



**Projections of Panama Canal  
Commodity Flows, Transits, and  
Tolls through 1985**

**Proyección del Canal de Panamá de  
Flujos de Carga, Tránsitos y Peajes  
hasta 1985**

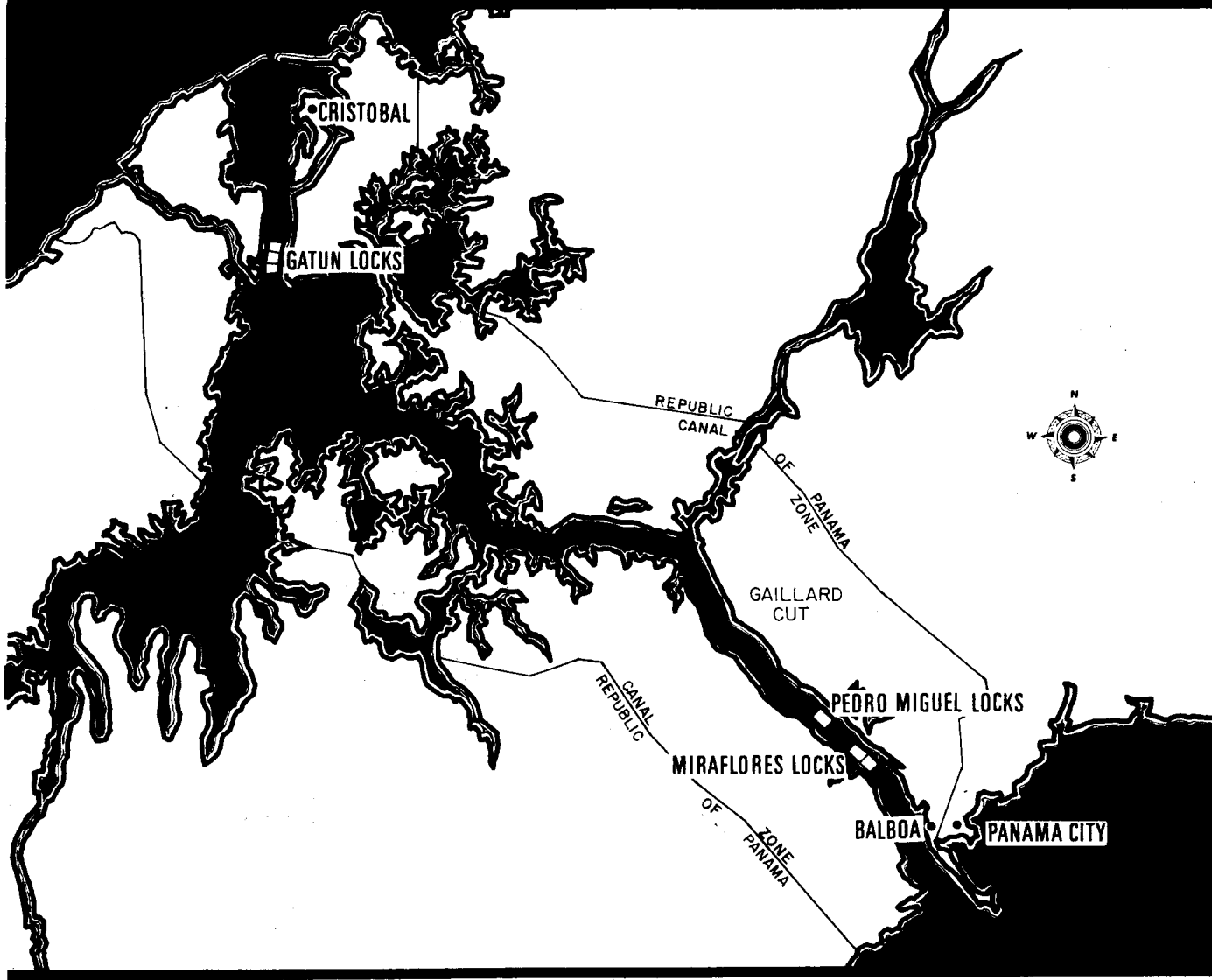
**Economics Research Associates**

**23 de junio de 1972**

**Introducción y Resumen**

# PROJECTIONS OF PANAMA CANAL COMMODITY FLOWS, TRANSITS, AND TOLLS THROUGH 1985

PREPARED FOR  
THE PANAMA CANAL COMPANY



 Economics Research Associates

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Section I  
INTRODUCTION

The Panama Canal Company is charged by the United States Government with the efficient and economic management of one of the world's most important arteries of commerce. This management covers the total operation of a complex system of waterways, locks, vessels, harbors, docks, and their concomitant maintenance and support facilities both in the Canal Zone and the United States. The entire process centers upon moving ships between the Atlantic and Pacific oceans in an orderly, expedient manner.

To ensure that the Canal is prepared to handle the volume of shipping needing its facilities at both entrances, long-term forecasts of traffic through the waterway are necessary. Occasionally, outside consultants have made such forecasts, but because of the dynamic nature of world trade, these have proved inadequate for truly effective long-range budgeting of expansion projects and funds. The Panama Canal Company, therefore, desired a forecasting system capable of immediate updating to reflect changes and to signal, at an early stage in those changes, the ultimate effects on Canal traffic.

Accordingly, the Company retained Economics Research Associates in 1969 to develop both a static long-range disaggregate forecast and a computer forecast system. The results of the static forecast were to be incorporated in the model in such a way that detailed traffic analyses and

modifications could be readily made. The research objectives of the study team were to forecast oceangoing commercial traffic through the Canal<sup>1/</sup> for fiscal years 1971 through 1975 and for 1980 and 1985. This information would include long tons of cargo by: (1) major commodity category,<sup>2/</sup> (2) major trade routes, and (3) type and size of ships for the milestone years. The computer system would then expand this basic data to generate total transits by commodity, vessel length, beam and draft, and tolls income under the present system and rates.

The first comparisons of the original ERA forecasts and Panama Canal traffic data were available in 1971. Actual results were fairly close to projections in many cases, and the Panama Canal Company authorized ERA to analyze the relationships of historical to forecast data and update the forecasts where necessary. The following report represents the results of these analyses for the years 1972 to 1985.

