

**AN OVERVIEW OF THE POTENTIAL ROLE OF
THE INLAND WATERWAYS
IN AN INTEGRATED U.S. TRANSPORTATION SYSTEM**

A Report Submitted to the:

**U.S. ARMY ENGINEER
INSTITUTE FOR WATER RESOURCES
KINGMAN BUILDING
FORT BELVOIR, VIRGINIA 22060**

**U.S. DEPARTMENT OF TRANSPORTATION
OFFICE OF FACILITATION
WASHINGTON, D.C.
20590**

under

Contract Number DACW3173-C-0082

Approved for public release; distribution unlimited.

AUGUST 1975

IWR Contract Report 75-5

**AN OVERVIEW OF THE POTENTIAL ROLE OF
THE INLAND WATERWAYS
IN AN INTEGRATED U.S. TRANSPORTATION SYSTEM**

A Report Submitted to the:

**U.S. ARMY ENGINEER
INSTITUTE FOR WATER RESOURCES
KINGMAN BUILDING
FORT BELVOIR, VIRGINIA 22060**

**U.S. DEPARTMENT OF TRANSPORTATION
OFFICE OF FACILITATION
WASHINGTON, D.C.
20590**

**by
Bechtel Incorporated**

**under
Contract Number DACW31-73-C-0082
Approved for public release; distribution unlimited.**

AUGUST 1975

IWR Contract Report 75-5

Copies may be purchased from:

**National Technical Information Service
U. S. Department of Commerce
Springfield, Virginia 22151**

The contents of this report reflect the views of the contractor, who is responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policy of the Federal Government, the Department of Transportation or the U. S. Army Corps of Engineers.

The U.S. Army Engineer Institute for Water Resources and the Department of Transportation, Office of Facilitation requested Bechtel Incorporated to conduct an overview study of the "Potential Role of the Inland Waterways in an Integrated U.S. Transportation System." It was stressed at the outset that Bechtel was to function as an independent contractor and that neither the Corps nor DOT wished to in any way influence the findings and conclusions.

This report, therefore, presents a Bechtel viewpoint for consideration. It relies heavily upon current information derived from an intensive program of field interviews with key executives in the waterways industry and in government - supported by specialist consultants in inland waterways transportation and institutional matters, a shipper survey, and a review of current and recent literature relative to the inland waterways. As an initial study in a planned program of continuing effort, and as an overview, the work is limited in scope, and it has been necessary to be selective relative to inclusion and depth of treatment of subject matter, depending upon a judgment evaluation of importance.

In the matters of development of findings, conclusions, and recommendations, no attempt has been made to reflect a consensus viewpoint nor necessarily a majority viewpoint of those in and concerned with the inland waterways - rather these conclusions and recommendations have been developed and presented on the basis of whether they are considered by Bechtel to have merit for consideration, and further investigation and study.

Although space does not permit a listing of the organizations and individuals contributing information to this study, Bechtel acknowledges a sincere appreciation to all who helped on this report. Also Bechtel wishes to recognize the project coordinators for the sponsoring agencies for this contract study: Mr. John T. Norris, Jr., Office of Facilitation of the Department of Transportation and Messrs. Robert W. Harrison and Howard E. Olson of the U.S. Army Engineer Institute for Water Resources. The manager of this project for Bechtel was Mr. Henry M. Ferree.

CONTENTS

<u>Section</u>		<u>Page</u>
	FOREWORD	ii
1	INTRODUCTION	1-1
	The Waterways	1-2
	Need for Study	1-3
	Approach	1-4
	Basis of Conclusions	1-6
	Scope	1-8
2	AN INTEGRATED TRANSPORT SYSTEM FOR THE U.S .	2-1
	Need for an Advocacy Role in Government	2-2
	Industry Background	2-3
	Roles of Transport Modes	2-6
	Modal Competitive Position	2-7
	Transport Regulation - (Rates and Services)	2-8
	Objectives for Regulation	2-8
	Requirements for Free Competition	2-8
	Attitude Toward Regulation	2-9
	Overall Impacts of Regulation	2-9
	Modal Impacts of Regulation	2-10
	Regulatory Choice	2-11
	Need for Regulation	2-12
	Potential Regulatory Development/Trends	2-13
	Economic Implications	2-15
	User Charges	2-15
	Subsidy	2-20
	Problems of Application of Economic Regulation	2-20

CONTENTS (Continued)

<u>Section</u>		<u>Page</u>
2	Cost/Benefit Analysis and New Water Projects	2-21
	Integrated Transport System - Intermodal Movements	2-23
	Factors Affecting Intermodal Movements	2-24
	Waterway Views on Intermodal Movements	2-25
	Barriers to Intermodal Movements	2-26
	Intermodal Potential	2-27
	Container/Piggyback Potential	2-28
	Factors Favoring Intermodal Movements	2-30
	Potential Intermodal Facilitation Improvements	2-31
	Encouragement of Integration of U.S. Transport	2-34
	Comments on Intermodal Aspects of Other Domestic Shipping	2-35
	Factors Affecting Modal Regulatory Need	2-38
	Planned Support for Technological Improvements	2-38
	Information Needs	2-39
3	SUMMARY AND CRITICAL ISSUES	3-1
	The Waterways Industry	3-2
	Role of Government	3-3
	Waterway Constraints/Problems	3-5
	Potential Waterways Role	3-7
	Technological Improvements - Waterway Vessels and Operations	3-7
	Intermodal Coordination	3-8
	Economic and Social Issues	3-10
	Critical Issues	3-11
	Conclusions	3-15
	Recommendations	3-19
	Basis of Recommendations	3-19
	General Recommendations	3-21
	Specific Recommendations	3-22
	Program of Further Work	3-24

CONTENTS (Continued)

<u>Section</u>		<u>Page</u>
4	PROPOSED NEW INSTITUTIONAL CONCEPTS	4-1
	Underlying Needs for Major Change	4-3
	Recommendation for Transportation Planning/Regulation - Industry Institutional Concept	4-5
	Concept for Regulation/Planning Agency	4-6
	Transportation Industry Institutional Changes	4-8
	Recommendation for Environmental Concepts	4-10
	Concept for Total Resources Evaluation	4-10
	Concept of Blanket Impact Assessment	4-12
5	INSTITUTIONAL PROBLEMS AS RELATED TO TRANSPORT	5-1
	Modal Institutional Factors	5-1
	Modal Comparison	5-1
	Modal Development Factors	5-7
	Competitive Action	5-9
	Joint and Through Rates	5-9
	Rail/Water Intermodal Factors	5-10
	Government Aid and Support	5-10
	Exclusive Rights and Competition	5-12
	Environmental Comparisons of Trans- portation Modes	5-13
	Modal Energy Demand Comparison	5-17
	Role of Government	5-23
	Interstate Commerce Commission	5-24
	U.S. Army Corps of Engineers	5-26
	The Department of Transportation	5-29
	Maritime Administration	5-31
	Federal Maritime Commission	5-31
	The Occupational, Safety and Health Administration	5-31
	Environmental Protection Agency	5-31
	Other Agencies	5-34

CONTENTS (Continued)

<u>Section</u>		<u>Page</u>
6	TRANSPORTATION POLICY AND ITS IMPLEMENTATION	6-1
	Difficulty in Realizing a National Transportation Policy	6-1
	Policy Background	6-1
	Need for Rate Regulation/Regulatory Approach	6-3
	Policy Objectives	6-5
	Expressions of Transportation Policy	6-6
	Policy Impact Matrix Analysis	6-15
	Analysis of Policy and Goal Factors Affecting the Waterways	6-16
7	ECONOMIC AND SOCIAL IMPACTS OF THE INLAND WATERWAYS	7-1
	Regional Development	7-2
	Social Well-Being	7-8
	Social Costs	7-8
	Distribution of Population and Industry	7-8
8	THE INLAND WATERWAYS SYSTEM	8-1
	Description	8-1
	The Waterways	8-1
	The Locks and Dams	8-2
	System Improvements	8-14
	Perceived Benefits/Disbenefits of the Waterways	8-15
	Structure of the Waterways Industry	8-16
	Waterway Operations	8-18
	Tows/Barges	8-18
	Manpower	8-19
	Domestic Waterway Terminals	8-21
	Costs	8-23
	Movements	8-24
	Factors of Future Growth	8-26
	Inland Waterways Technology and Potential Improvements	8-28
	Vessel Technology	8-30
	Terminal Technology	8-32
	Deep Draft Ports	8-32
	Modal Impacts	8-32
	Improved Waterway Utilization	8-33

CONTENTS (Continued)

<u>Section</u>		<u>Page</u>
9	WATERWAY CONSTRAINTS	9-1
	Physical Constraints	9-2
	Inherent Constraints	9-2
	Locks and Dams	9-2
	Channels	9-3
	Operations	9-3
	Constraints Imposed on the Waterways by	
	the Government	9-4
	Other Constraints	9-8
10	BIBLIOGRAPHY	10-1

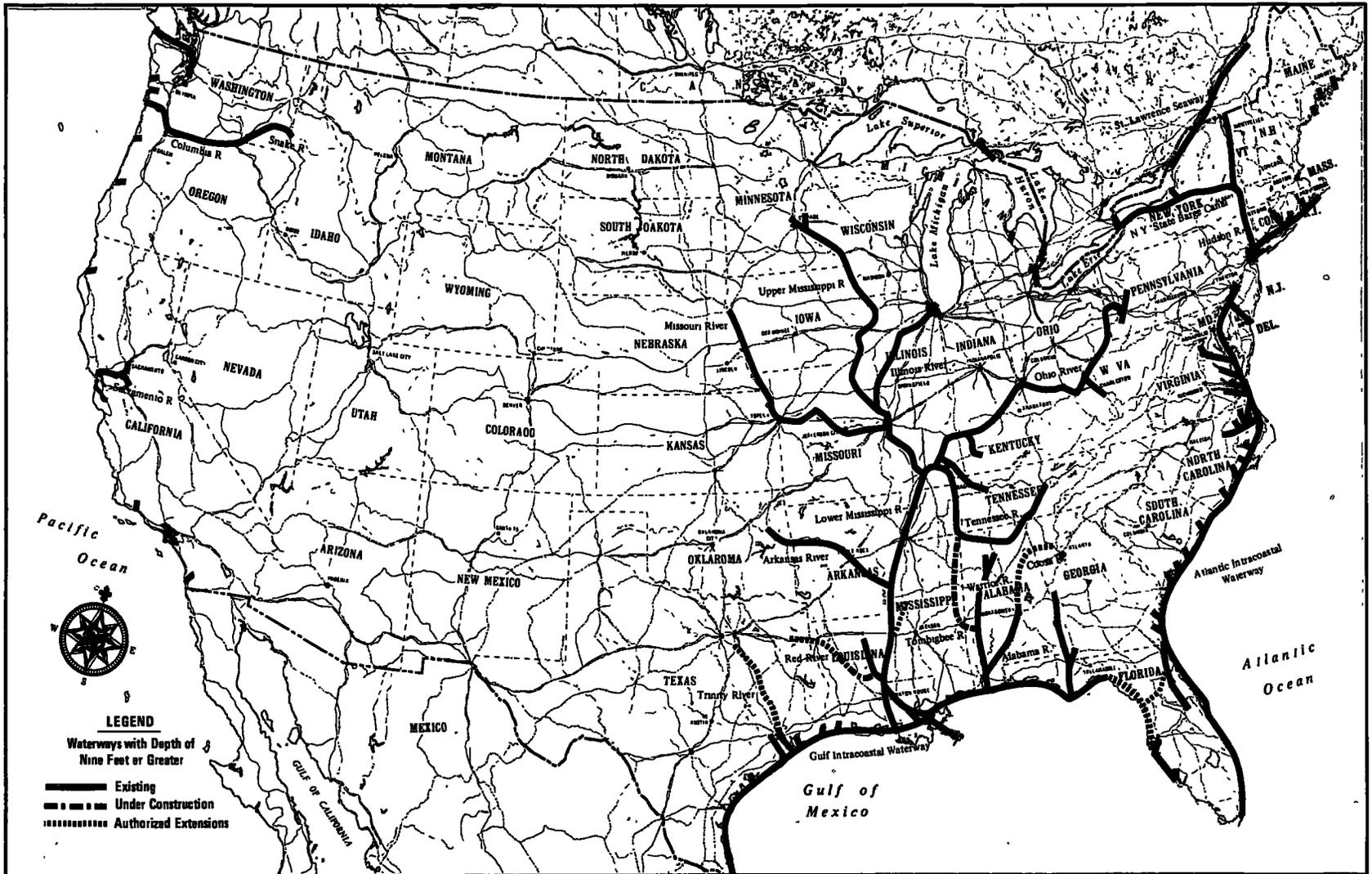
ILLUSTRATIONS

<u>Figure</u>		<u>Page</u>
Frontis.	Commercially Navigable Waterways of the United States	x
8-1	Waterway Summary - Lower Mississippi River	8-4
8-2	Waterway Summary - Middle Mississippi River	8-5
8-3	Waterway Summary - Upper Mississippi River	8-6
8-4	Waterway Summary - Ohio River	8-7
8-5	Waterway Summary - Illinois Waterway	8-8
8-6	Waterway Summary - Tennessee River	8-9
8-7	Waterway Summary - Alabama-Coosa River	8-10
8-8	Waterway Summary - Missouri River	8-11
8-9	Waterway Summary - McClellan-Kerr Arkansas River Navigation System	8-12
8-10	Waterway Summary - Gulf Intracoastal Waterway	8-13
8-11	Inland Freight Tonnage by Direction of Movement - 1971 - Mississippi River and Selected Tributaries and the Gulf Intercoastal Waterway	8-27

TABLES

<u>Table</u>		<u>Page</u>
2-1	Barge Versus Rail - Competitive Economics	2-19
5-1	Comparison of Surface Transport Modes	5-2
5-2	Comparative Line Haul Modal Energy Intensiveness (Energy Required/Distance Moved)	5-4
5-3	Distribution of Energy Within the U.S. Transportation Sector	5-18
5-4	Qualitative Matrices for Range of Possible Environmental Impacts of Transportation Modes - Waterway Transport	5-19
5-5	Qualitative Matrices for Range of Possible Environmental Impacts of Transportation Modes - Rail Transport	5-20
5-6	Qualitative Matrices for Range of Possible Environmental Impacts of Transportation Modes - Highway Transport	5-21
5-7	Water Pollution Potential of Transport Modes: 1971	5-22
5-8	Air Emissions for Transport Modes: 1969	5-22
5-9	Scope of Federal Economic Regulation of Interstate Transport by Mode	5-27
6-1	Policy/Event Impact Matrix Analysis	6-17
8-1	Navigable Lengths and Depths of U.S. Waterway Routes	8-3
8-2	Average Maximum Tow Size - Selected Inland Rivers	8-20
8-3	Annual Costs for Typical Inland Waterways Vessels	8-25

COMMERCIALLY NAVIGABLE WATERWAYS OF THE UNITED STATES



Section 1
INTRODUCTION

This report examines present physical, operational, and institutional conditions of the waterways industry of the United States and evaluates constraints; considers what might be done to improve efforts to produce an integrated U.S. transport system; explores national goals and policy alternatives as well as recent legislative trends affecting transport; and presents recommendations. Recommendations for action are directed towards those things which might be effected under continuation of present trends. The report also offers recommendations stressing innovative concepts for major change, which have the potential of removing some, if not most, of the significant barriers to development of an integrated U.S. transport system under conditions of private enterprise in substantially free competition. It is recognized that while very significant problems exist in the implementation of new concepts, and major obstacles would have to be overcome, the merits and the potential benefits of their implementation warrant their serious consideration at this time. It must also be pointed out that the differences in tenor between the recommendations pertaining to existing conditions and the new concepts result primarily from the different conditions under which they might be applied.

The report is also structured differently from most reports of its kind. The major section on "An Integrated Transportation System for the U.S." precedes the section on "Summary and Critical Issues", and is intended to be read prior to the latter. It does so because initial review of the report showed that it was vital that the reader be fully cognizant of the material in the section on integrated

transport to fully understand and appreciate the findings and recommendations. For those desiring additional background at the outset, it is suggested that they also read the sections on "Institutional Problems as Related to Transport", "Transportation Policy and Its Implementation", and "Economic and Social Impacts of the Inland Waterways" prior to reading the section on "Summary and Critical Issues."

THE WATERWAYS

The inland waterways are a significant element of the total transportation capability of the United States. They serve: the entire central portion of the United States via the Mississippi and its tributaries; the northeastern U.S. via the Great Lakes and connecting waterways; and the East and Gulf Coasts by intracoastal waterways as well as by waterways extending inland from the coast. On the West Coast, inland waterways include portions of the Sacramento and Columbia rivers, and Puget Sound. Exclusive of the Great Lakes, the inland waterways include more than 25,000 usable miles of navigable channels, most 9 feet or over in depth.

Typical commodities moving on the waterways include: raw materials (coal, ores, minerals, farm products, etc.) - almost two-thirds of total ton-mile movements; processed products (such as petroleum and chemical products and semi-finished steel) - over one quarter of total movements; and other commodities representing less than one tenth of the total. Most commodities move in bulk in unregulated commerce.

The inland waterways are recognized as having inherent economic advantages over other modes of transport and are indicated to be more economical in their use of energy per ton-mile transported than other modes of surface or air transport. Such sub-surface modes as pipelines may be still more economical for movement of selected materials, such as petroleum products. The waterways

represent a sunk government investment estimated to be over \$3.3 billion in such facilities as dams, locks and channels, and an industry investment in carrier equipment of those for-hire carriers operating on the inland waterways (exclusive of the Great Lakes) of approximately \$2 billion.

Inland waterways have played a vital role in the development of our country and in service to shippers and, except for a few early barge canals, such as the New York-Lake Erie Canal their use has always been free to all. There has been a long history to the concept of "toll-free" waterways. Article IV of the Northwest Ordinance of 1787 said, "The navigable waters leading into the Mississippi and Saint Lawrence . . . shall be common highways, and forever free, . . . without any tax, impost, or duty therefor." in the same spirit the Rivers and Harbors Acts of Congress have frequently provided that no tolls would be charged for use of waterways and improvements to navigations belonging to the United States. The 1909 Act specifically made the prohibition applicable to both existing and future improvements. Moreover the Constitution provides that no preference be given to the ports of one state over those of another. Under this provision user charges if imposed would need to be set with this provision in mind. However, the Panama Canal and the St. Lawrence Seaway utilize tolls as a means of meeting expenses.

