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FEDERAL PROMOTION OF TRANSPORTATION ON
THE INLAND WATERWAYS OF THE UNITED STATES

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ABSTRACT

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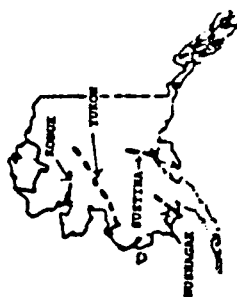
The Maritime Administration of the U.S. Department of Transportation promotes the commercial usage of the waterways. The Agency's Title XI Ship Financing Program, providing Government guarantees of private sector loans, for example, helps operators to acquire new vessels. In addition, the Agency conducts research on the markets for inland marine transport services, performs analyses and makes projections of commodity flows and vessel requirements, and forecasts the need for new port facilities and development.

This promotional activity is made complex by other Federal activities and policy decisions. For example, the world demand for steam coal creates a need to provide improved terminals and shipping systems to reduce transportation costs and keep U.S. coal competitively priced. At the same time, the need to reduce all Federal costs has led to proposals to impose substantial user fees for navigation and safety services provided by the U.S. Army Corps of Engineers and the U.S. Coast Guard. These fees would be paid by commercial users of our ports and waterways who can be expected to pass the added costs to consumers. Shifts to other modes of transport may then occur.

In addition, there is considerable utilization within the United States of intermodal transportation services which combine the advantages of individual transport modes. Easing of truck and rail regulations in 1980 has resulted in immediate interest in coastal shipping in this context, but inland waterway transportation offers similar new opportunities for coordinated, efficient national transportation.

These issues demand current, accurate data and improved analytical tools to support the decision making process as the Government and the industry address seemingly conflicting needs in the waterway system. Improved analysis will better define fundamental economic and operational constraints on waterways operations. It will thus provide direction not only for policy development and new legislation but for technological development of vessels and marine equipment. Such development will improve marine service efficiency and attract new markets for marine services.

THE INLAND WATERWAYS OF THE UNITED STATES



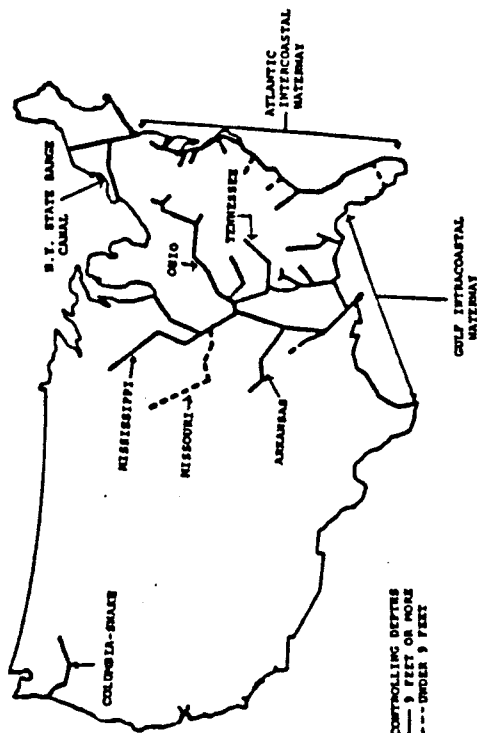
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Introduction

The United States has an extensive inland water transportation system, over which large and steadily growing tonnages of cargo are moved by a diversified private towing industry. For the most part, these movements are free of Government regulation.

Various Federal Government agencies, however, have functions which either directly or indirectly serve to promote and sustain the maintenance, improvement, and development of that system and the associated waterway industry. While some of the functions are primarily regulatory, even these have generally beneficial effects.

Evolving national priorities have brought about new transport issues which demand creative application of existing MARAD programs and resources.



This paper will describe the system and industry, and sketch the functions of the agencies, particularly the Maritime Administration, that play a role in promoting the inland water transport. It will also touch on some contemporary issues, and point to some areas which would benefit from additional or revised effort.