### RESEARCH SCOPE

The forecast analyses delineate the commodities that flow through the Canal, identify their geographical areas of origin and destination, and describe the ships in which they move. Those commodities carried in large volume are analyzed individually, while the remaining tonnage is projected on the basis of general trade patterns among various areas in the world.

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<sup>1/</sup> Does not include government and noncargo-carrying vessels.

<sup>2/</sup> Commodities (or related commodities) that move in large volume through the Canal.

As they effect traffic forecasts, the following factors were studied and analyzed to arrive at a forecast of transits through the Canal:

1. Current sources of commodities and their future stabilities.
2. Emerging sources of commodities and their opportunities in world commerce.
3. Present demand for commodities in specific countries as well as future demand, considering the economic growth.
4. Trends in types and sizes of ships.
5. Port and harbor developments.
6. Alternate shipping routes.
7. Alternative means of transportation.

All analyses of commodity traffic through the Canal assumed the present toll rates and measurement systems. Additionally, the analysis did not specifically consider the potential impact of any significant increase in trade between mainland China and the United States. This could be a significant factor by 1985 in certain commodities such as grain and coal, but due to current political uncertainties and the wide variation in estimates of projected impact, no specific projections were developed for this trade route.

#### RESEARCH METHODOLOGY

The project team analyzed all traffic data accumulated by the Canal Company over the past 20 years and in particular the years 1969 to 1971. Based on this analysis, team members were each assigned specific commodities for intensive study and evaluation. Those commodities for which 1971 results differed significantly from forecasts were the subject of special

attention, however, all commodities were reviewed. Team members then collected significant economic information as well as statistics on commodity production, movement, and use. Besides agencies of the United Nations and of the United States Government, international shipowner, commodity, and trade associations were personally contacted. In addition, important companies that produce, ship, and/or consume goods moving in world commerce were interviewed.

The study's emphasis was on acquiring quantitative data, both of a historical and forecast nature. Import-export trends and the factors which determine them were examined and discussed with experts. The possible diversion of commodity sources by economic or political means was analyzed, and future source development projected.

