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DEEP-DRAFT NAVIGATION USER CHARGES: RECOVERY OPTIONS AND IMPACTS

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16. Abstract

Alternative cost recovery options for Federal deep-draft navigation expenditures are investigated and the impacts of user charges on waterborne trades and commodity traffic, both foreign and domestic (Great Lakes and coastwise), are assessed. In addition, the foreign experience in port governance, pricing, and investment policies is examined, including representative levels of port-use fees. A detailed commodity traffic analysis for petroleum, grain, coal, iron ore, and general cargo has revealed that 100-percent recovery of total Federal deep-draft costs by uniform (on vessel or cargo tonnage for example) user charges will not substantially disrupt domestic or foreign waterborne traffic levels or patterns. However, port-specific user charges can significantly affect future port development and traffic levels in certain smaller and more costly ports, and encourage port consolidation. Action by domestic overland carriers, waterborne carriers, and shippers may act to minimize any adverse impacts. For traffic which navigates both inland river and coastal ports, effects of potential double (shallow- and deep-draft) user charges are examined. In general, a vessel-based system use-recovery approach will tend to minimize impacts across waterborne trades and commodity flows as well as traffic using both shallow- and deep-draft systems.

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PREFACE

The development of a consistent and equitable approach to the recovery of all Federal deep-draft expenditures was mandated by Section 80(c) of the Water Resource Development Act of 1974. The U.S. Department of Transportation initiated an analysis of alternative cost recovery options as well as traffic and carrier impacts of user charges during May 1975. This report represents one of a series of studies conducted to determine modal traffic and regional impacts of imposing user charges on the U.S. shallow- and deep-draft navigation system. The information provided by these studies will be used by Government and industry to help shape future transportation policies and aid in public resource allocation decisions across Federal programs.

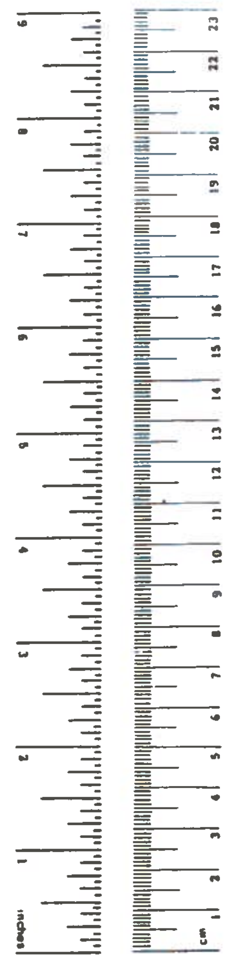
Work to date has focused on the evaluation of various Federal cost recovery options, such as fuel taxes, segment tolls, lockage fees, and vessel-based license fees. Relative impacts of alternative user charges on both waterborne commodity movements, alternative distribution systems, and regional economies have also been determined. In addition, specific issues associated with deep-draft navigation user charges have been examined, including optimal recovery methods and allocation of cost payback among domestic and foreign traffic types. Domestic traffic impacts concentrate on Great Lakes, coastwise, and internal movements in the U.S. port system.

The report was prepared by the National Transportation Research Division of the U.S. Department of Transportation, Transportation Systems Center in Cambridge, MA. The study was sponsored by Dr. Philip E. Franklin, Chief, Special Projects Division (TPI-34) in the Office of the Secretary, Washington, D.C. Cooperation of the U.S. Coast Guard and Army Corps of Engineers is acknowledged and appreciated.

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
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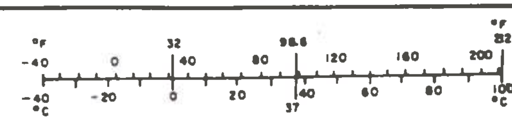

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EXECUTIVE SUMMARY

The United States currently assesses a tonnage tax on up to five visits per year to the port system by a vessel engaged in the U.S. foreign trade. In addition, specific port user charges set to recover public and/or private investment in navigation-related facilities have substantial precedence in both the U.S. and foreign experience. Use-related fees in U.S. ports consist of local authority cost recovery coupled with private wharfage, lading, stevedoring and other costs associated with cargo handling. At present collection levels, the Federal tonnage tax recovers less than five percent of total Federal deep-draft navigation expenditures. Further, the current tax applies only to vessels in foreign trade, excluding domestic coastwise and Great Lakes vessels from cost recovery. The development of a consistent and equitable approach to recovery of all Federal deep-draft costs was mandated by Section 80(c) of the Water Resource Development Act of 1974. The following study examines the major issues associated with the introduction of full Federal deep-draft cost recovery.

Section 1 investigates a number of specific issues and practices related to foreign and domestic port operation. Initially, U.S. port governance policies are examined. It is found that the division of Federal versus non-Federal responsibility is unique among maritime nations. Private interests develop shoreside port facilities while the Corps of Engineers maintains the harbor area, including channels, basins, etc. Specific port-related data on berths, including lease and rental arrangements for shippers, are examined. Foreign port operations differ substantially from the U.S. experience. Port development is often totally coordinated by Federal or national-level agencies. In order to recover part of operating costs, foreign nations levy a complex set of fees on activity within the port. Port-financing questions are then examined, including a discussion of local financing and self-supporting ports. Finally, issues of consolidation of port activity into "load center" ports and the development of very deep-draft (greater than 100-foot channels) ports are explored.

Section 2 describes the Corps of Engineers and Coast Guard deep-draft navigation expenditure data used in the study. The Corps data are available at both the national and port-specific levels. The Coast Guard provided expenditures at the national and district level only. The Corps port-specific data are for operations and maintenance expenditures only although nationwide implementation data were provided. Total Federal deep-draft expenditures averaged 197-million dollars per year during the

fiscal year 1971 to 1975 period compared to over $300-million per year expended by the Federal government on the shallow-draft (inland) system. Port-specific expenditures for Corps of Engineers projects represent major U.S. coastal and Great Lakes facilities that account for over 98 percent of total U.S. commercial waterborne tonnage in recent years.

In Section 3, a variety of user charge options for deep-draft cost recovery are identified, sample tolls are estimated, and generic impacts outlined. Issues of expenditure allocation and international channels are also discussed.

First, a system-use fee approach based on the existing foreign trade tonnage tax structure is outlined. This approach taxes foreign trade vessels on the basis of volumetric capacity (net register tonnage) for each voyage into the U.S. customs area. For user charge purposes, certain changes in that structure are recommended, including uniformity of fee per n.r.t. regardless of itinerary, and an increase in the maximum annual payments per vessel to 10 to 15 transactions (only the case of 15 is analyzed). Extension of the approach to domestic deep-draft vessels is also outlined in the form of a vessel registration fee--based directly on the foreign trade fee levels to preserve equity between traffic classes. The estimated fee per voyage (up to 15 per year) for foreign trade vessels is 46 cents per n.r.t. for recovery of Federal OM&R expenditures and 60 cents if new construction expenses are included, with domestic service vessels paying an annual charge equivalent to 15 voyages. This amounts to 20 to 25 cents per long ton of capacity for bulk carriers, and 10 to 15 cents per measurement ton for general cargo vessels, depending on vessel utilization levels. Vessels making more than 15 voyages per year (including domestic trades) face lower effective impacts.

Next, harbor and channel use fees are discussed. This option, with the greatest precedent in existing world practice, taxes each use of a harbor channel as opposed to each voyage. While existing data prohibit calculation of sample tolls for this option, certain generic impacts are pointed out. These include an increased burden on general cargo traffic in secondary ports and consequent pressure for more consolidation of container activities in load center ports, and a larger burden than a system use fee on domestic traffic. Reduced tolls for coastal and lakewise traffic are a solution to the latter, but not the former problem.

Cargo taxes, which tax the lading and discharge of cargo in a manner similar to existing wharfage charges assessed at marine terminal facilities, are the third approach. A uniform cargo tax of 13 cents per short ton is estimated.

Because this impacts domestic traffic doubly (once for lading and again for discharge), an alternative which taxes domestic cargo at a rate one-half that for foreign cargo is also estimated. That approach requires a charge of 18 cents per short ton for foreign cargo and 9 cents for a lading or discharge in the domestic trade. Port-specific lading taxes are also calculated, and it is found that the variability of fee levels between ports is much lower than that found for inland waterway segment tolls although dike disposal costs make Great Lakes port costs significantly higher than average.

The final Federal tax option discussed is a fuel tax. After noting that the tax would be infeasible and/or ineffective for foreign trade vessels, its impact as a recovery mechanism for domestic coastal activity is discussed. Recovery of one-third of total deep-draft costs through a tax on domestic deep-draft tanker fuel would require a tax of about $1.80 per barrel. This would have a considerably higher cost impact per ton than the system use or cargo tax approaches although adjustments in recovery proportions could bring about more parity between the options. Other problems with the fuel tax are noted. First, there is little (or possibly a perverse) relationship between facility use and fuel tax liability. Secondly, segregation of diesel fuel bunkered in the inland system and the deep-draft system would be required since different tax levels are appropriate with severe equity problems resulting if both pay the same.

Finally, local responsibility for port development, as an alternative to continued Federal expenditure is briefly treated. Significant jurisdictional problems make this approach impractical at this time, but its feasibility as a long-run solution is suggested.

Section 4 details traffic patterns in major U.S. coastal lakes and foreign trades that use Federally maintained port facilities or channels. Foreign trade accounts for the majority of tonnage handled at U.S. ports (over 60%), and consists primarily of crude petroleum and petroleum products, iron ore, chemicals, and steel products. Coastal and lakewise traffic also constitute significant traffic, particularly in petroleum, iron ore and coal. In general, general cargo accounts for less than 10 percent of total waterborne foreign commerce although such cargo is high-valued and generates substantial carrier revenue.

Section 5 examines the impact of a uniform cargo-based deep-draft cost recovery tax on the U.S. petroleum distribution system. Total tonnage on the U.S. deep-draft system is dominated by the shipment of energy-related products. In

1975, crude petroleum, residual fuel oil, distillate fuel oil, and gasoline accounted for 68.1% of imports and 73.3% of coastwise shipments. The effect of a deep-draft user charge on these four commodities was analyzed to determine potential modal diversion due to changes in relative modal costs and price increases in final markets where petroleum products are consumed.

Imports consist mainly of crude oil necessary to supply about a third of U.S. refinery demand while domestic coastwise traffic is oriented toward product shipments. A modal overview indicates that in general significant head-to-head competition exists only between pipeline and coastal tanker. For specific movements barge rates average 2 to 2-1/2 times pipeline rates while rail rates may be 7 times those of pipeline. Barge is fairly extensively utilized as a peak-load delivery system to handle shipments in times of excessive demand when pipeline capacity is not adequate and also as the most feasible mode of transport when shipping to small facilities where annual volume requirements do not warrant the construction of a pipeline. In the latter case, if these facilities are not served by water, rail is the only viable mode of transport (it is insignificant at the national level except in the case of residual fuel oil which is too viscous to move by pipeline). Tanker contract rates are quite competitive with pipeline rates to East coast ports; tankers ship large volumes of both crude and products to centers of high demand along the Eastern seaboard.

There will be no diversion of petroleum tanker and barge traffic at deep-draft ports as a result of the imposition of deep-draft user charges. Imports will continue since U.S. production of crude oil is not sufficient to meet refinery demand --the price of foreign crude is already well above the domestic crude price and the user charge will have a negligible effect on this differential. Domestic shipments should not be reduced from their current level (as a result of user charges). Pipelines are operating near full capacity and companies have already undertaken additional expansion where feasible. Increased capacity now requires major new investments which should not be induced by a minor shift of 2.8 to 4.2 cents per barrel in relative modal costs. Dramatic changes in modal costs would be necessary given the uncertainty in future petroleum markets with regard to growth rates in regional demand and independent action by OPEC that may have major consequences. Also, large fixed investment in tankers and unloading facilities will insure that throughput is maximized in the short run. In the long run, required maintenance expenditures to handle foreign traffic will permit U.S. coastwise shipments to be handled at only marginal expense.

Price increases on all petroleum traffic reaching its consumption site via a coastal port will be 2.1 to 4.2 cents per barrel. Refineries on the East coast will see increases of 2.1 to 2.8 cents per barrel on their input costs since they receive all crude oil by water (mostly imported). PADD V faces about a 1.0 to 2.0 cent per barrel rise in the average impact at refineries along the West coast. There is no effect in PADD IV. The Crude Oil Entitlement Program will soften regional differentials in input costs by attempting to equalize the cost of crude oil at the refinery gate but the East coast will still remain the most heavily impacted and the Rocky Mountain region the least affected.

Product price increases have been calculated as "worst-case" impacts for consumers which receive 100% of petroleum products via coastal ports. The major markets utilizing residual fuel oil, distillate fuel oil, and gasoline were examined and percentage increases in output costs were determined.

Electric utilities consuming residual fuel oil would pass on a user charge as a 0.06% to 0.12% increase in electricity prices. Heating bills for commercial facilities burning residual fuel received by water would increase by 0.16% to 0.31%. A sampling of energy-intensive industries demonstrated that the rise in the cost of production operations due to small increases in residual fuel costs would be miniscule.

Distillate fuel oil is consumed mostly in the heating of households and commercial facilities. Those consuming only distillate fuel oil by water would face a 0.14% to 0.28% increase in their heating bill. Price increases in diesel fuel would result in a 0.01% to 0.02% increase in both trucking and railroad costs. Impacts on electric utilities and vessels would be identical to those calculated for residual fuel oil.

Gasoline shipments constitute the largest percentage of coastwise shipments. Prices at the pump would increase by 0.08 cent per gallon or about 0.15%.

National average price impacts are substantially less than those noted above since only a portion of the products move via a coastal port. If crude petroleum is shipped coastwise instead of refinery output, then "worst-case" price impacts on products will be softened due to the Crude Oil Entitlements Program.

Traffic impacts on corn, soybeans, and wheat (which represented 31% of U.S. exports in 1975) are analyzed in Section 6. Most of the corn and soybeans entered the world market via the Gulf coast (particularly from ports between Baton Rouge and the Mouth of Passes) and the Atlantic coast (Norfolk, Baltimore, and Philadelphia). Wheat is generally shipped through the Texas ports (in addition to New Orleans) and the Northwest.

Two scenarios regarding the grain and soybean export market were examined. In the first case, the export price was held constant and the burden of the user charge entirely on the domestic market. It was assumed that there is no excess profit in the domestic distribution system due to intense competition among export elevators, transportation carriers, processors, inland elevators, etc. This leads to the conclusion that no segment of the market has the absorption capacity to pay any of the additional expense except the farmer so he must bear the entire tax. Farmers would thus see a decrease of 1/2 cent per bushel in their income. An effort to assess the impact of this change on farmer prosperity demonstrated that with "normal" levels of profit the effect would be negligible.

In the second case, the full tax was added to the export price in an attempt to force foreign countries to pay the additional transportation costs. This scenario is justifiable given the importance of the U.S. role in the world market for grain and soybeans. The demand for U.S. crops is not totally inelastic however and a price increase would mean a small reduction in the total level of exports. The total demand for U.S. production (domestic plus foreign) would decrease by a small fraction so that prices received by farmers would slightly decline. Again farmers would bear the entire burden of the user charge but the impact on income would be minute.

The actual outcome of imposing deep-draft user charges would probably lie somewhere between the two scenarios --a small increase in the export price would occur while the domestic market would pay the majority of the new expenses. As a result, farmers' incomes would fall by a fraction of a cent per bushel. This would only have a significant impact on farmer prosperity when a very small margin is being earned on production. The price fluctuations generating low profits in the market are many times more significant than the 1/2 cent per bushel necessary to recover deep-draft expenditures.

Port-specific taxes were also considered. Within a single coast, cost differentials would make the cheaper ports more attractive resulting in congestion problems while the relatively more expensive ports would lose traffic causing under utilization of capital with large fixed investments such as elevators, transfer equipment, etc. The economics of the situation dictate that pricing structures would equalize through adjustments in railroad rates, charter rates, elevator charges, etc. so that relative throughput at each port would return to its original level.

Section 7 examines iron ore traffic impacts. Iron ore shipments account for over half the tonnage moving on the Great Lakes. Large quantities of iron ore are mined in northeastern Minnesota and the upper Michigan peninsula and shipped via lakes bulkers from the Upper Great Lakes ports to Lower Lakes ports for consumption at iron and steel facilities or transshipment to inland plants.

The alternative to the current distribution system of rail-bulk or rail-bulker-rail is shipment by rail direct from mine to plant. A comparison of relative modal rates demonstrates widespread differentials (up to $12.00 per ton) between the alternative routes. Modal diversion does not appear to be a possibility. Extensive vertical integration in this industry increases the likelihood that the distribution system will not change.

Assuming a uniform cargo tax, the increased cost of handling each ton of iron ore on the Great Lakes would range from 13.5 to 27 cents per ton. This amounts to a 0.3% to 0.6% increase in the delivered price of iron ore pellets at Lower Lakes ports. The price increase for final products would be substantially less - given that the current average price for one ton of steel product is about $350.00, the increase due to deep-draft user charges would be 0.04% to 0.08%.

Section 8 discusses impacts on export and coastwise movements of bituminous coal. Effects on export coal prices were found to be less than one-half of one percent, with the increase likely to be paid by foreign consumers due to inelastic coal export demands. For domestic utility coal movements on the Great Lakes, a toll of as little as 25 cents per ton on Lakewise bulk flows may alter the competitive position of lake versus rail final delivery. Lakewise coal traffic to U.S. utilities has been declining in recent years due to rail unit-train competition. Recent ICC rulings however may offset the user charge impacts by reducing pre-Lakes rail rates to Lake bulk-loading facilities. Finally, coastwise movements of coal would experience a delivered price increase of less than one-half of one percent at New Jersey utilities (the only plants receiving coastal coal flows at present) under 100-percent deep-draft cost recovery. A major combination inland river and cross-Gulf coal flow to Tampa utilities would face higher prices but modal shift is impractical since the utility owns the entire distribution system. If user charges are imposed for both deep- and shallow-draft systems, the transportation costs to the utility will rise by over 20 percent.

The impacts of user charges on general cargo trades is discussed in Section 9. Potential losses in liner trade (imports or exports) as a result of user charges are found to be negligible. Average price increases on the order of 0.01-0.02 percent (depending on toll option) are indicated, and even the small losses in trade resulting from these increases would tend to be minimized by liner value-of-service pricing practices. Since both imports and exports would be impacted, the balance of trade would be basically unaffected.

Traffic redistribution among ports is indicated as a possibility as a result of user charges, particularly for containerized traffic. While this phenomenon would not be a significant factor under a system-use fee or cargo tax approach, it could play a more significant role under a port-use approach under which carriers would strive to consolidate vessel calls in ports which yield greatest revenue per visit. Service frequency in ports with lower volumes of liner traffic could fall dramatically although precise estimates are not possible without port-specific vessel activity data for such ports. Port-specific charges - especially port use fees - would quite probably impact the viability of Great Lakes container operations. Whether this traffic would divert to Canadian or U.S. North Atlantic ports may well depend on the success of such new approaches as rail bridge from Great Lake Ports - initiated recently by Seatrain.

A final potential issue is the equitability of different options for operators using different container logistic approaches. Encouragement for rail-bridge services and possible dramatic negative impacts on carriers using feeder service and LASH are indicated for some options --the magnitude of such tendencies being dependent on the choice of toll options, and the share of expenditures earmarked for collection from domestic service vessels. Avoidance of these biases between different technologies is possible by careful structuring of recovery mechanisms.

Finally, Section 6 examines the impact of charging shallow-draft traffic for operations in deep-draft ports.

Although a substantial amount of U.S. waterborne traffic operates in both shallow-draft rivers and deep-draft ports, the impacts on these flows of combined shallow- and deep-draft navigation cost recovery are not substantially different from those reported in the inland waterway user charge study. However, the combinations of separate shallow- and deep-draft fee structures appear administratively complex and very difficult to implement. For example, assume segment tolls on the inland system and a cargo-based port charge for deep-draft navigation are the options. The utility coal flow from Kentucky to Tampa would pay three separate inland segment tolls, two deep-draft tolls at New Orleans and one at Tampa Bay. In that transportation data bases are still quite primitive in identifying the total movements within a distribution system, the difficulties of even reporting flows (much less charging them tolls) is obvious.

An alternative approach in the form of a combination vessel licence fee for both shallow- and deep-draft systems would simplify user charge administration greatly. Without having to know exact transportation flow information by water, barges and vessels engaged in waterborne trades (already registered with the Coast Guard) could serve as the tax unit. Future user charge studies should investigate such a combination tax scheme as a method for assuring equity between deep- and shallow-draft waterborne traffic.

1. INTRODUCTION

1.1 BACKGROUND AND SCOPE

The navigable waterways of the United States are defined as "water bodies which are presently, or have been in the past, or may be in the future, susceptible for use for purposes of interstate or foreign commerce."[1] As such, they include the inland waterway system -- channels, locks and dams, and harbors in Mississippi River and tributaries system, the Gulf Intracoastal Waterway, the Warrior River system, the Atlantic Intracoastal Waterway, the Columbia-Snake system and certain other minor shallow-draft rivers -- and what we shall refer to as the deep-draft navigation system. This latter system is composed of the coastal and Great Lakes harbors (entrance channels, turning basins and anchorages, break waters, etc.) and the connecting channels between these harbors and open water or between stretches of open water -- e.g., the Detroit River, channels in Lake St. Clair, the Sacramento Deepwater Ship Channel, the Passes of the Mississippi River, the Hudson River, the Cape Cod Canal, etc. The deep-draft system also is defined here to include those coastal and Great Lakes shipping lanes served by Coast Guard aids to navigation.

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[1] U.S. Army Corps of Engineers, Digest of Water Resources Policies and Activities, EP 1165-2-1 (Washington, D.C.: GPO, 28 December, 1972), p. A-62.

The distinction between the inland waterway and deep-draft systems is somewhat arbitrary and cannot be made in terms of depth or purpose or location alone. The Mississippi River at and below Baton Rouge has a project depth of 40 feet and is one of the busiest ocean ports in the United States, and yet is at the same time a link in the Mississippi River-GIWW barge system.[1] Conversely, many coastal rivers (e.g., the Connecticut River below Hartford or the Thames River, CT.) serve either as "elongated ports", shipping and receiving foreign and coastwise traffic, or as appendages to ports, interacting with a coastal port at the mouth, but not with the rest of the "inland system."

Nor is depth itself an adequate metric for classifying projects. A draft criterion would place many coastal harbors (commercial cargo, fishing, and recreation) together with the inland waterway system, even though they functionally resemble the deeper-draft harbors -- i.e., they are generally "point" projects (not system links) which interact with other ports, but whose commerce may involve significant movement in open waters beyond Government-maintained channels.

Earlier TSC studies have dealt with the issue of inland waterway user charges, concentrating on the contiguous river system consisting of the Mississippi River and tributaries, GIWW, and Warrior River systems. The present study deals with

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[1]The barge traffic might be said to use the waterway (the river), but not the CoE project which is maintained for the benefit of deeper-draft vessels.

the remaining commercial navigation projects, with special emphasis on ports and connecting waterways whose major channels exceed 20 feet. As noted above, the divisions imposed by the analysis are artificial,[1] and the decision whether to implement user charges and what collection option to utilize requires examination of how the alternatives affect each "system", since it is impossible to segregate traffic operations. For example, a fuel tax on diesel bunker fuel would fall on harbor and coastwise tugs burning this fuel as well as river towboats. It would be extremely difficult to institute an inland waterway fuel tax without extending that option to the rest of the system. Therefore, this study will also examine issues of shallow- and deep-draft systems interactions.

The present study will not extensively treat the numerous shallow-draft coastal harbors which serve primarily fishing and recreational activity. There are several reasons for this omission. In the first place, these activities are beyond the scope of TSC's expertise. Secondly, Federal maintenance on these projects is typically infrequent, and, as a result, the expenditure data available at the time of this study are inadequate for representing the average annual costs of such harbors.

[1] In addition to empirical reasons concerning the availability of traffic and expenditure data and the fact that user charge analyses have historically focused on the inland river system in isolation, the TSC analysis was segregated because the Mississippi River system is a set of highly interactive projects, qualitatively different from the coastal port system which consists predominately of individual projects which interact with the rest of the world at least as much as with each other. Additionally, while some inland water options such as a fuel tax have definite implications for the deep draft system, others such as the lockage fee are unique to the river system.

The remaining subsections of the chapter deal with a number of specific issues and practices related to both domestic and foreign port operation. Questions of port governance and maintenance/development responsibilities are followed by an examination of financing arrangements in foreign ports. Finally, trends towards port consolidation and self-supporting (user-pays) ports are examined.

1.2 PORT GOVERNANCE IN THE U.S.[1]

Functionally, a port is made up of a sheltered harbor (approach channels, turning basins, anchorages, and breakwaters as well as non-channelized areas) and landside terminal areas (berths, docks and wharves, cranes and unloading equipment, warehouses and storage areas, inland transportation receiving facilities, etc.).

The division of Federal and non-Federal responsibility within U.S. ports is unique among major maritime nations.[2] While the Federal government does not engage directly in the development and operation of shoreside port facilities, the Army Corps of Engineers does generally perform the construction and maintenance of "waterside" or harbor projects (channels, basins, etc.) in most ports. (The dredging of

[1] Ports may be defined narrowly as the loci of vessel terminal activity (including approach channels), or more broadly to include the immediate economic areas surrounding these transportation facilities. In this discussion, the limited transportation definition will dominate although the important interactions between the port and its immediate economic area, regional hinterland, and, for some traffic, the national economy are recognized.

[2] Foreign practices with respect to port development and financing will be discussed briefly below.

berthing areas and access channels from the main authorized channel is a local responsibility.) Appendix A lists the identifiable Army CoE projects (and non-project harbors) in the coastal (including non-contiguous) and Great Lakes areas. Much of Coast Guard activity in support of maritime commerce is also "offshore" - aids to navigation, ice-breaking, vessel traffic systems - but this agency also bears certain environmental and cargo security functions (basically regulatory) which cross the shoreline.

Decisions with respect to facility development and operations are made at the non-Federal level. The vast majority of the 150 to 200 commercial ports in the United States are governed by non-Federal bodies such as state and local governments, with the remaining few developed by private corporations.[1] These non-Federal institutions may exercise authority over a wide variety of functions from the simple development and operations of maritime transshipment facilities to the supervision of facilities unrelated to the maritime industry (airports, bridges and tunnels, industrial parks, rapid transit systems, etc.). Similarly, the geographic scope of the port organization ranges from the local authority which may be responsible for developing a limited portion of the waterfront

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[1] The following paragraphs on port governance are substantially paraphrased from Port Development in The United States, A Report by the Panel on Future Port Requirements in the United States, Maritime Transportation Research Board, National Research Board, National Research Council (Wash., D.C.: National Academy of Sciences, 1976), p. 40-41.

within a municipality, county, or special district to the state or multi-state authority which is responsible for siting and developing port facilities within a larger, possible multi-port, area. Within these extremes, the governing body of the port may be a departmental unit of the city, county, or state government (e.g., as an agency of the State D.O.T. as in Maryland), or it may exist as a special-purpose district (as in Virginia) which may have independent taxing power.

While these non-Federal governmental bodies own and operate facilities and exercise varying degrees of regulatory control within their respective port areas, there are also a large number of privately owned and operated facilities within those same harbor areas. Table 1 indicates that an estimated 60% of U.S. port facilities are owned by private, profit-making organizations - most of which are for the exclusive use of the proprietor in handling a limited number of bulk commodities (often only one) as an integral part of a corporate logistics system. Publicly owned terminal facilities, on the other hand, are dominated by general cargo facilities. Of the almost 800 million dollars of expenditures on facilities by public port agencies between 1966 and 1974, only 16.5 percent went for bulk cargo facilities.[1]

The operating practices of publicly owned port terminal facilities vary as shown in Table 2. In smaller ports, where no single carrier's traffic is sufficient to justify operation of (or exclusive access to) general cargo facilities,

[1]Maritime Administration, Ibid., p. 11.

TABLE 1

OWNERSHIP OF U.S. PORT FACILITIES

Type of Ownership	Number of Terminals (Estimate)	Percent of U.S. Total (Estimate)
Private (profitmaking organizations)	1,488	62.0
Local government agencies	576	24.0
State government agencies	288	12.0
U.S. Government agencies (non-military)	43	1.75
Private (non-profitmaking organizations)	6	0.25
	2,401	100.00

Estimates are extrapolated from data contained in Joint Economic Committee, the Congress of the U.S. State and Local Public Facility Needs and Financing, Volume I, Chapter 15, Marine Port Facilities, December 1966, prepared by the Maritime Administration, pg. 332.

Source: Maritime Administration, Public Port Financing in the United States, June, 1974, p. 3.

TABLE 2

BERTH OPERATING PRACTICES AT SELECTED U.S. PORTS

Small Ports	Total Berths	Exclusive Lease	Preferential	Open
Buffalo, N.Y.	8	0	0	8
Providence, R.I.	8	0	1	7
Wilmington, Del.	8	0	0	8
Gulfport, Miss.	7	0	0	7
Brownsville, Texas	9	0	0	9
Vancouver, Wash.	9	0	0	9
Medium Ports				
Toledo, Ohio	11	10	0	1
Cleveland, Ohio	11	7	0	4
Philadelphia, Pa.	30	30	0	0
Baltimore, Md.	28	0	18	10
Hampton Roads, Va.	21	19	0	2
Savannah, Ga.	19	0	0	19
Jacksonville, Fla.	15	2	2	11
Galveston , Texas	37	0	20	17
Houston, Texas	29	0	3	26
Oakland, Calif.	18	11	4	3
San Diego, Calif.	16	0	0	16
Large Ports				
New York/New Jersey	90	71	0	19
New Orleans, La.	88	0	82	6
Long Beach, Calif.	45	0	45	0
Los Angeles, Calif.	86	0	86	0
San Francisco, Calif.	80	0	63	17

Data compiled from Committee II, Standardization and Special Research, American Association of Port Authorities, Survey Questionnaire on Leasing Practices at U.S. Ports, October, 1964.

Source: Public Port Financing in the U.S., ibid. Pg. 5.

public authorities tend to operate terminals on an open berth (common carrier) basis, assigning berths on request and collecting fees for the number of days on berth (dockage) tons moved through the facility (wharfage), and other services (pilotage utility charges, etc.). In larger ports, where service frequencies by a single carrier require almost full-time access to berth space and significant storage areas, the port authorities often contract their facilities (or land) to a specific tenant - often a steamship operator or stevedoring company - and charge an annual rental fee.

Finally, there are a handful of private or non-project ports operating in the U.S. These ports are typically owned and operated by a single, bulk shipper who not only operates the specialized terminal facilities, but also maintains any harbor channels. (Aids to navigation, as well as certain environmental functions, bring some Federal responsibility to these ports.) Examples of the type of port include Taconite Harbor and Silver Bay (Minnesota ore shipping ports) and Encina and Ventura (California petroleum ports). Although these ports require no direct Federal expenditures for channel or harbor maintenance, questions arise as to whether traffic using non-project harbors should be charged a fee for Coast Guard functions that benefit navigation. The issue will be examined in Section 3.

1.3 FOREIGN PORT DEVELOPMENT

As noted earlier, the United States is virtually the only major maritime nation in which harbor channel maintenance is the responsibility of the National government, while the construction and operation of terminal facilities remain a local or private concern. The aforementioned MARAD study of public port financing briefly reviews the role of the national government in the port industries of Japan, Great Britain, France, the Netherlands, Australia, and Canada, and reports that "(i)n almost all of these settings, there is some degree of control of the port industry's capital and development projects by the central or federal government."[1] In France, for example, where six autonomous port authorities administer the major ports, the national government finances 80 percent of expenditures on major installations such as construction of locks, wharves, fairways and channels, and 40 percent of secondary improvements such as wharf extensions. Also, "(w)hile the state finances all maintenance requirements in the port, the Port Autonome is responsible for the financing of all dockside installations out of wharfage revenues."

In Great Britain, the state-owned British Transport Docks Board (BTDB) manages 20 nationalized ports (formerly owned by railroads) in competition with ports administered as local public utilities (as in the U.S.). A National Ports Council, which is entrusted with the development of national port plans, enjoys a consultative role in any port improvement prior to the commitment of any government assistance.

With respect to the subject of this user charge study, little if any information is available concerning the degree to which user fees in foreign ports are sufficient to recover

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[1] Ibid. P. 55.

expenditures by local and federal interests. In each port, U.S. or foreign, a variety of charges are made on vessels and cargo utilizing port facilities.[1] Daily dockage fees (usually based on some metric of ship size - net revenue tonnnage, gross revenue tonnage, or length) are charged for use of berth space. Wharfage fees, which may vary for different commodities or commodity forms (dry bulk, liquid, etc.), are charged on a cargo tonnage basis for shipments loaded or off-loaded. These do not include stevedoring costs. In addition to the above charges, which are levied on uses of terminal facilities, most ports also collect some form of port dues for the use of the harbor itself - whether or not a public facility is used. In the United States,[2] vessels engaged in foreign trade pay a Federal tonnage tax (based on net registered tonnage) for each visit to the U.S. port system payable up to 5 times in any one year. The tax is 2 cents per n.r.t. if the ship enters U.S. waters from North or Central America or the Caribbean area (up to 10¢ per n.r.t. annually), and 6¢ per n.r.t. (up to 30¢ per n.r.t. annually) upon entry from any other port. This adds up to between $1000 - $3000 for a 10,000 n.r.t. vessel calling in the U.S. five or more times in one year. Additionally, there is a schedule of seldom-used punitive special tonnage taxes and light dues applicable to ships not meeting certain criteria, but from which the ships of most nations are exempt. Finally, there is a negligible navigation fee of $2.50 per visit to the U.S. port system on foreign trade vessels. None of these fees are charged to vessels in domestic service. Individual ports in the United States also publish schedules of pilotage fees, mooring fees, harbormaster dues, etc. which are chargeable to all vessels utilizing the harbor. Only the final item above - harbormaster dues - is not tied directly to service performed (e.g., pilotage), and these dues seldom exceed 25-50 dollars per visit.

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[1] In private ports or at private facilities, these charges are normally implicit, appearing in total product costs.

[2] 46 USC 121, 122, 128, and 145.

The United Kingdom charges a national light dues - ostensibly for recovery of expenditures for aids to navigation - on both domestic service and foreign trade vessels. The charge in 1971-2 was 3.9375 p (about 9¢) per-ton per visit for vessels in the coastal trade and 7.21875 p (about 17¢) per-ton for vessels in the foreign trade. Individual ports in the United Kingdom also publish schedules of harbor dues -- for one port a charge of £ .01 (about 2.5¢)/n.r.t. was found, while vessels visiting another harbor were charged 5 p (about 12.5¢)/n.r.t. for the first twelve voyages in a year and 3.75 (about 9¢) p/n.r.t. for each visit thereafter. These charges apparently are applicable to coastal as well as foreign trade vessels, and regardless of terminal facility used.

As a final example, Canadian harbors fall under several different central government jurisdictions, each of which publishes its own schedule of harbor dues. At the National Harbors, vessels pay 1.5 cents per n.r.t. for each entry into the harbor (half that amount for Canadian vessels entering from another Canadian harbor). This fee is paid by vessels in both foreign and domestic trades, except pleasure craft and Canadian fishing vessels, which are exempt. Interestingly there is also a fee for vessels which never leave the confines of the harbor (Table 3). Under this scheme, a (10,000 n.r.t.) vessel visiting Canadia once each month and calling at two ports each visit would pay $2400 in fees annually. That same vessel in the domestic trade making one port call per week would pay $3900. Finally, sick mariner dues are assessed at a rate of 2 cents per n.r.t. ($2 minimum) for the first three visits to a Canadian port.

In summary, some measure of central government involvements in port development is found in all major maritime nations. In most nations this extends beyond harbor development - as in the United States - into the planning and/or

TABLE 3

HARBOR DUES FOR VESSELS OPERATING WITHIN HARBOR LIMITS - NATIONAL HARBORS[1] 1971 - 1972

	Self-Propelled	Non Self-Propelled
Not over 50 n.r.t.	$25	$25
50 to 100 n.r.t.	50	35
Over 100 n.r.t.	250	65

[1]If vessel leaves and re-enters the harbor, an additional charge of 1/2 cent per n.r.t. is made for each re-entry.

construction and maintenance of terminal facilities.[1] Most ports in foreign nations levy a complex set of fees for both terminal and harbor use. It is not possible, however, given existing data and studies, to determine whether these charges are adequate to cover all port development and operating costs.