NEED FOR STUDY

Future U.S. needs for transportation are projected to be significantly higher than present day volumes. Further, transportation technology is changing and the nation is faced with problems of energy conservation, environmental protection, and best use of scarce economic goods. To ensure that future transportation requirements are met in conformance with desired national transportation goals and objectives, major decisions and positive actions will have to be taken in the near future; therefore, the Department of Transportation and the U.S.

Army Corps of Engineers have asked Bechtel Incorporated to conduct a study of the "Potential Role of the Inland Waterways in an Integrated Transportation System of the United States." In this study the U.S. transportation system was to be evaluated as a dynamic entity. Consideration was to be given in the study to the contribution which each transport mode makes towards the achievement of national goals and objectives - including the balance between economic, social, and environmental aspects.

The nation has a genuine need for all modes of transport. The basic problem is how to preserve each of the various modes, to make each strong, profitable, and efficient, and to realize an integrated transportation system which would utilize each mode to the best interest of the nation and provide good service to shippers. It should be emphasized that what is best for the nation with respect to an integrated system may not be best for any one of the various transport modes.

The study is intended to serve as the basis for forward thinking by those who may read it. Further, the findings are intended to be free of an advocacy role, in which one transportation mode is given biased preference over others.

APPROACH

The study is intended to provide a balanced level of treatment, while limiting the depth to that necessary for the stated intended use as an "overview" for policy guidance; for convenience of further reading a bibliography is included. More intensive studies to examine critical issues in greater depth are expected to follow, with this report serving as the basis for decisions regarding subject matter and scope of such subsequent studies. A conscious effort has been made to be creative in the suggestions and recommendations of this report, and to extend the application of this thinking to other transport modes in the context of

possible means of improving the U.S. transportation system and integration of modes. The intent has been to present concepts and ideas for consideration in the context of the improvements which may result from their potential application; there has been no intent to single out any agency or transport mode for criticism.

Initial investigation and analysis indicated that the inland waterways themselves, primarily the Mississippi River Basin and its tributaries, are the most critical portion of our domestic waterway transport system with respect to the necessity for immediate attention and near future decisions, and from the standpoint of barge volumes transported. For example, the inland waterways now face problems of possible irrevocable commitment of water to other uses, such as irrigation water for agriculture, or water use related to conversion of coal to gas; immediate environmental problems in acquiring acceptable areas for disposal of dredging spoils, and in opposition to new projects, waterway improvements and maintenance; restriction, or use for other purposes, of suitable construction sites for industry along the waterways; and commitment or restriction of waterway banks to uses which would be inimicable to the future development of the waterways. In addition, sharply rising costs, higher discount rates for evaluation of costs and benefits, and greater competition for government funds, coupled with changes in goals, could result in presently justifiable projects never reaching construction in the future if subjected to short-term delays.

The portion of the Intracoastal Canal extending from the Mississippi at New Orleans westwards to Brownsville, Texas, and that portion eastwards to Panama City, Florida, are seen as having similar problems and are considered as a logical extension of the Mississippi basin inland waterways system. Movements over other portions of the intracoastal waterways, particularly on the Atlantic, are of relatively minor significance and do not face the same immediate problems as the inland waterways system itself. Similarly, the Great Lakes system and intercoastal movements are not seen as having problems of such a magnitude or immediacy.

The approach to the conduct of this study, and the findings and the conclusions resulting therefrom, are the result of an extensive program of field interviews with key persons in top management in the inland waterways transportation field and with personnel in government affecting the waterways; consultation with outside experts in the fields of waterways transport and regulation; a shipper questionnaire survey relating to waterway usage; and a review of recent published literature.

BASIS OF CONCLUSIONS

The problem of dealing rationally and equitably with multiple goals is clearly evidenced by the fact that competent, qualified, and sincere men of good will hold different opinions and espouse different positions. Further, while as a whole, certain groups may be categorized as holding certain views and opinions, they frequently differ widely and sometimes violently on specific points representative of the position of the group or category with which they are identified - such as government, academia, a region, or the waterways industry. It is also clearly evident that, with closeness and prolonged involvement, positions and viewpoints tend to harden and any ideas presented for consideration are viewed from a personal bias (with things read into them which are not there), or ideas which may be thought to be clearly stated are not understood, glossed over, or not accepted.

Because human beings were involved in the preparation of this overview report, the same frailties may be considered to exist herein. Furthermore, it is quite possible that some of the recommendations may not seem possible under present conditions from the standpoint of pragmatic political reality, or because of conflict with some national goals and objectives, or because funds are not available. However, these same recommendations are presented for consideration because it is felt that they represent potentially valid means or worthwhile principles or concepts by which certain of the objectives of this study may be achieved.

In viewing the conclusions and recommendations of this study, it must be recognized that this is, first of all, an overview study and that it is not intended to address all matters or to come up with solutions intended to evolve from future studies. Further, clearly, selective judgment had to be employed in the selection of material for inclusion to permit readability and understanding - single topics which have only been given passing attention have been studied and been the subject of controversy for years and have had many books written about them.

Throughout the course of conduct of this study, an attempt has been made to talk with and consider the viewpoints of as many advocates as possible within the inland waterways industry, government, and academia. To the extent possible, the selected sample of key persons contacted and surveyed was felt to be knowledgeable, to occupy key or respected positions in their fields, and to have views that would encompass the diversity and range of views of interested parties. The resultant views of this study (and the intent has been to take a position) rest upon detailed analysis and evaluation of the following:

- 1. An intensive field program of direct interview with key people in government and the waterways industry and a selected sample cross-section shipper survey**
 - a. Waterways operators - presidents and vice presidents (encompassing common, contract, and exempt carriers)**
 - b. Shippers**
 - c. National Waterways Council**
 - d. Labor**
 - e. Trade Groups**
 - f. Government - District Offices of Corps of Engineers, Department of Transportation, Congress**

- g. Terminal Operators
 - h. Ports
 - i. Consultation with and assistance from transportation specialists and economists of recognized stature
2. Research - including:
- 160 reports/papers
 - 7 books
 - 2 conference proceedings.

The purpose of the study is to broadly define the problems, to indicate potential changes and their impacts, and to provide the basis for development of an intended follow-on program of work.

It is not purported that any one of the groups or persons who contributed directly or indirectly to this report would give full support to everything presented herein - in fact, most strongly oppose certain portions. However, support exists for all of the concepts and ideas presented herein. The hope is that each concerned person or group will give due consideration to those views that he is not in agreement with, to try and ascertain if they may have merits, and thus possibly permit a reconciliation of some opposing views and reduction of obstructionism - so as to allow development of an integrated transportation system of the United States.

SCOPE

The scope of this study includes the following:

1. Examination of the Inland Waterways System and Its Basic Requirements - present day facilities, operations, ownership, market, etc.

2. Examination of the Constraints on the Waterways System - physical and institutional
3. Analysis of Modal Comparison of Surface Transport
4. Evaluation of National Policy as it Impacts on the Waterways and on an Integrated System
5. Assessment of Potential Improvements to Realize an Integrated System, Improve Intermodal Transport, and Increase Waterway Potential
6. Evaluation of Potential of the Waterways
7. Preparation of a Statement of Critical Issues
8. Presentation of a Suggested Program of Action - Suggestions for additional studies to aid in determining how needed changes in industry, laws and regulations, and relationships might be implemented

Section 2

AN INTEGRATED TRANSPORT SYSTEM FOR THE U.S .

The topic of what an integrated transport system is and what the "optimum" development of the various modes might consist of must be addressed at the outset. The clear implication of an "integrated transport system" is that it is somehow possible to define what is the "best" use of each mode, and that practical means exist to achieve these ends. It must be made evident first that an efficient integrated transport system does not carry with it any corollary regarding a corresponding high degree of intermodalism. Further, in an integrated transport system, whatever may be best for individual modes may not be best for the system as a whole. If it were possible to establish and reach agreement on what were rational and equitable goals and objectives for such an integrated national transport system, the principles by which these should be effected, and the means to be employed, then (and only then) would it be possible to directly achieve this objective. However, such a "formal" interpretation of an integrated system would seem to imply the need for a very high degree of regulation and direct control by government over the activities of both the transportation and shippers - an approach viewed as undesirable, less efficient, and more costly as well.

As a "general principle" the report recommends minimization of Federal regulation and of the Federal bureaucracy to the extent consistent with national goals and objectives. However, this report recognizes that either because of prior developments, or to achieve specific goals deemed desirable, some Federal direction or direct Federal intervention and regulation may be the most practical means of achieving these ends. The report recognizes this and suggests certain areas for Federal action.

Consistent with the foregoing, the recommendations of the report are directed towards removal of the barriers precluding movement of traffic between the inland waterways and other modes, investigation of what the role of the waterways should or could be in an integrated system, and what could be done to improve the capability and efficiency of the inland waterways industry. Within the limited scope of this report it has not been possible to address the larger question of what the balance should be between the various transport modes and details of how other modes could be improved. In fact, no valid data or means of developing consistent goals for such work exist today.

In the treatment of complex arguments and issues in this overview study, it has been necessary to greatly simplify, be selective, and to deal in general principles. The suggestions are presented as concepts for consideration and it is recognized that many practical difficulties lie in the way of the implementation of these ideas -not the least of which may be "it has never been done that way!"

NEED FOR AN ADVOCACY ROLE IN GOVERNMENT

Our present Federal government is largely founded on an advocacy role for various special interests to ensure that they are represented and that their voices are heard in the planning, regulation, and disbursement of benefits. Thus, we find that there are departments of Labor, Commerce, Agriculture, Transportation, etc. While this tends to support fragmentation, disparity of views, and provincialism, it does provide assurance that discrete viewpoints are available and heard by those responsible for planning, evaluation, development of legislation, and administration of laws and regulations. The power of overall decision regarding the merits of various courses of action affecting the nation and the courses which should be followed between competing viewpoints is thus properly delegated

to those who are best equipped and should do so - Congress and the upper levels of the Executive branches .

Similar problems of disparity of views and need for representation are found within the Department of Defense, wherein there are Departments of Army and Navy, and wherein the Air Force was established to provide a voice for this important service. A somewhat similar parallel exists within the Department of Transportation (DOT) which is supposed to serve all transport modes. However, DOT is oriented heavily towards rail and to a lesser extent towards highway transport, has only a limited planning role for the waterways, and has no effective spokesman for the inland waterways. It would seem unlikely that a balanced modal viewpoint can be achieved unless bias at the policy and planning decision level is limited and all pertinent facts are presented and available to the Department of Transportation - thus in the long term it is quite likely that the waterways may suffer, and inadequate and inappropriate use may be made of them unless representation for them is provided within DOT.

It may be argued that factionalism of this nature may not be conducive to an integrated transportation system and to promotion of intermodal movements. However, such developments will have to depend upon decisions regarding the most appropriate modal role share in various commodity movements, and upon establishment of conditions favoring such use of our national transport system. These decisions must be made on the basis of knowledge and full consideration of each mode. Thus, it is concluded that there is a need for a spokesman within DOT for the waterways, such as an Assistant Secretary, and a balanced voice for all modes of transport. This study, financed in part by DOT, is a step towards providing increased waterway knowledge and representation within DOT.

INDUSTRY BACKGROUND

At a time when large future demands upon our transportation system are anticipated, and serious questions are being raised regarding our future

capability of meeting these needs, the nation is faced with a serious problem concerning the economic viability of our most important single mode - rail. The railroads have seen their role and modal share decline from one of complete dominance and monopoly to one of general retrenchment and precarious existence for some lines - resulting largely from incursions made by truck. Trucks provided flexibility, service and speed and a high degree of reliability, rendering worthwhile their higher cost, and resulting in siphoning off the most desirable and highest revenue-producing traffic from the rails.

To compound the problem, the railroads have been faced with rate limitations; labor restrictions; the problems of weak and strong railroads; factionalism between various lines; rates kept low by competition and carryover of prior ICC practices and philosophies; and by the railroad lines acting as cartels through rate bureaus; and by preclusion of individual lines from lowering rates, to retain or recapture traffic, by rate bureaus or the ICC. Also, the railroads generally have not had sufficient capital return in recent years to attract investment for necessary improvements or for the development of needed technological advancements - nor has this condition fostered a progressive attitude within railroad management. It is small wonder then that the railroads, as a whole, have done all in their power to retain all possible long haul rail movements - in some cases, no doubt, doing so at less than their variable costs. Thus, they have acted to restrict intermodalism by the selective establishment of rates to encourage exclusive rail use wherever they have had the opportunity to do so. Such actions were made possible through the rate bureaus which provided the means of establishment and upholding such rates within the railroad industry. It should be noted that the ICC does not generally approve rates opposed by the rate bureau, and thus the opportunity for internal policing action by the railroad cartel is provided for. Internal policing is also made possible by the fact that the ICC, while having jurisdiction over the total amount of through rates, does not exercise jurisdiction over the division of through rates between rail carriers

unless action is initiated by carriers. Thus, recalcitrant carriers can be disciplined within the cartel. Weaker railroads also act through the rate bureaus to prevent selective lowering of rates by certain carriers which would be conducive to intermodal movements but might be detrimental to weaker roads.

Many of the eastern railroads are now faced with a great financial burden in bringing up their tracks and roadbed to current standards, whereas the western roads could generally forego several years maintenance and still meet the standards. The railroads also have heavy fixed costs and a difficult problem in properly allocating costs to various movements. Under these conditions it is little wonder that the railroads often consider it desirable to move traffic at rates that barely meet or only slightly exceed their short run variable costs - and sometimes at even lower rates - rather than let another mode share in part of the movement. Providing rail rates exceed variable costs, movements at such rates are attractive to the railroads if they would either attract additional traffic, or would retain traffic they would otherwise lose. However, if such practices permeate the rate structure, the ability to acquire future capital needs and to maintain the system will be greatly diminished or non-existent - the condition of many eastern railroads.

The Congress has repeatedly affirmed its position that the use of the waterways shall be free and this, in conjunction with the high waterway industry efficiency and direct competition on the inland waterways, has assured low water rates. Congress has also admonished the ICC to preserve the "inherent economic advantages" of the waterways by precluding other regulated carriers from establishing rates that were not consistent with this requirement. Thus, under this combination of subsidy and protective umbrella the waterways have flourished. Much industry location also has been significantly influenced by the availability of low cost waterway transport, as has the economic health and development of various regions.

Roles of Transport Modes

One of the primary problems with respect to development of an integrated transportation system is that no agreement exists as to what the probable role should be for each transportation mode, nor the conditions under which all will prosper. Actions to resolve these problems are rendered more difficult by both monopolistic and free competition modes within our transportation system. The need for regulation is also rendered more important by the imbalance in size and resources between competing modes, and the availability of noncompetitive market service areas to one mode and the absence of availability of noncompetitive markets to the other (e.g., rail vs. water).

The thinking with regard to the proper role for each transportation mode is greatly influenced by the historical sequential development which has taken place for the three basic modes of surface transport - barge, rail, and highway trucking. It is also influenced by the magnitude of Federal investment already made in the waterways (estimated at \$3.3 billion) and the large private investment in the railroads. Each is now viewed according to the importance of its past role and its potential. There can be no question but that the accepted role for the various modes would be significantly different if each originated at the same time and developed its appropriate share of the market in today's competitive circumstances.

Rail also has been hampered in maintaining its market position by the dispersion of receipt and delivery points to suburban areas (as a result of movement of industry to the suburbs) - locations, in many instances, where it was either not practical, possible, or economical for rail to follow. Thus trucking acquired a high degree of practical control over many movements by the necessity for and additional cost and delay of "de-vanning" for intermodal shipments requiring transport for a portion of the movement.

Large bulk movements are considered to be best transported by rail or waterways - for service areas in which waterways are available. The movement of finished goods is commonly allocated to truck or rail depending upon size, distance, and commodity value.

While trucking competes directly with rail, it is largely complementary to the waterways, and one major barge line owns a trucking company. The railroads are inhibited by the Panama Canal Act from owning barge lines in all areas in which they offer competing service.

Modal Competitive Position

With respect to competition between rail and water, it is significant that within movements in regulated commerce there is direct competition within the waterways industry by competing barge lines offering services over the same routes to the same points of origin and destination. These lines are also faced with competition from private carriage and rail. Further, the regulated waterway carriers and the exempt carriers must earn their profits on the waterways alone; there is no way in which they can move cargo off the waterways by barge.

The waterways have, without question, been favored by the provision of waterways, locks, and dams by the government without cost, and they have prospered accordingly. Profitable operation in a free competitive mode has been made possible by the relative lack of complexity of the barging industry, the limited number of commodities moving on the waterways, the sheltered position of the industry, and because no great disparity in efficiency, or resources, of significant magnitude exists between the various waterway companies. However, the waterways are vulnerable because of: their exposure to selective rate reductions by the railroad industry, their continuing need for water-oriented industry sites for origin and destination of traffic movements, their need for fleeting areas, the need for continued dredging and maintenance of channels, and the need for maintenance and operation of locks and dams. Should the waterways industry be driven by rail competition from the inland waterways, it is highly probable that it could never resume its present position of importance and that its competitive posture vis-a-vis other transportation modes would be considerably diminished.

Imposition of segmental user charges (based upon the cost of maintenance and operation and of new construction of various segments of the waterways), could result in making certain waterway segments non-competitive. This could diminish the overall utility of a major waterway system, and could reflect unfavorably upon the waterways industry as a whole. While the impact of segmental user charges quite possibly could be construed to be applicable to the evaluation of a new waterway construction project, it would appear to be far more beneficial that any actual application of user charges be in the form of a general user charge on the waterways as a whole - in preference to the use of a segmental system. User charges are discussed more fully in an ensuing section.

TRANSPORT REGULATION - (RATES AND SERVICE)

Objectives of Regulation

Formal regulation, according to Harvard economist John R. Meyer, has four objectives:

1. To prevent unreasonable prices which produce excessive earnings arising from natural monopolies
2. To insure sufficient profits for development and expansion of the industry
3. To prevent discrimination between various groups of customers with unequal bargaining power
4. To provide services to meet a broad public need that would not normally be fulfilled.

Requirements for Free Competition

Free competition in transportation has certain general requirements, as follows:

1. Low cost of entry into business
2. Unrestricted entry into business
3. Free access by the transport mode to both shipper and receiver
4. Equal access of competing transporting companies to use of right-of-way between points of origin and destination.

Attitude Toward Regulation

At the present time there is great clamor for deregulation of the transportation industry, particularly by academics, and strong criticism of the independent regulatory agencies. To appreciate whether this criticism is valid, the performance of the agencies must be viewed in the overall light of their accomplishments with respect to their impact upon the total transportation capacity of the nation, and in the light of the circumstances leading to development of regulation.