The results of the commodity tonnage forecasts and the discussion of the derivations appear in the following report. The attached computer report presents the forecasts in detail by commodity, trade route, and type and size of ship. Section II contains the summary and conclusions of the research study while Sections III through XX, present the individual commodity studies. The primary market research team consisted of Clive B. Jones, project leader, Jill Gold, and G. Christopher Davis. Administrative supervision was supplied by Harrison A. Price, President of Economics Research Associates, and John A. Greiner, Vice President of ERA. ERA acknowledges gratefully the great assistance rendered by Hugh Norris and other members of the Panama Canal Company. Thanks are also due the many persons in the business firms and government agencies who gave time and valuable information to the project team.

Section II  
SUMMARY

METHODOLOGY

As mentioned earlier, a disaggregate approach has been used in the projection of Canal traffic through 1985. This method was selected instead of a general one (such as historical trend or regression analysis) because of the Canal's need to review and update forecasts for specific commodities. The Canal's traffic derives largely from particular components of trade (commodities and trade routes), rather than from world trade in general or from trade among the major developed countries. The flow of traffic by commodity is strongly influenced by the condition of supply in the exporting countries and the change in demand arising in the importing countries. These circumstances cannot be accurately analyzed by the aggregate method. The disaggregate approach permits the inclusion of changes in technology, politics, and commerce peculiar to a specific trade route and commodity. Most important, it allows periodic review of projections using historical data to isolate changing developments and interrelationships in one or more specific areas of the forecast. Deviations from the forecast can then be classed as temporary or fundamental and projections revised accordingly.

As will be discussed in subsequent sections, many factors were identified and analyzed for each commodity and its major trade routes. An attempt was made to identify the major influences on traffic within each commodity category and to evaluate them to the maximum extent possible



within the time constraint. The chief problem in this type of approach is the probability of the emergence of important new commodities or new sources of existing commodities that cannot be identified at this time. In order to compensate for this contingency, tonnage projections for the commodity category of general cargo included an allowance for these unforeseeable events.

It was assumed for purposes of the forecast that the developed nations will continue to expand their economies in line with recent experience and that no major depressions will occur. It was also assumed that the underdeveloped countries will continue to progress toward their goals of increased output and higher living standards. In addition, the projections reflect a draft limitation of 39 feet for the Canal's waters.

Summarized below are ERA's projections of tonnages by major commodity group and the resulting transits and tolls, based on the expected frequency distributions of ship type and size, for these products and their trade routes. The accompanying computer reports, the Forecast System Input Report and the Forecast System Output Report, should be referred to for detailed results of ERA's study.

#### ANALYSIS OF ERA 1969 FORECAST

On an overall basis, ERA's projections for tonnage, transits and tolls in 1971 compared favorably to actual results. Summary Table 1 presents a summary comparison of actual to projected traffic along with the percentage difference for each category. As shown, total tonnage was low by about 2.4 percent, while total tolls and transits were within 1 percent. For Atlantic-

Summary Table 1

COMPARISONS OF ERA PROJECTIONS TO  
PANAMA CANAL 1971 TRAFFIC FIGURES

	<u>Actual</u>	<u>Projected</u>	<u>Percentage Difference</u>
<u>Total Traffic</u>			
Number of Transits	13,757	13,677	- 0.58
Long Tons of Cargo (thousands)	118,627	115,818	- 2.36
Tolls (thousands)	\$97,380	\$97,194	- 0.19
Panama Canal Net Tonnage (thousands)	111,006	111,344	+ 0.34
<u>Atlantic to Pacific</u>			
Laden Transits			
Number	6,238	5,953	- 4.6
Long Tons of Cargo (thousands)	74,170	74,106	- 0.1
Tolls (thousands)	\$48,460	\$47,454	- 2.1
Panama Canal Tonnage (thousands)	53,845	54,425	+ 1.1
Ballast Transits			
Number	823	873	+ 5.7
Tolls (thousands)	\$3,453	\$3,704	+ 7.3
Panama Canal Tonnage (thousands)	4,795	5,146	+ 7.3
<u>Pacific to Atlantic</u>			
Laden Transits			
Number	5,579	5,605	+ 0.5
Long Tons of Cargo (thousands)	44,097	41,712	- 5.4
Tolls (thousands)	\$37,908	\$36,122	- 4.7
Panama Canal Tonnage (thousands)	42,121	40,189	- 4.6
Ballast Transits			
Number	1,117	1,266	+13.4
Tolls (thousands)	\$6,749	\$8,339	+23.6
Panama Canal Tonnage (thousands)	9,373	11,584	+23.6