1.4 PORT FINANCES

The construction and maintenance of harbor facilities (channels, basins, etc.) are normally financed out of general Federal revenues through the civil works budget of the Corps of Engineers. There are notable exceptions to this rule. First, there are a few wholly private ports in the U.S. which, because they are not authorized Corps of Engineer projects, must develop their own navigation project. Secondly, a local jurisdiction will occasionally undertake to expand a navigation project within an existing project harbor and then turn it over to the Army for future maintenance. For example, the City of Los Angeles dredged the entrance channel to a depth of 52 feet up to the supertanker wharf, while the Port of Long Beach deepened its entrance channel to 62 feet to accommodate larger tankers. Both are now under Federal maintenance, although these two harbors traditionally require very little, if any, maintenance dredging.

Public port bodies are responsible for the financing of the terminals under their jurisdiction. Revenues are derived from a variety of sources including the various terminal user charges discussed earlier (dockage fees, wharfage, sheddage, harbor dues, etc.) as well as less traditional functions such as bridge fees, building rentals, airport fees, etc.

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[1] E.D.A. grants and loans to the port industry for public works programs and technical assistance ($100-million between 1965 and 1974) have brought the U.S. Government into shoreside development on a fairly modest scale.

Lease rentals from private terminal operators in authority-owned facilities are a common income source in larger ports.

Virtually, all public ports received some form of public subsidy - state or local - in the form of direct appropriations, tax-supported bonds, taxes collected by the authority, taxes levied by the local government in behalf of the authority, or indirect subsidies such as tax exemption and provision of local public services.

In most ports, the revenues from terminal operations are adequate to cover terminal operating expenses and at least some portion of capital costs. A study of the financial accounts of a "composite" port from a survey of 31 ports undertaken by the American Association of Port Authorities (AAPA) found an average net return on investment (before debt service) in the ports responding to the survey of 4%. The return after debt service was 1%.

Several caveats must be attached to these figures. First, the survey was performed in a period of major facilities construction in the U.S. port system. Thus, the gross investment based upon which rates of return are calculated has grown rapidly in recent years, while the full revenue potential of these capital improvements may not yet be realized. Thus, the two North Atlantic ports in the survey (Maryland Port Administration and Norfolk Port and Industrial Authority) show a level of gross investments in facilities (capital base) of $25.7 million and a capital expenditure in the survey year of over $5.00 million. These ports showed a net negative return to total investment after debt service. Another related factor which might be depressing returns to facilities' investments is the alleged overbuilding of the

[1]Ibid.

modern container facilities which comprise the greater part of recent terminal investments. Also, the accounting practices used to measure the capital base are not described in the MARAD report[1], so it is not known what facilities are included or how they have been valued.

On the other hand, the figures probably exaggerate the "profitability" of the ports by not accounting for indirect subsides to the ports such as those mentioned earlier.[1] Another factor which may tend to bias the apparent return to port facilities upward (although the opposite bias is possible) is the fact that the financial accounts are normally for all the functions of the authority, and not for maritime terminal operations alone.

No information is available on the profitability of investments in private (bulk or non-bulk) terminals whose operations and finances are inextricably entwined with their related production or logistics operations.

1.5 SPECIAL PORT ISSUES AND PROBLEMS

There are several trends and potentialities in the port sector which deserve a brief discussion in this introductory section. The most important of these has to do with the developing technological movement toward larger (deeper draft) vessels and the related consolidation of port activity into fewer "load center" ports. In the first place, the economics of the container revolution in the general cargo trades have led to ever-larger, deeper draft, and faster containerships whose high capital costs demand high utilization and

[1] Specifically, Army CoE port maintenance and Coast Guard aid to navigation expenditures.

rapid port turn-around for profitability. In addition to large shoreside terminal capital expenditures, the emerging technologies demand increased Federal investment in deeper, wider, and straighter approach channels in many ports.[1] To justify the large investments in land, terminal equipment, ships, and channels - and to develop the requisite utilization factors - it has become necessary to concentrate traffic in relatively few, highly efficient ports. As a result, ports such as Philadelphia and Portland, Oregon have suffered general cargo losses to load centers such as New York and Seattle.

Few ports wish to be left behind in these new developments, because it is feared that if a certain baseline level of activity, which requires significant expenditure in container facilities, is not maintained, then the ability of the port to attract vessel service adequate for even local needs will be damaged. This has led to an alleged overbuilding of container capacity in U.S. ports. If all these ports strive through local terminal development to remain viable container ports, increasing ship drafts may increase demands on Federal harbor-dredging activity, far beyond existing National funding levels. This would lead to a situation in which the Federal government would have more effective control (through the authorization process) over which ports could become primary load centers. An increased Federal role in port development decision-making has generally been eschewed by the port industry.

A second, similar development has been the increasing size of superships in the world fleet. "The typical tanker of the World War II period was 16,000 deadweight tons (commonly called the T-2 tanker). By 1966, a tanker of over 200,000 deadweight tons had been placed in service.

[1] Port Development in the U.S., Ibid., p.22.

Two years later, tankers exceeding 300,000 deadweight tons had been built, and in 1974 two tankers exceeded 400,000 deadweight tons, with ships of more than 500,000 tons on order and million-tonners under design."[1]

While terminal facilities for receiving these ships are normally a private concern, it has been noted that harbor channels for their movement into port areas are traditionally a Federal responsibility. Among all the ports on the U.S. mainland, only Puget Sound and Long Beach are capable of handling even moderate-sized supertankers (the former naturally, and the latter as a result of locally funded channel development). Most other large ports have channel depths of 35-50 feet or less, compared to the 60-100 foot drafts of the supertankers.

The potential development of offshore superports may make the question of deep-draft dredging for supertankers academic. Depending on the domestic distribution system (pipe or coastal tanker) developed in conjunction with these deepwater terminals, there might even be a reduced justifiable demand for dredging at existing project depths in some locations. While the offshore terminal may prove to be the solution for the supertanker's draft requirements, it does not appear to be a viable option for another class of super-ship - the "superbulker",which is capable of carrying ever-increasing volumes of dry bulk commodities. The world has already seen one of these vessels take on a partial load of wheat in the Columbia River and then continue on to Puget Sound for topping-off because the channel depths on the Lower Columbia are inadequate for the fully laden ship. The Maritime Administration has estimated that by the year 2000,

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[1] Port Development in the U.S., Ibid., p. 30.

TABLE 4

PROPORTION OF THE WORLD'S FLEET BY SHIP TYPE EXCLUDED FROM A PORT WITH A DEPTH OF 40, 50, and 60 FEET
(Percent of Total Number of Ships)

	General Cargo			Dry Bulk			Liquid Bulk (Product Tanker)		
Year	40	50	60	40	50	60	40	50	60
1975	*	*	*	27.5	*	*	30.0	*	*
1980	*	*	*	36.5	8.0	*	40.0	10.0	*
1985	*	*	*	42.8	12.0	*	42.5	13.0	*
1990	*	*	*	45.8	15.0	*	44.0	16.0	*
1995	*	*	*	48.6	17.5	*	47.0	18.0	*
2000	*	*	*	50.0	18.0	*	40.0	20.0	*

*Indicates less than five percent excluded.

Source: U.S. Department of Commerce, Maritime Administration, Office of Policy and Plans, "Projections of Ship Draft in the World's Merchant Fleet," July 1974 (Appendix 2).

fifty percent of the dry-bulkers in the world fleet will have a draft in excess of 40 feet, including almost twenty percent with a draft in excess of 50 feet. (See Table 4.) [The proportion of dry-bulk <u>capacity</u> in these draft classes would, of course, be much greater.]

The relevance of these trends to this study has to do with the fact that significant increases in Federal expenditure may be required in the near future for the creation of harbor channels capable of handling the new generations of ships - especially bulks and tankers - which only a few U.S. ports are presently capable of receiving. It is unlikely that such investments will be justifiable (or even affordable) in all the ports currently handling these classes of traffic. The question may then arise whether the Federal government should create and maintain some ports as load centers through an implicit subsidy of harbor development, while forcing other ports to decline to a secondary status by non-authorization of deeper channels as Federal projects. The situation would appear even more inequitable under a system-wide scheme of port user-charges which would essentially require the financing of the new, deeper channels in some ports by the traffic in all ports. Local funding of "super channels", as in the cases of Los Angeles and Long Beach discussed earlier, is one possible solution to this equity question, but this will be discussed in more detail when user-charge options are evaluated in a later chapter.

1.6 SELF-SUPPORTING PORTS[1]

General rules of economic efficiency in resource use imply that an investment in facilities be justified by an expected revenue stream that exceeds or at least matches capital investment and interest charges over the lifetime of the operation. Port investment, whether landside or harbor/channel expenditures has often been tied to national and international economic considerations, such as the competitive position of a country in world trade. Further, investigations into the foreign experience reveal no substantial information exists on the relation between port user fees and levels of National or local authority investment in facilities and harbors. Given that port fees are about half of ocean transportation fees and are one of the few "costs" a nation could vary to improve its competitive position in certain trades, it is doubtful that many world ports are truely self-supporting. Previous analysis (such as the United Nations report) has even extended the analogy between subsidy and development further. Citing potential reasons of national economic policy (beyond competitiveness in world trade), the question of whether port fees must cover all fair and reasonable costs of facilities and services, or be fixed on levels expected to produce best results for the economy as a whole, is raised (although left unanswered).

Since most ports collect some fees associated with use by vessels, various approaches to port-use charges have been developed. The remainder of the section discusses two analyses of the subject.

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[1] The following section is drawn from the United Nations Department of Economic and Social Affairs, Port Administration and Legislation Handbook. New York. 1969.

The procedure used extensively in the United States is the Frees formula. Frees proposes that users be assessed port fees on the basis of calculated (engineered) cost of providing facilities and service. In this manner, revenue collected may be used to pay off construction bonds, accrued interest, and direct costs of equipping the facility, over and above operating and maintenance charges. When actual usage fees are developed, provision can also be made for possible improvements and capital maintenance at replacement costs.

The United Nations report states that the overwhelming opinion appears to favor self-supporting harbor facilities. Many U.S. port authorities that use the Frees formula are self-supporting in that the general taxpayer does not contribute to actual facility construction and operation, only to harbor dredging and navigation safety expenditures. However, as previously stated, consistent data on foreign port payback versus expense for comparison are not available.

The United Kingdom studied British ports to determine whether they were adequate to meet present and future national needs and how maintenance or expansion of facilities would be accomplished. The Rochdale Report concluded that recovering costs in a manner similar to the Frees formula was fair and reasonable. In theory, ports are commercial ventures and should receive reasonable compensation for services (and resources) rendered to vessels and shippers. In other words, they should be self-supporting.

However, the Rochdale Report raised serious questions about the ability of the existing United Kingdom ports to be self-supporting. Whether overbuilding in the past is a factor that contributes to the current solvency issue is not directly addressed, although it is noted that the United Kingdom has over 300 ports, of which more than 40 handle over 400,000 tons per year. In conclusion, the report defined a viable port as one that could achieve certain minimum financial objectives; operating costs, interest on bonding or loans, depreciation and taxation. In 1964, the Institute of Transportation Journal reported that not a single British port met even these minimum financial payback criteria.

In summary, although the concept of self-supporting ports has economic appeal, the reality may be continued subsidy to meet broader objectives of national policy (e.g., foreign trade competitiveness). At minimum, any policy seeking cost payback of public funds invested in U.S. port facilities, including harbor dredging and safety expenses, should proceed slowly to allow sufficient analysis of impacts at each recovery stage.

2. FEDERAL DEEP-DRAFT EXPENDITURES

2.1 INTRODUCTION

During the last five fiscal years, Federal agencies have expended approximately 197-million dollars per year in maintaining and improving coastal and Great Lakes ports serving deep-draft navigation. Table 5 details National Corps of Engineers expenditures by year and location of activity. In comparison to deep-draft expenditures, shallow-draft system Federal costs averaged over 300 million dollars over the five year period. Deep-draft expenditures generally range from twenty-seven to thirty-one percent of total Federal navigation expenditures. Federal OM&R costs on both the shallow- and deep-draft system are expected to continue increasing faster than inflation over time due to low water on the inland system and diked disposal problems in harbors.

In Table 5, deep-draft (14'+) harbors are the major coastal and Great Lakes ports dredged to handle ocean-going or coastal vessels. Shallow-draft harbors are generally fishing ports but also include channels in certain major harbors such as New York with dredged depths of less than 14 feet. Great Lakes refers to improved (project) harbor and channel activity by the CoE in support of all navigation.[1] Non-project (private) harbors such as Taconite Harbor costs are not included. Small boat harbors are recreational boating facilities, mostly harbors of refuge and marinas, many located on the Great Lakes. Inland and intercoastal waterway expenditures refer to the Mississippi River system and tributaries, Atlantic and Gulf Intercoastal Waterways, Columbia River, besides other smaller projects.

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[1] These expenditures are already represented in the other four columns. They are included separately to show the major impact of diked disposal projects in 1974-1975.

TABLE 5

U.S. ARMY CORPS OF ENGINEERS
OPERATIONS, MAINTENANCE & REHABILITATION
AND CONSTRUCTION EXPENDITURES:

FISCAL YEARS 1971 TO 1975

Fiscal Year	Coastal: Deep-Draft (14 feet or greater)	Coastal: Shallow-Draft Coastal (less than 14 feet)	Small Boat	Inland and Intercoastal Waterways	Great Lakes (Included in other Columns)
I. OM&R					
1971	73,944,777	10,915,876	3,857,800	100,280,248	16,946,794
1972	86,611,158	13,126,707	2,720,550	102,462,525	18,635,955
1973	94,606,142	15,444,602	4,899,661	117,853,691	17,274,927
1974	106,124,074	16,600,642	11,244,299	152,968,476	24,953,541
1975	123,772,195	12,723,021	7,009,816	146,861,318	57,649,845
II. CONSTRUCTION					
1971	48,811,274	3,273,488	952	194,668,758	3,384,475
1972	46,695,168	3,694,263	6,253	214,170,125	5,277,335
1973	51,265,759	6,147,185	10,937	185,945,367	3,846,494
1974	38,283,050	10,090,862	142,128	195,686,455	7,625,675
1975	39,556,881	15,217,190	900,154	222,508,734	5,956,380

III. TOTAL

	ALL PROJECT TYPES: OM&R	ALL PROJECT TYPES: Construction	ALL PROJECT TYPES: Total	Deep-Draft only (OM&R & Construction)
1971	188,998,701	246,754,472	435,753,173	122,756,051
1972	204,920,940	264,565,809	469,486,749	133,306,326
1973	232,804,096	243,369,248	476,173,344	145,871,901
1974	286,937,491	244,202,495	531,139,986	144,407,124
1975	290,366,350	278,182,959	568,549,309	163,329,076

Sample toll calculations and impact assessment in the study are based on the 100-percent recovery of both operations and maintenance and implementation expenditures by the Federal government in support of deep-draft navigation.[1] In that specific new construction costs and project economic life data were not available for deep-draft projects, recovery tolls are based on actual implementation expenditures in any year, rather than amortized, annual costs. While this may be an acceptable compromise for the system as a whole, it tends to overstate the relative expenditures in individual ports where new construction was underway during the last five years. Therefore, port-specific fees calculated in the next section are only operations and maintenance expenditures recovery, excluding implementation.

Section 2 begins by examining Federal Corps of Engineers and Coast Guard deep-draft navigation expenditure data provided by the respective agencies. The CoE provided expenditure data for OM&R and implementation at the National level and OM&R data for major ports and harbors. Coast Guard provided O&M expenditures and a portion of implementation costs at the National and Coast Guard district level. No port-specific data for Coast Guard costs were available or calculated. All data are for fiscal years 1971 to 1975.

Army Corps of Engineers and Coast Guard expenditures associated with deep-draft navigation operations in U.S. ports and channels benefit a variety of system users, including foreign and coastwise trade, recreational traffic, fishing vessels, and ferries. The recovery methods to be investigated in this study refer to fees on commercial use of U.S. ports and channels.

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[1] Complete Coast Guard implementation data were not available for the study.

Table 6 contains National level OM&R and implementation expenditures for Corps and Coast Guard during FY 1971 to 1975. Tables 7 and 8 present estimates of port-specific OM&R expenditures (for the Corps projects only) during the same years. Receipt of the data during the final stages of the study did not allow calculation of port-specific Coast Guard expenditures. The Federal expenditures represent those to be recovered under proposed deep-draft user charges. Specifically, certain cost categories have been excluded entirely or have only a portion included in both CoE and Coast Guard data. A brief explanation of the data and their content, provided by the CoE and Coast Guard, is summarized below. Detailed inquiries concerning the data should be addressed to the relevant agencies.

2.2 CORPS OF ENGINEERS EXPENDITURES

The Corps of Engineers defines deep-draft projects as those having a depth greater than 14 feet. While this is somewhat less restrictive than our definition of deep-draft navigation, there are, in fact, few projects in the 14-20 foot range. Most channels in the inland waterway system have depths twelve feet or less, while most coastal and Great Lakes ports have project depths in excess of 20 feet. A second departure between CoE project taxonomy and our definitions has to do with projects such as the Lake Washington Ship Channel and Black Rock Channel in the Port of Buffalo. Such projects are classified as inland waterways for budget purposes, and so are excluded in Table 5. However, these expenditures are included in Port of Buffalo expenditures reported in Table 8 and their impact on recovery fees can be evaluated.

In recent years, significant expenditures have been required for the construction of dikes for the disposal of dredge spoils which are prohibited by EPA rules from being dumped in open waters, either because they are polluted, or because open-dumping is deemed hazardous to the marine environment.[1] These dikes provide a dumping area for a number of years, and thus are essentially construction projects, yet for CoE budgetary purposes they are recorded as operations and maintenance.[2] It might be argued that expenditures for such dike construction should be treated in toll calculations as implementation, and amortized over their useful life, rather than loaded in a single year's expenditure.

A second controversy concerning the dike disposal expenditures has to do with whether they should be charged to navigation users at all. It is argued that the pollution in the Great Lakes, where the bulk of the dike disposal projects are located, comes not from navigation, but from the rivers and drainage areas emptying into the Lakes. The resolution of this argument is not within the scope of this study. It should be pointed out, however, that the environmental restrictions which have necessitated dike disposal have simultaneously curtailed dredging activity in the same areas. The fact that the Great Lakes have been enjoying the high-water portion of a 20-30 year cycle has allowed deferral of normal dredging in the past few years. As water levels decline in lakes, harbors, and channels, supra-normal

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[1] Even non-polluted sediment can be harmful to marine life; directly by affecting oxygen and sunlight qualities of the water, and indirectly by destroying bottom habitants.

[2] The act of dumping spoils behind the dikes is recorded with the actual dredging expenditure, and not with the separate dike disposal project.

TABLE 6 FEDERAL DEEP-DRAFT EXPENDITURES USED IN THIS STUDY($1000)

Fiscal Year	1971	1972	1973	1974	1975
Operations and Maintenance:					
Corps of Engineers*	73,945	86,611	94,606	106,124	123,722
Coast Guard**	34,877	40,326	43,115	52,824	56,136
Total O&M	108,822	126,937	137,721	158,948	179,858
Implementation:					
Corps of Engineers	48,811	46,695	51,266	38,283	38,557
Coast Guard	8,491	9,066	9,926	16,732	9,509
Aids and Icebreaking	4,391	6,166	6,526	8,932	7,709
Truman-Hobbs	4,100	2,900	3,400	7,800	1,800
Total Implementation	57,302	64,827	71,118	55,015	48,066
Total O&M and Implementation	166,124	182,698	198,913	213,963	227,924

* Includes rehabilitation
** Excludes Second District which is entirely Mississippi River and tributaries above Louisiana
Source: Army Corps of Engineers and Coast Guard

dredging will be required to "catch up." Thus, even if diked disposal costs are excluded from the navigation account, deferred maintenance may increase CoE OM&R toward the levels shown in Table 6.[1] Annual costs in the future will be even higher than shown if they are not excluded.

The Corps of Engineers data are apparently quite comprehensive in that they represent the aggregation of expenditures over all projects for about 40 cost-accounting categories, including allocated costs such as supervision and administration, as well as costs of direct activities (dredging, repair of breakwaters, etc.) and project condition surveys and studies.

2.3 COAST GUARD

The Coast Guard performs a wide variety of navigation-related functions including search and rescue, policing the maritime frontiers of the United States, vessel traffic systems development, port safety, marine environmental protection, and boating safety as well as the provision of aids to navigation and domestic icebreaking services. This diversity of mission has several implications for this study, and for the user charge issue in general. First, as in the case of diked disposal discussed earlier, some of these functions such as marine environmental protection, can be construed to be for the benefit of the public at large, even if they are necessitated and/or are in direct response to commercial maritime activity. Thus, the question of whether each particular function is chargeable to navigation users arises. Once again, this study defers this decision to others. Secondly, once it is decided that a program is chargeable to navigation users, the liability of particular groups of users

[1] Diked disposal expenditures in the Great Lakes were in 1974. No estimate of deferred dredging costs for the Nation as a whole is available at this time.

comes into question. For example, aids to navigation in a particular location may serve both commercial and recreational users. What portion of the costs of the aids is the responsibility of each group if they are to be charged under different taxes? Finally, the division of Coast Guard expenses between functions is less than an exact science. A Coast Guard vessel may be fulfilling multiple functions on any particular mission. Thus, while a vessel is patrolling fishing grounds off the coast of New England, it may simultaneously be fulfilling a role in the region's search and rescue program.

Decisions regarding the inclusion of expenditures in the user charge base were made by the Coast Guard. Operations and maintenance expenditures in Table 6 represent 50 percent of total aids to navigation costs, and 100 percent of domestic ice-breaking and Truman-Hobbs bridge adjustment expenditures.[1]

2.4 PORT-SPECIFIC EXPENDITURES

Table 7 and 8 detail Army Corps OM&R expenditures for selected coastal and Great Lakes harbors and channels. In total, these ports represent approximatley ninety-eight percent of total foreign and domestic traffic over FY 1971 to 1975. For the remainder of U.S. coastal and Great Lakes ports, expenditures per unit of traffic will be lower for cost recovery given the discrepancy between costs and tonnage in Table 6 ports. The expenditures are the sum of various Corps pro-

[1]O&M expenditures for District 2, the Mississippi River System above the Louisiana border were deducted from the national total. Similar deductions for the estimated shallow-draft portions of the Columbia-Snake and Warrior River and G.I.W.W. systems would have reduced the total by another 1.5 to 2.0 million dollars.

TABLE 7

U.S. ARMY CORPS OF ENGINEERS OPERATIONS AND MAINTENANCE EXPENDITURES FOR SELECTED COASTAL HARBORS

(000's of dollars)

Coastal Ports and Harbors	Fiscal Years 1971	1972	1973	1974	1975
Portland, ME	75	13	-	-	-
Boston, MA	28	26	24	96	2
Cape Cod Canal	1,387	2,099	2,108	2,475	2,648
New Haven, CT	-64	104	226	1,858	11
Hudson River	-	138	697	610	329
New York	6,808	8,200	7,675	8,204	8,165
Philadelphia/ Wilmington	6,640	8,805	6,398	7,981	9,521
Baltimore	1,031	902	724	266	855
Hampton Roads	2,950	1,395	2,613	1,520	4,953
Jacksonville	699	663	1,138	1,244	1,179
Tampa	106	700	1,450	446	134
Mobile	1,514	1,832	1,726	1,131	2,497
New Orleans/ Baton Rouge	9,466	7,601	11,555	23,074	22,826
Houston Ship Channel	1,244	2,178	1,024	1,679	2,485
Galveston Harbor Channel	897	1,458	658	1,790	1,223
Texas City Channel	1	413	239	15	1,052
Los Angeles/ Long Beach	-	-	-	-	-
San Francisco Bay Ports	4,855	5,631	6,755	5,539	5,906
Columbia River	4,176	5,142	5,495	4,459	7,597
Wilmington, NC	1,062	799	1,053	2,197	1,658

TABLE 7 (CONTINUED)

Charleston Harbor	1,701	2,329	2,668	4,629	3,691
Shipyard River	220	250	277	255	291
Savannah Harbor	2,624	1,971	3,128	2,983	5,176
Port Everglades Harbor	3	-	-	-	-
Canaveral Harbor	359	892	1,323	844	862
Sabine Neches Waterway	2,487	3,062	1,415	4,807	4,055
Corpus Christi Ship Channel	887	554	1,886	1,607	1,524
Coos Bay	1,223	447	885	1,963	1,228
Seattle Harbor	225	-	-	31	46[illegible]
Lake Washington Ship Canal	966	1,174	2,134	2,460	2,51[illegible]
Tacoma Harbor	9	26	207	159	-

Source: U.S. Army Corps of Engineers.

TABLE 8

U.S. ARMY CORPS OF ENGINEERS
OPERATIONS AND MAINTENANCE EXPENDITURES
FOR SELECTED GREAT LAKES PORTS

(000's of dollars)

Great Lakes Ports and Channels	1971	1972	1973	1974	1975
Buffalo	1,762	1,194	1,003	1,987	7,645
Duluth-Superior	435	625	873	1,056	1,215
St. Mary River	3,643	3,859	4,243	4,410	5,019
St. Clair River	533	386	118	225	409
Channels in Lake St. Clair	178	260	237	52	60
Detroit River	1,033	1,273	1,334	1,520	1,719
Cleveland	2,170	2,450	2,928	6,456	7,979
Chicago Harbor[a]	18	14	11	24	100
Calumet River & Harbor[a]	386	157	398	988	34
Indiana Harbor[a]	83	217	105	17	41
Two Harbors[a]	236	652	-	-	5
Toledo Harbor[a]	875	1,022	952	1,535	1,586
Ashtabula Harbor[a]	259	185	191	362	380
Lorain Harbor[a]	166	166	103	315	328
Conneaut Harbor[a]	232	284	91	318	270
Sandusky Harbor[a]	65	203	615	170	540
Diked Disposal[b]	-	2,452	3,180	10,323	26,011

Source: U.S. Army Corps of Engineers

a - Excludes diked disposal.
b - Portions included in harbor expenditures above.

jects that make up the ports. The channel expenditures are costs of maintaining via dredging various connecting channels in the system. Port-specific expenditures for Coast Guard operations were unavailable at the time of this study. An additional problem with the Coast Guard expenditures involves the fact that a significant share of expenditures on the included functions are not associated with a single port, but are located in coastal waters beyond harbor limits. Further, these expenditures are tabulated only on a district-by-district basis and cannot be readily assigned to areas within each district. Questions of feasibility aside, it might even be argued that provision of a uniform level of navigational safety at equal cost to users at all ports is a reasonable National policy. This would imply recovery of these Coast Guard expenditures through a National uniform navigation tax, regardless of the approach chosen for place-specific expenditures such as for channels and harbor projects.

2.5 ALLOCATION BY TRAFFIC TYPE

Because the user charge options for cost recovery from certain traffic groups are limited,[1] it may be necessary to segment the expenditure base for recovery via different options. This allocation may be performed in accordance with any number of formulas, and across a variety of traffic classes (e.g., foreign, coastwise, and lakewise, local) within ports. Wherever such allocations are necessary for toll estimation in this study, relative cargo tonnages in each class are used to allocate shares.

The following section details various cost recovery options for Federal deep-draft navigation expenditures. Sample tolls are also calculated using the data outlined in Section 2.

[1]For example, a fuel tax may be ineffective for recovery from foreign trade vessels who may have purchased untaxed bonded fuel or restrict fuel purchases in U.S. ports, yet it may be quite appropriate for domestic vessels. Similarly, harbor craft may require a different approach than oceangoing vessels.

3. DEEP-DRAFT USER CHARGE RECOVERY OPTIONS

User charges for the recovery of Federal deep-draft expenditures may be cargo-related (based on tonnage laden or unladen in a port), or vessel-related (harbor dues, license fees, dockage, fuel taxes), or a combination of the two as in the case of port charges at most existing marine terminals. Additionally, fee schedules could be port-specific - based on the expenditures and activity at individual locations - or uniform across all locations. The implications of the various options are discussed below, and sample fee levels presented. Detailed impacts on specific commodity distribution systems are reserved for later sections.

An alternative to Federal taxation for the recovery of navigation expenditures for port projects would be the cessation of Corps of Engineers activity in harbor areas and subsequent local responsibility for channel development and maintenance. The implications of this approach are also treated below. First, however, certain general issues concerning toll construction are discussed.

3.1 EXPENDITURE ALLOCATION

A large share of Federal deep-draft expenditures (such as CoE harbor dredging) is allocable to specific ports or even particular areas within ports and is thus well-suited to recovery via traditional port fee techniques. There are other groups of expenditures which are not unambiguously allocatable to specific port areas, because of the nature of the project, or the manner in which data are kept, or both. Examples of the former are the channels in Lake St. Clair, which connect the ports on Lakes Michigan, Superior, and Huron with the Lower Lakes, and the Cape Cod Canal. Somewhat more complex are channel projects which serve both as ports (terminal locations) and connecting waterways to upstream ports. These include the Detroit River, the Hudson River, the Lower Mississippi River at New Orleans, and the San Francisco Bay area projects between San Francisco and the inland ports of Sacramento and Stockton. A final, still more amorphous, category of expenditure is Coast Guard maintenance of aids to navigation. While the location of all aids is known at any point in time, and many are located within harbor channel and connecting waterway projects and thus have identifiable beneficiaries, a large number are also in coastal waters outside of port and project areas. Further, the costs of maintaining each buoy are unknown, with the costs being identified as operating costs of buoy tenders within a coastal district, and significant allocated program overhead costs.

None of these allocation problems are relevant under a system-wide recovery scheme, under which the location of a project expenditure does not enter into the toll calculation or collection. Only total expenditure counts. The implication of these various non-specific expenditures on port-specific cost recovery approaches depends on the project type or category. Connecting channels, for example, could be treated as separate projects for recovery purposes and bear passage fees of the type charged on the St. Lawrence Seaway or Panama Canal. Ship's manifest or waybill information would allow measurement of vessel traffic in most channels without the creation of a new traffic monitoring function. Additionally, vessel activity data in most channels are currently available from the Vessel Operations Report which carriers are required to file with the Corps of Engineers.

Alternatively, the expenditures on these projects could be allocated to ports in the general region - e.g., Great Lakes connecting channel expenditures might be allocated to all Great Lakes ports according to some traffic-based formula and collected in conjunction with port-user fees. This approach, as in the case of any system-wide approach, would lead to some cross subsidization of traffic since cost recovery would not be tied directly to facility use. Also, the allocation of expenditures for a project such as the Cape Cod Canal or the C and D Canal, each of which may involve the traffic of a large number of ports, would be rather arbitrary.

Coast Guard costs, which include an even greater share of non-place-specific expenditures, might also be allocated by some formula (e.g., in accordance with tonnage-moved, vessel activity, place-specific government expenditure, etc.). Alternatively, and regardless of whether a port-specific approach is chosen for recovery in harbor projects, non-place-specific expenditures could be subject to a nationwide navigation tax. Thus, direct Federal expenditures on specific harbor and connecting channel projects might be subject to port fees and channel tolls whose level is set to recover the required percent while Coast Guard costs might be simultaneously recovered via a fuel tax or a scheme modelled after the existing Federal tonnage tax.

3.2 INTERNATIONAL CHANNELS

Several of the connecting channels between the Great Lakes are maintained entirely by the United States Corps of Engineers, but are used by vessels in the Canadian foreign and domestic trades. [We are advised that the U.S.-maintained channels actually cross the international boundary in some locations.] This jurisdictional situation derives from the negotiations which led to the development of the St. Lawrence Seaway, with the Canadians operating the Welland Canal and most of the locks on the St. Lawrence River and the United States responsible for two locks on the St. Lawrence and the Upper Lakes channels. The fact that the Canadians have placed tolls on the Welland Canal and are now advocating compensatory tolls on the Seaway in accordance with a "user-pays" national transportation policy makes a strong case for compensation from Canadian users of U.S.-maintained channels, but any such action would clearly require bilateral negotiation.

This aspect of the Great Lakes channels also has implications for the recovery approach selected. Any non-specific recovery approach for such facilities [e.g., a fuel tax, a license fee, or allocation of expenses to the port level] would leave foreign and Canadian users who do not call in U.S. ports untouched. Assumption by the Canadian Government (or Seaway Authority) of a (negotiated) portion of costs would be required in such cases.

3.3 OPTIONS

The options for cost recovery for deep-draft projects are numerous, especially when considered in the many feasible combinations evident in world ports. The analysis in this section will deal only with the major alternatives and only in single tax approaches except where combinations are required because of non-applicability of an option to some segment of commerce. First, a port system use fee will be analyzed. This approach is exemplified by the existing foreign trade tonnage tax, which would be extended to domestic vessels through a related vessel registration fee (license fee). Next, a harbor and channel use tax is discussed. This approach, which assesses a toll for each use of a facility (rather than the deep-draft system as a whole as in the previous option), has greatest precedent in world practice. Precise analytical treatment of this approach is hampered by the non-availability of summary data on vessel port activity at this time, but a reasonable picture of its relative impacts is presented. Third, a cargo tax, both national and port-specific, is presented. This approach, which resembles existing wharfage charges for recovery of marine terminal costs, taxes the lading and discharge of cargo and not vessel activity per se. The final direct approach is a fuel tax. Because this option is inapplicable or infeasible for foreign trade vessels because of the bonded fuel option, it must be discussed in combination with other tax approaches. Also, the non-separability of diesel vessel bunkering for inland versus deep-draft use presents some complexities and potential inequities. Finally, the option of local responsibility for harbor maintenance is briefly discussed. Limited existing jurisdictions and port authority financial problems may rule out this option, yet local construction initiatives such as channel deepening in Los Angeles-Long Beach lend it some credibility. It is clearly not applicable to all categories of expenditure (e.g., Coast Guard coastal aids to navigation).

3.3.1 System-Use Fees

A special case of a vessel tax - relevant only in the case of system-wide approach - is the existing Federal tonnage tax, which charges for each use of the port system rather than for each use of a port. Under the current structure of this tax, not only are all uses of the port system by a vessel in the U.S. foreign trade exempt from payment after the fifth entry, but each port call during a visit to U.S. waters is free after the first - i.e., the fee for the first five entries to U.S. waters is the same whether the vessels calls at one port or a dozen. The fact that this tax is already in force (in addition to its compliance with the efficiency criterion) makes it a strong candidate for continued use as a user charge for the recovery of Federal navigation costs from foreign trade vessels if a system-wide uniform fee is desired.[1] The level of fee would obviously have to be changed to conform with the mandated recovery level. Consideration should also be given to eliminating the differential fee for vessels in the overseas and "nearby" foreign trades, since such a differential makes little sense in the context of user charges.

The revenue yield from the tonnage tax on vessels engaged in the U.S. foreign trade increased from $7.2 million in FY 1971 to $11.3 million in FY 1976, during which period the number of transactions (payments) remained relatively constant (Table 9). The increase in the size of the average transaction ($270.71 to $435.85 from FY 1971 - FY 1976) is primarily due to increasing vessel sizes.

Adaption of the tonnage tax to Federal cost recovery goals would require changing the fees in order to increase revenue yields to the desired level. These might include structural changes such as alteration of the exemption list, an increased payments limitation and extension of the tax to domestic trade vessels as well as simple adjustments in fee levels. In the first place, the 2 cent fee for short-sea voyages and the total exemption for voyages to Ontario might logically be eliminated and replaced with a uniform fee for all commercial

[1]If a port-specific approach is adopted, this fee might still be used for recovery of non-port-specific expenditures as discussed earlier. Thus, the Federal tonnage tax might be set to recover Coast Guard aids to navigation costs, while a port-specific harbor dues was used to collect channel costs in each port.

TABLE 9

TONNAGE TAX COLLECTIONS AND TRANSACTIONS

PERIOD (Fiscal Year)	TONNAGE TAX Collections	Transactions	Average Collection per Transaction
1971	$7,182,146.65	26,531	$270.71
1972	7,855,483.93	25,314	310.32
1973	9,442,824.00	27,715	340.71
1974	10,242,131.00	27,457	373,02
1975	10,549,838.36	25,655	411.22
1976	11,283,712.60	25,889	435.85
1976 T	4,327,659.83	6,760	640.19
1977 (through March)	6,853,954.57	12,824	534.46

Source: Treasury Department, Customs Bureau foreign trade vessels. On purely economic grounds there would appear to be little reason to discriminate between users of a harbor on the basis of their voyage itinerary. [Any such changes might have repercussions in other nations' ports, however, and so should be reviewed by the State Department]. The bulk of vessels affected by such a change would be in the cross-lakes trade with Canada and the tanker and dry-bulk (especially bauxite) trade with the Caribbean. It is not possible to calculate with any precision the revenue impact of this change because the number of 2 cent transactions and tax exempt entries is not tabulated separately. Supplementary data indicate an absolute upper bound of a doubling of the revenue yield if the 2 cent fee and Ontario exemption were lifted, but the increase would not be likely to be as high as 50 percent and might be considerably smaller. Elimination of other exemptions for particular vessel types or activities (yachts, vessels in distress, etc.) would not have a major impact on yields.