There is considerable application to the transport industry of Lincoln's statement to the effect that this nation could not continue to exist half slave and half free. This is the underlying basis of much of the criticism of the regulatory agencies - the fact that modal competition exists between regulated and unregulated transport modes, and wherever such competition exists there are bound to be both inequities and inefficiencies. However the need for rate regulation is dictated by the institutional characteristics of the modes themselves. The primary problem of deregulation is whether the transportation capability of the nation will be increased and the modes rendered more efficient by deregulation.

Overall Impacts of Regulation

D. Daryl Wyckoff in an article in the March 1975 Container News said, "The question of the desirability of continued regulation has to be broken into three separate elements:

- Competence of the regulators
- Effectiveness and cost of administration of the regulation
- Net benefits of the regulatory process."

It is claimed that regulatory policies have lead to higher transportation costs and transportation inefficiencies. Robert W. Harbeson estimated that the economic losses arising from the use of trucks in instances where railroads were more economical was somewhere between \$1 to \$2.8 billion in 1963. Estimates of potential savings through competition and more efficient use of transportation capabilities as a result of deregulation range from \$3 to \$10 billion per year.

The imposition of regulation on intercity trucking services has converted a trucking industry which by itself should have functioned efficiently in a free competitive atmosphere into one which operates as a semi-monopolistic transportation mode. Regulation has also fostered private trucking and the use of company owned equipment on the inland waterways as an alternative to for-hire transport for large shippers, industry, and cooperatives.

Modal Impacts of Regulation

Rail transportation is a mode which by virtue of the magnitude of investment required, and limitations on traffic available to it, must function as a virtual monopoly as far as other transport is concerned. Yet, trucking competition has removed rail transport from its monopoly position with respect to movement of: finished goods, those goods with high time value (style factor or inventory value), and certain bulk movements. Further, for bulk movements which have easy water access, water transport competes and in most instances will capture the movement. In addition, rail has been restricted in intermodal competition by: the mandate by Congress to the ICC "to preserve the inherent advantages of each transport mode"; by ICC forcing rail transport to provide service (because of common carrier

status) to points which in many instances are not profitable; and by the ICC establishment of "value of service" rates (or "what the traffic will bear" rates) - in which lower rates are established for commodities which cannot bear higher transportation costs, with the difference in return to the rail industry purportedly recaptured by higher rates on the movement of more expensive commodities, such as finished goods. Thus, some areas of the nation are served by railroad transportation at prices lower than alternate transport modes as a result of cross subsidization in their rate making from more profitable services.

Rail has also been inhibited by the ICC by being prevented from reducing rates beyond the extent necessary to meet competition, although the railroads might have considered it competitively advantageous to further reduce rates and capture a market. However, in contrast, rail has been allowed to charge discriminatory rates for the transportation of similar goods in similar traffic movements (by the exemption of all modes of regulated carriers from the provisions of the Anti-trust Act) under the guise of meeting water-competitive rates.

Railroads and regulated water carriers have also had to comply with tedious and sluggish regulation while at the same time competing with unregulated competition that has greater operational flexibility and ability to set prices without interference from the ICC and other regulatory agencies.

Legally excluded from regulation are bulk shipments on the inland waterways (accounting for approximately 85 percent of all waterway movements), most agriculture products transported by highway carrier, and all shipment by private carriers by truck or water.

Regulatory Choice

When it comes down to the choices available for the conditions under which the United States transportation system should operate, only a limited number of options are available. These include the following:

1. **Private free-enterprise free-competition operation of the transport industry (full deregulation or no regulation)**
2. **Full regulation of all movements in all transportation modes**
3. **Government ownership of all transportation modes**
4. **Forced allocation of traffic between modes (government-forced master planning)**
5. **Modal subsidies**
6. **Combination of one or more of the foregoing (detente, or what we have now).**

Need for Regulation

There are very valid reasons why none of the foregoing alternatives represents a desirable choice for the nation. Recognizing this fact, and understanding that the major transport modes in the United States had a sequential development, the patchwork quilt that is evident in transportation regulation becomes more understandable and acquires a certain rationality. In the same context, the objective frequently attributed to the ICC of "preservation of the modal status quo" becomes more plausible. Considering the diversity of goals, objectives and interests of various segments of the nation, and the characteristics and conditions under which the various modes now operate, a compromise combination might well seem to be the best approach to the regulatory atmosphere, and the most equitable solution to best represent the composite needs of various interest groups and the various transportation modes. However, such compromise cannot remain static, and continuing change or adjustment is required to accommodate this melange of regulation to the changing attitudes, goals, and conditions within the nation.

On the basis of the foregoing, it is clear that no specific detailed program can be presented for a regulatory solution, nor should such a solution be

presented in an overview study such as this. However, factors affecting such a solution and general concepts are presented in ensuing text. It can be hoped that additional insight and improvements may be made possible if a proposed commission on regulatory reform should be established by Congress. The results of this present study would suggest that continued regulation will be required in the transportation industry to some degree, but that selective deregulation may be possible - such as rate deregulation of the waterways industry as a whole, and that under special conditions virtually complete rate and service deregulation of transportation might be possible.

POTENTIAL REGULATORY DEVELOPMENTS/TRENDS

There is broad recognition that substantial transport industry assistance and regulatory changes are required - both within Congress and within the regulatory agencies. Thus, in the Second Session of the 93rd Congress, bills were introduced for establishment of a National Commission on Regulatory Reform (HJ Res 1166 and HR 17417 and SJ Res 253) to study and report on the impact of the Federal Communications Commission, Federal Power Commission, Securities and Exchange Commission, Interstate Commerce Commission, Federal Trade Commission, Civil Aeronautics Board and Consumer Product Safety Commission. The President has again proposed to the 94th Congress the establishment of a Commission on Regulatory Reform. The apparent will of Congress would seem to be to perform this work in existing Senate committees. Senate Bill 3604 in the 93rd Congress introduced by Senator Proxmire also proposed the abolition of the ICC.

The Surface Transportation Act of 1974 (HR 35385 by Congressman Adams et al) was directed primarily at assistance to the railroads in the northeast section of the United States. It would provide for Federal loan guarantees on loans to railroads amounting to \$2 billion, research and development efforts on development of a national rolling stock information system, and would prohibit discriminatory taxation on railroads by the states. With respect to intermodal aspects and

modal competition, the bill would allow a plus or minus 7 percent flexibility in railroad rates without ICC approval required (and would prohibit the ICC from interfering with such rate changes), and would allow railroads to realize the full benefits of lower competitive tariffs, providing they had invested \$1 million or more in a new service and the rate reductions were the result of that improvement. From the standpoint of competitive equity the "Adams Bill" would require the following:

1. ICC would be required to see that all rates under its jurisdiction at least cover variable costs.
2. ICC rates would have to be established to provide coverage of total operating expenses plus reasonable profit. (This provision was intended to insure retention and attraction of capital in amounts sufficient for a sound and efficient transport system in the U.S.).
3. Rate discrimination between commodity movements was allowed to the extent necessary to meet competition, but would otherwise not be permitted.
4. Rate discrimination would be outlawed where the purpose was to maintain a monopoly position and to discriminate between modes.

A provision of the bill strongly objected to by the waterways industry would have required the filing and publication of water transport rates for dry bulk commodities. Although it was not proposed to regulate such rates at the time, this was viewed by the waterways industry as a first step to regulation.

The waterways interest also feared the "Adams Bill" because they felt that the potential magnitude of federal expenditure might be such as to create an impelling need to protect that investment and lead to a favored position in Congress for the railroads. Bill S671 by Senator Humphreys would provide for a Federal Inland Water Administration within the Department of Transportation.

The ICC also has two major investigations under way with respect to rail-way rate structure, and railroad rate bases and rate of return - ex parte 270 and ex parte 271. These rate investigations have grown largely out of the fact that in recent years there have been general rate increases (many on a percentage basis) and these have distorted the relationship between costs and rates for short, and long distance hauls, and have impacted on competitive position between modes. This effect has been compounded because the Commission was not sure if the original rates were sound and properly cost-related to each other. However, sub part 5 of ex parte 270 concluded that the coal rate structure was satisfactory. This investigation could have a profound effect on intra- and intermodal competition.

The current hearings in Congress relative to granting the right of eminent domain to slurry pipelines could also have an impact on the volumes of western coal available to the railroads and to the waterways industry. These could also have an impact on the water resources of the nation.

ECONOMIC IMPLICATIONS

User Charges

Economists argue that no economic means exist to control the use of any "free good" - that all things have time and place utilities and that most of these come down to (or can be represented or controlled by) money. It is their contention that any free good which serves a useful purpose will tend to be used to its full capacity, and problems of congestion will ultimately arise. They cite as examples the interstate highway system and the inland waterways.

Economists also contend that adjustment of the "utilities" of various goods and services by economic means can be used to achieve various public objectives, and that such economic adjustment is a simpler and often a better and less costly

way of achieving desirable goals (e.g., effective use of a facility) than by direct regulation. Such economic applications might be in the form of "user charges" for highways and waterways, or pollution taxes on effluent discharges or air pollution. Thus, bottlenecks, queuing and congestion problems at locks on the waterways could be reduced by locking charges which would direct lock use to those forms which had the greatest shipper utility. Further, overall usage of the waterways (or system demands) could be reduced by economic factors to a level the waterway could serve through a general user charge which would direct traffic to other modes, or result in some movements not taking place if they thereby no longer had adequate utility. Similarly, pollution taxes could be selectively applied until a desired degree of water quality in a river or water basin had been achieved.

Economic control applied in the form of taxes and charges can be an effective means of achieving certain single goals which can be defined in advance, and have the advantage of being revenue-producing and can be applied through a trust fund, or other means, to supply facilities to serve those taxed - a favored economic principle is that the beneficiaries should pay for the costs of the services provided or made available.

As a result of the foregoing line of thought and current conditions there is an increasing demand for the imposition of some form of user charge upon the waterways. This comes from the railroads so that they can better compete; from economists, because they see it as a fair charge, a means of lessening the federal burden, a matter of principle that those who benefit should pay, as a means of rationing a scarce economic good, and to defray losses incurred to the general public - such as loss of power generation capacity by water usage for navigation in multi-purpose dams, etc.; and from the federal government as a means of lessening need for federal funds and taxation. Strong sentiments also have been expressed in the Department of Transportation, Office of Management and Budget, and by some members of the Congress for the imposition of user charges on the

waterways. Thus there is a general dissatisfaction with the method and extent of regulation of the transportation industry and with the apparent lack of a workable transportation policy. It would appear likely that legislation changes will be forthcoming which may significantly affect the separate modes of transportation and their relationship to each other.

User charges have been unequivocally opposed as a matter of principle by the waterways industry. They fear that, once the principle is accepted, the rates will be raised to such an extent that the waterways can no longer effectively serve as part of the U.S. transportation system. Advocates of user charges maintain that they don't propose to apply charges to recover the prior sunk investment, nor possibly even all of the present cost of operation and maintenance - but, that user charges should pay for new improvements and that they would be beneficial as a device to reduce congestion and possibly eliminate the need for some new facilities. They further maintain that user charges applicable to construction, operation, and maintenance of a new facility should be deducted from savings benefits for all new projects, whether imposed or not.

To counter arguments that such user charges would damage the waterway industry - "zero-sum" concepts have been proposed in which user charges would be imposed on all those who used a facility (such as a lock), but those who made the "best" or "highest" or most efficient use would receive an annual rebate. The amount of rebate to users would vary according to the degree that they conformed to desired uses - with the intent that the rebates to the more efficient or "better" users would be exactly counterbalanced by the charges on less efficient or "lower" users. User charges could also be rendered more palatable by putting them into a trust fund for waterways improvement and expansion.

Major arguments against user charges are usually based upon premises similar to the following:

1. **No charges should be levied because the flow of social benefits transcends the pricing mechanism (this argument has been employed against charging for air traffic control services).**
2. **The project provides benefits which are so complex/broad that it is not possible to identify and properly allocate the charges.**

To the foregoing might well be added the position of the waterway industry that it is the will of the Congress/people that the waterways should be free; the precedent against such taxes; and that the anticipated disbenefits to the nation/regions will exceed any possible benefits obtained by the imposition of such user charges.

There is no right or wrong, or black or white, about the various positions espoused - only shades of gray depending upon position. What is needed at this time is a long range viewpoint to consider what the future needs and goals of the nation should be, and then a determination must be made as to how the nation can best be served in the short term to reach the desired future objectives.

Thus, the railroads must be encouraged to technologically innovate and to reap the benefits of their innovation, and at the same time the waterways must be maintained to meet the needs of those dependent upon it and to serve the expected great future transport requirements. For this reason it is recommended that user charges be studied to evaluate their impact but that no precipitate action be taken to impair the ability of the waterways to serve future transport needs nor to impair the economic health of particular industries or regions - without first determining that the gains are commensurate with the resultant dislocation and losses.

Comparative economics of barge versus rail transport are presented in Table 2-1, along with illustrations of some user charge concepts and estimates by others of potential diversions as a result of user charges of various magnitudes.

Table 2-1

BARGE VERSUS RAIL - COMPETITIVE ECONOMICS

SELECTED COMMODITY MOVEMENTS	VARIABLE COSTS ONLY DOLLARS - KEARNEY STUDY							TOTAL AFTER INVENTORY		NET BARGE ADVANTAGE AFTER FUEL TAX		CHARGES		
	COMMODITY	FROM	TO	LINE HAUL	HANDLING		TOTAL	INVENTORY COSTS (1)	INVENTORY COSTS	¢/GAL (3)	¢/27¢/GAL (4)	ALTERNATIVES BASIS	WATERWAY OPERATING & MAINTENANCE COSTS @ \$77 MILLION/YR	WATER OPERATING MAINT & CONSTR. COSTS @ \$233 MILLION/YR
					LOAD	UNLOAD								
(1) Rail Water	Cash Grains	Sioux City	Chatta nooga	9 80 6 39			10.65 7 19					1) Fuel Tax (Variable Cost) or 2) Annual License Fee (Fixed Cost) a) Barges Only or b) Towboats Only or	9¢/Gallon	27¢/Gallon
			Barge Advantage Δ	3 41			3 48	(1 24)	2 22	1 62	44			
(2) Rail Water	Grain Mill Prod	Chicago	St Louis	3 46 1 45			4 31 2 25						\$4/Ton of Capacity (Jumbo Barge) (\$5,600/Yr)	\$12/Ton of Capacity (Jumbo Barge) (\$16,000/Yr)
			Barge Advantage Δ	2 01			2 06							
(3) Rail Water	Primary Iron & Steel	Pitts- burgh	Louis- ville	5 12 1 33	30 1 50	30 1 50	5 72 4 33						\$62/HP (6,000 HP Towboat) (\$372,000/Yr)	\$186/HP (6,000 HP Towboat) (\$1,116,000/Yr)
			Barge Advantage Δ	3 79	(1 20)	(1 20)	1 39		1 13	92	48			
(4) Rail Water	Paper	Vicks- burg	Chicago	6 13 3 02	45 1 30	35 1 30	8.93 5 62	45 (2) 89 (2)	7 38 6 51			3) Segment Tolls (Variable Cost) Mississippi Kentucky River Average	01¢/Ton Mile 3.5¢/Ton Mile .054¢/Ton Mile	
			Barge Advantage Δ	3 11	(85)	(85)	1 31	(44)	87	49	(28)			
(5) Rail Water	Fabricated Metal Prod	Chicago	St Louis	4 32 1 45			6 32 4 45					4) Lockage Fee (Variable Cost) (5)	\$100 - 1,000 Est	
			Barge Advantage Δ	2 87			1.87							
(6) Rail Water	Metal Ores	Corpus Christi	Sheffield Ala	10 19 5 66			11 24 6 46							
			Barge Advantage Δ	4 53			4 78							
(7) Rail Water	Nonferrous Primary Metals	Little Rock Ark	Mobil Ala	5 89 3 18			6 49 6 18					Resultant Estimated Diversion of Traffic Charles Rivers Study Kearney Study Swift & Spencer	20% for 9¢/Gallon Minimal (5)	
			Barge Advantage Δ	2 71			31							60% for 24¢/Gallon (6)
(8) Rail Water	Sugar	New Orleans	Chicago	6 44 3 91			7 64 4 81							
			Barge Advantage Δ	2 53			2 83	(41)	2 42	1 90	88			
(9) Rail Water	Coal	Hunt- ington W Va	New Orleans	7 17 4 44	45 45	90 90	8 52 5 79							
			Barge Advantage Δ	2 73	00	00	2 73	(07)	2 66	2 09	98			

(6) Source Swift & Spencer 1973

(5) Source Domestic Waterborne Shipping Market Analysis Inland Waterways Trade Area Report A T Kearney Inc Feb 1974

(4) Recover \$233 Million/Yr Annual Construction, Operating & Maintenance Costs of Waterways

(3) Recover \$77 Million/Yr Annual Operating & Maintenance Costs of Waterways

(2) Value \$162/Ton, 5 Days by Rail, 10 Days by Barge

(1) 055%/Day = 20% Per Annum

Subsidy

Economic means can also be used to achieve public goals by direct subsidy or provision of facilities for general use out of public funds. This is a role frequently assumed by the Federal government for projects which are deemed in the public good, but for which the direct benefits cannot be clearly allocated, projects which are not likely to be undertaken by lesser forms of government or private industry because of cost or size, or projects to be achieved at locations other than where a private facility might be installed, or where a project recognized as having public worth could not otherwise be provided. Thus, for example: farmers are subsidized to encourage them to take actions which are considered to be of benefit to them or to the nation by planting certain crops or storing them; our merchant marine is directly subsidized by funds supplied to make our shipyards competitive in costs to foreign yards; U.S. lines in foreign service receive operating subsidies to allow them to compete with lower cost foreign shipping; harbors and inland waterways (including channels, locks and dams) are planned, constructed and maintained and locks are operated by the Corps of Engineers for projects authorized by Congress - subject to the availability of funds and compliance with environmental restrictions; navigation aids, safety measures and emergency assistance are provided by the Coast Guard; and state and local government receive Federal aid for interstate highways and their urban connectors.

