO						6,500,000

1/Gasoline is a local cost; diesel fuel and lubricants are dollar costs.

2/Does not include depreciation of vehicles or other equipment purchased under AID Loan 4

SUMMARY OF QUANTITIES AND COSTS OF HIGHWAY AND STRUCTURES

Project 4

ITEM	Quantities Highway	Quantities Structures	Unit	Unit Price (Dollars)	Total Cost (Dollar Equivalent) Highway	Total Cost (Dollar Equivalent) Structures
Clearing and Grubbing	645		Hect.	550.00	409.750	
Common and Special Roadway Channel Excavation and Borrow	7,837,000		C.M.	0.87	6,918,190	
Common and Special Roadway Excavation (Slide Removal)	200,000		C.M.	0.87	175,000	
Rock Roadway Excavation	1,237,000		C.M.	2.00	2,474,000	
Rock Tunnel Excavation	10,000		C.M.	17.00	170,000	
Incidental Tunnel Items (Rock Bolts, Grouting, Drainage, etc.)			Lump Sum		17,000	
Selected Fill	1,045,000		Sq. M	0.08	83,600	
Pit-run Gravel Sub-base and Base (compacted)	87,000		C.M.	3.00	261,000	
Crushed Gravel or Stone Base (compacted)	227,000		C.M.	5.00	1,135,000	
Prime Coat	1,088,000		Sq.M.	0.21	228,480	
Double Bituminous Surface Treatment	893,000		Sq.M.	0.68	607,240	
Hot-Mix Asphaltic Concrete (5 cm.)	115,000		Sq.M.	1.80	207,000	
Retaining Wells	25,500		C.M.	23.00	586,500	
Sub-Surface Drains	39,000		L.M.	20.00	780,000	
Guard Posts	15,250		Each	5.75	87,688	
Traffic Signs	250		Each	15.00	3,750	
Rubble cement Concrete (Cyclopean Concrete Structures)		1,000	C.M.	34.00		34,000
Cement Rubble Masonry		200	C.M.	32.50		6,500
Structural Concrete		30,000	C.M.	128.00		3,840,000
Prestressed Concrete		4,700	C.M.	290.00		1,363,000
Concrete Tubular (Piles 12")		2,000	L.M.	30.00		66,000
Miscellaneous Iron and steel		65,000	Kg.	0.92		59,800
Steel Sheeting		2,200	Sq. M.	24.00		52,800
Structure Excavation (Aqueous)		3,800	C.M.	11.00		41,800
Selected Excavation (regular)		30,000	C.M.	3.25		97,500
Selected Embankment		40,000	C.M.	1.82		72,800

ITEM	Quantities Highway	Quantities Structures	Unit	Unit Price (Dollars)	Total Cost (Dollar Equivalent) Highway	Total Cost (Dollar Equivalent) Structures
Tremie Concrete		750	C.M.	67,00		50,250
Grouted Rip-Rap		625	C.M.	28.00		17,500
Concrete Railing		4,780	L.M.	16.00		76,480
Timber Sheeting		8,300	Sq.M.	8.00		66,400
Heavy RipRap		14,000	C.M.	5.50		77,000
Culvert Pipe 24"		7,800	L.M.	24.00		187,200
Culvert Pipe 30"		1,500	L.M.	28.00		42,000
Culvert Pipe 36"		730	L.M.	36.00		26,280
Culvert Pipe 42"		260	L.M.	51.00		13,260
Culvert Pipe 48"		1,400	L.M.	67.00		93,800
Culvert Pipe 54"		1,860	L.M.	88.00		163,680
Culvert Pipe 60"		3,100	L.M.	100.00		310,000
Culvert Pipe 66"		1,600	L.M.	121.00		193.600
Culvert Pipe 72"		6,800	L.M.	138.00		938,400
			Sub-Totals		$ 14,043,198	7,890,050
			Total Construction Cost			21,933,248
			Contigencies (15% of Construction Cost			3,289.987
			Sub-Total			25,223,235
			Engineering (Final Design and Supervision of Construction 5-8% of Construction and Contigencies 1/			1,471,765
			Right-of-way			180,000
			Sub-total Cost Project 4			26,875,000
			Rounded Trip			26,900,000

1/ Does not include depreciation of vehicles or other equipment purchased under AID Loan No. 44.-

The Government of Bolivia now owns a great deal of the land required for the proposed improvement. Only $180,000 has been incorporated in the estimate for the acquisition of righ-of-way.

TOTAL COST OF PROJECTS 1 and 4 $ 33,400,000

RECAPITULATION AND DISTRIBUTION OF CONSTRUCTION COSTS

Project No. 4

Materials	Unit	Quantity	Unit Cost (Dollars)	Total Cost (Dollar Equivalent) U.S.	Local	Total
Reinforcing Steel	Lb.	7,600,000	0.132	1,003,200		
Tension Wires	Lb.	650,000	0.30	195,000		
Miscellaneous Steel	Lb.	143,000	0.19	27,170		
Tubular Steel Piles	Lb.	170,000	0.18	30,600		
Sheet Piling	Lb.	95,000	0.105	9,975		
Rails	Lb.	20,000	0.30	6,000		
Miscellaneous Hardware	Lb.	22,000	0.30	6,600		
Cement	Sacks	384,000	1.73		664,320	
Lumber	MBF	2,700	100.00		270,000	
Traffic Signs	Each	250	11.736	2,934		
Asphalt	Ton	4,750	95.00	451,250		
" Concrete Tile	L.M.	23,000	1.00		23,000	
Rock Bolts	L.S.			5,000		
		Sub-Totals		1,737,729	957,320	2,695,049
Fuel and Lubricants 1/						
Structures				18,887	579,434	
Grading and Base				671,707	815,182	
		Sub-Totals		690,594	1,394,616	2,085,210
Equipment Rental (Excluding Fuel)						
Structures				2,250,213		
Grading and Base				7,625,237		
		Sub-Totals		9,875,450		9,875,450
Labor						
Structures					1,051,601	
Grading and Base				244,770	1,149,338	
		Sub-Totals		244,770	2,200,939	2,445,709
Contractor's Administration Costs						
Performance Bond				221,749		
Overhead and Other Indirect Expenses				1,726,187	831,221	
		Sub-Totals		1,947,936	831,221	2,779,157
Contractor's Profit						
Structures				479,005	310,000	
Grading and Base				1,263,668		
		Sub-totals		1,742,673	310,000	2,052,673
Total Construction Cost						21,933,249
Contigencies (15% of Construction Cost)						3,289,987
Total Construction Cost and Contigencies						25,223,235
Right-Of-Way Costs						130,000
Engineering 2/						
Additional Surveys, Final Design and Preparation of Contract Documents (1-7% of Construction Cost and Contigencies) 2/						444,000
Supervision of Construction (4.1% of Construction Cost and						

Sub-Total Cost Project 4	26,875,000
Rounded To	$ 26,900,000

1/ Gasoline is a local cost; diesel and lubricants are dollar costs.

2/ Does not include depreciation of vehicles or other equipment purchased under AID Loan No. 44.-

DESIGN STANDARDS

Projects 1

The design standards shown below are recommended, to serve the projected traffic adequately, safely and economically.

RECOMMENDED DESIGN STANDARDS

Design Speed	100 kilometers per hour
Maximum Degree of Curvature 1/	16 degrees 2/
Curve Widening	None
Superelevation	AASHO 3/Standards, maximum 10%
Maximum Profile Grade	5%
Width of Roadway Platform	9.0 meters
Type of Surface	15 centimeteres crushed gravel
Bridge Design Load	H-20-33 (AASHO Standards)
Width of Bridges (Curb to Curb):	
Length Greater than 100 Meters	6.5 meters
Length Less than 15 Meters	9.0 meters
Length From 15 to 100 Meters	7.0 meters.
Stopping Sight Distance	155 meters
Right-of-way Width	40 meters

1/ Metric definition (angle subtended by 100 meter arc).

2/ Radius of curvature about 360 meters.

3/ American Association of State Highway Officials, "A Policy on Geometric Design of Rural Highways".

The nature of the terrain throughout the length of the proposed highway lends itself well to high design standards. Most of the alignment traverses extremely flat country and the remaining portion, in the vicinity of Villa Tunari, is in moderately rolling terrain. Proposed gradients would be light and horizontal curvature would be smooth and flat. A design speed of 100 kilometers per hour is obtained readily.

The maximum curvature of sixteen degrees is derived from the "standard curve formula" in conformance with AASHO recommended procedures. For the flat curvature proposed, it is considered impractical to make provision for curve widening on the project.

DESIGN PROJECTS

Project 4

The design standards shown below are recommended for the proposed project. The standards were developed for adequacy under the present and projected traffic, with due consideration given to the varying topography through which the aligment would pass. In addition to safety and economy, consideration has also been given to the composition of the traffic, which would continue to be comprised of a relatively high percentage of single unit trucks.

RECOMMENDED DESIGN STANDARDS

	Cochabamba to Sacaba	Sacaba to Villa Tunari 1/		Villa Tunari 1/ to Isiboro River	
	Flat and Rolling Terrain	Flat and Rolling Terrain	Mountainous Terrain	Flat and Rolling Terrain	
Minimum Design Speed	90 KPH	70 KPH	35 KPH	70 KPH	
Minimum Radius of Curvature	270 Meters	150 Meters	30 Meters	150 Meters	
Maximum Profile Grade	3%	6%	7% 2/	6%	
Superelevation and Curve Widening	A S H O S t a n d a r d s				
Roadway Base Course:					
Material	- Crushed Gravel or Stone			- Pit-run Gravel	
Width	10 Meters	9 Meters	8 Meters	6 Meters	
Roadway Surface Course:					
Material	5 cm. Asphaltic Concrete	Double Bituminous Surface Treatment		None	
Width	7 Meters	6 Meters	6 Meters	-	
Design Loading of Bridges	AASHO H 20-44				
Width of Bridges (Curb to Curb)					
Length under 15 mts.	None	9 Meters	8 Meters	9 Meters	
Length 15 to 100 M.	8 Meters	7 Meters	7 Meters	7 Meters	
Length over 100 M.	None	6.5 Meters	6.5 Meters	6.5 Meters	

1/ At intersection with Project 1.
2/ Compensated.-

ANALYSIS OF

TECHNICAL FEASIBILITY AND ECONOMIC JUSTIFICATION

PROJECT 1

Traffic

Inasmuch as Puerto Villarroel is now connected to the National highway network only by a jungle clearing and trail leading to Villa Tunari, present traffic to and from the port is limited to an occasional pedestrian or mule.

Future traffic on the projected highway would be generated mainly by colonization along the route, and by river commerce at Puerto Villarroel. Most of Project 1 would form an important link in the widely discussed "Marginal Highway of the Jungle", following the eastern piedmont of the Andes through Colombia, Ecuador, and Peru, and extending southeastward across Bolivia, as a major segment of the Pan American Highway System. A joint statement of intention to build the Marginal Highway was recently signed by the four countries involved, and funds for a preliminary survey of the feasibility of the highway have been made available by the Interamerican Development Bank. Parts of TAMS Projects 1, 2, 3, 4 and 7 would be incorporated in such an arterial highway. The succeeding traffic projections, however, do not include the sizable additional traffic that would result along Project 1 from completion of adjacent sections of such an artery.