Source: Economics Research Associates.

to-Pacific traffic, the tonnage forecast was within 0.1 percent while the number of laden transits was 4.6 percent low. Ballast transits were overestimated by 5.7 percent.

For Pacific-to-Atlantic traffic, the tonnage was underestimated by 5.4 percent, but laden transits were within 0.5 percent. Ballast transits again were overstated at 13.4 percent.

In general, the results show that tonnage projections were relatively accurate, but some adjustments are necessary to more precisely relate tonnage to transits, tolls and PCC tons, and ballast returns. The revised forecast has adjustments intended to more accurately reflect these relationships.

Finally, the projected distribution of Canal cargo by ship type was comparable to actual data as shown below:

<u>Type of Ship</u>	<u>Percentage of Total Canal Cargo</u>	
	<u>1971</u>	<u>1971</u>
	<u>Actual</u>	<u>Projected</u>
General Cargo	33.0%	30.8%
Reefer	2.8	1.8
Container	1.2	1.7
Passenger	0.4	0.6
Tanker	15.1	16.3
Dry Bulk Carrier	44.6	43.5
Combination Carrier	2.5	4.2
Other	0.7	1.1

PROJECTIONS OF COMMODITY TONNAGE  
TRAVERSING THE PANAMA CANAL

The Panama Canal is expected to experience significant growth in traffic from its 1971<sup>1/</sup> total of 118.6 million long tons. In 1972, 111.0 million long tons of cargo are projected to pass through the Canal, increasing to 128.7 million long tons by 1975 and reaching over 174 million long tons by 1985. Summary Table 2 presents the tonnage estimated to transit the Canal for each major commodity or group of commodities by trade route direction for the years 1972, 1975, 1980, and 1985. As can be seen, the increase in total Canal traffic is attributable to most of the commodity categories, the exceptions being coal, bauxite-alumina, and scrap metal. Petroleum, petroleum products, manufactures of iron and steel, coarse grains, and the general-cargo commodity category<sup>2/</sup> are projected to experience the largest absolute increases.

Increases in crude petroleum are a result of the oil discoveries on the Alaskan North Slope and in South America. ERA projects that about 3.0 million long tons of North Slope crude will transit annually during the 1978 to 1985 period. Shipments of South American oil to ports on the Gulf and East Coasts of the United States are expected to total 10.0 million long tons by 1975 and 11.0 million by 1985.

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<sup>1/</sup> Any reference to a year refers to the Canal's fiscal year, July 1 to June 30.

<sup>2/</sup> Includes all commodities not isolated for special study.

Summary Table 2

PROJECTED CANAL TRAFFIC BY YEAR, COMMODITY, AND ROUTE DIRECTION  
(Thousands of Long Tons)