Problems of Application of Economic Regulation

Unfortunately, the application of economics to national multilevel goals is not a simple matter in its implementation. In spite of the general recognition of the value of the principle that people or industry should be willing to pay for benefits received and that these costs should be borne as close to the beneficiary or user as possible, it is often extremely difficult to establish any clear, viable and equitable means for imposition of such charges. Further, there are many worthwhile needs or goals which would probably never be realized unless the

charges or costs were considerably removed from the beneficiaries. This is the rationale behind federal expenditures for transport - especially since transport is such a key factor in decisions regarding plant and industry location (thereby affecting regional development) and such a large percentage of the delivered cost of goods; this in turn affects our ability to compete in foreign markets. In addition, the large public investments are significant contributors to stimulation of the local economy, in terms of jobs and demands for materials and services in the area in which construction takes place.

The problem which now arises is that the nation is faced with significant problems and needs, a high level of national debt, and competing demands for funds which cannot all be served. This is the climate which has led to increased clamor for some form of user charges by economists generally, and by many in the executive branch of government. A climate is now being created in which it is quite possible that in the future the often expressed will of Congress that the waterways shall be free to all will be superseded by imposition of user charges. This is, of course, avidly supported by the railroads because of their high fixed charges resulting from private investment which render them less able to compete with those other modes of surface transport supported to a greater degree by federal expenditures. It remains to be seen whether, and to what extent, subsidy will be continued or user charges will be imposed, and whether such actions will result in overall benefit to the nation and to the long term objective of economically serving our projected large future demands for all forms of transport.

Cost/Benefit Analysis and New Water Projects

Those waterways which offer the greatest benefits and could be developed at the lowest costs have already been largely developed. This fact appears to be recognized by the waterway industry, and the consensus of opinion seems to be that the industry would prefer to see existing waterways adequately maintained and improved in preference to new waterway construction - especially with the

prospect of reduced funds available for such waterway operation, maintenance and construction.

The appropriate basis of calculation of cost/benefit ratios as a means of ranking public investment, or the basis for decision as to whether such new investment should be made is also a matter of great current debate. Congress recognized at an early date that some means had to be established to aid them in making decisions about appropriations. Therefore, they established the "cost/benefit" approach which required that it had to be established (in the absence of some other reason) that the benefits for a new project must exceed costs. This principle is accepted by most but, as noted, there is great difference of opinion on its application.

Future benefits must be discounted by some discount rate percentage to economically relate these future benefits to the present (present worth concept). Adversaries (those opposed to or competing with the beneficiaries of a project) generally push for higher discount rates to make the evaluation "realistic" and to reduce the value of distant future benefits; they are supported in this by the Office of Management and Budget which believes in everything paying its own way and thus advocates discounting at the cost of capital to the Government. Advocates generally claim that the present discount rates are too high because they will cause many a good project never to be constructed; they also cite the fact that the actual benefits resulting from later usage often exceed the initial estimates. A frequent argument also advanced is that there is a "need" for the project now, or a future need which would require making appropriations now for the facility to be ready when needed.

In addition to the factor of the appropriate present worth of future benefits, there are questions as to what benefits consist of. There are questions whether benefits should include savings in facilities which would be otherwise required, reduction of losses that are estimated to occur over the life of the project, and transportation cost savings as measured by the difference between existing rail rates and future barge costs. Purists decry the fact that waterway transportation

savings comparisons, by law, are made on the basis of savings to shippers measured by the present rail rate vs. expected barge cost, and not on an actual cost comparison basis. The railroads also believe that the reduction in revenue to them should be considered a "disbenefit" to waterway projects. Further, a question also remains as to the benefits which should be considered; thus, the Corps of Engineers can only consider primary or direct benefits in its evaluation, but the TVA can include secondary benefits in its evaluation of new projects.

Finally, there remains the primary problem as to whom the benefits actually apply and whether they are truly benefits or merely transfers. Thus, many economists point out that benefits which do not result in an overall demonstrable worth to the nation as a whole (such as an increase in GNP) are not truly benefits for a Federal project, but merely act to redistribute or transfer wealth between regions or industries. Regional transfers may be significant but should not be confused with national economic gains.

These problems are cited to show that great difference of opinion exists, and to point out that considerable precedent has been established. Thus, any contemplated project evaluation changes must be considered in the light of past actions, how effectively these prior actions have served the nation to date, and what the impact of such future changes might be. Such considerations are made more difficult by the limitations on funds available, the competition for available funds, and the changes in emphasis on national goals.

With respect to the waterways in particular, the decisions are also made more difficult because of the need to preserve the value of the large public investment already made to date, estimated at 3.3 billion dollars.

INTEGRATED TRANSPORT SYSTEM - INTERMODAL MOVEMENTS

The achievement of an integrated transport system in the United States is an objective of both the Department of Transportation and the United States Army Corps of Engineers. However, again, it is necessary to carefully distinguish

between an integrated transport system (one in which each mode is employed to produce the greatest overall transport benefit to the nation) and a national transport system based upon maximizing intermodal movements. It is quite possible that an integrated system developed to its optimum would have a significant volume of intermodal movements between rail and truck, less truck and water, and only limited intermodal movements between rail and water. Further, it is possible to have commodities moving in intermodal traffic without the availability of through rates (in which one combined rate is offered for movement by two or more modes of transportation) and without joint rates (in which separate rates are offered for a continued movement of a commodity from origin to destination by two or more modes).

Factors Affecting Intermodal Movements

The extent of intermodal movements is affected by many factors including the following:

1. Handling costs involved in intermodal transfer
2. Time value of goods and relative speed of transport
3. The volumes of shipment and size of the units making up the shipment
4. Density or specific gravity of the cargo
5. Reliability, quality and regularity of service
6. Potential for in transit damage
7. Environmental risk entailed in the shipment
8. Safety

The foregoing factors may dictate for the shipper the modes, or a particular mode, of shipment irrespective of such factors as the ton-mile modal economic or energy efficiency of movement, or tariff differentials. The shipper places values upon the worth of a transportation service and these factors must be recognized in determining what the optimum integrated transport system of the U.S. should consist of.

Waterway Views on Intermodal Movements

Field interviews conducted with members of the waterway industry disclosed a very high degree of unanimity of opinion that intermodal movements were low in present or potential future significance to the inland waterways. Two terminal operators felt that intermodal had some significance in opening up new international markets, and in offering general benefits - although not reflected in the total share of volume movements.

Much of the heavy bulk movements on the waterways (except grain) moves directly from port to port with virtually no intermodal movement. Intermodal movements are largely confined within shipping limits, and more distant movements are typically by truck within the local area. Grain movements are an exception because they must be accumulated. Grain is typically transported by rail, or occasionally by truck, to a terminal where it is then processed and graded. If the grain terminal is in New Orleans, it is most probable that the grain will go by rail all the way to New Orleans.

The maximum waterway penetration inland from the river terminal was reported by one carrier to be 150-175 miles. Another terminal operator considered that steel could move up to 100 miles, and twine up to 300 miles. The limits on steel movements are determined by the intermodal handling costs and the rate structure established by rail lines serving the river port; those for binder twine, by the rapidity with which the farmer requires the material after its arrival at the river terminal.

The waterways industry felt that, irrespective of whether an integrated system should be developed or not, that shippers should continue to have free choice of transport mode. Some of the regulated carriers were of the opinion that intermodal movements could be expected to grow significantly, and that efforts should be directed towards bringing about an integrated system. It was felt that intermodal movement would have to be a part of the rate structure. It was also pointed out that most waterway traffic has a land origin, with an over-land haul to the river, and that relatively few movements were of the interplant type. River Forwarders Incorporated and Southern Railway operate as freight forwarders for the waterways and Valley Lines provides some consolidation services; River Forwarders accepts quantities as small as 30 tons. The only application of freight forwarders is in "pool barges". It is difficult for a forwarder to move an 800-ton barge load in a reasonable time and, therefore, the opinion within the waterway industry is that freight forwarder loads should go by rail or truck. It is not anticipated that shipments less than 600 tons will move in any significant quantities on the waterways.

Barriers to Intermodal Movements

The problems and barriers to intermodal movements include the following:

1. Intermodal handling costs
2. Resistance of other modes
3. Rate making and rate structures, lack of published rail rates
4. Port handling equipment
5. Customs
6. Uniform through bill of lading
7. Legal responsibility of inland carrier
8. Regulatory/institutional

It was deemed that a much higher degree of cooperation was needed at the operator levels between rail and water to develop intermodal shipments. Exempt carriers felt that supply and demand would provide the means to integrate the modes. Another comment offered was that railroad-water competitive rail rates should be dispensed with.

Intermodal Potential

American Commercial Barge Lines has developed an agreement for intermodal movement of coal arriving at the water in St. Louis by Burlington which would be transported onward by ACBL to water-located power plant destinations. ACBL commenced negotiation with the coal companies and the power plants, and then worked out an agreement with top level railroad management. A major factor in achieving the success of this joint movement was the fact that Burlington would be transporting coal on its own trackage only as far as St. Louis, and it would be necessary for them to either allow their unit trains to travel by other railroad lines to destinations beyond St. Louis, or to reload to other rail line cars for onward rail movement. One barge movement of coal on the waterway would accommodate the volume transported to St. Louis by three unit trains. Rail-originated waterway coal movements also occur in Illinois and Minnesota.

Phosphate rock originating in Tampa, Florida, destined for New Orleans is another example of an intermodal rail-water movement. Phosphate moves by rail to water, and by barge on the Intracoastal Canal. Rail supported and participated in such a joint movement because the commodity might otherwise move by truck.

Commodities mentioned as offering intermodal potential include the following:

1. Grain
2. Coal
3. Sugar
4. Semi-finished steel
5. Chemicals - packaged and bulk
6. Zinc
7. Ore
8. Forest products
9. Rubber (moving up from the Gulf of Mexico) with through truck rate to rubber manufacturing plants.

Container/Piggyback Potential

Piggyback movements and container movements are not seen as being applicable to inland water transport as long as packaged goods are not transported. A typical jumbo barge can transport between 25 and 30 trailers and approximately 36 40-foot containers stacked 4 long x 3 wide x 3 high. It was pointed out by the major regulated carriers (who have made studies of the potential of such movements) that the principal problems are those of accumulating a barge load within a reasonable time period and the need for an available back haul, or a reason for the commodity to move in containers.

Studies by the largest of the regulated carriers indicated that containers would be feasible to move by barge under the following conditions:

1. Possible to accumulate 26 containers in a short period (barge load)
2. Could transport 26 containers in a single point-to-point movement, or
3. Could transport a 26-container load to an export destination.

There is minimal revenue from the transport of 2 to 4 containers on the barge deck, and studies indicate that the delay to barge movements and the value of the container investment and cargo value of commodities moving in containers apparently preclude profitable container or piggyback movements. The only possible domestic container movement suggested was the possibility of one-way haul of sugar out of New Orleans.

In support of the foregoing, one of the major regulated carriers offered the following; it requires approximately 3 to 4 days to accumulate the 25 to 30 trailers required for a barge load, a day to load them and approximately 5 days to transport them to a typical destination. He indicated that since these were worth approximately \$40-45 per day this would make movement by another mode more economic.

The report by A. T. Kearney, Inc. for the U.S. Maritime administration generally supported the conclusions of the waterways industry with respect to inter-modal movements. As an example, the Kearney Report showed that for the movement of paper from Vicksburg, Mississippi, to Chicago, the difference between the total for line haul transportation and intermodal transfer would allow transportation of paper 10 miles from the river port by truck - based on typical trucking costs of \$.04/ton-mile. This was based upon the shipment originating at the water's edge at Vicksburg. If inventory costs based upon .055 percent per day of inventory value were applied, there was no residual saving at all to move the paper beyond the river port.

The Kearney Report also made an economic investigation of movement of a 40-foot container from Chicago to New Orleans by both rail and barge. Their

study indicated that after the drayage from shipper to terminal, loading the container, line haul, container rental and inventory cost, the net advantage to rail was \$44 for the container movement; \$507 for rail as compared to \$551 for the barge movement. This included container rental at \$5/day and an assigned inventory value of .055 percent per day on an assumed inventory value of \$2,400/ton. They also pointed out that a container lift to barge is more costly than loading on a freight car because of the more efficient facilities in rail yards to handle the high volume of piggyback traffic as compared to a river terminal; efficient equipment cannot be justified at the river ports because they are a low-volume operation and, therefore, lift costs are higher. They further stated that the long transit time by barge contributes to higher container rental costs for the marine movement and higher shipment inventory in-transit costs. They emphasized that the example presented was a long-haul movement which would tend to maximize the marine line haul advantage, and they thereby concluded that barge movement of containers is unlikely under present conditions.

Some container movements can be expected by LASH or Seabee barges in international trade because there is no additional interface cost at the coastal port, since containers remain on the barges. Further, the additional time required by barge as compared to rail or truck is diminished in importance because of the total overall greater time of movement for export and import shipments, as compared to the shorter domestic movements.

Factors Favoring Intermodal Movements

Intermodal waterways traffic movements are favored by the following conditions:

1. **Storage/classification/processing required at intermediate location between source and destination (e.g., grain)**
2. **Distribution/warehousing (e.g., semi-finished steel)**
3. **Rail connection with barge line and commodity transfer taking place at the outer limit of the service area of the originating rail line (e.g., western coal to St. Louis for transport to utilities)**
4. **Need for flexible distribution of liquid products from a pipeline terminal or distributors (e.g., oil and petroleum products distribution in irregular movements of insufficient size to warrant a pipeline for such service).**

Potential Intermodal Facilitation Improvements

There does not appear to be any substantial constraint to the achievement of an integrated intermodal national transport system which would preclude its realization through the normal legislative processes, and implementation by the existing regulatory authorities. To a great extent, the necessary permissive authority to encourage intermodal transport is already available. If the authority is not positively stated, at least the constraints which are on the books are limited to special situations. With proper policy direction and some legislation, existing legal and regulatory structures can influence the use of the various modes to substantially produce the results of an integrated transport system, and to increase intermodal movements as these may be appropriate. The speed with which this can be achieved will depend much upon the will, good faith, and conviction of those in position of authority acting within the established democratic processes.

Changes in the following areas would facilitate integration of the transport modes. However, while these changes would increase the potential for an integrated system, they may not all be in the best total public interest. This means that interpretation of service of the public interest should not necessarily be judged by whether intermodal potential is increased.

Legal and Regulatory Changes

1. Remove the dictate to the ICC by Congress that the ICC shall "preserve the inherent advantage of each mode". Such a policy is diametrically opposite to the objectives of an integrated transportation system.
2. Remove the rail anti-trust exemption on rate discrimination as it applies to intermodal competition. This inhibits use of the more economical mode.
3. Require all transport modes to publish rates. The lack of published rates by the waterways acts as a potential restraint to the establishment of through or joint rates by the railroad industry with waterways. However, publishing rates would reduce the speed with which rates would respond to changing conditions and would most probably lead to higher transport costs for those commodities now moving by unpublished rates.
4. Allow free ownership of one transportation mode by another. The barriers to ownership of barge lines by railroads where competing service is offered are a significant constraint to an integrated transport system. However, such ownership could be highly detrimental to the overall health and development of the waterways industry.
5. Apply more uniform regulatory restrictions to the various modes. Uneven regulation inhibits the competitive position of the more regulated mode. The ICC has no regulatory authority over movements between regulated and unregulated carriage.
6. Improve the position of the inland ports in foreign trade. Make available adequate customs service and prohibit rail discrimination against such inland ports by rate structures vis-a-vis coastal ports in export movements. Give FMC jurisdiction over export movements from inland ports.

Technological Changes

1. **Consolidate waterway terminals to achieve economies of scale and use technologically modern and efficient equipment. However, such terminals must be justified by the availability of adequate volumes through the terminals and are complicated by the extreme differences in water levels between high and low water at most river terminals. Present justification of such large terminals appears low in probability.**
2. **Concentrate emphasis upon either containers or piggyback as a means of intermodal movements. Piggyback favors trucking because it uses existing truck equipment, while containers would be advantageous to rail because the energy requirements of moving containers containing the same transported volume is less than the energy requirements for the same movements in trailers.**
3. **Standardize upon container sizes which can be efficiently transported by both truck and rail. Multiple container sizes (20, 24, 35, and 40-foot box lengths and 8-foot and 9-foot 6-inch height containers) contribute to increased difficulties in efficient handling of containers.**
4. **Institute the use of high capacity materials handling equipment at river terminals. Again, such efficient equipment is more costly and must be justified by available traffic.**
5. **Install suitable equipment for effective use of LASH and Seabee barges.**

Economic Changes

1. **Take no action which would reduce the transport cost differential between transportation modes. The imposition of user charges on the waterways would lessen the line haul savings by use of the waterways, and would reduce the intermodal potential because of the impact of the intermodal transfer costs.**

2. **Ensure that rates of competing modes are established on the same basis - such as full cost of service, or at least long run variable costs. This will tend to produce an integrated system of transport in which the values placed on the modes by the various shippers will provide the basis of optimization.**

The foregoing possibilities have been proffered upon the sole basis as to whether they would offer increased potential for increase of intermodal shipments, and have no other considerations as to feasibility or political pragmatism, or attractiveness in consideration of a national integrated system of transport to fit the needs of the nation as a whole.

Encouragement of Integration of U.S. Transport

Direct Approach. Direct encouragement of an integrated transport system depends upon the government integrating its functions of transport, coordinating activities at all levels, and removal of barriers and conflicts which negate worthwhile developments and preclude integration. Specific steps to accomplish these ends by activities of planning, regulation and improving competitive relationships in the interests of overall transport efficiency are treated elsewhere.

Indirect Approach. The indirect approach would include education of the public, shippers and industry regarding the benefits, capabilities and services of the various modes as they fit into an integrated system, and encouragement of the modes to integrate by such means as conferences and government-sponsored meetings. Selective taxation and user charges could be employed to encourage integration and influence the employment of modes as subsequently suggested. A program of studies, such as suggested in this report as further follow-on work, would also tend to induce integration of the modes.

Comments on Intermodal Aspects of Other Domestic Shipping

Coastal and Intercoastal. In coastal and intercoastal shipping, the bulk carriers - both liquid and dry - have been generally more competitive than general cargo carriers, largely because of bigger lot sizes, lower valued cargo, and more efficient handling procedures. Even so, this waterborne market has declined, losing ground to both rail and pipeline. Both the intercoastal water service between east and west and the coastal service have declined over time.

There are no legal, financial or regulatory arrangements that are foreseen to have the power to significantly increase the intermodal potential in this trade. The factors of relative economy, speed and regularity of service plus loss and damage of goods over the docks has swung more and more of this trade to rail movements. There is an open area of jurisdiction now between FMC and ICC in that FMC now has jurisdiction over the marine transport only if no land transport is involved in the same movement. Thus, the carrier can choose which agency he wants to have regulatory jurisdiction by the way he establishes the rates.