Based on experience in other colonization areas and on the colonization program, it is expected that a typical farmer settling in the area penetrated by the proposed highway would have about 4½ hectares under cultivation by his fifth year and 6¾ hectares in the tenth year. The area under cultivation would increase only gradually in subsequent years and reach about 8½ hectares in 20 years. It is estimated that shipments from the farm would total approximately 29,000 kilograms in the tenth year, requiring 4.8 truckloads at an average of six metric tons each. The number of truckloads shipped from each farm would gradually increase thereafter to more than six in the twentieth year.

During clearing of the land by settlers a small part of the timber would probably be hauled to lumber mills. It is assumed that an average of one truckload per year would be shipped during the first five years of clearing each farm, and that the rate would decline rapidly thereafter as the clearing activity diminished.

The total number of truckloads from each farm thus would increase from an estimated 3.8 in 1972 to 6.5 in 1987. From the total of 2,500 farms, therefore, estimated annual outbound truckloads would number 9,500 in 1972, increasing to 16,250 in 1987.

Traffic studies conducted on highway leading from colonization areas near Santa Cruz and the Alto Beni area (Deaprtment of La Paz), and on the existing road between the Chapare area and Cochabamba, indicate that the total number of vehicles traveling in both directions ranges between 2.1 and 7.8 times the outbound truck movements of agricultural and timber products. It is assumed that a factor of 3 should be applied to agricultural and timber products brought from farms in the new Project 1 colonization area in 1972, increasing to 5 by 1987. Estimated total annual traffic generated by colonization thus would amount to 28,500 vehicles in 1972, and would increase to 81,200 in 1987.

The National Roads Council recently completed a thorough study of potential commerce on the Mamoré River system; included in their report are estimates of cargo that would pass through a port on the Ichilo River in the vicinity of Puerto Villarroel if a highway connection were available through Villa Tunari. A small part of such commerce would have been diverted from the present route via Puerto San Francisco, but the large majority would be newly developed river commerce. The estimates of potential commerce are based upon the assumed realization on schedule of the National Planning Commission's Ten-Year Social and Economic Development Plan, covering the period 1962-1971. For purposes of the present feasibility analysis, however, it is assumed that only about 75% of the potential indicated for 1971 would be realized by 1972 (five years after construction of Projects 1 and 4), and that the full amount would be reached by 1977.

It is probable that the combined southbound volume of cargo from the port and of agricultural produce from farms along the highway would exceed the combined northbound volume of cargo to the port and of miscellaneous items to the farms. The estimated southbound cargo from the port, at an average load of six metric tons, would require 14,800 trucks in 1972 and 19,750 in 1977, or 29,600 one-way trips in 1972 and 39,500 in 1977. It is assumed that, after 1977, the river-highway traffic would increase about 7% per year, based on projection of the normal rate of traffic growth for the country indicated by the trend in gasoline sales between 1954 and 1962. By 1987, therefore, annual one-way trips would reach 77,700.

The report of the National Roads Council makes no allowance for exports to Argentina from the Mamoré basin. It is estimated that 2,500 tons of exports to Argentina would originate on the Mamoré system in 1972 and would increase to 7,500 by 1987, requiring 800 one-way trips in 1972 and 2,500 in 1987.

Estimated total truck traffic to accommodate commerce at the port thus is 30,400 vehicles in 1972, increasing to 80,200 in 1987. Some associated highway traffic would probably be generated by activity at the port; it is assumed that such associated traffic would amount to an additional 10%.

As a result of both colonization and port activities, the total number of vehicles entering and leaving the project area annually via the proposed Chapare River bridge is expected to be about 61,900 in 1972, increasing to 169,400 in 1987. The estimated average daily traffic at each end of the project is given below:

PROJECTED AVERAGE DAILY TRAFFIC

Year	At Chapare Bridge	At Puerto Villarroel
1972	170	90
1977	240	120
1982	320	170
1987	460	240

Benefits

Tangible benefits from construction of the proposed highway would be made up of development benefits from new colonization along the highway and from linkage to navigation on the Ichilo-Mamoré River system.

It is assumed that farm prices in the project area would be slightly less than those now prevailing in the Chapare area because of the additional transportation costs resulting from the greater distance between farms served by the new highway and their markets. Gross income from a typical farm in the tenth year would be about $940. Deducting for labor, interest on capital and marketing expenses would give a net annual farm income in the tenth year of about $150. Based on the 2500 new farms assumed to be developed in the Project 1 area, it is estimated that the total new net agricultural income attributable to the combined highway and colonization program would equal $620,000 in 1972 and would increase to $2,600,000 in 1987.

New income would be generated along the rivers where navigation would be linked to the highway system by the proposed construction. Increased movement of cattle from the area, at an estimated increased income of $10 per head income, and new income from sawmills in the lowlands, indicate a total net income on the order of $1,6 million in 1972 and $3,6 million in 1987.

Total estimated tangible benefits from colonization and linkage to navigation are as follows:

ESTIMATED TOTAL ANNUAL TANGIBLE BENEFITS

(Thousand of Dollars)

Year	Benefits from Colonization	Benefits from Linkage to Navigation	Total Tangible Benefits
1972	620	1,580	2,200
1977	1,280	2,110	3,390
1982	1,720	2,750	4,470
1987	2,600	3,600	6,200

There are many benefits that cannot be measured quantitatively but which will be important to Bolivia's progress. Some perishable or high value cargo is transported by airplane from the Beni Department. Transportation savings would accrue from the movement through Puerto Villarroel of such commodities now transported by air.

The highway development program of Bolivia contemplates five separate projects having at least part of their routes along the base of the eastern mountain range. These sections, including almost all of Project 1 and an adjoining segment of Project 4, together could be incorporated in the proposed "Marginal highway of the Jungle". The development and transportation benefits of such an artery would be very substantial and, as adjoining sections are completed, an appropriate portion of such benefits would be attributable to Project 1.

Highway and river access provided by the proposed project to areas now relatively inaccessible would facilitate the establishement of health and welfare services, and would afford better opportunities for community recreational and social activities. It would facilitate national and local administration. The acceleration of agricultural production would tend to reduce imports and stimulate exports, both favoring Bolivia's international trade balance. The stimulation of demand through reduced market prices and new incentives to those industries that rely in part upon the resources and development of the areas served by the highway and connecting river would have a far-reaching influence on the over-all economic growth of the nation.

Annual Costs

As the highway and colonization projects are interdependent in their functions, the costs of both types of projects must be considered in the economic analysis.

The total cost of highway construction under Project 1 is given as $6,500,000. It is assumed that the project would have an economic life of fifty years, and that an equitable return on the highway investment would be 6%.

The annual capital recovery cost, therefore, would amount to $412,000. It is estimated that the annual average cost of maintenance of the project over a 50-year life would be about $81,000; included in the estimate is the extraordinary maintenance costs of periodic replenishment of the gravel in the base course.

Based upon information given in a IDB internal document dated December 11, 1962, the colonization costs associated with the program for the Chapare area would total $4,664,000. Of the total amount, $2,594,000 would be loaned from the Bank's Social Progress Trust Fund at an annual combined interest and service charge rate of 2%. An additional $1,075,000 would be loaned from the Bank's Fund for Special Operations at an annual interest rate of 4%. Finally, the Government of Bolivia would relinquish the virgin land at the site (which is evaluated in this analysis at zero cost, inasmuch as the land has no logical alternative use) and would provide about $33,000 at an assumed annual interest rate of 6%. It is assumed that about 52% of these loans would be applied to colonization within the zone of influence of Project 1 and 48% in areas opened by Project 4, based upon the expected distribution of families in the two areas. Each colony would be perpetual, but a 50-year economic life has been assumed. On the basis of this life and the appropriate rates of interest and credit fee, the total annual capital recovery cost of the colonization associated with Project 1 would be $79,000.

Total annual cost for the combined Project 1 highway and colonization thus would be $317,000.

Benefit Cost Ratios

The ratios of the annual tangible benefits to the total annual cost for selected years are as follows:

Year	Ratio
1972	3.8
1977	5.9
1982	7.8
1987	10.8

PROJECT 4

Traffic

Highway traffic between Cochabamba and Villa Tunari fluctuates seasonally, largely according to crop harvests. Two traffic surveys were conducted in the project area at an interval of about six months, in January and June 1963. Seasonality, indicated by monthly gasoline sales in Bolivia and by other partial data on vehicle movements in the region, was considered in adjusting and combining the data derived from the two surveys in order to provide the estimated present average daily traffic (ADT) by segment.

About 87 percent of the vehicle between Aguirre and Villa Tunari have a capacity of two tons or more, whereas only about 77 percent fall in the same category between Cochabamba and Sacaba, where the traffic density is greatest. Principal cargoes carried out of the Chapare area include fruits, coca, and lumber; most trucks return northbound empty or with mixed cargoes.

For purposes of analysis it is necessary to estimate the hypothetical present ADT that would utilize various segments of the proposed route. It is reasonable to assume that, of the present 72 vehicles daily between Aguirre and Villa Tunari, 65 would be diverted to the proposed new route; of the present 20 vehicles daily between Aguirre and Colomi, five would travel to and from the Yungas of Corani.

Traffic on the existing road between Tiraque and Aguirre probably amounts to one or two vehicles per day during the dry season, and none at other times. Nonetheless, certain crops produced in the project area have markets in areas east of Aguirre, although of much less importance than those in Cochabamba and other points to the west. Markets east of Aguirre probably extend as far as Epizana, thence south to Sucre, Potosí and intermediate points. These markets include relatively non-perishable products not produced locally, such as bananas, citrus fruits, rice, coca and lumber. At present most such commodities are taken to Cochabamba where some are transshipped to outlying markets. The possible destinations of these products have been examined with reference to the projections for final demand published in the National Planning Commission's Ten-Year Social Economic Development Plan including population distribution, disposable income levels, local self-sufficiency, and possibilities for product substitution.

Pertinent data indicate that the 1971 potential markets to the east of Aguirre and south of Epizana will be about 10 percent of the total, while those to the west of Aguirre will be about 90 percent. A review of similar information for other years indicates that there would be no significant change in this relationship before or after 1971. It is concluded that about 10 percent of the less perishable products from the Chaparo area might be transported to destinations east of Aguirre and south of Epizana, while 90 percent go to Cochabamba, Oruro and other western markets. Yucca, avocados, corn, and other farm produce probably would be confined to markets west of Aguirre. Based on the present types of cargo trucked out of the Chaparo, and ADT of about 5 vehicles would probably utilize a road between Aguirre and the Cochabamba-Santa Cruz highway, if it were now available, in travelling to and from the southeastern markets.

If the proposed Project 4 highway via Colomi, with the spur to Tiraque, were in existence today, the pattern of present traffic probably would be approximately as shown in the following table (new traffic that would be generated as a result of such a new highway is not included):

PROBABLE PATTERN OF PRESENT TRAFFIC ON PROPOSED HIGHWAY

Segment	Present ADT
Cochabamba - Sacaba	350
Sacaba - Aguirre	85
Tiraque - Aguirre	5
Aguirre - Colomi	85
Colomi - Yungas of Corani	70
Yungas of Corani - Villa Tunari	65

Future traffic on the Project 4 highway should be composed of existing traffic increased by normal growth, generated traffic, development traffic, and supplementary traffic resulting from the construction of Project 1. This does not take into account the traffic that would result along Project 4 from completion of adjacent sections of the Marginal Highway.