Commodity Description	Fiscal Year 1972 <sup>1/</sup>			Fiscal Year 1975			Fiscal Year 1980			Fiscal Year 1985		
	Atlantic to Pacific	Pacific to Atlantic	Total	Atlantic to Pacific	Pacific to Atlantic	Total	Atlantic to Pacific	Pacific to Atlantic	Total	Atlantic to Pacific	Pacific to Atlantic	Total
Wheat	1,882	306	2,188	1,808	375	2,183	1,862	375	2,237	1,943	375	2,318
Coarse Grains	5,610	991	6,601	8,490	1,090	9,580	9,935	1,140	11,075	11,420	1,170	12,590
Bananas	12	1,107	1,119	25	1,190	1,215	30	1,340	1,370	35	1,500	1,535
Sugar	2,463	3,439	5,902	1,900	3,800	5,700	2,100	4,100	6,200	2,550	4,500	7,050
Soybeans	3,704	37	3,741	3,620	70	3,690	4,040	100	4,140	4,560	100	4,660
Lumber	105	5,286	5,391	100	5,900	6,000	100	6,525	6,625	100	7,300	7,400
Pulp, Paper, and Paper Products	1,078	2,041	3,119	1,210	2,675	3,885	1,425	3,355	4,780	1,580	4,050	5,630
Phosphates	4,526	8	4,534	4,656	25	4,681	4,880	25	4,905	4,496	25	4,521
Potash, Fish Meal, and Fertilizers	1,571	2,503	4,074	1,630	2,900	4,530	1,855	2,850	4,705	1,885	2,950	4,835
Iron Ore	587	2,041	2,628	650	2,488	3,138	750	2,535	3,385	800	2,535	3,435
Miscellaneous Ores	665	1,999	2,664	1,020	2,100	3,120	1,410	2,440	3,850	1,560	2,940	4,500
Scrap Metal	1,700	20	1,720	2,100	25	2,125	1,150	25	1,175	600	25	625
Alumina and Bauxite	1,500	850	2,350	1,020	600	1,620	750	20	770	700	20	720
Miscellaneous Metals	595	1,539	2,134	680	1,525	2,205	780	1,690	2,470	860	1,800	2,660
Coal	15,000	382	15,382	11,055	400	11,455	11,136	425	11,561	11,800	450	12,250
Crude Petroleum	4,300	1,975	6,275	2,700	12,700	15,400	2,100	15,000	17,100	2,100	16,500	18,600
Petroleum Products	8,600	1,800	10,400	9,900	2,700	12,600	11,400	3,000	14,400	12,900	3,500	16,400
Chemicals	1,738	818	2,556	2,025	1,200	3,225	3,095	2,080	5,175	7,620	4,750	12,370
Iron and Steel Manufactures	1,870	7,148	9,018	1,900	7,700	9,600	1,900	8,500	10,400	1,900	9,500	11,400
Autos and Trucks	670	694	1,364	705	1,076	1,781	770	1,340	2,110	805	1,468	2,273
General Cargo	6,902	10,847	17,749	8,600	12,400	21,000	12,000	16,200	28,200	16,200	22,300	38,500
Total	65,078	45,831	110,909	65,794	62,939	128,733	73,468	73,065	146,533	86,414	87,758	174,172

<sup>1/</sup> Computer output adjusted to reflect estimated impact of U.S. dock strikes in FY 1972.

Source: Economics Research Associates.

Shipments of manufactures of iron and steel are projected to grow from 9.0 million long tons in 1972 to 11.4 million in 1985, primarily because of Japan's exports to the United States and Europe. Japanese imports are also responsible for the large projected increase in coarse grains traffic. Rapid growth in corn and sorghum imports is expected to last through 1985 as they continue their shift to meat consumption.

Substantial increases in the general-cargo commodity category, from 17.7 million long tons in 1972, to 38.5 million long tons by 1985, are estimated. Significant growth has been forecast for most of the major trade routes; traffic on the United States-Asia trade route in particular is projected to rise 6 to 8 percent annually until 1985. Also included in this category are the unknown factors--new sources and new commodities--which have been estimated to equal approximately 11 million long tons together by 1985.

The traffic in coal from Hampton Roads, United States, to Japan is projected to decrease sharply from its 1972 level of 15.0 million long tons to 11.1 million long tons by 1975. About 50 percent of the coal sent to Japan will probably bypass the Canal by 1975 and 60 percent by 1985 as the large oil-bulk-ore (O. B. O.) ships of 100,000 DWT (dead weight tonnage) and more travel around the Cape of Good Hope to Japan. Less important are the projected decreases in scrap metal shipments to Japan from 1.7 million long tons to 600,000 long tons by 1985 and in bauxite-alumina shipments from 2.4 million long tons in 1972 to almost 700,000 long tons in 1985.