Great Lakes, and the St. Lawrence Seaway. While tonnages carried on the Great Lakes have been increasing, the Great Lakes' share of the total transportation market has been on the decline for the past 30 years, and was estimated to be down to about 6 percent of the intercity ton-miles carried in 1970. Iron ore, coal and limestone are the major items transported.

Although still a small part of the total Great Lakes traffic, there is a growing international trade in the higher valued cargos made possible by the opening of the St. Lawrence Seaway in 1959. This is the deepwater network of port and channels which connect the Great Lakes with the Atlantic Ocean and which is used to carry waterborne international commerce. This Seaway is in the peculiar position of depending heavily on a group of inland carriers, particularly railroads, which serve both it and the hinterland of competing deep water ports. The connecting routes to Seaway ports are often much shorter than the routes to alternate

coastal ports. No special arrangements are foreseen to produce a significant impact on this specialized trade.

Ocean. The U.S. pioneered containers and is pioneering in ocean barge transport. The latter is particularly significant because of the interdependence and commercial and economic relationship between ocean barge traffic, noncontiguous domestic trade, and inland barge operations. It has been fostered by the growing importance of the offshore states and territories, as well as by the need of the adjacent Caribbean countries and the Far East for low cost bulk transport of raw materials.

The dominant factor in trade with U.S. offshore states and territories is the Jones Act (Section 27 of the Merchant Marine Act of 1920). It excludes foreign built or operated ships from the domestic trade. The U.S. flag merchant fleet has declined over the past two decades, over 50 percent in number of vessels, and from 43 to 5 percent of the nation's ocean foreign trade. Despite this steep decline in the volume of foreign trade cargos, there has been a fairly stable volume of domestic deep sea cargo.

The factors which could influence increase in intermodal transport in foreign trade include a good simplified through bill of lading for movement by all involved modes, standardizing of commodity descriptions, agreement on "weight" or "weight or volume measurement" as a basis of tonnage tariffs for the land and ocean transport modes, and resolution of the conflict between ICC and FMC regulatory approaches and jurisdiction.

Ocean to Non-contiguous States and Territories. The non-contiguous trade consists of traffic to and from ports in the continental 48 states and those in Alaska, Hawaii, Puerto Rico, the Virgin Islands and other Pacific Ocean islands controlled by the United States. It is the strong expansion of this traffic that accounts for the stability in total domestic deep sea traffic, despite the decline

in dry cargo traffic in the coastal and intercoastal trades. Tanker traffic has increased much more spectacularly, a major factor being the discovery, a few years ago, of oil in Alaska. As a result of the construction of refineries in Puerto Rico using Venezuelan and Caribbean crude oil, Puerto Rican tanker cargo shipments have also risen. In all, non-contiguous cargos about equal the total tonnage carried by U.S. flagships in foreign trade. Containerization and rail/water intermodal is significant in movements to Hawaii, Guam, Alaska and Puerto Rico. Roll-on/roll-off is also important for movements to Hawaii.

With the impending large scale shipments of crude petroleum from the North Slope via pipeline to Valdez, Alaska, to California, it is estimated that as much as a quarter billion dollars per year may be generated in shipping revenues as the project comes into operation during the next decade. A fleet of new U.S. flag tankers will be required for this run, estimated to aggregate roughly 2 million deadweight tons.

No legal, financial or regulatory arrangements are foreseen to be required which would significantly improve intermodal coordination in this trade other than resolution of differences between FMC and ICC.

Foreign Ships in International Traffic on Domestic Waterways. With the introduction of LASH/Seabee barges, and mini-ships to a minor extent, foreign commerce has been placed farther upriver in the U.S. inland water system. This new interface raises a number of problems in facilitating the flow of international trade. These include the need for appropriate terminal and port facilities, channel depths, arrangements for the interchange and consolidation of containers and barges, documentation and customs procedures, marine insurance, coverage and claims, and familiarizing domestic operators with these new barge systems.

Federal economic regulation over water transportation in foreign commerce is now vested in the Federal Maritime Commission.

FACTORS AFFECTING MODAL REGULATORY NEED

Factors affecting the need for transport regulation, and precluding equitable competition between modes include the following:

- 1. Significant difference in size and economic resources between modes (a player with limited resources can never win at "table stakes" poker)**
- 2. Significant differences between the ratios of fixed and variable costs between modes**
- 3. Availability of large non-competitive markets to one mode and not to another**
- 4. Greater degree of subsidization to one mode than to another**
- 5. Major differences in the degree and type of competition within the total service area of the competing modes**
- 6. Significant differences between the type, need and extent of regulation applied**
- 7. Differences in profitability**
- 8. Differences in knowledge of true costs and in philosophy of allocation of costs and pricing**
- 9. Significant differences in ease/difficulty or cost of entry into business.**

PLANNED SUPPORT FOR TECHNOLOGICAL IMPROVEMENTS

As noted elsewhere, the inland waterways are technologically advanced, except for terminal operations and control and operation of the locks. The management of the waterways industry is generally alert, aware, and progressive with respect to technological change. Advanced technology is available for terminal materials handling, and it is employed to the extent that its use is economically justified and it is applicable to waterway conditions.

It is suggested that support for additional technological improvements take three forms, as follows:

1. Technological Research - including research into potential technological improvements and their application, and systems analysis of improvement in waterways facilities and their operation
2. Application and Dissemination of Potential Technological Advances - through government/industry conferences and seminars and furnishing of technical assistance, such as the assistance supplied by agents of the Department of Agriculture to the farmers of this country
3. Coordination with Other Industry and Government - to maximize the impact of technological gains made in transport.

INFORMATION NEEDS

Information needs required to advance the capabilities of the waterways and to aid in determining its potential in an integrated transport system are set forth under the Program of Future Work in the Summary and Critical Issues Section.

Planning needs for information would require availability of comparable information on rates, volumes, and operations from all modes and employment of this information for long range planning.

The waterways industry has little need for additional information regarding financing or operations - as they gather such information through their own operations and interchange of information between operators. The government could provide a service to supplant this in part by broader dissemination of information on waterway water levels (present and projected), lock congestion, etc. Information on advanced operating techniques could also be helpful to the industry.

Section 3

SUMMARY AND CRITICAL ISSUES

This overview study of the "Potential Role of the Inland Waterways in an Integrated U.S. Transportation System" has been commissioned by the Department of Transportation and the U.S. Army Corps of Engineers. An integrated system is considered in this study as one which in its ultimate development would result in all traffic moving by the mode or modes determined to be most fully in consonance with national goals and objectives, and with full ultimate integration of modes possibly requiring formal means such as positive regulation, common private ownerships, or government ownership. The study is intended to be free of an advocacy role for any transport mode. Further, it is intended to define issues and suggest a further work program, not to provide the answers expected to be developed in the ensuing more detailed studies.

One of the most readily apparent findings of the study was that the industry and government do not speak with one voice regarding the waterways and their problems, and what should be done to improve their effectiveness. It would be possible, with certain notable exceptions, to express virtually any viewpoint regarding the waterways and find it reflected by some segment of industry or government. Further, by knowing the position of any individual relative to the waterways, it can also be predicted with some degree of accuracy what his viewpoint may be. Thus, for example, viewpoints range from recommendations of full "laissez faire" and free competition by those carriers which are not regulated and haul exempt cargo, to a willingness to submit the entire industry to regulation to preclude the possibility of the ICC allowing railroad rate reductions to

compete with inland waterways movements. With respect to such a controversial topic as "user charges", advocates are found only in the railroads and in portions of government and academic fields and none are found in the waterways.

THE WATERWAYS INDUSTRY

The inland waterways industry is efficient and highly competitive, low in energy consumption, technologically advanced, healthy, and anticipated to grow in the future at approximately the same rate as it has over the last 10 years. Present institutional restrictions are not a severe limitation on the overall operation of the waterways. The inland waterways include over 25,000 miles of navigable waters.

The waterways are considered important to many regions and to the economic health of key segments of the U.S. economy, including agriculture, industry, petroleum, and utilities. Principal movements in order of importance are energy (in the form of petroleum, petroleum products, and coal) - accounting for nearly 60 percent of total; followed by sand and gravel, grain and grain products, sea shells, logs, industrial chemicals, iron and steel products, limestone, sulphur, cement, coal tar products, soybeans, bulk wood, fertilizer, and paper and paper products.

An estimated 85 percent of the waterway movements are in unregulated commerce. In 1973, 503 million tons were transported on the inland waterways excluding the Great Lakes; 51 percent of U.S. domestic waterborne commerce, and about 9 percent of total intercity ton-miles of commerce.

Intermodal movements on through or joint rates are virtually non-existent on the waterways, although most shipments are intermodal in the sense that they originate from, or are destined for, points off of the waterways.

Virtually all shipments are in barge loads (up to 1,500 tons) or greater size, transported for the most part in "integrated tows" - typically ranging up to 48 barges on the Lower Mississippi and 15 barges on the Ohio River.

There is a trend to larger companies in the industry and to ownership of such companies by large corporations and cooperatives.

Waterway shipments are viewed by shippers as being necessary to the nation and to industry, but confined primarily to liquid bulk and raw materials, followed in order by dry bulk, intermediate products and finished goods, and a poor last by general cargo. The benefits to shippers are viewed as being primarily economy, with availability, convenience (including movement of oversize manufactures), and the concept of a "materials pipeline" also of interest.

ROLE OF GOVERNMENT

The inland waterways industry is regulated by a plethora of government agencies. However, only about 10 percent of the approximately 1,850 companies engaged in the barge and towing industry in the United States are regulated under the Interstate Commerce Act; the other 90 percent engage in either exempt for-hire service, or in private transportation. Further, of the total commerce moving on the waterways, only approximately 15 percent moves in regulated commerce. Thus, the economic regulation of the inland waterways is restricted to a relatively small portion of the total. The following are the major roles of the principal Federal agencies affecting the waterways:

1. The Interstate Commerce Commission passively or actively approves published rate schedules of the common carriers and investigates and penalizes those carriers who fail to live up to common carrier obligations; provides a Certificate of Convenience and Necessity to enter the trade for common carriers and permits for contract carriers; can approve or deny mergers; and can approve minimum rates for contract carriers.
2. The U.S. Army Corps of Engineers is responsible for the construction, maintenance, and operation of some 22,000 miles of improved inland and intracoastal waterways including 275 locks and other control structures for navigation. Since the first appropriations for

river improvement in 1824, the Corps has been responsible for planning, constructing, maintaining, improving, and operating inland waterways including harbors for commercial navigation in the United States. This responsibility involves: (a) Providing and maintaining channels at their authorized depth and width, (b) Improving and maintaining harbors, including provisions of protective works such as jetties and breakwaters, (c) Providing condition surveys for channels and harbors, (d) Providing certain navigational facilities, and (e) Establishing locks and dams at strategic locations.

3. The Department of Transportation, through the U.S. Coast Guard, specified standards for safety and design and operation of vessels, maintains navigational aids on the waterways, and enforces the provisions of the Federal Water Pollution Act on the inland waterways. DOT, while denied an active modal administration role for the inland waterways, also influences the waterways through its participation on interagency committees and the Water Resources Council. DOT also has a statutory mandate to lead and actively participate in any major policy changes to improve transport, including intervention with other agencies and commissions. It has been assigned a facilitation role that includes the inland waterways.
4. The Maritime Administration, in its responsibilities to further the development of the entire U.S. shipping industry, has assumed the role of advocate for the inland waterways industry.
5. The Environmental Protection Agency enforces the provisions of the Federal Water Pollution Act and the National Environmental Policy Act on land.
6. The Occupational Safety and Health Administration enforces the provisions of the act by which this agency was created.
7. The Federal Communications Commission has jurisdiction over communications equipment and its use, and administers control over such.
8. Other Agencies. The waterways are also influenced by the actions of the Federal Energy Administration and, on multi-purpose projects, by Agriculture, Interior, Commerce, Federal Power Commission, and the Tennessee Valley Authority. Anti-trust laws are also enforced by the Anti-Trust Division of the Department of Justice. The Federal

Maritime Commission regulates international movements of LASH and Seabee barges. State and regional agencies (including state DOT's and environmental agencies) also impact on the waterways and their operation.

WATERWAY CONSTRAINTS/PROBLEMS

The problems of the waterways are generally not deemed to be insurmountable by the industry. The waterways generally have surplus capacity at the present time, but are congested and limited in certain key areas. Principal current constraints and problems include the following:

- 1. Institutional Constraints.**
 - a. Absence of uniform regulation and jurisdiction of regulatory powers as applied to the various modes**
 - b. Conflicts in regulations and jurisdictions between Federal agencies and state and Federal agencies - particularly in safety and environment**
 - c. Costs and restrictions resulting from safety, environmental, and operational regulation and restrictions - dredging, water pollution, and operational controls**
 - d. Railroad opposition and rate discrimination**
 - e. Competing demands for Federal funds and higher discount rates for cost benefit evaluation resulting in lessened availability of money to the waterways and elimination of some new and replacement projects, and stretch out of other projects**
 - f. Lack of waterway-knowledgeable personnel in regulatory agencies and lack of an advocate at the policy level in the executive branch of the government**
 - g. Potential water commitments to other consumptive uses - limiting the amount of water available for navigational uses**

- h. Potential future constraints include the possibility of "user charges", deregulation, railroad rate flexibility, and results of the government commitments to the railroad industry.

2. Physical Constraints.

- a. Inherent constraints - slow speed, size of minimum tender, circuitry, north-south orientation, limited service area, winter closure on northern waters, and low water closure on Missouri

- b. Locks and Dams

<u>Waterway</u>	<u>Constraint (Lock Name or Number)</u>
Upper Mississippi	26
Ohio	Gallipolis
Illinois	System "twinning"
Gulf-Intracoastal	Vermillion Calcasieu
Lower Mississippi River New Orleans Arcs	Industrial

- c. Waterways - Gulf Intracoastal needs widening from New Orleans to Texas, 12-foot depths desirable on the Ohio and all-year 10-foot availability on the Lower Mississippi
- d. Shortage of fleeting areas, auxiliary services, and trained manpower
- e. Terminal operations, communications, and aids to navigation
- f. High costs of intermodal transfer

POTENTIAL WATERWAYS ROLE

Waterways are now expected to continue in their present role as a transporter of high volume, large or bulk commodities - primarily raw materials, energy, and some intermediate products. Passenger traffic is expected to have only limited potential - possibly as commuter traffic in urban core areas or as recreational travel. This report addresses commercial use of the inland waterways and omits the large use by recreational boating on the inland waterways.

The ultimate share of the movements going on the waterways will depend upon the priority and value attached to the waterways and the economic control exercised to thereby increase or decrease the relative economic attractiveness of shipment by water versus shipment by rail. Should judgment of actual full costs of waterway movement and energy consumption be deemed lower for the waterways, presumably water transport might be encouraged by continuing restriction of minimum rail rates, elimination of rail rates discriminating against water, encouraging through and joint rail/barge rates, and continued public investment in water facilities. Conversely, if rail were deemed more important and a more desirable alternative, permitting greater freedom of competition by rail versus barge might greatly diminish the volumes moving on the waterways. The future role of the waterways will depend upon many forthcoming policy decisions - in such fields as regulation of rates, user charges, environmental protection, and energy and resource conservation. It will also depend on the technological improvements made in the rail mode.

TECHNOLOGICAL IMPROVEMENTS - WATERWAY VESSELS AND OPERATIONS

Technological improvements are concluded to represent little potential for advancement of the waterways industry. Tow size is presently at the maximum allowed by river and lock conditions, and towboats of the 10,000-horsepower size will handle the largest such tows. Economic factors and river conditions

limit the efficiency of river port technology, and the ports are generally as advanced as economic conditions will allow. LASH and Seabee barges (transported by a mother vessel between ocean ports and on the waterways in tows) are seen to offer some potential for intermodal in foreign trade, but piggyback and containers are not seen to have any present potential. Skimmercraft (hydrofoils and bubble vessels) may have some potential for commuting use on the waterways.

Roll-on/roll-off vessels offer potential for movements between non-contiguous U.S. states and possessions but will have little or no impact on the inland waterways. Mini-ships appear to have declining potential. Deep draft ports are expected to have no significant impact on the waterways since virtually all will be oil ports with offshore single point moorings.

Intermodal technology may be enhanced, as economically feasible, by broader application of use of containers and port side container cranes and by greater use of LASH or Seabee. The latter are only anticipated to continue as a small fraction of inland waterways movements.

INTERMODAL COORDINATION

Changes in the following areas would facilitate intermodal coordination. While these changes would increase the potential for an integrated system, they may not all be in the best total public interest, politically pragmatic, nor economically feasible.

Legal and Regulatory Changes

1. Remove the dictate to the ICC by Congress that the ICC shall "preserve the inherent advantage of each mode."
2. Remove the anti-trust exemption on rate discrimination as it applies to intermodal competition.

3. Require all transport modes to publish rates.
4. Apply more uniform regulatory restrictions to the various modes.
5. Improve the position of the inland ports in foreign trade.

Financial Changes - allow free ownership of one mode by another.

Technological Changes

1. Consolidate waterway terminals to achieve economies of scale and use technologically modern and efficient equipment.
2. Concentrate emphasis upon either containers or piggyback as a means of intermodal movements.
3. Standardize upon container sizes which can be efficiently transported by both truck and rail.
4. Install suitable equipment for effective use of LASH and Seabee barges.

Economic Changes

1. Take no action which would reduce the transport cost differential between transportation modes.
2. Ensure that rates of competing modes are established on the same basis - such as full cost of service, or at least long run variable costs.

Rail/waterways intermodal potential could be advanced by allowing the railroads to own barge companies, by the availability of published rates for barge shipments, and by prohibition of rail discriminatory rates to meet water competition.

Truck/waterways intermodal potential does not offer great significant opportunity for enhancement by legal, financial, and regulatory arrangements; because the modes are largely complementary.

Domestic intermodal with ocean shipping could be enhanced by removing the shipping company option of regulation by FMC or ICC depending upon whether land rates are included as part of the through movements.

Domestic ocean and foreign shipping would benefit in intermodal movements by availability of improved through bills of lading, common commodity descriptions, uniformity of container sizes, and settling upon use of "weight or volume measurement" tons or "weight" tons rate determination for tonnage by both water and land transport modes.

