A SURVEY OF THE ECONOMIC AND ENVIRONMENTAL ASPECTS OF AN ONSHORE DEEPWATER PORT AT GALVESTON, TEXAS

PART I
POTENTIAL ECONOMIC EFFECTS

by

Daniel M. Bragg
Industrial Economics Research Division

Texas Engineering Experiment Station
Texas A&M University
College Station, Texas

April 1974

TAMU-SG-74-213

FOREWORD

This report, "A Survey of the Economic and Environmental Aspects of an Onshore Deepwater Port at Galveston, Texas" is the result of a brief, organized effort aimed at assessing the nature and magnitude of the two principal factors expected to play significant roles in decisions made concerning onshore deepwater port facilities. It is hoped that a survey of this type, while not providing many definitive answers--since it involved no original field studies, will nevertheless help to clarify some areas of speculation, and thereby bring the study sponsors closer to a decision point in these key areas.

Part I of the study considers the economic aspects of the project, and was prepared by Daniel M. Bragg of the Industrial Economics Research Division. Part II discusses some of the environmental implications of the project, and was co-authored by Roy W. Hann, Jr., and Wesley P. James of the Environmental Engineering Division.

The discussion and conclusions of this report are based upon extensive literature reviews, and interviews with knowledgeable persons in several pertinent areas of expertise. The authors are grateful to these many individuals, too numerous to mention, who provided information and suggestions which helped shape the final report.

This project was partially supported by an institutional grant 04-3-158-18 made to Texas A&M University through the National Sea Grant Program, National Oceanic and Atmospheric Administration, U. S. Department of Commerce, and by a grant from the Galveston Wharves Board of the City of Galveston, Texas.

Roy W. Hann, Jr., Head
Environmental Engineering Division
Texas A&M University

Perry J Shepard, Head
Industrial Economics Research Division
Texas A&M University

April, 1974

PART I

POTENTIAL ECONOMIC EFFECTS

TABLE OF CONTENTS

PART I

POTENTIAL ECONOMIC EFFECTS

LIST OF TABLES

PART I

POTENTIAL ECONOMIC EFFECTS

LIST OF FIGURES

SUMMARY

SUMMARY

Much has been said concerning the pro and con features of offshore and onshore terminals. One of the primary advantages attributed to the offshore monobuoy terminal, compared to a dredged onshore terminal, is one of cost.

The cost of an offshore terminal, including supporting and transportation facilities, both onshore and offshore, is estimated to range from $500-750 million. Of this total cost, the offshore portion ranges from $183-507 million (2). For an onshore terminal, the total cost is estimated to be $440 million for the dredged channel and turning basin. Annual maintenance cost of the dredged works is estimated to be $6 million (7).

The difference in first costs for the two types of projects can be attributed mostly to the difference in offshore costs, since similar onshore support and transportation facilities will be required in both cases. Thus, the first cost difference can range from a $67 million advantage to a $257 million penalty for the onshore terminal. This, however, is not the whole story.

An important measure of the cost of any deepwater facility is the unit cost per hour of "uptime" (as opposed to downtime), or availability of the facility for loading or unloading cargo. The most significant limitation to utilization of an offshore monobuoy is the inability to operate a small boat for hooking up mooring lines and hoses; this occurs at fairly low levels of wave height. In the Western Gulf, such a limitation could reduce monobuoy utilization by

as much as 25 percent during the winter months, and by some smaller percentage over a period of a year.

In contrast, an onshore facility will experience an extremely low percentage of downtime, with fog or other low-visibility conditions constituting the primary cause. Foggy conditions can also restrict use of the offshore terminal, thereby increasing offshore downtime.

Besides average annual utilization, other cost factors can work in favor of the dredged-channel, onshore terminal. The $440 million dredging cost, estimated in the Galveston Wharves report (7), has a good potential to be reduced. A dredging project of the magnitude of the proposed onshore port has never been attempted, and there is strong evidence that a cost breakthrough could occur in this project.

In consideration of these various points, then, it cannot be shown absolutely that an offshore terminal would have a cost advantage over a terminal located onshore. For this reason, cost in itself cannot be the sole determining factor in deciding the feasibility of the onshore deepwater terminal at Galveston.

A problem to be faced, in looking at the possibility of constructing a deepwater facility for dry bulk superfreighters, is in preparing accurate forecasts of cargo tonnage which can be used to help secure the necessary financing. Traditional forecast techniques, mainly straight-line extrapolation of historical trends, do not provide a clear enough insight into what is most likely to move, tonnagewise, in future dry bulk foreign trade. Published predictions of future world dry bulk trade vary greatly and, consequently, are not of much help to a planner. Thus, other indicators must be utilized.

Between now and the beginning of the 21st century, even though United States population may approach zero growth, reaching 266 million in 2000 (provided we do not exceed an average birth rate of 2.1 children per family unit), Gross National Product is expected to rise by a factor of 3, from a 1970 level of $807 billion to more than $2.4 trillion in 2000. To achieve such a level could require increases in consumption of non-energy resources, ranging from 1.6 times the 1970 consumption for cobalt and manganese to as much as 2.1 and 4.3 times 1970 levels for iron and aluminum, respectively. Consumption of energy in the year 2000 could increase threefold over that of 1970, or, from 68.8 to 206.4 quadrillion BTU (12).

If such consumption rates become a reality, this--coupled with declining indigenous reserves of many basic resources--could force the United States to import these resources in large quantities. Without efficient bulk transportation systems, including facilities for mammoth bulk ships, the country could be faced with a sheer inability to import sufficient quantities of these materials to meet demand. This could not only become an unbearable burden on the nation's economy, but it could also make our finished goods less competitive in world markets.

Additionally, study of the proposal for a Galveston deepwater terminal must consider the future growth of the Houston-Galveston megalopolis around Galveston Bay and the need for regional planning in port facilities, as well as in other transportation modes and social systems. To adequately and efficiently handle the transportation needs of this region, and the state, in 2000 and 2050, a port complex such as Europoort at Rotterdam should be considered as a planning goal. Not only are deep-draft facilities needed at Galveston and Texas City, but also certain new facilities may be needed east of Baytown and in southern Chambers County to complement existing facilities and those under construction in Houston, Galveston and Texas City.

Finally, in light of recent developments in shallow-draft vessels, consideration must be given to the development of alternative plans for the Galveston terminal, such as planning to build only Phase One--a 60-foot channel--at the present time, and treating the succeeding depth increments as future options, to be exercised on the basis of need.

The economic impact of an onshore deepwater terminal at Galveston will be somewhat greater, throughout the region, than will the impact from an offshore oil terminal.

In addition to the impact which could result from growth in oil refining, and supporting industry, the onshore port will have an impact of additional jobs and expenditures resulting from the operation of the port. Such things as tug hire, stevedoring, line handling and similar, port-related activities, will be of a greater magnitude than they would be at an offshore terminal.

The primary, secondary and tertiary impact, related to oil refinery growth and port operation, could <u>exceed</u> that of an offshore terminal by as much as:

1975	\$307.2 million
1980	\$612.5 million
1985	\$1,032.7 million

No attempt has been made in this study to estimate the economic impact which could result from the growth in new industry induced by the availability of deep-draft port facilities, for all types of cargos, at Galveston. This can, however, be significant and additional to the impact shown above.

INTRODUCTION

INTRODUCTION

With the advent in recent years of an entirely new generation of oceangoing bulk ships, which reach sizes far larger than the so-called supertankers and other bulk carriers of the early 1960's, ports in the United States have come full circle and are now behind the rest of the world in total facilities capabilities. Where, just a few short years ago, the U. S. could boast that its ports were capable of accommodating the largest ships in service, today other nations, notably Japan, have moved ahead in both port construction and shipbuilding, and we now find that the United States is a "have-not" nation in terms of port facilities for ships over a maximum size of 65,000 deadweight tons (DWT), fully loaded.

The shortfall in port facilities capable of handling these ultra-deep draft ships, coupled with a rapidly growing volume of imports and exports of bulk commodities, has resulted in a critical need for new port capabilities in this country. A number of solutions have been proposed for the problem. Some of them have involved offshore facilities--a departure from the usual practice, while some are onshore like traditional ports.

As a result of research to date, most of the major offshore proposals, such as manmade islands, platforms, breakwaters and lightering have been all but eliminated in favor of the monobuoy, or single point mooring, because of problems of cost, along with uncertainty as to long-range utilization and payout. But the monobuoy, though low in cost and relatively safe ecologically speaking, has several possibly critical limitations. For example, it is basically designed to handle only those commodities which are in liquid form and, in terms of productive utilization, it is sensitive to adverse weather. The operation of tying up a tanker, and connecting the cargo transfer hoses, cannot be carried on with wave heights over approximately six feet if a line boat is used. Utilizing certain other techniques, some still under development, a vessel can be moored and prepared for unloading up to wave heights of as much as 12 feet, but the risk of accidents and oil spills increases substantially in the upper wave height ranges.

