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Foreword

The following papers represent the two formal sessions of Transportation Research Board Committee on Inland Water Transportation, at the Fifty-fifth Annual Meeting of the board. These papers are significant in that they discuss the activities, needs, processes, and resources involved in the place of water transportation as an emerging entity in our national transportation policy. One session, that with papers by Goodwin and Haefner and others, develops a framework for integrating port planning into multimodal transportation planning and statewide transportation studies, and views the port as a complex entity involving several federal agencies and their planning processes.

The second session reflects on emerging issues in national water transportation policy that are relevant to the long-run use of national resources. The papers by Clark and Cooke and by Hershey overview the complex problems of user charges and federal transportation regulatory policy. A discussion of the impact of waterway improvement projects is undertaken in the paper by Antle, and the necessity for appropriate economic and environmental analysis is demonstrated. The sessions build a framework for long-run Transportation Research Board activities in studying the integration of water transportation into the multimodal analysis scheme and the stimulation of improved interagency cooperation.

—Lonnie E. Haefner

State Management of Inland Waterways Port Development

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This paper reviews the involvements of various states in the development of inland waterways transportation and in particular the responsibility of state and local governments for the development of onshore facilities that serve the inland water mode of transportation. The efforts of the state of Tennessee in the organizational structure of its department of transportation and its state assistance to local governments in port development are used to illustrate possible modes of involvement of a state government in waterways transportation. The conclusion of the paper is that in the future many states will be committed to an active role in the physical development of onshore port and industrial areas to serve the inland water transportation mode and may even be influential in national policy issues that affect waterways.

The influence of the inland waterways on the early economic development of America is well documented. Most of the major inland urban areas of today were established on the waterways. Water transportation of goods and people was vital to the economic and military needs of the nation until the last quarter of the nineteenth century. Even in the period of the growth of rail and automobile transportation, the waterways continued to be an important mode of transportation for certain goods. The advantages of water transportation for bulk commodities have led to massive industrial development on the waterways and contributed to regional economic growth.

In recent years, water transportation has emerged as the most energy-efficient, low-cost mode of transportation for the movement of bulk products. The technological evolution in the towing industry has led to the development of barges having 1500-Mg (1500-ton) dry-cargo capacity and liquid bulk tank barges of up to 3400-m³ (900 000-gal) capacity. The tow boats of today have powers of 7500 kW (10 000hp). These developments allow for the movement of up to 54 000 Mg (60 000 tons) of dry cargo in one tow. The size of a tow is limited by the physical characteristics of the waterway and its attendant locks, but, on the lower Mississippi River, tows of 36 to 40 barges are common. The average size of tows on selected rivers in the mid-America area is shown below (1).

Waterway	Number of Barges
Allegheny River	11
Illinois River	15

Waterway	Number of Barges
Arkansas River	2
Upper Mississippi River	15
Lower Mississippi River	40
Missouri River	8
Monongahela River	15
Ohio River	20
Tennessee River	4

The commodities most suitable for movement by inland water transport are petroleum products, grains, and coal.

The two major characteristics of inland water transport, its energy efficiency and its low cost, will increase its importance and future role in a national economy of energy shortages and a world economy of food shortages. The emerging and developing nations will probably want to exchange their petroleum products and other natural resources for American grain technology and capital goods. The Soviet Union and the People's Republic of China will become larger users of our coal and grain. The incoming and outgoing products will be transported from ocean ports in tankers and dry-cargo bulk ocean carriers, but they will be collected and distributed, in great part, on the inland waterways system.

THE MID-AMERICA INLAND WATERWAYS SYSTEM

Most of the inland waterways system is composed of the Mississippi River, its interconnected tributary rivers, and the Gulf-Intercoastal waterway. For the purposes of this paper, this system is referred to as the mid-America inland waterways system. Figure 1 maps the system, including the depths of the navigable channels. It has 40 000 km (25 000 miles) of waterways directly serving 21 states and indirectly serving the remainder of the area between the Rocky Mountains in the west and the Appalachian Mountains in the east. The completion of the Tennessee-Tombigbee channel will add 750 km (470 miles) to the system and provide considerably greater flexibility. It is particularly important that this system serves the great grain belt in the midwest and the central coal deposits. It is inevitable that the western rivers and

the total system will play an important role in the movement of the western coal deposits.

The importance of the mid-America waterways system is indicated in the recent study conducted for the U.S. Department of Commerce Maritime Commission (1). Table 1 shows the 1969 total flow of commodities in the inland waterways trade area by all surface modes. These commodity flows represent the market potential for the inland marine carriers. Table 2 allocates this market potential to the various inland waterways market areas (2). The data in these tables indicate that over 95 percent of the national inland water carrier market potential is in the trade area of the mid-America system and that a high percentage of this market consists of coal, chemicals, petroleum products, and grain and other agricultural products.

STATE INVOLVEMENT IN WATERWAYS PORT DEVELOPMENT

This brief review of the mid-America inland waterways system and its importance to the states it serves was to focus on the need for state transportation authorities and other state agencies to become involved in the planning and development of inland waterways. More important, however, is the need for staff officials to become more knowledgeable about and concerned with the national policy issues that may affect the inland water transportation system and to take part in policy development.

With the creation of the U.S. Department of Transportation (DOT), it was envisioned that the states would follow the lead of the federal government and create state DOTs to deal with intermodal transportation. This has not happened to the degree expected. By 1974 only 27 states had created departments of transportation (2), and

Figure 1. Mid-America inland waterways system.

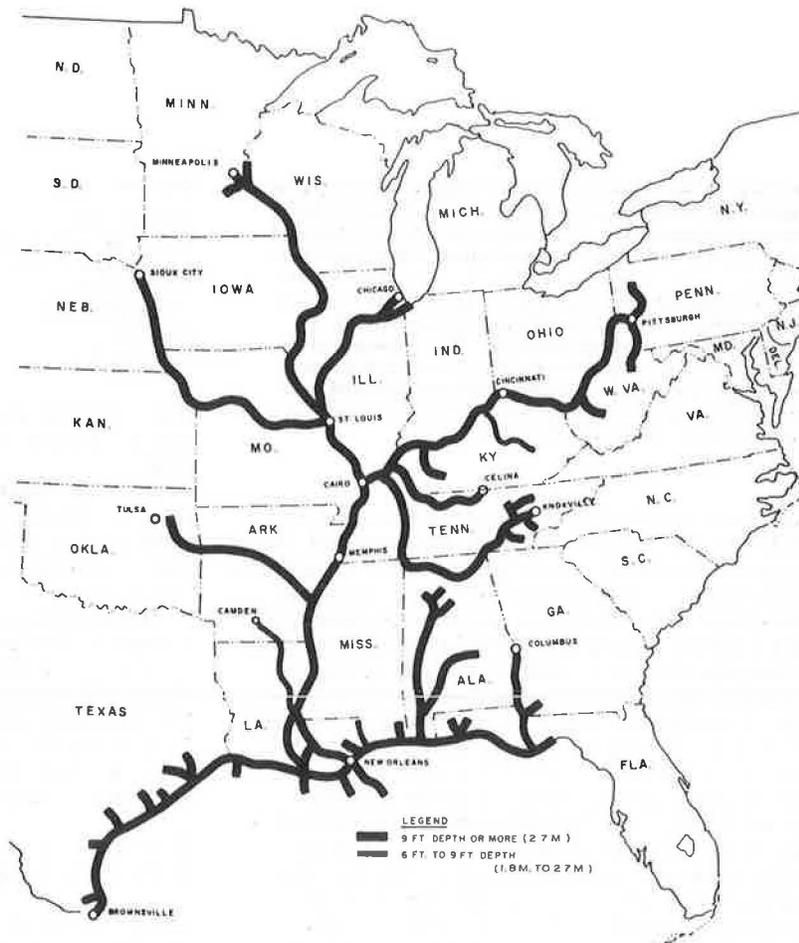


Table 1. Commodity flow by all surface transportation modes in the inland waterways trade area.

Commodity	Flow (Tg/year)	Percent of Total	Commodity	Flow (Tg/year)	Percent of Total
Coal	167	22.0	Iron ore	14	1.9
Mining products	153	20.0	Nondurable manufactures	14	1.8
Fuels and lubricants	75	9.9	Paper	12	1.6
Durable manufactures	61	8.0	Fabricated metal products	10	1.4
Chemicals	55	7.2	Metal ores	5.8	0.8
Crude oil and natural gas	52	6.9	Lumber	5.1	0.7
Cash grains	44	5.8	Nonferrous primary metals	3.7	0.5
Primary iron and steel	43	5.7	Raw and refined sugar	3.1	0.4
Agricultural products	22	2.8	Canned fruits and vegetables	1.8	0.3
Grain mill products	17	2.3			
			Total	758.5	100.0

Notes: 1 Tg = 1 102 000 tons.
Excludes pipeline and exempt truck movements.

two of these, those in Hawaii and California, had been formed before the establishment of the federal DOT. Of these 27 state departments of transportation, only 14 include water transportation as one of their responsibilities. This would seem to be gross neglect of a mode that hauls 16 percent of the nation's freight. However, all of the states are not directly involved in inland water transportation. A more meaningful measure of state interest in water transportation would be to look at the actions of those states served directly by the mid-America waterways system.

Of the 21 mid-America system states, in 1974 only nine had departments of transportation and only six of

these included water transport as a responsibility (see Table 3) (2, 3). The absence of a specific water transport responsibility does not mean that there is no interest in waterways development. In almost all of the states there are state and local agencies and private associations that actively support port development and waterways improvement programs. The absence of the water transport responsibility from the state DOTs does, however, suggest that the states have not recognized the importance of water transportation in the planning and implementing of a total multimodal transportation system.

In addressing the subject of state management of the inland waterways it must be immediately recognized that the state responsibility begins on the shore. Traditionally, the federal government, through the U.S. Army Corps of Engineers, the U.S. Coast Guard, and the Tennessee Valley Authority, has assumed the responsibility for the development and improvement of the navigation channels and the locks and dams. This federal role does not minimize the importance of the onshore responsibility. The planning of a total multimodal state system requires that the planning for inland ports be coordinated with that for highways and other transportation modes. The existing and future ports must be integrated into the overall transportation system. The state responsibility for the planning of highways and rail locations extends to including the service of these modes to industrial parks and locations.

The involvement of the states in national policy issues could be even more important than the state planning and management of the onshore development of the water transport system. Most of the states directly served by the inland waterways are the beneficiaries of a large establishment of industry that depends on water transportation. Any national policy that affects the inland water carrier industry serving the manufacturing industries on the waterways must be of concern to state economic development authorities.

The 1974 national transportation study required that the individual state transportation departments include the inland waterway ports and facilities in their state plans. Most of the states then discovered that there was little, if any, coordinated planning of port and water transport development. In the 21-state mid-America waterways system area the responsibility for port development varies from statewide port authorities with responsibility for inland and deepwater ports to a system of small local authorities granted by special legislative acts. The challenge to the states now is to develop organizational structures to promote public investment in inland port development and waterways improvement for transportation as being justified by the economic benefits to the state and its substate regions.

The following sections of this paper describe the actions recently taken by the state of Tennessee in meeting this challenge.

THE TENNESSEE PLAN FOR MANAGEMENT OF ITS WATERWAYS

Tennessee has a very large interest in the inland waterways system. Its navigable waterways consist of the Tennessee, Cumberland, Clinch, Emory, and Hiwassee rivers. This system connects a large area of Tennessee with the intercoastal waterways via the Ohio and Mississippi rivers. It links ports in 20 states that extend from the Great Lakes to the Gulf of Mexico, and, with the potential Tombigbee interconnecting link between the Warrior River in Alabama and the Tennessee River, there would be yet another waterway that could lead to more economic growth by providing access to the Gulf of Mexico separate from the Ohio and Mississippi rivers route.

Table 2. Allocation of commodity flow to inland waterways market areas.

Trade Region	Flow by All Surface Modes (Tg/year) ^a			
	Inbound	Outbound	Total	Percent of Total
Mississippi-Gulf system ^b				
Upper Mississippi River	59.8	82.7		
Lower Mississippi River	96.3	96.7		
Illinois River	81.8	63.4		
Ohio River	162.2	168.8		
Missouri River	20.7	21.6		
Tennessee River	41.8	34.8		
Arkansas River	3.4	3.0		
Alabama Rivers	6.8	11.0		
Gulf Coast	130.7	121.6	603.6	94.6
Atlantic Coast				
Hudson River and New York State Canal ^c	17.0	7.3	24.3	3.8
Pacific Coast				
Sacramento River ^d	0.9	—	0.9	0.1
Columbia River ^e	9.5	—	9.5	1.5
			638.3	100.0
Unallocated marine traffic ^f			121.4	
Total			759.7	

Note: 1 Tg = 1 102 000 tons.

^a Excludes pipelines.

^b Flows between the region and all other Mississippi-Gulf system regions. Also includes intra-regional flows.