ECONOMIC AND SOCIAL ISSUES

National economic and social problems are affected greatly by transport. The waterways contribute to national goals by being the most efficient of all modes on a ton-mile basis of energy consumption and in efficient labor utilization cost offered to shippers and will encourage raw materials development in new regions and manufactures in populated regions. Inland ports extend the benefits of water transport to the regions they serve and contribute to adjacent land values - particularly waterway sites for inland industry. Deepwater ports provide the link between domestic inland water transport and foreign trade.

The subsidization of the waterways by provision by the Federal government of locks, dams, and canals, and their operation and maintenance as well, induces a misallocation of resources benefitting one region at the expense of another and conceals the true social cost. This is becoming more critical as development is considered of waterways which are higher in cost, which offer less benefit potential, and which are becoming progressively more inflated in cost.

Social well-being is enhanced by the waterways by contributing to broader distribution of population and industry - although there is no explicit population distribution policy. This population distribution is also seen as contributing to higher categories of land use.

The potential for reduction of congestion and costs of highway maintenance by enhanced use of the waterways is seen as very slight - because of the complementary roles of the modes.

Waterways and dams contribute to the environment by protecting from flood damage, by the low risk in transport of hazardous materials, and by the low air and noise pollution. They also afford recreational benefits by the water pools made available and the extended water flow season. However, they tend to degrade natural stream beauty in many instances and change the character of fishing. The waterways offer the least potential for job creation of any of the three modes of surface transport.

CRITICAL ISSUES

The critical issues facing the inland waterways may be broadly grouped within three general areas: issues relating to waterways development and maintenance, modal competition, and regulation.

The first waterway development and maintenance issue relates to the appropriate standards by which new waterways projects should be evaluated. Present law spells out the number of years over which benefits are to be calculated; that "rates" rather than transport "costs" are to be used to calculate benefits; and the law specifies the discount rate to be applied to benefits - for fiscal year 1975, 5-5/8 percent. Advocates of competing modes and many transportation economists suggest such changes as use of "cost differences" and inclusion of "user charges" for waterway projects in calculation of benefits, and discounting future benefits at the current cost of capital. The railroads contend that loss of revenue to their

industry should be deducted from the benefits. The waterways industry contends that there should be a lower discount rate to preclude elimination of "worthwhile projects", and seeks broadening of benefits to include secondary benefits as well. The industry has also advocated an "inflation impact assessment" to measure impact of project delay on rising costs.

The second waterway issue has to do with environmental limitations on construction of new waterways and maintenance of existing waterways. The Upper Mississippi is particularly environmentally sensitive, as is the Apalachicola River in Florida. All new projects must provide for dredging spoil disposal areas. Further, all new projects must go through the extensive problems of preparation of Environmental Impact Statements. The waterways industry and its advocates do not view such requirements as being in the best interests of the nation (and their industry), and they contend that the delay in construction of Lock 26 could result in a future fuel shortage in Chicago if a cold winter occurred. They also view the acts of the environmentalists and the intervening railroads as pure harassment. The environmentalists claim that they need to protect the Upper Mississippi from any possibility of the negative environmental effects of deepening to a 12-foot channel (for which they view the proposed deeper lock sill of Lock 26 as the first step). They are concerned over placing dredging spoil on, or flooding of, valuable wetlands on the Upper Mississippi.

Competing modal alternatives also present problems to new waterway project developments. The railroads claim that proper consideration of other transport alternatives has not been made for the Lock 26 assessment (e.g., rail) as an alternative for the increased volume of traffic movements presented as part of the benefits of Lock 26, and other intervenors are concerned that a proper assessment has not been made for a project of the magnitude of \$383 million.

Water availability may be a critical issue on some waterways, possibly the Missouri. Consumptive use of all or virtually all of the water of the Missouri would probably require one or more locks and dams on the Lower Mississippi.

The time to realize new waterway improvement projects is also a critical issue, as a span of 18 to 22 years is typical of the time from inception of a new project to its placement in full operation. The time is required by initial studies, engineering, permit requirements (including environmental assessment), approval, allocation of funds (including stretch out), and construction.

Monetary factors of inflation and escalating costs are critical issues as well, as costs of new construction appear to be rising faster than resultant benefits of projects. The lessened availability of Federal funds for such projects, the change in emphasis of Federal goals, and the competition for such funds also contribute to making monetary matters a critical issue.

Modal competition issues relate to economics and regulatory factors. In 1973 the trucking industry paid \$5.3 billion in taxes to the states and the Federal governments in highway use taxes. The users of the inland waterways paid no similar taxes on the waterways. Further, the Corps of Engineers maintains the waterways of all approved projects (as they do the channels of deep water ports), and constructs and maintains and operates the locks; the Coast Guard also installs and maintains the aids to navigation.

Trucks are allowed use of the highways and streets, paying highway use taxes which defray a substantial part of the costs for the use they make of them.

Many railroads, primarily the western railroads, had substantial Federal land granted to them, and they are provided Federal aid for grade crossings and for replacement of bridges deemed "a hazard to navigation". However, the railroads are considered to have since repaid the value of the land grants by providing transport of goods for the Federal government at reduced cost. Direct aid is now proposed to certain railroads in dire financial straits in the form of loan guarantees and grants. In addition, the general exemption of the transport industry to certain provisions of the anti-trust act has allowed the railroads to practice rate discrimination to compete with water transport movements (by Section 5A of the Interstate Commerce Act).

The foregoing is merely indicative of some of the complexities, problems, and background behind the position of the railroads that beneficiaries should pay for benefits, and the thrust by the railroads to have "user charges" imposed upon the waterways. User charges are also advocated by many segments of government (including OMB and the National Water Commission), and by many transportation economists. Just as consistently they have been opposed in the past by Congress and the waterways industry. User charges are clearly a critical issue.

Another critical competitive mode issue is that of "transportation companies" in which railroad companies would be permitted to own barge lines. This is now restricted by the Panama Canal Act (largely to preclude the abuses that drove the packet boats off the waterways) in those cases where the railroad offers competing land service. The waterways fear that the combination of a monopoly position over most of the railroad service area (on land) in conjunction with their greater financial resources would allow the railroads to drive the present barging industry out of business by lowering rates. Further, they contend that the efficiency of the waterway industry and the prevailing direct competition keeps present rates so low that the railroads could not lower costs. Conversely, the railroads would like to diversify and enter an apparently profitable business, and to control through traffic movements to a greater extent. Shippers have an interest in "transportation companies" in the context of potentially lower rates and dealing with fewer groups. This is a critical issue because of its possible great impact on the waterways.

Rate competition is also a critical issue, because the extent to which the railroads can lower rates to compete with the barging industry affects the modal split and the waterways industry. The waterways fear that permitting the railroads to compete with waterways on the basis of sole recovery of "short run

variable costs" (avoidable costs) would also drive the waterways out of business. The waterways claim that the competing rail rates should be based on "full costs." Most economists advocate competition on the basis of "long run variable costs."

CONCLUSIONS

The following conclusions have been reached as a result of this study:

1. To adequately meet the projected future transportation needs of the nation, all transportation modes will have to be strong and healthy.
2. Each of the three surface transportation modes of the United States has its own area in which it plays a dominant role in the transportation system. However, for many shipments rail competes with both trucks and water transport; trucks and barges are largely complementary.
3. The best use of each of the various transportation modes should be encouraged, as reflected and defined by the national interest.
4. There is no broadly recognized meaningful national transportation policy, nor a corollary waterway transportation policy. Existing national policy statements are in conflict.
5. Barring major changes, the effects of an integrated transportation system will probably be realized through direct and indirect encouragement, and by providing economic conditions that will favor such development. Equitable joint or through rates are probably one of the most important developments which would foster integration. It is now difficult to establish such rates and it would be better if some formal basis existed by which joint and through rates could be established with exempt carriers. Encouragement of intermodal movements could be commenced for regulated carriage by the ICC using its power to establish through rail-barge rates for commodities regulated in both modes, and its power to establish the modal division of the transportation revenue from such movements. Integrated transport could also be advanced by improvements in interface hardware capability to make modes compatible and to increase the physical efficiency of the interface between the modes.

6. An adequate rate of return is necessary for each mode if it is to attract the necessary capital for maintenance, replacement, and expansion of facilities to provide services demanded by shippers. However, the market will determine whether the mode can earn such a return.
7. "Transportation companies," based upon railroad ownership of rail and barge lines, under present conditions of railroad territory limitations would probably offer insufficient benefits to offset potential disadvantages and risks. However, quite a few shippers expressed an interest in transportation companies including, surprisingly, some who transported significant volumes by water. It was felt that this latter viewpoint represented a desire for the benefits of through bills of lading and joint rates. Transportation companies, are not anticipated in the relatively near future, but may be a potential long-range development or may arise as a result of policy or regulatory changes.
8. It appears that a slight trend towards greater cooperation between rail and water transport is commencing. Examples of this are the rail/barge movement of western coal to Central U.S. utilities, and the cooperation of the modes in supporting the "Surface Transportation Act."
9. Rail technology improvements could alter the modal shares--increasing rail traffic at the expense of trucks and barges. In the absence of such improvements, the modal share is anticipated to remain approximately the same.

Waterways Industry

1. The inland waterways industry is a virile, healthy, individualistic, growing, progressive, highly competitive low-cost transportation mode.
2. The waterways industry will continue to grow and prosper as long as no significant changes detrimental to it occur in regulation or imposition of charges, and as long as the waterways can continue to be maintained and improved commensurate with traffic growth.

3. The waterways are presently considered essential to the economic health of the nation, particularly to certain regions and to large segments of key elements of the United States economy, including agriculture, manufacturing, energy, and utilities.
4. By the low transport costs afforded, the waterways expand the export market for our products.
5. Institutional matters (embodying laws, directives, and regulatory and other agencies of Federal, state, and local government) presently have relatively minor total impact on the waterways as a whole and upon total traffic movements. If future legal and regulatory conditions are comparable to present laws, and if laws are administered and enforced by present agencies similar to the way they now are, institutional matters would be expected to have relatively minor future effect on waterways operation and growth as well.
6. The technological development and efficiency of waterway operations and of towboats and barges is high. The benefits of economy of scale have almost entirely been realized in terms of management and size of physical facilities and equipment of the waterways. Except for selective channel deepening and replacement of certain locks, possible selective extension of certain waterways, and some non-structural improvements, it will become progressively more difficult to justify future increases in capacity of the present waterways network or size of equipment on the basis of efficiency and cost/benefit ratio. No significant major technological improvements in the waterways industry are anticipated. However, there will be broader application of present levels of technology and small incremental improvements.
7. There is a trend to larger companies in the inland waterways transport industry, to consolidation of firms, and to the ownership of waterway transport firms by large corporations and cooperatives. This has already largely taken place and its continuation is expected to produce little further effect.
8. Rising costs of goods and rising interest rates are factors which decrease the attractiveness of movement of finished goods and higher cost commodities by water because of the impact of cost of capital.

A need by industry for larger inventory quantities of raw materials, or semi-finished goods stockpiles, could increase waterways use (materials pipeline/floating warehouse concept of the waterways). Rising costs of energy tend in part to offset the foregoing trends because of the lower energy intensiveness of water transport as compared to other surface modes.

9. Waterways are expected to continue in their present role of transportation of high volume, large or bulk commodities over long distances.
10. Future waterways traffic projections were not part of the study, but it is anticipated that future growth will be at approximately the same rate as has taken place over the last 10 years, and that possibly greater volumes of such commodities as grains, chemicals, coal, ores, and cement may move on the inland waterways. Conversely, there may be a lessening in the percentage share of total for such movements as iron and steel, and in movements of regulated commodities generally. Application of improved rail technology could adversely affect waterway potential.
11. The exempt share of traffic movement is anticipated to stay at about 85 percent of the ton-miles moved on the inland waterways, or could possibly rise as a result of greater coal movements.
12. Minimum quantities of tender for shipment will rise from the present 300-ton minimum to approximately 600 to 1,000 tons, or possibly 1,500 tons. Small shipments and rapid service are considered to have no place on the inland waterways.
13. Intermodal movements in regulated common carriage by joint rates or through rates are expected to remain a small share of the 15 percent of the traffic now moving in waterway regulated carriage. The volume of such movements will depend to a large extent upon the growth and acceptance of Seabee and LASH. Other than Seabee/LASH, little or no waterways traffic is expected in containers or trailers, nor is freight forwarding seen as a factor in the trade. Increased intermodal movement of western coal by joint or through rates is anticipated.

14. Only limited development of new waterways/river canalization is anticipated - some now planned or authorized may never be built because of reevaluation, competition for funds, or environmental opposition. However, the need to fully develop major river basins to conserve water could result in waterways extensions or in some new waterways. Planned or approved waterways which might be affected by this limiting trend could include the Tennessee-Tombigbee, the Cross Florida Canal, and the Trinity River project in Texas. Rising costs and declining potential economic benefits of incremental additions will result in an economic limit for new projects within the foreseeable future. Environmental opposition, changes in national goals and Federal economies in the face of rising inflation are anticipated to further limit system expansion. However, while little or no construction of new waterways is anticipated, deepening of part or all of several of the major waterways is considered to be highly likely.
15. Continued regulation of the waterways by the ICC, assuming no major changes, is anticipated by those regulated carriers engaged in the movement of regulated commodities. In the opinion of the regulated portion of the waterways industry, the Interstate Commerce Commission is knowledgeable and performing a good job. However, in view of the competitive nature of the industry and the small volume of traffic moving in regulated commerce, consideration may ultimately be given by the ICC to the removal of economic regulation of waterway rates over a period of time; it appears probable that such changes are now under active consideration. Such deregulation might mitigate against the service available to the small shipper and could reduce the value of the investments of the regulated common carriers.

RECOMMENDATIONS

Basis of Recommendations

The conclusions of this study reflect the opinion that the integration of the U.S. transportation system means, for the most part, integration of water and truck with rail transport and strongly infers a necessity of helping the rail mode.

The forthcoming decisions which are necessary and which will be made with respect to rail transport will affect all other modes of surface transport. The impact of these decisions will in all probability result in diversion of traffic from trucks and water to the rail mode.

There is no question but that rail is in the greatest need of assistance at the present time. However, great potential exists for increases in efficiency in interchange and in use of rail rolling stock and rail right-of-way. Rail has not kept pace with the changing needs and demands of the marketplace and has not provided the service and rates necessary to attract the volumes required to support a strong and healthy rail operation.

Rail interchange with truck is indicated to be feasible, practical, and desirable. Technology exists to facilitate such efficient interchange and there is potential for rail improvements which should make rail/truck intermodal movements desirable for many of the most preferable types of rail traffic. Such intermodal movements offer significant potential for increased over-all transportation efficiency and for significantly lower energy utilization by the transport modes. A substantial market for such an improved intermodal service and exchange between truck and rail exists as well.

In contrast, waterway traffic does not lend itself readily to increased rail/water interchange. This reflects the nature and value of the commodities, differences in speed, high costs of intermodal transfer, and shipment size and volumes of movements. Because of the limited economic potential and the limited difference (relatively as compared to rail/truck) between rail and water in transportation cost and energy utilization, there appears to be only slight potential that conditions can be sufficiently changed, without substantial government intervention, to make massive intermodal rail movements with inland water attractive in the marketplace. However, as noted, there are special isolated circumstances for specific commodity movements which appear to offer real intermodal potential.

The following recommendations reflect the foregoing conclusions regarding an integrated U.S. transportation system. An attempt has been made to develop examples illustrative of the types of action which might be taken to implement many of the various specific recommendations.

General Recommendations

The general recommendations of the study are directed towards methods or means to develop and realize the benefits of an improved integrated transportation system in the United States. These general recommendations follow:

1. Improve the capability, utilization, efficiency, and service of each mode in the type of movement for which it is best suited. As a corollary, remove or lessen the restrictions inhibiting the activities or proper development of each mode.
2. Promote the exchange of movements between modes and the complementary use of each to optimize the utilization of the best capabilities of each.
3. Encourage movements of commodities by the transport mode which would make the use of the transport capability of the nation most consistent with the goals of an integrated transport system.
4. Establish a consistent set of goals and priorities for transportation as a whole, and for water resources and waterway development in particular.
5. Make no abrupt or major changes in regulation or policy (user charges, rate regulation, safety, pollution, etc.) which would significantly affect the modal balance of traffic movements, economic health of regions of the nation, and transportation costs of competing ventures without full and careful evaluation of the economic, social, and environmental impact on regions, transport modes, industry, agriculture, etc.

Specific Recommendations

To further amplify the general recommendations, the following suggestions and recommendations for subsequent courses of action are presented to amplify the general recommendations and to be more specific with respect to the waterways, rails and trucks. These are offered with the objective of furthering the development of an integrated system of transport under conditions not representing a radical departure from present practices or existing conditions.

Inland Waterway Improvements. The following recommendations represent the primary recommendations for actions to be taken with respect to the inland waterways:

1. Expedite and complete the present INSA system study of the inland waterways by the Corps of Engineers. Such a system analysis and evaluation is essential to intelligent, economic, and efficient future development of the waterways system.
2. Fund, construct, and place in service those additional or replacement waterway facilities which are justified on the basis of balanced overall system efficiency and cost/benefit ratio at the earliest date for which funds can be made available. This recommendation is based upon maximizing the efficient use of the estimated \$3.3 billion waterway investment to date.
3. For any new projects beyond those covered by the foregoing Item 2, such as new systems, extensions, or other system expansions, evaluate the cost/benefits of each such project on the basis of inclusion of appropriate "user charges" for operation, maintenance, and incremental capital investment (whether charges are imposed or not). Further, discount future benefits at the current cost of capital to the government. This recommendation is based upon the conclusion that it could lead to more effective use of limited federal monies.
4. Establish a Federal Inland Waterway Administration within the Department of Transportation.

The following suggestions would potentially improve waterway efficiency and utilization of the waterways:

1. Require each tow on congested waterways to enter each lock under its own power. Either limit the maximum tow size to lock size (single locking), or require use of auxilliary services to produce the same locking effect as a single tow.
2. Automate and optimize operation of individual locking by means of local computer determination of locking sequence, timing and lock control - with automated valves and lock gates under the direct control of the lockmaster. The lockmaster would be capable of full manual override at any point of operation.
3. Limit the locking time of pleasure boats unless locked with a commercial tow, or when there is no lock congestion.
4. Impose congestion tolls.
5. Schedule lock usage, with special privileges for off-peak use (season/day/hour).

Rail Efficiency and Intermodal Improvements. Intermodal rail efficiency and rail/barge potential might be increased by the following:

1. Provide positive encouragement for increased rail transport efficiency. One means could be by removing the restrictions to and permitting and encouraging "consolidated pool service" of competing rail lines in those cases where the institution of such service would allow regularly scheduled through semi-express rail freight service. This would allow space to be allocated to various rail lines in scheduled freight unit trains for those lines entering into the basic service agreements between major points of origin and destination. This would be comparable to the successful space allocation practices followed by consortiums of foreign steamship lines in container service between Japan and the U.S.