A second possible amendment would be the removal of the limitation on payments per year. If the five payment limit were lifted, and all commercial vessels were subject to the 6 cent per n.r.t. fee as described above, revenue yields would be approximately doubled (see Table 10). Removal of the limitation would have a differential impact depending on the trade in which the vessel operates and the type of service. A liner operator on a long trade route (to the Far East, for example) making frequent port calls would probably not be making 5 voyages per year now. Similarly, the tanker route from the Persian Gulf has a round-trip duration which would forestall many (if any) extra payments. At the other extreme, a high-speed container service on the North Atlantic or a cross-Lakes operation would experience a significant increase in payments.[1] If the limitation is

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[1] A container ship on the North Atlantic might make more than 15 voyages in a year.

TABLE 10

VESSEL ENTRANCES TO THE U.S. CUSTOMS AREA IN THE FOREIGN TRADE OF THE UNITED STATES[1]

Calendar Year	(1) Entrances	(2) 1000 n.r.t.	(3) Average Vessel Size[2]	Prospective Revenues from Unlimited 6 cent Tonnage Tax ($1000) col. (2) x .06
1970	53293	254,154	4769	15,249.2
1971	51443	255,779	4972	15,346.7
1972	54147	295,281	5453	17,716.9
1973	57205	344,772	6027	20,686.3
1974	54565	346,830	6356	20,809.8
1975	51443	355,179	6904	21,310.7

Source: Vessel Entrances and Clearances - Annual Reports, Bureau of Census, Document FT975.

[1] These data exclude entrances by vessels in the following situations: Entering in distress and not discharging or lading cargo; entering for stores, bunkers, crew charge only; in the non-contiguous trade, yachts and research and training vessels; military vessels entering and clearing without commercial cargo; tugs whose accompanying craft are recorded; vessels entering from canal zone in intercoastal trade; vessels whose arrival or departure are " reported only" but which are not required to formally enter.

[2] The average for individual ports varies from 25,000 n.r.t. at an oil port like Martinez to 23.7 n.r.t. in Eastport Maine (apparently fishing and ferry traffic).

removed, there would be a closer relationship between use of the port system (but not necessarily uses of ports) and taxes paid. Additionally, the final fee per voyage after adjustment of levels to recover the desired costs would be lower, giving less discouragement to the casual visitor to U.S. waters. Alternatively, a payments limitation would meet the efficiency criterion. As a result of this, a vessel which made at least five calls to the U.S. in a year would have no incentive to divert a voyage to another nation's ports (especially Canada) for purposes of tax avoidance.

There are several possible reasons for a limitation on payments. In the first place, some vessels such as ferries, fishing craft, short-sea cargo vessels, etc. use a harbor almost daily (or conceivably several times daily). A limitation protects such vessels from excessive payment liability. They might also be protected, if desired, by an exemption from payment or a special fee schedule. A second, related reason has to do with the theory of economic efficiency which posits that the price for the marginal use of a facility (or purchase of a good or service) should not differ from the cost of providing that facility for the marginal use. Since Federal costs in the deep-draft system are essentially fixed - i.e., an additional entry of a vessel into a harbor neither adds to nor subtracts from the costs of channel maintenance - then additional (marginal) entries should not be discouraged because they provide economic benefits without adding to costs. Limitation of payments at a reasonably low number of visits per year makes additional port visits by most vessels free, and, therefore, prices in accordance with the basic efficiency criterion. Such limitations may violate some people's criteria for equitability, which might hold that those who use a harbor more frequently should always pay more dues than less frequent users. The two criteria are irreconcilable and must be weighted in accordance with outside values.

An intermediate step would involve increasing the maximum number of taxable voyages in any year. The effect of this would be to increase revenue yield, but less than proportionately, with each incremental voyage. This follows from the fact that with each increase in the limit, some additional vessels will become exempt from further payments. We estimate that a 10 and 15 payments limitation would have yielded about 75-80 and 90-95 percent of total potential collections (Table 10) respectively under a 6 cent fee.

In its current form, the tonnage tax approach is not directly applicable to vessels in the U.S. domestic trade, most of which never leave the U.S. Customs area, and thus cannot be taxed for "entering" it. While the concept of a voyage is fairly clear for a tanker or bulker where sailings typically include a single consignment between two points, the same cannot be said for most general cargo vessels. The most straightforward way to deal with this complexity is to assign the maximum number of taxable voyages per year (under the tonnage tax) to domestic vessels under the reasonable assumption that most, if not all, domestic trade routes involve sailing times which bring about at least that number of voyages per year. [This would not be a safe assumption if the payments limitation is raised beyond fifteen transactions.]

Table 11 shows the estimated size of the U.S. domestic fleet by area of operations as of June 30, 1975. Cost recovery levels from these vessels under a tonnage tax-based registration fee would obviously depend on the fee per n.r.t. and the payments limitation. At the 6 cent per n.r.t. fee level with the current five payment limit, collections from domestic trade vessels would be $1.03 million. Raising the payments limit to fifteen transactions per year would raise the collections from these vessels to $3.1 million at the 6¢ rate.

TABLE 11

ESTIMATED U.S. DOMESTIC FLEET: SELF PROPELLED VESSELS (1,000 g.r.t. OR OVER) JUNE 30, 1975[1] (TONS IN 000'S)

	TOTAL				PAX/CARGO				FFEIGHTERS				TANKERS			
Operation	Number	DWT[2]	GRT[3]	NRT[4]	Number	DWT	GRT[5]	NRT[5]	Number	DWT	GRT[5]	NRT[5]	Number	DWT	GRT[5]	NRT[5]
Coastwise	153	4653	-	1882	-	-	-	-	17	354	305	201	136	4299	2402	1681
Inter-Coastal	11	271	-	116	-	-	-	-	3	54	47	31	8	217	121	85
Non-Contiguous	41	763	-	376	1	7	10	7	28	417	359	237	12	339	189	132
Great Lakes	185	2678	1613	1064	11	N/A	36	24	161	2610	1534	1072[6]	13	69	43	28

[1]These vessels with U.S. flag foreign trade vessels account for the bulk (over 95%) of the total net registered tonnage of documented vessels in the U.S. Merchant Marine.

[2]Deadweight tonnage.

[3]Gross Registered Tonnage.

[4]Net Revenue Tons.

[5]Estimated ratio of DWT to GRT derived for each vessel type from Merchant Marine Fleets of the World (March 1976) 0.56 for tanker, 0.86 for freighter. Ratio of n.r.t. to g.r.t. estimated from file of ship characteristics; 0.7 for tanker 0.66 for freighter.

[6]Estimated n.r.t./g.r.t. based on relationship for all bulkers in the fleet.

Source: MARAD 1975 p. 62 and 75.

In accordance with the above estimates, a combined tonnage tax/vessel registration tax with a 6 cent per n.r.t. fee and a payments limitation of fifteen per year would have yielded approximately $23 million from deep-draft users in 1975 -- about $3 million from the domestic fleet and the rest from foreign trade vessel activity. This represents about 13% of that year's total deep-draft OM&R outlays and 10% of total Federal expenditures for OM&R and new construction. Recovery of 100% of OM&R costs would require an increase in the fee from 6¢ to 46 cents per n.r.t. (not accounting for potential declines in transactions in response to the tax) and 60 cents per n.r.t. for full recovery of all deep-draft expenditures.

Tables 12A-D provide an estimate of the impact of the amended tonnage tax on costs per ton for a number of vessels and vessel types in the U.S. foreign and domestic trades. Because of the numerous options involving recovery levels and payments limitations, only two are presented; full recovery of deep-draft OM&R (46¢ per n.r.t.) and full recovery of all deep-draft expenditures (60¢ per n.r.t.) each with an annual payments limitation of fifteen transactions.

Table 12A shows the tonnage tax impact in cents per measurement ton (40 cubic feet of cargo volume) for a variety of general cargo vessels. Several caveats are required for interpretation of the data. First, the cost impacts are directly applicable only to vessels in foreign trade activity making fifteen or fewer voyages per year. Subsequent voyages would be free of tax and thus reduce the impact on the average ton. Similarly, the implied cost impacts are high for any vessel in domestic service making more than fifteen "voyages" per year. Thus, the Boston, a Sea-Land feeder vessel operating on the East coast, makes weekly circuits in the

TABLE 12A

ESTIMATED TONNAGE TAX IMPACTS ON GENERAL CARGO VESSELS

Vessel Type	Deadweight Tonnage	Net Register Tonnage	Number of Containers[1]	Bale Cube (1000 cu.ft.)[4]	Tonnage Tax per voyage[2]	$/Cont.[1,2]	¢/MT[2,3]
Pres. Madison (C6-S-85B - Full Containership)	20,700	15,360	1,180	1,298	(a) $7,066 (b) 9,216	5.99 7.81	21.8 28.4
Pres. McKinley (C6-S-60C - Full Containership)	17,500	11,504	1,066	1,173	(a) $5,292 (b) 6,902	4.96 6.47	18.0 23.5
Del Rio (C3-S-43A - Partial Container)	13,100	6,162	-	611	(a) $2,834 (b) 3,697	- -	18.6 24.2
Delta Mar (C9-S-81D - LASH)	40,400	24,800	-	1,700	(a) $11,408 (b) 14,880	- -	26.8 35.0
African Comet (C4-S-58A - Breakbulk)	12,700	6,809	-	642	(a) $3,132 (b) 4,085	- -	19.5 25.5
Allison Lykes (C3-S-37C - Breakbulk)	11,300	5,492	-	553	(a) $2,526 (b) 3,295	- -	18.3 23.8
Almeria Lykes (C8-S-82A - Sea bea)	38,400	12,128	1,180	1,298	(a) $5,579 (b) 7,277	4.73 6.17	17.2 22.4
Ashley Lykes (C5-S-37F - Breakbulk)	14,300	7,780	-	711	(a) $3,579 (b) 4,668	- -	20.1 26.3
Hawaii Enterprise (Private Design - Full Container)	27,100	16,427	1,395	1,535	(a) $7,556 (b) 9,856	5.41 7.07	19.7 25.7

TABLE 12A (CONTINUED)

Golden Bear (C8-S-81B - LASH)	29,800	18,707	-	1000-1460	(a) $8,605 (b) 11,224	- -	23.8-34.4 31.0-44.9
Santa Barbara (C4-S-65A - Breakbulk)	12,700	5,403	-	479	(a) $2,485 (b) 3,242	- -	20.8 27.1
Boston (C4-S-A1-C - Full Container)	9,300	7,849	360(35/40)	720 -864	(a) $3,611 (b) 4,709	10.03 13.08	16.0-20.1 20.1-25.1
Elizabeth port (Private design - Full Container)	15,800	12,479	476(35/40)	952- 1,142	(a) $5,740 (b) 7,487	12.06 15.73	20.1-24.1 26.2-31.4
Sea-Land Commerce (SL-7 - Full Container)	27,300	25,389	1,096(35/40)	2,192- 2,630	(a) $11,679 (b) 15,233	10.66 13.90	17.8-21.3 23.2-27.8
Sea-Land Producer (C7-S-88A - Full Container)	26,600	16,128	733(35/40)	1,466- 1,759	(a) $7,419 (b) 10,664	10.12 14.52	16.9-20.2 24.3-29.1
American Apollo (C7-S-63E - Full Container)	20,000	13,621	1,330	1,463	(a) $6,266 (b) 8,173	4.71 6.14	17.1 22.3
Sam Houston (C9-S-81D - LASH)	40,900	24,800	-	1,780	(a) $11,408 (b) 14,880	- -	25.6 33.4

[1] Twenty-foot equivalents except where otherwise indicated.

[2] (a) - 46¢ per n.r.t. for recovery of 100% OM&R.
(b) - 60¢ per n.r.t. for recovery of 100% OM&R plus new construction.

[3] Cents per measurement ton: A measurement ton equals 40 cubic feet, a unit use for assessing liner rates.

[4] Estimated interior capacity of containers (or barges) for container ship (and barge carriers). MARAD (unpublished) for breakbulk and partial containerships.

SOURCES: Deadweight tonnage - Vessel Inventory Report, U.S. Flag Dry Cargo and Tanker Fleets 1,000 Gross Tons and Over as of December 31, 1975, MARAD (3/76).
Net Register Tonnage - CoE Vessel Records
No. of Containers - Inventory of American Intermodal Equipment, 1976, MARAD.

Boston-Hampton Roads range. All other things equal, this would reduce the average impact per ton of cargo by a factor of 3-3.5. Secondly, the figures are based on 100 percent utilization for a unidirectional cargo flow - or, equivalently, 50 percent utilization on each leg of a two-way flow. If greater utilization levels are enjoyed in the two-way liner trade (almost certainly the case on most routes), then cost impacts would be correspondingly reduced. Full (i.e., 100 percent) utilization inbound and outbound would halve the cost impact per unit of capacity. This implies that the tonnage tax/vessel registration tax would have an impact of 10-13 cents per measurement ton of available capacity (inbound plus outbound) - less for short-sea and feeder traffic - with the actual levels determined by route utilization factors[1] and liner rate-making practices (see Section 9). This is in the range of only .1-.2 percent of typical liner rates.

Table 12B indicates tanker cost impacts in the range of 20-25 cents per long ton (depending again on recovery levels). Since most tanker traffic is unidirectional, with the return voyage in ballast, adaption of the estimate for utilization is not required. The comments above concerning voyage frequency do apply here, however. Whereas tankers from the Persian Gulf certainly make fewer than fifteen transits per year, and thus conform with the cost estimates in the table, most Caribbean and domestic routes entail more frequent trips, and thus lower costs per ton over the course of a year. Thus, if a particular coastwise route allowed 25 voyages per year, the effective cost impact per ton would be only 60 percent (15/25) that shown in the table.

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[1]Lower utilization means higher cost per ton of traffic.

TABLE 12B

ESTIMATED TONNAGE TAX IMPACTS ON TANKERS IN U.S. FLEET[1]

Vessel Type	Deadweight Tonnage	Net Register Tonnage	Tonnage Tax[2]	¢/LT[3]
Arco Juneau (Supertanker)	120,000	49,807	(a) 22,911 (b) 29,884	19.1 24.9
Atlantic Endeavor (Supertanker)	30,000	11,995	(a) 5,518 (b) 7,197	18.2 23.8
Amoco Connecticut	20,000	8,276	(a) 3,807 (b) 4,966	19.0 24.8
Exxon Baton Rouge	75,600	32,425	(a) 14,916 (b) 19,455	19.7 25.7

[1] While no foreign flag vessels are represented, the results would be virtually identical. Differences in operating costs would maker percentage impacts for U.S. flag and U.S. Domestic service considerably smaller.

[2] (a) 46¢ per n.r.t. for recovery of 100% OM&R. (b) 60¢ per n.r.t. for recovery of 100% OM&R and new construction.

[3] Cents per long ton (2240 lb). Technically, this figure should be slightly higher for deduction of the weight of vessel bunker fuel.

SOURCES: Deadweight Tonnage - Vessel Inventory Report, ibid.
Net Register Tonnage - Corps of Engineers Vessel Records.

Table 12C shows dry bulk carrier impacts in the same range as for tankers, based on a somewhat limited sample of U.S. flag bulkers. To the extent that bulk cargo densities may vary, possibly making cargo volume as opposed to weight the constraining factor on consignment size,actual impacts may vary. Also, considerations of backhaul utilization and voyage frequency may reduce average impacts as above.

Finally, Table 12D indicates cost impacts per short ton for U.S. flag bulk vessels in operations on the Great Lakes. The variability in impacts is probably due to differences in cargo densities as well as ship design differences. It must be noted, however, that all domestic Great Lakes routes involve substantially more than 15 shipload deliveries annually, implying that the estimates shown are probably overstated by at least a factor of two. Similarly, backhaul cargos or triangulation possibilities are often possible (stone or coal moving opposite to the iron ore patterns) implying a further upward bias. Adjustments can be made to these sample data by application of information concerning actual voyage frequency or annual liftings.

The similarity of impacts across vessel types is not coincidental since net register tonnage is a measure of the volumetric capacity of a ship, and there is a loose physical relationship between dead weight tonnage and n.r.t. In practice, impacts will depend on the utilization characteristics of the vessels in use and on route characteristics - particularly voyage frequency. The tax structure provides increased incentive to maximize annual vessel utilization - especially in domestic trades - and consequent reduction in the average tax per ton.

TABLE 12C

ESTIMATED TONNAGE TAX IMPACTS ON DRY BULK CARRIERS IN THE U.S. FLEET[1]

Vessel Type	Deadweight Tonnage	Net Register Tonnage	Tonnage Tax[2]	¢/LT[3]
Inger (Bauxite Carrier - +2-SE-Al-C)	23,500	10,207	(a) 4,695 (b) 6,124	20.0 26.1
Flor (Bulk Carrier - Prive Design)	23,500	6,226	(a) 2,864 (b) 3,736	12.2 15.9
Rice Queen (Bulk Carrier - +2-SE-Al-C)	14,400	6,703	(a) 3,083 (b) 4,022	21.4 27.9
(Aries Bulk Carrier -	80,500	32,300	(a) 14,858 (b) 19,380	18.5 24.1

[1]See footnote 1, Table 12B.

[2](a) 46¢ per n.r.t. for recovery of 100% OM&R.
(b) 60¢ per n.r.t. for recovery of 100% OM&R and new construction.

[3]Cents per long ton (2240 lb).

SOURCES: Same as Table 12B.

TABLE 12D

ESTIMATED IMPACT OF VESSEL REGISTRATION TAX ON TYPICAL GREAT LAKES BULKERS[1]

Vessel (Owner)	Net Register Tonnage	Capacity (Short Tons)	Tonnage Tax[2]	$/ST[3]
Roger Blough (U.S. Steel)	14,114	49,970	(a) 6,492 (b) 8,468	13.0 16.9
A.H. Ferbert (U.S. Steel)	6,403	21,450	(a) 2,945 (b) 3,842	13.7 17.9
Edward L. Ryerson (Inland Steel)	7,637	27,650	(a) 3,513 (b) 4,582	12.7 16.6
Raymond Reiss (Cleveland Clifts)	6,496	16,352	(a) 2,988 (b) 3,898	18.3 23.8
Detroit Edison (Boland & Cornelius)	10,296	24,100	(a) 4,736 (b) 6,178	19.7 25.6
H.L. White (Boland & Cornelius)	17,665	38,528	(a) 8,126 (b) 10,599	21.1 27.5
Steward J. Cort (Bethlehem Steel)	29,918	64,000	(a) 13,762 (b) 17,951	21.5 28.0
Presque Isle [barge] (Litton Great Lakes)			(a) 10,239 (b) 13,355	17.9 23.2

[1] Estimated impacts are valid for shipmaking lifting only 15 one-way consignments per year. Adjustment for voyage frequency and backhaul would reduce impacts by a factor of two to four, depending on the particular situation.

[2] (a) 46¢ per n.r.t. for recovery of 100% OM&R.
(b) 60¢ per n.r.t. for recovery of 100% OM&R plus new construction.

[3] Cents per short ton (2000 lb).

SOURCES: Net Register Tonnage and Capacity - Corps of Engineers Vessel Records.

A complication in this option is introduced by the fact that a single vessel may operate in both domestic and foreign trades in a given year, or even during a single round voyage. This might be dealt with by a pro-rated (ex post) reduction in the vessel registration tax for time spent on foreign trade voyages, with those voyages subject to the foreign trade tonnage tax. The fifteen payment limitation should continue to serve as an upper bound on payments, however.

3.3.2 Harbor and Channel Use Fees

The recovery approach with the strongest precedent in world maritime practice is the vessel-based harbor dues for port navigation channels and passage fees for connecting channel projects. Under this approach, charges would be assessed against each vessel calling in a port area, with the level of the fee determined by vessel size and, perhaps, the nature of the vessel activity. While a number of vessel attributes could conceivably be used - gross registered tonnage (g.r.t.), net registered tonnage (n.r.t.), draft, length on beam, displacement, etc. - net registered tonnage, which essentially measures cargo capacity, is the metric most often used.[1] It is also the basis of the existing Federal tonnage tax collected in United States foreign trade.

Within this generic recovery approach, several options are possible. First, the port fee can be either port-specific or uniform nationally. As its name implies, a port-specific approach would fix the fee per n.r.t. at a level which would recover each port's Federal costs from its own vessel traffic. A system-wide uniform fee would charge the same fee per n.r.t. for a visit to any port, with the level set to recover total

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[1] Different ports and canals in the world may exercise different definitions of net registered tonnage, including n.r.t. as shown on the records of the nation of registry or "Panama Canal Net Tonnage" or "Suez Canal Tonnage" which are defined in the respective treaties.

National deep draft costs - or at least that portion sought to be recovered under this approach.[1] In either case, the areas subject to taxation would need to be carefully delineated. If a close connection between project use and user charges were desired, the collection areas could be defined to include areas using common access channels. Thus, different sub-areas within a greater port area such as the Port of New York might bear different fees to reflect different channel use. Similarly, while distinction might be desired between the ports of Baton Rouge and New Orleans under a port-specific charge,[2] it is questionable whether a vessel calling at both parts should pay the same fee as two ships, each calling at one of the ports. [The ship calling at both ports would traverse the same length of channel as the vessel calling only at Baton Rouge.]

Secondly, port dues collection can be unlimited (i.e., payable for each use of a harbor) or subject to some maximum number of payments per year. The existing U.S. tonnage tax on foreign trade vessels is payable a maximum of five times per annum, after which entry to the U.S. port system is free. The practice of limiting total payments at a single port (or in total under a system-wide fee) is shared by some world ports, while in other locations payments are unlimited.[3]

Under such an approach, a fee (again probably n.r.t. - based) would be assessed for each vessel transiting the

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[1] Recall that a vessel fee can be used in conjunction with other tax approaches.

[2] It is arguable on the basis of some kind of equity consideration that navigation to Baton Rouge requires a greater level of Federal expenditure than navigable channels to New Orleans alone.

[3] In Canada, sick mariner's dues are payable on three times per year, and harbor master fees at Public Harbors only twice a year, but harbor dues at National Harbors appear to be unlimited. Nation light dues and local harbor dues at most ports in the United Kingdom are payable an unlimited number of times, yet one United Kingdom port publishes a fee which declines after the twelfth payment.

Canals and connecting channels require some special treatment if a port-specific vessel tax is selected for recovery of harbor costs. As pointed out earlier, most of these projects serve more than one port and their costs are not allocable to particular harbors in a straightforward manner. Additionally, if a port-specific approach is chosen in order to collect individual project costs from their actual users, it would be desirable to do the same for non-port projects by means of location-specific passage fees. Canal tolls or passage fees of this sort are used on the St. Lawrence Seaway, and Panama and Suez Canals.

Under such an approach, a fee (again probably n.r.t. - based) would be assessed for each vessel transiting the waterway, with the level set to recover the desired portion of Federal expenses for that channel alone. A vessel making a partial transit - to discharge cargo at a port within the waterway, for example - could be charged a fraction of the total fee. This partial liability would have precedent in practices on the St. Lawrence Seaway, where partial transit tolls in the St. Lawrence River section are 15% of the applicable toll for each lock traversed.

If a uniform port fee (especially in the format of U.S. tonnage taxes) is chosen as the recovery option, then a separate recovery for channel passage is not necessary (or even very logical). Expenditures for connecting channels would simply go into the national recovery base.

A port use fee, mainstay of foreign port recovery schemes (see Section 1), is an alternative to a vessel-based charge structured after the existing tonnage tax. Under a usage-based fee, each use of a port or channel by a vessel would be taxed.[1] Although the CoE collects data on vessel activity in each port by n.r.t., it has not been tabulated recently and was not available for this study. Several observations are possible, however. First, the toll per n.r.t. for a port call would be significantly lower than the tonnage tax levels discussed above.[2] This is because each entry into the U.S. port system involves at least one port call and frequently two or more. For example, a liner vessel may make six or more calls in U.S. ports per voyage. A domestic vessel in all services generally makes many more than five port calls per year. Sea Land's feeder vessel Boston makes five port calls per week, and some vessels, such as lighters, ferries, etc. make daily calls and would require some relief or rebate process. Based on port-specific tonnage (cargo) based tolls calculated in Section 3.3.3 below, the average charge per n.r.t. entrance into major U.S. coastal ports would vary by a factor of 3 to 1 between high and low cost ports. Some Great Lakes ports would bear an even greater relative burden when channel passage fees are included.

Unlike the tonnage tax approach, a port use fee could impact existing patterns of port use. First, some ports would be more costly to operate through with port-specific taxes. Second, a levy on each port visit would encourage consolidation into load centers by providing a disincentive for additional port calls, particularly for container traffic and by penalizing low traffic ports, even under a uniform fee. (See Section 9.)

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[1]This differs from the tonnage fee which taxes each use of the port system rather than each call at an individual port.

[2]A charge 50 to 75 percent lower than the tonnage tax fee levels calculated above might be expected under a uniform ports-use fee. It would, however, be chargeable for each port call -- 5 to 10 per voyage for some liner operators.

Substantial incentives for consolidation already exist in the form of higher capital and operating costs of ships visiting many ports versus a few load centers. These costs would generally dwarf any additional incentives provided by a port-specific charge. A possible exception to this observation is that vessels operating in a container feeder service may make as many as 200 to 250 calls per year. If treated on the same basis as line-haul vessels, such a service may become economically non-viable under a port use fee. This issue will be treated in more depth in a later section.

3.3.3 Cargo-Based Taxes

A cargo-based recovery method would assess a fee on each ton loaded or discharged in a port area. The fee would be uniform across commodity classes and U.S. ports or could vary by port, depending on relative Federal expenditure levels. In a similar fashion, the cargo-based fee could be applied to channels, where each ton would contribute a uniform amount to recover Federal project costs. This section first examines National uniform cargo-based taxes for Corps and Coast Guard expenditures, and then, develops port-specific fees for selected U.S. ports.

3.3.3.1 National Cargo-Based Fees

Table 13 shows U.S. commercial cargo tonnage passing through U.S. ports in the past five years. Each ton of domestic cargo (coastwise, lakewise, and intra-territory) is represented by two port transfers, while each ton of foreign-trade cargo makes use of only a single port, although subsequent distribution to smaller ports (as in the case of petroleum traffic or container feeder service) provides an exception to this observation.[1] The volumes in the table

[1] In the data, this prior or subsequent distribution is, in fact, tabulated as a coastwise movement.

TABLE 13

TOTAL U.S./FOREIGN WATERBORNE COMMERCE FOR UNIFORM TOLL CALCULATION[1] TOTAL TONS (000'S)

1971	1,338,242
1972	1,409,093
1973	1,562,792
1974	1,531,047
1975	1,476,938

Source: U.S. Army Corps of Engineers *Waterborne Commerce of the U.S.* National Summaries. CY 1971-1975.

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[1] Includes import, export, coastwise, lakewise, and intra-territory. Coastwise, lakewise, and intra-territory tonnage is double to account for the two usages of U.S. ports this traffic represents--once at origin and once at destination.

thus represent aggregate cargo activity (ladings and discharges) in U.S. ports and harbors.

Table 14 presents the calculations for a uniform cargo tax to recover total Federal deep-draft expenditures (as described earlier) for both OM&R and new construction. A simple measure of expenditure per ton moving through U.S. ports is estimated, and a five-year average calculated. According to the estimates, each port transfer of a ton of commercial cargo would bear a charge of 13.5 cents.[1]

While this uniform tax hits each cargo transfer equally, it would have a relatively larger effect on the delivered price of domestic cargo than foreign cargo, because each domestic ton would pay 27 cents (13.5 cents at both origin and destination) while each foreign ton would be taxed once. In a similar vein, a ton of container cargo moving on a feeder vessel to a consolidation point where it would be transhipped to an overseas line-haul vessel would pay three times (just as it would be required to pay triple wharfage and stevedoring charges at public terminals).

It might be desirable to give domestic cargo some relief under this approach by using a differential charge per ton for cargo destined to or arriving from another U.S. port. If the domestic fee were one-half that for foreign cargo, for example, the uniform cargo tax would be 18.3¢ for each transfer (lading or discharge) of foreign cargo, and 9.15¢ for cargo destined for or arriving from a domestic port (Table 15). Any other relationship between the foreign/domestic fee levels could, of course, be used, depending on the desired burden distribution.[2]

[1] While a slight upward estimate over time is evident, the 1975 tax estimate is unnaturally high because of the traffic fall-off in that year. The toll for Coast Guard expenditures alone would be 3.8 over the five years, with a toll of 4.4 to 4.5 being estimated for 1974-1975.

[2] Precedent for such fee discrimination exists in the port fee structures of other nations and even in the existing U.S. tonnage tax from which domestic trade vessels are immune.

TABLE 14

CALCULATION OF A UNIFORM CARGO TAX FOR RECOVERY OF ALL FEDERAL EXPENDITURES

Year	Total Expenditure (000's of dollars)	Cost per Ton-Activity in U.S. Ports ($/ton)
1971	166,124	0.12414
1972	182,698	0.12966
1973	198,913	0.12728
1974	213,963	0.13975
1975	227,924	0.15432
	5-year average	0.13503

TABLE 15

UNIFORM CARGO TAX CALCULATION
WITH DOMESTIC TOLL EQUAL TO .5 FOREIGN LEVEL

Year	Total Tons[1] (1,000 ST)	Cost per Ton
1971	952,115	0.1745
1972	1,019,458	0.1792
1973	1,165,092	0.1707
1974	1,147,569	0.1865
1975	1,112,822	0.2048
	Simple 5-year average	0.1831

[1]Foreign + Lakewise + Coastwise + Intra-territory.

3.3.3.2 Port-Specific Cargo Taxes

It is also possible to structure a cargo tax to recover the Federal outlays on each project from the traffic actually using it. In this case, tonnage passing through a private port would pay no toll for that portion of its movement, except for Coast Guard and possibly other non-place-specific expenditures, and ports and channels with high Federal costs per ton of activity would bear correspondingly higher charges. This approach is most analogous with an inland waterway segment toll.

Several definitional problems would have to be overcome prior to implementation of a port-specific cargo tax.[1] First, projects must be carefully delineated, and differential taxes for different sectors of layer port complexes developed if desired. This is the problem of where "New Orleans" ends and "Baton Rouge" begins, and whether each should bear the same fee. Second, it must be determined what traffic will be subject to the tax - a particularly important consideration in ports with extensive commerce with an inland waterway hinterland (Baton Rouge-New Orleans, Portland-Vancouver) or significant local traffic (New York). This involves the question of whether shallow-draft traffic arriving at a port from a river hinterland should contribute to the maintenance of project depths far in excess of its requirements. Inclusion of such traffic in the taxation base would reduce the toll level significantly in some ports, but it would at the same time subject much traffic to double taxation - once for discharge from a barge and

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[1] In fact, these considerations are also germane to a national cargo tax, but the implications are more diffuse.

a second time for relading on an oceangoing vessel.[1] This would be particularly onerous for barge/ship transfers of bulk commodities such as grain and ores. The remainder of this section is devoted to the estimation of port-specific tolls for the recovery of 100% of Federal OM&R expenditures in each port for which data are available (95-99% of the total). Non-availability of new construction data at a port-specific level excludes the inclusion of those costs in the tolls, making them non-comparable to the National cargo tax levels above. Coast Guard expenses, which are not straightforwardly allocated to individual ports, are added to tolls on a uniform basis per ton.

Tables 16 and 17 indicate the deep-draft traffic (define as coastwise + lakewise + foreign) at major U.S. coastal and Great Lakes ports respectively. Corps of Engineers expenditure data by port are found in Section 2. Tables 18 and 19 give the estimated toll per short tone of cargo transferred in each port (and traversing each channel). These figures are derived by taking a simple average of the ratio of expenditure to cargo tonnage for each facility for the years 1971-1975. The second column is derived by adding in the uniform Coast Guard of 3.6 cents per short ton. It may be noted that the variability of fees is fairly small relative to inland waterway segment tolls, with the highest cost ports being within a factor of four or five of the average, and the majority of ports being much closer to the average. Great Lakes tolls are influenced upward by the existence of massive dike disposal expenditures (40% and 46%

[1] Precedent for such double charging does exist. For example, LASH barges arriving at a port for lading on a barge carrier have in some instances been subject to dockage fees even though berth occupation did not occur. The barge carrier is also subject to terminal charges.

TABLE 16

FOREIGN AND COASTWISE COMMERCE AT SELECTED U.S. COASTAL PORTS

(000's of short tons less duplications)

Coastal Ports and Harbors	1971	1972	1973	1974	1975
New York	111,769	98,700	134,803	123,008	110,379
Philadelphia/Wilmington	83,793	86,604	92,859	92,738	84,620
Baltimore	31,756	34,299	39,672	46,611	41,070
Hampton Roads	47,090	49,357	51,039	59,819	55,217
Jacksonville	10,738	12,558	13,458	12,868	11,453
Tampa	33,623	41,862	41,086	40,248	39,447
Mobile	12,641	12,924	16,990	17,596	16,608
New Orleans area	115,963	116,438	122,943	137,349	148,655
Houston Ship Channel	45,160	47,406	58,746	59,611	59,131
Galveston Harbor Channel	3,597	3,885	6,237	6,279	5,164
Texas City Channel	8,258	9,272	9,092	9,002	13,698
Los Angeles/Long Beach	42,340	42,793	50,581	50,027	53,399
San Francisco area	31,857	40,265	42,241	39,295	39,309
Columbia River	18,843	20,282	23,943	22,621	21,528
Portland, ME	31,227	30,344	28,541	27,442	27,378
Boston, MA	24,355	25,004	26,091	24,555	23,348
Cape Cod Canal	12,784	13,633	13,652	13,194	11,485
New Haven Harbor	11,611	12,988	13,554	11,744	10,932
Wilmington, N.C.	5,037	6,266	7,327	7,447	7,174
Charleston, S.C.	6,622	7,201	8,440	7,879	7,429
Savannah, GA	6,592	7,260	8,186	8,637	7,002
Port Everglades	9,966	11,095	12,384	11,493	10,474
Canaveral Harbor	1,384	1,524	1,671	2,127	1,919
Sabine Neches Waterway	82,577	81,989	84,707	86,590	79,296
Corpus Christi Ship Channel	26,746	25,496	27,172	37,781	41,291
Coos Bay	3,664	4,754	5,770	6,492	4,909
Seattle Harbor	7,349	8,133	10,013	9,315	8,836
Tacoma Harbor	4,565	5,875	6,998	5,846	6,053

Source: U.S. Army Corps of Engineers. *Waterborne Commerce of the U.S.* National Summaries. Part V.

TABLE 17

FOREIGN AND LAKEWISE COMMERCE
AT SELECTED U.S. GREAT LAKES PORTS

(000's of short tons less duplications)

Great Lakes	1971	1972	1973	1974	1975
Duluth-Superior	37,051	37,896	48,158	40,345	33,067
St. Mary's River	75,950	80,207	97,597	86,801	78,153
St. Clair River	102,892	106,465	118,910	101,445	91,711
Channels in Lake St. Clair	101,864	105,330	117,818	99,318	88,954
Detroit River	115,142	118,991	131,676	110,516	100,419
Cleveland	20,462	23,823	24,823	21,934	18,145
Chicago Harbor	25,470	24,433	24,828	21,300	18,782
Calumet River & Harbor	6,493	5,882	6,112	6,983	7,126
Indiana Harbor	14,815	16,225	16,758	15,502	15,704
Two Harbors	4,910	6,778	8,630	9,789	9,606
Toledo Harbor	26,945	24,938	24,622	21,330	23,423
Ashtabula Harbor	11,252	12,050	10,854	10,842	8,733
Lorain Harbor	7,138	9,842	11,513	8,604	7,277
Conneaut Harbor	15,852	14,684	16,732	16,566	19,192
Sandusky Harbor	4,848	5,584	4,854	3,994	4,454
Buffalo	10,753	8,918	12,908	10,209	7,412

Source: U.S. Army Corps of Engineers. Waterborne Commerce of the U.S. National Summaries. Part V.