As shown in Summary Table 2, ERA projects the growth in Canal traffic to occur primarily in the northbound direction (Pacific to Atlantic) while the southbound trade remains relatively constant until 1980. The currently uneven balance of trade, therefore, is expected to go from a 7:4 ratio in favor of the southbound traffic to an essentially balanced condition by 1985. Practically all commodity groups are projected to experience traffic growth in the northbound direction while the southbound trade increases are substantially offset by the decline in coal tonnage.

The Canal traffic is projected to increase moderately during the period from 1972 to 1975, primarily due to exports of South American crude oil, as shown below:

	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>
Total Canal Tonnage (thousands of long tons)	110,909	122,853	127,692	128,733

As mentioned earlier, the coal bypass will probably cause a drastic decline in Atlantic-Pacific Canal traffic but this is offset by projected crude petroleum transiting the Canal in the Pacific-to-Atlantic direction.

Considerable coal and iron ore traffic will probably bypass the Canal because of its inability to handle the large O. B. O. ships carrying these commodities. Total bypass volume is estimated to be 16.4 million long tons in 1972, 26.7 million in 1975, and 33.6 million in 1985. Figure 1 presents the projected Canal traffic through 1985 and the total potential long tons if the Canal were not limited as to ship size.

MILLIONS  
OF TONS

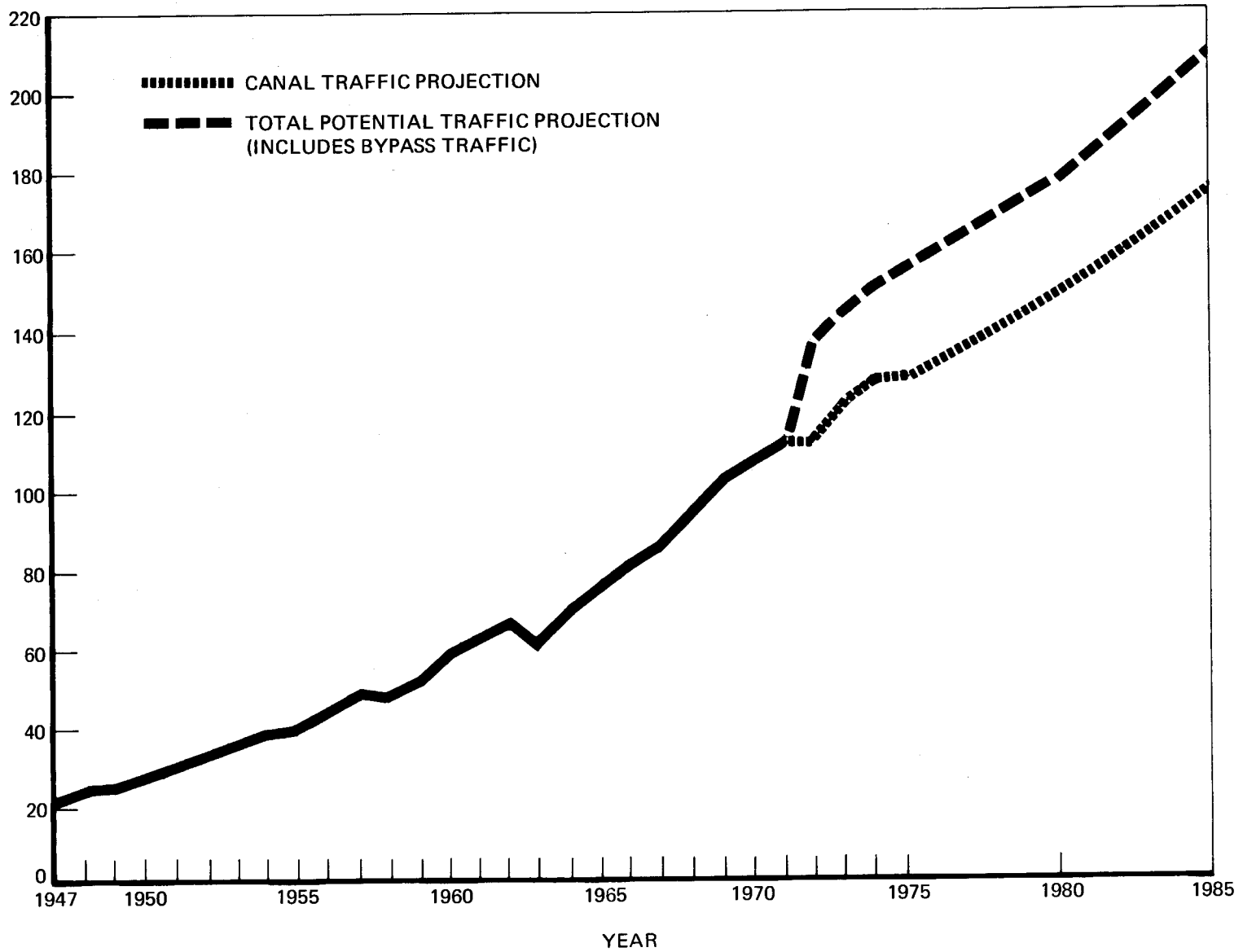


Figure 1

PROJECTED PANAMA CANAL COMMERCIAL  
AND BYPASS TRAFFIC, LONG TONS OF CARGO