The System and the Industry

The inland navigation system of the United States consists of over 25,000 miles of navigable channels, 15,000 of which are 9 feet or more in depth. The system is dominated by the Mississippi River and its tributaries with almost 9,000 miles of navigable channels. Natural rivers, bays and estuaries have been improved and extended by dredging, widening and canalization. As indicated in the figure, they form an extensive network that includes the Atlantic and Gulf intracoastal waterways; the Mississippi River and its tributaries; and the Columbia-Snake River of the Pacific Northwest (1,2,3).

In 1940, the earliest year for which national statistics are available, over 183 million tons of cargo were transported on the inland waterways (4). In 1980, 629 million tons of cargo were carried by barge, which corresponds to a growth rate of about 3 percent per year. In terms of tonnage and service, there were 22.4 billion ton-miles of carriage in 1940 compared with about 300 billion ton-miles of annual carriage today. This corresponds

PRINCIPAL COMMODITIES TRANSPORTED ON U.S. INLAND WATERWAYS

	<u>1980 Transport, Thousands of Short Tons^{a/}</u>
Petroleum and Petroleum Products	220,842
Coal and Coke	142,443
Iron Ore, Iron, and Steel	13,641
Sand, Gravel, and Stone	60,330
Grains	44,276
Logs and Lumber	21,517
Chemicals and Related Products	40,115
Shells	9,241
All Others	76,759
Total	629,164

a/ Source: Department of the Army, U.S. Corps of Engineers, Waterborne Commerce of the United States, 1980; Part 5: National Summaries

to an annual growth of nearly 7 percent and reflects the greater distances over which cargo is transported on the waterways today (5,6).

As shown in the table, the principal commodities transported on the inland waterways are liquid and bulk raw materials. They include coal, grains, petroleum and products, sand and gravel, chemicals, and fertilizers. These major commodities constitute approximately 80 percent of the total inland waterway tonnage.

The inland waterway towing industry is made up of some 1,800 companies that operate over 29,000 dry cargo and tank barges and more than 4,400 towboats (7). Barges vary in size, but a typical dry cargo barge is 195 feet long and 35 feet wide. It has a 9-foot draft and a capacity of 1,500 short tons. Tank barges of similar dimensions have a liquid capacity of 454,000 gallons. Towboats also vary in size and in horsepower. Several 10,500 shaft horsepower boats ply the lower Mississippi where tows of 40 barges are not uncommon (3).

It is estimated that this industry employs 80,000 people, afloat and ashore.

Federal Programs for the Inland Waterways

Several Federal agencies have specific jurisdiction over certain activities on the inland waterways.

U.S. Army Corps of Engineers - The physical features and capacities of the navigation system are the province of the Corps of Engineers. It maintains authorized water depths through dredging and flood control activities; exercises responsibility for design and construction of new facilities, such as locks and dams, and maintenance and repair of existing facilities; and issues permits to establish barge floating areas (mooring places along the river bank) (8).

U.S. Coast Guard - The safety of vessel operations on the system is sustained by the Coast Guard through implementation and enforcement of appropriate regulations and provision of technical services. The subjects of these regulations range from pollution abatement to personnel qualifications, while technical services encompass such functions as vessel traffic system operation and placement and maintenance of navigation aids.

Department of Agriculture - Statistical data on the transport of farm commodities by all modes, including inland barge, are collected and published by the Department of Agriculture's Office of Transportation.

Maritime Administration - A quite different role with respect to the inland waterways, falls to the Maritime Administration (MARAD). This role was established by the Merchant Marine Act of 1936 which declares that it is necessary that the United States have a merchant marine "sufficient to carry its domestic

waterborne commerce...and to provide shipping service on all routes essential to maintaining the flow of such domestic...waterborne commerce at all times." This mandate was reaffirmed by the Merchant Marine Act of 1970, which extended the scope of Federal aid available to the entire merchant marine (9).