The most reliable indicator of the long-term trend in Bolivia's traffic growth is sales of gasoline, which increased between 1954 and 1962 at an average annual rate of 7.2 percent. Traffic on the existing road to and from the Chaparo, reported by the National Roads Council, increased between 1957 and 1962 at an average annual rate of 12.5 percent; presumably a large share of the increase was the result of the rapid development of the Chaparo region. It is assumed that normal traffic growth between points now connected

by roads in the project area will be 7.0 percent annually.

Generated traffic consists of motor vehicle trips that would not be made if the proposed highway improvements were not provided; all such traffic should develop within two years after completion of the project. In the United States generated traffic has been found to be generally between 5 percent and 25 percent of the volume moving prior to completion of the project. It is assumed that the proposed improvements from an existing single-lane road of stabilized local material to a two-lane paved road of high design characteristics would result in a generated traffic increase of 20 percent, while similar improvement of an existing gravel-surfaced road would result in an increase of 15 percent; it is further assumed that improvement from a fair-weather earth road to an all-weather stabilized earth road would result in a generated traffic increase of 5 percent. Based on the existing highway conditions in the project area, it is estimated that, of the present traffic shown above, generated traffic would average an additional 15 percent between Cochabamba and Aguirre, 5 percent between Tiraque and Aguirre, and 20 percent between Aguirre and Villa Tunari.

The combination of normal and generated traffic growth components results in projected increases above the present ADT ranging from 110 percent in 1973 to 460 percent in 1988 between Cochabamba and Aguirre, from 100 percent to 450 percent between Tiraque and Aguirre in the same years, and from 115 percent to 465 percent between Aguirre and Villa Tunari.

The number of truckloads shipped from each farm in the CBF colonization program served by Project 4 would be about the same as for Project 1. Although the new farms expected to locate along the highway between Km. 90 and Km. 150 would not receive the Government assistance planned for those in the sponsored colonies, the greater proximity to markets for the products of the spontaneous colonies would tend to equalize their rate of development with that of the sponsored colonies. Lumber shipped from the farms is assumed at the same rate as for Project 1.

Total number of truckloads from each farm thus would be the same as for Project 1. From the total of 1.900 farms planned by CBF for the area northwest of Villa Tunari and the 600 farms estimated for the area along the proposed highway between Km. 90 and Km. 150, estimated annual outbound truckloads would total 9.500 in 1973, increasing the 16.300 in 1988. Applying the same factors used for Project 1, estimated total annual traffic generated by colonization thus would amount to 28.500 vehicles in 1973, and would increase to 81.500 in 1988.

The preceding forecasts of Project 1 and 4 the proposed Project 4 highway have been combined to furnish following estimates of total projected average daily traffic:

TOTAL PROJECTED AVERAGE DAILY TRAFFIC

Segment	A D T				
	Present	1973	1978	1983	1988
Cochabamba-Sacaba	350	970	1.350	1.850	2.600
Sacaba-Aguirre	85	420	580	790	1.120
Tiraque-Aguirre	5	40	50	70	100
Aguirre-Colomi	85	450	620	850	1.190
Colomi-Yungas of Corani	70	410	580	790	1.110
Yungas of Corani-Villa Tunari	65	390	550	750	1.050
Villa Tunari- Isiboro River	-	50	70	100	140

Benefits

Tangible benefits from Project 4 would consist mainly of reduction of road-use costs and development benefits.

An analysis was made by TAMS of vehicle running speeds and operating costs for the existing and proposed roads between Cochabamba and Villa Tunari, bases on data published by AASHO and adjusted in accordance with conditions prevailing in Bolivia. In areas where grades are sustained for considerable distance, average running speeds of medium and heavy vehicles were adjusted downward to allow for crawl speeds in the uphill direction. Operating costs per kilometer for each type of vehicle were estimated, based on dominant geometric characteristics and the estimated running speed for each segment of the existing and proposed roads between Cochabamba and Villa Tunari. The composite effect of higher running speeds, improved roadway surface, and elimination of long segments of road at high elevations results in average savings in vehicle operating costs between Cochabamba and Villa Tunari of about five cents per kilometer for light vehicles, 11 cents for medium vehicles, and nearly 30 cents for heavy vehicles. The estimated costs of a one-way vehicle trip between Cochabamba and Villa Tunari on the existing road (180 kilometers) compared with those on the proposed highway (162 kilometers) are as follows:

ESTIMATED VEHICLE OPERATING COSTS OF A ONE-WAY TRIP
BETWEEN COCHABAMBA AND VILLA TUNARI

(Dollars)

Route	Type of Vehicle		
	Light	Medium	Heavy
Existing	17.30	37.00	83.60
Proposed	7.50	15.40	27.70

Based on the estimated reductions in operating costs per kilometer, average trip lengths, and projected traffic, construction of the proposed

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new highway between Cochabamba and Villa Tunari, together with the connection between Aguirre and the Cochabamba-Santa Cruz highway near Tiraque, would result in total annual savings in vehicle operating costs of almost $3.1 million in 1973, increasing to $7.7 million in 1988. For traffic between the Cochabamba-Santa Cruz highway and Aguirre on the fair-weather road now under the assuption that during three months of the year such traffic would be forced to detour via Cochabamba.

As with Project 1, development benefits associated with Project 4 are measured in terms of the attributable increases in the net farm income. Gross income in the tenth year from a typical farm in the proposed CBF colonization area west of Villa Tunari would equal about $1,000.

In estimating net farm income, deductions from gross income were made for the costs of labor, capital, and marketing. It was assumed that in most cases, land would be provided free of cost to the settler. Typical net annual farm income in the tenth year, estimated as for Project 1, would amount to about $570. Farm prices would be somewhat higher along the proposed highway between Km. 90 and Km.150, but the resulting higher gross incomes would be offset by correspondingly higher production costs because of the more rugged topography of the region; net income, therefore, would be of the same order as in the CBF colony. Based on the 1,900 farms planned for the CBF colony and the 600 farms expected to be settled between Km. 90 and Km. 150, it is estimated that the total new net annual farm income attributable to the combined highway and colonization programs would equal $700,000 in 1973 and would increase to $2,800,000 in 1988.

Total estimated tangible benefits from savings in vehicle operating costs and from new farm income are as follows:

ESTIMATED TOTAL ANNUAL TANGIBLE BENEFITS
(Thousands of Dollars)

Year	Road-User Benefits	Development Benefits	Total
1973	3,050	700	3,750
1978	4,310	1,420	5,730
1983	5,720	1,870	7,590
1988	7,710	2,800	10,510

As discussed above, the segment of Project 4 between the intersection with Project 1 and the Isiboro River would become a part of the proposed "Marginal Highway to the Jungle". As adjoining sections are completed, an appropriate portion of the development and transportation benefits would be attributable to Project 4. Other benefits not easily measured would be similar to intangible benefits described for project.

Annual Costs

The total cost of highway construction under Project 4 is given as $26.9 million. It is estimated that an additional $1.5 million would have

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to be expended in about 1980 for strengthening of the pavement on certain segments of the highway required by increased traffic volume.

It is assumed that the project would have an economic life of fifty years (except for a twenty-year life of pavement), and that an equitable return on the highway investment would be 6%. The annual capital recovery cost on construction, therefore, would amount to $1,737,000 until about 1980, at which time it would increase to $1,858,000.

Although current maintenance expenditures on the existing road between Cochabamba and Villa Tunari are relatively low, future volumes of traffic on the existing road would require rapid increases in maintenance costs to a level at least as high as that estimated for the improved road. For the twenty-year period of this analysis it is assumed, therefore, that the new highway to Km 165 would generate neither higher nor lower maintenance costs and that there would be no net additional maintenance cost attributable to the project between Cochabama and Villa Tunari. For the new highway between Villa Tunari and the Isiboro River, it is estimated that the average annual cost of maintenance over a fifty-year life would be about $41,000; included in the estimate is the extraordinary maintenance cost of periodic replenishment of the gravel in the base course.

The total annual capital recovery cost of the colonization program associated with Project 4 would be $75,000, estimated in the same manner as for Project 1. It is assumed that there would be no public costs associated with the 600 new families expected to locate spontaneously between Km. 90 and Km. 150, other than the costs of construction and maintenance of the new highway.

Total annual cost for the combined Project 4 highway and colonization projects thus would be $1,843,000 prior to 1980 and $1,974,000 thereafter.

Benefit Cost Ratios

The ratios of the annual tangible benefits to the total annual costs for selected years are as follows:

Year	Ratio
1973	2.0
1978	3.1
1983	3.8
1988	5.3

ESTIMATED CROP AND LIVESTOCK SALES OF TYPICAL FARM IN TENTH YEAR (PROJE

Crop	Shipments (Kilograms)	Farm Price ($b/kg.)	Gross Sales (Dollars 1/)
Rice	2,700	0.735	165
Bananas	16,000	0.100	133
Corn	600	0.460	23
Peanuts	325 2/	1.060	26
Yucca	3,500	0.305	88
Coffee	225	3.940	74
Citrus	2,000	0.532	88
Avocados	2,000	0.732	122
Others	1,250	0.975	101

Livestock	(Number)	($b/Unit)	(Dollars 1/)
Heifers	1	690	57
Hogs	3	130	32
Chickens	8	10	29 3/

1/ At 12 pesos bolivianos ($b) to the dollar
2/ Shelled.
3/ Includes 58 dozen eggs at $b. 4.65 per dozen.

NET ANNUAL AGRICULTURAL INCOME ATTRIBUTABLE TO COMBINED HIGHWAY (PROJECT 1) AND COLONIZATION PROJECT

(Dollars)

Year	Annual Average Per Farm: Gross Sales	Marketing Costs	Net Income	Total Net Annual Income (2,500 Farms)
1972	570	320	250	620,000
1977	940	430	510	1,280,000
1982	1,180	500	690	1,720,000
1987	1,550	510	1,040	2,600,000

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TRAFIC SURVEY COVERAGE (PROJECT 4)

Station	January 1963 Dates (Inclusive)	January 1963 Hours Per Day	June 1963 Dates (Inclusive)	June 1963 Hours Per Day
Kilometer 7	2-16 1/	24	23-29	24
Aguirre	3-16	16	23-29	24
Villa Tunari	3-16	16	23-29	16

1/ Included interviews to ascertain origins of eastbound vehicles and destinations of westbound vehicles.

ESTIMATED PRESENT AVERAGE DAILY TRAFFIC (PROJECT 4)

Segment	ADT
Cochabamba-Sacaba	355
Sacaba-Aguirre	90
Aguirre-Colomi (spur road)	20
Aguirre-Villa Tunari	70
River Crossing at Villa Tunari	45

DERIVATION OF MARKET DISTRIBUTION WEST AND EAST OF AGUIRRE (PROJECT 4)

(Projected for 1971)

	West	East
Average Total Annual Disposable Income Per Capita Available for Purchase of Non-processed Food	$ 31	$ 31
Produced by Consumer	12	15
Expended for Local Substitutes	6	8
Available for Purchase of Non-processed Foods from Outside Local Area	13	8
Population 2/	944,000	179,000
Aggregate Income Available for Purchase of Non-processed Foods from Outside Local Area.	$12,270,000	$ 1,430,000
Percentage of Total Market in Indicated Area	89.6%	10.4%

1/ From final demand analysis for 1971 in the Ten-Year Economic and Social Development Plan.