^c Includes the following interregional flows: inbound: Great Lakes to Hudson River and New York State and East Coast to Great Lakes (via Hudson Canal system); outbound: Hudson system to Hudson system, Hudson system to East Coast, and Hudson system to Great Lakes.

^d Flows within the Sacramento River region.

^e Flows within the Columbia River region.

^f Includes commodities not published on a region-to-region basis by the Corps of Engineers.

Table 3. Modal responsibility of state highway and transportation departments in mid-America inland waterways area.

State	DOT	Modal Responsibility					
		Highways	Aviation	Mass Transit	Railroads	Water Transportation	Pipelines
Texas		X					
Louisiana		X					
Mississippi		X					
Alabama		X					
Florida	Yes	X	X	X	X	X	
Georgia	Yes	X	X	X			
Arkansas		X					
Oklahoma		X					
Missouri	Yes ^a		X	X	X	X	
Tennessee	Yes	X	X	X		X	
Kentucky	Yes	X	X			X	
West Virginia		X					
Pennsylvania	Yes	X	X	X	X	X	
Ohio	Yes	X	X	X			
Indiana		X					
Illinois	Yes	X		X		X	
Iowa		X					
Wisconsin	Yes	X	X	X			
Minnesota		X		X			
Nebraska		X					
Kansas		X					

^a Missouri has a DOT with indicated responsibilities but also has a Department of Highways responsible for highways.

Figure 2. Bureau of Industrial Marine Watercraft Transportation.

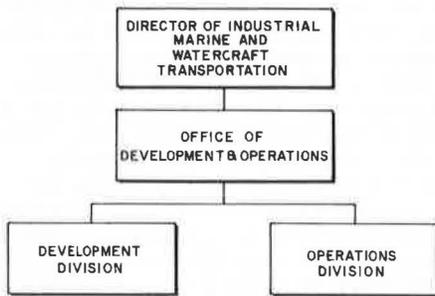
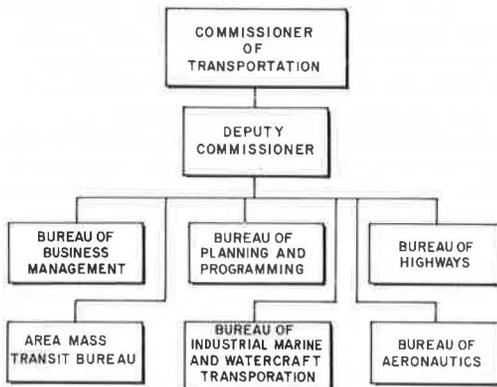


Figure 3. Tennessee Department of Transportation.



About one-third of the counties in the state are served directly by a navigable waterway, and all of the counties except the five in the extreme northeast part of the state are within 80 km (50 miles) of an access to a navigable river port. The four major urban areas of the state—Knoxville, Nashville, Chattanooga, and Memphis—are all located on navigable rivers. Memphis, on the Mississippi, is the second largest inland port in the mid-America system of inland waterways.

On July 1, 1972, the state of Tennessee created a department of transportation to provide for the systematic planning, construction, and maintenance of a system for the "efficient movement of people and products by road, water, and air throughout the State." In establishing the new department, an Industrial Marine and Watercraft Transportation Bureau was created to advise the governor on problems and planning in the area of industrial marine as well as marine pleasure boat transportation. The enabling legislation is as follows:

SECTION 17. A bureau of industrial marine and watercraft transportation is hereby created. The director shall advise and assist the Governor on problems and planning in the area of industrial marine as well as marine pleasure boat transportation. He shall coordinate and regulate, so far as permissible under federal law, the development and operation of all modes of marine transportation used on the waterways of this state, including, so far as permissible under federal law, location, development, construction, operation and maintenance of harbors, ports, port authorities, and docking facilities. All such planning for the development, operation, and maintenance of such modes and facilities shall be consistent with the provisions and goals of the statewide comprehensive transportation plan.

Tennessee Water Transportation Goals

The following goals were developed for the Industrial Marine and Watercraft Transportation Bureau:

1. To assist, with other governmental agencies, in the proper development of a water right-of-way system that will adequately serve existing and potential state development patterns, promote the implementation of other state functional plans, and meet the existing and projected traffic patterns for water-transportable freight;

2. To assist, with other governmental agencies, in the proper development of a system of industrial marine port facilities for both private and public use that will adequately serve the existing and potential state development patterns and promote the implementation of other state functional plans;

3. To develop a statewide water transportation plan that will enhance the environmental qualities of Tennessee, causing minimum disruptions of the natural resource base, desirable existing neighborhood and community development, agricultural land patterns, and recreational opportunities, and minimizing air, water, noise, and visual pollution;

4. To develop a system of waterways, ports, and carriers that is both economical and efficient, while attempting to meet the other objectives of the state transportation plan;

5. To provide for safe industrial marine operations by reducing exposure to water and port-related accidents, thus minimizing the loss of human life and property and human suffering; and

6. To develop an industrial marine system that is integrated with and complements other modes of transportation, terminal facilities, and subsystems.

Water Transport and the Tennessee DOT Organization Structure

The Industrial Marine and Watercraft Transportation Bureau is one of four modal bureaus within the Tennessee Department of Transportation. The others are highways, mass transit, and aeronautics. Two other bureaus—the Bureau of Business Management and the Bureau of Planning and Programming—provide services to the four modal bureaus. The Bureau of Planning and Programming is the more directly related to the waterways bureau, as it has the responsibility for statewide planning for all modes and also integrates the modal activities relative to the state transportation system plan. To assist in statewide planning, a study entitled "Tennessee's Opportunities on Its Waterways System" was recently completed. This study describes the physical characteristics of the rivers and the available transportation facilities. A data base system is being developed within the Bureau of Planning and Programming, which will also have the responsibility for keeping it continually updated. Now that the planning study has been completed, it is the responsibility of the waterways bureau to implement its results. This implementation may occur through encouraging local governmental units, including port authorities, to undertake development activities, or in a cooperative involvement between local government and the bureau. In a number of cases the bureau of waterways will undertake its own research related to developing in-house policy and procedures. For example, the position that the state should take relative to waterway user fees will be studied by this bureau.

Current Tennessee Waterways Activity

The management of the waterways bureau rests with the director of the bureau, and he, in turn, reviews program activities with the deputy commissioner for approval by the commissioner. The bureau has two divisions, the Division of Development and the Division of Operations.

It is funded from the highway fund. The organization charts in Figures 2 and 3 (2, 3) show its position relative to those of other bureaus within the Tennessee DOT.

Current activities in the waterways area include four feasibility studies for specific port and industrial park locations along the Tennessee and Cumberland rivers and two studies of the impact of the Tombigbee project. There is also a recreation study in cooperation with the State Department of Conservation and the U.S. Corps of Engineers. These studies are as follows:

1. Celina-Gainsboro feasibility study: This study was made to determine the most desirable site and the economic feasibility of a public port and industrial park in Jackson and Clay counties on the upper reaches of the Cumberland River. The study recommended that a port and industrial park complex be developed in Celina in Clay County. This development is in the final planning and design stage.

2. Chattanooga port feasibility study: Chattanooga is the major transportation center of a large area of Tennessee, Georgia, and Alabama. This study has attempted to determine the economic feasibility of a large public port facility in the Chattanooga urban area. It will also include the determination of future land needs for industrial development along the waterways.

3. Cumberland City-Clarksville study: The Tennessee Department of Transportation has recently awarded a contract to a private engineering firm to do a feasibility study of a port and industrial park development in the Cumberland City area on the Cumberland River in the vicinity of Clarksville. This area was recommended as having potential for development, but, if there is a potential, the area should be developed so as to complement other developments on the Tennessee River.

4. Humphreys County port feasibility study: This study is not directly funded by the Tennessee DOT, but the department is assisting the contractor and will become involved in the final planning and design of the docking facility and the complementary industrial land. This involvement represents the willingness of the department to serve a supporting role even when it is not directly involved in the funding.

5. User charge impact on industrial development study: The DOT now has in the proposal stage a study of the effects of a waterways user charge on industrial development. For over 30 years the Tennessee Valley Authority and the state have sold the waterways in their efforts to attract industry to the state, and there is serious concern over the impact that the imposition of a user charge would have on the continued development of the waterways industry and the consequent effects on the economic growth of the substate regions.

There are several other studies that deal directly or indirectly with the waterways in Tennessee. Although the Tennessee DOT has not originated or participated in the funding of all of them, it will monitor them and offer technical or planning assistance. These studies are

1. Interstate port authority in Memphis: The subject of this report is the feasibility of establishing a multi-state authority to fully develop the potential of inland waterways in the Memphis area. This study has been completed. Its recommendations include the action required to organize the port authority, and it calls for its organization within two years.

2. Inventory of industrial land sites: Memphis State University is preparing an inventory of available, usable land sites on the rivers of the mid-America waterways system south of the Ohio-Mississippi rivers intersection.

The study will also produce a model with which to determine the quality of the site for a port or industrial park development.

3. Impact of Tennessee-Tombigbee on economic development in a five-state area: The Appalachian Regional Commission has an ongoing study to determine the impact of the Tennessee-Tombigbee channel on the economic development of the five-state area of Kentucky, Tennessee, Alabama, Mississippi, and Georgia. The findings of this study are expected to provide the base for additional planning and capital investment by the commission in its efforts to develop the economies in the rural regions of Appalachia.

4. Central Gulf Coast Regional Port Study: The state of Louisiana has proposed a study to determine the adequacy and interrelationship of the gulf and river ports of the region and the development of regional port facilities. This proposal calls for funding from 19 of the mid-America waterways system states and the U.S. Maritime Administration, and Tennessee has agreed to participate.

SUMMARY

The Tennessee Department of Transportation plan for state management of the inland waterways is basically one of planning and cooperation with local governments and port authorities. The current assumption is that having local authorities promote the use of ports and terminals and the inherent advantages of water transportation can best serve a regional economy that aggregates into a more healthy state economy. It is believed that state resources and influence should be used to encourage better planning and local investment in ports so as to facilitate the most effective integrated multi-modal transportation system possible for the state.

The Tennessee Department of Transportation is committed to a future involvement in waterways development. This includes more factual knowledge of the national policy issues that may affect the transportation system and the economy of the state and, to the extent possible, influencing the direction that national policy issues may take.

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Need for a Port Planning Methodology

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This paper reviews waterway and port development within a set of complex institutional, governmental, and intermodal issues. The lack of a policy statement relating port facilities to national transportation needs and planning activities and the widely varied investment criteria for port-related transportation facilities (highways, rails, and public transit) have established an environment conducive to overinvestment in regional port facilities. This paper develops a commodity flow analysis and reviews potential implementation and funding options and the integration of ports into federal transportation activities and the regional and metropolitan transportation planning process.

The object of this paper is to assess the need for formalizing port and intermodal planning mechanics into regional transportation and public works planning. To date, waterway and port planning and the provision, funding, and timing of related facilities have received little attention in formal transportation planning evaluation and implementation, and in capital and operating guidelines in dealing with regional planning, A-95 activities, and categorical or block funding. The result has often been overinvestment in regional port facilities. In addition, investment criteria for related transportation modes (highway, rail, and public transit facilities) in and adjacent to port and intermodal areas vary widely, causing difficulty in processing the package of transportation facilities required for a particular port or intermodal site and making assessment of possible benefits difficult. Finally, no concrete statement of policy as to the place of port facilities, their planning, study, or subsidy characteristics has emerged in national transportation needs and planning activities. As such, the specific objectives of this paper are

1. To conceive the port, its goods movement, and the associated private and public land uses and activity generation as a complex entity, embodying all facets of transportation planning analysis;
2. To develop a regional and site-sensitive goods-movement forecasting model that is compatible with analysis of sunk-cost types of public and private investments as found at port and intermodal sites;
3. To catalog the current funding and guideline deficiencies in dealing with port planning implementation and to overview some implementation and funding options; and

4. To offer tentative conclusions as to the place of port planning in federal transportation activities, and the structuring of port planning in regional or metropolitan transportation planning processes.

THE PORT AS A COMPLEX ENTITY

A port is historically designed or created to exploit the break-bulk capabilities of a region or metropolitan area due to the presence of a waterway. Ideally, port sites are located and developed to do one or more of the following:

1. Complement the use of other modes in the movement of goods;
2. Develop a geographic focus for origin, destination, or change-of-mode for specific cargo types;
3. Cater to specific high-volume, high-bulk, low-priority components of commodity flow such as grain and coal;
4. Improve the regional marketing position of a metropolitan area by extending the market radius of goods by alteration of transport costs or by capture of market inventory currently diverted elsewhere;
5. Provide a regional stimulus through increased agricultural, industrial, and construction employment; and
6. Alter and solidify private sector land use planning in the vicinity of the port. This last objective can be accomplished by offering planned industrial and commercial sites to users who could benefit from proximity to a port location in terms of their raw material, market, or transport activity orientation. A critical result of this process is the alteration of land values and the real estate market structure in the area. Thus, the port may be one type of anchor for the community land use planning process.