If line boats are used, that is, when wave heights are six feet or less, a monobuoy located off Freeport-Galveston would be able to operate only 75-78 percent of the time on a year-round basis, as shown by analysis of figures in Table 1. Under the more extreme conditions, i.e., waves up to 12 feet, an offshore monobuoy in the same area would be operable up to 95 percent of the time on a year-round basis. Thus, there could be from 5 to 25 percent downtime experienced by a monobuoy terminal in the Freeport-Galveston region.

An onshore deep draft facility, on the other hand, offers flexibility as to types of commodities that can be handled across it and, from the availability standpoint, its utilization is reduced only by exceptionally dense fog, or other low-visibility conditions, which occur with varying frequency in different locations and seasons, and which make navigation hazardous. Its availability is not influenced to any significant degree by winds or waves.

TABLE 1

PERCENT FREQUENCY OF WAVE HEIGHTS AND PERIOD
OFF GALVESTON, TEXAS

PERIOD (SECONDS)	HEIGHT (FEET) 1	1-2	3-4	5-6	7	8-9	10-11	12-16
6	1.7	19.0	25.9	9.0	2.7	1.2	0.2	0.2
6-7	0	2.0	5.7	10.5	4.6	2.5	0	0.2
8-9	0	0.8	0.5	1.6	2.0	0.6	0.6	0.5
10-11	0	0.6	0.3	0	0.6	0.3	0.2	0
12-13	0	0	0.2	0	0	0	0	0
13	0	0	0.3	0.2	0	0	0	0
TOTAL FREQUENCY OF WAVE HEIGHTS	1.7	22.4	32.9	21.3	9.9	4.7	1.0	0.9

SOURCE: Summary of Synoptic Meteorological Observations, North American Coastal Marine Areas, Vol. 6.

Other reasons for seriously considering onshore, deep-draft facilities are many and include the following:

- Projected growth in oil importation and refining levels, coupled with the many problems inherent in the building of pipelines give rise to expectations that there will be sizeable increases in the seaborne movement of petroleum products between processing and consuming regions, such as from the Gulf Coast to the eastern seaboard.

- Growing depletion of domestic reserves of various minerals, such as iron ore, greatly increases the probability of massive imports of these commodities in future years.

- Changes in American foreign trade policies will cause greater emphasis to be placed on the worldwide marketing of agricultural products.

- An onshore terminal can be expanded to include additional berths less expensively than would be the cost to install more monobuoys and pipelines at an offshore terminal.

Since the economies of scale tend to favor the use of giant vessels for bulk movements such as these, it appears that deepwater facilities for dry bulk commodities and petroleum products will become more useful. Present technology and practices do not favor the handling of such cargos at an offshore monobuoy; therefore, onshore facilities could become a necessity to support growth in the Houston-Galveston area.

In planning for development of an onshore deepwater port at Galveston, it is imperative to establish quite early the general economic feasibility of the project. Also, any possible or probable environmental impacts which might occur as a result of construction and operation of such a port must be defined in order to ensure their minimization or avoidance.

Earlier studies have evaluated the probable economic and environmental implications of deepwater ports to be located offshore; however, it has not been ascertained with any degree of confidence that the impacts from a deepwater onshore port will be the same as, or similar to, those resulting from the offshore facility. Therefore, it would be imprudent, at the least, to attempt to apply the findings of the earlier studies across the board to the case of an onshore port without further study.

The purpose of this study is threefold, that is, it attempts to:

1. Evaluate the results of earlier studies, which forecasted the regional economic impact of offshore ports, to determine if these results are applicable to an onshore deepwater port such as that proposed for Galveston.

2. Define the parameters of the most probable environmental impacts expected to result from construction and operation of the proposed port.

3. Prepare recommendations and a work plan covering the in-depth studies which should be undertaken before construction of the proposed port is started.

POTENTIAL ECONOMIC EFFECTS

TAMU

POTENTIAL ECONOMIC EFFECTS

GENERAL CONSIDERATIONS

To the same degree as with an offshore port, proposals for the construction of onshore deepwater terminals must undergo close scrutiny and must be subject to the strictest standards of justification. This applies not only to establishing project feasibility from the standpoint of investment and payout--although these, of course, are critical factors which will be exhaustively studied by varied financial interests before any construction money is spent. Rather, and more importantly, extensive evaluation of the possible socioeconomic and environmental changes likely to result from construction and operation of such a terminal must be undertaken to ensure that the potential impact of these changes be fully considered in any decisions affecting the terminal project.

The potential for socioeconomic perturbations in the region most likely to be influenced by an onshore deepwater terminal at Galveston will be examined in the following section. A later part of this report will consider the possible environmental impacts of such a facility and will define the most likely problem areas needing detailed study.

BACKGROUND

A considerable amount of material has been written about deepwater terminals and their possible impact upon the economy of different regions of the United States. In particular, the United

States Maritime Administration (16) and Texas A&M University (2) have documented their assessments of what such a project might do--for the whole United States, in the former case, and for the State of Texas in the latter. Both of these studies generally concluded that liquid commodities (principally crude oil) would be the only cargos moving in large enough volumes to justify these special purpose terminals, and that the optimum locations for such deepwater terminals would be offshore.

Recently, the Bureau of Business Research at the University of Texas at Austin (13) published the findings of their study about the economic impact of the onshore Port of Corpus Christi, Texas, including a proposed 72-foot deep channel and terminal for very large crude carriers. This study differs from previous deepwater port studies in that it considers the deepwater terminal project as an integral growth component of the existing port, and does not address the potential impact of the deepwater facilities separately. However, since a so-called "superport" represents a radical departure from traditional port development practices, an impact evaluation which lumps the effects of conventional port growth in with the impacts expected from deepwater terminal development does not provide a clear enough delineation of the effects peculiar to the deep channel and terminal sufficient to permit informed decision-making. To ensure that adequate consideration is given to the impacts of the deep channel project, the tentative conclusions, as well as the recommendations for future studies contained in this report, have been determined under the assumption that the proposed onshore deep port at Galveston is a stand-alone project.

In further attempting to determine accurately the economic impact of the proposed Galveston project, a study of some interest is that done in 1970 by Dr. Warren Rose (11). In this analysis, a number of significant relationships were developed concerning the impact of the existing port on the City of Galveston. Some of these were the following:

1. Wages paid for port-related employment represented 61 percent of the total of such payments in the city in 1968;
2. About three-fifths of the workers in the city in 1968 were employed in port-related jobs; and,
3. In 1968, more than three out of every ten workers in the city were directly employed by the port or some other water transportation activity.

In reviewing this earlier work, it becomes obvious that an essential element of any in-depth study done for the purpose of estimating the economic impact of the Galveston onshore deepwater terminal on the Galveston-Houston region will be an updating of the economic relationships identified by Dr. Rose and extrapolation of these to the entire region. The study reported herein has not attempted to examine these regional relationships in as much detail as did Dr. Rose. Instead, attention has been focused on identifying which of the relationships might be affected by a deepwater terminal and how these might be impacted differently in the case of an onshore terminal as compared to an offshore facility.

STUDY ASSUMPTIONS

It can be said, without much doubt, that the proposed onshore deepwater terminal at Galveston will have a significant impact upon the region's economy. At the same time, it is obvious that construction and operation of the port will not produce a "boom-bust" imbalance in the economic and social conditions of the region, either. The primary basis for this conclusion is the fact that the port's impact will occur against a background of existing growth in the local economy. Therefore, the greatest effect the port is likely to have is to cause the economy to achieve certain levels of activity sooner than might occur without the project. The impact will mainly be a rapid, short-term effect (transient impact), followed by a relatively static period during which utilization of the port begins to build (long-term impact). Figures 1 and 2 are examples of how the port could change economic levels and growth rates in the Galveston region.

In making an estimate of the economic impact of the Galveston deepwater terminal, it is necessary that a normal or "unperturbed" state of the economy be projected as a base case for comparison purposes. Although this "unperturbed" economy is one without the onshore port, it is by no means an economy that lacks upgraded and expanded port facilities. Port development in the Galveston Bay region has been, and will continue to be, a significant contributor to regional economic activity. According to the United States Maritime Administration (18), ports in this region have spent over $35 million on new or upgraded facilities since 1966. This expenditure represents 19.3 percent of the total spent by all Gulf ports during the same period, and it is 3.5 percent of the amount spent by all ports in North America since 1966.