MARAD assists the domestic fleet, including the vessels of the inland waterways, by conducting studies, sponsoring research and legislative action, and administering financial aid programs. These actions help to keep waterway transport competitive with other modes. Over the years, this promotional program has been extremely far-ranging (10,11,12). It has included:

- . Market and general economic analyses
- . Studies of inland waterway ports and their requirements
- . Analysis of fleet operations
- . Fuel consumption and energy requirements comparisons
- . Technical evaluations of river boats and barges and their alternative configurations
- . Analysis of the transport of hazardous materials

Under this program, the agency regularly works with representatives of industry, labor, and Government to review such topics as needed legislative and regulatory change, waterway system maintenance and improvements, manpower and training, needed port and intermodal development, markets for services,

capital formation and financing, needed technological development, shipbuilding and repair, and productivity.

Currently, MARAD has regional port studies underway for the State of Maryland and the New York City area (13). Projects-in-planning include additional barge fleet research for the inland waterways and marketing efforts to encourage shippers to make increased use of Great Lakes ports and ports on the Columbia/Snake Rivers.

MARAD also administers the Federal Ship Financing Program, which was established under Title XI of the Merchant Marine Act of 1936. This program provides loan guarantees for the financing of ship construction or reconstruction in U.S. yards for U.S.-flag service. The program enables owners or prospective owners of eligible vessels to obtain long-term financing at interest rates that are comparable to those usually available only to large and financially strong corporations. The amount of obligation that is guaranteed does not exceed 75 percent of the actual cost of most eligible vessels, including towboats and barges.

Since this is a guarantee program and not a direct loan program, construction funds are obtained from the private sector. The main sources for such funds include banks, pension trusts, life insurance companies, and bonds sold to the general public.

The Title XI program has been very successful in helping the inland towing industry to build new equipment. In the past 5 fiscal years alone, 54 towboats and tugs and over 2,000 river barges were built under the program with actual costs of about \$96.1 and \$641.1 million, respectively.

Changing Issues in Federal Support

The Federal role in the promotion of the inland waterways as a viable segment of the U.S. transportation system has undergone extensive reexamination in recent years in an attempt to meet transportation needs while maintaining budget restraints in all areas of Federal spending. The development of appropriate programs has become increasingly complex. Potential actions to meet important short-term needs often appear to conflict with proposed measures to ensure the long-term fiscal soundness and successful completion of new water projects. Better understanding of the interaction of transportation markets, commercial waterway operations, and Government action is required in order to resolve these conflicts.

Demand for Coal. The distinction between promotion of inland waterways and U.S. ocean ports is a fine one on the issue of U.S.

coal exports. This issue is really four (14):

- . The potential U.S. coal export market
- . Development of foreign trade policy
- . The Federal role in dredging harbors and deep channels
- . The outlook for alternative technologies

Coal tonnage is the greatest of all single commodity tonnages shipped on the inland waterways. Most U.S. coal is consumed domestically by electric utilities, but there is an increasing world demand for steam coal. In recent years U.S. exports of coal have increased dramatically, rising from 66 million tons in 1979 to about 106 million tons in 1982 (15). This figure is expected at least to double by the year 2000 (6,14). One barrier to expanding United States trade in international steam coal lies in the limited capacity to store and load coal at coastal ports. In 1981, this limitation kept ocean-going vessels at anchorage for long waiting periods, some up to 40 days in the ports of Hampton Roads and Baltimore. Without adequate ground storage for steam coal at the ports, shippers were unable to maintain or move the volumes necessary to fill orders and load ships.

It is increasingly clear that within a few years, a larger percentage of world steam coal will move in vessels of 120,000 deadweight tons or greater capacity (14). This presents yet another problem for U.S. coal export, that of making ports

accessible to the larger vessels. Port channel deepening; the development of broad beam, shallow-draft vessels; and coal top-off operations using smaller self-unloading vessels to fill large colliers are among the alternative solutions under consideration. With the current oil glut and falling prices for petroleum, the rush to expand steam coal markets has lessened somewhat. Some port authorities have taken a wait-and-see attitude. Nevertheless, there is underway coal loading facility construction that will provide an additional 145 million short tons per year of through-put capacity by 1985, boosting total capacity to about 300 million tons (15,16).