The above objectives of port development will have different combinations and strengths in each individual location. All are theoretically significant and should be understood in the context of the port as a complex entity (1).

THE PORT SYSTEM AS A MICROCOSM OF THE TRANSPORTATION PLANNING PROCESS

The reason for port planning is to couple the transportation facilities (water and ground) into a complex entity. As shown in Figure 1, the port process is a microcosm of all of the related activities of transportation planning. The availability of water goods movement allows break-bulk activities and results in intermodal transfer of commodities by rail, truck, or air and causes traffic flow alterations. The stimulus of a port location causes basic and nonbasic industrial siting in its vicinity, the associated commercial services, and possible potential for residential land use shifts. These land use alterations will generate ground transportation person and goods trips of employees, users, and commodities from the site complexes, and further alter regional origin-destination distribution, route choice, and traffic flow patterns.

Thus, all of the facets of site and transportation planning activities are involved in this process. Specifically these are forecasting goods and person trip generation; forecasting land use; forecasting trip distributions, route assignments, and traffic flows by mode; and providing transportation supply to serve the following activities: port proper facilities (wharves, crane and transfer facilities, transit sheds and tanks), rail yard and rail line-haul facilities, air freight services as needed, local and long-haul truck delivery capabilities, parking, adequate highway capacity and interchange capabilities for the appropriate highway class, and appropriate and compatible mass transit capabilities.

These activities are sensitive to the forecasts of goods movements at the site and the funding sources available to implement appropriate facility investment levels. The development of a comprehensive and sound port planning process must integrate a meaningful and locally sensitive forecasting approach with well-understood guidelines with respect to project investment and funding mechanics.

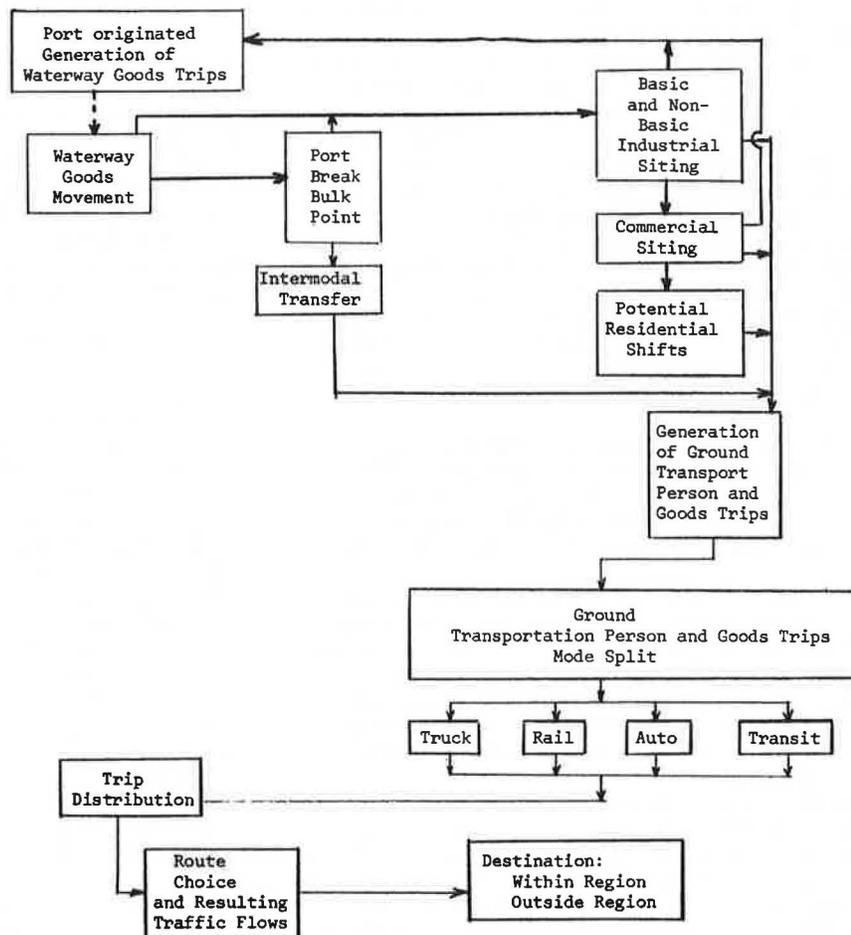
DEMAND AND REGIONAL GROWTH ISSUES

The investment required to develop port and related transportation systems is not only substantial but is also a sunk cost in that only minimal adjustments of capital investment strategies are available after construction thresholds have been implemented. Realistic forecasting techniques of the anticipated demand for commodity movements must be used to ensure optimum capital development. Properly planned and implemented, the development or expansion of port facilities will provide significant regional benefits.

Economic activity is a primary determinant or generator of the transportation flow of any commodity. Each of the modes of transportation, with its inherent capabilities, economics, and resulting advantages and disadvantages, competes with the others for the movement of various commodities, and the development and technological innovation of transportation systems in turn provide other economic growth opportunities.

The relation between historical trade flows of a specific commodity and the level of economic growth in producing and consuming sectors is the basis for the forecast of the volume of future flows. Techniques for

Figure 1. The port as a microcosm of the transportation planning process.



forecasting commodity movements by mode must be able to identify specific regional economic growth prospects and incorporate local economic analysis with commodity trade flows and projections of the volume, share, and shift between competing modes.

There are several problems in attempting to correlate commodity flows with the economic analysis of the industrial hinterland related to a specific port location. First, there is the need to assemble a data base for the specific local area and the corresponding problem of comprehensive information relating to a small economic area. Second, the uncertainty in forecasting future levels of economic growth must be minimized so that forecasting errors do not have large repercussion on capital budgetings.

The following forecasting technique was developed in connection with a plan for the development of a multi-modal distribution center in a southwestern metropolis. The approach followed was to use national aggregate indicators or estimators of commodity flows for the particular metropolitan area as a beginning point and then to modify and refine the preliminary commodity-flow projections by a Bayesian statistical format that accounts for local or site-specific growth conditions and prospects.

NATIONAL AGGREGATE INDICATORS OF MODAL FLOW VOLUME, SHARE, AND SHIFT

The Maritime Administration (MARAD) has recently released a comprehensive study of nationwide modal commodity movements (2). A primary object of the study was to assemble a comprehensive transportation data base containing region-to-region flows of all commodities by surface transportation modes. Data on marine movements from the Corps of Engineers, rail movements from the Interstate Commerce Commission and the U.S. Department of Transportation, and truck movements from the U.S. Department of Commerce were used. Another object of the study was to forecast the future level of regional commodity flows by mode from the computerized data base. This report is the first such comprehensive transportation data base.

The data concerning historical trade flows by origin and destination were assembled in the MARAD report by economic regions as defined by the U.S. Department of Commerce Bureau of Economic Analysis (BEA). There are 173 BEA regions, nicknamed BEARs, in the United States. Each contains at least one major urban center and the surrounding counties that form its economic hinterland.

The trade flow data base of the MARAD report is arranged according to 19 commodity groupings. These groupings were selected on the basis of their importance to present and potential flow by the marine mode, and to provide homogeneous commodity groups as far as possible.

The MARAD projections for individual commodity groups were developed from multiple regression models in which the specific commodity flow in and out of each region (BEAR) by mode is the dependent or forecast variable. The independent variables are gross information on travel time, transportation costs, rate structures, and economic growth conditions for the origin and destination region.

A crucial point is relevant to the MARAD forecasts. In some cases, the predictive quality of the regression equations is limited, and the forecasts are made according to broad regions and are therefore not specific to the particular area under study. They are, however, together with a review and analysis of other sources of

specific commodity potentials relevant to the study area, an excellent starting point from which to study commodity flows. The MARAD forecasts were thus used as unrefined predictors of the modal market share.

LOCAL ECONOMIC ANALYSIS AND REFINEMENT OF AGGREGATE COMMODITY FORECASTS

Economic growth forecasts cannot be made with 100 percent accuracy. However, a statistical distribution of possible alternative economic growth forecasts, each with an assigned percentage chance or probability of occurring, can be developed. Several different levels of economic growth forecasts, termed states, can thus be used to independently forecast future modal commodity flows, and the weighted average of the forecasts according to the various states (based on the percentage chance of occurrence of each state) represents the best fit, hedged projection against which to plan large, relatively inflexible investments.

Independent in-depth field interviews and analyses of the economic activity indicators of the local subregion were undertaken to develop alternative growth states specific to the hinterland of the particular port site. Among the proxies or indicators of economic activity and growth prospects considered were the following: population growth rates, industrial employment funds by Standard Industrial Classification and category corresponding to the classifications of the commodities used in the MARAD report, and personal income levels and trends.

Thus, in order to derive sound predictive, hedged commodity modal forecasts and to refine the MARAD projections for the specific localized economic conditions expected in this southwestern metropolitan area, four alternative possible states of economic growth were conceptualized for the metropolitan area for 1990. As described in the next section, the MARAD forecasts were adjusted and refined according to each of the states and a weighted average forecast was developed.

Figure 2 shows the four alternative economic growth rate states used (3) and the percentage chance of occurrence assigned to each state. Table 1 gives the final economic indicator criteria used to formulate and delineate these states and their forecasted percentage increases from 1970 to 1980 and 1980 to 1990.

FORMAL FORECASTING APPROACH

The formal forecasting approach is shown in Figure 3. This approach, which evolves from Bayesian statistics, involves adjusting and refining current estimates of modal commodity movements against the alternative future growth states of Figure 2. Each historical and projected MARAD commodity flow for the study area BEAR was reviewed independently. The quality of the predictive value of each commodity regression equation and the modal split was assessed, and adjusted commodity modal flow was developed and then arrayed for each alternative state of growth. These revised and refined forecasts over each state for each commodity were then recalculated to reflect the weighted average or hedged forecast. The final adjustments were made to distribute the flows among the various local river terminal systems. An example of a final output is shown in Table 2.

PLANNING IMPLEMENTATION AND FUNDING ISSUES

Because of the complex sunk-cost investment aspects and the need to plan investments on regionally sensitive fore-

Figure 2. Alternative future economic growth states for a southwestern U.S. metropolitan study area.

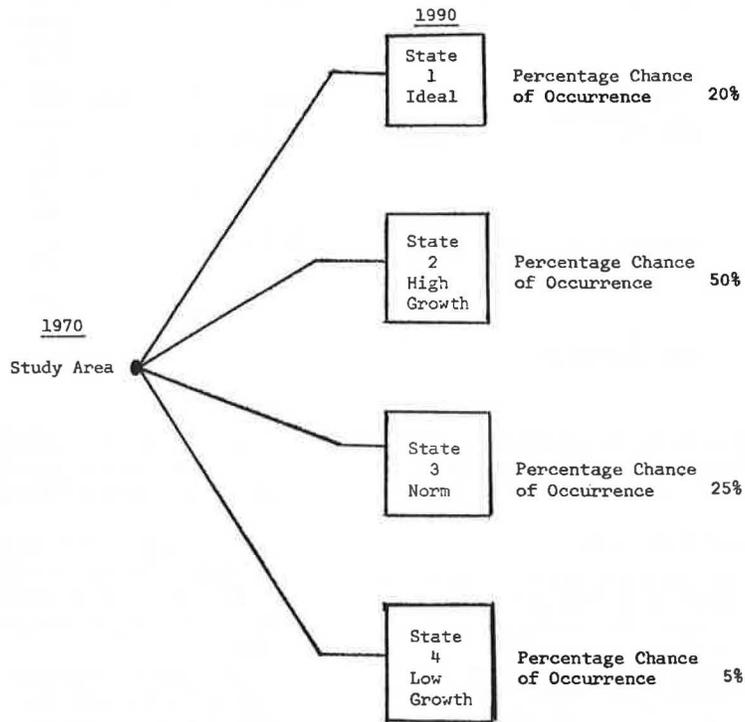


Table 1. Criteria expressed as percentage increases used to delineate the state space.

State	Population		Total Employment		Manufacturing Employment		Total Personal Income	
	1970-1980	1980-1990	1970-1980	1980-1990	1970-1980	1980-1990	1970-1980	1980-1990
1	19	19	32	25	35	27	77	61
2	18	18	25	17	25	18	68	57
3	15	15	19	14	18	11	62	49
4	8	10	18	11	16	10	51	47

Figure 3. Formal forecasting approach.