TABLE 18

PORT-SPECIFIC CARGO FEES FOR COASTAL PORTS BASED ON DEEP-DRAFT COMMERCIAL ACTIVITY ONLY

(Five Year Average: FY 1971 to 1975)

Coastal Port or Channel	Corps O&M Expenditure toll ($/ton)	Corps O&M and Coast Guard Expenditure toll ($/ton)
New York	0.068	0.104
Philadelphia/Wilmington	0.090	0.126
Baltimore	0.021	0.057
Hampton Roads	0.051	0.090
Jacksonville	0.080	0.118
Tampa	0.014	0.052
Mobile	0.116	0.154
New Orleans Area	0.113	0.151
Houston Ship Cahnnel	0.032	0.070
Galveston Ship Channel	0.250	0.288
Texas City Channel	0.030	0.068
San Francisco Bay Area	0.149	0.187
Columbia River	0.157	0.195
Portland, ME	0.001	0.037
Boston, MA	0.001	0.037
Cape Cod Canal	0.167	0.203
New Haven Harbor	0.037	0.073
Wilmington, N.C.	0.201	0.238
Charleston, S.C.	0.431	0.467
Savannah, GA	0.427	0.463
Port Everglades	0.289	0.326
Canaveral Harbor	0.496	0.533
Sabine Neches Waterway	0.038	0.074
Corpus Christi Ship Channel	0.041	0.077
Coos Bay	0.228	0.264
Seattle Harbor	0.017	0.053
Tacoma Harbor	0.320	0.357

TABLE 19

PORT-SPECIFIC CARGO FEES FOR GREAT LAKES PORTS BASED ON DEEP-DRAFT COMMERCIAL ACTIVITY[1]

(Five Year Average: FY 1971 to 1975)

Great Lakes Port or Channel	Corps O&M Expenditures ($/ton)	Corps O&M plus Coast Guard Expenditures ($/ton)
Buffalo	0.320	0.359
Duluth-Superior	0.022	0.060
St. Marys River	0.051	0.089
St. Clair River	0.003	0.042
Lake St. Clair Channels	0.002	0.037
Detroit River	0.012	0.050
Cleveland	0.212	0.250
Chicago	0.002	0.038
Calumet River & Harbor	0.059	0.096
Indiana Harbor	0.006	0.042
Two Harbors	0.029	0.065
Toledo Harbor	0.050	0.087
Ashtabula Harbor	0.227	0.063
Lorain Harbor	0.026	0.062
Conneaut Harbor	0.015	0.051
Sandusky Harbor	0.068	0.104
Taconite Harbor	-	0.036
Silver Bay	-	0.036

SOURCE: TSC Calculations.

[1]Removal of Diked Disposal from Buffalo reduces the tolls to 0.16 cent per ton for O&M only and 0.20 cent per ton for O&M plus Coast Guard. Recovery of a portion of channel expenditures from Canadian traffic would significantly reduce those tolls.

of total Great Lakes expenditures in 1974 and 1975, respectively). Tables 20 through 22 provide traffic traffic data and toll estimates based on the inclusion of shallow-draft commerce in the traffic base. Recalculation is not performed for the Great Lakes ports because only Chicago has significant internal and/or local traffic where approximately 45% of traffic is in these categories. The issue of inclusion of this traffic is treated more comprehensively in Section 10 below.

3.3.4 Vessel-Based Fuel Tax

The fuel tax, which would charge a fee per gallon or ton of fuel oil laden by vessels, is a viable recovery option for shallow-draft and coastwise traffic but apparently not for foreign trade vessels.[1] Many foreign vessels engaged in U.S. trade could avoid paying a fuel tax to recover Federal deep-draft expenditures. First, because of the bonding option, foreign carriers can maintain and re-fuel from stocks of petroleum products physically located in the U.S. but owned and controlled by other nations. Negotiations with trading partners would be required to alter this arrangement. Second, for a variety of reasons, foreign carriers could simply avoid refueling in U.S. ports if Canadian and Caribbean stops were included in the visit. Finally, sufficiently high fuel taxes would encourage some conversion of cargo space for additional bunker fuel capacity.

This section will consider the option of recovering a share of Federal deep-draft expenditures from coastwise traffic via a fuel tax. The foreign trade share of expenditures will be assumed to be recovered via a vessel-based tonnage tax as in Section 3.3.

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[1]Some domestic service vessels might develop evasive fueling options under the impetus of an onerous fuel tax, particularly in the Great Lakes where Canadian ports are in easy reach.

TABLE 20

TOTAL COMMERCE IN SELECTED U.S. COASTAL PORTS

(000's of short tons, less duplications)

Coastal Ports and Harbors	1971	1972	1973	1974	1975
New York	181,025	196,843	216,896	195,096	177,815
Philadelphia/Wilmington	123,281	126,604	139,362	143,238	131,596
Baltimore	44,003	45,799	53,787	59,891	52,661
Hampton Roads	59,962	58,356	63,964	73,102	66,937
Jacksonville	12,449	14,886	15,514	14,795	13,496
Tampa	34,975	43,230	41,923	40,919	39,858
Mobile	24,919	27,291	30,518	33,154	32,453
New Orleans	177,274	188,622	196,018	213,709	224,232
Houston Ship Channel	68,424	71,431	88,518	89,106	83,674
Galveston Harbor Channel	3,953	4,274	6,662	7,171	5,971
Texas City Channel	17,952	20,355	19,959	20,152	23,864
Los Angeles/Long Beach	44,189	44,632	53,119	52,813	57,333
San Francisco	49,720	50,275	56,146	51,741	49,955
Columbia River	18,843	20,282	23,579	22,621	21,578
Portland, ME	31,679	30,682	28,844	27,607	27,566
Boston, MA	26,157	26,483	27,057	25,729	24,719
Cape Cod Canal	12,784	13,633	13,652	13,194	11,485
New Haven Harbor	11,855	13,163	13,709	12,055	11,433
Wilmington, N.C.	6,051	7,590	9,301	8,718	7,372
Charleston, S.C.	6,946	7,477	9,380	8,993	8,380
Savannah, GA	7,232	8,037	8,980	9,699	7,593
Port Everglades	10,066	11,183	12,541	11,557	10,522
Canaveral Harbor	1,999	1,835	2,363	3,422	2,937
Sabine Neches Waterway	82,577	81,989	84,707	86,590	79,296
Corpus Christi Ship Channel	26,746	25,496	27,172	37,781	41,291
Coos Bay	6,748	6,544	7,730	7,633	6,376
Seattle Harbor	14,558	14,663	17,000	14,251	15,008
Tacoma Harbor	7,110	8,477	9,805	7,600	7,898

Source: U.S. Army Corps of Engineers. Waterborne Commerce of the U.S. National Summaries. Part V.

TABLE 21

TOTAL COMMERCE IN SELECTED U.S. GREAT LAKES PORTS

(000's of short tons, less duplications)

Great Lakes	1971	1972	1973	1974	1975
Duluth-Superior	37,051	37,896	48,158	40,345	33,607
St. Marys River	75,950	80,207	97,597	86,801	78,153
St. Clair River	102,892	106,465	118,910	101,445	91,711
Channels in Lake St. Clair	101,864	105,330	117,878	99,318	88,954
Detroit River	115,742	118,991	131,676	110,516	100,419
Cleveland	20,552	23,866	24,828	21,939	18,145
Chicago Harbor	47,430	46,838	47,381	45,886	42,589
Calumet River & Harbor	6,493	5,882	6,112	6,983	7.126
Indiana Harbor	15,915	17,611	17,898	17,165	17,126
Two Harbors	4,910	6,778	8,630	9,789	9,606
Toledo Harbor	27,311	25,249	24,922	21,557	23,629
Ashtabula Harbor	11,261	12,064	10,872	10,852	8,738
Lorain Harbor	7,483	10,173	11,584	9,077	7,650
Conneaut Harbor	15,852	14,684	16,732	16,566	19,192
Sandusky Harbor	4,883	5,613	4,914	4,221	4,533
Buffalo	11,067	9,226	13,177	10,442	7,614

Source: U.S. Army Corps of Engineers. Waterborne Commerce of the U.S. National Summaries. Part V.

TABLE 22

PORT-SPECIFIC CARGO FEES FOR COASTAL PORTS BASED ON TOTAL COMMERCIAL ACTIVITY

(Five Year Average: FY 1971 to 1975)

Coastal Port or Channel	Corps O&M Expenditure Toll ($/short ton)	Corps O&M and Coast Guard Expenditure Toll ($/short ton)
New York	0.041	0.077
Philadelphia/Wilmington	0.060	0.096
Baltimore	0.016	0.054
Hampton Roads	0.042	0.078
Jacksonville	0.069	0.107
Tampa	0.014	0.052
Mobile	0.059	0.097
New Orleans Area	0.073	0.115
Houston Ship Channel	0.022	0.060
Galveston Ship Cahnnel	0.224	0.262
Texas City Channel	0.015	0.054
San Francisco Bay Area	0.111	0.149
Columbia River	0.157	0.195
Portland, ME	0.001	0.037
Boston, MA	0.001	0.037
Cape Cod Canal	0.167	0.203
New Haven Harbor	0.036	0.072
Wilmington, N.C.	0.174	0.210
Charleston, S.C.	0.391	0.427
Savannah, GA	0.389	0.425
Port Everglades	0.287	0.323
Canaveral Harbor	0.353	0.389
Sabine Neches Waterway	0.038	0.074
Corpus Christi Ship Channel	0.041	0.077
Coos Bay	0.164	0.200
Seattle Harbor	0.010	0.046
Tacoma Harbor	0.233	0.269

SOURCE: TSC Calculations.

Both residual fuel oil and distillate oil are burned by coastwise vessels in the U.S. trades. In 1975, residual oil consumption was approximately 31-million barrels and diesel use was estimated at about 3-million barrels. Table 23 estimates total coastwise fuel use of both residual and diesel for the years 1971 to 1975. Bureau of Mines total vessel residual oil bunkering data minus U.S. foreign trade fuel lading data yields an estimate of coastwise, military, fishing, etc., use. Time constraints prevented further disaggregation of the data to eliminate other uses. For diesel, foreign trade and estimated inland use was subtracted from total U.S. vessel diesel bunkering data from Bureau of Mines. In both cases, total bonded fuel sales are included in U.S. foreign trade fuel lading data from Census.

Table 24 calculates sample fuel taxes for two options; recovery of one-third of deep-draft expenditures from coastwise residual use only and recovery from residual plus diesel use.[1] Expenditure data are drawn from Table 5. On average, if one-third of expenditures were recovered from residual fuel users only, a tax of $2.00 per barrel would be required. If distillate fuel users were included, the fuel tax would drop to $1.82 per barrel. In terms of tax per gallon, coastwise distillate users would pay four cents tax per gallon as opposed to a shallow-draft tax per gallon of between 25 and 50 cents, depending on whether implementation costs were recovered. Obviously, an equity problem exists, made worse by the fact that coastwise and inland distillate fuel users may be the same vessels, and certainly share bunkering stations.

If coastwise diesel users paid a 25 cents per gallon tax on fuel, recovery from this traffic would be over 30-million dollars, almost half the calculated "share" of Federal expenditures allocated to coastwise traffic. A

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[1]One-third represents the coastwise and lakewise share of total deep-draft ladings and discharges. Other proportions are obviously possible

TABLE 23

FUEL LADEN ON VESSELS ENGAGED IN U.S. COASTWISE TRADES (000'S OF BARRELS)

Year	Residual Oil	Diesel
1971	34,637	2450
1972	35,410	2708
1973	35,566	3321
1974	29,687	2819
1975	30,828	3257

Source: Bureau of Mines, Mineral Industry Survey, Sales of Fuel Oil and Kerosine, 1971 to 1975.

Bureau of Census, Petroleum Fuel Laden on Vessels Engaged in U.S. Foreign Trade. FT 810.

TABLE 24

FUEL TAX CALCULATIONS FOR RECOVERING ONE-THIRD OF DEEP-DRAFT EXPENDITURES (FY 71 TO 75)

Year	One-Third of Corp and Coast Guard Expenditures (000's)	Fuel Tax; Residual Oil ($/BBL)	Fuel Tax; Residual & Distillate ($/BBL)
1971	$54,821	$1.58	$1.48
1972	60,290	1.70	1.58
1973	65,641	1.85	1.69
1974	70,519	2.38	2.16
1975	75,115	2.44	2.20
Average (5-year)		$2.00	$1.82

rebate system could be instituted but separating inland and coastwise ton-miles and fuel use for vessels engaged in both trades is difficult if not impossible.

Alternatively, a six cent per gallon diesel tax[1] would recover over $7.5 million dollars from coastwise diesel using traffic, or about 10 percent of total allocated expenditures to coastwise traffic. In that fuel use by coastwise diesel is approximately ten percent of residual fuel use (and 7 or 8 percent of total coastwise fuel use), a six cent per gallon tax does not inequitably burden coastwise diesel traffic. A four cent per gallon tax is slightly more equitable in terms of fuel use.

Equity issues among U.S. carriers involving the fuel tax as a recovery option also arise. In domestic trade, a vessel on a simple 1000 mile coastal route (for example, petroleum from Gulf to New England) uses twice the fuel of a vessel on a 500 mile route. If the vessels are identical and the vessel on the shorter route delivers product to five ports while the longer-haul vessel visits only two ports, a fuel tax would require the long-haul operation to subsidize the short-haul, many ports operation. Over a year, two ships engaged in similar trading activity would use approximately the same amount of fuel. However, across classes of carriers, domestic long-haul operations would be impacted more by a fuel tax than short-haul shipments. A carrier that spends more time in ports (and thus avails itself of more port services) will pay less under fuel taxes than one who visits ports infrequently or for short periods of time. Also, the larger haul route involves lower annual cargo liftings and subsequently higher fuel tax impacts per ton.

[1] The original DOT fuel tax proposal charged a 6 cent tax on diesel and $1.00 per barrel tax on residual oil.

A second equity consideration involves the fact that similar vessels in identical trades may use different fuel types. For example, while the majority of Great Lakes bulkers are steam powered residual oil burners, some are diesel powered, and a much smaller, older group are coal burners. If diesel bunkered for inland waterway use cannot be segregated from that burned in the deep-draft trades, then payment by the deep-draft vessels of the higher-level inland diesel taxes would be a significant, if not disastrous, burden. Coal burners on the other hand, would be untouched unless the fuel tax were somehow extended to them.

Fuel taxes also violate one of the basic efficiency arguments associated with cost payback for Federal subsidy on deep-draft navigation, in that the recovery unit (fuel) is unrelated to incurred use costs of a vessel in a public port. Since fuel use relates more to type of trade a vessel or carrier is engaged in, a fuel tax may act to distort the economic markets among which the carrier operates. For example, port collection activities may be reduced in favor of land-based modes. Port traffic may fall off at smaller harbors and increase at major facilities.

Alaskan and coastwise petroleum movements would be substantially affected by a deep-draft user charge, in that they tend to be the longest haul movements in domestic trade. If foreign carriers could avoid bunkering in U.S. ports or continued to use bonded fuels, and relative recovery levels from domestic and foreign traffic were not carefully chosen, the domestic trade might suffer relative to imports in those few cases where direct competition is found.

In summary, recovery of the one-third coastwise share of Federal deep-draft expenditures would require a fuel tax of only four or five cents per gallon on all fuels (residual and diesel) burned in U.S. coastwise trades. The remaining two-thirds would be recovered from an increased vessel tonnage tax. On a per barrel basis, a tax of $1.80 would be sufficient for full cost recovery of expenditures allocated to coastwise traffic.

3.3.5 Local Responsibility

An obvious extension of port-specific cost recovery is local responsibility for navigation works. While such an option is not readily applicable to the inland waterways, where most river segments have no obvious geo-political counterpart - there is a different state on each bank, with much traffic merely passing through from other jurisdictions - the jurisdictional situation is much simpler in most harbors. Implementation of this option would require some jurisdictional changes, however. Although most ports are currently governed by a port authority, this agency's power of taxation is generally exercised only over authority owned and/or operated facilities. Taxing power over all users of a harbor would have to be established. For extensive port areas with shared channels (Lower Mississippi ports, San Francisco Bay-Sacramento, New York-Albany, Columbia River ports, etc.). These jurisdictional changes would be complex.

Determination of the recovery method would then be up to the local authority. In addition to the options available to the Federal government, the local authority might also have recourse to financing through shoreside property levies, local property taxes, or other tax subsidy. Recovery structures could be set to match the peculiarities of each port's unique situation. This appears optimal from the point of view of efficiency - each investment would be judged on the basis of its ability to generate a reasonable rate of return, with greater accountability for the decisions than exists with National funding. On the other hand, not all the benefits of port development are local, although some ports clearly serve only local interests and many ports confer their benefits predominately on their immediate locality. The existence of significant external benefits might lead to under-investment in port facilities.

Another possibility is that the significant economies of scale in port operations and the existence of competition for hinterland cargo would lead to underpricing of port use, large local subsidization, and possible over-investment (as is claimed by some has occurred in container terminal development). This might lead to pressure for greater Federal regulation of the port industry.

While the private ports on the Great Lakes (Taconite, Silver Bay) and the local supertanker channel development in Los Angeles and Long Beach (see Section 1) provide some precedent for local responsibility, the application of this approach to the large, multi-user harbor and channel projects which characterize the deep-draft system would require immense legal changes to function well. It is also not at all appropriate for recovery of non-place-specific expenditures such as coastal aids to navigation.

3.3.6 General Impacts of Recovery Options

The impacts of user charges on deep-draft traffic and delivered prices of commodities obviously depends on the option chosen and, in the case of a mixed strategy -- e.g., tonnage tax on foreign traffic and fuel tax on domestic vessel -- what fraction of expenditure is to be recovered through each. We can make certain general observations about the relative impact of each generic option on different traffic classes.

3.3.6.1 System Use Fees

This approach, which taxes vessels in the foreign trade on a voyage basis (up to 15 payments per year) and charges a registration fee equivalent to fifteen voyages on domestic coastal and Great Lakes vessels, has several basic characteristics.

First, because of the payments limit (and fixed payment for domestic vessels), no single class of traffic bears a disproportionate share of the cost recovery burden. Under a port use fee, general cargo vessels and vessels on domestic and foreign short-sea routes make a much greater share of total payments.

As a corollary of the above point, identical vessels operating in similar trades (in terms of route length and sailing frequency) pay similar amounts over the course of a year, regardless of whether one is on a domestic route and the other is on a foreign one.

The fact that the addition of a port call to a voyage itinerary adds nothing to the tax burden means that this approach provides no new incentive for consolidation of general cargo activities in a few large load centers.

Relatedly, since a visit to at least one U.S. port on each voyage would continue to be a virtual necessity for a viable liner service serving U.S. importers and exporters, little probability of additional diversion to Canadian ports is expected. [The relatively insignificant level of the tax mitigates against this occurrence under any option.] This is not a major concern for bulk cargos at this time.

The fact that the tax is not only "equitable" between foreign and domestic trade, but also that it protects short sea routes from excessive liability, protects U.S. producers who ship coastwise or lakewise in competition with foreign imports. This is particularly applicable on the Great Lakes for iron ore shipments.

As any other fixed cost element, the tonnage tax in the general cargo trades would tend to be allocated by operators to those commodities which could most easily bear rate increases. This would tend to minimize traffic impacts which are already expected to be minimal.

3.3.6.2 Port and Channel Use Fees

The impacts of this tax would obviously depend on whether a port-specific or uniform fee were charged. For example, if diked disposal is included in the recovery base, and if wholly Canadian traffic escapes taxation, Great Lakes vessel activity would be relatively hard hit. Still, the overall differences between high and low cost ports are less dramatic than for segments of the inland waterways. Certain generic observations are possible concerning impacts under either version of this option.

First, vessels engaged in services which involve relatively frequent port calls - general cargo trades in general and domestic and foreign short-sea trades in particular - bear a relatively greater burden under this approach than under the system use fee. These trades are benefitted by the payments limitations under a system use fee.

Port use fees would encourage load centering (port consolidation) in the liner (especially container) trades. Since the payment is based on the full capacity of the ship at each port while secondary ports contribute to filling only a small portion of that capacity, the cost burden per general cargo ton will be much greater in low volume ports. [The fact that bulk vessel calls generally involve a shipload-sized consignment and because load centering is less of a factor in bulk trades exempts them from this consideration.]

Unless some consideration is given to relief for vessels sailing between U.S. ports, domestic trade vessels will be disadvantaged relative to vessels carrying competing cargos from abroad because the domestic service would involve harbor dues at both origin and destination. Partial liability (e.g., 50 percent) for such vessels is a logical possibility.

3.3.6.3 Cargo-Based Taxes

As in the case of port and channel dues, the specific impacts depend on whether a port-specific or uniform approach is implemented. Again, however, certain generic observations are possible.

First, unless some consideration is given to domestic cargos (e.g., partial liability), domestic coastwise moves such as petroleum and lakes ore, this would involve double payment. For a liner operator with a waterborne feeder service, triple taxation would be suffered - twice for the feeder move and once for lading on the line-haul vessel. Different financing and recovery approaches tailored to each port's particular needs would emerge, just as existing ports publish unique schedules of facility tariffs. While a richer variety of options are available to local jurisdictions, concerns of competition for hinterland traffic and development benefits which are external to the decision-making jurisdiction might encourage sub-optimal investment and pricing decision and/or increasing Federal regulation. Existing private and local activity in the development of some ports demonstrates the basic feasibility of this option.

While partial liability would provide some protection against excess burden on domestic traffic, the cost impact on this segment of traffic would still exceed that for the system use fee, where the annual payments ceiling would lend additional shelter.

This approach, particularly in its uniform version, does not encourage port consolidation trends because there is no relationship between tax costs per cargo ton and tons laden per port call as in the case of harbor dues.

Although it is not seen as a major factor under any approach because of the low magnitude of tolls, this approach gives the greatest encouragement to diversion to Canadian ports. Unlike the vessel based taxes, where the lading of an additional ton causes no additional tax once a port call is made, cargo taxes require an added payment implying less freedom to burden shifting among commodities.

3.3.6.4 Fuel Taxes

This approach alone is not applicable to foreign trade vessels because of the bonded fuel option and other evasion possibilities, some of which may be available to domestic vessels in certain instances. This requires a division of recovery between foreign trade and domestic accounts, with the former subject to an alternative tax, probably the tonnage tax (system use fee). The impacts of the fuel tax on domestic trade obviously depend on the division of expenditures between accounts. Aside from this, certain observations are possible.

The diesel bunker tax required for inland waterway cost recovery is significantly larger than that required for deep-draft cost recovery (at the one-third two-third cost division). If shallow-draft deep-draft bunkering activities cannot be segregated, a significant and potentially disastrous burden would be imposed on coastal users.

There is little relationship between port system use and fuel consumption. Long-haul carriers (e.g., Gulf-Pacific, Alaska-Gulf) would bear significantly greater burdens per ton carried than short-haul carriers even though they engage in considerably less port activity.

3.3.6.5 Local Responsibility

This option, which would require significant and complex changes in jurisdiction in port system operations and planning, would leave project financing and/or development up to local or regional authorities.

4. U.S. DEEP-DRAFT TRAFFIC OVERVIEW

The deep-draft ports of the United States serve a vital role in the U.S. economy through their functioning in foreign trade and in the transport of domestic goods. Currently there are approximately 150 U.S. ports[1] which are able to handle ocean-going vessels with drafts of 25 feet or more. In 1975, total commerce at these ports amounted to 1,191-million tons of traffic.[2] The majority of this tonnage is attributable to foreign commerce - 477-million tons of commodities were imported in 1975 while 272 million tons were exported. The remaining 37% of total traffic (442-million tons) is domestic with 232-million tons moving coastwise, 129-million moving lakewise, 78-million moving locally,[3] and 3-million moving between territories. Those ports handling more than 10-million tons of traffic in 1975 are listed in Table 25A and 25B

[1]Location includes the Atlantic, Pacific, and Gulf coasts, the Great Lakes, Alaska, Hawaii, Puerto Rico, and the Virgin Islands.

[2]There were an additional 504-million tons of internal traffic which may originate or terminate at a deep-draft port but are not accounted for in the reported figure. The type of collection scheme will affect how this port activity is impacted.

[3]Most of this traffic occurs within coastal ports although this figure does include traffic in some ports on the inland river system.

TABLE 25A

TRAFFIC AT COASTAL PORTS WITH 1975 COMMERCE GREATER THAN 10-MILLION TONS
(THOUSANDS OF SHORT TONS)

Port	Total	Foreign		Coastwise		Internal		Local
		M	X	Receipts	Shipments	Receipts	Shipments	
New York	177,815	48,966	6,726	32,991	21,696	3,825	16,650	46,961
New Orleans	140,409	12,205	35,454	2,641	14,531	50,117	21,148	4,312
Houston	83,674	18,273	18,001	3,315	19,542	10,995	9,838	3,710
Baton Rouge	60,226	11,995	8,413	2,116	6,829	11,631	18,666	576
Baltimore	52,661	20,657	13,859	5,052	1,504	4,720	2,564	4,307
Philadelphia	52,030	28,386	5,104	2,529	3,105	8,940	2,180	1,785
Norfolk	49,743	6,463	31,917	2,277	409	2,421	5,280	977
Tampa	39,858	4,082	12,687	14,619	8.059	5	266	140
Corpus Christi	35,487	13,038	5,196	202	11,923	1,393	3,081	654
Mobile Harbor	32,453	7,896	5,405	364	3,014	7,559	6,832	1,384
Los Angeles Harbor	30,746	13,131	2,965	6,147	6,104	668	691	1,040
Beaumont	30,583	6,038	3,961	947	9,760	5,136	4,552	188
Portland (ME)	27,566	23,159	16	3,619	585	14		174
Paulsobor (NJ)	27,132	11,811	118	4,611	1,744	3,465	5,149	233
Port Arthur	26,598	8,179	2,158	2,791	7,300	1,326	4,832	11
Long Beach Harbor	26,587	11,540	5,650	5,902	1,960	695	467	372
Boston	24,719	5,988	547	14,148	2,666	11		1,360
Marcus Hook (PA)	24,395	12,322	160	3,308	2,242	2,995	2,815	552
Texas City	23,864	5,663	532	406	7,066	5,403	4,763	32
Pascaguola	19,951	5,800	2,251	682	4,265	2,331	4,510	111
Portland (OR)	19,600	2,030	6,560	3,266	340	3,304	2,203	1,897
Lake Charles	17,463	4,553	1,127	128	2,240	5,897	2,846	671
Newport News	17,259	1,094	11,426		66	2,227	2,445	
Seattle	15,008	3,362	1,857	1,650	1,967	4,253	1,349	570
Richmond Harbor	14,358	2,842	389	5,394	3,147	1,016	1,301	269
Jacksonville Harbor	13,496	3,621	1,590	5,398	844	84	1,728	231
New Haven Harbor	11,433	1,765	162	7,605	1,399			501
New Castle	11,244	4,088		1,013	3,768	1,619	737	
Port Everglades	10,522	1,898	260	7,230	1,087	4	44	
San Juan	10,522	3,840	306	4,098	1,325	631	319	3

TABLE 25B

TRAFFIC AT GREAT LAKES PORTS WITH 1975 COMMERCE GREATER THAN 10-MILLION TONS

(thousands of short tons)

Port	Total	Foreign		Coastwise		Lakewise		Internal	Local
		M	X	R	S	R	S		
Chicago	42,589	1,898	2,722	10	28	9,453	4,708	21,176	2,595
Duluth-Superior	33,607	307	4,772			2,361	26,166		1
Detroit	26,488	3,722	596	56		21,227	514	12	361
Toledo	23,629	1,261	6,419			3,796	11,947	37	169
Conneaut	19,192	2,152	6,552			8,960	1,527		
Cleveland	18,145	3,811	212			13,281	799		41
Indiana Harbor	17,126	1,909				10,413	3,382	933	489
Taconite Harbor	11,901								
Calcite	11,646								
Escanaba	10,876								
Silver Bay	10,354								

with a breakdown by type of activity. The ten most heavily utilized ports have been isolated in Table 26, and a comparison is made with total commerce at these ports in the 4 previous years to demonstrate the recent growth trends. Both these tables indicate the dominance of port activity along the Atlantic and Gulf coasts. Total commerce at all ports has grown about 50% since 1960. Table 27 shows the annual totals from 1960 to 1975 with relative contributions of foreign and domestic traffic.[1] Domestic traffic (coastwise, lakewise, local, and intraterritory) remained fairly constant over the past 15 years while foreign traffic has nearly doubled.

The majority of activity at U.S. ports is foreign commerce with imports largely dominating exports. Table 28 shows the growth of imports and exports from 1960 to 1975 with detailed information on Great Lakes traffic. It can be seen that most Great Lakes foreign commerce is with Canada, and thus, relatively short-haul when compared with trade with overseas countries. The ratio of total import traffic to export traffic is also presented. In recent years, imports have contributed almost twice as much traffic to deep-draft ports as exports - reflecting heavy petroleum imports.

Imports and exports for which the U.S. is neither the true destination nor true origin are designated as in-transit cargo. These commodities are not consumed or produced in the

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[1]These numbers do not include the interaction of internal traffic with the deep-draft ports.

TABLE 26

TOTAL COMMERCE IN TEN LARGEST PORTS
1971 - 1975
(thousands of short tons)

Port	1971	1972	1973	1974	1975
New York	181,025	196,843	216,896	195,096	177,815
New Orleans	120,067	125,719	136,104	144,189	140,409
Houston	68,424	71,431	88,518	89,106	83,674
Baton Rouge	47,017	52,903	53,569	59,126	60,226
Philadelphia	51,134	48,357	54,630	59,920	52,030
Baltimore	44,003	45,799	53,787	59,891	52,661
Norfolk	47,120	47,781	52,333	55,304	49,743
Chicago	47,430	46,838	47,381	45,886	42,589
Tampa	34,975	43,230	41,923	40,919	39,858
Corpus Christi	21,776	22,301	24,795	32,844	35,487

TABLE 27

GROWTH OF TOTAL COMMERCE IN U.S. DEEP-DRAFT PORTS

1960 - 1975

(Millions of short tons)

YEARS	Total	Foreign	Domestic
1960	809	339	470
1965	904	444	460
1970	1060	581	479
1971	1033	566	467
1972	1110	630	480
1973	1258	767	491
1974	1236	764	472
1975	1191	749	442

TABLE 28

GROWTH OF U.S. FOREIGN COMMERCE 1960 - 1975

(thousands of short tons)

	Imports				Exports				
			Great Lakes				Great Lakes		Ratio
Years	Total	Coastal	Canadian	Overseas	Total	Coastal	Canadian	Overseas	Import/ Export
1960	211,316	198,466	11,974	877	127,961	104,810	19,168	3,982	1.65
1965	269,835	244,874	21,050	3,901	173,892	142,121	25,693	6,078	1.55
1970	339,340	312,934	21,820	4,586	241,629	205,698	29,146	6,785	1.40
1971	359,746	333,777	19,105	6,864	206,240	172,759	24,757	8,724	1.74
1972	397,566	372,418	18,861	6,287	232,415	197,430	25,352	9,632	1.71
1973	490,088	461,828	22,989	5,271	277,306	238,807	28,436	10,063	1.77
1974	497,283	473,940	19,027	4,315	266,806	238,687	23,343	4,776	1.86
1975	476,573	455,117	18,122	3,333	272,135	236,708	28,707	6,720	1.75

U.S., but U.S. ports serve as an intermediate stop either due to location or distribution logistics. The first can be represented by tanker receipts of crude petroleum in Portland, Maine (22-million tons in 1975). They are loaded into pipeline and transported directly to Canada; Portland serves this market due to its advantageous position relative to the demand centers. An example of logistical considerations is containers being shipped from foreign countries to Puerto Rico via New York. Such shipping patterns are generated by volume demanded in different areas as well as routing and timing schedules.

The deep-draft system is also an important element of the domestic transportation system of the U.S. Four major types of traffic characterizing this commerce are, in order of magnitude: coastwise, likewise, local, and intraterritory. Coastwise traffic refers to any transportation along or among the Atlantic, Pacific, and Gulf coasts. Examples of coastwise traffic are motor gasoline moving from Houston to New York (intracoastal) or residual fuel oil moving from Houston to Los Angeles (intercoastal). Lakewise traffic refers specifically to shipments between U.S. Great Lakes ports. Iron ore shipped from Two Harbors, Minnesota to Ashtabula, Ohio is a prime example. Movements of cargo within the limits of a single port are defined as local traffic. This traffic class is dominated by petroleum distribution within the various port areas. Intraterritory traffic refers to shipments between Puerto Rico and the Virgin Islands. Table 29 demonstrates the growth trends in each type of traffic since 1960.

TABLE 29

GROWTH OF U.S. DOMESTIC COMMERCE
1960 - 1975
(thousands of short tons)

Years	Total	Coastwise	Lakewise	Local	Intra-territory
1960	469,516	209,197	155,109	104,193	1,017
1965	459,554	201,508	153,695	102,865	1,485
1970	478,604	238,440	157,059	81,475	1,630
1971	467,380	242,916	140,955	81,253	2,257
1972	479,823	242,660	145,013	90,266	1,883
1973	490,921	236,795	156,621	93,223	4,283
1974	471,678	233,358	146,067	88,198	4,055
1975	442,395	231,932	129,331	78,279	2,852

Transportation services utilizing deep-draft ports include liner, irregular, and tanker operations for both foreign and domestic commerce, while domestic traffic may also include barge transport due to the short-haul nature and limited tonnage of some domestic shipments (coastwise, lakewise, and especially local). Maritime Administration statistics for 1973 indicate that liner operations accounted for 8.1% of foreign commerce tonnage, irregular service carried 44.6% of tonnage, while 47.3% of tonnage was handled by tanker.[1] Liner service is generally provided by a common carrier on a regular time schedule with frequent sailings between specified port groups. The cargo (break bulk or unitized-container, LASH, RORO, etc.) is of relatively high value, e.g., coffee, alcoholic beverages, road motor vehicles and parts, or iron and steel products. In 1973 although liner operations accounted for only 8.1% of the import-export tonnage, it was responsible for over 59% of the value of shipments in waterborne foreign trade in that year. Irregular service is provided by ships when demand is sufficient to warrant sailing. Generally, a full shipload of a single bulk commodity is carried with no trading restrictions - 44.6% of tonnage amounted to 30% of value in 1973. Examples of products generally transported by this means are coal, iron ore, corn, and wheat. Tankers carried 47.3% of tonnage but only 11% of total value of commodities in the foreign trade

[1] Barge may carry some cargo between Canada and the United States (Great Lakes traffic) or between Mexico and the United States.

market. Tankers are designed to carry bulk quantities of liquids such as crude petroleum, residual fuel oil, and distillate fuel oil. Some tanker tonnage in the official data may also represent deck cargo.

Traffic distribution at most deep-draft ports is relatively easy to characterize due to the dominance of a few important commodities in each major distribution system (import-export, coastwise, lakewise, and local). Foreign commerce is the most important and most easily discussed since only one U.S. port is involved in each shipment rather than an O/D combination. Table 30 shows total imports and exports from the Bureau of Census for each of the six major coastal regions in the U.S. with a breakdown according to type of transportation service. The Census data show the major areas of port activity in the import and export markets with a rough indication of the commodities handled in each area. The large quantity of tanker traffic in the import market suggests the dominant role of crude petroleum and petroleum products. The large share of exports handled by irregular service carriers indicates a great deal of shipload bulk dry cargo such as coal and grains are shipped from the U.S. Anlaysis of the data published by the ACoE substantiates these observations. Tables 31 and 32 list import and export data with commodity detail. Four commodities account for almost 80% of imports (crude oil alone totals 53.7%), while five commodities amounted to almost 60% of exports.

TABLE 30

U.S. WATERBORNE FOREIGN TRADE BY COASTAL RANGE AND TYPE SERVICE - 1975

Imports (000's Tons)

Region	Liner	Irregular	Tanker	Total*
North Atlantic (to VA)	9,971	45,141,	140,663	196,107
South Atlantic (to Key West) (including P.R.)	2,028	5,920	28,076	36,082
Gulf	3,740	32,019	97,387	133,619
S. Pacific (Cal., HW)	3,294	4,620	37,928	45,887
N. Pacific (Alaska, WA, OR)	1,276	8,767	7,708	17,973
Great Lakes	493	19,393	1,569	21,456
Total	20,802	115,860	313,331	451,124

*May not sum due to exclusion of in-transit dry cargo

Exports (000's Tons)

Region	Liner	Irregular	Tanker	Total
North Atlantic	8,766	61,076	1,430	71,943
South Atlantic	2,617	4,448	723	7,985
Gulf	8,830	84,180	13,125	106,411
S. Pacific	4,404	10,612	2,425	17,525
N. Pacific	2,137	27,410	1,771	31,709
Great Lakes	591	34,575	128	35,305
Total	27,345	222,301	19,602	270,878

TABLE 31

1975 U.S. IMPORTS BY COMMODITY

Commodity	000's of Tons	Cumulative Percentage of Total Traffic
Crude Petroleum	255,913	53.7
Residual Fuel Oil	59,172	66.1
Iron Ore	49,280	76.5
Bauxite	14,847	79.6
Steel Products	10,948	81.9
Basic Chemicals & Products, NEC	6,378	83.2
Distillate Fuel	6,278	84.5
Limestone	5,712	85.7
Kerosene	4,648	86.7
Sugar	3,802	87.5
Gasoline	3,506	88.2

TABLE 32

1975 U.S. EXPORTS BY COMMODITY

Commodity	000's Tons	Cumulative Percentage of Total Traffic
Coal	65,274	24.0
Corn	35,976	37.2
Wheat	34,037	49.7
Soybeans	13,728	54.8
Logs	10,915	58.8
Phosphate Rock	10,667	62.7
Coke, Petroleum Pitches, and Asphalt, Solvents	9,025	66.0
Basic Chemicals and Products, NEC	8,577	69.2
Iron and Steel Scrap	7,439	71.9
Wood Chips, Staves, Moldings	6,417	74.2
Grain Mill Products, NEC	5,804	76.4

The North Atlantic[1] and Gulf easily dominated imports in 1975 (most of which were by tanker). The North Atlantic received 196.1-million tons (43.5%) of total import cargo. The following figures indicate the major areas of activity:

Area	Millions of Tons	Percentage Of North Atlantic Imports	Cumulative Percentage
Delaware River (Trenton to the Sea)	68.3	35	35
Port of New York	49.0	25	60
Portland	23.2	12	72
Baltimore	20.7	11	83

On the Delaware River, 43.3-million tons of imports were crude petroleum , while 17.0-million were iron ore and concentrates -- together they accounted for 88% of Delaware River imports. In New York, 18.3-million tons (37%) of crude petroleum and 16.5-million tons (34%) of residual fuel oil made up the majority of imports. Almost the entriety of Portland imports were crude petroleum that was in-transit bound for Canada. Iron ore made up 58% of imports in Baltimore.