In Figure 1, the growth of an unperturbed economy is represented by the lower solid line, while the impact or "perturbation" to the economy is shown by the crosshatched areas. In order to predict the magnitude of impact by using economic multipliers, such as those

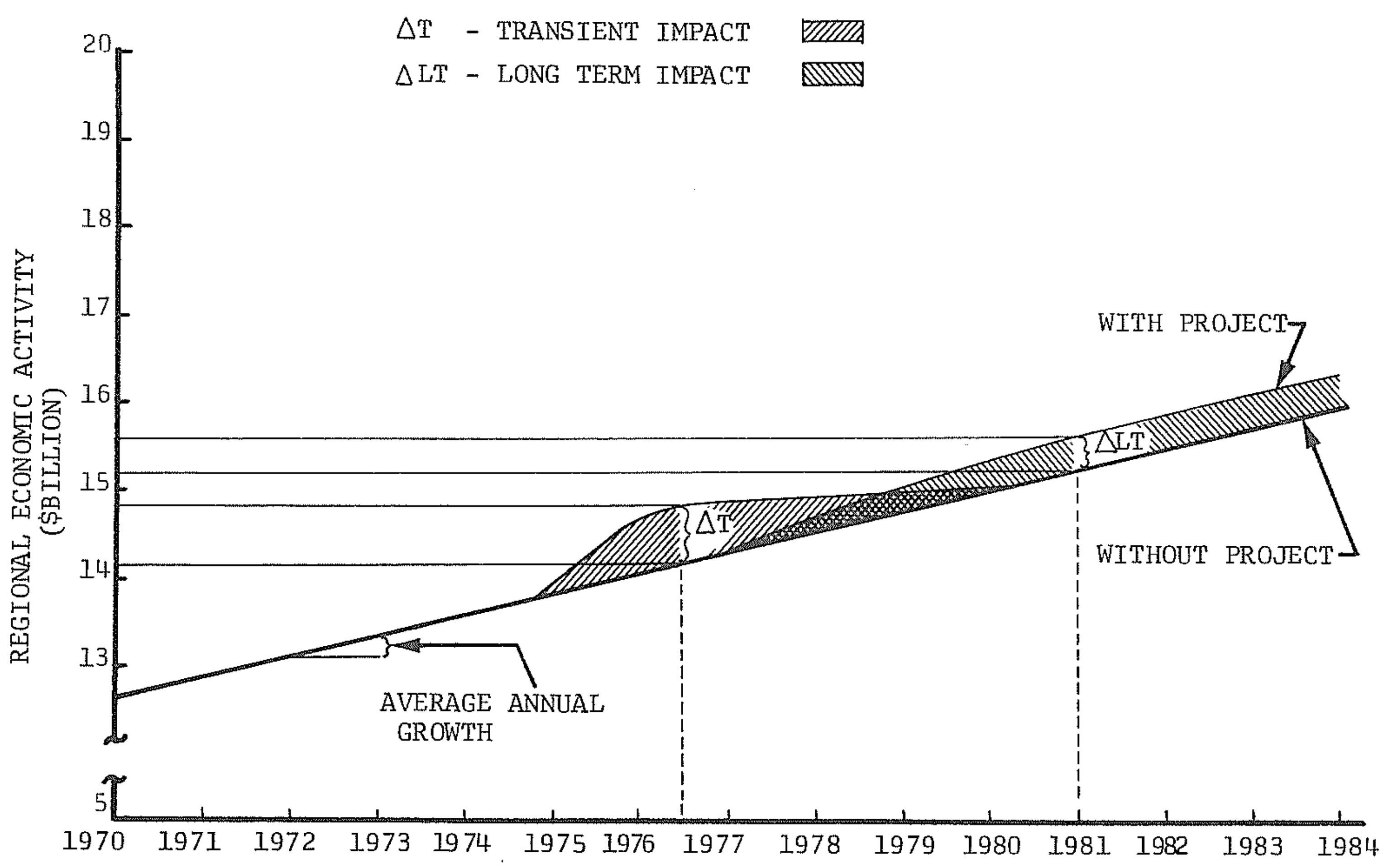

FIGURE 1

REGIONAL ECONOMIC IMPACT OF A MAJOR PROJECT

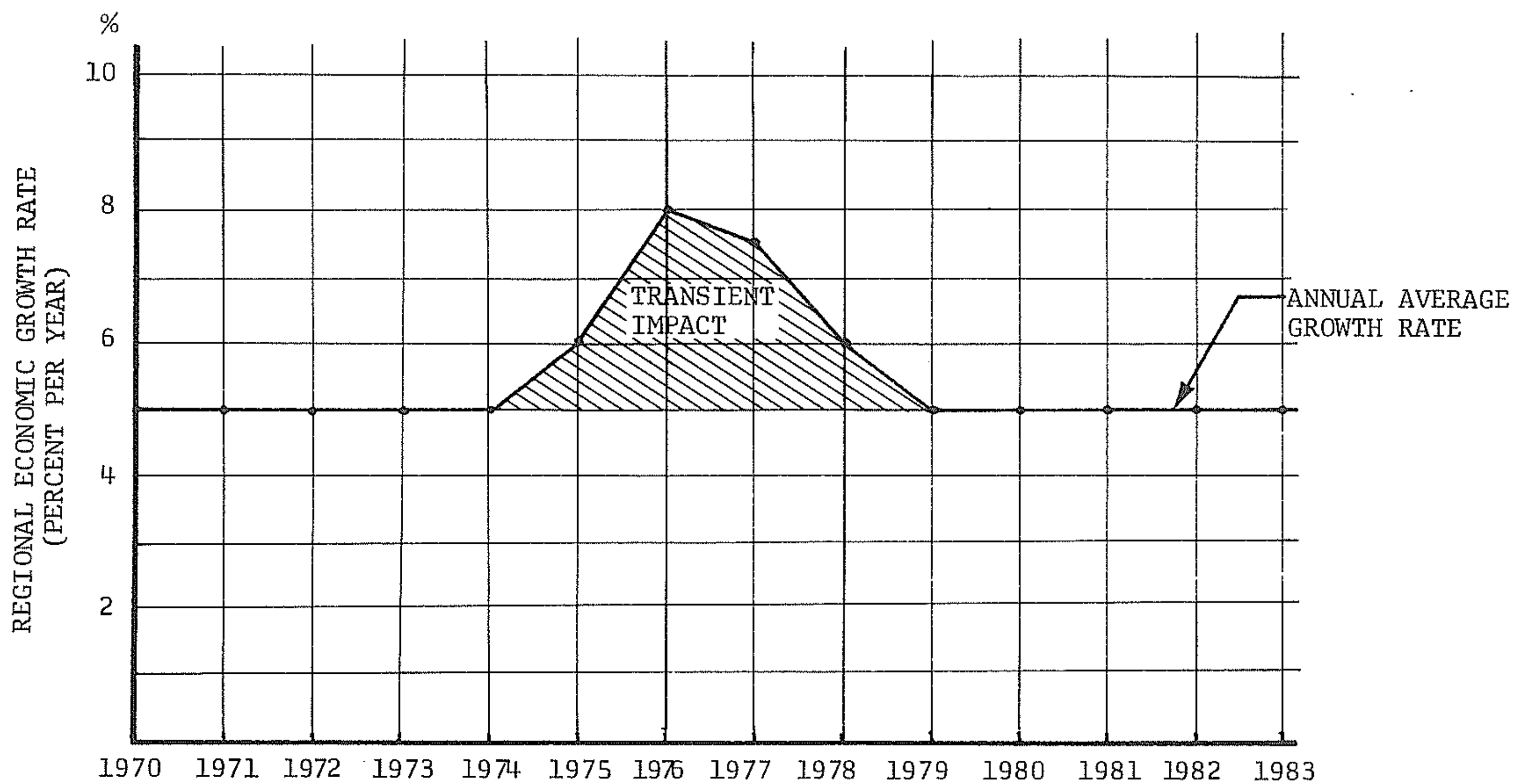

FIGURE 2

IMPACT OF A MAJOR PROJECT ON REGIONAL ECONOMIC GROWTH RATES developed by an input-output (I-O) study, it is necessary to assume that functional relationships between the various industries will be maintained. This is the underlying premise by which I-O theory is applied. It is recognized, of course, that such a situation cannot exist in a dynamic, free enterprise society but, for the purpose of estimating economic impact, there is probably no better tool than the I-O model method. In using this approach, however, the "no-change" condition must be assumed.

Under the fixed relationship assumption, an impact estimate such as that contained in this study is valid insofar as determining the immediate impact of an isolated action such as the deepwater terminal. It cannot, however, account for non-cyclical events such as political changes and natural calamities.

ELEMENTS OF ECONOMIC IMPACT

In an earlier study by Bragg and Bradley (2), economic impact was estimated for a deepwater terminal located offshore along the Texas coast. Under the assumptions of that study, the economic effects resulting from constructing and operating such a facility were placed into two categories: port-related, or those resulting from operation of the port, such as stevedoring, drayage, tugboat services, customs and broker services, etc.; and other impacts, or those directly and indirectly resulting from growth in the Texas oil refining industry.

PORT RELATED IMPACTS

For port-related changes, the authors of the referenced study used an indirect approach to estimate forecasted impact. This was because the port studied was located offshore, instead of onshore as is traditional, and no precedent existed for determining port-related changes to the local economy in such a case. To overcome this difficulty, an assumed method, known as the Philadelphia method, was used to estimate the changes.

In the present case, that of a deepwater terminal located onshore, no such problem exists. Since numerous studies have already been made of port/community interrelationships, including one on the port and city of Galveston by Rose (11), a fairly accurate and reliable estimate of the impact of the proposed port on its adjacent community (the city of Galveston) should be readily attainable. This estimate can be made using either the Rose method, whereby historical relationships are extrapolated on some inferred assumptive basis, or by the economic multiplier method, using relationships established by an input-output model. The decision as to the method to be followed will depend to a great extent upon the availability of hard data for the region. However, either method will give satisfactory results.