There is no doubt of U.S. abilities to produce more coal for the export trade and for domestic use. The problem lies in shipping it at competitive prices and providing adequate port facilities (17). This problem is of direct concern to the inland waterway industry.

Waterway User Charges. An issue that has been prevalent for many years is the establishment of user charges to fund the heavy expenditures of the U.S. Army Corps of Engineers for the development and maintenance of the waterways. Advocates maintain the fairness of the approach on strict economic grounds while opponents claim general benefits to the public as a basis for financing from general taxes (18). Both of these views were

considered in the enactment of Public Law 95-502, the Inland Waterway Revenue Act of 1978. The Act established an initial waterway user charge schedule based on fuel consumption and directed that a study of the economic impacts of this and more comprehensive user charge systems be made. This study was concluded in February 1982 (19).

The most striking result of the analysis was a forecast of very strong future water traffic growth, with or without user charges. For example, under a "high diversion scenario," in which it is assumed that there is a system-wide fuel tax resulting in 100 percent recovery of waterway development and maintenance costs, and that there is no freight rate increase by the competing railroads, tonnage in the year 2000 is projected to be 50 percent greater than in 1977, but 9 percent less than it would be without user charges. Under a segment-specific ton-mile charge, with 100 percent cost recovery, and a 50 percent railroad rate increase, it is estimated that traffic by the year 2000 would increase 56 percent over 1977, and would be only 5 percent less than that which was forecast assuming no user charges.

The study shows that grain interests and barge operators would be adversely affected by high cost-recovery user charges. If rates were increased to cover these charges, the study predicts the barge industry would experience an immediate reduction in business. According to the study, in 4 to 5 years the growth in

river traffic would bring the barge traffic back to where it was before user charges were imposed, and from that point on, traffic would continue to grow.

Various organizations have conducted their own studies of the economic impact of waterway user charges on localities, states, and regions (20,21). Many of these studies contend that any form of user charge that is tied directly to U.S. Army Corps of Engineers expenditures for navigation adversely affects the entire waterway system. This is a variation of the so-called "equity" demand in the opposition to user fees. Equity proponents demand that the benefits of the waterways to all users, on all segments of the system, be assessed. Fees, if they are to be charged, would be set proportionately.

Cost recovery through user charges has also been proposed for deep channel dredging in port areas and for the performance of certain Coast Guard services such as maintenance of radio navigation aids, icebreaking, and search-and-rescue work. Legislation for all three types of water-related user charges was drafted in 1982, with several variations of the inland waterway and deep-draft cost-recovery proposals being introduced as bills in the U.S. Congress. All of these proposals were characterized by a total or high-level cost-recovery objective. Although none of these measures became law in 1982, legislative efforts are continuing in 1983. New deep-draft legislation has been

introduced and is undergoing analysis by MARAD and other agencies for possible presentation of findings at Congressional hearings. New inland waterway (shallow-draft) cost-recovery bills have also been introduced.

Examination of port and waterway requirements shows that they cannot be met without a significant contribution by non-Federal interests (6,22). Accordingly, one form of "promotion" that must be undertaken is a continuing operational and economic analysis of the waterway system and its transportation services. This work would support the design and adjustment of revenue-producing mechanisms, such as user fees, and provide the quantitative basis for policies, programs and regulatory changes needed to preserve the inland system and its transport industry (23).

Intermodal Transport. Relatively few cargoes actually begin or end their entire journey at a waterside terminal; they usually require connecting land transportation at one or both ends. However, until quite recently the path of such movements was a series of discrete events rather than a smooth and continuous flow via two or more modes of transportation. Scheduling was not fully coordinated; each mode or carrier issued its own separate documents of accountability such as bills of lading; and a shipper or forwarder usually had to deal with the participating carriers individually. The several modes saw themselves as open competitors rather than as collaborators.