The South Atlantic ports ports received 36.1-million tons of imports in 1975 with almost half going to Puerto Rico (mostly crude petroleum). The remainder were fairly evenly distributed between Wilmington, NC, Charleston SC, Savannah GA, and Jacksonville, Canaveral Harbor, Port Everglades, and Miami Harbor FL.

[1] The North Atlantic port range includes Atlantic Coast ports north of Hatteras.

Over 50% of the imports into these 7 ports were residual fuel oil. Other major imports were limestone, building cement, and iron ore.

Thirty percent of U.S. imports in 1975 were received along the Gulf Coast. Texas (most importantly Beaumont, Port Arthur, Houston, Texas City, Corpus Christi, and Harbor Island) and Louisiana (especially ports along the Mississippi River from Baton Rouge to the Mouth of Passes) imported 62.3-million tons (47%) and 51.1-million tons (38%) of cargo, respectively. About 80% of Texas imports were crude petroleum going to refineries, while another 10% was aluminum ore. These two commodities also made up the majority of imports in Louisiana accounting for 68% and 15%, respectively. Other ports along the Gulf Coast with substantial imports were Mobile (7.9-million tons, 60% iron ore and 24% aluminum ore), Pascagoula (5.8-million tons, 97% crude petroleum), and Tampa.

The southern Pacific coast (California and Hawaii) imported 45.9-million tons of cargo in 1975. The two most important ports were Los Angeles (13.1-million tons) and Long Beach (11.5 million tons). Seventy-one percent of the receipts in Los Angeles were crude petroleum with residual fuel oil accounting for another 10%. Long Beach imports exhibit similar products and percentages

Almost one-half of the imports on the northern Pacific coast (Oregon, Washington, and Alaska) enter the Puget Sound area (mainly Seattle, Anacortes, and Tacoma). Important commodities received in this area are crude petroleum, sand and gravel, lumber, basic chemicals, and salt.

In 1975, 85% of the imports at Great Lakes ports were from Canada, while 15% originated overseas. Fifty percent of imported materials were iron ore from Canada being received at the following ports: Chicago, Indiana Harbor, Detroit, Toledo, Cleveland, Conneaut, and Buffalo.

The majority of exports from the U.S. in tonnage terms were originated along the Gulf and North Atlantic coasts by irregular service operations (dry bulk in shipload quantities.) The Gulf accounted for about 40% of exports in 1975. About 45% of these exports were shipped from the Lower Mississippi between Baton Rouge and the Mouth of Passes -- of the exports originating on this segment almost 80% were grains or grain products (corn, 21.2-million tons; soybeans, 8.5-million tons; wheat, 3.6-million tons; and grain mill products, NEC, 4.0-million tons). Houston accounted for another 17% of Gulf exports, mostly grains and primarily wheat. Tampa, Florida adds another 12% of exports from the Gulf bringing the total from these three areas to 78.1-million tons or almost 75%

of Gulf exports (exports from Tampa are largely fertilizer and materials with phosphate rock being by far the dominant cargo).

North Atlantic ports shipped 71.9-million tons of commodities to foreign countries in 1975, accounting for 27% of total U.S. exports. Approximately 80% of these shipments originated from only two ports, Hampton Roads and Baltimore (Hampton Roads alone shipped 60% of all North Atlantic exports). The major cargo exported (in tonnage terms) was coal and lignite (76%) with corn accounting for an additional 11%.

Three ports on the South Atlantic coast ship 61% of exports from that region. They are Savannah GA (1.8-million tons), Jacksonville FL (1.6-million tons) and Charleston SC (1.4-million tons) and mainly export grains, phosphate rock, clay, pulp, paper, and paperboard.

The ports of Long Beach and Los Angeles account for about 50% of export traffic on the southern Pacific coast. About one-half of Long Beach exports are coke, petroleum asphalts, and solvents, while a substantial amount of agricultural products are also exported. Major exports from the Port of Los Angeles are nonmetallic minerals, NEC, iron and steel scrap, and residual fuel oil.

Exports from Great Lakes ports totaled 35-million tons in 1975 --80% was destined for Canada and the remainder went overseas. About 60% of exports to Canada are coal and lignite while the balance is mostly limestone, iron ore and concentrates, wheat, and corn. Wheat and corn were the dominant overseas exports.

Total domestic traffic on the Great Lakes in 1975 was 129.3-million tons. Three commodities contributed 114.2-million tons (88%) of this traffic --iron ore and concentrates totaled 51%, limestone was 21%, and coal and lignite 17%. Table 33 shows the commodity mix of traffic on the Great Lakes for 1975. Cumulative percentages are also presented as evidence of the dominating role of relatively few commodities.

Large iron ore deposits in Northern Minnesota are the source of supply for Lake Superior ports, specifically Duluth and Superior, Two Harbors, Silver Bay, and Taconite Harbor. Two other important shipping points are Presque Isle (Lake Superior) and Escanaba (Lake Michigan) which are both located on the Upper Michigan peninsula. Ore is then shipped to Lower Lake Michigan, Detroit, and Lake Erie for consumption at iron and steel plants along the lakes or trans-shipment to rail with the ultimate destination being inland facilities. Lake Michigan receiving ports are Chicago, Indiana Harbor, Gary, and Burns Harbor. Major receiving sites on Lake Erie are Toledo, Huron, Lorain, Cleveland, Ashtabula, Conneaut, Erie, and Buffalo.

TABLE 33

1975 LAKEWISE TRAFFIC BY COMMODITY

Commodity	000's Tons	Cumulative Percentage of Total Traffic
Iron Ore	65,781	50.9
Limestone	26,641	71.5
Coal and Lignite	21,793	88.3
Building Cement	3,090	90.7
Distillate Fuel Oil	1,537	91.9
Gasoline	1,500	93.0
Wheat	1,442	94.2
Residual Fuel Oil	1,377	95.2
Nonmetallic Minerals, NEC	1,357	96.3
Sand, Gravel, and Crushed Rock	853	96.9
Gypsum, Crude, and Plastics	600	97.4
Slag	403	97.7
	129,331	

Limestone shipments originate on the southeastern end of the Upper Michigan peninsula and the northeastern part of Lower Michigan. Shipping points in order of importance are Calcite, Stoneport, Port Dolomite, and Port Inland. Receiving areas are widespread, but most tonnage is received at Detroit and Lake Erie ports. Many smaller shipments go to a wider range of Lake Michigan ports with a scattering to areas along Lake Superior and Lake Huron.

Lakewise traffic for coal and lignite is analogous to limestone in that there are few large shipping points with many consumers over the entire Lake region. Toledo loads over half the coal moving on the lakes, while Chicago ships another 20%. Other important originating areas are Conneaut, Sandusky, Duluth, and Superior.

Of the 78.3-million tons of local traffic within the U.S. ports in 1975, 46.9-million (60%) occurred within the Port of New York. Another 20% of local traffic moved within the ports of New Orleans, Baltimore, Houston, and Chicago. Energy products dominate local traffic shipments: in 1975, residual fuel oil shipments were 25.4-million tons; distillate fuel oil contributed 14.3-million tons; gasoline 7.4-million tons; crude petroleum 4.3-million; jet fuel 1.4-million; and kerosene 0.5-million tons. Together these commodities accounted for 68% of tonnage. In order of importance, other commodities in local traffic that are significant are sand and gravel, waste and scrap, rafted logs, coal and lignite, and marine shells. Table 34 lists these and several other commodities which contribute to local traffic along with tonnage and percentage figures demonstrating their importance.

Patterns of coastwise traffic are more difficult to document than the other classes of traffic. In contrast to foreign commerce, in which there is only a single U.S. port involved as either originating or receiving a shipment, coastwise traffic involves two ports, one shipping and one receiving. Whereas lakewise O/D patterns are easy to examine due to the limited number of commodities and readily identifiable production and consumption sites, coastwise traffic encompasses a wider range of commodities and a large number of shipping and receiving areas. The nature of local traffic makes it very conducive to understanding at a general level.

Energy-related products account for 75% of coastwise traffic; the remaining traffic is made up of several commodities each contributing relatively equal amounts of traffic (see Table 35). The majority of these commodities move within a single coast (the Atlantic, Gulf, or Pacific) although substantial traffic does move between the Gulf and Atlantic Coast. About 25% of total coastwise traffic consists of crude petroleum and its products moving from the Gulf to the East Coast. [This is 1/3 of coastwise energy-related shipments.] Gasoline accounts for almost

TABLE 34

1975 LOCAL TRAFFIC BY COMMODITY

Commodity	Thousand Tons	Cumulative Percentage
Residual Fuel Oil	25,392	32.4
Distillate Fuel Oil	14,321	50.7
Sand, Gravel, Crushed Rock	8,586	61.7
Gasoline	7,371	71.1
Crude Petroleum	4,268	76.6
Waste and Scrap, NEC	3,396	80.9
Rafted Logs	2,242	83.8
Coal and Lignite	2,231	86.6
Jet Fuel	1,431	88.5
Petroleum & Coal Products, NEC	1,394	90.2
Marine Shells, Unmanufactured	1,081	91.6
Basic Chemicals and Products, NEC	570	92.3
Kerosene	567	93.1
Iron and Steel Scrap	541	93.8
Sulphuric Acid	417	94.3
Iron Ore and Concentrates	367	94.8
Asphalt, Tar, and Pitches	348	95.2
Crude Tar, Oil, Gas Products	329	95.6
Veg. Oils, Marg., Short	320	96.0
Benzene and Toluene	278	96.4
TOTAL	78,279	

TABLE 35

1975 COASTWISE TRAFFIC BY COMMODITY

Commodity	000's Tons	Cumulative Percentage of Total Traffic
Gasoline	51,345	22.1
Residual	46,685	42.3
Distillate	46,200	62.2
Crude Petroleum	26,039	73.4
Phosphate Rock	8,012	76.9
Jet Fuel	4,806	78.9
Sand, Gravel, Crushed Rock	3,867	80.6
Coal and Lignite	3,453	82.1
Liquid Sulfur	3,279	83.5
Asphalt, Tar, Pitches	3,214	84.9
Lubricating Oils and Greases	3,069	86.2
Basic Chemicals and Products, NEC	2,958	87.5
	231,932	

half of Gulf to East coast shipments with distillate, residual, and crude being next in order of importance. Crude moving to the East coast is refined at a variety of Atlantic coast refineries (along with large quantities of imported crude petroleum), and in turn, shipments of products are generated to other Atlantic coast ports. The influence of Gulf to East coast shipments means coastwise receipts dominate coastwise shipments along the Atlantic, while the reverse is true for the Gulf coast.

5. PETROLEUM TRAFFIC IMPACTS

5.1 INTRODUCTION

The transport of energy-related commodities dominates the traffic on the U.S. deep-draft system. In 1975, crude petroleum, residual fuel oil, distillate fuel oil, and gasoline accounted for 68.1 percent of imports, 73.3 percent of coastwise shipments, and 65.6 percent of local traffic. Imports consisted largely of crude petroleum for refining, while products were responsible for the majority of coastwise and local shipments. Specific tonnages of each commodity with the percentages of total U.S. traffic are given in Table B-1.[1]

For each of the four commodities being considered, two important types of analysis were performed. First, modal diversion due to alterations in relative modal costs was studied as was the impact that this may have on the level of port activity. The most in-depth analysis was conducted for crude petroleum since very detailed data on crude production, imports, refinery location and capacity, and transportation are available for 1975. Similar information on petroleum products is more general, and thus, cannot support the same level of analysis. Second, given a specific user charge, the price impacts were calculated for those industries in which petroleum products are a significant input. The change in delivered price is calculated as both a percentage and absolute increase.

In studying modal diversion and price impacts, three types of cargo taxes were considered. One assumed each ton was affected equally regardless of whether it utilizes two ports (coastwise traffic) or only one (import or export

[1] All tables are presented in Appendix B.

traffic); the toll was estimated to be 18.3 cents per ton. A second was based on equitable collection for each visit, so that coastwise traffic pays twice as much (27 cents per ton) as import or export traffic (13.5 cents per ton). Port-specific charges were examined in the third case.

The format of the analysis is very similar for each of the four commodities. First, an aggregate supply and demand picture is constructed for each PAD[1] district based on production, imports, exports, changes in inventory (when available), and sales. This is used to understand transportation requirements among districts. Second, "hard" transportation data are analyzed in light of the above description of regional supply and demand, and the role of tanker and barge is discussed -- its importance is considered relative to other modes, and cost comparisons are made when feasible. Third, the transportation system and distribution pattern for each commodity is evaluated in terms of potential modal shifts and decreases in port activity resulting from changing relative modal costs, logistics or service-related factors, or exogenous influences such as alternative supply sources or independent OPEC action. Last, the uses of each commodity are discussed for the major petroleum markets, and final price impacts are measured.

5.2 MODAL OVERVIEW

The current distribution for petroleum consists of an extensive network of pipelines for both crude petroleum and refined products, tanker and barge transport along the coasts and inland waterway system, and railroad to more isolated areas not served by either pipe or water.[2] A comparison of the tonnage share of each mode in 1975 is given in Table B-2.

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[1]Petroleum Administration for Defense District. See Figure 1.

[2]Truck is utilized in the local distribution of petroleum products, but is not important in long-haul or high-volume moves.

Pipeline is by far the dominant mode of shipment. The ability to link high-production areas and major demand centers with a relatively low-cost mode characterized by minimum congestion and delay implies that pipeline is clearly the preferred method of shipment in most areas of the U.S. Tanker and barge also play an important role in certain petroleum markets. Receipt of large tanker shipments at East coast ports is economical for refineries and consumption sites able readily to receive in this manner. Barges are used for delivery of smaller shipments to Mississippi River locations and for transfer among wells, refineries, and terminals along the Gulf. Barges are justifiable in two cases: first, they often serve as a peak-load delivery system to handle shipments in times of excessive demand when pipeline capacity is not adequate; second, they are economical in shipping to small facilities in locations where annual volume requirements do not warrant the construction of a pipeline. Where consumption sites are located a substantial distance from the coasts or river system and volume requirements are not able to justify pipeline construction, railroads are utilized since they are the only viable mode of delivery.

A general comparison of modal cost advantages can be made by taking a brief look at some representative shipment rates. Table B-3 demonstrates that barge rates may average over two and one-half times pipeline rates for a typical point-to-point flow, while rail rates may be as much as seven times higher than pipeline. Average shipment size is also indicative of the advantages of pipeline (when large volumes are required): a four-to six-hour runoff from the Capline pipeline amounts to over 15,000 tons of petroleum; a barge shipment ranges from 1,000 to 3,000 tons; a rail tank car carries about 400 tons. A coastwise tanker generally has the capacity to carry 14,000 to 15,000 tons. Tanker rates are not readily available for coastwise shipments since they are established under contract and are thus company confidential; however, they are much lower than barge rates, and apparently are very competitive with pipeline rates to coastal areas (analysis of East Coast refinery procurement patterns indicate that in some areas tankers may be more economical than pipeline).

5.3 CRUDE PETROLEUM

At the beginning of 1976, there were 265 refineries in operation in the United States. They are scattered throughout the U.S. though most heavily concentrated in Texas (49), California (36), Louisiana (22), and Oklahoma (12); and Pennsylvania, Illinois, Kansas, and Wyoming (11 each). The demand for crude oil by refineries in each PADD is substantially different than the production in each region (see Table B-4). Long-haul shipment of crude is required to move excess supply to areas of excess demand. Pipeline and tanker and barge deliver almost all of the crude oil to refineries.

Domestic production is not nearly adequate to meet refinery requirements in the United States. In 1975, refinery input was divided between 67% domestic crude (3.0-billion barrels) and 33% foreign crude (1.5-billion barrels). Most of the foreign crude was received at the consuming refinery by tanker (1.1-billion barrels), while another 0.4-billion barrels were received by pipeline (this consists mainly of Canadian shipments, 0.22-billion barrels, but also includes shipments unloaded by tanker and piped fairly long distances to refineries).

PADD 1 contains two Bureau of Mines refining districts[1] which receive crude oil in very different manners. Table B-5 lists the location of refineries in PADD I by state with their throughput capacity and method of receipt of crude oil. Table B-6 shows the number of barrels of crude oil input to

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[1] There are 13 Bureau of Mines refining districts. See Figure 1.

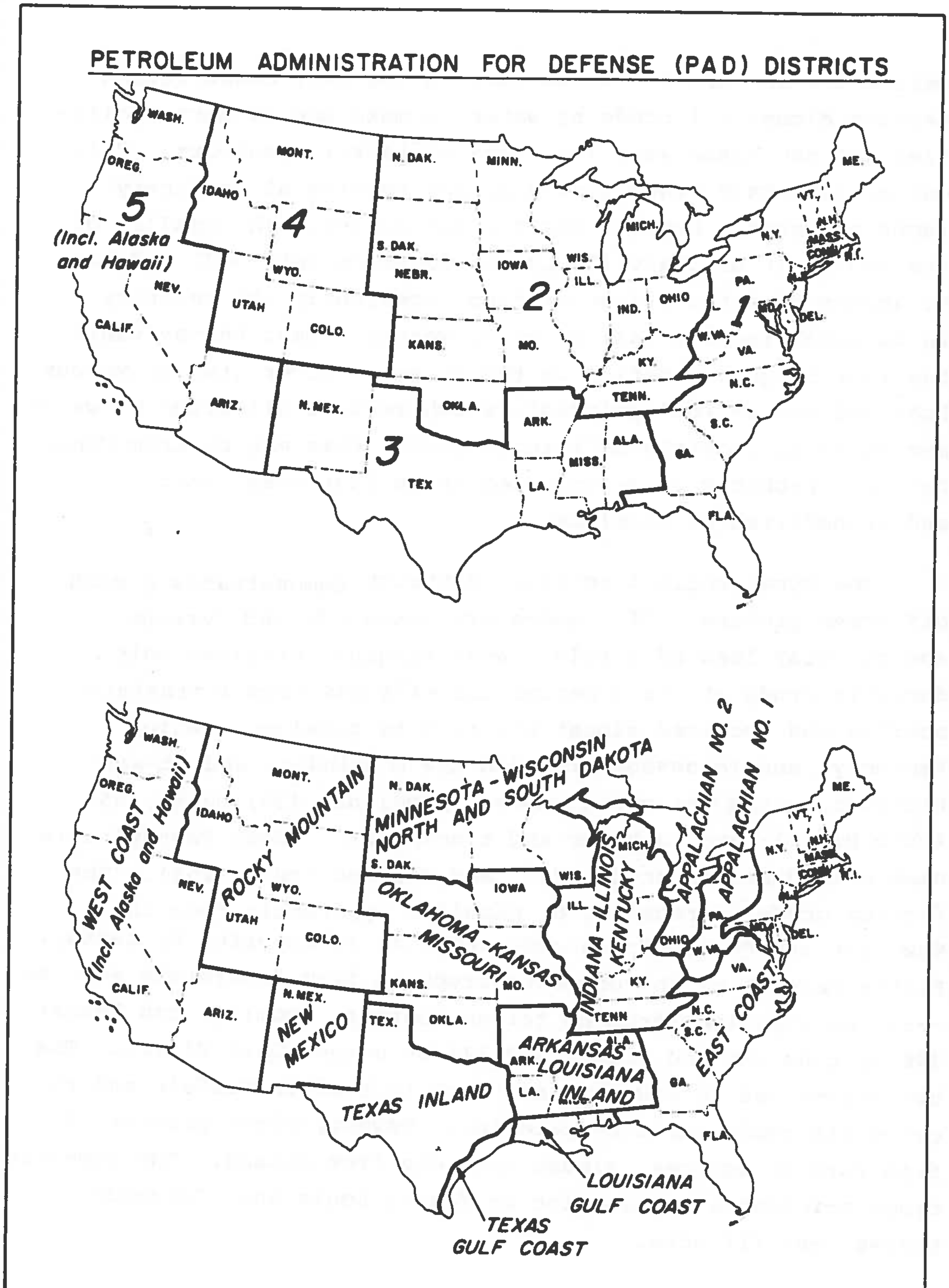

Figure 1. BUREAU OF MINES REFINING DISTRICTS

refineries in PADD 1. Refineries in the East coast region receive almost all crude by water to make use of port facilities and the associated low costs of tanker transport. Only Georgia and East Pennsylvania do not receive all refinery input by water. Georgia has two refineries. The smaller of the two is in Douglasville on the Southern Railroad, and has no access to water transportation (apparently the refinery in Savannah receives all crude by water). East Pennsylvania has four large refineries on the Delaware River (two in Marcus Hook and two in Philadelphia), which receive all crude by water except 2% of receipts of foreign crude (this may be from Canada but more probably it is unloaded at an East coast port and transferred by pipeline).

The Appalachian 1 refining district demonstrates a much different picture. All modes are involved, and foreign sources play less of a role. West Virginia utilizes only domestic crude at its 3 refineries--40% was from intrastate sources and received almost entirely by pipeline. Ohio, Kentucky, and Tennessee provided the remainder, and it was received by the following modes: pipeline, 43%; barge, 35% (Ohio River); and tank car and truck, 22%. West Pennsylvania uses both domestic crude (75%) and foreign crude (25%). The foreign crude is received by pipeline apparently from the New York and Philadelphia area where it is imported by tanker. Eighty percent of the domestic crude is from interstate sources --53% by pipeline (from as far as Montana, Wyoming, and Texas), 35% by tank car and truck, and 12% by barge (Ohio River). The two refineries in New York are both located in Buffalo and receive all crude input by pipeline. Seventy-eight percent is from foreign sources, almost entirely from Canada. The domestic crude originates by pipeline in Texas, Louisiana, Colorado, Kansas, and Illinois.

Since all modes deliver both domestic and foreign crude oil to refineries in the Appalachian 1 refining district, this area provides insight into the comparative modal advantages discussed earlier. Domestic crude is apparently received by pipeline at refineries with sufficient capacity to handle the shipment volumes required to make pipeline economical. Smaller refineries receive by barge if they are on the Ohio River and able to utilize water transportation. Rail supplies those refineries that are distant from the river, and do not throughput sufficient volume to justify the construction and use of pipeline. Buffalo refineries are much larger than other refineries in the Appalachian 1 region (excepting the refinery at Warren, Pennsylvania which is almost equivalent in size), and rely on Canadian crude due to the high demand in this area in combination with the distance from major U.S. production areas.

Deep-draft user charges will create no changes in the current distribution system--imports and coastwise traffic will not be diverted. Ninety-three percent of the crude oil received at East coast plants is from foreign sources--two factors indicate that these flows must continue. First, these refineries import foreign crude in spite of the fact that the average price is several dollars per barrel higher than the average price of domestic crude. U. S. production is not adequate to meet refinery demand--imports are required to meet the balance. Second, East coast refineries consume low-sulfur crude that is available from foreign sources. These quality considerations insure that the demand for foreign crude will remain. For domestic crude consumed on the East coast, the improved competitive position of pipeline will not influence shipping strategy. These refineries are built to receive by water, and have a large fixed investment in both terminals and receiving facilities and ships. In the short run they will attempt to maximize their use of fixed capital. In the long-run these facilities must be continued and maintained to accommodate foreign vessels; thus, tankers moving coastwise can be handled at only marginal expense. An important point is that the level of user charge being considered on domestic shipments of crude oil is in the range of 2.8 cents per barrel (18.3 cents per ton) to 4.2 cents per barrel (27 cents per ton). This is probably insufficient to induce pipeline expansion since major investments are needed to increase the current capacity of the pipeline system, and they will not occur given the uncertainty in the world market for petroleum. Port-specific charges will not cause diversion between ports since delivery is established and locked in by refinery location.

In contrast to the East coast, the Appalachian 1 region appears to be fairly isolated from deep-draft user charges since most refinery demand is met only from sources that do not utilize a deep-draft port.[1] Only Western Pennsylviana would be impacted since 25% of its receipts are accounted for by foreign crude that must pass through an East coast port prior to delivery via pipeline. As with East coast refinery imports discussed above, crude oil availability and quality factors insure that this flow will not be diverted, especially in light of the magnitude of user charge being examined.

Although no modal shifts will occur in PADD 1, the price of crude oil delivered to the refinery gate will increase under the scenario of full passthrough of additional transportation expense. This price increase will amount to 2.1 cents per barrel (13.5 cents per ton) to 2.8 cents per barrel (18.3 cents per ton) for foreign crude imported through a U.S. port. For the east coast, it was shown that virtually

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[1]For impacts on shipments on the Ohio River see Modal Traffic Impacts of Waterway User Charges, Volume II: Distribution Systems Analysis."

all crude oil is received by water. Ninety-three percent is from foreign sources in which the average price (unloaded at the dock) was $14.45 per barrel as of February 1977. Given the price of crude delivered to the refinery may be somewhat higher (one estimate is 40 to 50 cents), an increase of 2.1 to 2.8 cents per barrel amounts to a 0.14% to 0.19% rise in the price of crude at the refinery gate. The result is that product prices of East coast refineries will increase 2.1 to 2.8 cents per barrel[1]--this will be less than a 0.14% to 0.19% increase since product prices are generally higher than crude oil prices. This is miniscule when considered in relation to price increases generated by independent OPEC action.

In the Appalachian 1 refining district, the only price increases would be in Western Pennsylvania where foreign crude is received. Although it may be shipped to only one refinery, it is best treated as an input to the Western Pennsylvania region, so that all refineries are equally impacted. Since foreign crude represents 25% of the crude oil received in this region, price increases will be about 0.5 to 0.7 cents per barrel or about a 0.04% increase. The effect will be the same on refinery products (the percentage increase will be less). Production costs in Western New York and Western Virginia will be unchanged by deep-draft user charges.[2]

PADD 2 consists of four Bureau of Mines refining districts: Appalachian 2 (Eastern Ohio); Illinois, Indiana, Kentucky, Tennessee, Michigan, and Western Ohio; Minnesota, Wisconsin, North and South Dakota; and Oklahoma, Kansas,

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[1]This assumes an oil company will pass through a price increase equally to all products. It may be the case that different elasticities of demand for products will result in differential price increases.

[2]Domestic prices are frozen and not able to fluctuate with foreign prices when they compete in the same market. Only stripper oil, which currently represents 12% of domestic supply of crude, is not controlled.

Missouri, Nebraska, and Iowa. Refinery location and operating throughput capacities by state are given in Table B-7. Receipts in this PADD are second only to those in the Gulf Coast. In 1975, a total of 1.25 billion barrels were input to refineries in this district. Table B-8 lists the states within each refining district with the receipts by mode from domestic and foreign sources. The foreign component was 23% (282.7-million barrels) and almost entirely received by pipeline (120-million barrels were from Canada). Domestic receipts are substantially dominated by pipeline flows. Intrastate shipments were 218.1-million barrels by pipeline, and only an additional 7.9-million were handled by rail and trucks. Interstate shipments were entirely by pipeline (719.7-million barrels) except for 16.6-million barrels received by barge in Kentucky, Tennessee, and Indiana, and 1.0-million barrels received by rail and truck in Kansas.[1]

Domestic shipments of crude received in this region will be unaffected by deep-draft user charges since they almost strictly originate at pipeline terminals in PADD 2, the Gulf (Texas, 332.0-thousand barrels; Lousiana, 154.9-thousand barrels; and Mississippi, Alabama, and Arkansas, 6.8-thousand barrels), the Rocky Mountain States (Montana, 16.0-thousand barrels; Wyoming, 44.4-thousand barrels; Utah, 1.3-thousand barrels; and Colorado, 3.9-thousand barrels), and New Mexico (54.5-thousand barrels). Water plays a role in the delivery of domestic crude to refineries in Indiana, Kentucky, and Tennessee. Since there are 11 refineries in these states (see Table B-7), it is probable that some may receive only by water, and are not linked to the pipeline due to volume considerations, while others receive only by pipeline. It is not

[1] A negligible amount is also received by rail and truck in Indiana, Kentucky, Tennessee, Missouri, Nebraska, and North and South Dakota.

likely that direct competition exists between the modes since pipeline clearly has the cost advantage.

Foreign crude entering PADD 2 by pipeline will be faced with a price increase due to deep-draft user charges in the event that there was a prior move by tanker. In 1975, 162.3-million barrels (57%) of the 282.5-million barrels of foreign crude received in PADD 2 originated in countries other than Canada. The supply and demand situation is such that foreign crude is already purchased at a higher price than domestic crude, and the 2.1 to 2.8 cents per barrel increase due to user charges would do little to change this differential by a significant degree. Procurement of crude oil by refineries is not particularly price-sensitive due to limited supply availability, and modal diversion or shifts to alternative sources cannot readily occur.

Assuming full passthrough of user charges, price on foreign crude received via tanker and pipeline will increase by 2.1 to 2.8 cents per barrel. This will affect the cost of input at each refinery differentially, depending on what percentage of foreign crude is received at the refinery (and how much of that crude is supplied by Canadian sources). Thus, refineries in the Dakotas and Minnesota would see no price increase, while those in other areas of PADD 2 would face some degree of increase. For the purposes of this analysis, a single percentage was calculated for all of PADD 2. Thirteen percent of crude oil consumed in this region originates at foreign sources overseas. Thus the average price increase in crude inputs to refineries in PADD 2 will be 0.27 to 0.36 cents per barrel. This represents a 0.03% increase in crude prices at the refinery gate.[1] Product prices will also increase by 0.27 to 0.36 cents per barrel which will amount to less than a 0.03% increase.

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[1]This estimate is high since the composite price used for crude was the first-sale or wellhead price.

In 1975, PADD 3 received 1.92-billion barrels of the 4.55-billion barrels received at refineries in the entire United States. The six states are divided into five Bureau of Mines refining districts--a listing of the districts with the number of refineries and operating throughput is given in Table B-9. Receipts of foreign crude represent 23% of input to refineries in this district. This is the same percentage as foreign crude received in PADD 2--whereas all receipts in PADD 2 are by pipeline, receipts in PADD 3 are almost entirely by tanker and barge. Figures in Table B-10 show the amount of crude consumed in each state with the mode of receipt and distinction between domestic and foreign source. Receipts of domestic crude are dominated by pipeline flows (89%), but water shipments play a much more significant role than seen in PADD 2. This is especially true for interstate shipments in which 72.6-million barrels (24%) are moved by water transport.

Refineries in New Mexico and Arkansas are not served by water transportation. New Mexico is a net shipper of crude, and is able to satisfy its own demand. Arkansas receives its interstate crude by pipeline from Texas and Louisiana. Water plays a very minor role in the delivery of crude to Alabama refineries - most of its supply is received by pipeline from Arkansas, Mississippi, and Florida. Mississippi refineries do not receive domestic crude by water - all interstate receipts are by pipeline from Louisiana. In 1975, 86% of the refining capacity in Mississippi was at the Pascagoula refinery. Foreign receipts of crude oil by tanker are very important at this location. In light of the arguments set forth above with regard to imported crude, it is safe to assume that no diversion will occur at this facility.

Texas and Louisiana prove to be the most interesting areas for analysis of potential diversion from the tanker and barge mode. The role of water transportation is extremely important in these two states: 72% of all intrastate tanker and barge traffic occurs here; 42% of all interstate tanker and barge shipments are received in these two states; 36% of foreign imports are received in this Gulf region. Crude imports should not be affected due to the inability of U.S. supplies to meet the high demand in these refining districts (37% of U.S. refining capacity exist here). Diversion of intra-PADD coastwise shipments to pipeline could have substantial effects on this area's port activity and requires close examination (recall that it was shown that inter-PADD shipments, receipts on the East coast, will not be diverted due to deep-draft user charges).

Procurement patterns of domestic crude for Texas and Louisiana are shown in Table B-11--the quantity received from each state is given along with the appropriate percentages. Only a small quantity of Texas intrastate receipts are by water, whereas 46% of interstate receipts are by water, mainly from Louisiana and Florida. Louisiana, on the other hand, exhibits the reverse trend, receiving a small percentage of interstate receipts by water and 22% of intrastate receipts by this means. Reasons for barge service in the movement of petroleum have been previously discussed (to move small volumes and to handle peak-load shipments) and should apply here. A review of the 25 refineries along the Texas Gulf coast and the 15 refineries along the Louisiana Gulf coast indicates that although the aggregate capacity of these refineries is over five-million barrels per day, some facilities exist[1] with throughput capacity of less than 10,000 barrels per day. Other refineries with small capacity exist, suggesting that at some of these locations barge receipts may be the most economical mode of delivery. The peak-load argument is supported by historical evidence regarding the sharp decline in barge shipments from 1972 to 1974 when the energy crisis occurred. The Gulf area was heavily impacted by decreased demand during this time. Barge traffic is still very important in this region, and will continue to be due to the specialized nature of operations. Little (if any) diversion to pipeline will be induced by deep-draft user charges. Only dramatic shifts

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[1]Houston and Alvin, Texas, and Church Point and Jennings, Louisiana.

in relative modal prices (not the 2.8 to 4.2 cents per barrel that is being considered) would prove adequate to cause distributional changes and modal shifts.

Each barrel of crude oil that is imported or shipped coastwise will cost an additional 2.1 to 4.2 cents per barrel at the refinery gate depending on the recovery scheme employed. The most heavily impacted refinery would be the one which receives 100% of its crude by water. The data available only permit the calculation of tanker and barge receipts by state. For Mississippi, Louisiana, and Texas, the percentages are 39%, 32%, and 32%, respectively. As a state average, the increase in refinery input costs would be 0.8 to 1.6 cents per barrel for Mississippi, and 0.7 to 1.3 cents per barrel for Louisiana and Texas. This is a 0.07% to 0.15% average increase in the price of crude at the refinery gate for Louisiana and Texas, and a 0.08% to 0.15% increase for Mississippi.[1] The absolute increase in product prices will be identical (0.8 to 1.6 cents per barrel in Mississippi and 0.7 to 1.3 cents per barrel in Louisiana and Texas).

Four states in PADD 4 receive crude petroleum for refining (refinery location and capacity by state are given in Table B-12). All of the 155.3-million barrels consumed in 1975 were received by pipeline, rail, and truck. (See Table B-13.) Foreign receipts (11%) are from Canada, and have no previous link to U.S. ports. Wyoming is by far the major producer of both crude and refined products, which accounts for the dominance of intrastate shipments in this state. PADD 4 is also a large producer of crude oil, so that domestic interstate shipments are almost all within this district. Water plays no role in the delivery of crude to this region, so that distribution and price levels would be unaffected by user charges.

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[1] These estimates are high since the composite price used for crude was the first-sale or wellhead price.

In 1975, PADD 5 received 707.5-million barrels of crude at its 48 operating refineries. California, with 36 refineries, and Washington, with 7, combined to possess 95% of refinery capacity in this district. Table B-14 lists the location of refineries in PADD 5 with their capacities.

Foreign sources supplied 44% of crude input. Tanker and barge shipments dominated interstate shipments while intrastate shipments were handled mainly by pipeline. Table B-15 shows the relative modal shares for refinery receipts in PADD 5.

Tanker and barge play an important part in transporting domestically produced crude oil from Alaska to California and Washington. A fair amount of water transport also occurs within the state of California. The arguments regarding the specific function of barge, where it is used with no lower-cost alternative, support the conclusion that no diversion of this water traffic will result from the imposition of user charges. Receipt of overseas foreign crude will continue as necessary to meet refinery demand in PADD 5.