Effect of a Port on the Local Economy

A major port contributes substantial benefits to the adjacent community, both in the form of transportation economies for goods consumed in the community, and in expenditures for payrolls, goods and services used in accomplishing the transportation function.

The benefits which accrue from transportation economies are those which result from lower prices of both raw and intermediate materials used as inputs into the productive processes of local industries, as well as for final consumer goods which move through the port for local consumption. Such savings undoubtedly are quite substantial when compared to the costs of transportation by modes other than water.

In addition to these direct, cost-saving benefits, the availability of water transportation is often a major inducement to industrial development in the area. This occurs directly through the attraction of industry which derives its principal support from waterborne commerce, and indirectly as a result of the diversification of the local industrial base, which causes growth in supporting industries and business services. Such diversification leads to a broadening of the tax base beyond that which would occur if only water-oriented industries were attracted.

Expenditures for payrolls, goods and services required in accomplishing the transportation function are many and varied. Figure 3 gives some examples of these transactions. And, for every dollar spent by the port, or because of the port, two to three dollars more are spent in the area as a result of the economic multiplier effect. For example, someone receiving one dollar of direct income from the Port of Galveston will spend some portion of that dollar, perhaps 90 cents, on the purchase of goods and services in the same area. The recipient of the 90 cents will in turn spend some fraction of what he receives for other purchases in the area, and so on.

This secondary impact multiplier has, in past port studies, been assigned values ranging from 2.0 to 3.0. In the case of the proposed deepwater terminal at Galveston, because of its functional similarity to a conventional port, the secondary impact multiplier will, most realistically, also have a value somewhere between 2.0 and 3.0.

A. Vessel Marine Services

1. Stevedoring
2. Pilotage
3. Line Running
4. Customs Overtime
5. Entrance and Clearance Fees
6. Vessel Repairs
7. Tug Hire
8. Plant Quarantine
9. Equipment Rental
10. Clerking and Checking
11. Chandler
12. Medical Supplies
13. Laundry and Cleaning
14. Waste Disposal
15. Fuel
16. Water
17. Provisions

B. Transportation Interface

1. Barge Movement - Inland
2. Rail Movement - Inland
3. Truck Movement - Inland
4. Rail Switching Service
5. Local Cartage Service
6. Pipeline Movement - Inland

C. Crew Spending

1. Personal Needs
2. Gift Buying
3. Clothing
4. Food and Entertainment
5. Transportation
6. Medical

D. Other Services

1. Commodity Brokerage
2. Customs Brokerage
3. Freight Forwarding
4. Warehousing
5. Marine Insurance
6. Banking
7. Advertising
8. Sampling
9. Weighing
10. Fumigating
11. Vessel Cleaning
12. Marine Surveys
13. Export Packing
14. Communications
15. Railroad Car Blocking
16. Other

FIGURE 3

FACTORS OF COMMUNITY ECONOMIC IMPACT ATTRIBUTABLE TO OPERATION OF A PORT

The validity of using a value between 2.0 and 3.0 for analysis of the secondary impact in Galveston is partly borne out by the findings of Rose (11). In his study he determined that in 1968 ". . . three out of every five workers in the City of Galveston (were) employed in port-related activities, while more than three out of every ten . . . (were) employed <u>directly</u> in port-related activities." This would seem to indicate that every dollar in wages paid by <u>directly</u>-related port activities generated nearly one dollar in additional wage payments from secondary activities in the area. Continued extrapolation of this "ripple effect" into tertiary and induced spending levels, such as shelter, food, clothing, education and services, very quickly elevates the multiplier above the 2.0 level.

Regardless of what method is used to estimate the port-related impact of the proposed onshore deepwater terminal at Galveston, the extent of such impact will very likely be a direct function of how fully the potential of the new port is realized. In other words, growth in employment, spending and population, over and above that experienced by an "unperturbed," or baseline, economy will, to a great extent, depend upon the tonnage levels handled by the port.

Anticipated Tonnages at Galveston

<u>Petroleum Imports</u> - The major portion of U. S. foreign trade activity, between today and the end of this century, will result from movement of crude oil. Oil will represent most of the tonnage and most of the dollars. Because of the dire consequences that would result from an oil shortage, much attention has been directed to the oil import program and its many ramifications.

A multitude of conflicting and overlapping predictions have been made concerning national oil import needs. Because of its strategic location, the Gulf Coast region has figured prominently in all of this planning. This is because a key factor of the energy crisis, other than the lack of crude oil, is a nationwide shortage of petroleum refining capacity. The Gulf Coast area--particularly Texas and Louisiana--possesses not only a significant portion of the present U. S. refining capacity but it also has an abundance of sites for new refineries, as well as a receptive attitude toward new refineries and petrochemical plants.

Forecasts of future Gulf Coast crude oil imports prepared on the national level, have in some instances been made up under somewhat shaky assumptions. An example of this is found in Figure 1-1, Part 1 of the study by Soros (15). This forecast predicts crude oil imports into the Gulf, in 1975, 1980 and 1985, to be approximately 0.1, 0.3 and 1.0 million barrels per day respectively. For the Atlantic Coast, on the other hand, he predicts 1975, 1980 and 1985 imports to be 2.8, 4.5 and 6.5 million barrels each day in the respective years. Evidently, this researcher overlooked a basic requirement--that crude oil must be refined before it can be used. With only about 1.5 million barrels per day of refining capacity in the entire Atlantic Coast region, and with public sentiment running solidly against the construction of additional refineries--as indicated by the recent rejection of a major project proposed by the Onassis interests, it does not appear feasible or reasonable to forecast imports of up to 6.5 million barrels a day into the region.

Most forecasts of crude oil imports into Texas and the Gulf Coast region have been predicated on the assumption that the region would continue to maintain its traditional share of national refining capacity. The two forecasts shown in Table 2 are representative of this theory. Unless radical changes in demand occur, it must be assumed that these are the levels at which crude oil will be imported.

TABLE 2

CRUDE OIL IMPORTS AND NEW CRUDE RUNS
TEXAS AND TOTAL GULF COAST
(Million Barrels/Day)

ITEM	1975	1980	1985
Texas (1)*			
Crude Oil Imports	1.0	2.1	3.5
New Crude Runs	0.9	2.0	3.5
New Production Shipped to Eastern Markets	0.4	0.9	1.4
Gulf Coast (2)*			
Crude Oil Imports	1.6	4.7	6.8
Crude Pass-Through (Not Refined on Gulf)	- 0.3	- 0.5	- 0.8
New Gulf Crude Runs - Total	1.3	4.2	6.0
New Gulf Crude Runs for Eastern Markets	---	- 2.4	- 3.5
New Gulf Crude Runs for Gulf Markets	1.3	1.8	2.5

* Indicates source of forecast.

SOURCE: (1) Bragg, Daniel M. and James R. Bradley, "The Economic Impact of a Deepwater Terminal in Texas," Sea Grant Report TAMU-SG-72-213, Texas A&M University, College Station, Texas, November, 1972.
(2) Arthur D. Little, Inc., "Potential Onshore Effects of Deepwater Oil Terminal-Related Industrial Development: Volume III of IV - Gulf Coast-Louisiana and Texas," Council on Environmental Quality, Washington, D. C., October, 1973.

Dry Bulk Movements - Although it now appears that crude oil, without a doubt, will be the predominant commodity moving in foreign trade between 1973 and 2000, national energy self-sufficiency programs notwithstanding, what about other bulk commodities? Most deepwater terminal studies to date, with one major exception (15), have concluded that only crude oil will be shipped in the volumes necessary to clearly justify and demand the use of very-large and ultra-large ships. Not only will the tonnage of oil be very large but other conditions, such as voyage distances and port facilities at both origin and destination, will be optimum for the use of the gigantic vessels.

There are limitations, however, to the use of giant ocean vessels in dry bulk commodity trade. Some of these are:

- lack of adequate water depths at one or both ends of most trade routes;
- lack of adequate handling and storage facilities at one or both ends of trade routes; and
- reluctance, or inability, of most commodity owners to deal in lot sizes as large as the cargos carried by very-large and ultra-large bulk vessels.

Although the number of very-large and ultra-large dry bulk vessels is growing yearly, the relatively low volumes of dry bulk commodities moving on a regular basis in Gulf Coast trade at the present time, or forecasted for movement in the next several decades, makes it difficult to ascertain the traffic levels that a Galveston superport could expect.

Many other factors affect the ability to forecast Gulf Coast bulk commodity trade, and these same factors also affect the accuracy of the forecasts made. Some of them, such as growth in population and market demand, as well as changes in world business conditions, affect the forecasting of movements in commodities like oil, coal, iron and aluminum ores. These factors are relatively fixed and predictable. Others such as world-wide vagaries of the weather, which affect world demand for, and export movement of, grains and other agricultural products, are not.