2/ Population projections of the Bureau of Statistics, Ministry of Finance, for each market area for 1971.

ESTIMATED RATE OF NORMAL AND GENERATED TRAFFIC GROWTH

(BETWEEN COCHABAMBA AND VILLA TUNARI (PROJECT 4)
(Percenta Increases above Present Traffic)

Growth Component	1973	1978	1983	1988
Normal	95	175	285	445
Generated:				
Cochabamba - Aguirre	15	15	15	15
Tiraque-Aguirre	5	5	5	5
Aguirre-Villa Tunari	20	20	20	20
Totals:				
Cochabamba-Aguirre	110	190	300	460
Tiraque-Aguirre	100	180	290	450
Aguirre-Villa Tunari	115	195	305	465

PRESENT TRAFFIC INCREASED BY PROJECTED NORMAL AND GENERATED TRAFFIC BETWEEN COCHABAMBA AND VILLA TUNARI (Project 4)

Segment	Present	A D T 1973	1978	1983	1988
Cochabamba-Sacaba	350	735	1,015	1,400	1,960
Sacaba-Aguirre	85	180	245	340	475
Tiraque-Aguirre	5	10	15	20	30
Aguirre-Colomi	85	185	250	345	480
Colomi-Yungas of Corani	70	150	205	285	395
Yungas of Corani-Villa Tunari	65	140	190	265	365

PROJECT 1 TRAFFIC USING PROJECT 4 HIGHWAY (PROJECT 4)

	A D T 1973	1978	1983	1988
Totals	185	255	350	490
Distribution to and from:				
Points West of Aguirre	164	227	310	433
Points East of Aguirre	21	28	40	57

ESTIMATED CROP AND LIVESTOCK PRODUCTION OF TYPICAL FARM IN TENTH YEAR

PROJECT 4

Crop	Area Under Cultivation (Hectares)	Production (Kilograms)	Disposition of Production (Kgs.) Seed and Feed	Home Consumption	Shipped off Farm
Rice	2.0	3,000	100	200	2,700
Bananas	1.0	18,000	1,000	1,000 1/	16,000
Corn	1.0	1,600	760	300	600
Peanuts	0.85	375 2/	-	50	325
Yucca	0.5	8,250	3,000	1,750 1/	3,500
Coffee	0.5	250	-	25	225
Citrus	0.25	3,125	-	1,125 1/	2,000
Avocados	0.25	3,125	-	1,125 1/	2,000
Others	0.50	2,500	500	750	1,250
Sub-totals	6,75	40,225	5,300	6,325	28,600

Livestock	Livestock Population	Shipped (Number)	(Kgs.)
Bull	1	-	-
Cows	3	-	--
Heifers	1	1	200
Hogs	6	3	225
Chickens	15	8	35
Eggs	-	58 doz.)	
		Sub-Total	460
		Total Shipments (Rounded)	29,900

1/ Includes some wastage.

2/ Shelled

ESTIMATED ANNUAL FARM SHIPMENTS (PROJECT)
(Number of Truckloads)

Year	Typical Farm: Agricultural and Livestock Products	Timber	Total	Total from Colonies: Km. 90-Km. 150 (600 Farms)	CBF Colony (1900 Farms)
1973	2.8	1.0	3.8	2,300	7,200
1978	4.8	0.2	5.0	3,000	9,500
1983	5.3	0.2	5.5	3.300	10.500
1988	6.3	0.2	6.5	3,900	12,400

ESTIMATED DEVELOPMENT TRAFFIC

D T

	1973	1978	1983	1988
To and From Km. 90. Km. 150	19	29	36	53
To and From CBF Colony	59	91	115	170

ESTIMATED DEVELOPMENT TRAFFIC

	1973	1978	1983	1988
Totals	78	120	151	223
Distribution to and from:				
Points West of Aguirre	73	112	140	207
Points East of Aguirre	5	8	11	16

PROJECTED INCREMENTS IN NET INCOME FROM BEEF AND TIMBER IN MAMORE BASIN ATTRIBUTABLE TO HIGHWAY PROJECT (Project 4)

	Cattle		Timber	
	ead Shipped	Net Income	Tons Shipped	Net Income
Forecast for 1977:				
If Projec 1 Constructed 1/	230,000		42,000	
Assume About 10% Shipped Via Puerto San Francisco if Project 1 Not Constructed	23,000		4,000	
Net Increase Attributable to Projec 1	207,000		38,000	
Assumed Unit Net Income		$ 10/Head		$ 1/Ton
		$ 2,070,000		$ 38,000
Total New Net Income for Selected Years (Rounded):				
1972 2/		1,550,000		30,000
1977		2,070,000		40,000
1982 3/		2,700,000		50,000
1987 3/		3,540,000		60,000

1/ Forecast in Mamoré Basin report for 1971, and assumed in thisanalysis as applicable for 1977 (rounded)

2/ 75% of 1977.

3/ Increase after 1977 at rate of 5.5% the assumed growth rate for gross national product.

RUNNING SPEEDS BETWEEN COCHABAMBA AND VILLA TUNARI

BY VEHICLE TYPE 1/ AND ROUTE (PROJECT 4)

Running Speed (Kilometers per Hour)	Percentage of Distance on Existing and Proposed Roads					
	Light Vehicles		Medium Vehicles		Heavy Vehicles	
	Existing	Proposed	Existing	Proposed	Existing	Proposed
0-9	-	-	53	-	67	-
10-19	63	-	27	-	19	-
20-29	23	-	7	1	3	11
30-39	2	1	13	14	12	27
40-49	12	14	-	27	-	16
50-59	-	28	-	12	-	-
60-69	-	12	-	46	-	46
70-79	-	45	-	-	-	-
TOTALS	100	100	100	100	100	100

1/ Light vehicles include trucks up to 2 tons capacity medium vehicles have a capacity of 2 - 1/2 to 9 1/2 tons: heavy vehicles have a capacity of 10 tons or more.

ESTIMATED CROP AND LIVESTOCK SALES OF TYPICAL FARM IN TENTH YEAR (PROJECT 4)

CROP	Shipments (Kilograms)	Farm Price (Cost/Kg)	Gross Sales (Dollars)
Rice	2,700	6.3	170
Bananas	16,000	1.0	160
Corn	600	4.0	24
Peanuts (Shelled)	325	9.0	29
Yucca	3,500	2.7	95
Coffee	225	33.0	74
Citrus	2,000	466	92
Avocado	2,000	6.3	126
Others	1,250	8.3	104
Livestock	**(Number)**	**(Dollar/Unit)**	**(Dollars)**
Heifers	1	58	58
Hogs	3	11	33
Chickens	8	0.80	32 1/
	Total		995

1/ Includes 58 dozen eggs at 40 cents per dozen

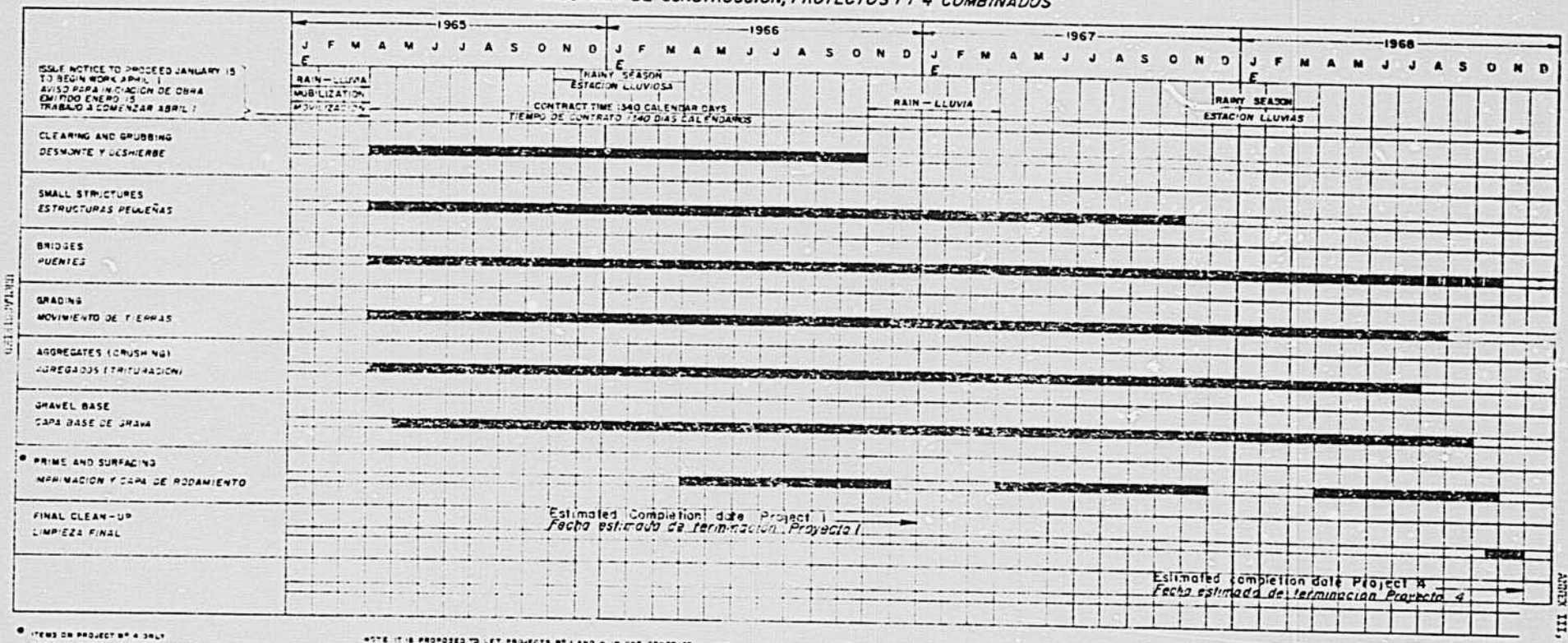
NET ANNUAL AGRICULTURAL INCOME ATTRIBUTABLE TO COMBINED HIGHWAY AND COLONIZATION PROJECTS (PROJECT 4)

(Dollars)

Year	Gross Sales	Annual Average Per Farm: Production and Marketing Costs	Annual Average Per Farm: Net Income	Total Net Annual Income (2,500 Farms)
1973	600	320	280	700,000
1978	1,000	430	570	1,420,000
1983	1,250	500	750	1,870,000
1988	1,630	510	1,120	2,800,000

TABLE
CUADRO 40

SCHEDULE OF CONSTRUCTION, COMBINED PROJECTS I AND 4
PROGRAMA DE CONSTRUCCION, PROYECTOS I Y 4 COMBINADOS



● ITEMS ON PROJECT Nº 4 ONLY
ITEMS EN PROYECTO Nº 4 SOLAMENTE

NOTE: IT IS PROPOSED TO LET PROJECTS Nº 1 AND 4 IN ONE CONTRACT
NOTA: SE PROPONE ADJUDICAR PROYECTOS Nº 1 Y 4 EN UN CONTRATO