Deep-draft user charges will result in a cost increase of 2.1 to 4.2 cents for each barrel of crude oil using a coastal port. Refineries receiving all crude by water will pay the entire increase on every barrel. Given the data which are available, refineries in each state will be assumed to receive an equal share of crude by water. For California, this amounts to 48%; for Washington, it is 44% (pipeline receipts of foreign crude are all directly from Canada); and for other states[1] in

[1]Alaska, Hawaii, Arizona, and Oregon are combined in the data.

PADD 5, the percent of crude received by water is 43. The state average increase in refinery input costs is 1.0 to 2.0 cents per barrel for California, and 0.9 to 1.8 cents per barrel for the remaining states. This is equivalent to a 0.1% to 0.2% increase in the cost of crude received in California, and a 0.09% to 0.18% increase in costs to refineries in other states. Product prices in these states will increase by the same absolute amount but the percentage increase will be softened due to the fact that product prices are higher than crude oil prices.

In summation, a deep-draft cargo tax will cause no diversion of foreign imports or coastwise shipments. Imports are necessary to meet U.S. refinery demand; a user charge of 2.1 to 2.8 cents per barrel will not induce supply substitution (especially since foreign oil is already much more costly than domestic oil). Domestic coastwise shipments will not be diverted to pipeline as a result of an additional cost of 2.8 to 4.2 cents per barrel. Tanker movement is cost effective along the coasts, and barge is necessary for special operations involving small volumes or peak-load demand. The small shift in relative modal costs would not warrant huge investment in pipeline construction or expansion in a market whose future is so unpredictable with regard to both supply and prices. Port-specific charges would not induce changes in current distribution strategy since delivery is fixed by refinery location.

The noticeable impacts will be on the increased price of crude oil at the refinery gate. The heaviest impact will be on those refineries which receive 100% of their crude input by water (or pipeline when a prior tanker move is involved). In each region, there are undoubtedly refineries which receive entirely by water and others that rely strictly on pipeline. Due to the manner in which the data are available however, impacts were calculated on a regional basis so that each refinery in a specific area (often the state level) was assumed to receive the same percentage input of crude oil by water.

The region most heavily impacted was the East coast (100% receipts by water), where the increase was 2.1 to 2.8 cents per barrel. PADD 5 saw increases of about 1.0 to 2.0 cents per barrel, while the Gulf coast was about 1.0 cent per barrel. These changes in refinery input cost are relatively insignificant: 2.8 cents per barrel of foreign crude amounts to a 0.19% increase.

The absolute increase in product prices is the same as the rise in crude oil prices (e.g., if a barrel of crude received at a refinery costs an additional 2.8 cents, then product prices will increase 2.8 cents per barrel). Since product prices are generally higher than crude oil prices,[1] the percentage increase will be even smaller. It is worthwhile to trace additional costs on crude oil through to the final demand markets in which products are consumed - this will be done in each of the product sections.

It is important to realize that regional variations in price increases will be lessened as a result of the Crude Oil Entitlement Program. The intent of this program is to make the petroleum industry more competitive by attempting to equalize the cost of crude oil to U.S. refineries. The average price of all crude imports, the current import tariff, and the price of domestic crude are utilized to calculate an entitlements price. Refiners consuming more than the national average of domestic crude must buy entitlements from those consuming less than the national average. Extensive cash exchanges occur among all refiners with the net effect being roughly equivalent input costs for everyone. The consequence of this program as it relates to deep-draft user charges is

[1]This is not always the case--residual fuel oil sometimes sells for less than crude.

that increases of 2.1 to 4.2 cents per barrel on crude using a coastal port must be shared by all refineries in the United States. The equalization scheme is not perfect however; since national averages are employed in the entitlements formula, the price increase to refiners using more costly oil will be greater than it is for refiners using oil at the old prices. Prices will increase to all refineries due to user charges but the increases will be different regionally. The East coast will not pay the full 2.8 cents per barrel since other regions must bear a part of the increase--the East coast will remain the most heavily impacted however. The Rocky Mountain states will not be totally unaffected even though they receive no crude by water; however, they remain the least impacted.

It should also be noted that price increases due to user charges are miniscule when compared to the rate of increase in the price of foreign crude oil. Also, even though OPEC price increases have been dramatic, there has been no dramatic change in U.S. refinery procurement patterns or distribution strategies. The demand for crude petroleum is quite inelastic, and sizable price changes are only in response to market forces. Table B-16 demonstrates the magnitude of price increases in 1976.

Three other important issues that will prove to be of much greater significance in the future of U.S. port activity are changes in regional production of crude oil within the U.S., possibilities of superport development, and independent action by members of OPEC. The production of crude oil in PADD 3 will continue its declining trend. Coupled with increased demand in this region, shipment of domestic crude by coastwise tanker will decrease (as will pipeline shipments from PADD 3). The FEA has forecast national production to remain stable through 1990 however, with the shift in the source of supply to PADD 5 as a result of the recovery of Alaskan oil. Table B-17 demonstrates expected regional shifts in production. PADD 3 can be seen to decrease from 69% to 48% of national output while PADD 5 (Alaska) increases its share from 11% to 40%. Declining supplies in other regions coupled with rising national demand means increased dependence on crude petroleum imports.

The alteration in supply source location has several implications for port activity. Alaskan crude will be received at West coast ports for refining and for transshipment via pipeline to the Midwest. Possibilities of shipping to the Gulf by tanker for refining and transfer to the Midwest must also be considered. One problem with Alaskan crude is that it is rather heavy and cannot compete directly with imports of lighter crude from places such as Indonesia. This is mainly due to the desired product mix in the United States which leans heavily toward the output of motor gasoline (in some countries such as Japan, the output of residual and distillates is a much greater percentage). This could result in a three-way trade of Alaskan crude to Japan, European receipts of potential Japanese supply, and American receipts of North Sea oil.

Increased port activity on the West coast is a certainty. The extent to which Gulfport activity will be influenced by Alaskan oil distribution cannot be estimated, but increased imports in this region should cause some growth in port activity. East coast imports will probably rise as receipts from the Gulf decline. Overall, we should witness increased port activity due to crude petroleum shipments as a result of rapidly growing U.S. demand for energy.[1] Relative shares of traffic at coastal ports may change, but aggregate movement will increase.

The second issue that will have a much more significant effect on U.S. ports than user charges is the possibility of superport development. The least-cost method of shipping crude petroleum long distances is by large supertankers which have drafts somewhere between 60 and 100 feet. U.S. ports are unable to handle ships of this size--only the ports along

[1] Completion of facilities now under construction will result in an increase of almost 10% in the existing refinery capacity of the United States.

Puget Sound and Long Beach can accommodate moderately sized supertankers. Recent proposals have been made to encourage the development of offshore terminals to handle petroleum traffic--this would allow the most economical means of transport to be employed in ocean carriage serving in the United States. The result would be a decrease in the number of ships utilizing the onshore facilities since pipeline systems from the offshore terminals to inland points would be preferable to lightering (environmental considerations are a factor here as well as economics). This should not be understood as being disadvantageous to coastal ports; rather, due to the forecasted increases in petroleum demand, the reduction in the number of ships utilizing these ports may be viewed as necessary for safety reasons and may lower costs resulting from congestion.

The third issue that needs to be mentioned is the influence of OPEC action. Foreign governments may decide that it is more profitable to refine their own crude and ship products to the United States. The level of crude imports would thus decline regardless of the increase in domestic demand. Port activity would not be largely impacted, however, since products would replace crude receipts at coastal ports.

5.4 PETROLEUM PRODUCTS

The demand for crude is a function of the demand for petroleum products. Given crude supplies and the distribution patterns previously discussed, production of production can occur near consumption areas in all parts of the United States. Economic decisions have dictated that refining capacity in excess of local demand should exist close to the areas that have large supplies of crude oil, while the reverse is true for areas that have meager supplies. The result is that substantial volumes of residual fuel oil, distillate fuel oil, and gasoline must be shipped between regions. Imports are then required to fulfill the balance of demand that U.S. refining capacity cannot meet.

The deep-draft user charge will increase the cost of products shipped along the coast or imported by 2.1 to 4.2 cents per barrel. This burden will not be borne by all consumers since no entitlements program comparable to that for crude oil exists. Thus, a barrel of product shipped from the Gulf coast to the East coast will be slightly more impacted than a barrel of crude. Refinery location will not be affected, however, since it is fixed for several years; moreover, dramatic transportation price differentials for crude and products would be necessary to create a situation in which refinery location was altered.

For residual fuel oil, distillate fuel oil, and gasoline, an overview of the transportation system is presented. Modal diversion is then examined (shifts in production location have been dismissed). A detailed analysis is then made of price increases for the major final markets. This is calculated for the worst case in which all product receipts are by water. Analysis of the national impact is also made by figuring the percentage of total product consumed in the United States that moves through a coastal port. The data on shipments of products do not readily lend themselves to understanding impact at a more disaggregate level (as was possible for crude oil).

The worst-case impacts in markets where 100% of product is received by water provides insight into the situation in which 100% of crude receipts at a refinery are by water (recall the effects will be somewhat softened by the entitlements programs). Where less than 100% of refinery receipts are by water, price impacts in end markets will decline by an equivalent percentage. The extent to which some products may be taxed twice (for example, crude imported to the Gulf coast, refined, and product-shipped coastwise) is not known at this time.

5.5 RESIDUAL FUEL OIL

Residual fuel oil is too viscous to be transported by pipeline. Consequently, shipment is restricted to tanker, barge, rail, and truck. The latter two modes are quite expensive, so consumption is very skewed, predominating in areas served by coastal transport (in inland areas, distillate is generally the preferred fuel since it can move by pipeline). Actual production, import, export, and consumption (sales) data are given in Table B-18. These rough control totals are indicative of the transportation requirements among regions.

The balance of each PADD is shown in the last column. PADD 3 is a net shipper of residual fuel oil, while the other four PADD's are deficit areas.[1] PADD 3 ships to PADD's 1 and 2, mainly by tanker and barge. Water is much preferred to rail; this is reflected in the comparable modal cost data for residual fuel oil in Table B-19.

Coastwise shipments reported by the Army Corps of Engineers for 1975 were 280.1-million barrels. The Bureau of Mines reports 58.0-million barrels of interdistrict coastwise movements (54.7-million from the Gulf to East coast), 94.7-million barrels of receipts from the Virgin Islands, and 2.5-million barrels from Puerto Rico. Deducting these figures from the total reported by the ACoE leaves 124.8-million barrels of intracoastal shipments. Local shipments total another 152.4-million barrels.

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[1]This may not be true due to the fact that the totals do not balance since inventories have not been accounted for. A definite statement about PADD's 3 and 4 cannot be made from these data.

In contrast to the 335.3-million barrels moving coastwise and locally, rail shipments for 1975 totalled 35.4-million barrels (as reported in the Carload Waybill Statistics). The non-profitability of long-haul shipments by rail is evident by the lack of such moves in these data--29.3-million barrels moved within the five ICC railroad districts without crossing regional boundaries.

Water transport of residual fuel oil is clearly the most economical means of shipping this product. The rates for residual moving by rail are on the order of twice the water rates (see Table B-19); tanker rates are well below the barge rates. In general, little (if any) residual oil moves by rail in competition with tanker and barge. Rail deliveries of residual are to inland plants not served by the waterways. Rail shipments do not generally move very long distances since crude oil can be piped to or produced in areas isolated from the waterways, and then processed to residual closer to the point of comsumption. Also in such areas, facilities utilizing distillate instead of residual are more widespread due to better transportation service--distillate can be moved by pipeline. As one moves away from the coasts and areas served by water, the ratio of residual to distillate consumption falls drastically.[1] Limited quantities are consumed in inland areas that must face high transportation costs.

The weight of the evidence leads to the conclusion that modal diversion will not occur. Distribution patterns of residual fuel oil and the level of port activity will remain unchanged in the face of deep-draft user charges.

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[1] The highest ratios are Hawaii, 4.19; Florida, 3.35; California, 2.62; Delaware, 2.26; Virginia, 1.62; Connecticut, 1.46; and New York, 1.41. The lowest are Iowa, 0.03; Tennessee, 0.04; South Dakota, 0.04; Oklahoma, 0.08; Wisconsin, 0.08; and Vermont, 0.09.

Delivered price impacts on the markets which consume large quantities of residual fuel oil must be considered. Table B-20 lists the uses of residual oils in the United States in 1975. More than half is consumed at electric utilities. The direct impact is to raise the cost per barrel of delivered oil by about 2.1 to 4.2 cents. An example of one utility which receives 100% of its fuel as residual oil will demonstrate the maximum impact on electricity prices.

The United Illuminating Company located in Bridgeport Harbor, Connecticut, consumed 6.46-million barrels of residual fuel oil in 1974.[1] A 100% passthrough of cost increases would result in an increase of 2.1 to 4.2 cents per barrel input to the facility. In November, 1976 the utility paid an average of $12.14 per barrel of fuel oil.[2] The user charge thus results in an increase of 0.17% to 0.35% on the delivered price of fuel. Assuming fuel costs are 1/3 of operating expenses and the 1976 average commercial electricity prices are 4.34 cents per kilowatt hour in New England,[3] then electricity prices would rise by 0.06.% to 0.12% or by 0.0025 to 0.005 cents per kilowatt hour (one-quarter to one-half of a hundredth of a cent per KWHR).

Similar impacts can be predicted for all utilities which consume only residual fuel oil and receive it all by water (coastwise or imported). Some variations will occur due to regional differences in current electricity prices and delivered fuel costs. Two factors would function to lessen the impact of user charges at many utilities: the impact would decrease as the percentage of receipts by

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1 Steam-Electric Plant Factors, 1975 Edition.

2 Fuel Price Analysis, Vol. 1, Number 11, November 1976 prices.

3 DRI Energy Bulletin, 7/76, p. 72.

water declined and as the fuel mix percentage at utilities favored coal and natural gas to residual fuel oil (they can be more readily received by other modes).

Heating use of residual fuel oil accounted for another 17.3% of U.S. consumption. Assuming a price of $13.50 per barrel for residual fuel oil, there would be a 0.16% to 0.31% increase in the heating bill of commercial facilities burning residual received entirely by water.

When residual is used at industrial operations (which consume 12.6% of all residual fuel in the United States), it is generally a very small percentage of a company's production costs. A sample of industries within five of the highest energy-using manufacturing groups yields the following statistics on residual fuel consumption as a percentage of value of the shipments for the United States: bread, cake, and related products (SIC 2051), 0.015%; paper mills except building paper (SIC 2621) 1.089%; plastic materials and resins (SIC 2821), 0.255%; ready-mixed concrete (SIC 3273), 0.040%; and blast furnaces and steel mills (SIC 3312), 0.283%.[1] The increase in the price of output generated at the operations receiving residual by water would be miniscule even if the entire toll were passed through to the consumer.

Vessels consumed 96.7-million barrels of residual fuel in 1975 (10.8% of U.S. consumption). An examination of cost data on U.S. liner vessels in 1973 indicated that fuel costs represented about 20-25% of total vessel expenses per voyage (labor, maintenance and repairs, insurance, etc.) and approximately 10% of total voyage expenses per voyage day (including such things as port charges and cargo costs but excluding capital costs). A 0.16% to 0.31% increase in the cost of fuel translates into a 0.02% to 0.03% increase in total voyage expenses per voyage day.

[1] 1972 Census of Manufactures .

For bulk and tanker vessels, estimated operating expenses for 1976 indicate that fuel represents about 40% of total vessel expenses per voyage for war-built vessels and about 50-60% of total vessel expenses per voyage for new vessels.[1] This means that fuel costs as a percentage of total voyage expenses per voyage day (excluding capital costs) would be somewhat higher than 10% for non-liner vessels; thus the increase in costs would be slightly higher than 0.02% to 0.03% for these vessels. Regulations pertaining to purchasing U.S. fuels needs to be considered in light of additional expenses.

Oil-company use accounted for 5.6% of total U.S. residual consumption in 1975 (50.49-million barrels). The majority of this was consumed at U.S. refineries, where it was produced so that no shipment of any significant distance was required. User charges would not impact this segment of the residual fuel market.

5.6 DISTILLATE FUEL OIL

Unlike residual fuel oil, distillate oil is a pipeable product which moves extensively by this mode. The importance of pipeline and relative cheapness compared with rail and truck makes it the major competitor and threat to water transport. Comparable modal shipment costs are given in Table B-21. Rail is an unlikely candidate to transport distillate unless areas not served by water with very small demand (where pipeline is not warranted) consume this product. Tanker rates for distillate are less than barge rates and are apparently very competitive with pipeline rates since coastal areas receive distillate in this manner.

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[1] Estimated Vessel Operating Expenses - 1976, U.S. Dept. of Commerce, Maritime Administration.

The aggregate picture for distillate shipments can be easily seen by examining rough control totals for distillate production and consumption. Production, import, export, changes in inventories, and consumption (sales) data for each PADD are presented in Table B-22. The last column shows the balance in each PADD. The major shipping patterns that are evident are similar to those of residual. PADD 3 is a net shipper while PADD's 1 and 2 are major receivers. Some transport from PADD 4 also occurs. PADD 5 has a net deficit.

Analysis of available transportation data yields the following results. The Army Corps of Engineers reports 304.9-million barrels of coastwise shipments in 1975. Subtracting movements accounted for by the Bureau of Mines (124.8-million barrels intercoastal, almost entirely from the Gulf to the East Coast; 18.9-million barrels recived from the Virgin Islands; and 8.2-million barrels from Puerto Rico) leaves 153.0-million barrels of intracoastal shipment. Local shipments (within a single port) contribute an additional 94.5-million barrels.

Pipeline commands the largest share of distillate shipments in the United States. In 1975, 667.1-million barrels were turned into lines while 668.0-million barrels were delivered from lines in the same year. Flows between PADD districts were 215.7-million barrels, the balance occurring within districts. Seventy-eight percent of these inter-PADD shipments (167.5-million barrels) were from PADD 3 to PADD 1 while another 7% (15.3-million barrels) were from PADD 3 to PADD 2.

Rail has a specific role in the delivery of distillate to certain facilities, but in the aggregate, it is an insignificant mode relative to pipeline and tankers and barge. Total volume shipped according to the QCS for 1972, 1973, and 1974 was 7.44-million barrels, 8.62-million barrels, and 7.27-million barrels, respectively.[1]

PADD 1 is the most important area to examine with regard to potential diversion -- deep-draft traffic and pipeline both serve this region extensively. In 1975, PADD 1 produced only 121.0-million barrels of distillate but required 466.0-million for consumption. Some 54.3 million barrels were imported, net receipts by pipeline totaled 155.0-million barrels, and 126.8-million barrels were received by water (124.2-million moved coastwise from the Gulf). These tanker and barge shipments as well as the 153.0-million barrels of intracoastal traffic and 94.5-million barrels of local shipment[2] appear to be fairly well isolated from any diversion to pipeline unless dramatic changes in relative modal costs occur. Pipelines are operating at almost full capacity currently, and new construction could not be justified due to a marginal increase of 2.1 to 4.2 cents per barrel on distillate delivered through a coastal port. As such, tanker and barge will continue to serve demand centers along the coasts where cheap water transport will remain very competitive with shipment by pipeline. Modal diversion will not result from the imposition of deep-draft user charges.

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[1] QCS data for 1975 was not readily available at the time of this writing. Distillate fuel oil is combined with other petroleum products in the <u>Carload Waybill Statistics</u>.

[2] These totals of intracoastal and local traffic are for all coasts.

The markets for distillate fuel in the United States are listed in Table B-23. The direct impact of the user charge is a 2.1 to 4.2 cent per barrel increase in distillate delivered via a costal port. Based on a current average price of about $15.00 per barrel, this means a 0.14% to 0.28% increase in the cost of distillate fuel oil.

Nearly half of the distillate consumed in the United States is used for heating commercial facilities and households.[1] As seen with residual fuel, those people burning distillate fuel oil would see a small increase in their heating bill, on the order of 0.14% to 0.28%. These are worst-case impacts for commercial operations and households that receive all of their fuel by way of a coastal port. Many commercial and household consumers would not be impacted. Given that about 43% of distillate fuel oil utilized a deep-draft port, the notion of a national aggregate impact would be that heating costs for the average commercial facility or household burning distillate fuel oil would increase by 0.06% to 0.12%.[2]

On-highway diesel fuel use by the trucking industry accounted for 217.2 million barrels in 1975 or 21% of U.S. consumption. Motor carrier statistics indicate that in 1975 the average cost of fuel and oil for intercity

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1 A more specific breakdown is not available.

2 This assumes that each final market for distillate fuel oil consumes an equal percentage of the distillate shipped by water.

common carriers[1] was 6.35% of total operating expenses.[2] For a carrier consuming only distillate shipped coastwise or imported, the impact due to deep-draft user charges would be about a 0.01% to 0.02% increase in trucking costs.[3] Since 43% of distillate moved through a coastal port, the aggregate impact would be less than a 0.01% increase in average trucking costs in the United States.

Railroads consumed 93.2-million barrels of diesel fuel in 1975 (8.9%). A recent study of cost breakdowns by factor input[4] reveals that for general rail service averaging a 600-mile trip distance,[5] the percentage of cost attributable to fuel requirements is 6-7%. The impact of deep-draft user charges on railroads is thus almost identical to that on the trucking industry: railroad costs would increase by 0.01% to 0.02% if all distillate consumed moved via a coastal port and by less than 0.01% as a national average.

The impacts on electric utility companies (and electricity) and on vessels will be very similar to those calculated in the residual fuel oil section.

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1 Class I and II General Freight Carriers holding interstate operating authority.

2 Trinc's Blue Book of the Truck Industry, 1976 Edition.

3 This impact is actually overstated since the retail price of diesel fuel is somewhat higher than the $12.00 per barrel used in these calculations.

4 U.S. Cargo Transportation Systems Cost and Service Characteristics, April 1976.

5 Relative input costs vary depending on different values of equipment and utilization assumptions.

5.7 GASOLINE

The major product output at refineries is gasoline - at the national level it represented 46.5% of refinery yields (the range was 43.2% in PADD 3 to 53.7% in PADD 2). The importance of gasoline in U.S. demand and refinery operations is also indicated by our preference in importing lighter crudes that are readily refinable to gasoline products. The output of motor gasoline is 99.4% of U.S. gasoline production--aviation gasoline accounts for the remainder.

As with residual and distillate fuel, gasoline production from crude cannot satisfy local demands due to the lack of refining capacity in regions of high demand. However, at the national level, gasoline production is almost adequate to meet total U.S. demand--imports are not quite 3% of total U.S. supply. Production and imports by PADD are given in Table B-24 along with demand for motor gasoline in each district. These rough controls show that, as with other products, PADD 3 is a net shipper and must supply PADD 1 with the majority of gasoline that it consumes.

The available transportation data provide an overview of the major shipping patterns of gasoline as well as demonstrating the relative shares of each mode. Coastwise shipments reported by the Army Corps of Engineers for 1975 total 395.36-million barrels.[1] According to the Bureau of Mines, 118.75-million barrels moved from the Gulf to the East coast, while 3.46-million barrels moved from the Gulf to the West coast; 25.39-million barrels were received from the Virgin Islands; 16.62-million barrels came to the United States from Puerto Rico. The remaining 161.14-million barrels moved as intracoastal traffic. The total amount of gasoline moving by water in the U.S. was 736.01-million barrels (including internal, local, imports, and lakewise traffic).

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[1] The ACoE include natural gasoline with their gasoline total.

Pipeline carried about 2-1/2 times the total volume of gasoline shipped by water transport in the United States. The Bureau of Mines reports that in 1975, 1.823-billion barrels of gasoline were turned into lines. Some 529.1 million barrels moved between PADD's, the majority going from PADD 3 to PADD 1.

The QCS reports total rail shipments of gasoline (including jet fuel and other high-volatile petroleum fuel, except natural gasoline) for 1972, 1973, and 1974 to be 11.56-million barrels, 10.32-million barrels, and 9.72-million barrels, respectively. This is about 1/2 of one percent of the quantity shipped by pipeline. As with residual and distillate, rail has a specific role in serving certain markets, but in the framework of a national transportation picture, it is insignificant.

The picture is very similar to that of distillate fuel oil--shifts in modal transport will not occur. PADD 1 depends most heavily on other refinery districts for its receipt of gasoline. Almost twice as much gasoline moves into this region by pipeline as by tanker and barge; however, the two modes operate very competitively so that tanker and barge traffic serving coastal markets is fairly well protected from any minor changes in relative modal costs.

Almost all gasoline consumed in the United States is motor gasoline. The increase due to deep-draft user charges on all petroleum products shipped coastwise or imported would be 2.1 to 4.2 cents per barrel. Assuming a 100% passthrough of increased transportation costs, the impact would be an increase of 0.05 to 0.10 cents per gallon at the pump or less than 1/10 of one cent for gasoline received 100% by water. Based on a current price of regular gasoline of 60.0 cents per gallon, this represents a 0.08 to 0.16% increase in current prices.

On a national level, given that 2.4 billion barrels of gasoline were consumed in the United States in 1975 and 0.46-million barrels were shipped via a deep-draft port, the impact will only be 20% of that estimated, or about 0.01 to 0.02 cents per gallon of the average gallon of gasoline sold in the United States.

6. GRAIN TRAFFIC IMPACTS

The export of corn, wheat, and soybeans accounts for an important share of U.S. port activity. From 1971 to 1975, these three commodities represented between 20% and 30% of total U.S. exports. Table 36 lists the relative export shares of each commodity.

The role of specific ports in the grain export market is a function of the linkage they are able to provide between overseas destinations and the major growing regions in the United States. The grain bid they offer is indicative of their ability to serve foreign countries (the bid at each port is defined by the acutal prices at foreign ports--indexed at Rotterdam--less ocean rates, transfer costs, and the profit margin). A port's proximity to production areas (defined in terms of transport costs) demonstrates its potential to attract traffic. When the port bid minus access costs is favorable relative to other ports, it will throughput the most grain. Thus, corn and soybeans grown in Illinois and Indiana will be shipped via the Atlantic, Great Lakes, or Gulf coasts to almost all parts of the world while wheat produced in the Dakotas will be shipped through Northwest ports when bound for the Far East, and through the Great Lakes and Gulf coast when destined for other locations. The relative importance of selected ports in the grain distribution system is given in Table 37.

As overseas prices dictate the maximum bid at U.S. ports, the U.S. port bids in turn determine what the inland elevators scattered throughout each growing area may pay the farmer for his grain and soybeans although the relationship is somewhat more indirect. Grain reaches coastal ports through an efficient domestic transportation system based on heavy competition between rail and barge in most growing areas. Grain and soybean traffic on the inland waterway system is extremely export-intensive. Railroads have responded to

TABLE 36

U.S. EXPORTS OF CORN, WHEAT, AND SOYBEANS: 1971 TO]975
(000's TONS)

Commodity	1971	1972	1973	1974	1975
Corn	14,177	24,425	35,951	32,049	35,976
U.S. Total	6.9	10.5	13.0	12.0	13.2
Soybeans	12,590	13,175	14,524	15,170	13,728
U.S. Total	6.1	5.7	5.2	5.7	5.0
Wheat	17,711	23,229	40,756	27,448	34,037
U.S. Total	8.6	10.0	14.7	10.3	12.5
Corn, Soybeans, Wheat	44,478	60,829	91,231	74,667	83,741
U.S. Total	21.6	26.2	32.9	28.0	30.7

TABLE 37

THE ROLE OF SPECIFIC PORTS IN THE GRAIN EXPORT MARKET: 1975

(000's TONS)

Port	Corn	Soybeans	Wheat
U.S. Total	35,976	13,728	34,037
Major Gulf Ports	24,413	10,417	17,814
Baton Rouge to Mouth of Passes	21,238	8,543	3,598
New Orleans	15,947	6,324	3,036
Texas Ports	2,524	512	12,732
Houston	2,248	267	7,573
Mobile and Pascagoula	651	1,362	1,484
Major Atlantic Ports	7,790	1,403	2,037
Norfolk	3,460	432	487
Baltimore	2,715	642	1,087
Philadelphia	1,615	329	463
Great Lakes	2,968	1,736	3,931
Toledo	1,269	1,225	354
Duluth-Superior	304		3,432
West Coast	153		9,965
Portland			3,943
Seattle			1,049

cheap barge transport with innovative rate concepts structured to encourage continuous large volume shipments. Grain and soybean bids at barge and rail terminals are set to reflect the difference between port bids and modal rates, transfer costs, and a margin of profit. Local processors and feeders located among rail and barge export terminals post a grain price insuring that they will gather the optimal quantity of corn, wheat, or soybeans necessary to make their operation most profitable. The inland elevator operator offers farmers a bid based on the return he can expect after selling his grain to the most attractive outlet--the barge terminal, the rail terminals, or the processor or feeder. Thus, in a very real sense, the export bid at U.S. coastal ports is a major determinant of the price a farmer will receive for each bushel of output. Fluctuations in world prices, and thus U.S. export prices, filter through the marketing system to result in changes in farm income.

The following user charge analysis will focus on two levels of cargo taxes: The first is designed to affect each ton equally regardless of whether it utilizes two ports (coastwise traffic) or only one (import or export), and is estimated to be 18.3 cents per ton; the second promotes equity among visits, so that coastwise traffic pays twice as much (27 cents per ton) as import or export traffic (13.5 cents per ton). The relevant toll range to be considered for export grain is thus 13.5 to 18.3 cents per ton or about 0.4 to 0.5 cents per bushel. Port-specific charges will also be briefly considered.

Impacts will differ according to the extent to which additional costs are absorbed by the U.S. producers. Two scenarios will be discussed: in the first, the export price remains unchanged, and the burden of the user charge will fall entirely on the domestic market; in the second, the full tax is added to the export price in an attempt to force foreign consumers to bear the burden of the additional transportation costs. It should be kept in mind that the cargo tax would amount to a charge of only 1/2 cent per bushel, a change so miniscule as to make it very doubtful that any noticeable impact would occur.

If it is assumed that the price of U.S. grain to foreign countries can only fluctuate with the world price set in Rotterdam, then the initial impact of a port user charge would be to lower the export bid at coastal ports (by the amount of the tax). Rail and barge terminals in major growing areas would then decrease their bids by an equivalent amount. Processors set their price to optimize plant throughput--since they compete with export facilities for grain and beans, they would be able to lower their price accordingly. The inland elevator operator, perceiving a lower bid from each of his buyers, will offer the farmer less money for his product.

Farmers would receive less for their crop since in this scenario, they bear the entire burden of the user charge. It is difficult to measure the effect of this decline on farmer prosperity, given that they are faced with far greater fluctuations in prices daily. The magnitude of this change should mean a negligible effect on farm income, especially since receipts from crop sales account for only part of the income of farm families. An effort will be made to quantify the impact by comparing the user charge-induced price decrease to the estimated net margins for each crop.

Since crop costs and farm incomes are measureable in many different ways (depending particularly on the measure of land costs), and since they vary widely from region-to-region and year-to-year, these illustrations may only be considered as suggestive of the actual effects in any area.

The unit costs of producing the "average" bushel of corn in 1974 was $2.06-2.17. The average farm price of corn in that year was $2.92, exceeding unit production costs by 75-86 cents. A user charge-induced price decline of 1/2 cent would have meant approximately a 0.6 percent decline in the net return on a bushel of corn in that year. This overstates the overall percentage impact on the farmer's compensation for corn production since some elements of cost represent the compensation for self-provided labor and management services. Additionally, it overstates the impact on total farmer income because it treats only one source of family income--crop sales.

Presently, the farm price of corn is below $2.92. Ignoring any production cost increases since 1974, this makes the <u>relative</u> impact of a user charge imposed today somewhat greater than that analyzed.

Wheat production costs in 1974 stood at $2.63-3.02 according to estimates by U.S.D.A. This compares with an average price received by farmers for wheat <u>in that year</u> of $4.48. The impact on the net return per bushel for farmers would have been a 0.2%-0.3% decrease in revenue, less than half the impact of that on corn producers. However, the current price of wheat is substantially below $4.48, and the pecentage impact would be many times greater.

Finally, the farm price of soybeans is currently over $9.00 per bushel, more than $5.00 in excess of "normal" unit production costs. If this price is at all representative of the market in future years, any impacts of user charges on farm incomes from soybeans should be negligible.

The analysis in the second case assumes the price of U.S. grain to foreign countries increases by the amount of the deep-draft user charge (about 1/2 cent per bushel). Although the U.S. export price is influenced by the world price, this possibility needs to be considered since there is some likelihood that the U.S. price influence the world price (statistics for the crop year 1976 indicate that the U.S. supplied 65% of soybean exports in the world, 61% of coarse grain exports, and 43% of wheat and wheat flour exports). However, the world demand for U.S. crops is not totally inelastic. One argument states that U.S. price increases are an inducement to other countries to bring marginal lands into cultivation. Foreign governments are already providing heavy subsidies to farmers to bring land up to suitable production standards, and it is unlikely that a 1/2 cent per bushel increase in U.S. crop prices would have a significant influence on farm policy in foreign countries. Land is now being developed at as fast a rate as is feasible.

The result of the port charge, in this case, would be that U.S. exports would appear relatively less attractive than those of other countries that we are now competing with. The U.S. would lose a small share of its export total; however, since the demand for U.S. crops is fairly inelastic, the percentage decrease in sales should be less than the percentage rise in price.[1] The total demand for U.S. production (domestic plus foreign) would decrease by a small fraction, and thus, the price received by farmers would slightly decline. The extent of that price decline would depend on the ability of the domestic market to absorb new supplies. If domestic demand were totally inelastic--i.e., accepting no additional supplies, the results would be as in the first case above. Otherwise, price effects would be smaller.

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[1]Export demand elasticities for U.S. grain are estimated to be less than one.

The actual outcome of a deep-draft user charge policy would probably lie somewhere between the two scenarios--a small increase in export price would occur while the domestic market would have to absorb a slightly greater portion of the supply. Farmers' incomes would fall by a fraction of a cent per bushel; it is assumed that every other participant in the distribution system will be unaffected by maintaining their same margin of profit. The effect on farmers' prosperity will vary depending on inland elevator bids and the corresponding level of net profit. When demand is high, prices received by farmers are high, and the percentage decrease in net income is minimal. When demand is low, farmers are earning a small margin, and the percentage decrease in net income due to user charges is much more significant. The important point is that price swings that farmers must face due to shifting demand overwhelm the impact of user charges in determining the profitability of a farmer's operations.

Differences in port-specific charges would imply some diversion between ports as shippers seek the most profitable export routes. Large cost differentials would make the cheaper ports more attractive resulting in congestion problems, while the relatively more expensive ports would lose traffic causing underutilization of capital with large fixed investments, such as elevators, transfer equipment, etc. The economics of the situation dictate that if the differences were small enough, pricing structures would equalize through adjustments in railroad rates, charter rates, elevator charges, etc., so that relative throughput at each port would return to its original level. New Orleans, one of the more expensive ports to maintain, is only 0.27 cent per bushel higher than Baltimore and 0.23 cent per bushel higher than the Houston Ship Channel. It is thus very unlikely that the required port-specific charges would induce any change in the relative level of grain and soybean export activity.

7. IRON ORE TRAFFIC IMPACTS

Iron ore shipments account for more than half the domestic traffic on the Great Lakes (see Table 38). Large quantities of iron ore (85% of U.S. production) are mined in northeastern Minnesota and the upper Michigan peninsula and shipped via Great Lakes bulkers through the ports of Duluth-Superior, Two Harbors, Silver Bay, Taconite Harbor, Presque Isle, and Escanaba. This ore is consumed in iron and steel production facilities along the lower Great Lakes or transshipped to Ohio River Valley steel areas, such as Pittsburgh.

Imported iron ore supplies about one-third of the U.S. raw material requirement. It serves the East coast plants and Gulf coast extensively. Small amounts of these imported ores move from the Atlantic coast to plants in the interior--even as far west as Chicago--but their exact volume is difficult to determine.

If a uniform cargo tax affecting each ton equally is employed (18.3 cents per ton), the important issue is diversion from the Great Lakes routing to direct rail shipment. If a tax is levied on a per-lading basis, imports would be charged only 13.5 cents per ton while lakewise traffic would face a tax of 27 cents, so that import substitution becomes an important consideration as well as modal diversion. Both of these cases are examined as well as delivered price impacts.