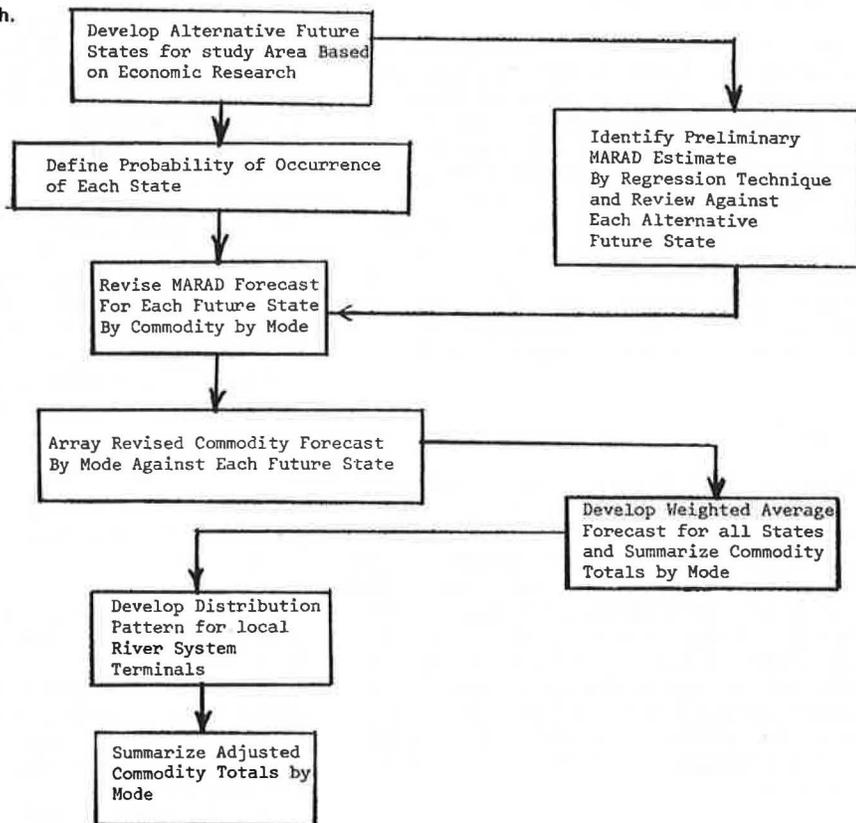


Table 2. Commodity modal forecast examples.

Commodity	Origin	Destination	Growth State	Adjusted MARAD Forecast (Gg)					
				Rail		Truck		Water	
				1980	1990	1980	1990	1980	1990
Chemicals	Houston	Little Rock	1	122	206	38	64	14	23
			2	110	185	34	57	12	20
			3	98	167	31	52	11	18
			4	89	150	27	46	9	16
			Avg	108	183	34	56	12	20
Primary iron and steel	New Orleans	Little Rock	1	153	250	—	—	17	28
			2	147	240	—	—	16	27
			3	128	209	—	—	15	24
			4	115	188	—	—	13	21
			Avg	142	232	—	—	16	26

Note: 1 Gg = 1102 tons.

casts, it is desirable to develop a more formalized implementation and funding capability for port planning. A concept for this is shown below.

Subprogram	Program Elements
Port proper facilities	Site-related (transit sheds, tank farms, and cranes), intermodal transfer, moorage
Private development stimulus	Taxing structure, utilities, zoning, private venture capital, land supply
Rail	Rates, line-haul facilities, yards
Highways	Interstate, urban system, urban high density, economic growth center program, local and site roads and parking, trucking rates
Mass transit	Demonstration technology, bus, rail

Port and port-related transportation and land use planning can be conceived as a program budgeting framework whose investment elements integrate across several subprograms. Three plausible general implementation and funding mechanisms are explored in this context.

Current Categorical Grant Approach

This, the current method of facility provision, uses the ongoing categorical grant approach, with programs administered by a state department of transportation or other relevant individual agency, coordinated through the A-95 format. The essence of this structure is that it uses current legislative structures subject to typical local matching requirements, and fits together modal components in a conventional way. It does not specifically address the question of funding, or defining as private or public, the specific port components such as moorage and terminal and cargo handling facilities, nor does it consider the integration of such funding with private sources of capital and local port-specific sources of income.

Port Arena Concept

An alternative to the conventional approach is that of the development of an intermodal package program, which identifies all intermodal transportation facility necessities of water, terminal, moorage, cargo handling, highway and parking, rail, and transit associated with the port and the port-related private capitalized land use. Such a spatial and facility identification conceptually creates a port arena of public and private facilities. In this concept, the public facilities can be funded as a block grant, termed an intermodal arena grant, and ultimately plausible mechanisms for guidelines for such a block grant program should be developed. Such guidelines should specifically consider

1. How to spatially define the area,
2. How to appropriate governmental levels of funding, i.e., state versus federal determination of local matching,
3. How to integrate land uses and port endeavors at the site and their contribution to matching,
4. How to institute the A-95 Unified Work Program as a viable intermodal planning and capital activity, and
5. How to determine the eligibility of specific port-related items such as moorage and cargo handling facilities for public funding.

Structured Joint Funding Programs (Integrated Grant Administration)

A third approach, proposed as a middle ground between categorical granting and site block grants, is the emerging joint funding simplification program, previously known as integrated grant administration. This concept was developed at the General Services Administration and is currently being moved to the Office of Management and Budget. It allows the use of funds eligible for project-related activities in cases in which inadequate planning might have voided such potentials. The recent demonstration programs of joint funding have been reasonably successful in combining the support of several agencies dealing with housing, land use, sanitation, and education under a single lead agency. It is possible to develop an implementation structure for a regional port by drawing on the several modal support options in the Department of Transportation, the U.S. Corps of Engineers, the Economic Development Administration qualified public project process, certain MARAD options, and revenue sharing and community development sources, in addition to other local sources. Port development could be structured within existing agency operations and typical public and private ownership mixes, and seemingly have adequate access to all available implementation funds.

CONCLUSIONS

The following conclusions as to the current status of port planning and its relation to multimodal planning processes are offered.

1. The port is an inherent multimodal entity whose activities parallel the transportation planning process in its entirety.
2. The development of forecasting tools that are regional and site-sensitive with respect to economic and growth states and an aggregate goods-movement modal-split analysis are needed. A preliminary approach to such is presented here.
3. There are several plausible approaches to port

planning implementation and funding. A study of their efficacy and their capability for integration with A-95 regional planning implementation activities and intermodal planning activities should be made.

4. Formal guidelines should be developed for port and intermodal planning and development and should be integrated into current regional transportation planning guidelines and processes.

5. Legislation appropriate to executing such guidelines and related forms and types of federal-state-local funding combinations should be written.

6. Formal recommendations as to the position of port and intermodal planning in national transportation planning perspectives and related national transportation policy statements should be developed.

Ports represent a sizable, fixed-capital investment requiring immense local force to develop. They yield significant benefits if successful, but vast waste and disillusionment if they are unsuccessful. It is in the interests of federal and local government and society at large to standardize their planning, funding, and implementation process to a degree more typical of, and integrated with, related transportation modes.

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Industrial Needs for Water Transportation and Inland Water Transportation Policy

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Policy perspectives to accommodate demonstrated industrial needs for water transportation are elusive and require definitions of policy, inland waterways, and the relationship of policy to the decision-making process. Policy choices always represent compromises and are closely related to national resource factors and current public attitudes. The eight policy questions discussed are designed to be national in outlook, economically equitable, and neutral in geographic impact.

There will be no attempt in this brief paper to develop the factual or statistical case for the need of industry for inland water transportation in the United States. In view of the extent of published material on the subject, we shall merely take judicial notice of the volumes of waterborne cargoes of materials such as farm produce, construction materials, steel, chemicals, coal, and oil, and further of the demonstrated dependence of major industries on inland water transportation for economical, dependable, low-cost distribution and supply. A more difficult problem is involved in the closely related matter of perspectives on national inland water transportation policy, for it requires that we carefully define both the terms inland waterways and policy.

By inland waterways, we mean all of the commercially navigable rivers, lakes, and canals including the Great Lakes, and the waters used for intercoastal shipping including international straits and passages related to U.S. territorial waters and the infrastructure of ports, terminals, marinas, locks, and dams.

Policy, as used in the remarks that follow, is defined as a prescribed course of action, selected from among alternatives, with which to guide decisions to achieve stated objectives. Put more simply, it is a pre-selected answer to a recurring question. Policy takes its place in the order of the decision-making process in the sequence from goal to policy to program. To achieve certain goals (or objectives), certain policies are selected; these, in turn, dictate choices of programs that may be prescribed action or deliberate inaction.

Policy may be carefully delineated as in the familiar published policy statements of business and professional associations, but it may also be the unwritten precepts to be inferred from a consistent course of action over a long period of time by an individual, organization, or institution, which is known as *de facto* policy. For ex-

ample, in September 1975 the federal government's first written statement of a national transportation policy was developed. This action was mandated by the 1967 act that created the U.S. Department of Transportation. The 53-page statement reflects a number of previously unwritten policies, as well as some new policy directions.

Policy has an important time element. Being rooted in experience, it has one foot in the past, but if it is properly drawn, it is valid for the future. The important aspect is that policies must necessarily undergo revision over time as conditions change. For example, our vast land and mineral resource base, a generally benign attitude toward commerce, resource use patterns based on public expectations of near-limitless availability, and an ample supply of domestic capital have been basic to adoption of many national policies. All of these are being questioned, and we are now seeing massive revisions in business and public attitudes to accompany changed conditions.

The foregoing should explain the selection of the policy items that will now be considered. One must appreciate that policy statements are necessarily compromises. The ones that follow are no exception to this rule.

The present and potential industrial needs for water transportation suggest the following policy considerations, which are designed to be national in outlook, economically equitable, and neutral in geographic impact.

1. The primary responsibility for the conduct of commercial inland water transportation should be that of private enterprise. This policy statement is so fundamental that it is apt to be overlooked as self-evident. The free enterprise concept is basic to the production, distribution, and marketing of the nation's goods and services, and its proper functioning is critical to our continued progress and concept of the general welfare. The present privately operated inland waterway transportation system represents a beneficial use of a public resource for wide public benefit.

2. The federal regulatory role should include those things, but only those things, necessary to permit a low-cost, convenient, and competitive business climate operating under conditions of safety and efficiency. Article I, section 8, of the U.S. Constitution specifically provides

for federal regulation in such basic matters as interstate commerce, a system of weights and measures, and the value of our money. A rational extrapolation of the federal role is that of guaranteeing diverse benefits and safeguards. Proper regulation is in the nature of marking the field, prescribing the rules, and refereeing the play. The extension of regulation to interfere with the result of the game, to choose one unit over another, or otherwise interfere with the self-adjustment typical of the free market system, is undesirable.

3. Necessary and desirable research and development should receive federal support, but that on purely operational matters should be carried out by private enterprise. The federal role should be focused on basic studies of potentially wide public benefit that are beyond the capacity of private industry or beyond normal business planning periods. Federal research programs are appropriate for development of new modes and facilities and the resulting local and regional impacts. For example, the problems and opportunities associated with the interface of inland water transportation with coal slurry pipelines, transport of liquefied natural gas, deep-sea ports, natural resource conservation, and expanding operations in the hostile Arctic environment are areas calling for careful study of the separate roles of federal and private research and development efforts.

4. The policy of multiple use of the inland waterways should be retained. Industrial use is but one of the appropriate uses. Recreation and fisheries are important other uses and have a potentially large supporting constituency.

5. Environmental protection of the waterways is fundamental to their continued use. In recent years there has been a growing public demand for environmental protection of air and water quality as well as land use. Industrial use of public inland waterways must be conducted in a way consistent with these public expectations. However, there must also be increased attention to the importance of making land available for both the expansion of existing terminal facilities and building new facilities to accommodate the projected growth in demand for inland water transport. Misadministration of air and water protection laws and regulations could result in using these measures in an unintended manner, viz., to control land use, and such practices could jeopardize the use of inland waterways for their special advantages of cost and energy efficiency.

6. The critical problem of energy shortages demands the maximum use of water transportation, which is inherently energy-efficient. Approximately one-sixth of our freight is carried on inland waterways. This type of transport is at least twice as energy-efficient as the nearest competing mode, and in view of our predicted energy problems, this advantage is self-evident.

7. Federal and state entities should attempt to eliminate legal impediments concerning ownership and control of inland waterways. There should be prompt efforts to resolve conflicting interstate, state versus federal, and international claims related to inland waterway boundaries. The common boundary with Canada illustrates this point, and the future administration of the Coastal Zone Management Act suggests another potentially troublesome area. Likewise, any new law of the sea receiving international ratification will raise new problems of this kind. Commerce is aided by certainty; therefore the elimination of state, federal, and international jurisdictional uncertainties should be actively pursued.

8. The question of the imposition of user charges requires objective analysis to ensure future development, operation, and maintenance of the waterways and guaranteed participation in any new federal system

of transportation funding. This is a highly complex and emotional issue made all the more so by the long history of free use and the absence of clear cost versus benefit criteria. The free-use policy was clearly appropriate in the early development of our inland waterways and may be so today, but it is being challenged at the federal level for reasons of present-day competitive equity, geographic neutrality, and fiscal burden. It is unrealistic to ignore the issue. Future U.S. capital requirements for transportation are projected to be of such magnitude as to represent a threat to the continued development and operating efficiency of the waterways. If all present transportation user charges were combined into a single national transportation trust fund, there is a risk that inland waterways would be denied proper support because of the competition among the various modes—airways, highways, urban mass transportation, and waterways—for collected user charges.