2. **Selectively assist, by loan guarantees or subsidy, those railroads which will coordinate services with other railroad lines and modernize, and which will constructively promote intermodal movements with truck and water.**

Truck Intermodal and Overall Transport Efficiency Improvements.

Truck efficiency, intermodal potential, and overall transport efficiency might be enhanced by the following:

1. **Encourage intermodal traffic movements in domestic and foreign trade. One possible means of encouragement might be by increasing overall allowable length of trucks and trailers to permit twin trailers of 40 feet and 20 feet - if transporting containers in intermodal service.**
2. **Encourage overall transport efficiency and minimize negative impact of transport on the public - such as congestion on highways. An example of a means by which this could be effected might be to place limitations on certain long-haul truck traffic to divert it to rail (if rail were more efficient) and to conserve energy, and to reduce congestion on the Interstate Highway System. However, it should be noted that determination of modal efficiency should be made on the basis of specific movements for total transport from origin to destination (including initial pickup and ultimate delivery).**

PROGRAM OF FURTHER WORK

The following program of further study work is suggested as an outgrowth of this study. It should be noted that portions of this work are now under way or have been done, such as the "INSA Study," within the Corps of Engineers, and the projection of future traffic growth which has been made by MARAD. However, it is suggested that such work be re-evaluated with respect to its applicability and correspondence to the objectives of this study (the potential for the inland waterways in an integrated transportation system of the United States) and that

it be supplemented or redirected to correspond to these objectives as necessary. Suggested programs of further work listed in priority of importance, include the following:

1. Systems Analysis Study of the Capabilities of the Waterways and Locks and the Impediments to Inland Waterways Navigation. Such a program of work is underway as the "INSA" program of the Corps of Engineers. It is suggested that, as it applies to this program of work, that it should consider the impact of delays for future construction of facilities on the waterways, and that it include studies of improved utilization and modification of existing facilities as alternatives to new construction, as applicable. In addition, it is noted that INSA Study covers other programs such as multi-modal study of surface transportation and commodity flow projections, as indicated in paragraphs 4 and 5 below.
2. Waterways Impact Report. A blanket Environmental Impact Statement should be prepared for the proposed plan for systems development of the inland waterways. Such a blanket EIS of the entire proposed system expansion program could be compared to the Alyeska Pipeline EIS, and the one prepared for Gulf Coast Offshore Drilling Platforms. It could provide broader and more complete coverage and eliminate the burden and lessen exposure to court challenges of separate individual impact reports.
3. Institutional Study. The institutional study should investigate in further detail the existing and proposed laws, the regulatory agencies, and the practices impinging on the waterways and their operations - particularly the extent of existing government regulations, the limitations imposed on the waterways, the enforcement conflicts between agencies, and the impact of potential changes in institutional factors upon the waterways. It should also include an analysis and investigation of a single agency to plan for and regulate the inland waterways.
4. Modal/Intermodal Study of Surface Transportation. The modal/intermodal comparison study of surface transportation should include a study of actual transportation costs and energy consumption by barge, railroad, and truck, and it should be performed by competent personnel in the fields of transportation without bias in favor of any transportation mode. It could include actual comparable field

tests such as transport of grain from Minneapolis to New Orleans via barge, rail, and truck. The comparative study should also include evaluation of the environmental and social impacts of expansion of facilities in each of the three modes; the energy efficiency and demand of the modes; determination of the capacity and capability of the various modes and of the costs and requirements of expansion (including critical materials); as well as the evaluation of the impacts of changes in rate philosophy, rates, and various levels of "user charges" upon competing modes and upon shippers, consumers, producers, balance of trade, etc. A part of such study is underway as an integral part of INSA study. INSA evaluates several modes on an aggregate level with respect to network, capacity, and cost characteristic. It is suggested that the INSA Study be continued in the future to cover macro-level multi-modal transportation as an extension of current INSA effort of macro-level of modal analysis.

5. Commodity Traffic Projections. These should be developed on more recent commodity traffic data than that of the Kearney report of MARAD and without the intent of promotion, per se, of inland waterway traffic. Such projections should reflect the alternate scenarios for national goals and policies and selected potential events - such as the increased importance of coal on the waterways, curtailment of oil supplies, deregulation, etc. These projections are currently being studied under INSA program. It is suggested that a continuing study and update of these projections be made in the future under the INSA program.
6. River Terminal Study. A study should be made of the adequacy of the river terminals to handle projected future volumes, the suitability of fleeting services on the river and the availability of fleeting areas, of intermodal handling practices and equipment with respect to future growth, and whether expected volumes will support terminal improvements. Such studies should be directed towards analysis of existing methods and practices, and potential improvement and their corresponding costs. It is suggested that this study be included in the future INSA effort.
7. Manpower Study. An analysis and updating of recent manpower studies on the inland waterways should be made in light of the anticipated future volumes developed from the traffic projections, and more recent knowledge of the efficacy of the inland waterways training programs.

Section 4

PROPOSED NEW INSTITUTIONAL CONCEPTS

One of the primary and major conclusions of the study was that there seemed only slight probability of realizing fully the objectives of an integrated transportation system, if this were to be attempted under existing institutional arrangements as the transportation industry and government are now constituted. A fresh bold new concept seems to call for a new start.

Major barriers to realization were considered to be the complete lack of integration of transportation planning and regulation within the government, the fundamental differences between the modes themselves and the manner in which they are regulated, and the unbalanced approach inherent in the environmental assessments of proposed new projects. For this reason, considerable attention was directed towards finding a concept or concepts as possible solutions to the resolution of these problems, a means by which these difficulties and inherent constraints could be overcome. The point of departure for this analysis was the place where the problems originate in terms of barriers to integration and efficiency. As a result of these efforts, certain innovative concepts were developed, and these are presented herein and offered as an entirely separate alternate series of recommendations.

It is recognized that these proposed concepts have very significant obstacles to their implementation; however, there are significant problems under existing conditions, and it is strongly felt that a completely new approach is necessary and, also, that integration of transport activities must start at the top with the government itself

as a necessary precedent to integration of the transportation industry. Further, resolution of the current problems is considered beyond attack by a limited piecemeal approach. Small changes generally only make the overall problem more complex, and primarily shift the areas of impact. Thus, while recognizing the difficulties posed by putting the concepts into action, it is nonetheless believed that the merits and potential benefits resulting from their implementation warrant serious consideration at this time.

The underlying objective of development of the concepts was to create conditions under which balanced modal planning could be undertaken leading to development of an integrated U.S. transportation system, coincident with the objectives of balanced regulation, minimization of the extent of rate regulation, employment of economic factors as an instrument of public policy, provision of conditions under which free competition by private enterprise might be enhanced within the transportation industry, and lessening of the burdensome aspects of individual environmental assessment requirements - coupled with a more balanced approach to assessment of non-cost/benefit factors relating to new projects.

Four new concepts were developed as a result of work directed towards the achievement of the foregoing objectives. If all were implemented there would be a radical change in the transport industry and its regulation. While each concept could be implemented separately, they are, in fact, two coupled pairs of recommendations which by implementation in sets of two greatly enhances the potential benefits. The first of the proposed concepts relates to the creation of the integrated transportation department encompassing the functions of regulation and planning and including representation of all modes in both the planning and regulation functions. Its paired recommendation is directed towards reducing the significant institutional differences between the transportation modes that preclude the practical

removal of rate regulation from the various surface modes. The other paired recommendations include a suggested broadening of the requirement for an environmental impact assessment into a total assessment for new projects, coupled with preparation of blanket impact assessments for major developments and plans, which would allow separate projects in conformance with the plan to proceed without need for further assessment.

UNDERLYING NEEDS FOR MAJOR CHANGE

The federal government is now badly fragmented in its treatment of various modes with respect to planning, transportation policy, regulation, and approach of the various government agencies. Thus, there are: independent regulatory agencies such as ICC regulating the railways, most of the intercity trucking, and a very small percentage of waterways traffic; the Department of Transportation charged with overall transportation planning, but with waterway planning delegated to The Corps of Engineers and including no specific waterway representation within the department; and myriad other federal departments, agencies and authorities regulating the transportation industry in one manner or another but, for the most part, with only limited expertise in the various transportation fields. The results are, as might be expected, confusion, conflict, and lack of overall direction and progress. It would appear that no significant progress towards an integrated transportation system can be made until such time as a balanced degree of knowledge and representation of the viewpoints of the various modes can be provided and evaluated at a single point within the federal hierarchy. Further, it is a broadly accepted principle of management that substantial progress towards achievement of goals cannot be accomplished until such time as the goals have been defined. As matters now stand, this nation would have no way of

knowing when, or whether, it had achieved the desired goal of an integrated transportation system, as defined within this report. These are the reasons which underlie the development of the ensuing recommended concept of an integrated Department of Transportation in the federal government.

It is also a significant fact, not too broadly recognized, that the existing institutional differences between the various modes of surface transport will continue to require rate regulation of one or more transport modes as long as the objectives of an integrated transportation system are pursued. The present surface transportation modes differ significantly in their inherent characteristics, and as a result of the conditions and times under which they developed. Thus, the surface transport modes differ greatly in: competitive type - from monopoly (rail) to free competition (barge exempt carriage); ratios of fixed to variable costs from very high (rail) to very low (truck and barge) and also differ greatly in such other important factors as financial resources and capability, economic health and well-being, difficulty of entry into transportation service, flexibility of service, and in the degree of governmental support and subsidy. These foregoing factors preclude service of the needs of the nation for an efficient integrated transportation system without a high degree of regulation. Further, the by-products of this necessary regulation are higher transportation costs and lower efficiency than would prevail under conditions of free competition; discriminatory treatment of certain modes affecting their competitive position; and discrimination and detrimental impacts to certain elements of the nation. Thus, it would appear that as a result of the foregoing factors, the basic solution to many of the regulatory problems of the transportation industry must lie in a substantial change in conditions within the industry itself, which would permit a higher degree of free competition and thereby diminish or remove the need for rate regulation. The foregoing factors result in the second new concept proposal of this report.

The present National Environmental Policy Act (NEPA) is oriented primarily and directly towards environmental aspects. The concentration and emphasis of required assessments deal primarily with the environmental aspects, to the exclusion of broader factors. Approval of a project at the permit issuance level of authority is precluded if objections are raised by other interested federal agencies or by state clearinghouse agencies. There is also a rash of court actions attacking individual impact assessments -- producing delays, higher project cost, and blocking many projects. The preceding factors suggest that a new approach to assessment of projects might be in the national interest. Thus, two new paired assessment recommendations were developed, directed towards broadening the scope of the assessment of positive and negative features by which new projects would be evaluated, and enlarging the physical size of the unit considered by such assessments so as to preclude the need for as many individual assessments, each subject to possible limitation by court suit.

RECOMMENDATIONS FOR TRANSPORTATION PLANNING/ REGULATION - INDUSTRY INSTITUTIONAL CONCEPT

The following text describes the two transportation industry-related concepts which are suggested for consideration by joint implementation. The integrated planning/regulation transportation agency is seen as providing a means by which balanced representation could be provided for all transportation modes, and it is anticipated that it could provide conditions under which a rational approach and plan could be developed for an integrated United States transportation system. Consolidation of the modes under such an integrated transport agency could provide a logical framework and location for the government to carry out long range transportation planning to improve policy guidance and effectiveness of day-to-day policy implementation. It could also provide a means by which activities of regulation and planning could be correlated to enhance the integration of the U.S.

transportation system in accordance with the developed national goals. It could further ensure that the regulation of the transportation industry (as a result of the mandates for regulation by such agencies as the Environmental Protection Agency and the Occupation, Safety and Health Administration) would be applied and enforced through people who were knowledgeable of the transportation industry. Thus, it is anticipated that, under an integrated U.S. transportation department, conditions would be created that would be favorable to both the establishment and achievement of the goals of national transportation policy.

The recommended transport industry institutional change concept presented (which creates similar conditions of fixed to variable cost ratios among the various modes of surface transport, relatively similar ease of entry into transportation service, and extends user charges to all transportation modes) would appear to create conditions under which rate regulation could be materially reduced or eliminated in the surface modes of transportation, and at the same time free competition by private enterprise could be materially enhanced. This would be anticipated to produce economies, greater efficiency, and to allow the marketplace to dictate the appropriate role of the various transportation modes. Through the medium of control over right of entry and application of economic control by the medium of the user charges, the objectives of the nation with respect to an integrated transportation system could be substantially achieved within the marketplace.

Concept for Regulation/Planning Agency

It is clearly evident that no perfect solution exists with respect to the regulation of the transport industry. One of the major problems is how to plan and coordinate the work of the various independent regulatory agencies so as to protect the mandate of each and also to provide and employ the requisite specialists required in various fields of expertise. Thus, there must be coordination between

generalists and specialists, and a reconciliation of regulatory mandates which extend across many fields and industries. Further, the many relatively newly created agencies generally do not have either a sufficiently defined policy basis developed at the outset, or a background for precedent, to provide good guidance; they also generally lack breadth of expertise and special expertise in particular fields to which they are applying regulation.

Assuming an objective of providing regulation which will be most beneficial and correspond most directly to transport-oriented objectives, an integrated transport system for the U.S. almost has to start with the government. Therefore, the following regulatory and planning agency concept is suggested for consideration:

1. Combine all transportation policy formulation and planning (including regulatory policy) and regulation of all transport modes into a single agency.
2. Divide the agency into two major areas of activity: a Plans and Policy Formulation Branch and a Regulation/Enforcement Branch. Head each of the foregoing by an Assistant Secretary.
3. Within each branch represent each transport mode by a strong advocate in the Plans and Policy Branch, and by its own Commission in the Regulation and Enforcement Branch. Provide a Deputy Secretary as the modal advocate for each transport mode in the Plans and Policy Formulation Branch.
4. Establish a separate "Commission" for each mode in the Regulation/Enforcement Branch. Within each commission there would be a subfunctional for regulation -- responsible for developing regulations in support of transport policy and reflecting the interests and policy requirements of such other agencies as EPA, OSHA, FCC, etc. There would also be a subfunction under each commission which would be concerned with enforcement of the regulations and reporting.

Below these two subfunction levels, in both regulation and enforcement, there would be appropriate specialists, knowledgeable of

industry requirements and needs, safety, environment, etc. and, while these would be responsible only to the modal regulatory agency commission, they would report to both their own commission and to the parallel outside agency of interest, e.g., EPA, OSHA, etc.

This suggested concept would also provide for coordination between modal commissions for the establishment of joint and through rates between the various transport modes. It would also provide a means to limit conflicts between regulatory agencies, and could provide a basis for establishment of sound and enforceable regulations based upon a balanced view of the needs of the various transportation modes and their place in an integrated transportation system in the United States. It would also tend to eliminate needless duplication and could ensure that regulation was based, to a higher degree, on knowledge rather than on ignorance and bias.

Transportation Industry Institutional Changes

The primary problem in developing an integrated transport system, and in rate deregulation, is what to do with the rail mode. Under present circumstances, rail must both be strengthened and regulated. It is quite possible that both truck and waterways transport could survive and thrive under free competition.

Three concepts under which transport integration might occur are as follows:

1. Deregulate truck and water transport and subsidize rail to the extent necessary for its survival under a regulated operation.
2. Allow rail to freely own trucks and barges and allow rail to pool shipments with competing rail lines on high frequency scheduled optimum size trains operating between major traffic centers.

3. **Government takeover of all rail trackage, with operating private rail lines paying user charges for use of the trackage and terminal facilities. The railroads would continue to operate the trackage and to maintain it under an operating agreement with the government - their costs of operation and maintenance of trackage paid for by the user charges. The user charges would also be used for new construction and to provide a return to the rail lines now owning the trackage on the basis of appraised value and utility of facilities.**

The last concept would appear to offer considerable potential to overcome most of the barriers precluding the development of an integrated transportation system operating under a free enterprise approach. It would also seem to offer the potential to deregulate all modes of surface transport - providing the right of entry continued to be controlled and user charges were imposed upon all modes. The concept is somewhat similar to one suggested by the 1942 National Resources Planning Board.

With the barrier of need for acquisition of rail trackage and right-of-way removed as a requirement of threshold entry into the rail transport business, other large companies could enter into rail and intermodal transport - including trucking companies. Further, the limitations on service areas could be substantially or entirely removed. Transportation companies, operating in all surface transport modes, would make sense under such conditions since they could function efficiently because of the broadened service area of each, and because there would be no incentive to destroy a competing mode in order to defray a portion of the high fixed costs of investments. The ability of rail to provide its own pickup service would allow abandonment of unprofitable spur and branch lines.

Rail would have to compete on the same all-in cost basis as other modes of surface transport because, except for equipment and rolling stock amortization or depreciation, all of its costs would clearly be of the long run variable classification. Again, under conditions of similar fixed/variable cost ratios and low

fixed costs for all surface transport modes, providing an equal competitive platform, there would be little incentive for rate discrimination as a means of partially offsetting fixed costs.

Under this institutional concept it is anticipated that a setting would be created in which market factors could determine the role of the various modes and ensure efficient transport service and use. However, if it should be necessary in the national interest, modal balance and protection of the modes could be effected by the economic means of adjusting user charges to change position in the marketplace, in conjunction with control over the right of entry. Because of its role in provision of facilities, the government could also (if it wished) direct domestic intermodal traffic into containers - because of the greater efficiency of containers in rail transport. Planning decisions on new construction and system improvements would be made by the government in conjunction with industry, and the costs would be borne by user charges. This concept would appear to require published rates for all modes, and separate user charges for intercity trucking.

RECOMMENDATION FOR ENVIRONMENTAL CONCEPTS

The following text presents the two new environmental concepts. The total resources assessment is envisioned as a necessary step to balance environmental concern with other goals, and would appear to reflect recent public sentiment. The blanket impact assessment is seen to permit a broader view and to reduce the burden of impact of assessments and lessen the number of "nuisance suits" in the courts.

Concept for Total Resources Evaluation

A "Total Resources Evaluation Act" could broaden the scope and improve the balance of the concept of assessment of the impact of new projects by encompassing the economic, social, and environmental impact of new projects upon man and nature. This broad concept would in all probability evolve and be defined by use and court test as did NEPA at its outset.