The current distribution system for Mesabi and Old Range ore involves rail shipments from mines to Upper Lake ports and bulker transport from Upper Lake ports to Lower Lake ports for consumption or transshipment to railroads serving Ohio River Valley steel plants. The only alternative for this iron ore

TABLE 38: MAJOR COMMODITIES IN DOMESTIC TRAFFIC ON THE GREAT LAKES: 1974 AND 1975

	1974		1975	
Commodity	000's Tons	Cumulative Percentage	000's Tons	Cumulative Percentage
Iron Ore	74,572	51.1	65,781	50.9
Limestone	33,198	73.8	26,641	71.5
Coal and Lignite	21,741	88.7	21,793	88.4
Petroleum Products	4,699	91.9	4,414	91.8
Building Cement	3,339	94.2	3,089	94.2

is direct shipment by railroad from mine to plant. A comparison of transportation costs by each routing is given in Table 39. In each case, identified shipment using cheap transport on the Great Lakes is the least-cost route. Rail movement is much more expensive, and cannot compete in this distribution system.[1]

It should be noted that one other factor functions to reduce the possibility of modal shifts. There is strong verticial integration back through the raw material extraction and transportation process. Most steel corporations control their own iron ore mines, the railroads and water transportation lines which transport the raw materials, and some even maintain the lakes ports which they utilize. Dramatic price shifts would be required to encourage reduced use of facilities and equipment in which large investments have already been made.[2]

It is difficult to assess the impact of charging tolls on a per-visit basis, in which imports would appear more favorable relative to domestic shipments. Although rate data are available for Canadian shipments and for rail movements from Philadelphia and Baltimore, ore is sold on a contract basis, and selling prices are not obtainable.[3] Moreover, many steel corporations own portions of Canadian and overseas mines, and may purchase little if any iron ore from other companies.

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[1]Some ore can be found terminating in the Chicago district by rail; however, this originates around Black River Falls, Wisconsin, or the St. Louis area.

[2]It is more difficult to evaluate the loss from a break in a wholly owned and controlled logistics system implied by all-rail shipment.

[3]The delivered price of iron ore at Lower Lake ports is frequently quoted, but this is a ceiling or spot price, and cannot be used for the above analysis.

TABLE 39: COMPARATIVE SHIPMENT COSTS FOR DOMESTICALLY PRODUCED IRON ORE[1]

X-310A, X-313, and CFA 1005 Levels (where applicable)
(Dollars Per Gross Ton)

Rail Freight Rates from Mines to Upper Lake Ports:	
Mesabi Range to Duluth-Superior	2.78
Marquette Range to Escanaba	1.40
Lake Freight Rates from Upper Lake Ports to Lower Lake Ports:	
Head of Lakes to Lower Lake Ports	3.70
Escanaba to Detroit and Lake Erie	2.78
Escanaba to Lake Michigan Ports	2.22
Rail Freight Rates from Lower Lake Ports to Consuming Districts:	
Lake Erie Ports to Pittsburgh and Wheeling Districts	5.07
Lake Erie Ports to Johnstown	5.78

Total Routing Cost	Via Great Lakes	Rail Direct
Mesabi Range to:		
Lake Erie Ports	6.48	18.94
Pittsburgh and Wheeling	11.55	19.77
Johnstown	12.26	20.19
Lake Michigan Ports	6.48	10.06
Marquette Range to:		
Lake Erie Ports	4.18	15.07
Pittsburgh and Wheeling	9.25	16.27[2]
Johnstown	9.96	16.72
Lake Michigan Ports	3.62	8.19

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1 Source: Skillings' Mining Review - 10/25/75
2 This is the Pittsburgh rate. The rate to Wheeling is $15.68.

Given the extent of vertical integration in this industry, it seems highly unlikely that a 13.5 cents per ton differential would encourage major changes in mine production or distribution strategy. As seen in the previous case, the differential between lake shipment and rail direct is substantial, and 27 cents per ton would have no effect on modal diversion.

A uniform cargo tax would increase the cost of handling iron ore on the Great Lakes by 13.5 to 27 cents a ton. As of April 1977, the delivered price of iron ore at Lower Lake ports was $18.03-$18.85 per ton for Mesabi non-Bessemer, $18.25-$19.06 per ton for Old Range non-Bessemer, and $47.26 to $49.40 for a ton of pelletized iron ore. The majority of iron ore is now shipped as pellets since it is more economical in terms of both transportation and storage costs. If no absorption occurs, and port fees are passed through in the price of delivered iron ore, there would be a 0.3% to 0.6% increase in the price of pellets (the increase would be about 0.7% to 1.4% for unconcentrated ore).

The price increase for final products would be substantially less. The production of one ton of steel consumes approximately one ton of iron and manganese ores and concentrates (0.016 ton directly, and 0.995 ton indirectly in the pig iron production process). Given that the current average price for one ton of steel product is about $350.00, the increase due to deep-draft user charges would be 0.04% to 0.08%.

It is worth noting that a vessel registration tax would have a lesser impact on delivered prices than that established above. The flat fee would amount to about 16 to 25 cents per long ton for a 15-trip year, but this toll would decrease as trip frequency increases since it will be allocated over a greater amount of tonnage. If 30 trips were made a year, the user charge would be on the order of 10 cents per ton. This may be further decreased for vessels which can allocate part of the additional expense to backhaul traffic such as coal.

8. COAL TRAFFIC IMPACTS

8.1 BACKGROUND

The United States is currently the largest coal exporter in the world, averaging over seven percent of U.S. coal production during the last ten years. Bituminous coal exports totaled 65.7 million tons in 1975; 74 percent via coastal ports and the remainder from Great Lakes ports. Hampton Roads and Norfolk Harbor in Virginia are the largest coastal coal export points with over 36-million tons loaded in 1975. Baltimore Harbor exported 6.8 million tons in 1975, followed by Mobile, Alabama with 2.8-million tons. Delaware River ports and New Orleans accounted for slightly over 1-million tons of coal exports each during 1975. Lake Erie ports were the major Great Lakes coal export points. Japan is the major receiver of U.S. coal at about 25-million tons per year with Canada importing over 16-million tons of U.S. steam coal per year. The majority of the remaining coal is purchased by European countries (20-million tons per year).

Major deep-draft movement of coal among domestic ports occurs on the Great Lakes, where Lake Erie ports supply over 15-million tons of coal per year to utilities located on Lakes Michigan, Huron, and Erie. Substantial flows (over 15-million tons per year) of western coal via Duluth-Superior to Michigan and New York state utilities will begin in a few years. Some coastwise movement of coal out of Norfolk to Delaware River utilities exists, but most coastal coal traffic ceased when New York and New England utilities switched to imported fuel oil for power generation. Over 3-million tons of coal moves by deep-draft barge from New Orleans to Tampa, Florida to fuel electric generation. In general, coastal flows of steam coal may experience a resurgence under current coal-conversion orders or new construction of coal-fired powerplants able to accept such delivery. Utilities in urban areas are especially troubled by lack of coal-storage areas or land for rail-loop track for unloading unit trains. If water delivery is possible, it may be the only feasible delivery option if conversion is required.

The remainder of the section will discuss impacts of deep-draft user charge imposition by type of traffic (export and utility coal), with specific examination of areas of movement (coastal versus lakewise) within each. A-1 impacts are based on the recovery of 100 percent of deep-draft OM&R expenditures by the Federal government as reported in Section 2.

8.2 EXPORT COAL IMPACTS

The United States should remain the major world exporter of coal through the 1980's. Exports of bituminous coal are predicted to rise to 80-million tons per year by 1985. Existing port shares of export coal will remain essentially the same as in 1975, with Norfolk/Hampton Roads having 55 percent of total export traffic.

Export coal prices f.a.s. ship vary widely depending on the movement. Japan, a major coal importer from the United States pays approximately $30.00 per ton, whereas smaller importers pay over $40.00 per ton. On a national average basis, a 14 cents per ton port use fee would increase coal export prices by less than one-half of one percent. If the coal previously moved by barge for export to New Orleans or Mobile, and a 100-percent OM&R shallow-draft tax, higher impacts on export prices will result. Export flows from Ohio River origins would be subject to a fuel tax of as much as $1.10/ ton coupled with the 14 cents per ton deep-draft user charge. Export prices would rise by four percent for high-volume export flows and less for lower-volume moves (due to higher export prices).

Table 40 contains estimates of port-specific cargo taxes for major coal export ports, ranging from five to fifteen cents per ton laded in a port. Discussions with port officials and carriers revealed that port diversion (e.g., shipments via Hampton Roads rather than Mobile for example) is unlikely due to the low level of charges even under a port-specific user fee. Tariff port-equalization policies by rail carriers will also counteract the small price increases.

Potential substitution of all-rail flows for Canadian coal exports is only a remote possibility. Most Canadian utilities receiving U.S. coal are set up to receive flows via Great Lakes bulk operations. Although little is known about Canadian utility receiving facilities, discussions with Great Lakes carriers indicate that diversion to all-rail moves is not likely as the result of Great Lakes user charges.

In summary, impacts of deep-draft user charges on export coal traffic appears minimal, both across major ports and with respect to total U.S. coal exports. Given a fairly inelastic demand for U.S. coal at present, the price increase due to user charges will likely be passed onto foreign consumers. However, foreign coal sources (Poland, Australia, and South Africa, for example) have lower production costs

TABLE 40

PORT-SPECIFIC CARGO FEES FOR MAJOR COAL EXPORT PORTS[1]

($/ton)

Coastal	Port Charge
Hampton Roads/Norfolk	0.089
Baltimore	0.059
Mobile	0.154
New Orleans	0.151
Philadelphia	0.128
Great Lakes	
Conneaut	0.051
Ashtabula	0.063
Toledo	0.065
Sandusky	0.103
National Average	0.135

[1] Includes Coast Guard uniform recovery costs.

than the United States and long-term substitution for U.S. coal sources is possible. The proposed deep-draft user charge of 14 cents would increase Great Lakes coal transportation charges (Toledo to Toronto) by about seven percent, which may affect the long-term competitive position of lakes carriers relative to rail for coal flows to Canada.

8.3 UTILITY COAL IMPACTS

Utilities located on the Great Lakes are by far the major consumers of coal delivered by deep-draft vessel. Typically, a five to eight hundred-foot motor vessel delivers and self-unloads between fifteen and thirty thousand tons of coal per trip. Pre-lakes movement is generally by rail to Lake Erie ports, where ground storage is rented to utilities by the railroads for winter storage of coal. In that the lake channels are not operational during all twelve months, utilities generally have delivery arrangements via rail unit train as well as water service. In some instances, limits on vessel sizes through Great Lakes locks restrict use of one thousand-foot vessels, the most economical for this trade.

Detroit Edison and Consumer Power Company, both in Michigan, are the major utilities receiving steam coal via lakes carrier. In general, utility representatives indicated that lakes carriage of coal was competitive with all-rail operations although the advantage often shifted. At present, the high cost of coal increased inventory holding costs during lakes winter shutdown for coal stored in Great Lakes ports awaiting bulker delivery. The utilities have purchased substantial fleets of coalhopper cars to move coal from Eastern fields, effectively replacing potential lakes operations.

Both utilities felt that rail was very competitive for these coal movements to plants located on the Great Lakes. A deep-draft user charge would increase the average vessel charge per ton for coal moves to Lake Huron from Lake Erie ports by twelve to fifteen percent. The utilities indicated that an increase of twenty-five cents per ton for lakewise operation for coal delivery would give rail an advantage for many of these flows. Estimated traffic losses were not available, in that lakes vessels are generally on long-term contract to utilities. However, domestic coal movements from Lake Erie ports have been falling substantially in recent years, approximately twenty-seven percent since 1965. This is partly due to conversion of powerplants to oil, but utilities indicated that strong rail competition in this period was responsible for diversion of many lakes coal flows to unit trains. Present domestic movements of lakewise coal from Lake Erie ports is approximately 16-million tons, with Detroit Edison being the principal consumer.

A recent ICC ruling in the case of the Lake Carrier Association versus the New York Central Railroad _et al._, sought to end alleged discriminatory ratemaking practices by carriers serving Great Lakes ports. Specifically, railroads were accused of offering less favorable rates to ports while charging lower ton-mile fees for all-rail movements to lakes-served utilities. The ICC has recently ruled in favor of the Lakes Carrier Association, but final adjustments in rates and their impacts on traffic patterns are some years off. Although rate impacts are only estimates, the effect of this ruling could easily offset the impacts of deep-draft user charges.

Another development that will affect coal traffic on the Great Lakes is the growth of western coal movements via Duluth-Superior. Requirements to reduce the sulfur content of stack gas emissions has led to the use of low-sulfur Montana and Wyoming coal. Due to eastern rail congestion on east-west lines, shipment of western coal by rail east of Chicago has proven economically infeasible. Detroit Edison is constructing a nine-million-ton coal transloading facility on Lake Superior which is expected to be in full operation by 1985. They will operate two motor vessels under lease to bring coal to Detroit Edison plants near St. Clair (on Lake St. Clair, north of the Detroit River, between Lake Erie and Lake Huron). Given the size of investment in ships and transloaders, Great Lakes user charges will not affect these flows and price increase due to cost recovery which is expected to be passed on to the consumer.

In summary, although existing Great Lakes coal flows are quite sensitive to all-rail delivery options at present, a favorable ICC ruling against rate discrimination on pre-lakes moves by railroads could ease the situation. If not, the deep-draft user charge of twenty-seven cents per ton could put Great Lakes vessel carriage of coal in a much worse competitive position relative to rail. User charges could induce substantial traffic loss under these conditions. However, the ICC ruling favoring lakes carriers could easily offset any user charge impacts. Finally, movement of western low-sulfur coal via the lakes will apparently be unaffected by deep-draft user charges due to the utility investments in the distribution system.

As previously mentioned, coastwise movement of coal is presently minimal, perhaps two to three million tons per year. Moving from Baltimore and Norfolk origins, the coal fuels utilities in Delaware and, up to last year, in Massachusetts.

The Brayton Point Plant of New England Power in Taunton MA typifies the situation at many coastal utilities that could burn coal received by coastwise vessel delivery. Brayton, as with many eastern U.S. plants, formerly burned coal and switched to oil in the late 1960's. The Arab oil embargo shut off imported residual oil supplies and the plant immediately converted back to coal, burning one-million tons during the crisis. After oil became available, EPA ruled that Brayton must convert back to low-sulfur oil. Brayton presently has substantial coal stockpiles and would like to burn coal (delivered by water) because it is substantially cheaper than oil. They would consume 3-million tons per year if all boilers were using coal. Discussions with other coastal utilities indicate similar experiences. EPA has blocked conversion to coal although the utilities would prefer the use of coal in at least some boilers to avoid dependency on foreign sources of oil and reduce power-generation costs.

The Brayton Point plant would also like to extend the delivery channel to the plant to forty feet, so that larger classes of tankers and/or coastal colliers could be accepted. Local lobster fisherman have so far prevented the CoE from dredging the channel due to environmental problems.

For such plants, actions by agencies such as EPA and the Corps of Engineers would have substantially greater impacts on plant operations than a deep-draft user charge. For example, at Brayton Point a forty-foot channel would lower delivery costs for either coal or oil by much more than the twenty-five cents per ton user charge. In summary, coastal movement of fuels would be much more affected by environmental or energy-policy considerations than by deep-draft user charges.

Tampa Electric of Florida moves approximately 3.5-million tons of coal per year from New Orleans to Tampa Bay via ocean-going tugs and barges across the Gulf of Mexico. About 700,000 tons of coal, or fifteen percent of the total burn is brought in by rail. Land availability for rail facility expansion is not available, and the utility would find it difficult to increase rail shares.

Discussions with utility representatives indicate that a twenty-seven cents per ton coastal deep-draft user charge would not alter current traffic patterns. Tampa Electric owns its distribution system, including all river and gulf tows as well as transloading facilities. Any user charges would be passed on to Florida consumers. Under a deep-draft user charge coal-aquisition costs would rise approximately one percent, and electricity consumer costs would increase by one-third of one percent. No modal shifts are predicted for these movements.

In that the coal burned by Tampa Electric is brought by barge from Kentucky to New Orleans and transferred to deep-draft barges for final delivery, the utility represents a system user potentially affected by both shallow- and deep-draft user charge schemes. The utility and its coal delivery system will be discussed in more detail in the section (10) on shallow- and deep-draft system interactions and the implications.

Finally, the only utility currently receiving steam coal via coastwise operations is Public Service Company of New Jersey. Over two-million tons per year of coal move from various coastal ports by barge to the Hudson and Mercer steamplants. The Hudson facility has all coal delivered by rail to the Point Reading NJ CONRAIL coal pier, where it is transloaded to barge for a fifteen-mile movement to the Hackensack River plant. No alternative receiving capability exists, except for truck delivery from a rail rotary dumper located at the Public Service Gas and Electric's Bergen plant. Utility spokesmen indicate that changes in the delivery system are infeasible given the projected level of deep-draft user charges. In that the plant burns only low-sulfur coal to meet EPA emissions requirements, delivered prices of coal exceeded $40.00 per ton in 1975. A fourteen-cent deep-draft user charge would increase the delivered coal price by less than three hundreths of one percent. Increase in price to consumers of electricity are less than one-one hundreth of one percent.

The Mercer plant, located on the upper reaches of an improved channel (25-foot depth) of the Delaware River, receives approximately one-billion tons of coal from Baltimore Harbor and Norfolk Harbor origins via barge up the Cheasepeake Bay per year. All coal is received by water, and no other receiving facility exists at the plant. The charge for use of both ports by the utility would increase the transportation costs by over $270,000 per year on a delivered coal bill of 47-million dollars, or about a six-tenths of one percent delivered price increase, or two-hundreths of one percent increase in consumer electric prices.

8.4 SUMMARY

Great Lakes movement of utility coal appears to be the only waterborne coal traffic potentially affected by deep-draft navigation user charges. Substantial rail competition for these movements to steamplants located on the Great Lakes implies that a twenty-seven-cent toll may drive more coal traffic from Lakes bulker operation. Recent ICC rate rulings on proportional rail charges to utilities and Lakes carriers may alter this conclusion, depending on the final impact of the decision. Export coal price increases are expected to be borne by foreign consumers, given inelastic foreign coal demands. Finally, coastal receipts of utility coal will be basically unaffected by deep-draft user charges, in that alternative distribution systems are economically infeasible under current toll levels.

9. GENERAL CARGO IMPACTS

Commercial liner cargo accounted for only 8.5% of total U.S. oceanborne foreign trade cargo tons but more than 50% of cargo value in 1974. This cargo, which is composed of thousands of distinct commodities ranging from pulp to computers--each with a different transportation rate--is carried by a variety of technologies (break-bulk, container, RO-RO,LASH). In recent years, the share of traffic moving under unitized technologies has increased dramatically. By 1974, container tonnage had reached almost 40 percent of total liner tonnage--and probably a greater share of value (Table 41). [RO-RO and LASH services have also been increasing dramatically although from a lower base.] This growth in unitization has been motivated by a desire to reduce cargo handling costs (and damage) as well as to reduce time spent in port. It has been accomplished through several inter-related developments; an increase in vessels capable of handling unitized cargo through massive new construction and conversion improvements in cargo-handling equipment to reduce further port time and cost, containerization of commodities not previously considered amenable to containerization,[1] and introduction of additional markets.[2] Table 42 indicates the market concentration of containerized trade in 1973.

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[1]Liquid bulks, automobiles, and even live cattle are currently carrier in containers.

[2]For example, Port congestion in many developed nations has acted as a spur to LASH growth.

TABLE 41

CONTAINERIZED CARGO AS A PERCENTAGE OF TOTAL LINER FOREIGN TRADE 1970 - 1974

Year	Total Liner Cargo (1000 LT)	Containerized Cargo (1000 LT)[1]	% Container
1970	50,387	7,703	15.3
1971	44,209	8,345	18.9
1972	44,641	12,077	27.1
1973	51,244	17,487	34.1
1974	53,000[2]	20,819	39.3
1975	N/A	N/A	

Source: Total Liner Tonnage - Essential United States Foreign Trade Routes, MARAD, 6/75, p. 73. Containerized Tonnage - Containerized Cargo Statistics, 1974, MARAD, 8/76, p.11.

[1]Understates container tonnage slightly due to lack of filing requirement for voyages with fewer than 10 containers.

[2]Preliminary-rounded.

TABLE 42

TOTAL LINER AND CONTAINERIZED CARGO-SELECTED TRADE ROUTES FOR 1973 (1000 LT)

TRADE ROUTE*	TOTAL LINER TONNAGE	CONTAINERIZED TONNAGE
1	1359	86.0
4	1633	277.5
5,7,8,9	6270	5847.
6	1114	371.5
10	2433	1316.3
11	1424	669.
12	4366	1586.
13	1464	94.6
14	1708	93.5
16	1108	707.7
18	2016	6.6
19	1333	24.3
21	3768	692.7
22	2746	61.3
23	128	11.6
24	202	35.8
25	459	40.9
26	1433	762.
27	670	95.4
29	6950	4293.9
All Other	8660	413.4
TOTAL	51244	17,487

*MARAD reference on Table 1.

Trade impacts in the liner commodities (both imports and exports) are expected to be negligible as a result of user charges even at the levels required for full-cost recovery. This is due for the most part to the low level of taxes relative to commodity values (and rates). For example, it is estimated in Section 3 that the average impact per measurement ton under a system use tax would be 10-15 cents, depending on the recovery level (100% OM&R vs. 100% OM&R plus new construction) and vessel utilization. With liner rates averaging in the range of $75 to 100 per ton (weight or measure), this would imply ocean-transport cost increases on the order of 0.1 to 0.2 tenths of one percent,[1] and much lower delivered price impacts (liner rates are estimated to average between 5-15 percent of commodity value). The slight trade loss implied by such a price change[2] would be mitigated further by pricing practices which minimize traffic losses by allocating fixed costs to commodities which can best bear them.

Alternatively, a uniform cargo tax would increase delivered prices of liner cargos by 13-18 cents per long ton, compared to an average value per ton in the vicinity of $1200 in 1974, implying a delivered price increase of two hundredths of one percent.

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[1] The percentage may be higher or lower at the low-value and high-value ends of the commodity spectrum, respectively.

[2] The literature suggests an elasticity of demand for both U.S. imports and exports in the vicinity of -1. In this case, assuming the tax to be passed through uniformly (in % terms) to all tons, liner trade volumes would fall by about 0.0001. The same studies show imports to be more price-sensitive than exports for manufactured goods, meaning either that imports would fall off slightly more than exports or that exports would bear a higher burden from rate adjustments.

While this simplistic analysis shows little impact on liner trade levels as a result of deep-draft user charges, it should not be construed to imply that there may not be individual shippers (or receivers) of liner goods whose activities are more singificantly impacted, particularly under a port-specific option in a high-cost port. None of the data on individual port expenditures provided for this study indicate such a situation, however.

Given that user charges are not expected to have a significant impact on aggregate activity in the liner trades, the next issue is whether the distribution of traffic among ports and service types (direct call, feeder, Mini-bridge) would be affected.

The liner cargo-laden in any port consists of cargo originating in the immediate port area and cargo moving overland, which in turn includes cargo from interior points and bridge traffic from ports in other port ranges. Although little data exist on the issue, it is generally understood that overland traffic -- at least that which moves significant distances -- is heaviest in the unitized technologies. Traffic which originates within the immediate port area -- especially break-bulk cargo -- has the lowest probability of diversion.

The likelihood of diversion of traffic (particularly containerized) from the interior to an alternative port is a distinct possibility, but it is dependent on the user charge option selected and the rate responses of liner operators and surface transportation carriers. There has been a historical tendency for liner operators and railroads to equalize the overall transportation costs of alternative ports in the same port range, either through differential rate making or absorption of some terminal charges. Such practices might soften any emergent diversion propensities although there are probably limits to how far this would go in the face of large cost differentials.

The incentive for port diversion varies for different tax structures. The system use tax approach, which charges each entry to the U.S. Customs area, would have minimum impact. Under this scheme, no port would be more costly to use than any other, which is true of any uniform (as opposed to port-specific) approach, and additionally, incentive to ship through Canadian ports is insignificant unless a carrier is willing to shift its entire operation to Canada -- an extremely unlikely eventuality at the tax levels calculated earlier.

While a uniform cargo tax would provide no incentive to shift between U.S. ports, it would add to the variable costs of shipping a ton through U.S. ports as opposed to Canadian ports (13-18¢ per ton depending on the cargo base used). However, in light of the small size of the charge involved (about 0.1 percent of the average liner rate and 0.02 percent of average value), the diversionary impact would be negligible.[1]

A port-use fee would have potentially stronger impacts on port diversion. In the first place, even under a uniform fee per n.r.t. per port use, there would be an incentive for vessel operators to economize on port visits and to concentrate visits in ports where the greatest revenues per visit could be earned. This would encourage consolidation of traffic into

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[1]See below for potential diversion between service types as opposed to ports.

load centers (see Section 1). A vessel-based port-use fee would shift much of the recovery burden over to liner vessels from bulk and petroleum carriers in secondary ports. This is because bulkers and tankers normally deal in shipload lots, and thus have a fairly stable relationship between cargo discharged per port visit and taxable capacity (as measured by n.r.t). Liner calls in most secondary ports normally generate cargo which corresponds to only a fraction of total revenue capacity, yet they would pay port-use fees based on full capacity. All ports would probably retain liner service, at least for locally generated traffic, but the frequency and/ or character of service at lower volume ports would certainly decline. It should be noted that the tax in this case only adds to much greater existing pressures for consolidation.

The port-specific options would have similar impacts on liner trade, only more so, if low liner-volume ports tend to have higher tolls than primary ports. This appears to be most true on the Great Lakes where diked disposal costs drive up vessel and cargo fees.

Port-specific charges would tend to soften the potential for Canadian diversion of containers, on the other hand, because user charge-related cost increases in major container load centers would appear to be considerably lower than average. Thus, lower incentive for shift from load-center ports to Canadian ports is felt. Recall, however, that estimated tolls are not adequate to make this issue a significant factor.

In addition to differential impacts on liner trade in different ports, user charges under the various options will affect different service types differentially. Different liner operators -- particularly in the container trade -- serve the same trade patterns in different ways. For example, Sea-Land makes direct calls in its North Atlantic-Europe trade only in New York and Hampton Roads, serving other North Atlantic ports (Boston, Philadelphia and Baltimore) with relay vessels which are also gathering and distributing containers for line-haul vessels operating out of those same two ports for other world areas. Those same line-haul vessels will also be carrying containers which have moved overland from West Cost ports and by other relay vessels from the Caribbean and Central America and the West Coast. The Gulf Coast and South Atlantic are served by separate line-haul and relay vessels.

Other container lines may call at more North Atlantic ports (U.S. Lines line-haul vessels visit four or five U.S. North and South Atlantic ports per voyage in the Northern European trade) but without intra-coastal relay service, and with bridge service rather than direct service from the Gulf. Yet despite the differences in container logistics systems, each carrier is performing the port-to-port service at the going conference rate.

Analysis of the relative impacts of different user charge options on each logistic approach would require simulation of the total operations of each carrier -- a task beyond the scope of this preliminary effort. Certain observations can be made short of this however. [It must be re-emphasized that some of these observations may only be valid at much higher toll levels.]

Rail-bridge service will be favored over direct or feeder service where they compete directly because it involves fewer ships (system use fees), fewer port calls (port use fees), and fewer ladings[1] (cargo taxes) per ton carried.

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[1] Relative to feeder service.

Feeder systems would be relatively heavily impacted, especially under any approach which puts a larger burden on domestic, as opposed to foreign trade, activity. For example, while the registration tax on Sea-Land's North Atlantic feeder vessel would add only 5-6 cents per measurement ton of voyage capacity (with per-ton charges depending on slot-occupancy rates for the round voyage), a uniform cargo tax would add 39 cents per short ton of cargo[1] (2 payments for feeder lading and discharge, and another for line-haul lading).

There will be a tendency toward consolidation of operations within fewer ports by container operators currently making multiple calls per voyage under any port use fee although consolidation of different carriers in different ports will mitigate the service level losses in most larger ports.[2]

Estimates in Section 3 indicate that LASH vessels under a tonnage tax would be slightly more heavily impacted per unit of effective volumetric capacity than other technologies. To the extent that this is due to register tonnage measurement methods relative to effective capacity of carried barges, it could be ameliorated by redefinition of taxable register tonnage for these vessels. This technology may also suffer under a port use fee if LASH and Sea Bee barges are taxed for harbor use as well as the barge carrier. Note that this technology will also experience increased costs on the distribution leg from inland waterway user charges.

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[1] Load factors of 2/3 measurement tons per long ton are experienced in the North Atlantic container trade.

[2] All major carriers on the North Atlantic would continue to call in New York, but different operators might consolidate secondary calls in different ports.

All of these potential inter-technology biases are avoidable through careful construction of a recovery approach. Unless good reasons to the contrary can be forwarded, this should be a goal of any legislation.

10. SHALLOW-DRAFT/DEEP-DRAFT USER CHARGE INTERACTIONS AND IMPACTS

10.1 BACKGROUND

U.S. ports and channels generally support operations by both shallow and deep-draft vessels. Most shallow-draft traffic in ports consists of intra-port transfer operations or inland waterway flows (terminating or moving to other destinations). Examination of Tables 16 and 20 reveals that major coastal ports such as New York, Philadelphia, Hampton Roads, New Orleans, San Francisco, and Seattle have a substantial component of local and internal traffic. New York and New Orleans have the highest percentage of non-deep-draft operations with 38 and 34 percent, respectively. Ports not at the terminus of major inland river systems tend to have lower percentages of local and internal movements.

In that the shallow-and deep-draft systems share extensive public investment in port facilities, consideration should be given to cost sharing of deep-draft expenditures among types of traffic using the port. For example, Mississippi River barge traffic that originates or terminates along the Gulf Intercoastal Waterway passes through deep-draft channels associated with the Port of New Orleans. Similarly, intra-port transfer of commodities among waterborne trades or production facilities occurs in many coastal ports. In both cases, the smaller vessels engaged in the operations do not require full deep-draft channel depth for operation. In that a substantial portion of port expenditures by Federal agencies tend to be common (e.g., dredging) costs across various types of traffic, allocation of cost recovery is an important issue.

However, navigation facility public pricing and investment policies do not consistently address procedures for sharing common costs among various system users. The cost of constructing or improving a harbor or channel depends on the size (draft) of the largest vessel expected to visit a port, whereas the cost of subsequently using the facility is proportional to the number of movements of each type of vessel. Economists basically agree that individual user costs should be recovered via toll charges, but disagree as to if, or in what manner, common (fixed) facility costs should be collected. For navigation facilities, the problem is made more difficult because isolation of unit operating costs of a port facility by class of traffic has yet to be accomplished.

The section begins by examining various economic rationale associated with pricing and investment strategies in public decisionmaking for guidance on allocating port costs among traffic types. Next, impacts of navigation cost recovery on commodity traffic using both shallow- and deep-draft systems are examined. Finally, various proposed recovery schemes are evaluated in light of the above discussion.

10.2 PUBLIC PRICING AND INVESTMENT POLICY

In general, planning for port facilities requires consideration of present and future traffic volumes, vessel types and operation, and new ship technology as well as projected extension of alternative port capacities and new port development (such as superports). The choice of an optimal port-pricing policy depends on which public goals are to be satisfied. Public cost recovery, efficient use of resources, and guidance in future investment decisions are the three major, and sometimes conflicting, objectives associated with public navigation policies.

Efficiency in current resource allocation results from a short-run marginal cost-pricing strategy. Unit cost of single-vessel operation related to the operation and maintenance of port facilities would be the price (fee) charged. As previously mentioned, the impact of any vessel (or classes of vessels) on public navigation costs is unknown. For example, vessel operations may actually reduce channel-dredging requirements by suspending silt, so that river and harbor currents can carry it away. Further, maintenance and operation costs account for less than one-half of total public navigation expenditures. Short-run marginal pricing would not attempt to recover any non-use-related (fixed) costs associated with ports, such as dredging. Thus, inadequate guidelines for future investment in facilities would be available concerning the value of various channel depths to classes of traffic. Also, full-cost recovery of navigation-related public expenditures would not occur. Finally, an arbitrary transfer of income from those who financed port construction (taxpayers) to shipowners and users of commodities moving via ports would occur.

In order to improve payback of navigation expenditures, various departures from short-run marginal cost pricing are possible. Also, to increase recovery above marginal use costs, fees could be increased for those port movements where demand is least elastic. Although increasing returns to the Treasury, the approach does not provide a method for actually distributing common costs among traffic types; nor does it provide guidance for future investment decisions.

The above procedure is a special case of so-called "two-tier" pricing schemes. Fees to recover operation and maintenance costs would conform to short-run marginal cost pricing, while construction costs would be recovered by a lump-sum tax on port operations. A vessel-license fee, paid annually, and set to recover all deep-draft new construction costs would be an example of the lump-sum tax. Again, the scheme gives no guidance for cost-recovery allocation among classes of traffic using a facility.

Finally, long-run marginal cost-pricing strategies would charge a vessel operations fee that was set to recover operations and maintenance costs plus a share of new construction costs. Identification of imposed or required facility improvement costs by traffic type remains the unanswerable issue.

It should be remembered that departures from short-run marginal cost-pricing schemes in ports tend to discourage users that could pay unit O&M costs (if known), and result in inefficient resource allocations. Thus, no one scheme outlined above describes an optimal approach to the question of how shallow-draft users should contribute (if at all) to deep-draft port-facility investments.

As an alternative approach to the allocation problem, the next section considers differential traffic impacts associated with charging both a deep-and-shallow draft fee to inland system users of port facilities. Although a less rigorous solution, real world activities may provide further insights into whether, and by what amount, shallow-draft traffic should contribute to deep-draft port-cost recovery.

10.3 TRAFFIC IMPACTS OF SHALLOW-AND DEEP-DRAFT CHARGES

In general, waterborne export traffic that used both inland and port facilities would be at a further disadvantage relative to rail-to-port export flows under a system of both shallow-and deep-draft user charges. Coastal traffic moving among two U.S. ports and originating on the inland river system would likewise be affected, including an additional charge for the second port use. We would expect to find movements using both shallow-and deep-draft systems to experience the largest increases in transportation costs due to the double user-charges, and potentially, be more likely to shift modes, distribution systems, and ports, or all three.

The following summaries detail relative impacts on various commodity movements that involve ports, inland systems, and/or intercoastal waterways as well as ocean-going operations. They are examples rather than in-depth studies, and are used as guidance for how shallow-and-deep-draft traffic should divide port public costs.

10.3.1 Coal

The major coal flow involving inland, port, and oceangoing waterborne operations is the movement of 3.5-million tons of coal from Green River origins in Kentucky via the Ohio and Lower Mississippi to New Orleans for transfer to ocean vessels for Tampa Bay destinations. Tampa Electric owns the entire distribution system from Green River docks, shallow- and deep-draft tugs and barges, to the transloading facility in New Orleans. Phosphate rock from Florida mines forms some backhaul operations from Tampa to New Orleans.

Rail delivers 700,000 tons of coal per year and, due to urban plant locations, expansion of this total is not feasible at present. The utility would almost assuredly have to invest in dedicated rail cars to assure timely delivery, in that inventory storage is limited. Thus, the utility is committed to existing distribution systems and patterns.

If 100-percent OM&R cost recovery were introduced on both the shallow-and deep-draft system, total user fees for the coal flow could range as high as $1.23 per ton, or a 20-percent increase in transportation costs. Shallow-draft only fees account for about 15 percent. Tampa Electric indicated that such a charge would be passed directly onto customers and result in a five-to-seven percent rate increase. In that double wharfage may be charged in New Orleans (e.g., the ton of coal is charged for both unloading from the shallow-draft barge and loading into the deep-draft barge), transportation and final consumer costs may rise even higher. A vessel-license fee approach for both shallow-and deep-draft operations would have a much lower impact on costs, due to efficient utilization of the equipment.

In summary, charging both deep-and shallow-draft user tolls on the Kentucky to Tampa coal flow would increase (over the shallow-draft toll) transportation charges by as much as 10 percent and consumer electricity prices by three to four percent. The double-wharfage feature, which charges a ton of inland traffic being transferred to an ocean vessel for two port uses, warrants further examination. It should be remembered that the coal flow analyzed is a special case, unlike any other operations in the system, except phosphate rock which moves on the backhaul of this operation. Thus, generalizations of impacts to other traffic is inappropriate.

10.3.2 Petroleum

Shallow-draft/deep-draft user charge interactions become an issue for crude petroleum and petroleum products, originating on the Gulf Intracoastal Waterway West and the Lower Mississippi, and moving upriver to consumption points. Comparative modal shipment costs for pipeline, barge, and rail among major origin/destination points for existing waterborne traffic have shown that pipeline is generally the most cost-effective mode, with barge the next most expensive, and rail six times as expensive as pipeline. Barge transport has been found to be justifiable in two cases: first, it often serves as a peak-load delivery system to handle shipments in times of excessive demand when pipeline capacity is not adequate; and second, it is economical in shipping to small facilities in locations where annual volume requirements do not warrant the construction of a pipeline. Under these conditions, changes in relative modal prices should not significantly alter modal shipment decisions unless dramatic shifts occur.