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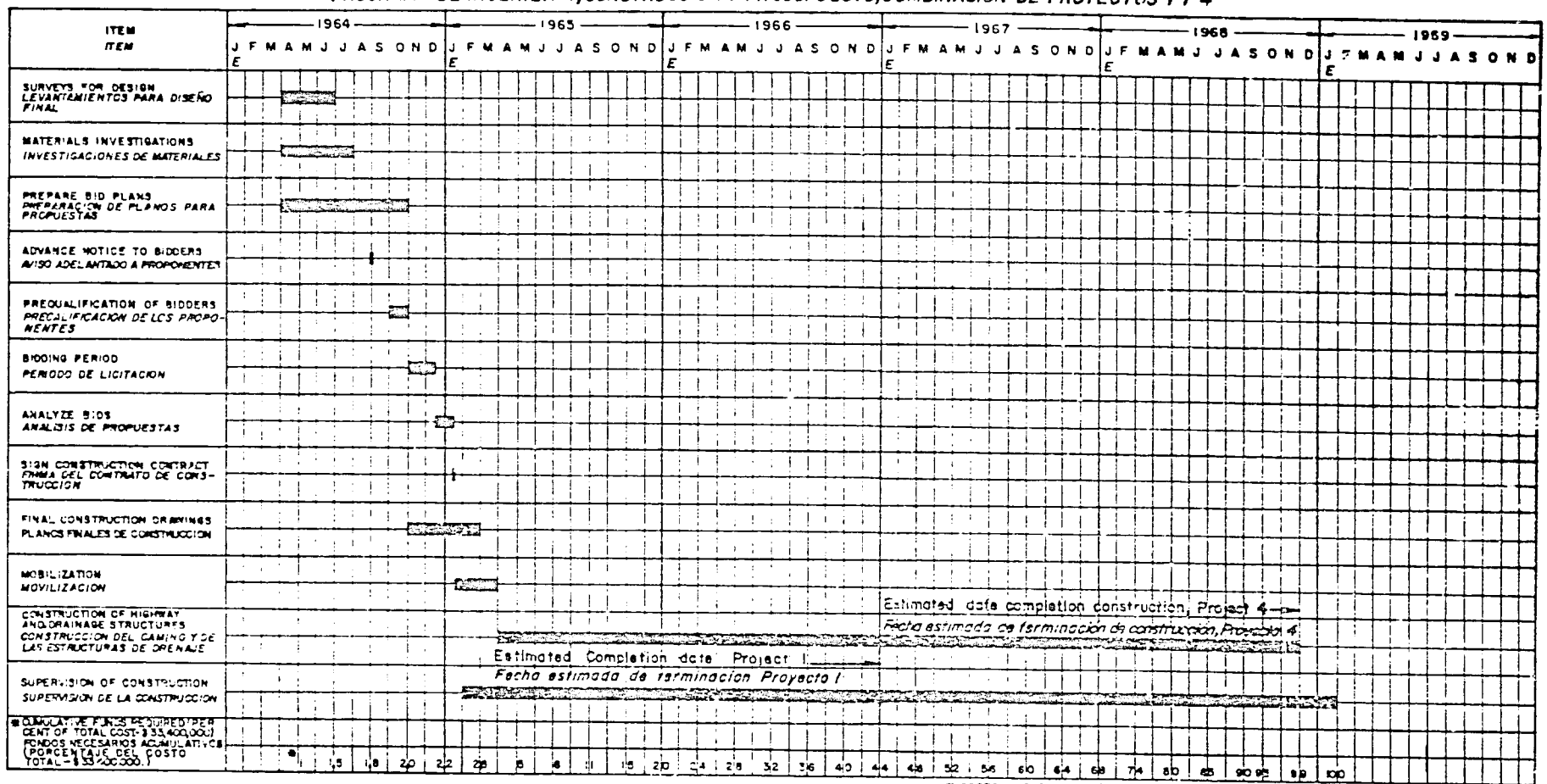
ANNEX III, Page 33 of 50

33.

SCHEDULE OF ENGINEERING, CONSTRUCTION AND FUNDING, COMBINED PROJECTS I AND 4

PROGRAMA DE INGENIERIA, CONSTRUCCION Y PRESUPUESTO, COMBINACION DE PROYECTOS I Y 4



* COSTS AND FUNDING FOR COMBINED PROJECTS I AND 4
COSTOS Y FINANCIAMIENTO PARA LOS PROYECTOS I Y 4 COMBINADOS

The large amount of equipment required for Project 1 and Project 4 combined and for the extensive additional road construction now scheduled is not available at present in Bolivia. A contract combining Projects 1 and 4 should be sufficiently attractive to large foreign contractors to induce them to ship the necessary construction equipment to Bolivia. Except for a few items, a fleet of new equipment could be fully amortized on these two projects. An estimate of the equipment needed for the projects is presented below:

CONSTRUCTION EQUIPMENT ESTIMATE

Project 1 and 4 1/

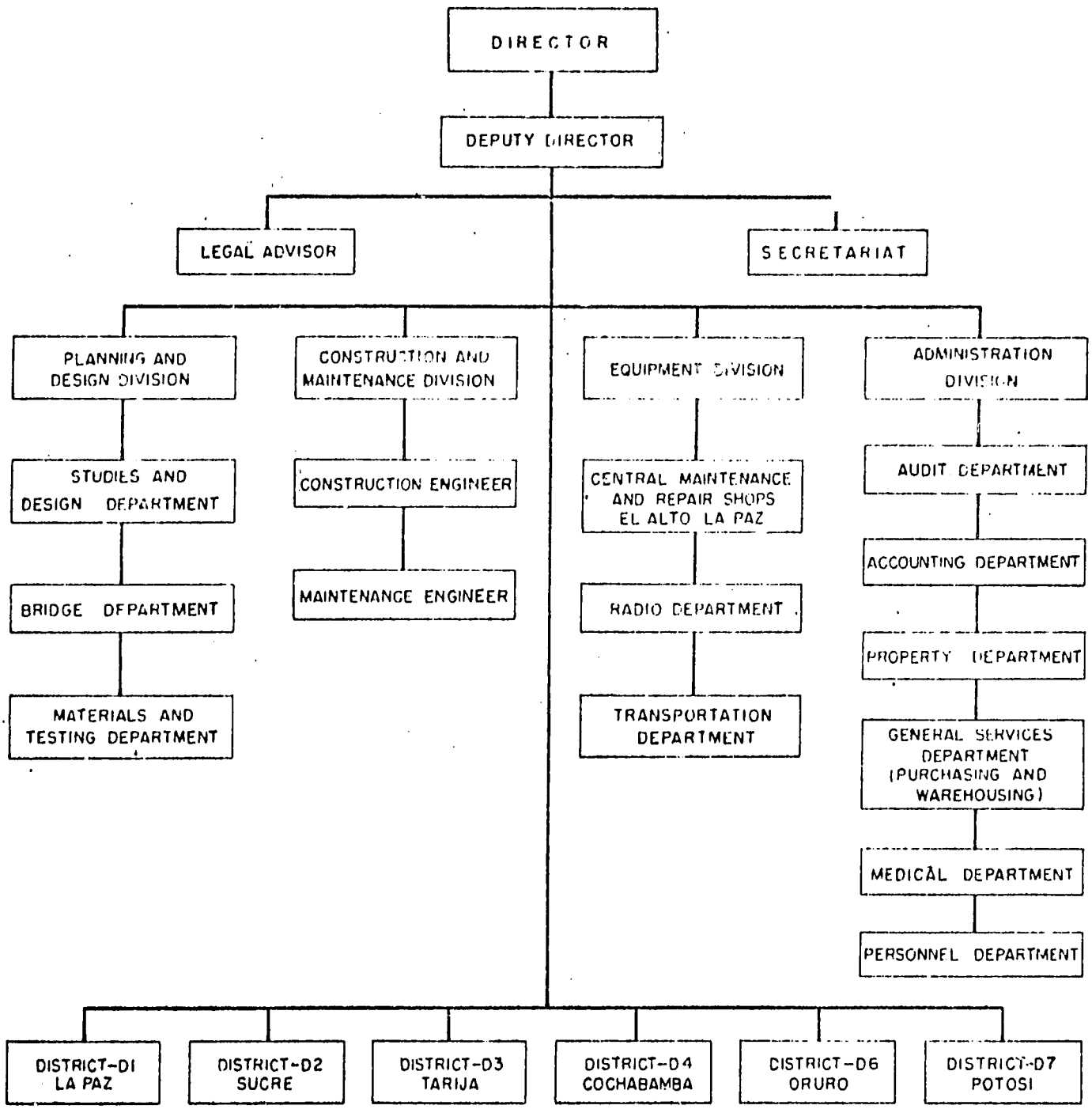
Number	Equipment	Cost FOB U.S.A. (Dollars) Each Unit 2/	Total	Estimated Hours Each Unit Used on Projects
	Equipment for Structures			
4	Concrete Mixer, 1/3 C.Y.	2,860	11,440	4,500
3	Concrete Mixer, 1 C.Y.	7,095	21,285	6,000
3	Batch Plant	5,500	16,500	6,000
5	Transit Mix Truck, 2 C.Y.	10,670	53,350	6,000
8	Truck, 4 Ton	7,920	63,360	5,000
4	Truck, 5 C.M.	11,660	46,640	5,000
6	Truck, 1 Ton	5,500	33,000	6,500
4	Truck Crane, 4 Ton	14,795	59,180	6,000
1	Pile Hammer Leads	7,590	7,590	1,000
1	Boiler, 50 H.P.	5,500	5,500	1,000
10	Pump, Portable, 1-1/2"	220	2,200	6,000
10	Pump, Portable, 4"	1,342	13,420	6,000
2	Welding Machine, 200 Amp.	341	682	3,000
3	Air Compressor, 600 CFM	14,278	42,834	5,000
4	Air Compressor, 250 CFM	8,052	32,208	5,000
10	Power Plant, 5 KW.	1,463	14,630	4,000
3	Set Small Tools, Concrete	3,740	11,220	5,500
2	Prestressing Equipment	3,850	7,700	3,000
2	Crane Crawler Type (available in Bolivia)			3,000
3	Motor, 30 H.P.	1,100	3,300	6,000
2	Loader, Front-End, 1 C.Y.	6,600	13,200	6,000
2	Crane, 8 Ton	19,250	38,500	2,000
2	Bin, 100 Ton	3,300	6,600	6,000
2	Conveyor	5,500	11,000	6,000
3	Drag-line, 3/4 C.Y.	23,430	7,290	6,000
2	Hammer, Steam	3,960	7,920	4,000
			593,549	