Public policy in this area is undergoing change, and a careful and objective analysis of this entire question is timely.

CONCLUSION

The eight policy items discussed are not the only ones but rather those most identifiable. Other considerations could be added and different emphases could be expressed. Continual debate will aid in constructive consideration of these complex questions.

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Carriers' Response to Emerging National Water Transportation Policy Issues

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A multiplicity of separate efforts obscure the character of expected legislated statements of transportation policy. Such statements may modify the existing policy articulated in the preamble of the Interstate Commerce Act. The policy statement of the U.S. Department of Transportation discussed here reflects many aims and recommendations common to ongoing efforts of other federal proceedings.

The intensity of attacks on the business of moving goods by water, especially over improved internal waterways, has increased recently with new indictments of alleged inequities and resource misallocation. This is despite the fact that nowhere else in the world can a transportation system move such large amounts of bulk freight for such low costs in both fuel and money. A national resource of great value is being challenged, although this mode handles 16 percent of the nation's intercity traffic for 2 percent of its freight bill.

Consider the current efforts to develop a new national transportation policy, a section of which must be a water transportation policy. The authors are from the White House (the Office of Management and Budget), the Water Resources Council, the Department of Transportation (DOT), the National Water Commission, the General Accounting Office, the Senate Commerce Committee, the House Public Works Committee, the House Interstate and Foreign Commerce Committee, and the U.S. Army Corps of Engineers. However, there is little real interagency coordination, and it is often overlooked that we already have a carefully drawn statutory declaration of internal transportation policy, effective September 18, 1940, as the preamble to the Interstate Commerce Act as amended. This statement, which remains the only official pronouncement of force and effect of a broad national transportation policy says,

It is hereby declared to be the national transportation policy of the Congress to provide for fair and impartial regulation of all modes of transportation subject to the provisions of this Act, so administered as to recognize and preserve the inherent advantages of each; to promote safe, adequate, economical, and efficient service and foster sound economic conditions in transportation and among the several carriers; to encourage the establishment and maintenance of reasonable charges for transportation services, without unjust discriminations, undue preferences or advantages; or unfair or destructive competitive practices; to cooperate with the several States and the duly authorized officials thereof; and to

encourage fair wages and equitable working conditions;—all to the end of developing, coordinating, and preserving a national transportation system by water, highway, and rail, as well as other means, adequate to meet the needs of the commerce of the United States, of the Postal Service, and of the national defense.

It would require many volumes to describe the efforts and conclusions of the governmental bodies seeking to rewrite the rules and practices governing transportation of people and things. Some claim the system is archaic in management, procedures, and pricing, and there are plans to take the watch apart and play with machinery that makes it go. Perhaps the sheer verbosity of these efforts is due to the prevalence of experts. No one who has ever ridden a bus, plane, or railroad coach lacks a suggestion as to how the system can be improved. Likewise, every traffic manager is convinced that, given the chance, he could improve the service and lower the price, especially as it relates to his particular commodity. The essence of these efforts was expressed by Secretary of Transportation William T. Coleman in the Statement of National Transportation Policy of September 17, 1975, and in lobbying efforts on behalf of the deregulatory provisions of the Railroad Revitalization and Regulatory Reform Act of 1976. The DOT statement does not fully address the issues, which are far more complex than it suggests, and will be discussed below under three headings: (a) the superficiality of the discussions and recommendations involving competition, (b) the assumptions, particularly as to public investment in transportation, for which no foundation is laid, and (c) serious omissions of issues of great importance to the consumers and producers of transportation.

THE COMPETITION ISSUE

The crucial role of the government in regulating competition, whether under the antitrust laws or under the Interstate Commerce Act, is to outlaw as anticompetitive any conduct, device, or practice that, by force of inordinate power or leverage, prevents the competitive struggle from being decided strictly on the basis of efficiency and performance. Where efficiency and performance win in the marketplace, the public interest is advanced. Where leverage and dominant economic power

decide the competitive struggle, only the private interest is advanced.

The DOT policy for lessening economic regulation, although advanced as a modest proposal, in fact amounts to total deregulation. The various safeguards against discriminatory and predatory rate making would be weakened, and the transportation industry would enter a world in which there would be neither the present safeguards of the Interstate Commerce Act nor any of the tested protection of general industry antitrust laws. The proposal, in particular, grossly underestimates the extent of monopoly power still possessed by the railroads, particularly the prosperous railroads, in certain regions of the country where water transportation does not reach and for certain commodities moving such long distances that trucks are not an economically feasible alternative.

What is a better source of inspiration for changes designed to invigorate intermodal competition than the antitrust policies?

When we test the DOT's proposed policies against the competitive policies that apply where there is no Interstate Commerce Commission (ICC) regulation, it is apparent that the proposal is inconsistent with and alien to accepted national policy governing healthy competition.

The response of the water carriers can be simply stated: The Congress should not leave transportation with fewer safeguards against predatory competition than the carriers would have if they were manufacturers of goods in the unregulated economy. The Interstate Commerce Act should be clarified and strengthened in this vital regard.

Lessened Regulation Coupled With Collective Pricing

Allowing collective pricing without effective government regulation of the result is alien to the national policy on competition. It is contrary to the public interest to permit collective action among competitors under which prices are fixed unless the resulting prices are fully subject to government regulation. Yet the DOT policy minimizes regulatory restraints while making only minor adjustments in the operations of rate bureaus, chiefly safeguarding independent action, an objective that is nowhere in dispute. Railroads would retain the opportunity to exploit their monopoly powers—regionally and over long-distance hauls of certain commodities—with no effective restraints on collective pricing. Lessening rate regulation is acceptable only if it is accompanied by appropriate safeguards and treble damages for abuse of monopoly power.

Price Squeeze Anticompetitive Tactics

The DOT policy fails to provide safeguards against a common abuse whereby railroad control of a rate or a type of service offered on a connecting route to or from a port artificially suppresses water competition. Without specific and effective regulation, the railroad can manipulate its rate or its type of service to or from the port so as to eliminate any opportunity for a combined rail and water service that would compete with the all-rail overland alternative. The railroad, in effect, controls whether or not it has any competition. Permitting the exercise of such power without restraint is alien to the policies relating to competition as expressed in the antitrust laws.

Destructive Geographic Discrimination

The DOT policy weakens, if it does not entirely eliminate, safeguards against the use of geographical rate discrimination to eliminate competition and create a monopoly. It may be desirable and useful for a railroad to have greater latitude to lower or raise its rates, for example, to even out a seasonal load, but it should not be permitted to do so in a discriminatory fashion either between different shippers or against competitors. Competition is unquestionably the most powerful force in promoting efficiency in the economy, and water competition plays a major role in the promotion of efficiency in transportation (Table 1).

Absence of Damage and Penalty Provisions

A major difference between pricing in industry generally and in the less-regulated world proposed by the new DOT policy is the absence of effective damage provisions for the suppression of competition. A very important aspect of enforcement of the antitrust laws is the treble damage provision. Fear of these provisions enlists industry itself in a process of self-regulation. Without damage provisions a railroad or any other competitor has every incentive to suppress competition. For example, millions of tons of coal per year were diverted from Great Lakes shipping operators as long ago as 1967 by a railroad rate action that has now been found unlawful by a Cleveland federal court. The very worst that ordinarily happens to a railroad successfully suppressing competition is that it enjoys the traffic only for the length of the litigation leading to a cease and desist order, which is sufficient incentive to suppress all of the competition possible particularly when cases can be delayed as long as 10 years. Failure to address this problem makes the DOT policy fundamentally protectionist and alien to sound national competition policy. The use of the treble damage penalty could very well lead to an era of self-regulation that would relieve the ICC of much of its present case load.

FALSE ASSUMPTIONS ON PUBLIC INVESTMENT

It is often alleged that a major reason for the decline of the eastern and northeastern railroads is the massive public support for other modes. No explanation is offered for the fact that railroads in other regions of the country, in which public investment in other transportation modes is as great or even greater, are nevertheless in a flourishing financial condition.

It is encouraging to observe a beginning of recognition, at least by Secretary of Transportation Coleman, that it is a mistake to think that there are no subsidies to railroads. There should be a detailed study of federal aids to railroads to determine whether, in fact, the government has not been, at the very least, evenhanded in its aid programs among different modes.

The federal government has a wide variety of programs designed to assist business enterprises in the public interest. These programs are of various types and include direct grants such as subsidies for carrying mail, research and development expenditures such as those for agriculture and health, use and sale of government assets or services, loans, loan guarantees and insurance, and, finally, tax concessions. Hardly any sector of economic activity in the country does not enjoy the benefits of one or another of these programs. Aids to railroads have included grants of funds, grants of land

Table 1. Selected water-competitive rail rate reductions.

Commodity	From	To	Rate (#/Mg)	
			Noncompetitive	Competitive
Acid, muriatic	Chattanooga	Chicago (2) ^f	3300	1470 ^b
	Baton Rouge (2) ^a	Listerhill, Ala.	1410	743 ^{c,d}
Alumina	Chalmette, La. (2) ^a	Kensington, Ga.	1450	1050 ^d
	Gregory, Texas	Listerhill, Ala.	2200	948 ^{c,d}
Aluminum billets and pigs	Alcoa, Tenn.	Riverdale, Iowa	2350	1750 ^c
	Omaha, Ohio	Chattanooga	2150	1480 ^c
Asphalt	Baton Rouge	Chattanooga	1800	1012 ^c
Calcium carbide	Calvert, Ky.	Louisville, Ky.	1820	570 ^{c,e}
Caustic soda, liquid	Port Neches, Texas	Lowland, Tenn.	1970	1405 ^c
Chloride, vinyl	Calvert, Ky.	Chicago	6240	1825 ^b
	Calvert, Ky.	Houston	5540	3040 ^b
Coal	Lake Charles, La. (2) ^a	Calvert, Ky.	3620	2220 ^b
	Palmer, Tenn.	Widows Creek Plant, Ala.	213	108
Coke and coke breeze	West Kentucky	New Johnsonville, Tenn.	845	407
	Chattanooga (2) ^a	Houston (165) ^f	3490	1360 ^b
Ethylene glycol	North Seadrift, Texas	Kingsport, Tenn. (2) ^a	2150	1210 ^{b,e}
	Texas City (13) ^a	Decatur, Ala.	1120	725 ^{b,e}
Gas, liquid, chlorine	Calvert, Ky.	E. St. Louis, Ill.	1700	910 ^c
	Vicksburg, Miss.	Calvert, Ky.	2420	1027 ^b
Grains, whole and soybeans	Various elevators	Southeast points (average)	2620	776 ^{b,c}
Iron or steel billets	Chicago	Anniston, Ala.	1920	1565 ^b
	Gary, Ind. (2) ^a	Fairfield, Ala. (2) ^a	1920	1120 ^{b,c,f}
Iron or steel scrap	Bessemer, Penn. (26) ^a	Calvert, Ky.	1910	1230
	Birmingham, Ala.	Chicago	2015	1680 ^c
Iron or steel slabs	Nashville	Rockwood, Tenn.	702	318 ^{c,d}
	Gary, Ind. (2) ^a	Ensley, Ala. (2) ^a	2050	1655 ^b
Iron or steel, wrought, tubular	Anniston, Ala. (3) ^a	Houston (23) ^a	2790	2305 ^b
	Calvert, Ky.	Ashland, Ky.	1145	955
Metallic alloys ^b	Calvert, Ky.	Burlington, Iowa	2280	1360 ^b
	Calvert, Ky.	Houston, Penn.	3060	1345 ^b
Methanol	Calvert, Ky.	Pittsburgh	2185	1250 ^b
	Bishop, Texas	Decatur, Ala.	3540	1760 ^b
Molasses, blackstrap	North Seadrift, Texas	Kingsport, Tenn.	4950	2370 ^b
	New Orleans (4) ^a	White Pine, Tenn. (2) ^a	2640	2040 ^b
Newsprint paper ^c	Calhoun, Tenn.	Houston	3330	2070 ^b
Phosphate rock	Florida points	Sheffield, Ala.	1330	1082 ^b
Pig iron	Birmingham, Ala. (10) ^a	Monaca, Penn.	3060	2240
	Gary, Ind. (2) ^a	Fairfield, Ala. (2) ^a	2320	1320 ^{b,c,f}
Pipe, wrought iron or steel	Preston, Tenn.	Corpus Christi	4720	3690 ^b
	Louisiana	Charleston, Tenn.	1760	660 ^{b,c,e}
Salt	Louisiana	Redstone Arsenal, Ala.	1670	716 ^{b,c}
	Louisiana	Birmingham, Ala. (30) ^a	2050	1124 ^{b,c}
Skelp, steel	Chicago (6) ^a	Birmingham, Ala. (30) ^a	2050	1124 ^{b,c}
Styrene	Baton Rouge	Chattanooga (3) ^a	2640	1626
	Houston (8) ^a	Decatur, Ala.	3080	1758
Sulphur	Port Sulphur, La.	Lowland, Tenn.	2710	1744 ^b
Toluene	Houston (7) ^a	Chattanooga (2) ^a	3580	1495 ^{b,c}
Zinc, pig or slab	Josephtown, Penn.	Chattanooga	2490	1435 ^b

Notes: 1 Mg = 1.102 tons.
Rates as of July 1, 1975.