Intermodal service would also offer railroads a way to escape the private maintenance burden of branch lines which paralleled or otherwise duplicate water routes. The availability of alternate modal service would be a valuable argument for use in Interstate Commerce Commission abandonment proceedings.

The obsolescence of physical facilities such as roadways and locks and the uncertainty of upgrading or replacement will afford carriers of all modes an incentive to develop intermodal services. In many cases, it will be possible to avoid traffic delays by bypassing a deteriorating stretch of highway, roadbed, or channel through connection with a carrier of another mode. Even with the cost of the interchange, the productivity gain realized could be enough to make the intermodal diversion worthwhile.

Still another attraction of the intermodal concept is the opportunity to limit non-productive vehicle time such as that which occurs in long, empty backhauls and marshalling delays. For example, in the movement of western coal to Gulf Coast markets, rail hopper cars can be more productively employed in shuttling east and west between the mines and the Mississippi River than in making the longer northwest to southeast direct run with an equally longer empty backhaul. The barges employed for the down river movement have a wider range of opportunities for

In this decade, the twin phenomena of emerging transport deregulation and infrastructure obsolescence will create new opportunities for the operation of true intermodal transportation services employing inland waterway capabilities. In these services, each participating mode would do what it does best, but as part of a total, rationalized transport enterprise which would offer shippers a better value and a simpler, better coordinated procedure than may have existed with single mode service.

There are clear and compelling incentives for the carriers to work together rather than exclusively. These take the form of demonstrable corporate savings rather than any recognition of system efficiency and rationality for its own sake.

While such landmark statutes as the Staggers Rail Act of 1980 and the Motor Carrier Act of 1980 can be expected to foster competition within and between modes, they should also encourage selective modal cooperation (24). One vehicle for such cooperation is the newly acquired right of railroads to negotiate shipper contracts. The opportunity -- or necessity -- to court dedicated shipper patronage under contract should lead to marketing of total transportation packages incorporating elements of highway, rail and water carriage.

backhaul cargo and can sometimes be used for interim storage with less system disruption than would occur with rail hopper cars. Western coal destined for markets on or adjacent to the lower Great Lakes can be railed to a port at the western end of Lake Superior and moved eastward by water, avoiding rail congestion at such switching points as Chicago.

These advantages are highlighted by a recently inaugurated (1979), intermodal service offered by the Burlington Northern Railroad and American Commercial Barge Line (ACBL) through the port of St. Louis. Burlington Northern's 110-car unit trains (1,000 of them a year) lift coal from Wyoming and Montana mines to the Hall Street Terminal of an ACBL subsidiary at St. Louis, where it is dumped at a rate of up to 40 cars an hour through rotary dumpers. Barge tows of 15-20 vessels are loaded continuously through a coal discharge system which can be controlled by a single person. The loaded barges then move 650 miles downstream to a Louisiana power plant. The terminal has three storage areas for intermediate stockpiling, including an active storage area with a 180,000-ton capacity and an inactive one with a 330,000-ton capacity that can be transferred to active status. A stacker/reclaimer with a 4,000 to 5,000 ton-per-hour capacity moves coal between rail line, storage area, and loader.

Intermodal prospects are not limited to bulk commodities or to rail movements. There are also situations where the high capacity and comparative fuel economy of barge transportation offset its lower speed, making it desirable for a motor carrier to ship trailers or containers by barge instead of committing sufficient tractors to handle each unit individually. This is particularly useful for a fleet operator with capital-intensive vehicles and an unbalanced cargo flow which requires more tractors at one end of a route than at the other.