Number	Equipment	Cost FOB U.S.A. (Dollars) Each Unit 2/	Total	Estimated Hours Each Unit Used on Projects
	Carried Forward.....		593,549	
	Equipment for Grading, Base and Surfacing			
5	Drag-line, 1-1/2 C.Y.	45,100	225,500	7,500
93	Truck, 4 C.Y.	9,735	905,355	7,500
15	Motor Grader, 13 ft. Blade	13,640	204,600	7,500
9	Sheep Foot Roller	2,200	19,800	7,500
9	Tractor (D-6)	16,500	148,500	7,500
13	Pneumatic Roller, Self-prop.	5,775	75,075	7,500
1	Tractor, Farm	5,500	5,500	7,500
15	Water Truck with Pump	7,700	115,500	7,500
10	Service Truck	6,600	66,000	7,500
15	Pick-up Truck	3,300	49,500	7,500
14	Dozer (D-8) with 8 ft. Blade	44,000	616,000	7,500
8	Loader, Front End, 2 C.Y.	9,790	78,320	7,500
6	Tractor, Scraper, 12-14 C.Y.	30,800	184,800	7,500
8	Tractor (D-6): with Dozer Blade	16,500	132,000	7,500
2	Crusher, Primary, 75-100 Ton/Hr. (3048); Crusher, Secondary, 75-100 Ton/Hr. (4022); Bins, Screens, Feeder, 3 Engines	66,000	132,000	6,500
1	Crusher Primary, 150 Ton/Hr; Crusher, Secondary, 150 Ton/Hr; Bins, Screens and Feeder; 3 Engines, 140-165 H.P.	110,000	110,000	6,500
1	Broom, Power	2,200	2,200	4,000
1	Distr., Bituminous 1,500 Cal.	10,945	10,945	4,000
1	Drag Broom	550	550	4,000
1	Roller, 3 Wheel, Flat	8,800	8,800	4,000
1	Spreader Box	2,750	2,750	4,000
5	Air Compressor and Aux. Equip., 600 CFM	14,278	71,390	7,500
5	Shovel, 2 C.Y.	68,970	344,850	7,500
20	Rock Truck	9,075	181,500	7,500
3	Ripper	2,500	7,500	7,500
	Sub-Total		4,292,484	
	15% Spare Parts		643,873	
	Sub-Total		4,936,357	
	23% Freight to Bolivia		1,135,362	
	TOTAL		$ 6,071,719	
	ROUNDED TO		$ 6,100,000	

1/ The listed equipment is predicated on the assumption that Projects 1 and 4 will be combined under a single contract.

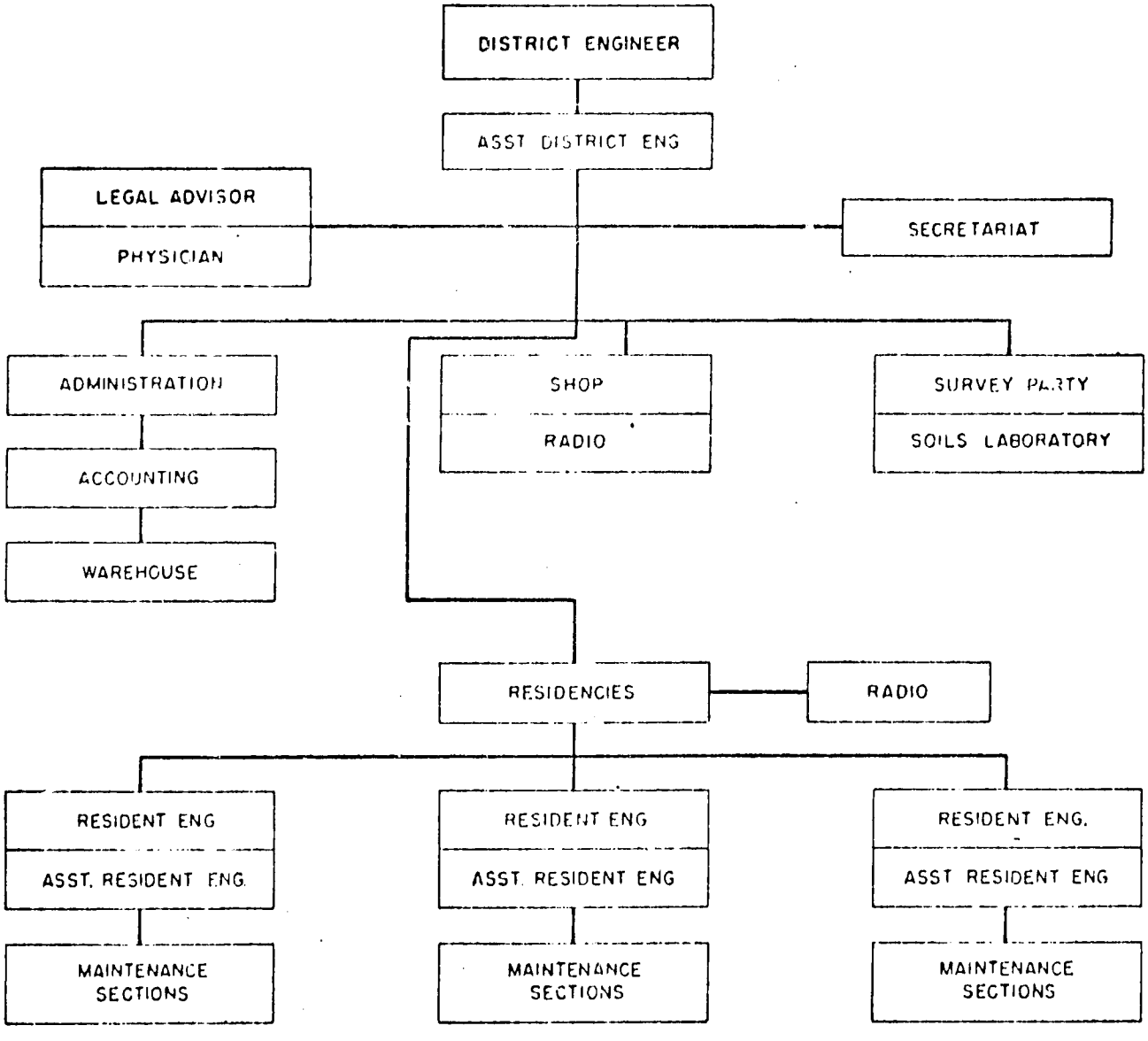
2/ Data from "Estimating Construction Costs" by Peurifoy, McGraw-Hill, Second Edition 1958; unit prices increased by 10%.

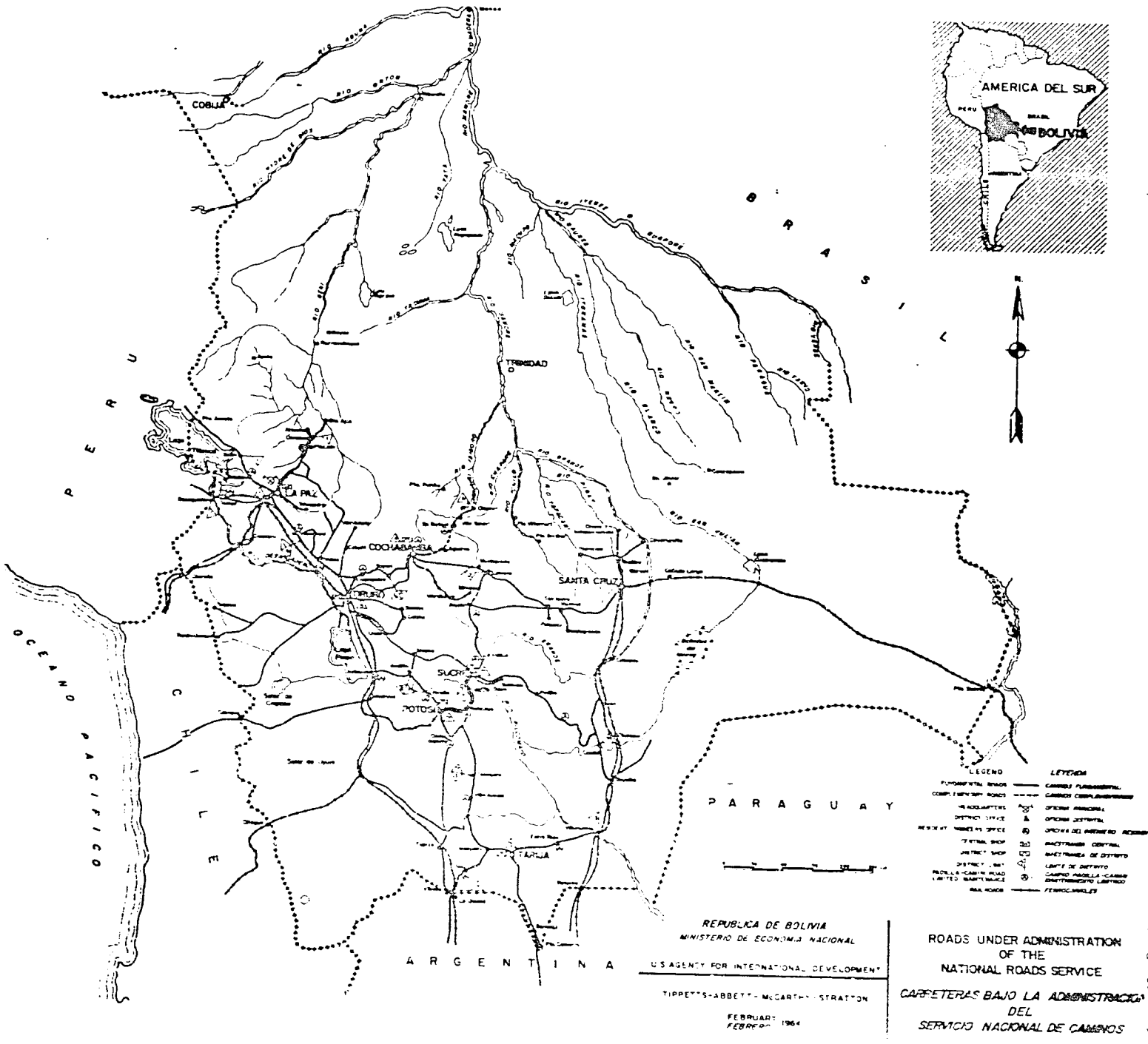
NATIONAL ROADS SERVICE ORGANIZATION



NATIONAL ROADS SERVICE

TYPICAL DISTRICT ORGANIZATION




AMERICA DEL SUR
PERU
BRASIL
BOLIVIA
COBIJA
TRINIDAD
LA PAZ
COCHABAMBA
ORURO
SANTA CRUZ
SUCRE
POTOSI
TARIJA
P E R U
B R A S I L
C H I L E
P A R A G U A Y
A R G E N T I N A
OCEANO PACIFICO
LEGEND
LEYENDA
REPUBLICA DE BOLIVIA
MINISTERIO DE ECONOMIA NACIONAL
U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT
TIPPETTS-ABBETT-McCARTHY-STRATTON
FEBRUARY
FEBRERO 1964
ROADS UNDER ADMINISTRATION
OF THE
NATIONAL ROADS SERVICE
CARRETERAS BAJO LA ADMINISTRACION
DEL
SERVICIO NACIONAL DE CAMINOS