^a Numerals in parentheses indicate total number of origins or destinations to which the competitive rates apply. The level of the noncompetitive rates shown is for the specific origins and destinations shown. For other points among which the competitive rate applies, the level of the noncompetitive rate might be somewhat different.

^b Higher minimum weight.

^c Multiple car.

^d Actual rate consists of two factors, the first factor applying on a specified minimum weight, the second factor applying on weight loaded in excess of the minimum. The rate shown is an average, calculated on a weight we would consider to be a reasonable carload, preserving, insofar as possible, comparability between the competitive and noncompetitive minimum weights.

^e Minimum annual volume.

^f Minimum monthly volume.

^g Ex-barge.

^h This is a general term that we apply to a group of commodities, such as ferromanganese, ferrochrome, and ferrosilicon-manganese. The lowest rate applicable on any given combination of these alloys is shown.

ⁱ Rates include off-track delivery charge.

and other property, tax exemptions, loans, loan guarantees, use of government-financed assets without payment and including maintenance thereof, research and development, and accelerated amortization and investment credits. Many of these programs, particularly the 5-year write-off of equipment, are far more favorable to railroads than are the similar programs applied to water carriers.

In the past 5 years the federal government, with the active aid and support in the Congress of the domestic water carriers, has adopted a variety of subsidy and subsidylke programs of enormous monetary value to the railroads. Among these are

1. The Regional Rail Reorganization Act of 1973 to revitalize the railroads in the Northeast and Midwest, which was first expected to involve \$1 700 000 000 and

is now estimated by Secretary Coleman to require about \$4 500 000 000;

2. Tax incentives to stimulate investment in freight cars, locomotives, and facilities, some of which are much more favorable than those available for water carriers, \$1 000 000 000 worth over the past 5 years (Table 2);

3. Relief from passenger losses of over \$400 000 000/year to enable railroads to concentrate on improving freight transportation (railroad losses on passengers from 1961 to the start of Amtrak totaled \$4 300 000 000);

4. Mandating expenditures from the Highway Trust Fund for grade-crossing eliminations to improve efficiency and safety (\$194 000 000 in 1973, a total of \$1 900 000 000 since 1961); and

5. The Railroad Retirement Act of 1974, which released railroad resources to improve efficiency of

Table 2. Analysis of railroad federal income tax.

Railroad ^a	Ordinary Income ^b (1)	Deferred Investment Tax Credit (2)	Tax Deferrals ^c		Other Tax Adjustments (5)	Actual Tax ^d (6)	Ordinary Income Before Tax ^e (7)	Actual Rate ^f (%) (8)	Nominal Tax ^g (9)	Difference ^h (10)	Balance ⁱ (11)
			IRS 167, 168 (3)	IRS 184, 185 (4)							
Eastern											
B&O	53 250	-13 505	5 530	—	22 607	191	68 073	0.3	32 669	32 478	17 846
C&O	89 700	—	2 998	—	12 580	21 765	127 043	17.1	60 974	39 209	23 631
EL	-17 200	—	—	—	—	0	-17 200	0	0	0	0
GTW	-7 939	—	—	—	—	0	-7 939	0	0	0	0
N&W	99 841	—	6 519	3 731	17 594	24 074	151 759	15.9	72 838	48 764	20 920
PC	-198 024	—	—	—	—	-8 809	-206 833	-4.3	0	8 809	8 809
Southern											
ICG	21 026	—	—	—	3 512	3	24 541	0.01	11 773	11 770	8 258
L&N	37 007	5 242	6 773	685	-1 345	10 995	59 357	18.5	28 485	17 490	6 135
SCL	98 214	-7 395	10 949	3 650	-2 476	108	103 050	0.1	49 458	49 350	44 622
SR	92 849	—	10 812	6 477	908	5 784	116 830	5.0	56 072	50 288	32 091
Western											
ATSF	66 948	2 833	10 984	7 916	-1 590	7 903	94 994	8.3	45 591	37 688	17 545
BN	82 560	-1 633	10 155	—	-7 821	15 283	98 544	15.5	47 295	32 012	31 311
C&NW	-983	586	-2 418	—	-49	0	-2 864	0	0	0	-1 881
MILW	11 402	-1 767	4 180	3	-649	0	13 169	0	6 315	6 315	4 548
CRIP	-23 097	—	—	—	—	0	-23 097	0	0	0	0
MP	49 722	—	-695	6 804	-1 837	7 124	61 118	11.7	29 330	22 206	17 934
SLSF	16 322	-2 236	2 112	2 064	—	1 349	19 611	6.9	9 407	8 058	6 118
SOO	14 307	—	2 019	628	353	6 165	23 472	26.3	11 260	5 095	2 015
SP	88 232	—	14 442	2 653	—	4 529	109 856	4.1	52 724	48 195	31 100
UP	99 177	—	13 422	12 142	4 579	34 332	163 652	21.0	78 546	44 214	14 071

Note: Monetary values are in thousands of dollars.

^a B&O = Baltimore and Ohio; C&O = Chesapeake and Ohio; EL = Erie Lackawanna; GTW = Grand Trunk Western; N&W = Norfolk and Western; PC = Penn Central; ICG = Illinois Central Gulf; L&N = Louisville and Nashville; SCL = Seaboard Coast Line; SRS = Southern Railway; ATSF = Atchison, Topeka and Santa Fe; BN = Burlington Northern; C&NW = Chicago and Northwestern; MILW = Chicago, Milwaukee, St. Paul and Pacific; CRIP = Chicago, Rock Island and Pacific; MP = Missouri Pacific; SLSF = St. Louis-San Francisco; SOO = Soo Line; SP = Southern Pacific; and UP = Union Pacific.

^b As reported to ICC.

^c Under Internal Revenue Service rulings.

^d Current federal income tax liability.

^e Sum of columns 1 through 5.

^f Column 6 divided by column 7.

^g Federal income tax computed at 48 percent rate (less 6500).

^h Between nominal and actual tax (column 9 minus column 6).

ⁱ Unaccounted for (includes investment tax credit provisions not specified in ICC Annual Report except C&O, 3092, and N&W, 16 157, column 10 minus sum of columns 2 through 5).

freight transportation in the amount of \$285 000 000/year for 25 years, or a total of about \$7 000 000 000.

All these programs have been supported by water carriers. The water carrier industry has also supported the Surface Transportation Act that would make possible loan guarantees to railroads of \$2 000 000 000.

The railroads are not fatally disadvantaged by investments in navigable waterways. In any event, the navigable channels at seaports assist the railroads with their export traffic and the flood control measures protect railroad rights-of-way and marshaling yards, benefits that are not included in any of the above listings.

OMISSIONS

Anti-Common Carrier and Pro-Private Carrier Bias of the Department of Transportation

One of the principal reasons given for the proposed changes in regulation is to aid railroads to compete more effectively in the marketplace. But one major area of regulation is ignored: That is the extent to which government policies are anti-common carrier and pro-private carrier. The government artificially fosters private carriage at the expense of common carrier railroads, water carriers, and truckers, and its premises about the economics of private carriage are fallacious. The savings of private carriage are often achieved only by shifting substantial costs to common carriers and the economics of balanced ladings away from common carriers.

So far, there has been reluctance to suggest that the financial problems of the eastern railroads in a region that, paradoxically, accounts for more than half

of the value added by manufacture in the entire nation may be related to the extent of private carriage. Much of the profitable traffic in the region has been skimmed from the common carrier system altogether. Unquestionably, the long-continued diversion of huge blocks of the most profitable traffic to private carriers has contributed to the present problems of the railroads.

Major shippers hold common carrier certificates and contract carrier permits to make the diversion even more effective. These and other shippers diverting traffic from the for-hire market serve their own interests first and cut deeply into the traffic base of the common carrier rail-water-truck system by selecting only the most profitable movements.

Private carriage creates no new freight. Its spectacular expansion is at the expense of the rail-water-truck common carrier service. The assumption that there is an inexhaustible common carrier traffic base that can be diverted to private carriage without harm to the public interest is erroneous. For a time, such diversions can be absorbed without apparent harm to the common carrier, but there is now evidence that this trend has been allowed to go too far.

Figures on private transportation are not readily available, but, for a number of major commodities, it accounts for over half of all transportation services performed. One steel company had total transport revenues of \$638 000 000 in 1974 on which it earned \$155 000 000 in gross profits.

It is ironic that the major manufacturers of the Midwest and Northeast, many of which maintain massive rail, truck, and water private fleets, lead the fight for federal aid to rescue their common carrier railroads. The vision they describe of a closed-down Penn Central Transportation Company causing massive layoffs in steel and automobiles and a spreading darkness as utilities run

out of coal is terrifying, but they have not explained why, if common carrier rail service is so vital, they so vigorously oppose rate increases adequate to cover the expenses of such service.

If the common carrier share of the traffic base in the Northeast has now become so thin that rail operation cannot be sustained without taxpayer support, perhaps a turning point has been reached. It may be time to develop more balanced policies and reverse the trend to private carriage. The advantage of private carriage is largely in the artificial tailoring of its movements. For example, a big block of captive one-way traffic may exist; it would not be economical to haul it by itself. But, by using the exemptions from regulation and the certificates and permits of wholly owned transportation subsidiaries, the private carrier can bid for common carrier traffic to fill in the backhaul. Typically he has less than enough capacity to serve all his needs and uses the common carrier system for his peak and standby capacity. This shifts the cost of that capacity to the common carriers and their customers and leaves to the common carriers the unprofitable and hard-to-handle traffic. The private operation appears to be a marvel of efficiency, but the efficiency is an illusion if a large part of the costs are paid by others.

The savings are even more illusory if so much of the common carrier traffic is diverted that economies of scale are lost and rates for those who do not operate their own transport facilities are increased. The private advantage of a few becomes the financial disadvantage of the many. Finally, if enough traffic is withdrawn from the common carrier systems, the taxpayer must pay the bill to maintain essential public services.

The right to operate do-it-yourself transportation is important, and the way should always be open for private carriage. The threat to use private carriage is often a useful prod to improve the efficiency of common carriage. However, private carriage should be reexamined because of the distortions that arise from the costs that it shifts to others, its internal financial justification that often belongs to another era, and the extent to which it is undermining common carrier transportation systems on which the general public must depend. The Senate Commerce Committee study of 1961 recommended a clear and simple course of action: legislation restricting private carriers to the carriage of their own goods and forbidding them from entering the common carrier for-hire market. The DOT statement should have suggested that it is time to implement the recommendation of 1961.

Impact of Inflation

The most important issue facing transportation is the overriding fact that every mode of the transportation industry has been underpricing its product for years. Railroads and water carriers, for example, are much more capital-intensive than industry generally, and inflation has been especially devastating. They urgently need a process by which they can adjust freight rates so that the effects of inflation are properly reflected. The revaluation provisions of Part I of the Interstate Commerce Act should be used to determine a fair rate of return on investment for all modes.

A sound approach to this, which has the agreement of railroads, water carriers, truckers, freight forwarders, leading investors in transportation, and leading shippers, has been developed under the auspices of the Transportation Association of America as a direction to the ICC to adopt new standards for adequacy of revenues and earnings. This is expressed as follows.

The Interstate Commerce Commission shall, with respect to railroads, domestic water carriers, motor carriers, and freight forwarders, promulgate and thereafter continually maintain standards and procedures for the establishment of revenue levels adequate under honest, economical and efficient management to cover total operating expenses, including depreciation and obsolescence, plus a fair, reasonable and economic profit and/or return on total capital employed in the business, which revenue levels should provide a flow of net income plus depreciation adequate to support prudent capital outlays, assure the repayment of a reasonable level of debt, permit the raising of needed equity capital and cover the effects of inflation; such revenue levels should insure retention and attraction of capital in amounts adequate to provide a sound transportation system in the United States. The Commission shall make an adequate and continuing effort to assist in attaining such revenue levels.

Clearly, if the customers of the transportation industry do not pay the bills, there is no source of financing other than the public taxpayer. The proper pricing of transportation is therefore the most important consideration of all.