## TRANSITS

The projections of Canal transits have been derived from the commodity tonnage projections and through an analysis of the types and sizes of ships that can be expected to carry the various commodities. Another element in these forecasts is the extent to which the available cargo capacity of the transiting ships will actually be used (load factor). In addition, the number of ballast transits associated with the movement of a commodity was estimated. The estimates of type and size of ships, of the load factor, and of the ballast factor are shown in detail for each trade route in the System Input Report. The results of those estimates and summary conclusions are presented below. The System Output Report should be consulted for detail transit results.

Total Canal commercial transits are projected to increase from about 13,722 in 1972 to 15,235 in 1980 and 17,443 in 1985. Summary Table 3 presents the number of laden and ballast transits for selected years in the period 1972 to 1985. Ballast transits are expected to increase to about 2,000 per year by 1980 and to increase only modestly through 1985. The proportion of ballast transits is expected to decline from 14.0 percent in 1971 to 13.0 percent by 1985.

Figure 2 presents the projected number of transits through the Canal from 1972 to 1985.

## TOLLS

Basing its analysis on the type, size, and number of ships passing through the Canal and the number of laden and ballast transits related to

Summary Table 3

SUMMARY OF CANAL TRANSIT PROJECTIONS  
1972-1985

<u>Year</u>	<u>Atlantic to Pacific</u>			<u>Pacific to Atlantic</u>			<u>Total Transits</u>		
	<u>Laden</u>	<u>Ballast</u>	<u>Total</u>	<u>Laden</u>	<u>Ballast</u>	<u>Total</u>	<u>Laden</u>	<u>Ballast</u>	<u>Total</u>
1972	5,928	730	6,658	6,081	983	7,064	12,009	1,713	13,722
1973	5,823	848	6,671	6,323	954	7,277	12,146	1,802	13,948
1974	5,757	960	6,685	6,533	930	7,463	12,258	1,890	14,148
1975	5,613	962	6,565	6,638	900	7,538	12,251	1,862	14,113
1980	6,017	1,007	7,024	7,233	978	8,211	13,250	1,985	15,235
1985	6,848	1,164	8,012	8,316	1,115	9,431	15,164	2,279	17,443

Source: Economics Research Associates.