PERMANENT LABOR CAMPS OF THE NATIONAL ROADS SERVICES

District	Name of Camp	Road	Section	Distance from District Office (Km)	Capacity	Present Force	Property	Electric Power Plant	Potable Water Supply	Toilet and Bath
La Paz	Batallas	La Paz-Achacachi	Residency	58.5	20	14	Own	Yes	Yes	Yes
	Laja	La Paz-Desaguadero	102-1	33.3	12	10	Rent	No	No	Yes
	Guaqui	La Paz-Desaguadero	Residency	90.7	16	9	Rent	Yes	Yes	Yes
	Pocota	La Paz-Oruro	103-1	41.0	15	9	Rent	Yes	Yes	[illegible]
	Viscachani	La Paz-Oruro	Residency	94.6	30	9	Rent	Yes	Yes	Yes
	Chuquiaguillo	La Paz-Caranavi	104-1	7.0	6	1	Own	No	No	No
	Urduavi	La Paz-Caranavi	104-1	46.0	12	8	Junta Caminos	Yes	No	No
	Sacramento	La Paz-Caranavi	104-2	67.0	12	10	Rent	Yes	No	Yes
	Challa	La Paz-Caranavi	104-3	111.6	7	2	Own	No	No	No
	Puerto Leon	La Paz-Caranavi	Residency	136.0	20	12	Own	Yes	No	Yes
Sucre	Yotalilla	Sucre-Potosí	200-1	20.0	10	8	Rent	No	No	No
	La Pelra	Sucre-Epizana	Residency	37.0	18	10	Own	Yes	No	Yes
	Zurima	Sucre-Epizana	200-2	65.0	8	10	Rent	No	No	No
	Constanza	Sucre-Epizana	201-1	115.0	15	10	Own	No	No	No
	Aiquile	Sucre-Epizana	Residency	150.0	35	10	Own	Yes	Yes	Yes
	Chujllas	Sucre-Epizana	201-3	180.0	14	8	Own	No	No	No
	Tomina	Sucre-Camiri	202-2	154.0	14	-	Own	No	No	No
	Padilla	Sucre-Camiri	Residency	189.0	16	-	Own	No	No	[illegible]
	Astillero	Sucre-Camiri	202-3	243.0	8	-	Own	No	No	No
	Río Azero	Sucre-Camiri	203-1	270.0	14	10	State	No	No	No
	Bartolo	Sucre-Camiri	203-1	290.0	12	8	Own	No	No	No
	El Molino	Sucre-Camiri	203-1-2	312.0	12	8	Own	No	No	No
	Timboy Pampa	Sucre-Camiri	203-2	341.0	12	8	Own	No	No	No
	Incahuasi	Sucre-Camiri	203-3	392.0	12	-	Own	No	No	No
	Itacua	Sucre-Camiri	203-3	448.0	12	-	Own	No	No	No
	Camiri	Sucre-Camiri	203-3	468.0	15	-	Own	No	Yes	Yes
	Mama Kabuiña	Sucre-Camiri		36.0	14	-	Own	No	Yes	No
	Janina	Sucre-Camiri		90.0	14	-	Own	No	Yes	No

(continued on page 52)

District	Name of Camp	Road	Section	Distance from District Office (Km)	Capacity	Present Force	Property	Electric Power Plant	Portable Water Supply	Toilet and Bath
Tarija	Sta. Bárbara	Tarija-Villazón	300-1	11.7	14	4	own	No	No	No
	Iscayachi	Tarija-Villazón	300-2	54.0	11	1	rent	No	No	No
	Yunchará	Tarija-Villazón	300-2	109.6	8	1	rent	No	No	No
	Tojo	Tarija-Villazón	300-3	130.0	12	9	rent	Yes	No	No
	Cienegüillas	Tarija-Potosí	301-1	76.2	12	6	own	No	No	No
	Las Carreras	Tarija-Potosí	301-2	113.3	12	20	rent	No	No	No
	Villa Abecia	Tarija-Potosí	Residency	138.5	12	7	rent	Yes	Yes	Yes
	La Pizarra	Tarija-Potosí	301-3	161.0	15	6	rent	No	No	No
	Santa Ana	Tarija-Villamontes	302-1	20.5	6	3	rent	No	No	No
	Narváez	Tarija-Villamontes	302-2	81.7	12	8	own	No	No	No
	Entre Ríos	Tarija-Villamontes	Residency	100.8	16	6	rent	Yes	No	Yes
	Serrano	Tarija-Villamontes	302-3	127.3	12	5	own	No	No	No
	Cañadas	Tarija-Villamontes	302-3	151.4	4	6	rent	No	No	No
	Isiri	Tarija-Villamontes	302-4	228.0	12	12	own	No	No	No
	Villazón	Tarija-Villazón	303-3	194.0	15	24	rent	Yes	Yes	Yes
Cochabamba	Suticollo	Cochabamba-Oruro	Residency	25.0	12	12	rent	Yes	No	No
	Sayari	Cochabamba-Oruro	401-3	76.0	15	7	own	No	No	No
	Campamento 68	Cochabamba-Chapare	400-1	68.0	5	1	own	No	No	No
	Campamento 82	Cochabamba-Chapare	400-1	82.0	5	1	own	No	No	No
	Limbo	Cochabamba-Chapare	400-2	125.0	8	1	own	No	No	No
	San Rafael	Cochabamba-Chapare	Residency	168.0	20	8	own	Yes	Yes	Yes
Oruro	Caracollo	Oruro-La Paz	600-1	39.1	9	5	rent	Yes	No	No
	Panduro	Oruro-La Paz	Residency	68.2	23	14	rent	Yes	No	Yes
	Sica Sica	Oruro-La Paz	600-3	105.1	8	7	rent	Yes	No	No
	Lequepalca	Oruro-Cochabamba	Residency	53.3	11	8	rent	No	No	No
	Challa	Oruro-Cochabamba	601-3	98.5	11	12	own	Yes	No	No
	Machacamarca	Oruro-Potosí	602-1	33.4	18	10	rent	No	No	No
	Pazña	Oruro-Potosí	602-1	85.2	15	8	rent	No	No	No
	Challapata	Oruro-Potosí	Residency	125.4	13	10	rent	Yes	Yes	Yes
	Tolapalca	Oruro-Potosí	602-2	187.4	4	8	rent	No	No	No

(Continued on Page 63)

District	Name of Camp	Road	Section	Distance from District Office (km)	Capacity	Present Force	Property	Electric Power Plant	Portable Water Supply	Toilet and Bath
Potosí	Cuchu Ingenio	Potosí-Tarija	Residency	41.0	20	18	rent	Yes	Yes	Yes
	Lecori	Potosí-Tarija	700-2	103.8	10	8	rent	No	No	No
	Muyuquiri	Potosí-Tarija	700-3	168.5	10	9	rent	No	No	No
	Retiro	Potosí-Sucre	701-2	87.0	10	8	rent	No	Yes	No
	Yocalla	Potosí-Oruro	Residency	49.6	10	10	rent	Yes	No	No
	Totora	Potosí-Oruro	702-1	31.0	12	6	rent	No	Yes	No
	Leñas	Potosí-Oruro	702-2	94.3	14	9	own	Yes	Yes	[illegible]
	Ventilla	Potosí-Oruro	702-2	120.0	6	10	rent	No	No	No

Note: Camiri District (N° 5) probably will be reactivated under the Service's new maintenance program currently under study.

Camps owned by the Service are being improved as funds permit.

During March, 1963 new camps were completed at Tolapalca and Leñas, both on the Oruro-Potosí road.

Source: National Roads Service.

REPAIR AND MAINTENANCE EQUIPMENT IN NATIONAL ROADS SERVICE SHOPS

Type of Equipment	Main Shop La Paz	District Shops Oruro	Potosí	Cochabamba	Sucre	Tarija
Lathe, Large	1	1	1	1	1	1
Lathe, Medium	2	1	1	1	1	1
Lathe, Small (Electrical Shop)	1					
Planer	1			1		
Power Saw	1	1		1		
Power Drills	1	1		1		1
Engine Block Honing Machine	1					
Crank Shaft Grinder	1					
Valve Grinder	1					
Test Bench for Diesel Injectors	1					
Test Unit for Generators				1		
Test Unit for Distributors	1			1		
Battery Charger	1	1	1	1	1	1
Spark Plug Cleaner	1	1	1	1	1	1
Electric Welders	3	3	2	2	2	2
Gas Burning Equipment	3	2	1	1	1	1
Blacksmith Shop	1	1	1	1	1	1
Carpenter Shop	1					
Paint Shop	1					
Air Compressor	1	1	1	1	1	1
Lubrication Rack	1	1	1	1	1	
Wash Rack	1		1	1	1	1
Press for Mounting Crawler Treads	1					
Hydraulic Press (50 T)	1	1	1	1	1	1
Body and Fender Repair Set	1					
Chain Hoists	3	1	1	1	1	1
Miscellaneous Tools for General Maintenance	x	x	x	x	x	x

Note: Additional equipment and tools purchased under AID Loan N° 26 is to be distributed to the several district shops. (See page 67).

ROAD MAINTENANCE EQUIPMENT OF THE NATIONAL ROADS SERVICE

Description	Manufacturer	Type	Model Year	Condition	Distribution: Headquarters	Main Shop	La Paz	Sucre	Tarija	Cochabamba	Oruro	Potosí	Totals
Heavy Equipment													
Tractors	International	TD-24	1955	Fair		3 1/	3		2	2		2	12
Tractors	International	TD-9	1957	Fair			2	3	2	2	1	1	11
Tractors	International	TD-9	1961	Good			1		2			2	5
Tractors	Caterpillar	D-7	1957	Fair							1		1
Tractors	Caterpillar	D-6	1957	Fair			1				1		2
Tractors	Caterpillar	D-4	1959	Fair			1	1	1		1	2	6
Tourmatractors	Le Tourneau		1956	Fair		2	1	1	1		1		6
Rubber Mtd. Tractor	Oliver			Good			2				2		4
Motorgraders	Huber-Warco	112	1957	Fair			5	3	4	2	4	3	21
Motorgraders	Huber-Warco	112	1958-59	Good			4	3	4	2	4	3	20
Motorgraders	Adams		1958	Good							2		2
Maintainers	Huber-Warco		1957	Fair			2	1	2	1	2	1	9
Rubber Mtd. Loaders	Case		1962	Good			1		1	1	1	1	5
Rubber Mtd. Loaders	Jaeger		1959	Good		3	1	2	1	1	1		9
Loaders (Crawler)	International	TD-9	1958	Fair			1		1	1	2	1	6
Loaders (Crawler)	Caterpillar	D-4	1959	Good			1	1	1	1		2	6
Cranes	Quick-way			Good			1						1
Light Equipment													
Carry-all	Chevrolet		1957-60	Fair	3		1	1	1		1		7
Carry-all	Chevrolet		1961	Good	2								2
Pick-up	Chevrolet and International	3/4T.	1957	Fair	1						1		2
Pick-up	Chevrolet and International	1/2T.	1957-59	Fair	2	2	7	5	3	3	4	3	29

(Continued on Next Page)

Description	Manufacturer	Type	Model Year	Condition	Head quarters	Main Shop	La Paz	Sucre	Tarija	Cocha-bamba	Oruro	Potosí	To-tals
Jeep-Pick-up	Willys	1/2 T.	1957	Fair			2	1	1	2	1	2	9
Station Wagons	Willys		1957	Fair						1			5 2/
Station Wagons	Willys		1958	Good				1	1		1	1	4
Power Wagons	International			Fair		1	1	1	2	1	1	1	8
Flat Bed Trucks	Chevrolet and International			Fair		8	2	3	4	2	3	3	25
Dump Trucks	Chevrolet	2 M3	1957	Fair			2						4 2/
Dump Trucks	International	2 M3	1958	Fair			10	10	12	7	9	9	57
Dump Trucks	International	2 M3	1959	Fair			9	8	11	7	7	9	51
Gas Tank Trucks	Chevrolet			Fair			1	1	2	1	2	2	9
Water Tank "	Chevrolet			Fair			1				1		2
Buses				Fair	1								1
Automobiles				Good	1								1
Other Equipment													
Compressors				Fair			3	4	5	2	5	3	22
Permanent Crushers				Fair			2						2
Mobile Crushers				Fair							1	1	2
Concrete Mixers				Fair			1	1	1	1	1	1	6
Water Pumps				Fair		4	2	3	3	1	1	1	15
Generating Sets				Fair	3	4	7	3	8	3	5	3	36
Others 3/				Fair		9	2				1		12

1/ For sale.