Impact of Completed Navigation Projects

Lloyd G. Antle, U.S. Army Engineer Institute for Water Resources, Fort Belvoir, Virginia

The assessment of the impacts of the McClellan-Kerr Arkansas River Navigation System since its completion in 1971 by the U.S. Army Engineer Institute for Water Resources and the Southwestern Division Corps of Engineers is reviewed. The assessment covered navigation and ports, hydropower, flood control, recreation, sediment control, and other purposes, as well as the impact of the project on national and regional economies and in the social and environmental areas. The general trends of the early years of operation are that aggregate benefits have exceeded costs, but that the composition of benefits is quite different from that anticipated. The regional response has been uneven, and there has been only limited waterfront industrial development in Arkansas and Oklahoma. The transportation economy of the region has been affected significantly by the introduction of a new mode. The new river ports are acting as intermodal transfer points and serving other important distribution functions, and in many cases are prime locations for industrial development parks. The wider range of modal choice has affected transportation rate structures and reduced rates to counter the competition of the new mode are not uncommon.

The Corps of Engineers Institute for Water Resources (IWR) has been involved in the assessment of the impacts of the McClellan-Kerr Arkansas River Navigation System since its completion in 1971. A map of the system, which encompasses upstream reservoirs and navigation channels, is shown in Figure 1. The specific components of the project are Oologah, Keystone, and Eufala Lakes upstream and 17 locks and dams on the mainstem that include four multiple purpose projects, Webers Falls, Robert S. Kerr, Ozark, and Dardanelle. The project has cost \$1.2 billion and is the youngest multiple purpose river basin plan implemented in the nation.

The values of the anticipated project benefits, updated to 1968 price levels, are as follows:

Benefit	Value (\$)	Benefit	Value (\$)
Transportation cost savings	40 470 000	Water supply	828 900
Power	14 383 900	Fish and wildlife	612 000
Flood control	6 602 600	Recreation	2 297 000
Channel stabilization	6 575 000	Redevelopment	3 355 800
		Total	75 580 200

The savings in transportation costs to users of the waterways are based on the following commodities:

Item	Quantity (Tg/year)	Item	Quantity (Tg/year)
Petroleum products	3.5	Flour and food	0.2
Iron and steel products	3.3	Less than barge lots	2.4
Coal	1.2	Miscellaneous	0.8
Wheat	0.5	Total	11.9

OBJECTIVES OF IMPACT ASSESSMENT

The objectives of the IWR study are related to the needs expressed by Fredrich J. Clarke in his remarks of March 14, 1969, to the Arkansas Basin Development Association:

The Arkansas Basin Project for many reasons is the best laboratory we have ever had for the clinical observation of a major project through all stages of its development and on through the years of the fulfillment of its purposes. We are going to learn many lessons from its performance which will be of immeasurable future value to our whole country in determining where we are going in the field of water resources development, and how we are going to get there. I don't need to urge you to do all you can to assure the fullest success of this project. However, I do ask that you insure a broad appreciation of the full range of social benefits which water resources development provides. It will help in meeting the challenge of the future.

Thus, the object of the impact study is to document the changes in the economy, in the social and political structure, and in the natural environment of the region impacted by the McClellan-Kerr multiple purpose Arkansas River project under rigorous with and without project criteria.

IMPLEMENTATION OF IMPACT ASSESSMENT

Haveman (4) has discussed the advantages of and obstacles to ex post investment evaluation. The advantages are manifold: "Real improvements in the public sector performance will not be achieved unless information on the input (costs) and output (benefit) results of ongoing and completed government undertakings is incorporated into the decision process." The obstacles include: (a) a substantial disagreement on what the legitimate objectives

of public investment are, and (b) the theoretical and empirical difficulties in filtering from a diverse set of changes in economic, social, and environmental indicators those that can be related to a public investment decision.

Two aims of the present study are to identify the changes associated with the use of the modified river regimen by the direct users of that system and to trace the indirect inputs through interaction models such as interregional input-output models.

ASSESSMENT OF EARLY IMPACTS

Antle (1) has described the impact assessment that was identifiable during the first full year of project operation (1971). The results are summarized below.

User Benefits Approach Costs During the First Year of Operation

The direct user benefits for the first year of operation (1971) are compared with those estimated on a 1968 base in Figure 2. Since there are valid criticisms of some of the assumptions, low and high bounds were also estimated and the rate of return to invested capital computed. There was a rate of return of between 2.5 and 7.4 percent during 1971. By comparison, the project benefits and costs computed for the 1970 budgetary presentation showed a 4.7 percent return to capital. The benefit-to-cost ratio has been unrevised since then.

Mix of User Benefits Differs From That Anticipated

The navigation benefits are substantial: The quantity of commodities moving on the waterway is developing at a rate that will probably exceed forecast levels within 10 years, but the mix is quite different from that forecast. This difference is, in part, attributable to the economic changes since the project was originally conceived in the early 1940s. The power benefits are somewhat lower than forecast because of a deficiency in flows during 1971 and because the total capacity has not yet been installed. The flood control benefits are also lower than forecast, but that is because of the absence of serious floods during 1971. The recreation benefits, however, are significantly higher than those used in project benefit-cost estimates.

Recreation benefits were not credited to the project during preauthorization planning studies in the 1940s or in the update in the 1950s because recreation benefit analysis was in its infancy; however, because of the recreational use at Corps of Engineers projects all over the nation in the early 1960s, parts of the overall system have been credited with recreation benefits. The high rate of recreational use at this project, as at many other water resource projects, is a result of increasing economic well-being, leisure time, and mobility, as well as of the recreational attractiveness of water resource projects.

Petroleum movements of the magnitude projected have not materialized, in part because of the pipeline network through the project area. However, in 1973 petroleum was 10 percent of the total tonnage. This is partly because the electrical utility in the Little Rock area is developing waterside petroleum handling facilities for receiving fuel oil for their power stations, and partly because the rail company is also developing fuel oil facilities. Grain movements are lower than estimated, mainly because of a lack of waterside grain-handling facilities, which is a result of rate changes introduced by competing modes. The existing waterside

grain-handling facilities are characterized by a fast-handling design, limited storage, and low capital intensity, a trend that appears to be a reasoned response until competitive rate structures stabilize. One significant point in the benefit estimate is that about half of the 1971 tonnage accounted for about 95 percent of the benefits.

Regional Response to the Project Is Uneven

A University of Arkansas port study has illustrated the wide range in regional response to essentially similar stimuli of potential transport rate reductions. This range reflects basic differences in the perception of the potential gains (and losses); differences in port development strategy; and differences in the organizational, managerial, and financial resources available for port development. The Catoosa port in Tulsa is a heavily capitalized and massive attempt to focus the metropolitan economic development strategy on the port and its industrial park. Other port cities have opted for much less dramatic roles for port development, feeling that the port should simply serve the transfer function of moving shipments from one mode to another or to storage.

Industrial Revolution in Arkansas and Eastern Oklahoma Has Resulted in Limited Waterfront Industrial Location

The Tulsa Tribune of July 19, 1972, commented that "one of the striking features of the . . . navigation project is the lack of industrial development along the 440 mile long waterway" and noted that some developers "feel that the fact that the Army Engineers own back from the waterfront from 300 to 500 feet on each side is a deterrent," that others feel that the Engineer's ownership "is wise and express the fear that the Verdigris will in time become a sewer for industry unless the government keeps control" and that "recreation interests would like to see the entire government holding along the 50 miles of the Verdigris channel preserved as a public recreation area." Government ownership in fee is limited to that part of the project above lock and dam 13 in Oklahoma and around Ozark and Dardanelle Lakes in Arkansas.

Concurrently, industrial development in Arkansas has reflected a visibly successful state policy of attracting some industry to every county seat, rather than following a developmental pole or growth center strategy. It is also important that the development of Interstate 40 in Arkansas and the Muskogee Turnpike in Oklahoma parallels both the river and the time of development of the McClellan-Kerr project, so that the impact analysis is doubly complicated by these and other significant causes.

An over \$1.1 billion investment has been reported for new industrial plants and expansion in the waterway area through early 1973. Over half of this is for power generation stations, with more than half of that for the Arkansas nuclear stations numbers 1 and 2 at Russellville. Cooling water is withdrawn from the Dardanelle Reservoir for one station, but a cooling tower is used for the other. Almost the only waterway traffic generated by the construction of these stations was the shipment of some of the large fabricated parts for the steam generator, but paradoxically, loaded coal barges destined for Tennessee Valley Authority power stations in Memphis pass the site. The latest power generation units to be announced in the project area will burn coal, with the Oklahoma Gas and Electric Company indicating plans to bring coal from Wyoming to the new Muskogee plant, evidently a response to air pollution regulations.

Figure 1. Arkansas River Navigation System.

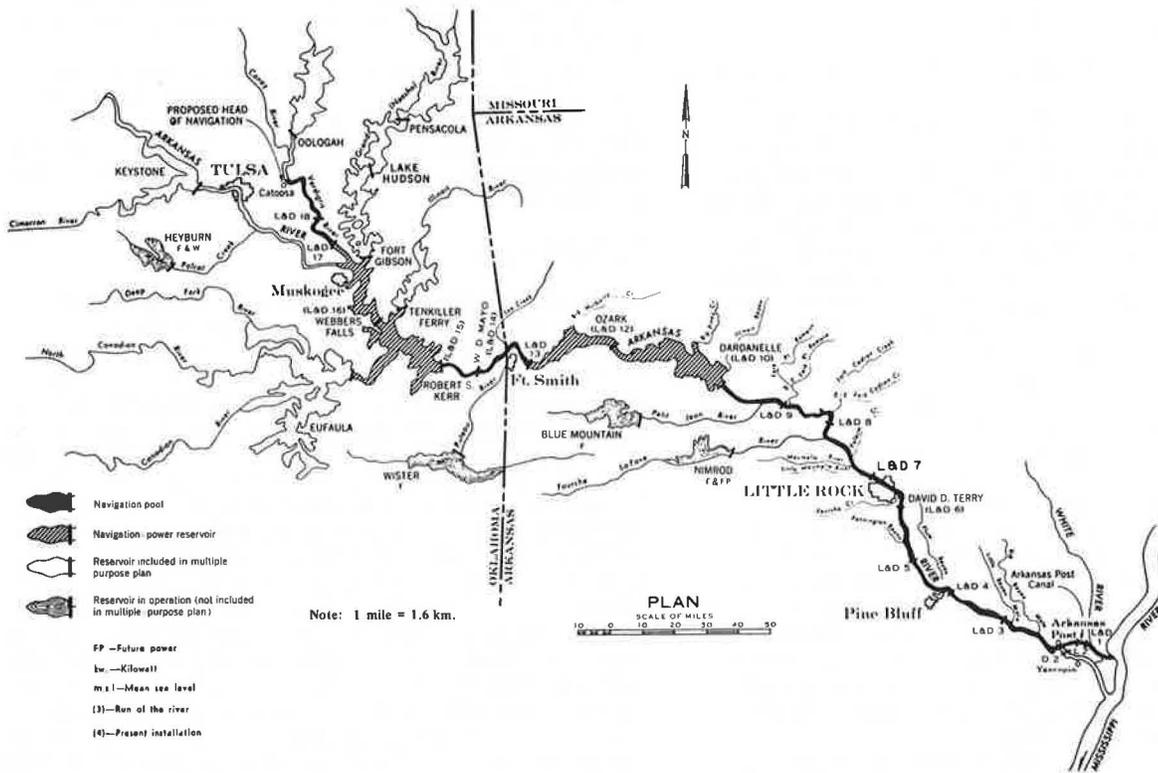
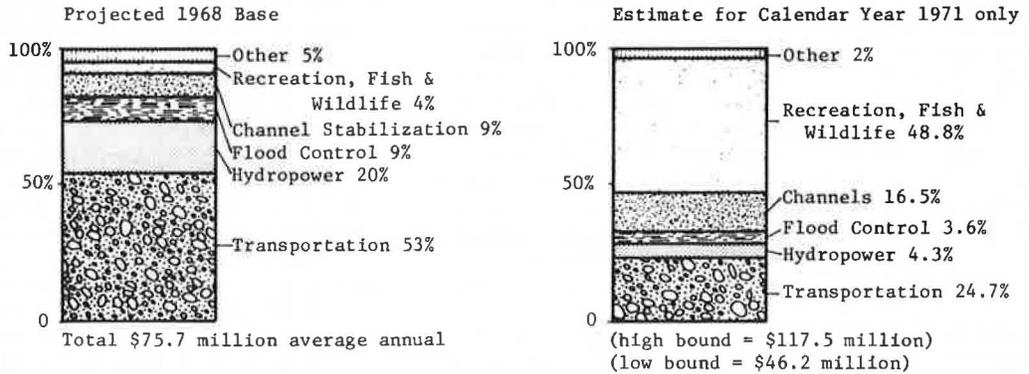
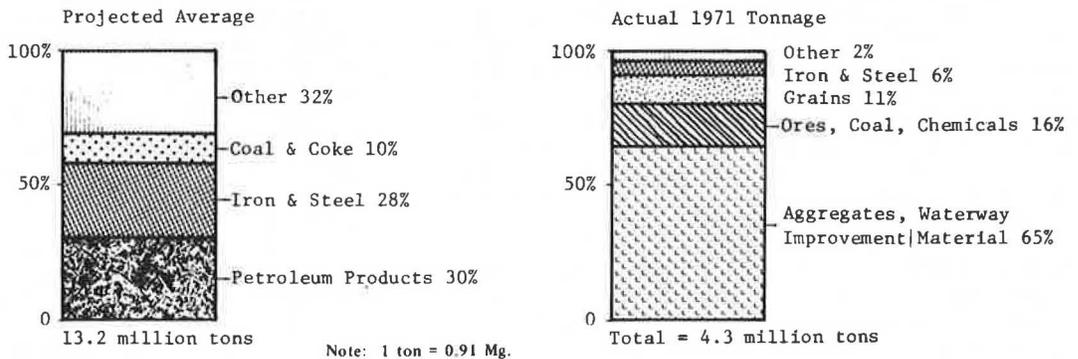


Figure 2. Estimated 1971 user benefits compared to annual user benefits estimated on a 1968 base.