For the purposes of this study, two major questions about commodity trade need to be answered. First, what are the most likely volumes of bulk commodity imports and exports that will move through Western Gulf ports? Second, which of these commodities are candidates for movement in very-large and ultra-large ships?

From 1960 through 1970, world oceanborne trade in five dry bulk commodities--iron ore, grain, coal, aluminum ore and phosphates--increased by 287 million short tons, from 251 to 538 million tons per year. In 1971, this volume jumped to 570 million tons. United States trade in these five commodities in 1971 was about 26 percent of the world total, or 150 million short tons (4).

Future United States trade volumes of a few selected dry bulk commodities, as forecast by several recent research studies, are shown in Table 3. Other items besides these, which could become significant in future years, include: manganese ore, chromite, sugar, green coffee, iron and steel scrap, gypsum rock and limestone.

A few researchers have seen fit to break out the Gulf Coast region as a separate entry in their dry bulk forecasts. Results of two of these, for several selected commodities, are shown in Table 4.

The major determinants of United States <u>export</u> trade volume are world demand and world production. Whether the Gulf Coast is a major exporter of any commodity is determined largely by which countries import them. The most likely markets for Gulf Coast exports are Western Europe, Africa, Latin America and some Asian countries.

TABLE 3

MAJOR FORECASTS OF UNITED STATES FOREIGN TRADE
IN SELECTED DRY BULK COMMODITIES
(Millions of Tons)

COMMODITY	*	1975	1980	1985	1990	1995	2000
Iron Ore (Import)	1	34.0	35.0	38.0	40.0	42.0	N.A.
	2	N.A.	34.1	N.A.	N.A.	N.A.	48.3
	3	N.A.	31.3	N.A.	N.A.	N.A.	52.4
	4	46.4	52.8	N.A.	N.A.	N.A.	95.4**
Bauxite/Alumina (Import)	1	15.0	17.0	20.0	23.0	26.0	N.A.
	2	N.A.	21.6	N.A.	N.A.	N.A.	31.1
	3	N.A.	33.7	N.A.	N.A.	N.A.	61.0
	4	23.5	34.4	N.A.	N.A.	N.A.	77.8**
Grains and Soybeans (Export)	1	59.7	68.4	77.3	89.0	101.9	N.A.
	2	N.A.	79.0	N.A.	N.A.	N.A.	117.7
	3	N.A.	61.8	N.A.	N.A.	N.A.	130.7
	4	77.9	110.1	N.A.	N.A.	N.A.	383.6**
Coal (Export)	1	41.0	48.0	51.0	53.0	55.0	N.A.
	2	N.A.	54.7	N.A.	N.A.	N.A.	53.7
	3	N.A.	63.1	N.A.	N.A.	N.A.	82.7
	4	38.7	43.0	N.A.	N.A.	N.A.	55.9**
Phosphate Rock (Export)	1	10.4	13.5	16.8	20.8	25.2	N.A.
	2	N.A.	17.9	N.A.	N.A.	N.A.	26.5
	3	N.A.	16.0	N.A.	N.A.	N.A.	37.0
	4	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Dry Sulphur (Export)	1	1.3	1.6	1.9	2.2	2.4	N.A.
	2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
	3	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
	4	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
TOTALS	1	161.4	183.5	205.0	228.0	252.5	N.A.
	2	N.A.	207.3	N.A.	N.A.	N.A.	277.3
	3	N.A.	205.9	N.A.	N.A.	N.A.	363.8
	4	186.5	240.3	N.A.	N.A.	N.A.	612.7**

* Indicates source of forecast. ** Forecast for the year 2003. N.A.-Not Available.

SOURCE: (1) Booz-Allen Applied Research, Inc., "Forecast of U.S. Oceanborne Trade in Dry Bulk Commodities," Washington, D.C., March 28, 1969.
(2) Robert R. Nathan Associates, Inc., "U.S. Deepwater Port Study," Washington, D.C. , July, 1972.
(3) Soros Associates, Inc., "Offshore Terminal System Concepts," New York, N.Y., September, 1972.
(4) Litton Systems, Inc., "Oceanborne Shipping: Demand and Technology Forecast," Culver City, California, June, 1968.

TABLE 4

FORECASTS OF GULF COAST FOREIGN TRADE
IN SELECTED DRY BULK COMMODITIES
(Millions of Tons)

COMMODITY	*	1980	2000
Iron Ore (Import)	1	10.6	15.1
	2	7.1	11.9
Bauxite/Alumina (Import)	1	17.4	23.9
	2	18.9	33.6
Grains (Export)	1	36.2	56.1
	2	34.3	69.7
Soybeans (Export)	1	17.9	30.7
	2	13.2	31.6
Coal (Export)	1	1.5	1.0
	2	4.0	9.6
Phosphate Rock (Export)	1	15.9	22.7
	2	15.5	35.8
TOTALS (Imports and Exports)	1	99.5	149.5
	2	93.0	192.2

* Indicates source of forecast.

SOURCE: (1) Robert R. Nathan Associates, Inc., "U.S. Deepwater Port Study," Washington, D.C., July, 1972.
(2) Soros Associates, Inc., "Offshore Terminal System Concepts," New York, N.Y., September, 1972.

The level of bulk commodity <u>imports</u> into the United States is determined by demand, availability and cost of substitute fuels, quantity and quality of domestic reserves, foreign and domestic prices, and import restrictions. Imports of petroleum were at one time motivated by price differentials; in 1973, as foreign prices rose, the determinant became a matter of demand exceeding the domestic supply. In future years, petroleum may be imported because it is cheaper than synthetic forms of energy, or because it is an exclusive source of certain raw materials, such as petrochemicals.

Dry bulk commodity foreign trade for the Texas Gulf Coast was forecast by Bragg and Bradley in 1972 (2). Results of this forecast are shown in Table 5.

TABLE 5

FORECAST OF
TEXAS GULF COAST FOREIGN TRADE
IN SELECTED DRY BULK COMMODITIES
(Millions of Tons)

COMMODITY	1955	1960	1965	1970	*	1975	1980	1985
Wheat (Export)	2.0	5.2	8.6	8.1	H L	12.3 11.0	14.6 13.0	17.0 15.0
Rice (Export)	0.15	0.45	0.70	0.72	H L	1.00 0.90	1.15 1.08	1.35 1.22
Grain Sorghum (Export)	1.5	1.9	3.1	3.6	H L	5.6 5.1	7.0 6.2	8.2 7.4
Dry Sulphur (Export)	1.22	0.69	1.62	0.73	H L	0.60 0.50	0.63 0.53	0.65 0.55
Iron Ore (Import)	0.10	0.20	0.90	1.10	H L	1.40 1.25	1.80 1.65	2.20 2.00
Bauxite/Alumina (Import)	0.9	3.3	3.2	3.0	H L	5.5 5.2	6.8 6.3	7.9 7.1
TOTALS (Imports and Exports)	5.87	11.74	18.12	17.25	H L	26.40 23.95	31.98 28.76	37.30 33.27

* Indicates high or low forecast.

SOURCE: Bragg, Daniel M. and James R. Bradley, "The Economic Impact of a Deepwater Terminal in Texas," Sea Grant Report TAMU-SG-72-213, Texas A&M University, College Station, Texas, November, 1972.

Total Tonnages - To arrive at a set of tonnage figures for use in calculating the port-related impact of the proposed onshore deepwater terminal at Galveston, a set of conditions must be assumed in order to establish a scenario of action. One such probable scenario might be as follows:

1. The commodity volumes forecasted in Tables 2 and 5 occur;
2. Deepwater terminals exist on all major bulk commodity trade routes;
3. The world fleet of O-O, OBO and OSO vessels continues to expand in the ultra-large size ranges to a point at which these size vessels are available as needed;
4. The freight costs for shipping goods in ultra-large bulk ships, in conjunction with transshipment by barges from outlying points to the bulk terminal at Galveston, are lower than the costs for shipping the same goods in smaller bulk ships which would call at intermediate ports; and
5. Texas Gulf Coast producers of refined petroleum products utilize ultra-large tankers exclusively to move all of their new and additional output for the eastern seaboard to those areas.

If this scenario occurs, the new annual tonnages of bulk commodities handled through the Galveston onshore deepwater terminal will amount to 101.3 million tons per year (MTY) in 1975, 191.0 MTY in 1980 and 296.2 MTY in 1985. Tables 6 and 7 give the details of these projected movements.

Total Port Related Impact

After evaluation of the dry bulk commodity picture, and its relation to possible economic impact, it has been concluded as follows:

> Unless the assumptions of the earlier-described scenario become a reality, the Galveston onshore deepwater terminal will have almost no port-related impact on the local and regional economies.

TABLE 6

FORECAST OF
ANNUAL TONNAGES OF BULK IMPORTS
GALVESTON ONSHORE DEEPWATER TERMINAL
(Millions of Tons)

COMMODITY	1975	1980	1985
Crude Oil	52.1	109.4	182.4
Iron Ore	1.4	1.8	2.2
Bauxite and Alumina	5.5	6.8	7.9
Total Imports	59.0	118.0	192.5

SOURCE: Tables 2 and 5.