A new service by the Tri-Continent Shipping and Terminal Service and the Riverway Barge Company is all-inclusive, offering terminal operation, barge service, inland feeder service, tariff provisions and stevedoring. It collects loaded containers at the river ports of St. Louis, Cape Girardeau, Memphis, Greenville, Muskegee and Pine Bluff, loads them onto 72 TEU capacity barges, and transports them downriver to New Orleans at rates competitive with rail or highway carriage. A potential new market for inland container transport is predicted by Data Resources, Incorporated, which forecasts that, by 1990, up to 35 percent of all auto parts will be made overseas and imported in containers for further movement to internal assembly plants (24).

Obstacles to intermodal service include the inertia of established shipper patterns; the enforced separation of modal ownership by the Panama Canal Act which prohibits railroad ownership of directly competing barge lines; and the natural tendency of modal management to concentrate on maximizing modal revenue, sometimes at the expense of either modal or system log and efficiency.

Notwithstanding such obstacles, the arguments posed herein and the visible successful examples of those intermodal activities which include inland water carriage are likely to encourage a fuller intermodal role for the barge lines in the 1980s.

Approach for the Future

The current way in which the waterways and their potential usage is perceived, coupled with overall budgetary constraints, has begun to shift the burden of waterway support from Government to the private sector. The waterways community must be responsible for raising some portion of the costs of maintenance, repair, and new construction of river facilities. Port development in the future will proceed with the participation of the Corps of Engineers but primarily through the initiatives and financial arrangements carried out by private interests in the port cities. There still remains, however, a responsibility on the part of the Federal Government to continue to provide selected services to the industry and the public.

Numerous Government studies relating to the inland waterways and domestic shipping in general have been conducted. These studies developed technical information, cargo projections, commodity forecasts, and useful analytical methodology. In many areas, however, good data are unavailable or incomplete and analytical tools must be improved.

MARAD is working with the U.S. Army Corps of Engineers and the Coast Guard to develop data on dry cargo and tank barges and towboats. Computerized information on all floating equipment and freight on the waterways would greatly aid the processing of Title XI applications, for example. It would also provide a planning capability for the industry. With a timely portrayal of commodity and vessel movements at hand, industry and Federal agencies would be able to make equally timely and effective management and policy decisions.

Such systems are being developed. In the latter part of 1981, MARAD and National Marine Service Inc. of St. Louis, Missouri, jointly conducted a study to improve vessel management capability. Under the study, National Marine Service converted a manual recordkeeping system to an on-line computer system that can track equipment and cargo, provide financial data and details of vessel contracts, and serve the vessel scheduling process.

This vessel management system is adaptable to the needs of other vessel operators and those of inland ports as well. Comprehensive systems capable of representing all cargo and all vessels throughout the inland system, with suitable graphics and hard-copy reports, are foreseen.

Summary

Until recently, Federal assistance to navigation was largely taken for granted. Today, inland waterway user charges are in place and there are Congressional proposals to increase them. Other cost-sharing is being considered for deepwater ports and for Coast Guard services.

Even as the domestic shipping industry is being offered relief from restraining regulation and a chance to take part in regulatory reform, it must constructively address the declines in business activity and profitability which have accompanied the recently trouble national economy. The role of the Maritime Administration in assisting that industry must include efforts to improve data collection and dissemination and to provide analytical tools for industry's use. Such contributions will allow better identification of fundamental economic and operational constraints and opportunities in waterways shipping and will provide direction for policy formulation and technological growth.