Comparison of 1971 Traffic Composition to Estimated Traffic



The 1971 estimate reflects the first year of operation of the water way to Catoosa, whereas the project estimate was based on an average value to be achieved over the life of the project.

Decision-Making Process Reflected in
the McClellan-Kerr Project
Influences Impacts of the Project

The McClellan-Kerr project reflected a highly personal style of decision making among a limited number of participants. Controversy at the regional level was limited to concern for emigration versus concern for loss of land, but controversy between regional advocates and the Washington decision-making community was significant and persistent (5). One of the interesting attributes of the controversy was that of the legitimate objectives of the project (6). Regional political advocates generally described the project rationale as that of economic development in a region characterized by relatively low income, low employment growth, and high emigration rates, especially of young people.

With this rationale dominating, the question addressed to the Corps of Engineers was "Can you justify the project?" However, the corps' justification criteria are formally limited to narrowly defined efficiency criteria and resulted in reports that never directly related the Arkansas River project to economic development strategies for the nation or for the region. Rather, the reports, which are clearly addressed to the Washington-level review community, discuss technical engineering issues and benefit versus cost calculations limited to project (budget) costs and direct user benefits (which is typical of all corps reports). Thus, there is a gap between the articulated concerns and issues of the region and the water resources plan.

The conflict was characterized by the issuance by the Board of Engineers for Rivers and Harbors of a not convinced declaration to the navigation features of the project in 1945; by a 1955 letter from S. D. Sturgis (the chief of engineers) that informed Congress, "While the ultimate economic feasibility appears to be established, the margin of future net benefits over costs and the reliability of the estimates are insufficient to justify a commitment to construction of the plan as a whole in the immediate future"; by the impoundment of funds allocated to the Arkansas project by President Eisenhower in 1956 (although work on some portions of the project had begun in 1950); and by omission of construction funds in the 1957 budget message, which ultimately resulted in Congressional addition of funds for construction starts on Eufaula and Dardanelle reservoirs.

It may be that the conflict itself transformed the issues into highly abstract images on all sides, as they appear to be when discussed with people who were involved in the controversy. The abstractions range from the image that the project would, by itself, transform the region into a modern industrial economy, to the image that the project justification was insufficient, from a national efficiency accounting stance, to warrant federal investment. Some simply do not want to advocate the use of federal water resources programs for any objective other than efficiency, but an effort to elicit some of the proponents' views of the mechanisms of the desired transformation resulted in responses that border on a faith that it would happen without further action beyond the completion of the project.

This problem of images and myths and that of conflicting interest groups within the region converge to stifle aggressive nonfederal action to achieve a modern industrial economy with planned avoidance of environmental blunders. Thus, state and local action is fragmented and hesitant. The federal agencies having direct responsibility for economic development make grants for cooperating investment (for example, ports) without long-range plans or even a vision of a desirable one. Local communities are left to their own devices to de-

velop grant proposals. Consistent, continued planning and decision processes to achieve the politically persuasive objectives for the Arkansas River project have not been available.

Even if the objectives for water resources development cannot be agreed upon, it would be desirable to shift some attention to the postconstruction implementation phase, rather than concentrating all of the decision-making resources on authorization and appropriation for construction.

Follow Through Has Failed

In common with the problems of relating public goals to planning objectives for public works projects, there should be a consistent dialogue with widespread public involvement and a broad-based decision process. In no other federal program is there such a preponderance of federal presence and funding in the planning, design, and construction phases as in water resources projects. The Corps of Engineers is capable of and responsible for bringing a project such as McClellan-Kerr on line, subject to the consensus of the local, state, and federal political structures. But, what of the economic goals that played such a significant role in motivating the regional proponents? Obviously, economic development in an area characterized by long-run emigration, low income, and limited industrialization requires a more deliberate sequence of steps than it would in a region that possessed an active economic base, huge capital and managerial resources, and a diversified labor force. In the latter case, the alteration of factors that affect prices (such as lowering transportation or electrical costs or improving the supply of industrial sites) might result in an instantaneous reaction of the economy.

This is not the case in underdeveloped regions and would not exist if factors and prices were freely mobile and if the production possibility frontiers were common (3). Long-run underdevelopment and the accompanying low incomes and productivity are generally accompanied by risk-averse behavior and social controls that reflect social risk aversion. Confronted by significant uncertainties about new production arrangements, markets, distribution of factor payments, and the possibility of dramatic shifts in the distribution of social and political power, underdeveloped regions require a special set of stimuli beyond the alteration of prices factor (5).

The development of public entrepreneurship is strategic to successful economic development. Entrepreneurship requires the acceptance of risk to achieve projects or social payoff, as well as the skill to organize production factors into the desired configuration. Developing public sector entrepreneurship and organizing its activities in such a way as to reduce information costs and uncertainty about private production possibilities would offer substantial benefits.

If local or regionally defined design objectives were accepted first and then evaluated from a local, a regional, and finally a national accounting perspective, formulating a plan might be expedited. Public involvement should focus on implementation steps rather than be limited to a yes or no decision to authorize and construct, since, in many cases, the level and distribution of impacts can be managed by operation rules. The Appalachian Water Resources Survey demonstrated a practical planning style that emphasized cooperative enterprise between federal, state, and local governments and the private investment required to achieve the target levels of regional economic activity and employment.

The lack of follow through in the Arkansas River project that has resulted in limited riverfront development could result in environmentally costly location

Figure 3. Linear discriminant model.

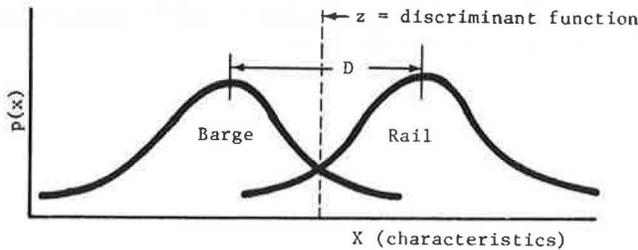


Table 1. Number of complete observations by Standard Industrial Classification Code and transport mode (1972).

Transport Mode	Number of Observations (Standard Industrial Classification Code)						Total
	Coal (12)	Paper (26)	Chemicals (28)	Primary Metals (33)	Fabricated Metals (34)	Grains (50)	
Rail	1	7	22	51	0	10	90
Barge	2	0	5	28	0	0	34
Truck	0	22	8	30	10	0	70
Total	2	29	35	108	10	10	194

decisions, in an otherwise avoidable conflict between competing user groups with respect to operating rules for the project.

Institutions that help transfer initiative from dominantly federal to dominantly local levels may facilitate the completion of projects. Several institutional forms have been recommended and some tentatively adopted, but little progress is visible.

What options are open to facilitate an environmentally successful economic development of this region, which in President Nixon's dedication address was held to be capable of supporting an additional 25 million fully employed people within 30 years? The industrial parks developed as adjuncts to port development have sufficient space and support facilities to accommodate for about 20 years the predictable expansion and location of those manufacturing and marketing industries that are normally located in industrial parks. Sites for free-standing, often environmentally threatening, activities have not been developed or designated. A move by the states, independently or bilaterally, to designate and acquire such sites would be warranted. Since there is now ample space to locate power plants, chemical plants, and paper and pulp mills in sites where environmental disruption would be minimized, timing is critical. Corps management of shorelines owned by the federal government in Oklahoma could be of strategic assistance to state implementation of socially, environmentally, and economically desirable land use patterns. The corps role could be a strategy of keeping options open, developing a continuing public dialog through hearings and impact statements on proposed private and public changes of land use requiring access to the river, and continuing pressure for strong federal-state implementation mechanisms.

Project Has Affected the Transportation Sector

Taylor and others (9) have studied the response of the region to the waterway improvement in terms of port development. Port development has been generally adequate in terms of quantity and its geographic distri-

bution of handling capacity. Port-related industrial parks are important parts of the economic development strategies of some metropolitan areas, but much less in other cases. Taylor recommends that the state governments delegate less port and industrial park development to local governments, to encourage longer planning horizons and the evaluation of alternative strategies and to facilitate coordination between port and waterway-planning activities. This suggestion could be implemented by a process of funneling federal and state planning and construction grants through state port-development organizations.

Although some ports are viewed as local projects, substantial federal funds are invested in the public ports along the McClellan-Kerr Arkansas River Navigation System. However, the relative share of federal funding was highly variable between ports, apparently reflecting local perceptions and investment strategies. The 1972 dollar investments in ports of the various sectors are shown below.

Port	Private	Local	State	Federal
Pine Bluff	1 750 000	2 858 050	—	2 506 000
Little Rock	3 850 000	4 898 235	—	1 798 390
Ft. Smith	—	599 450	—	393 500
Muskogee	—	1 557 000	—	5 222 100
Tulsa	1 500 000	21 582 000	—	573 000

Another major impact on the transportation sector is in the rate structures of competitive transport modes. A recent survey by the Corps of Engineers Southwestern Division (10) has documented rail rate adjustments for commodities that also used water transportation from 1967 to 1974 in the project area. For a sample of 167 358-Mg (184 479-ton) annual shipment of steel products, savings to shippers using rail averaged \$2.46/Mg (\$2.23/ton), or a 15 percent average weighted reduction in rates. These reductions countered normal increases in rates. For the shipments in the sample, savings from rate reductions totaled \$410 777 annually. The savings to shippers of steel products who used waterways were estimated to be \$1.75 million in 1971.

A modal-split model was developed from the 1971 survey of shippers using the waterway and shippers of similar commodities using rail and truck modes (7). The choice of transport mode is viewed as a behavior model of transport users and is based on actual choices of the user and the transportation characteristics contained in that choice. These are the quantity shipped each year, quantity per shipment, time of transit, rate of the selected mode, and handling costs. Most of the data are taken from shipping invoices.

Discriminant analysis is a statistical tool for analyzing differences in population groups (2). The linear discriminant model places weights on the variables (in this case the transportation characteristics listed above) in such a way as to maximize the distance (D) between weighted means of the groups. This is shown graphically in Figure 3. In the two-group case, the discriminant function can be duplicated by regression, by using a dummy variable to indicate the group (1 or 0). A discriminant function was estimated and parametric shifts in rates were introduced to estimate the demand function for water transportation in the project area (1). Table 1 shows the number of observations by mode and by the Standard Industrial Classification Code. The price-inelastic demand function ($E = -0.225$) calculated from this shows that a relative increase in barge rates of 10 percent would result in a 2.25 percent decrease in weight shipped.

This also results in a large consumer surplus, with greater benefits than would be obtained from estimating savings solely in terms of reductions in transport costs.

Since the demand function reflects the competitive influences of rail and truck modes, one would anticipate higher substitution effects that would tend toward greater price elasticity of demand. One possible explanation for the degree of inelasticity is that the shippers were substantially motivated by the savings that resulted from rail rate reductions as well as by the direct savings in transport costs that resulted from using the waterway.

OPERATIONAL PROBLEMS

Substantial flooding in the Arkansas and Mississippi River systems led to restrictions in navigation during 1973. During 1973, there were 198 days having flows in excess of 1960 m³/s (70 000 ft³/s), and 59 days in excess of 4200 m³/s (150 000 ft³/s) at the Van Buren, Arkansas, gauge (8). The effects of these high flows were to increase delays and to cause a large but temporary decline in sand and gravel movements on the waterway and a small, but apparently permanent, diversion of steel shipments from barge to rail modes.

CONCLUSION

Assessment of the impacts of completed navigation projects must confront the facts that indirect impacts may be as significant as direct, that individual and regional perceptions play an important role, that river ports are significant in determining impacts not only because of their economic and physical transfer functions but also because of the industrial parks that normally develop as conjunctive enterprises, and, finally, that the dynamics of adjustment to a new competitive environment by shippers and the transport modes are not well defined. Assessment of the completed McClellan-Kerr Arkansas River Navigation System indicates a need to study these issues.

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