TABLE 7

FORECAST OF
ANNUAL TONNAGES OF BULK EXPORTS
GALVESTON ONSHORE DEEPWATER TERMINAL
(Millions of Tons)

COMMODITY	1975	1980	1985
Petroleum Products	20.9	47.0	73.0
Wheat	12.3	14.6	17.0
Rice	1.0	1.2	1.4
Grain Sorghum	5.6	7.0	8.2
Sulphur (See note 1)	2.5	3.2	4.1
Total Exports	42.3	73.0	103.7

Note 1: Most sulphur is shipped in liquid form, requiring special ships with heated cargo tanks. This type of vessel is not expected to go above 40,000 tons' size in the foreseeable future.

SOURCE: Tables 2 and 5.

The reasoning behind this conclusion is that, without the existence of the conditions assumed in the scenario--especially numbers two, four and five--there will be little incentive for shippers to utilize the deepwater capabilities of the proposed port. Even if dry bulk foreign trade volumes attain the forecasted levels, these commodities will still be shipped, whether they move in ultra-large vessels or ships of a more conventional size.

On the other hand, if the assumed scenario becomes reality, then the port-related impact of the proposed Galveston terminal can be substantial. Table 8 shows in columns one and two the estimated impacts per ton, by cargo type, which occurred in a community served by a multicargo port, Green Bay, Wisconsin (14). The balance of the table gives estimates of the magnitude of these impacts in Galveston in 1975, 1980, and 1985. In Table 9 are shown the total estimated port-related economic impacts most likely to occur in Galveston if optimum conditions prevail.

OTHER IMPACTS (NON-PORT RELATED)

Besides estimating the economic changes, both positive and negative, generated directly by port-related activities of the Galveston onshore deepwater terminal, consideration must also be given to other possible impacts the port may bring about. In the analysis by Bragg and Bradley (2) and the study by the Corps of Engineers (8), the economic impact from "other causes" was primarily attributed to growth in petroleum refining levels. In both studies

TABLE 8

ESTIMATED ECONOMIC IMPACT OF CARGO MOVEMENTS THROUGH A PORT

TYPE CARGO	IMPACT PER TON	ESTIMATED FOR GALVESTON		
		1975	1980	1985
General	$24.00	$24.00*	$30.00*	$36.00*
Tanker	5.50	5.50	6.87	8.25
Coal	3.75	3.75	4.68	5.62
Grain	7.50	7.50	9.35	11.22
Ore	3.75	3.75	4.68	5.62
Salt	4.50	4.50	5.65	6.75
Other	3.50	3.50	4.38	5.25

*1974 Dollars.

SOURCE: Schenker, Eric, "Impact of the Port of Green Bay on the Economy of the Community," Sea Grant Report WIS-SG-72-216, University of Wisconsin, Madison, Wisconsin, November, 1972; Industrial Economics Research Division, Texas A&M University, College Station, Texas.

TABLE 9

PORT-RELATED IMPACT
GALVESTON ONSHORE DEEPWATER TERMINAL

YEAR	TYPE CARGO	VOLUME HANDLED (Millions of Tons)	IMPACT (Per Ton)	IMPACT IN GALVESTON (Millions of 1974 Dollars)
1975	General	1.0	$ 24.00	$ 24.0
	Tanker	73.0	5.50	400.0
	Bulk Grains	17.9	7.50	134.0
	Bulk Ores	9.4	3.75	35.2
	Totals	101.3		$ 593.2
1980	General	1.2	$ 30.00	$ 36.0
	Tanker	156.4	6.87	1,075.0
	Bulk Grains	21.6	9.35	202.0
	Bulk Ores	11.8	4.68	55.2
	Totals	191.0		$ 1,368.2
1985	General	1.4	$ 36.00	$ 50.4
	Tanker	255.4	8.25	2,105.0
	Bulk Grains	25.2	11.22	282.5
	Bulk Ores	14.2	5.62	79.8
	Totals	296.2		$ 2,517.7

SOURCE: Tables 6, 7 and 8.

refining in Gulf Coast areas was projected to rise as rapidly as the rise in national demand for petroleum products. Economic impact of the deepwater terminal was then assumed to consist almost wholly of the primary, secondary and induced impacts arising from the projected growth in petroleum refining.

Bragg and Bradley limited their detailed evaluation to the petroleum refining industry and used input-output methodology to estimate total impact. The Corps study, on the other hand, also covered the changes in the chemicals and allied products industries, and in the contract construction industry, that were most likely to be caused by the changes in petroleum refining. Detailed estimates of impact by the Corps were made by starting with Bureau of Economic Analysis (BEA) data on employment and earnings, then extrapolating these data along projected industry growth curves. The final results were estimates of economic changes for the forecasted time intervals.

Other principal researchers surveyed (1, 10, 15) arrived, albeit by their own methods, at approximately the same conclusions as did Bragg and Bradley and the Corps of Engineers.

Basic Approach

The basic procedure used to determine the "other impacts", i.e., those not directly port-related, of an onshore deepwater terminal at Galveston, was to evaluate the applicability of the findings of the Texas A&M offshore port study (2) to the case of the onshore terminal. More specifically, the approach to the study has been to respond directly to the charge received from the study sponsor, "Is the impact the same onshore (as) for offshore, and if different, in what ways?" To this end, considerable time and effort have been spent, not only on a close scrutiny of the Texas A&M study, but also on an evaluation of several other major offshore port studies (1, 5, 8, 10, 15) completed in the past few years.

The conclusion reached, after comparing these studies to each other on a point-by-point basis, is that the non-port related impact will be approximately the same whether the deepwater terminal is located onshore or offshore. The opportunities for economic growth, made possible by the ready availability of foreign crude petroleum, represent the dominant area of impact. And, these opportunities are the same, whether the petroleum is unloaded directly from ocean vessels into shoreside storage, or moved to shoreside storage by a pipeline running to an ocean vessel docked far offshore.

A slight additional non-port impact, for the state as a whole, may occur from a deepwater terminal located onshore. This is the advantage gained through being able to handle dry bulk cargos in ultra-large vessels, and thereby reduce the freight costs of moving these commodities from producer to consumer. The advantages of lower freight costs for basic industrial resources such as iron ore, bauxite or phosphate, sand and gravel, for example, are many:

- reduces the balance-of-payments deficit by reducing the amount of dollar payments to foreign flag carriers of imported goods;
- lowers the cost to the American consumer for goods processed from imported materials; and,
- makes our export goods more price-competitive in world markets.

The economic factors most likely to be affected by lower freight costs for bulk commodities are the following:

- national output and employment;
- regional output and employment;
- international balance of payments.

The possibilities that an impact from reduction of freight costs of imported dry bulk commodities will be felt in the Galveston-Houston region are, however, somewhat remote. This is because the principal locational advantage which has attracted industry to the region is the availability of raw materials such as crude oil, natural gas, limestone, salt, fresh water and petroleum byproducts. As a result, the major part of the region's industrial base is dependent upon liquid bulk raw materials, and dry bulk movements are not too significant. For the same reason, depletion of the area's mineral resources would not be cause for an upswing in demand for imported dry bulk commodities for local consumption.

Whether or not there will be an impact of this type in other parts of the state, or elsewhere in the port's hinterland, must be established through a separate, specialized study.

In conclusion, therefore, it appears that the only significant non-port-related impact which can be expected from an onshore deep-water terminal at Galveston will be similar to that expected from an offshore terminal which would be located in the same trade region. This impact, a result of growth in employment and spending attributable to growth in the oil refining and allied industries, will likely occur only if adequate facilities are available for importing crude oil to meet the rising demands in the region for petroleum products and their derivatives. Without deepwater terminals, importation of the required volumes of crude will be physically impractical and, as a result, new and additional petroleum refining capacity will, of simple necessity, be built elsewhere. For this reason, it is logical and reasonable to give credit to the deepwater terminal as being the primary and direct cause for the economic impact that results from growth in oil refining.

As estimated by Bragg and Bradley (2) and confirmed by A. D. Little (1), the economic impact in Texas from a deepwater terminal at Galveston, from factors other than those related to port operation, should be as shown in Table 10.

NOTE: These figures represent economic growth that is most likely to occur if the terminal is built. However, for best interpretation, the projections should be considered in the context of the growth of the total economy of the State of Texas over the same time periods.

TABLE 10

ESTIMATED NON-PORT RELATED IMPACT FOR ALL OF TEXAS FROM THE GALVESTON ONSHORE DEEPWATER TERMINAL
(Millions of 1974 Dollars)

FACTOR	1975	1980	1985
New Refinery Output	$1,531.2	$ 4,071.2	$ 7,075.0
Economic Impact	3,919.9	10,422.7	18,112.0

SOURCE: Bragg, Daniel M. and James R. Bradley, "The Economic Impact of a Deepwater Terminal in Texas," Sea Grant Report TAMU-SG-72-213, Texas A&M University, College Station, Texas, November, 1972.