Since the shipments being considered originate along the Gulf coast and terminate upstream, they are assumed to utilize only one deep-draft port; the toll is thus on the order of 2 cents per barrel for use of the deep-draft system.

Crude petroleum moves relatively short distances on the waterways compared to other commodities. As a result, the average barge rate for shipments originating on the GIWW West was \$1.94 per ton and \$1.74 per ton for shipments originating between Baton Rouge and the Mouth of Passes. A toll of 13.5 cents per ton would thus increase the transportation expenses by 8% and 7%, respectively, on top of a 10% increase by the shallow-draft fuel tax. Pipelines are at near full capacity however, and new construction is generally not feasible given the uncertainty in crude oil supply and demand. Even with the combined shallow- and deep-draft toll, the weight of the evidence indicates that little (if any) diversion to alternative modes will occur.

Distillate fuel oil and gasoline tend to move relatively short-haul from the Gulf coast to points on the Mississippi River system although several long-haul shipments do exist. The estimated barge rate for transport from Texas to St. Louis MO was $1.19 per barrel, while it costs $1.35 per barrel for a shipment to Chicago IL. The respective fuel taxes for use of the shallow-draft system were $.15 and $.18. Previous analysis showed that these levels of user charges coupled with declining production on the Gulf coast may cause diversion from barge to pipeline as competition for these products tightens. An additional 2 cents per barrel for use of a deep-draft port is less than a 2% increase in the barge rate, and should not prove large enough to cause significantly more diversion than that predicted under the shallow-draft recovery scheme.

Residual fuel oil is too viscous to move by pipeline, and in general, rail rates are two to three times as expensive as barge for similar movements. Even though the shallow-draft fuel tax raises average long-haul barge rates an average of ten to fifteen percent, it does little to make the two modes competitive. Barge enjoys too large a cost advantage over comparable rail moves. In general, little if any residual oil moves by rail in competition with barge. The addition of a deep-draft user chrge would result in an insignificant 1% increase in the barge rate; the conclusion of no modal diversion of residual fuel oil would remain.

In general, a vessel-license fee for both the shallow- and deep-draft system would reduce charges per ton even further, minimizing impacts on traffic using both ports and rivers.

For crude oil and petroleum products, the combination of deep-draft and shallow-draft recovery schemes increases the magnitude of the user charge, and makes shipment by water less attractive, furthering the possibilities of modal diversion from barge to pipeline. In shipping agricultural products however, the interaction of deep-draft and shallow-draft tolls has virtually no effect on modal preference.

Shipments of corn, soybeans, and wheat on the inland waterways are very export-intensive. Railroads provide strong competition in the export grain market, and have recently introduced innovative rate concepts and other improved services to capture a larger volume of shipments. As a result, a 1-to-3 cent per bushel increase on the shallow-draft system is predicted to cause significant diversion of traffic from barge to railroad. An additional deep-draft fee of 1/2 cent per bushel will affect all exports equally, regardless of whether they arrive at the port by barge or railroad; hence, railroad's competitive position is not improved due to the imposition of deep-draft user charges.[1]

The impact of a 1/2 cent per bushel port fee will probably be translated into a reduced bid at export facilities. Ultimately, the burden will probably be borne by the farmer

[1]Port-specific fees would create some differentials, but these would probably be phased out through equalization practices (see Section 6).

whose income will be reduced by the level of the uniform cargo tax. The total estimated impact on the American farmer will be the sum of reduced income due to shallow-draft charges (1 to 3 cents per bushel in the upriver areas) and deep-draft charges (1/2 cent per bushel).

10.3.4 Iron Ore

The discussion of Great Lakes shipments of iron ore is not affected by the imposition of shallow-draft user charges.[1] Shallow/deep-draft interactions need only be examined for imported iron ore moving through the Gulf coast. The only flow of significance is a barge-rail move initiated on the Warrior River system and destined for U.S. Steel's plant in the Birmingham area. The estimated barge, transfer, and rail rate sum to \$4.60-\$4.70 per net ton. Republic Steel and U.S. Pipe and Foundry also import the bulk of their iron ore through the Port of Mobile, but ship directly by rail from port to plant at a rate of \$4.47 per net ton (in 1800-ton minimum shipments). For reasons discussed in the shallow-draft study, it was judged that U.S. Steel would continue to absorb the extra cost even after the imposition of shallow-draft user charges. Recovery of deep-draft expenditures would not affect this conclusion since both the all-rail move and the barge-rail move must pay an additional 13.5 to 18.3 cents per ton for use of the Port of Mobile.

10.4 SUMMARY

Although a substantial amount of U.S. waterborne traffic operates in both shallow-draft rivers and deep-draft ports,

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[1] Except in the case where Great Lakes shipments may compete with shipments of ore moving on the inland waterways to areas such as Pittsburgh. In recent years, only 1/2-million tons move beyond Cairo and terminate along the Ohio and Monongahela Rivers. No sources contacted described the flow as a critical pattern for existing or expected scenarios.

the impacts on these flows of combined shallow- and deep-draft navigation cost recovery are not substantially different from those reported in the inland waterway user charge study. However, the combinations of separate shallow- and deep-draft fee structures appear administratively complex and very difficult to implement. For example, assume segment tolls on the inland system and a cargo-based port charge for deep-draft navigation are the options. The utility coal flow from Kentucky to Tampa would pay three separate inland segment tolls, two deep-draft tolls at New Orleans and one at Tampa Bay. In that transportation data bases are still quite primitive with respect to total movements within a distribution system, the difficulties of even identifying flows (much less charging them tolls) is obvious.

An alternative approach in the form of a combination vessel-license fee for both shallow- and deep-draft systems would simplify user charge administration greatly. Without having to know exact transportation flow information by water, barges and vessels engaged in waterborne trades (already registered) could serve as the tax unit.

APPENDIX A

PROJECT LIST, BY REGION,
U.S. ARMY CORPS OF ENGINEERS

NEW ENGLAND

KENNEBEC RIVER ME
PORTLAND HARBOR ME
PORTSMOUTH HARBOR ME-NH
SEARSPORT HARBOR ME
BUCKSPORT HARBOR + PENOBSCOT RIVER ME 22'

BOSTON HARBOR MA[x]
CAPE COD CANAL MA
CROSS RIP SHOALS MA
FALL RIVER HARBOR MA
MYSTIC RIVER MA[x]

NEW BEDFORD + FAIRHAVEN HARBOR MA
POLLOCK RIP SHOALS MA
SALEM HARBOR MA
TOWN RIVER MA[a]
WEYMOUTH FORE MA[a]

BEVERLY HARBOR MA 20'
GLOUCESTER HARBOR MA 20-25'
PLYMOUTH HARBOR MA 18'
PROVIDENCE RIVER + HARBOR RI
BRIDGEPORT HARBOR CT

NEW HAVEN HARBOR CT
NEW LONDON HARBOR CT
THAMES RIVER
NORWALK HARBOR CT 12'
STAMFORD HARBOR CT 16-18'

[x] Port of Boston.

[a] Quincy, MA - included by CoE in Port of Boston.

MIDDLE ATLANTIC

NEWARK BAY, HACKENSACK + PASSAIC R. NJ[x]
RARITAN RIVER NJ[x]
BUTTERMILK CHANNEL NY[x]
EAST RIVER NY[x]
GOWANUS CREEK CHANNEL NY[x]

HUDSON RIVER NY-NJ (to Port of Albany)
HUDSON RIVER CHANNEL NY-NJ[x]
JAMAICA BAY NY[x]
NEW YORK + NEW JERSEY CHANNELS NY-NJ[x]
NEW YORK HARBOR NY[x]

EAST CHESTER CREEK 7'[x]
HEMPSTEAD HARBOR NY 6'[x]
HUNTINGTON HARBOR NY 8'[x]
PORT JEFFERSON HARBOR NY 27'[x]
NEWTOWN CREEK NY 12-20'[x]

BAY RIDGE + RED HOOK CHANNELS NY[x]
DELAWARE R.-PHILADELPHIA TO SEA PA-NJ-DE[a]
IWW - DEL. RIVER TO CHESAPEAKE B. DE-MD
WILMINGTON HARBOR DE[a]
DELAWARE R. - PHILADELPHIA TO TRENTON PA-NJ[a]

SCHUYKILL RIVER PA[a]
BALTIMORE HARBOR + CHANNELS MD
CHANNEL TO NEWPORT NEWS VA
JAMES RIVER VA
NORFOLK HARBOR VA

THIMBLE SHOAL CHANNEL VA

[x]Port of New York--channels may also serve Albany.

[a]Delaware River Port area--projects cross individual port boundaries.

SOUTH ATLANTIC

CAPE FEAR RIVER ABOVE WILMINGTON NC
MOREHEAD CITY HARBOR NC
WILMINGTON HARBOR NC
PORT ROYAL SOUND SC
CHARLESTON HARBOR SC [x]

GEORGETOWN HARBOR SC
SHIPYARD RIVER SC[x]
BRUNSWICK HARBOR GA
SAVANNAH HARBOR GA
CANAVERAL HARBOR FL

CARRABELLE HARBOR FL
CHARLOTTE HARBOR FL
FERNANDINA HARBOR FL
FORT PIERCE HARBOR FL
JACKSONVILLE HARBOR FL

KEY WEST HARBOR FL
MIAMI HARBOR FL
PALM BEACH FL
PANAMA CITY FL
PENSACOLA FL

PORT EVERGLADES FL
PORT ST. JOE HARBOR FL
ST. AUGUSTINE FL
TAMPA HARBOR FL
ST. PETERSBURG HARBORS FL 19'

WEEDON ISLAND FL NP

[x]Port of Charleston SC.

GULF

MOBILE HARBOR AL
GULFPORT HARBOR MS
PASCAGOULA HARBOR MS
CALCASIEU R. AT DEVIL'S ELBOW LA[b]
CALCASIEU RIVER + PASS LA[b]

MISSISSIPPI R.- BATON ROUGE TO MOUTH LA[x]
MISSISSIPPI RIVER - GULF OUTLET LA[x]
MICHAUD CANAL LA[x]
ATCHAFALAYA RIVER AND BAYOUS CHENE, BOEUF, + BLACK LA 20'
ATCHAFALAYA RIVER - MORGAN CITY TO GULF LA 20'

BRAZOS ISLAND HARBOR TX[c]
CHANNEL TO PORT BOLIVAR TX
FREEPORT HARBOR TX
GALVESTON HARBOR AND CHANNEL TX
HOUSTON SHIP CHANNEL TX

MATAGORDA SHIP CHANNEL TX[d]
PORT ARANSAS - CORPUS CHRISTI TX
SABINE-NECHES WATERWAY TX [a]
TEXAS CITY CHANNEL TX

[x]Lower Mississippi River Ports--include Port of New Orleans, Baton Rouge, and smaller ports such as Destrehan, Good Hope, etc.

[a]Ports of Orange, Beaumont, Port Arthur, and Sabine Pass.

[b]Serves Port of Lake Charles and other facilities.

[c]Port Isabel and Brownsville, TX.

[d]Port Laraca.

SOUTH PACIFIC

SF BAY TO STOCKTON CA[x]		
HUMBOLDT H+B CA		
LOS ANGELES-LONG BEACH HARBORS CA[a]		
NAPA RIVER CA		
OAKLAND HARBOR CA[x]		
REDWOOD CITY HARBOR CA[x]		
RICHMOND HARBOR CA[x]		
SACRAMENTO R.-DEEP WATER SC CA[x]		
SAN DIEGO HARBOR CA		
SAN FRANCISCO HARBOR CA[x]		
SAN JOAQUIN RIVER CA[x]		
SAN PABLO BAY-MARE ISL. STRAIT CA[x]		
SUISUN BAY CHANNEL CA[x]		
PORT HUENEME CA		
CARPENTERIA CA	NP	
EL SEGUNDO CA	NP	
ENCINA CA	NP	
ESTERO BAY CA	NP	
MOSS LANDING HARBOR CA		15'
SAN LUIS OBISPO CA	20'	
VENTURA HARBOR CA	NP	
HONOLULU HARBOR HA		
KAHULUI HARBOR HA		
KAWAIHAE HARBOR HA		
NAWILIWILI HARBOR HA		
PORT ALLEN HARBOR HA		
BARBERS POINT HA	38'	
HILO HARBOR HA		
KAUNAKAKAI HARBOR HA	22'	
PEARL HARBOR HA	NP	

[x]San Francisco Bay Area Ports and connecting channels.

[a]C.O.E. project includes separate Port jurisdictions of Los Angeles and Long Beach.

NORTH PACIFIC

COLUMBIA R. - VANCOUVER TO THE DALLES WA-OR[x]
COLUMBIA + LOWER WILLAMETTE RIVERS WA-OR[x]
COLUMBIA RIVER AT MOUTH WA-OR[x]
COOS BAY OR
MULTNOMAH CHANNEL OR

UMPQUA RIVER OR
YAQUINA BAY + HARBOR OR
OREGON SLOUGH OR[x] 9'
TILLAMOOK BAY AND BAR OR 19'
BELLINGHAM HARBOR WA

GRAY'S HARBOR + CHEHALIS R. WA
OLYMPIA HARBOR WA
PORT GAMBLE HARBOR WA
PORT ORCHARD BAY WA
SEATTLE HARBOR WA [a]

TACOMA HARBOR WA
ANACORTES HARBOR WA 33'
EVERETT HARBOR + SNOHOMISH RIVER WA 28'
PORT ANGELES HARBOR WA 35'
PORT TOWNSEND HARBOR WA 12'

WILLAPA R.+ H. + NASELLE R. WA. 24'
LAKE WASHINGTON SHIP CANAL WA[a]
ILIULIUK HARBOR AK
SKAGWAY HARBOR AK
ANCHORAGE HARBOR AK

KETCHIKAN HARBOR AK 15'
SITKA HARBOR AK 22'
VALDEZ HARBOR AK
WRANGELL HARBOR AK 10'

[x]Columbia River Ports--projects serve a number of ports including Portland, OR, Vancouver, WA, Longview, WA.

[a]Port of Seattle.

GREAT LAKES

DULUTH - SUPERIOR HARBOR MN-WI
TWO HARBORS MN 28'
TACONITE HARBOR NP
SILVER BAY MN NP
ASHLAND HARBOR WI

GREEN BAY HARBOR WI
KENOSHA HARBOR WI
MILWAUKEE HARBOR WI
SHEBOYGAN HARBOR WI
KEWAUNEE HARBOR WI

MANITOWOC HARBOR WI
PORT WASHINGTON HARBOR WI
STURGEON BAY WI[e] 23'
OAK CREEK WI NP
CALUMET HARBOR + R. IL

CHICAGO HARBOR IL
WAUKEGAN HARBOR IL 22'
INDIANA HARBOR IN
BURNS WATERWAY HARBOR IN
MICHIGAN CITY IN 18' FISH

BUFFINGTON HARBOR IN NP
GARY HARBOR IN NP
LUDINGTON HARBOR MI
DETROIT RIVER MI[a,b]
GRAY'S REEF PASSAGE MI[c]

KEWEENAW WATERWAY MI
MUSKEGON HARBOR MI
ROUGE RIVER MI[a]
SAGINAW RIVER MI
ST. CLAIR RIVER MI[b]

CHANNELS IN LAKE ST. CLAIR MI [b]
PRESQUE ISLE MI
MARQUETTE HARBOR MI
FRANKFORT HARBOR MI
GRAND HAVEN HARBOR MI

HOLLAND HARBOR MI
MONROE HARBOR MI 16'
ST. MARY'S RIVER MI[d]
MANISTEE HARBOR MI
ST. JOE HARBOR MI 24'

MENOMENEE HARBOR MI
CHARLEVOIX HARBOR 18'
ALABASTER MI NP
CALCITE MI NP
ESCANABA MI NP

GREAT LAKES (CONTINUED)

PETOSKEY PENN DIXIE MI NP
PORT DOLOMITE MI NP
PORT GYPSUM MI NP
PORT INLAND MI NP
STONEPORT MI NP

ASHTABULA HARBOR OH
CLEVELAND HARBOR OH
CONNEAUT HARBOR OH
FAIRPORT HARBOR OH
HURON HARBOR OH

LORAIN HARBOR OH
SANDUSKY HARBOR OH
TOLEDO HARBOR OH
MARBLEHEAD OH NP
ERIE HARBOR PA

OSWEGO HARBOR NY
BUFFALO HARBOR NY[f]
BLACK ROCK CHANNEL AND TONAWONDA HARBOR NY[f] 21'
ROCHESTER (CHARLOTTE) HARBOR NY 24'
DIKED DISPOSAL - BUFFALO[f,g]

DIKED DISPOSAL - NCC (Chicago District)[g]
DIKED DISPOSAL - NCS (St. Paul District - Lake Superior)[g]
DIKED DISPOSAL - ERIE PA[g]
DIKED DISPOSAL - OSWEGO NY[g]
DIKED DISPOSAL - ROCHESTER NY[g]

DIKED DISPOSAL - ASHTABULA OH[g]
DIKED DISPOSAL - CLEVELAND OH[g]
DIKED DISPOSAL - CONNEAUT OH[g]
DIKED DISPOSAL - FAIRPORT OH[g]
DIKED DISPOSAL - HURON OH[g]

DIKED DISPOSAL - LORAIN OH[g]
DIKED DISPOSAL - SANDUSKY OH[g]
DIKED DISPOSAL - NCD (DETROIT District)[g]
DIKED DISPOSAL - BLACK ROCK CHANNEL[f,g]
GREAT LAKES CONNECTING CHANNELS[c]

[a]Port of Detroit.

[b]Connecting waterway - L. Huron-L. Erie.

[c]" " - L. Huron-L. Michigan.

[d]" " - L. Huron-L. Superior.

[e]" " - L. Huron-L. Michigan-Green Bay Harbor.

[f]Port of Buffalo.

[g]Construction of Dikes for containment of dredge materials which for environmental reason cannot be dumped in open water.

ANTILLES

ARECIBO HARBOR PR	
MAYAQUEZ HARBOR PR	
SAN JUAN HARBOR PR	
PONCE HARBOR PR	29'
ST. THOMAS HARBOR VI	39'
CHRISTIANSTED HARBOR VI	16'
FAJARDO HARBOR PR	

APPENDIX B

DATA TABLES FOR
PETROLEUM TRAFFIC IMPACTS

TABLE B-1

THE ROLE OF THE DEEP-DRAFT SYSTEM IN THE TRANSPORTATION OF ENERGY RELATED PRODUCTS - 1975

Product	Imports		Coastwise		Local	
	000's of tons	%	000's of tons	%	000's of tons	%
Crude Petroleum	255,912	53.7	26,039	11.2	4,268	5.5
Residual Fuel Oil	59,172	12.5	46,685	20.1	25,392	32.4
Distillate Fuel Oil	6,278	1.3	46,200	19.9	14,321	18.3
Gasoline	3,506	0.7	51,435	22.1	7,371	9.4
Total	324,868	68.1	170,269	73.3	51,352	65.6

TABLE B-2

COMPARATIVE MODAL TONS FOR CRUDE OIL AND PETROLEUM PRODUCTS - 1975
(000's of Tons)

Transport	Crude Oil	Petroleum Products
Pipeline[1]	454,654	441,079
Water[2]		
Deep-Draft[3]	286,220	280,424
Internal	47,581	98,257
Rail[4]	1,922	14,454

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[1]Source: Bureau of Mines, Mineral Industry Surveys. Crude Petroleum, Petroleum Products, and Natural Gas Liquids: 1975; Petroleum Statement, Annual.

[2]Source: Army Corps of Engineers, Waterborne Commerce of the U.S., Part 5, 1975.

[3]Includes imports, exports, coastwise, lakewise, and local traffic.

[4]Source: Carload Waybill Statistics: 1975.

TABLE B-3

REPRESENTATIVE CRUDE AND
PETROLEUM PRODUCT SHIPMENT RATES - 1975 DOLLARS[1]

Crude Oil

(Costs per Barrel)

PAD Origin	PAD Destination	Pipeline Rate[2]	Barge Rate[3]	Rail Rate[3]
3(Texas Gulf)	2A (Chicago)	48.3	132.3	344.3
3(East Texas)	3 (S. Louisiana)	23.0	50.4	117.2
Products				
3(Port Arthur, TX)	2A (Wood R., IL)	34.5		
2B(Tulsa, OK)	3 (Littlerock, AK)	28.8		
Houston	St. Louis		119.1	210.5

[1]Source: The PACE Company, Energy and Hydrocarbons in the U.S. to 1985, Tables F-55-59.

[2]Includes trunkline rate and 6.5 cents per barrel gathering changes.

[3]Specific point-to-point movements.

TABLE B-4

CRUDE OIL DEMAND AND PRODUCTION BY PADD: 1975

Region	Crude Oil Operating Throughout Capacity[1]		Crude Oil Input to Refineries[2]		Production[2]	
	000's Barrels/Cal. Day	Percentage	000's Barrels	Percentage	000's Barrels	Percentage
PADD I	1,677	11.3	513,803	11.3	48,498	1.6
PADD II	4,137	27.8	1,245,552	27.4	322,265	10.5
PADD III	6,197	41.7	1,919,828	42.3	2,044,056	66.9
PADD IV	552	3.7	155,395	3.4	249,177	8.2
PAD V	2,305	15.5	706,848	15.6	392,783	12.9
Total U.S.	14,868	100.0	4,541,426	100.0	3,056,779	100.0

[1]Source: Bureau of Mines, Mineral Industry Surveys. Petroleum Refineries in the United States and Puerto Rico, January 1, 1976; Petroleum Refineries, Annual.

[2]Source: Bureau of Mines, Mineral Industry Surveys. Crude Petroleum, Petroleum Products, and Natural Gas Liquids: 1975; Petroleum Statement, Annual.

TABLE B-5

PADD I REFINERY LOCATION, CAPACITY, AND METHOD OF RECEIPT: 1975

	Number of refineries in Operation	Operating Throughput Capacity (000's Barrels/Day)	Percent Crude Received by Water	Percent Water receipts from Foreign Sources
East Coast Refining District				
New Jersey	4	539	100	94
Delaware	1	140	100	90[1]
Virginia	1	53	100	100
Maryland	2	28.5	100	90[1]
New Hampshire	1	9	100	100
Florida	1	6	100	100[2]
East Pennsylvania	4	667.3	98	92
Georgia	2	18	75[3]	100
Total	16	1460.8		
Appalachian #1 Refining District				
West Virginia	3	19.6	21	-
West Pennsylvania	7	89.7	7	-
New York	2	107	-	-
Total	12	216.3		

[1] Receipts data are combined for Delaware and Maryland. About 90% of crude is received by water from foreign sources for these two states together; the breakdown is not necessarily 90% for each.

[2] Florida, Georgia, and Virginia are combined in the data. About 1/10 of 1% of water receipts of crude have a domestic origin and are probably shipped to Forida.

[3] Estimate based on the ratio of the capacity of the Savannah refinery to the Douglasville refinery.

TABLE B-6

CRUDE OIL INPUT TO REFINERIES
IN PADD I - 1975[1]
(000's Barrels)

State	Refinery Receipts of Domestic Crude	Refinery Receipts of Foreign Crude	Total Refinery Rece
Delaware, Maryland	5,153	44,497	49,925
Fla, Ga., Va.	831	21,983	23,278
New Jersey, R.I.	11,954	178,121	189,233
New York, N.H.	6,545	25,031	31,238
Penn. East	14,233	176,364	192,411
Penn. West	16,445	5,553	21,998
West Virginia	5,720	-	5,720
Total PADD I	60,881	451,549	513,803

[1]Portland, Maine, received 139.1-million barrels of crude petroleum that was in-transit bound for Canada.

[2]Does not necessarily sum due to losses and changes in stocks.

TABLE B-7

PADD II REFINERY LOCATION AND CAPACITY BY STATE: 1975

Location		Number of Refineries in Operation	Operating Throughput Capacity (000's Barrels/Day)
Eastern Ohio		1	64
	Total	1	64
Illinois		11	1,191.8
Indiana		6	559.3
Kentucky		4	167.8
Tennessee		1	43.9
Michigan		7	178.1
W. Ohio		5	505.4
	Total	34	319.0
Oklahoma		12	540.5
Kansas		11	454.8
Missouri		1	107
Nebraska		1	5
Iowa		-	-
	Total	25	1107.3
Minnesota		3	214.9
Wisconsin		1	45.4
North Dakota		3	58.7
South Dakota		-	-
	Total	7	319.0

TABLE B-8

MODE OF REFINERY RECEIPT OF DOMESTIC AND FOREIGN CRUDE IN PADD II: 1975
(000's Barrels)

	Domestic Crude By receiving state and method of transport						Foreign	
	Intrastate							
Location	PP[1]	TC&TR[2]	T&B[3]	PP[1]	TC&TR[2]	T&B[3]	PP[1]	T&B[3]
Eastern Ohio	-	-	-	8,281	-	-	12,593	-
Total				8,281			12,593	
Illinois	15,157	304	-	252,861	-	-	90,198	-
Indiana	1,397	72	-	129,150	91	2,515	30,389	-
KY, TN	2,560	1,100	-	27,520	95	14,147	24,842	159
Michigan	15,893	1,139	-	15,336	-	-	9,248	-
W. Ohio	59	-	-	121,625	-	-	40,734	-
Total	35,066	2,615		546,492	186	16,662	195,411	159
Minnesota, WS	-	-	-	8,768	-	-	60,198	-
N&S Dak.	13,204	108	-	1,263	41	-	3,285	-
Total	13,204	108		10,031	41		63,483	
OK	110,459	3,846	-	49,703	-	-	3,207	-
Kansas	59,345	1,362	-	71,784	1,019	-	7,420	-
MO&NB	-	-	-	33,414	26	-	400	-
Total	169,804	5,208		154,901	1,045		11,027	
Total PADD II	218,074	7,931	-	719,705	1,272	16,662	282,514	159

[1] Pipeline.

[2] Tank Car and Truck.

[3] Tanker and Barge.

TABLE B-9

PADD III REFINERY LOCATION AND CAPACITY BY STATE: 1975

Location	Number of refineries in Operation	Operating Throughput Capacity (000's Barrels/Day)
New Mexico	8	99.4
Total	8	99.4
Ark-Louisiana Inland		
Arkansas	4	59
Mississippi Inland	4	44.4
Alabama Inland	3	38
Louisiana Inland	7	75.9
Total	18	217.3
Texas Inland	24	535.2
Total	24	535.2
Texas Gulf Coast	25	3338.
Total	25	3338.
Louisiana Gulf Coast		
Louisiana Gulf	15	1678.2
Mississippi Gulf	1	280.
Alabama Gulf	2	49.2
Total	18	2007.4

TABLE B-10

MODE OF REFINERY RECEIPT OF DOMESTIC AND FOREIGN CRUDE IN PADD III: 1975
(000's Barrels)

Location	Domestic Crude: By receiving State & Method of Transport — Intrastate PP[1]	Intrastate TC&TR[2]	Intrastate T&B[3]	Interstate PP[1]	Interstate TC&TR[2]	Interstate T&B[3]	Foreign PP[1]	Foreign T&B[3]
New Mexico	24,775	3,858	-	54	347	-	-	-
Arkansas	12,666	626	-	5,902	6	-	-	-
Alabama	533	602	661	110,302	139	459	-	671
Mississippi	13,723	1,746	-	44,420	-	-	-	38,600
Louisiana	276,916	5,122	80,169	91,273	1,329	8,112	-	89,159
Texas	733,448	15,143	17,220	73,844	142	64,015	5,258	303,361
Total PADD III	1,062,061	27,097	98,050	225,795	1,963	72,586	5,258	431,791

[1]Pipeline.

[2]Tank Car and Truck.

[3]Tanker and Barge.

TABLE B-11

PROCUREMENT OF DOMESTIC CRUDE IN TEXAS AND LOUISIANA IN 1975

(000's Barrels)

Texas Receipts:

Texas	765,811	84.8
Louisiana	94,262	10.4
PAD I(Florida)	12,786	1.4
New Mexico	10,775	1.2
Ark.,Miss.,Ala.	9,809	1.1
Oklahoma	4,912	0.5
Utah	3,257	0.4
Colorado	1,626	0.2
Kansas	353	
	803,591	100.0

Louisiana Receipts

Louisiana	362,207	78.3
Texas	72,963	15.8
Ark.,Miss.,Ala.	15,746	3.4
PAD I(Florida)	11,794	2.5
Oklahoma	165	
	462,875	100.0

TABLE B-12

PADD IV REFINERY LOCATION AND CAPACITY BY STATE: 1975

State	Number of Refineries in Operation	Operating Throughout Capacity (000's Barrels/Day)
Colorado	3	63,200
Montana	7	149,431
Utah	8	154,200
Wyoming	11	184,950
Total PADD IV	29	554,781

TABLE B-13

MODE OF REFINERY RECEIPT OF DOMESTIC AND FOREIGN CRUDE IN PADD IV

(1975)

State	Domestic Crude						Foreign	
	By receiving State and Method of Transport							
	Intrastate			Interstate				
	PD	TC+TR	T+B	PP	TC+TR	T+B	PP	T+B
Colorado	2,463	2,035	-	8,742	2,797	-	162	-
Montana	8,795	971	-	19,805	12	-	12,656[1]	-
Utah	13,359	4,377	-	23,528	1,554	-		-
Wyoming	46,376	962	-	1,871	1,229	-	3,567	-
	70,993	8.354		53,946	5,592		16,385	

[1] Includes 43 by truck

TABLE B-14

PADD V REFINERY LOCATION AND CAPACITY BY STATE: 1975

State	Number of Refineries in Operation	Operating Through-put Capacity (000's Barrels/Day)
California	36	1820.7
Washington	7	366.9
Alaska	2	60
Hawaii	1	40
Oregon	1	14
Arizona	1	3
TOTAL PADD V	48	2304.6

TABLE B-15

MODE OF REFINERY RECEIPT OF DOMESTIC AND FOREIGN CODE IN PADD V: 1975
(000's Barrels)

	Domestic						Foreign	
	By Receiving State and Method of Transportation							
tate	Intrastate			Interstate				
	PP[1]	TC&TR[2]	T&B[3]	PP[1]	TC&TB[2]	T&B[3]	PP[1]	T&B[3]
alifornia	265,152	11,680	36,807	6,886	8,018	43,084	-	191,190
ashington	-	-	-	-	-	3,683	50,694	42,754
laska, Iawaii, Arizona, Oregon	20,411	325	-	-	608	32	509	16,688
	285,563	12,005	36,807	6,886	8,626	46,799	60,203	250,632

ipeline.

ank Car and Truck.

anker and Barge.

TABLE B-16

CHANGES IN CRUDE OIL PRICE IN 1976*,[1]

Country	1/1/76	1/1/77
Saudi Arabia	11.51	12.09
Nigeria[2]	12.75	14.35
Indonesia	10.65	12.42
Algeria[3]	12.90	14.30
Libya[3]	12.32	13.92
Canada[4]	12.95	14.15
Iran	11.40	12.59
UAE	11.92	12.50
Venezuela[3]	11.19	12.39

*Average price increase (1/76-1/77) was 10%.

[1]DRI Energy Bulletin, 2/77, p. 25.

[2]Buy Back Price.

[3]State Sales Price.

[4]Landed Price in the U.S., FEA Monthly Energy Review, January 1977 price from the $9.75 wellhead plus $4.40 export tax.

TABLE B-17

CRUDE OIL AND NATURAL GAS LIQUIDS PRODUCTION BY REGION[1]
(MMB/D)

Petroleum Administration District	1975	1980	1985	1990
I	0.2	0.1	0.2	0.2
II	1.1	0.8	0.6	0.6
III	6.9	6.0	5.2	4.8
IV	0.7	0.5	0.5	0.4
V	1.1	2.6	3.6	4.0
U.S.	10.0	10.0	10.1	10.1

[1]DRI Energy Bulletin. July 1976, p. 42.

TABLE B-18

CONTROL TABLE FOR RESIDUAL FUEL OIL: 1975
(000's Barrels)

PAD	Production	Imports	Exports	Total Supply	Sales	Balance
I	68,234	416,105	12	484,327	538,831	-54,504
II	69,690	14,015	114	83,591	95,176	-11,585
III	163,959	3,957	458	167,458	103,075	+64,383
IV	13,030	-	-	13,030	13,198	- 168
V	136,044	12,451	4,758	143,737	144,997	- 1,260
Total U.S.	450,957	446,528	5,342	892,143	895,277	- 3,134[1]

[1]Difference in totals may be due to changes in inventories which have not been accounted for.

TABLE B-19

MODAL SHIPMENT COSTS FOR RESIDUAL FUEL OIL: SELECTED ORIGIN/DESTINATIONS (DOLLARS PER BARREL: 1975)

Origin	Destination	Barge Rate	Rail Rate[1]
Houston, TX	Pittsburgh, PA	1.90	4.62
	St. Louis, MO	1.47	2.56
	Baton Rouge, LA	0.84	1.35
	Chicago, IL	1.68	3.41
	Florida	1.08	2.13
New Orleans, LA	Memphis, TN	0.76	1.72
	Chicago, IL	1.34	2.61
	Houston, TX	0.53	1.47
Baton Rouge, LA	New Orleans, LA	0.39	0.51
	Memphis, TN	0.65	1.78
	Chicago, IL	1.34	2.59
	Birmingham, LA	0.85	1.44
	Houston, TX	0.70	1.59

[1] Source: Railroad Petroleum Tariff Information.

TABLE B-20

SALES OF RESIDUAL FUEL OIL BY USE IN THE U.S.: 1975

Utility	000's Barrels	Percentage
Electric-Utility Companies	494,935	50.8
Heating	155,103	17.3
Industrial (except Oil Company use)	112,362	12.6
Vessels	96,673	10.8
Oil-Company Use	50,487	5.6
Military	19,068	2.1
Railroads	583	0.1
All Other	6,066	0.7
Total U.S.	895,277	100.0

TABLE B-21

MODAL SHIPMENT COSTS FOR
DISTILLATE FUEL OIL: SELECTED ORIGINS/DESTINATIONS
(1975 Dollars)

(Dollars per Barrel)

Origin	Destination	Pipeline Rate	Barge Rate	Rail Rate
Texas	Louisville, KY	0.52	1.28	2.98
(Port Arthur-Pipeline)	St. Louis, MO	0.63	1.19	2.11
(Houston-Rail& Barge)	Baton Rouge, LA	0.19	0.67	1.17
	Memphis, TN	0.42	0.98	2.20
	Chicago, IL	0.74	1.35	3.44
	Florida	0.45	0.88	2.14
	Pittsburgh, PA	0.74	1.24	4.07
Louisiana	Memphis, TN	0.33	0.60	1.63
(Lake Charles-Pipeline)	Kentucky River	0.45	0.79	2.27
(New Orleans-Rail & Barge)				

TABLE B-22

CONTROL TOTALS FOR DISTILLATE FUEL OIL 1975

(000's Barrels)

PAD	Production	Imports	Exports	Changes in Inventories	Total Supply	Sales	Balance
1	120,964	54,300	3	-9,787	185,048	466,038	-280,990
2	284,837	223	5	+ 224	284,831	319,240	- 34,409
3	431,928	1,441	61	-2,147	435,455	121,549	313,906
4	46,382	1	-	- 507	46,890	39,954	6,936
5	84,325	713	198	-2,713	87,553	96,780	- 9,227
Total U.S.	968,436	56,678	267	-14,930	1,039,777	1,043,561	- 3,784

TABLE B-23

SALES OF DISTILLATE FUEL OIL BY USE IN THE UNITED STATES: 1975

(000's Barrels)

Use	Barrel	Percent
Heating	487,120	46.7
On-Highway Diesel	217,206	20.8
Railroads	93,191	8.9
Electric Utility Companies	65,203	6.2
Industrial (excluding Oil)	63,993	6.1
Off-Highway Diesel	48,977	4.7
Vessels	26,138	2.5
Military	18,004	1.7
Oil Company Use	13,633	1.3
All other	10,096	1.0
Total	1,043,561	99.9

TABLE B-24

CONTROL TOTALS FOR GASOLINE BY PAD: 1975

PAD	Production	Imports	Exports	Industry Change	Total Supply	Disposition[1]	Balan
1	248,138	59,917	29	+1,262	306,764	826,742	-519,
2	733,910	1,285	2	+6,586	728,607	778,008	- 49,
3 I	994,980	1,554	623	- 70	995,981	333,705	+662,
4	84,195	22	-	- 500	84,717	71,612	+ 13,
5	331,455	4,471	196	+2,473	333,257	356,011	- 22,
Total U.S.	2,392,678	67,249	850	+9,751	2,449,326	2,366,079	+ 83,

[1]The sales data are from FHWA statistics on taxable fuel by state.

[2]Imbalances are the result of use of two different sources of supply and disposition data. Also, the supply data contain aviation gasoline, the total amounted to 14.1-million barrels in 1975.

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