2/ Complete distribution not available.

3/ Includes scrapers and rollers.

Source: National Roads Service.

UNCLASSIFIED

PERSONNEL OF THE NATIONAL ROADS SERVICE

(February 1964)

District	Engineers	Administrative Personnel	Shop Personnel	Technicians	Road Maintenance Personnel	Others	Total
Headquarters and Main Shop	15	59	51	10	20	8	163
La Paz	9	12	5	6	101	13	146
Oruro	8	12	18	8	88	12	145
Potosí	8	10	11	4	72	14	119
Sucre	6	12	13	3	71	12	117
Cochabamba	5	11	12	4	40	13	85
Tarija	9	12	19	8	104	14	166
Totals	60	128	129	43	296	86	942

Source: National Roads Service.

SPECIAL TAXES CONTRIBUTING TO ROAD WORK FUNDS

The following special taxes contribute funds for road work:

Gasoline Tax: Supreme Decree No. 05958 of January 5, 1962, which modified previous legislation, specifies that 11% of revenues collected on gasoline sold in Bolivia is to be employed for the improvement and maintenance of national roads. The Bolivian State Oil Company reports that in the fourteen months from October 1961 through December 1962, approximately $b 8,940,000 (US$ 752,000) were collected from this tax. Of this, the bus operators in La Paz, Cochabamba and Oruro received approximately $b. 3,400,000 (US$ 285,000) or 38% as a subsidy to maintain lower bus fares in those cities. Approximately $b. 200,000 (US$ 16,800) was charged to control and collection of the tax, or about 2.3% of the total. Some $b. 5,340,000 ($456,200) was turned over to the National Roads Council, or 59.7% of the total. Another government source has stated that about 64% of the tax revenues went to the bus operators and 36% to the National Roads Council, of which approximately 22% in turn was given to the office of the Inspector General of Local Roads.

Prestación Vial: This is a road revenue contribution that taxes all able-bodied men and women between the ages of 21 and 60 at the rate of 10 pesos bolivianos ($b. 10) per year, or in lieu thereof requires three days of the man's labor on the roads. The collection of the tax and labor has not been successful to date for various reasons. Some irregularities in the collection of each have been suspected and it is impossible to "collect" much of the labor because of the remoteness and inaccessibility of the regions in which many people live. Further, the labor is inefficient because of the time involved to collect the workers and transport them to the site of the work and because the farmers are not trained for road work.

Tax on products grown in the Yungas (North of La Paz): Law No. 21 of October 21, 1960, established the distribution of revenues collected from this source, 20% of which is to be used for roads of the North and South Yungas.

Tax on crude oil production, Department of Santa Cruz: On November 16, 1962, it was decreed that 3% of the tax on crude oil production in the Department of Santa Cruz was to be used for development of roads and waterway communication between Santa Cruz and the Beni Department.

Coca Tax: Supreme Decree No. 05996 of February 9, 1962, established that 7% of the revenues from this tax be used for roads in the areas Chaparaxi - Cajuata - Irupana, and Suri-Arcopongo.

Tax on coca and tropical products grown in the Yungas of Chapare: Supreme Decree No. 06033 of March 16, 1962, decreed that the established 10% tax on coca and other products originating in the Cochabamba Yungas, deposited in certain accounts called "Aduanas Limbo - Colomi - Sacaba" and "Road Construction, Agrigonto - Puerto Aurora", were to be used exclusively for construction, improvement, and maintenance of the Cochabamba Yungas roads and those roads connecting with the Province of Chapare.

Tax on Coca and Tropical Products Grown in the Yungas of Arani and Carrasco: Supreme Decree No. 06098 of December 23, 1962, decreed that the established 10% tax on coca and other products collected at the Aduanas of Tiraque, Santa Rosa, Chujillas, and Totora was to be used exclusively for roads in the Arani Yungas; those collected at Pojo and Montepuncu, in the Carrasco Yungas.

Tax on Sale of Certain Lands: A law was enacted on January 5, 1961, which placed a 10% tax on the sale of all lands within 100 meters of the Cochabamba-Quillacollo and the Cochabamba-Sacaba roads. The revenues are designated to be applied to the cost of paving these roads.

Tax on Chicha consumed in La Paz: On December 31, 1960, a law was passed placing a $b. 1.00 tax on each bottle of chicha (a fermented beverage made from corn) sold in the city of La Paz, 11% of the revenue derived therefrom being designated for road works in the Department of La Paz.

Tolls on Roads Tolata - Cliza - Ucureña, and Paracaya - Punata - Arani: Supreme Decree No. 06114 of May 29, 1962, provided for tolls on these roads, the revenues therefrom to be used for paving the roads. Established tolls are:

Empty trucks, buses, and micro-buses	- $b.	1.00
Loaded trucks, buses, and micro-buses	- $b.	2.00
Other vehicles, empty or loaded	- $b.	1.00

Toll at Sucre Bridge: Supreme Resolution No. 114313 of May 24, 1962, established a $b. 5.00 toll per vehicle crossing the structure, to be used for its repair and maintenance. The bridge crosses the Pilcomayo River on the road between Potosi and Sucre. The National Roads Service reports that between November 5 and December 31, 1962, a total of 950 vehicles used the bridge, paying tolls of $b. 4,750 (approximately US$ 400).

Toll at Rio Grande Bridge: A law passed November 8, 1961, established tolls at this bridge, which is located on the road between Sucre and Epizana. The tolls are:

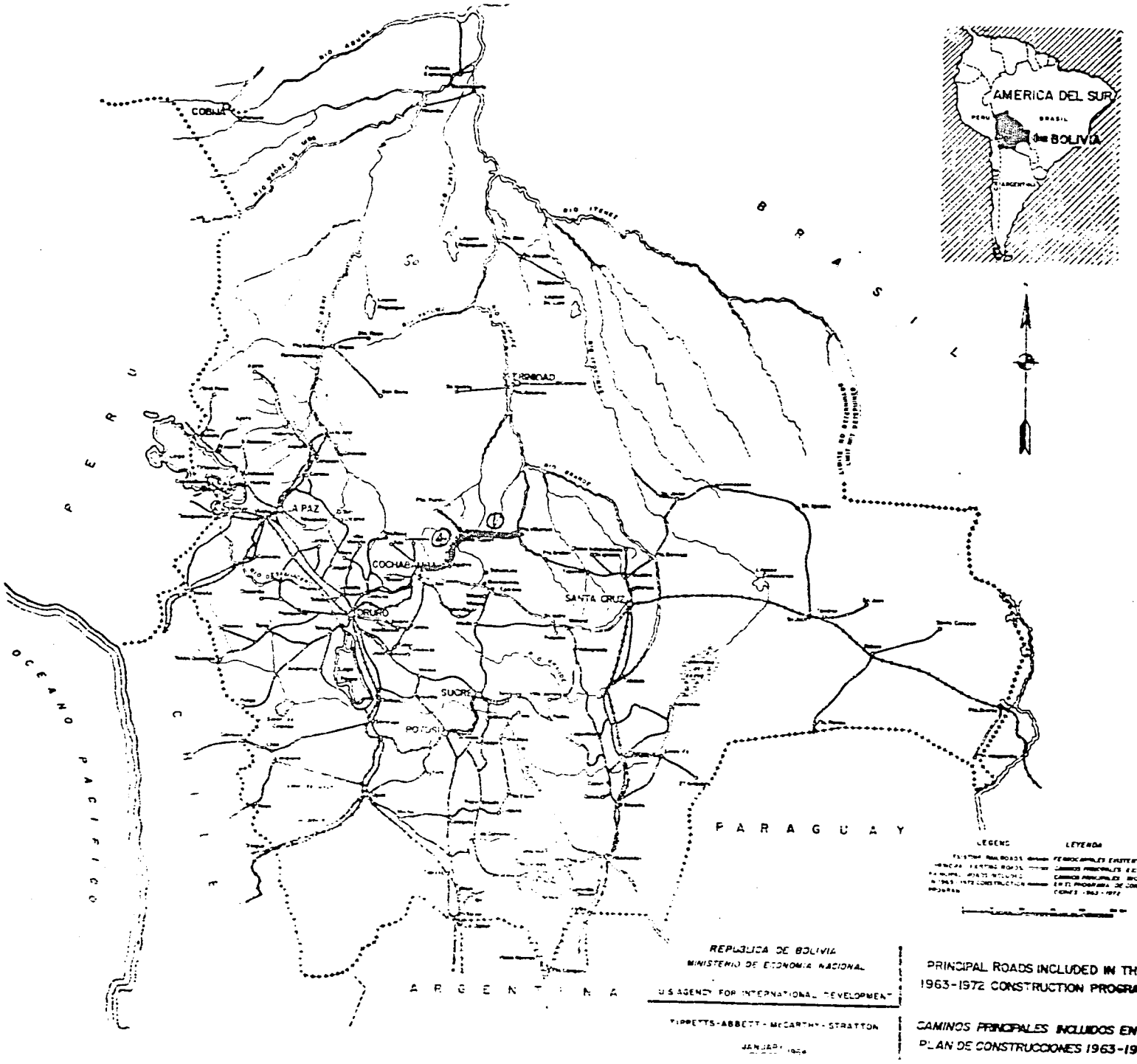
Trucks and buses	- $b. 12.00
Light vehicles	- $b. 8.00

Revenues from the tolls are designated to be used initially to defray the cost of the bridge and its approaches. After the bridge has been paid for, the revenues will be used to improve the Sucre-Epizana-Cochabamba road. The National Roads Services reports that 8,175 heavy vehicles and 1,201 light vehicles paid tolls for crossing this structure during 1962, producing an income of $b. 107,708 (approximately US$ 9,000).

Toll on Cochabamba-Quillacollo Road: Supreme Decree No. 05760 of April 5, 1961, established the following tolls on the subject road:

Buses and Carry-alls	- $b. 1.00
Trucks, automobiles, and others	- $b. 2.00

Revenues from these tolls are designated to be used first to defray the cost of paving the road, then to pay for its maintenance and for extension of the pavement to the Viloma River.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BOLIVIA
COBIJA
TRINIDAD
LA PAZ
COCHABAMBA
ORURO
SANTA CRUZ
SUCRE
POTOSI
PERU
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TIPPETTS-ABBETT-McCARTHY-STRATTON
JANUARY 1964
PRINCIPAL ROADS INCLUDED IN THE 1963-1972 CONSTRUCTION PROGRAM
CAMINOS PRINCIPALES INCLUIDOS EN EL PLAN DE CONSTRUCCIONES 1963-1972