TOTAL ESTIMATED ECONOMIC IMPACT

The total estimated economic impact of an onshore deepwater port at Galveston is assumed to be the sum of the two major elements of impact--port-related, that is, changes in the economy of the adjacent community resulting from growth in port activity, and non-port-related, that is, the impact resulting from growth in oil refinery output.

Because it was felt to require a greater degree of detailed analysis than called for by a survey type study such as this, the estimated economic impact from growth in refining in the immediate region around Galveston was not calculated during this study. Instead, the impact on the entire state was projected, utilizing data that was already available in the required format. Through later, more detailed studies, the economic impact from growth of refining and associated industry can be determined for the Galveston-Houston region. Even without a detailed analysis, however, there is every reason to believe that such impact will contribute substantially to the growth and industrialization of Galveston, Galveston County, the Galveston Bay region and the Houston SMSA.

Therefore, the total impact of the Galveston onshore deepwater terminal, under the conditions and assumptions of the scenario described earlier in this discussion, is estimated to be as shown in Table 11. These numbers, of course, show just one conclusion; there would be others under different conditions.

The economic impact of the proposed Galveston project, compared to that of an offshore monobuoy type terminal located in the same trade region, is estimated to be as shown in Table 12. Here again,

TABLE 11

TOTAL ESTIMATED ECONOMIC IMPACT GALVESTON ONSHORE DEEPWATER TERMINAL (Millions of 1974 Dollars)

TYPE OF IMPACT	1975	1980	1985
Port Related-- In Galveston trade region, from Port of Galveston growth only (if scenario develops).	$ 593.2	$ 1,368.2	$ 2,517.7
Oil Refining Growth-- Total in entire State of Texas (if imported oil is received).	3,919.9	10,422.7	18,112.0
Total Dollar Impact	$ 4,513.1	$ 11,790.9	$ 20,629.7
Total New Jobs	72,887	193,789	336,770

SOURCE: Table 9 and Bragg, Daniel M. and James R. Bradley, "Economic Impact of a Deepwater Terminal in Texas," Sea Grant Report TAMU-SG-72-213, Texas A&M University, College Station, Texas, November, 1972.

only the economic changes expected to result from growth in oil refining is considered, along with the impact resulting directly from the operation of the port.

Port-related impact for the offshore terminal, as calculated by Bragg and Bradley in 1972 (2) was revised downward by utilizing the more precise multipliers developed during this study.

No tertiary changes, resulting from growth in other kinds of industry, which may be induced to locate in the area because of the availability of deepwater facilities for dry bulk cargos, were included in the impact computations.

TABLE 12

ESTIMATED ECONOMIC IMPACT
ONSHORE VS. OFFSHORE TERMINALS
(Millions of 1974 Dollars)

TYPE OF IMPACT	1975	1980	1985
PORT-RELATED			
Offshore Monobuoy Terminal	286.0	755.7	1,485.0
Onshore Dredged Terminal	593.2	1,368.2	2,517.7
OIL REFINING GROWTH (Texas Total)			
Offshore Monobuoy Terminal	3,919.9	10,422.7	18,112.0
Onshore Dredged Terminal	3,919.9	10,422.7	18,112.0
TOTAL IMPACT			
Offshore Monobuoy Terminal	4,205.9	11,178.4	19,597.0
Onshore Dredged Terminal	4,513.1	11,790.9	20,629.7
ONSHORE PORT ADVANTAGE	$ 307.2	$ 612.5	$ 1,032.7

SOURCE: Table 11 and Bragg, Daniel M. and James R. Bradley, "Economic Impact of a Deepwater Terminal in Texas," Sea Grant Report TAMU-SG-72-213, Texas A&M University, College Station, Texas, November, 1972.

As shown in Table 12, the onshore terminal at Galveston should have a higher level of economic impact on the Houston-Galveston region, amounting to as much as:

1975	$307.2 million
1980	$612.5 million
1985	$1,032.7 million

OTHER CONSIDERATIONS

In attempting to predict future demand for a multicargo, onshore deepwater terminal at Galveston, Texas, the conclusions up to now have been based principally upon traditional forecasts of bulk commodity movements. These forecasts, as reflected in Tables 3, 4, and 5, appear to be extrapolations of historical trends, modified by a number of factors which attempt to precisely define future changes in demand. Rarely do such forecasts prove to be accurate and, such an approach cannot be the only one for evaluating the Galveston plan.

Another consideration, which should prove to be a meaningful indicator of the need for a deepwater port at Galveston, would be to think of Galveston Bay as the potential "Europoort" of the Gulf Coast. By tracing the development of this massive complex at the port of Rotterdam, Holland, a reasonable rationale can be established for predicting the growth of the Galveston deepwater port and the development of the Galveston Bay-Houston Ship Channel area.

THE ROTTERDAM STORY (12)

History

Starting as a rather insignificant fishing and farming village, Rotterdam became firmly established in the early 13th century when the city fathers built a dam across the Rotte River (thus Rotte-dam) to help reduce the damage suffered each year from spring floods. By the 14th century, Rotterdam was making its presence felt in the European maritime trade, even though problems of silting along the mouth of the Meuse River, into which the Rotte flowed, caused access to and from the open sea to be a constant challenge.

By the early 17th century, Rotterdam had come to be regarded as a modern port, and the city began to prosper from port activities. As the gateway to the Rhine Valley, Rotterdam enjoyed a steady growth into modern times. By 1938, oceanborne shipments through Rotterdam had reached a level of more than 40 million metric tons per year.

During World War II, Rotterdam was virtually destroyed by air raids and, as a result, much reconstruction became necessary at war's end. However, the planners of the postwar period were well aware of Rotterdam's history of port-related growth, and they were determined that the rebuilt port would also be designed for growth. The validity of the principle, "outstanding port facilities encourage outstanding growth," has been confirmed by developments which have occurred since completion of the Nieuwe Waterweg (or New Waterway) in 1872. This lock-free canal, cutting through the sand dunes at the mouth of the Meuse--an area known as the Hook of Holland--gave Rotterdam a direct route to the North Sea. More than 870 vessels used this new canal the first year and, from 1870 to 1920, Rotterdam's population grew from 120,000 to 500,000. By this time, the city had surpassed Amsterdam as the Netherland's leading port and was still growing.

After World War II, the Rotterdam city government embarked on a plan to develop the port area into an industrial complex. The Botlek plan, as it was known, was designed to attract industries oriented to ocean and waterway shipping, such as oil refineries, chemical and allied industries, bulk storage and distribution operations, ship-builders, and ship repair facilities. This plan, launched in 1947, was the beginning of a period of growth which ultimately resulted in creation of Europoort and Maasvlakte (or Meuse Sands), two massive developments designed for the accommodation of ships of 300,000 deadweight tons initially, and ultimate capability for ships up to 700,000 deadweight tons.

Rotterdam Today

Although primarily a transshipment port (32,000 ocean vessels and 225,000 inland tows called in 1969), the Rotterdam complex also offers on-site processing capabilities on a grand scale. A large free trade zone exists in which a significant amount of processing is performed on bonded goods. Demand for industrial sites at Rotterdam has been almost phenomenal: Botlek was large by 1947 standards, at 3,125 acres (water and land included) but the greater areas of later-developed Europoort (9,050 acres) and Maasvlakte (6,400 acres) underscore the need for more ambitious planning in the early stages of a development. This fact notwithstanding, however, the basic wisdom of Rotterdam's planners who, in 1947, envisaged a bright future of growth for the region, can now be adjudged sound. Considering that in 1970, cargo volume through the port had risen to a level of 215 million metric tons per year, compared to the 40 million tons of 1938, it would appear that the 1947 planners were savants of the future.

Construction and Research

To achieve the type of facilities now existing in Rotterdam requires large-scale construction, buttressed by hydraulic engineering and research on an equally large scale. Some of the world's largest trailing suction hopper dredges have been utilized in the work--dredges which do not exist in the United States today.

Also, much research must be performed to uncover possibly adverse consequences of the project in advance of the start of construction. Such a facility as the New Waterway serving Rotterdam, or a deep channel serving Galveston, is a great advantage for shipping. Yet, such a waterway also has the potential for causing great changes in the hydrology of the estuaries and bays it connects to the ocean. The tides ebb and flow, and the mass of the river water moves out to the sea.

Anyone planning to interfere with these forces must be fully aware of the consequences of his actions. Any changes made could have far-reaching effects and these must first be carefully calculated.

All hydraulic work done at Rotterdam is first tested with scale models at the hydraulic laboratories of Delft and in other facilities. Wave and tidal forces are calculated and the possible consequences of man's interference with the forces of nature are determined as nearly as possible.

Environmental Concerns

One of the primary concerns of the builders of Europoort and Maasvlakte has been to prevent saltwater intrusion into the freshwater aquifers of the region. With the deepening of the river mouth, and the cutting of a 75-80 foot deep channel, the salt content of the river increased. To prevent a scouring-away of the river bed upstream from the new port construction--thereby permitting movement of a flood tide further up the river, the river bed was stabilized with gravel. This has had the effect of preserving the quality of the water used for drinking and for agriculture.