References

1. Macbain, Merle. "A Softening of the Arteries," Seapower, 24 (May, 1981), 42-50.
2. Kelnhofer, Guy J., Jr. "The U.S. Waterway System: A Joint Venture," Water Spectrum, Spring 1981, 7-14.
3. The American Waterways Operators, Inc. Big Load Afloat: U.S. Domestic Water Transportation Resources. Washington, DC, 1973.
4. The American Waterways Operators, Inc. Big Load Afloat: The History of the Barge and Towing Industry. Vol. 1: The Early Years; Vol. 2: Economics. Arlington, Virginia, 1981, 1982.
5. U.S. Army Corps of Engineers. Waterborne Commerce of the United States, Calendar Year 1980; Part 5: National Summaries. Compiled under the supervision of the Water Resources Support Center, U.S. Army Corps of Engineers, Fort Belvoir, Virginia.
6. Koch, DuWayne A. The Federal Role in Water Transportation. Paper presented at the National Coal Association/Edison Electric Institute Seminar, Hyatt Regency - O'Hare, Chicago, September 26-28, 1982.
7. The American Waterways Operators, Inc. Inland Waterborne Commerce Statistics 1979. Arlington, Virginia, 1981.
8. U.S. Army Corps of Engineers. User Charges for the Use of Inland Shallow Draft Waterways. Report prepared by Price Waterhouse under Purchase Order No. DACW72-82-M-0309, September 13, 1982.
9. U.S. House of Representatives, Merchant Marine and Fisheries Committee. The Merchant Marine Act, 1936, The Shipping Act, 1916, and Related Acts (As Amended Through the 96th Congress). Serial No. 97-A, 97th Congress, 1st Session, January 1, 1981.
10. U.S. Department of Commerce, Maritime Administration. Progress through Productivity. Office of Domestic Shipping Report on the Second National Conference on Domestic Shipping, New Orleans, March 9-11, 1976.
11. U.S. Department of Commerce, Maritime Administration. Domestic Waterborne Shipping Market Analysis: Executive Summary. Prepared by Kearney: Management Consultants under contract MA-RD-900-73007, February, 1974.
12. U.S. Department of Transportation, Maritime Administration. Vessel Management Information System. Project report, National Marine Service, November, 1981.

13. Washington Public Ports Association. 1980 Port System Study for the Public Ports of Washington State. Prepared by CH2M HILL in association with George H. Pigott, Bellevue, Washington, November, 1980.
14. Congress of the United States, Office of Technology Assessment Coal Exports and Port Development: A Technical Memorandum. Washington, D.C., April, 1981.
15. U.S. Department of Transportation, Maritime Administration. Existing and Potential U.S. Coal Export Loading Terminals. Office of Port and Intermodal Development, January, 1983.
16. American Association of State Highway and Transportation Officials. Survey of State Funding of Landside Port Facilities and Cargo Terminals, 1982. Standing Committee on Water Transportation, Washington, D.C., November 20, 1982.
17. U.S. Department of Commerce, Maritime Administration. National Port Assessment, 1980/1990: An Analysis of Future U.S. Port Requirements. Office of Port and Intermodal Development, June, 1980.
18. National Waterways Conference, Inc. The Failure of the Market Test Doctrine: Merchandising of the Public Interest in U.S. Harbors and Waterways. Washington, D.C., 1981.
19. U.S. Department of Transportation, Office of the Secretary of Transportation, and U.S. Department of Commerce, Office of the Secretary of Commerce. Inland Waterway User Taxes and Charges. Report of the Secretary of Transportation to the United States Congress Pursuant to Section 205, Public Law 95-502, The Inland Waterway Revenue Act of 1978, February 1982.
20. State of Minnesota, Minnesota Department of Transportation. Waterway User Charges and Minnesota's Commercial River Transportation. Prepared by the Planning Division, May 1, 1981.
21. State of Tennessee, Tennessee Department of Transportation. Impacts of Waterways User Charge on the Economy of Tennessee. Prepared for the Bureau of Waterways and Rail by the Bureau of Business and Economic Research, Memphis State University, May, 1978.
22. U.S. Army Corps of Engineers. National Waterways Study Review Draft: Summary of Study Team's Proposed Recommended Plan. Institute for Water Resources, Fort Belvoir, Virginia, July, 1981.
23. Yates, Jeff L. "User Fee Consensus: Necessary If Timely Water Project Progress To Occur," The Waterways Journal, 96 (March 19, 1983), 4 and 10.
24. U.S. Department of Transportation, Maritime Administration. Integration of Domestic Waterborne Transportation (Draft). Office of Policy and Plans, March 8, 1983.