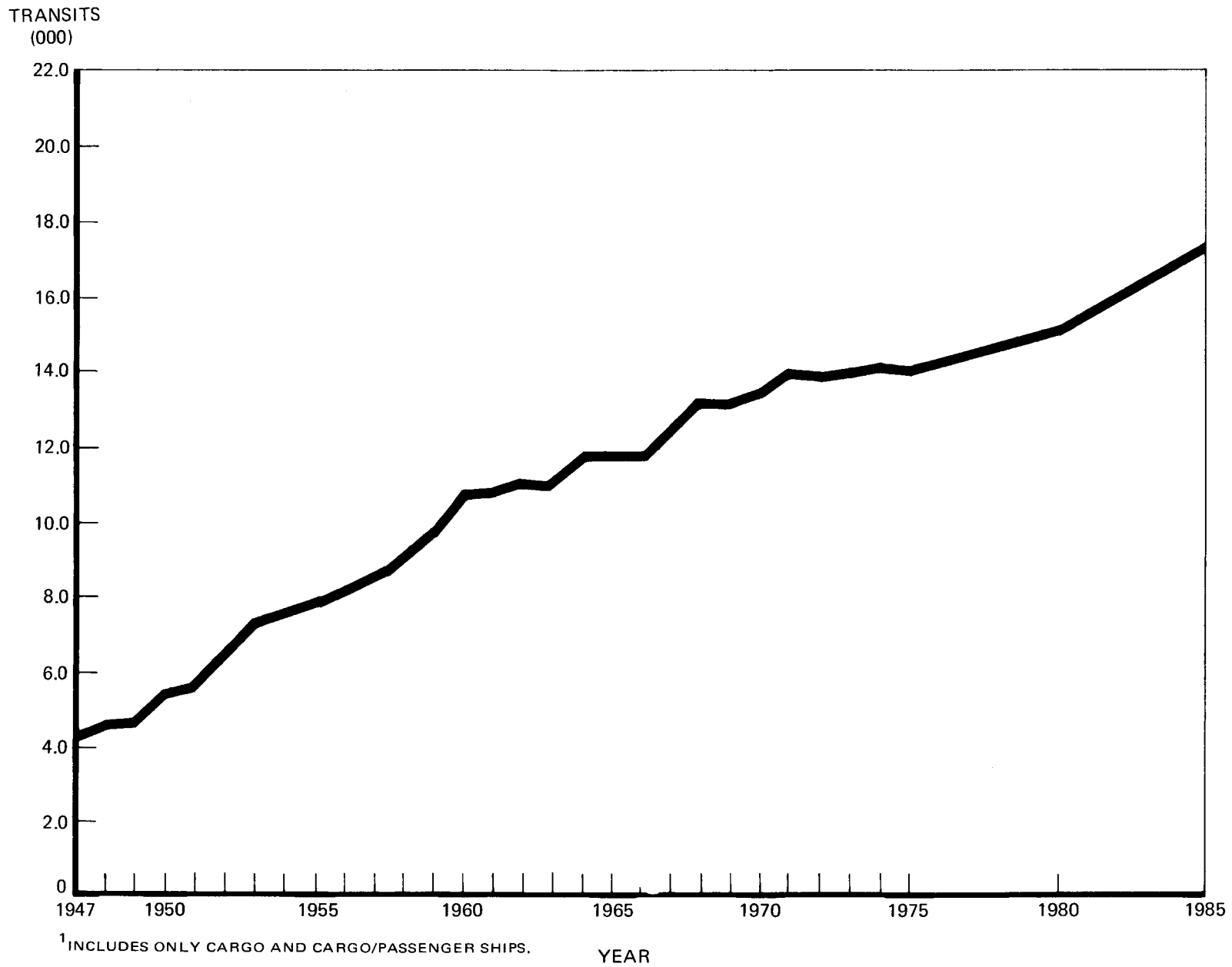


Figure 2

PROJECTED PANAMA CANAL COMMERCIAL TRANSITS<sup>1</sup>

each, ERA has derived the expected toll revenue for the Canal from 1972 through 1985.<sup>1/</sup> Summary Table 4 presents the estimated Canal revenue from tolls for selected years from 1972 to 1985 and the toll revenue that will be lost from bypass transits. Tolls are estimated to increase from \$99.4 million in 1972 to 154.9 million in 1985. Revenue lost from bypass transits is forecast to grow from almost \$7.4 million in 1971 to about \$15.3 million in 1985.

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<sup>1/</sup> Tolls are calculated at a rate of \$0.90 per laden Panama Canal ton and \$0.72 per ballast Panama Canal ton.

Summary Table 4  
 PROJECTED TOLL REVENUES  
 1972-1985  
 (Thousands)

<u>Year</u>	<u>Canal Revenue</u>	<u>Lost Bypass Revenue</u>
1972	\$ 99,428	\$ 7,446
1973	104,750	9,096
1974	110,619	10,674
1975	113,246	12,181
1980	129,769	13,563
1985	154,895	15,345

Source: Economics Research Associates.