In Galveston, as well, research must be done to assess the consequences of the proposed deep channel. Based upon results of the research, solutions to the problems may be identified early to ensure their timely implementation during the construction phases of the project. Only in this way can the possibly undesirable consequences of the project be minimized.

RAW MATERIALS AND WORLD COMMODITY TRADE

To help reinforce the rationale of the Galveston-Houston area as another Europoort, it is necessary to consider the validity of the proposition that a multicargo facility at Galveston for the new generation of superships is essential.

In looking at the present port facilities of the United States, it must be assumed that either:

- we are behind the times in port development, or;
- we have no need for deepwater, multicargo ports.

However, the answer is not this simple.

Many countries in Europe are heavily dependent upon imported raw materials to supply the needs of industry. This is one of the main reasons why ports are so important to them. Contrary to this, the United States has historically depended upon domestic sources of raw materials for our industries and we have not found it necessary to develop extensive port facilities for the importation of bulk commodities. However, this situation is due to change.

According to the National Commission on Materials Policy (17), the United States, with only eight percent of the world's population, uses as much as half of the world's material resources. Further, according to this Commission, "We are now almost completely dependent upon foreign sources for 22 of the 74 nonenergy mineral commodities considered essential to a modern industrial society." As a result, higher and higher levels of need for imported raw materials will develop, and our capability to handle these goods efficiently and economically will become more critical to our national economic security.

Most European countries regard seaport development as essential in supporting the national economy, and they regard them as centers of regional development. In France, the new superport at Fos--west of Marseille--will be capable of receiving 500,000 ton tankers. New inland transportation arteries (rail, road, pipeline) are being built between Fos and the major industrial centers of Spain, Italy and Germany to carry goods to these inland points. However, there is also a large industrial development complex being built at the Port of Fos, to contain oil refineries, petrochemical plants, steel mills, automobile plants, glass plants, tire and rubber plants, and others essential to an interrelated network of industries.

Other, similar developments, such as Le Havre-Antifer and Dunkirk in France, Bilbao in Spain, Wilhelmshaven in West Germany, Sines in Portugal and Maplin Sands in England are further proof of the growing awareness on the part of developed nations of the need for supership facilities to avoid slow economic strangulation.

SHALLOW DRAFT VESSELS

Another, major factor to consider in planning for a deepwater terminal at Galveston is the shallow-draft VLCC concept currently being studied in the maritime trade.

The shallow-draft VLCC concept, as now being studied by the Maritime Administration in the United States, and by several major Japanese shipbuilders, is a design approach in which a vessel is built with a much broader beam (or width), in proportion to its length, than is traditionally done. The purpose of this configuration change is to attempt to achieve the same cargo volume capacity in a vessel with a more shallow draft than a conventional ship has.

Traditionally, naval architects do not use a length-to-beam ratio of less than about six (a length of six times the beam, or more) because of problems of stability, maneuvering and excessive resistance or drag. Recently, however, because of growing depth-related trade route restrictions, which are hampering full utilization of the larger, more efficient vessels, much attention is being turned to the study of larger vessels--in the 150,000-450,000 deadweight ton class--with much shallower drafts, on the order of 50-72 feet. As a result of this research, early indications are that there should be no appreciable operational problems encountered with these vessels. Thus, there is no reason why the concept cannot be extended to vessels of all types, including those designed to carry dry bulk cargos.

Assuming that this trend continues, it would appear that the need for port depths of greater than 75-80 feet should be evaluated in considerably more detail than that which has occurred to now, both in this study and others.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

This nation currently faces a crisis stemming from an urgent need to import large amounts of crude petroleum, transported in ultra-large ships which are unable to dock in our existing ports, and a concurrent lack of concrete plans to make adequate port facilities available. But, this is not our only problem with regard to ports. We also do not have facilities adequate for the large, new dry bulk carriers, either.

Fortunately, there presently abounds much interest and activity with regard to deepwater oil ports, and it appears that this problem will be resolved in the next few years. Does it not seem, then, that we are being somewhat shortsighted by our failure to plan just as actively for multicargo ports, which can solve not only the oil-unloading problem, but also can provide facilities for a growing volume of dry bulk cargos? Must we always be responsive only to immediate crises?

An honest analysis of either of these questions will produce answers that weigh heavily in favor of such a project as the Galveston onshore deepwater port. Thus, even though we can see only an oil port crisis today, it would seem to make good sense to go ahead and begin to provide adequate facilities for the inevitable growth in dry bulk trade due to occur in the next few decades.

RECOMMENDATIONS

As pointed out in the preceding discussion, enough evidence exists to at least hint that the proposed onshore deepwater port at Galveston is a much needed and desirable facility. But, many imponderables exist which must be resolved before proceeding with the project. Therefore, the establishment of a comprehensive program of research should be the first priority of action following completion of the study reported here.

FUTURE STUDIES

A research program, along the lines suggested by the following partial list of subject areas, should be favorably considered by the Galveston Wharves Board:

Economic and Financial

In economic and financial areas, more detailed studies should be made of the following subjects:

1. Detailed analysis of the direct impact of the project upon jobs and incomes in the City of Galveston.

2. Detailed assessment of the direct impact upon jobs and incomes in the Houston SMSA and the entire state.

3. Estimates of impact of transportation savings inside the state.

4. Estimates of the indirect impact of the project upon the area of social services in Galveston, the Houston SMSA and the entire state.

5. Detailed assessment of the growth potential of the Galveston hinterland, under conditions of no-action, and with construction of the port.

6. In-depth investment risk study to realistically assess income potential of the proposed port facility.

7. Multi-scenario study of the type and size of support facilities needed at the proposed terminal, such as grain storage, dry bulk storage, liquid storage, cargo-handling systems, etc.

Alternate Depth Goals

In view of the recent interest in shallow-draft vessel technology, the planners of the Galveston deepwater terminal should perhaps consider proceeding with the project under an Alternate A plan, in which only a 60-foot-deep channel is constructed, while the balance of the project up to 100 feet is delayed until a clear-cut need arises.

REFERENCES

TAMU

REFERENCES

1. Arthur D. Little, Inc., "Potential Onshore Effects of Deepwater Oil Terminal-Related Industrial Development: Volume III of IV - Gulf Coast-Louisiana and Texas," Council on Environmental Quality, Washington, D. C., October, 1973.

2. Bragg, Daniel M. and James R. Bradley, "The Economic Impact of a Deepwater Terminal in Texas," Sea Grant Report TAMU-SG-72-213, Texas A&M University, College Station, Texas, November, 1972.

3. Eyre, John L., et. al., "Measuring Port Sales," The American Association of Port Authorities, Washington, D. C., undated.

4. Litton Systems, Inc., "Oceanborne Shipping: Demand and Technology Forecast," Department of Transportation, Washington, D. C., June, 1968.

5. "Louisiana Superport Studies-Report No. 1: Preliminary Recommendations and Data Analysis," Sea Grant Report LSU-SG-72-03, Louisiana State University, Baton Rouge, Louisiana, August, 1972.

6. Personal correspondence with Mr. Peter A. Hakman, Vice President, Soros Associates, New York, New York, dated January 17, 1974.

7. "Report of the Galveston Wharves to the Texas Offshore Terminal Commission," Austin, Texas, October 30, 1973.

8. "Report on Gulf Coast Deep Water Port Facilities, Texas, Louisiana, Mississippi, Alabama, and Florida," U. S. Army Corps of Engineers.

9. Ridker, Ronald, "Population, Pollution and Resource Adequacy," Annual Report 1972, Resources for the Future, Inc., Washington, D. C., 1972.

10. Robert R. Nathan Associates, Inc., "U. S. Deepwater Port Study," Institute for Water Resources, Corps of Engineers, Department of the Army, Washington, D. C., July, 1972.

11. Rose, Warren, "The Port of Galveston: Employment and Income Impact," Houston, Texas, February, 1970.

12. "Rotterdam-Europoort," Municipal Press and Information Services, City Hall, Rotterdam, Holland, 1971.

13. Ryan, Robert H. and C. W. Adams, "Corpus Christi: Economic Impact of the Port," Bureau of Business Research, The University of Texas at Austin, Austin, Texas, August, 1973.

REFERENCES (Continued)

14. Schenker, Eric, "Impact of the Port of Green Bay on the Economy of the Community," Sea Grant Report WIS-SG-72-216, University of Wisconsin, Madison, Wisconsin, November, 1972.

15. Soros Associates, Inc., "Offshore Terminal System Concepts," Maritime Administration, U. S. Department of Commerce, Washington, D. C., September, 1972.

16. "The Economics of Deepwater Terminals," Maritime Administration, U. S. Department of Commerce, Washington, D. C., 1972.

17. "Two More Environmental Shoes Will Drop," The Houston Chronicle, December 26, 1973.

18. United States Maritime Administration, "Port Development Expenditure Survey," United States Department of Commerce, 1973.