The present National Environmental Policy Act has as its essential thrust that no actions which will produce significant impact upon the environment should be undertaken without first determining and considering what the long-term irri-
trievable commitment of resources would be. The act also requires that alternate actions and their impacts be considered. However, the act does not prevent the approval and construction of a project with a negative environmental impact; it only requires that the environmental impact be considered and that the benefits of the proposed project outweigh the negative environmental impacts in the view of the organization which has regulatory authority and which must issue the permit for construction.

In most states a "Clearinghouse Agency" coordinates all state agency environmental comments, and often speaks as a single voice for the state in indicating the environmental acceptability of a project to all state agencies frequently overriding objections of some individual state agencies. However, objections raised by Federal agencies and not reconciled cannot be overruled by another Federal agency at the local level.

For the most part, those permits which have been contested in the courts have had injunctions issued stopping them only if it was adjudged that the substantive requirements of the act had not been complied with. With the exception of a recent court decision relating to the evaluation of the impact of earthquakes on a proposed project, the courts have generally refused to sit in judgment upon the quality and depth of an environmental assessment. Certainly it would appear right and proper to consider the environment, but the thrust should not be on environment alone; the assessment should consider the impact upon mankind itself, including the environment. A "Total Resources Evaluation Act" could require a "Total Impact Report" considering the impact of proposed projects, policies, laws, plans, or acts upon mankind - again including the environment. Such an assessment should include evaluation of the impact upon human life, resources, and economic development, and any limitations, restrictions, or eliminations of

opportunity to exercise future options. This would require consideration of the impact of alternate developments, and of larger and smaller projects, and the need to provide for future change or expansion. Clearly the costs for providing for the latter flexibility of future options need to be evaluated as part of the assessment.

Generally speaking, those projects which will preclude flexibility in exercising future options, alternatives, or changes in direction in response to changing goals or conditions, should be looked upon with less favor than those which do not.

Concept of Blanket Impact Assessment

Because of the amount of effort involved in intensive environmental or resource assessments, these should be made for broad plans and developments - such as a river basin, an inland waterway system, regional master plan, etc., and any sub-elements which are in conformance with an approved plan and impact statement should be allowed to proceed without further need for assessment. This procedure would lessen the opportunity for harassment-type court suits to delay or block individual projects by special interest groups.

Section 5

INSTITUTIONAL PROBLEMS AS RELATED TO TRANSPORT

The institutional problems related to an integrated transportation system, and in particular to the role of water transport in such a system, may be broadly aggregated into the institutional problems pertaining to the modes themselves and the characteristics which are relevant to them (or which they acquired in the process of their growth); and into institutional problems relating to the role of government in public transport in the areas of laws affecting transport, regulation and planning activities, and subsidy.

MODAL INSTITUTIONAL FACTORS

Modal Comparison

There are many institutional factors that characterize the various modes, influence their operations and the types of commodities which they transport, and determine the role of the various modes in the United States transportation system. These factors must be understood to properly assess the potential for integration of the various modes within the United States. Table 5-1 summarizes comparative physical factors and economics of the various modes of surface transport - barge, rail, and truck. Table 5-2 presents the source development of the relative energy intensiveness.

Table 5-1

COMPARISON OF SURFACE TRANSPORT MODES

	BARGE	RAIL	TRUCK
PHYSICAL FACTORS			
Capacity - Size - FT ³	Jumbo Barge 89,000	50' Box Car 5,000 (8)	8'x8'-6"x45' Trailer 3,060 (8)
- Tons Range - per Unit	(9) 1,000-3,000 per Barge	50-100 (8) per Car	10-35 (8) per Truck
- Tons Range - per Movement	(9) 5,000-55,000 per Tow	5,000-12,000 per Train	10-25 per Truck
Line Haul Speed - MPH	(9) 3-12	Reg. 25-45 Unit Train 35-45	40-60
Flexibility	Range of Service Geo- graphically Limited to Areas Adjacent to Waterway. "Door-to-Door" Service Requires Intermodal Movement for Locations Not Directly on Waterway	Rail Siding Permits "Door- to-Door" Service Between Many Inland Points.	Greatest Flexibility Can Provide "Door-to- Door" Service to Almost Any Inland Point
	Know Where Barge Is At All Times - Can Redirect At Any Time.	Often No Knowledge Where Rail Car Is - Usually Little Control Over Shipment When In Transit.	Usually No Direct Communication With Truck While In Transit.
	Little Or No Interchange With Other Barge Lines	Over 70% of Traffic Inter- changed Between Railroad Lines	Less Than 20% of Intercity Traffic Interchanged With Other Truck Lines.
Relative Average Line Haul Energy Intensiveness - Barge = "100"	(10) 100	134	497
Average Circuity	1.38 (2)	1.25 (1)	1.20 (1)
Relative Average Energy Intensiveness Circuity	138	167.5	591.4
Average Length of Haul	375 (12)	490 (11)	260 (11)
Typical Empty Mileage-Regulated Carriers-Percent	12 (3)	45 (4)	4-5 (4)
Share of Intercity Market (Ex P/L & Air) - % of Ton-Miles	(7) 11.1	37	22.6
States Served	(8) 38	50	50
Typical Manpower	10-14/Tow (3)	30/Unit Train (3)	2/Truck
Regulated Share of Intercity Traffic by Mode	15.2 (4)	100 (9)	
Annual Fatalities	(13) 320	698	54,385 (All Highway Accident Total)

Table 5-1 (Continued)

<u>ECONOMICS</u>	BARGE	RAIL	TRUCK
Transport Cost - Cents/Ton-Mile	(9) 0 1-1 1	Single/Multiple Car 0 8-2 5 Unit Train 0.5-1.0	2.0-4 0
Federal Subsidies - FY 1972 - \$Million	(5) 291	(Class I) (154 3)	(Rail Competitive) 325
Federal Expenditures for Right-of-Way Not Covered By User Charges - \$Million	(5) 291	—	325
Federal Subsidy to Date (1974) - \$Million	(5) 5,700 (8)	516 (6)	?
			User Charges Class I & II M.C.
Annual Right-of-Way Costs as Percent of Revenue	(9) —	21 0	5.9
Average Annual Operating Expense as Percent of Revenue	(9) 77.8	72.4	91.5
Average Annual Depreciation as Percent of Revenue	(9) 7.5	6.9	4 1
Average Annual Federal Taxes as Percent of Revenue	(9) 3 5	0.8	1 7
Average Annual Cash Flow as Percent of Revenue	(9) 14.1	10 8	6 2
Average Annual Return on Investment as Percent of Revenue	(9) 6 6	3 9	2.1
Average Annual Return on Equity as Percent of Revenue	(9) 10 6	2 7	12 9
Average Revenues as Percent of Assets	(9) 52	34	205

(13) National Transportation Safety Board 1973

(12) American Waterways Operations Inc "1973 Focus"

(11) DOT (1972 pg 25, 30): Association of American Railroads (1973 pg 35)

(10) Average of Comparable Estimates Reported in US Railway Association - Preliminary Plan

(9) Kearney Report

(8) Association of American Railways - New construction and operation and maintenance

(7) Great Lakes - St. Lawrence @5.2% makes up balance to 100 percent

(6) Aviation Advisory Service - Considered repaid by tariff reduction to federal government

(5) U S. Railway Association - Preliminary Plan

(4) "Railroads - The High Cost Mode", Robert S. Reebe, Handling & Shipping 11/73

(3) Reported by ACBL (6 men/train x 4 to 6 crew changes in 24 hrs for regular train) Barge crews 30 ds on & 30 ds off

(2) DOT Study

(1) Church (1970)

Table 5-2

**COMPARATIVE LINE HAUL MODAL ENERGY INTENSIVENESS
(ENERGY REQUIRED/DISTANCE MOVED)**

RELATIVE ENERGY INTENSIVENESS FACTOR*		STUDY/REPORT						WEIGHTED AVERAGE (AVAILABLE ESTIMATES)
		RAND CORP	OAK RIDGE	CARNEGIE MELLON	DOT	PEAT MARWICK MITCHELL	FEA	
		BTU PER TON - MILE						
1.	Inland Waterway	500	680	578	463	501	503	538
1.44	Oil Pipeline	1,850	450	519		601	452	774
1.34	Rail - General	750	670		771	700	704	719
.61	30,000 Ton Unit Train			330		330		330
	Intercity Only							
1.30	TOFC					700		700
2.66	Short Fast Train			1,430		1,430		1,430
4.97	Truck - General	2,400	2,800		2,774	2,774	2,617	2,673
3.53	Intercity Only					1,900		1,900
13.23	Local Only					6,935	7,299	7,117
75.20	Airfreight	63,000	42,000	13,500		43,341		40,460

*Based on average values from available comparable estimates from six studies

Validity of comparison affected by:

- 1) Circuitry - all modes
- 2) Transportation to rail/water head - not included

Service Area. With respect to area of service, rail and truck modes serve all 50 states of the United States, and the highway and rail trackage networks connect and serve all major United States population centers. In contrast, the inland waterways of the United States serve only 38 states of the United States and the orientation of the waterways (dictated by the physiographic land relief features of the nation) is predominantly oriented north and south - in contrast to the predominant eastwest flow of traffic within the nation. Of the various modes of surface transport, only trucks are able to serve virtually any origin and destination location on land. Rail transport must have an available rail spur, and barge traffic must be delivered to, or originate on, a waterway and be destined for an immediate waterside location.

Speed/Circuity. With respect to speed, truck service is the fastest, typically traveling 40-60 miles/hour, and commodities in intercity movements normally travel by one truck from origin to destination and by the least circuitous route of all modes. The average length of haul of trucking in intercity movements is 227 miles. The average circuity, in comparison to a great circle route, is approximately 20 percent for truck.

Rail is slower in speed than trucks for average line haul movements, averaging about 25-45 miles/hour for conventional trains and about 35-45 miles/hour for unit trains. However on the basis of portal-to-portal speed rail may often be slower than barges, since rail cars frequently only move 2 to 3 hours a day and the average speed while moving is indicated by recent studies to be less than 20 miles per hour. The average length of haul in intercity service is 525 miles for rail, and average circuity is approximately 25 percent.

There is great contrast between speed of movement of barge as compared to either rail or truck. Barges typically travel between 3 to 12 miles/hour on the waterways and have a circuity factor of approximately 38 percent and an average length of haul of 375 miles.

Scale. Significant differences of scale exist between the various modes as well. Thus, the basic transportation units of truck and rail are of similar magnitude - 3,000 and 5,000 cubic feet respectively, and 25 and 70 tons respectively. In contrast, the capacity of a jumbo barge is 89,000 cubic feet, and 1,000-3,000 tons. The comparisons in terms of movement sizes are 10-25 tons per truck vs. 5,000-12,000 tons per train and 5,000-55,000 tons per barge tow.

Energy/Labor Intensiveness. While there is considerable disparity of opinion regarding the line haul energy intensiveness of the various modes, it is generally accepted that the barge movement (with the exception of pipelines) is the least energy intensive, followed by that of rail transport and truck. An average of studies of energy intensiveness indicated that if the barge is accepted as having a value of 100, the relative energy intensiveness of rail would be approximately 134 and truck 497. Of carriers moving in regulated traffic, the empty mileage of trucks is the least at about 4 to 5 percent, barge is approximately 12 percent and rail approximately 45 percent. Empty backhaul is common for unregulated barge traffic. Truck is the most labor intensive, rail is next, and barge is the least labor intensive. The share of the intercity market, excluding pipeline and air movements is 37 percent for rail, 22.6 percent for truck, 11.1 percent for barge inland waterway movements, and 5.2 percent for movements on the Great Lakes-St. Lawrence System.

Modal Dominance. The foregoing factors suggest the reasons trucking is the dominant mode for movement of commodities over short hauls (particularly under 300 miles), and for high speed moderate haul movements of high value commodities. Rail is the dominant long haul carrier of finished goods, and of raw materials and bulk commodities in areas not served by inland waterways - thus rail predominates in overland shipments greater than 30,000 pounds and distances

greater than 300 miles. Barge is the dominant mode for bulk movements where waterways are available, and for some intermediate and low value products with origins and destinations in relatively close proximity to the waterways. The factors of cost, service, speed, and minimum tender size are dominant factors dictating the selection of the various modes by prospective shippers.

Modal Development Factors

The sequential growth of the United States transportation network has greatly influenced the nature and extent of the development of the modes and the position which each occupies.

Waterways. In the early years of this nation, the inland waterways were of major importance because of their ability to move large volumes of goods at relatively high speeds (for the times) and at low cost. Thus, a considerable network of canals was developed, and extensive use was made of the natural waterways. The importance of securing the use of the Mississippi as an artery of transport provided much of the impetus for early westward expansion of the nation. Water transport was already well established at the onset of the introduction of the railroad.

Rail. The railroad provided the benefits of greater speed than the waterways, ability to serve broader areas, permitted east-west movements, and served as the vehicle to open up the American West. To encourage regional development, substantial land grants were given to the western railroads to assist them in developing the capital needed for their expansion to the west, and to provide their right-of-way. Inasmuch as railroads were largely monopolies, it became a matter of prime interest for each railroad to stake out as much territory for itself as

possible; thus, branch lines were extended into territories where potential growth might occur, and spur lines were constructed to serve potential customers. Many of these main lines, branch and spur lines were subsequently proven to be valid capital investments. However, the basis for development of many of these lines anticipated traffic movements which were never realized, and they became relatively worthless appendages representing a continued economic drain upon the viability of those railroads.

Because of the potential of abuse of the monopoly position of the railroads, and in many cases their ruthless application of power, regulation of rates and service was imposed on the railroads through the establishment of the Interstate Commerce Commission. In the earlier years of the commission the combination of the firm control over rail rates it exercised in conjunction with poor rail management resulted in the railroads being unable to generate sufficient capital to provide the facilities and service required to capture expanding markets and serve transportation needs. Further, the regulatory pattern of thinking inhibited the railways in attracting the entrepreneurial management talent needed to effect the required service expansion. The ICC, as a result of either a limited interpretation of their Congressional mandate or as a matter of political expediency, subsequently continued to inhibit adequate rail rates of return even after the support of shippers was added to the demand of the railroads for rate increases. Now maximum rail rates tend to be established in the market place, so increased rail return now depends for the most part on greater efficiency and greater traffic volume.

Truck. It is against this background of restriction of the rail industry and lack of foresight on the part of rail management that the motor trucking industry developed. It stepped into the void in service, and by virtue of frequency, flexibility, speed, and reliability of delivery, it was able to command

the premium rates necessary for its operation. Further, by virtue of its ability to pick up goods at locations not served by rail it controlled many of the onward movements as well - movements which might otherwise have gone by rail. The degree of regulation imposed on the trucking industry is less, and there is a relatively very low threshold of entry cost - permitting many small operators with limited investment capital to enter the business.

Competitive Action

The waterways compete with rail movements in the areas served by the waterways, and trucks compete with the railroads throughout the nation. Waterways and truck modes of transport are largely complementary.

One of the major barge companies owns and operates a trucking line, and railroads were formerly allowed to own barge lines. However, the railroads drove the barge lines off the waterways by reducing water rates below the competitive capability of independent waterway operators, and as a result of this Congress passed the Panama Canal Act which restricted railroads from owning barge lines if they provided competitive rail land service. The barge lines fear the potential harm of such a reoccurrence should the provisions of the Act be relaxed - because of the significant difference between the financial resources of the railroads and the barge lines, and because of the ability of the railroads to make up those operating revenues lost in competition with barges on non-water competitive land routes.

Joint and Through Rates

The potential for integration by regulatory action of the various modes of transportation is somewhat limited because the jurisdiction of the ICC extends only to joint service and through rates between carriers which are regulated in both modes. Thus, as it specifically applies to the integration of rail and water

movements, they have jurisdiction over only approximately 1/7th of the traffic now moving on the waterways. * A further complicating factor is that no published rates exist for movements of unregulated commerce on the waterways. This is highly objectionable to the railroads, particularly with respect to the development of joint and through rates and the division of revenue between the modes for intermodal movements.

Rail/Water Intermodal Factors

Rail integration between modes, and within the rail mode itself, is further complicated by the fact that some 70 percent of the rail movements must be interchanged between rail lines between the points of origin and destination. Further, because of revenue advantages (but not necessarily profit) each rail line attempts to maximize routing over its own right-of-way irrespective of factors of efficiency and service. In addition, there is nearly as high a degree of factionalism between competing rail lines as between the rail modes of transport. This is particularly evident in the case of unit trains; where they are utilized it is extremely rare for such trains to be interchanged between lines. This contributes to a greater potential for intermodal rail/water movements of large-volume bulk shipments if the territorial limits of the originating rail line terminate on a waterway, and water movement is practical for delivery to destination.

Government Aid and Support

Rail. The development of the western railroads, as noted, was greatly assisted by the land grants given to them. In return for these land grants they were required to transport personnel and commodities for the Government without cost, or at reduced rates. A subsequent action of Congress decreed

*Further, the ICC has ruled that "joint rates" may not be entered into by a carrier subject to the ICC Act and one not subject to the Act, but combined rates may be quoted with ocean carriers.

that the railroads had fulfilled their obligation under the land grant act, and it is now considered that the railroads have repaid this obligation and thereby do not have to perform transport services for the Government at reduced cost.

Water. The inland waterways have, from their inception, been free to all - with the exception of a limited number of private canals. This free use of the waterways has been the expressed will and policy of Congress and has been reiterated on many occasions. In the years of existence of this nation, it is estimated that the Federal government has expended approximately \$4.6 billion on the construction, maintenance, and operation of the inland waterways of the United States.

The present inland waterway industry was essentially reborn during World War I with the establishment by the government of the Federal Barge Lines. This service was well run and highly innovative, and was the forerunner of the now privately owned Federal Barge Lines. One of the innovations tried by the Federal Barge Lines was the acceptance of small lot commodities for movement on the waterways. The results of extensive trial of this principle proved conclusively, in the opinion of the waterway operators, that such small volume shipments had no place on the waterways. This would appear to be borne out today by the fact that there is only one active freight forwarder on the waterways, River Freight Forwarders, a subsidiary of one of the major barge lines.

Since the reestablishment of the inland waterways as a viable transportation mode, with the aid of government furnished and operated waterway facilities, the waterways have shown a continuing growth in transport capability and volume movements, but the percentage share of commodities moved in the regulated mode has demonstrated a declining trend (however, the absolute volume has remained relatively constant). During this same time, the waterways industry

has made little direct contribution toward the operation, maintenance, and construction of the waterways other than the portion of the taxes imposed on the business operations that might be attributed to the waterways. There is, of course, a landside investment both private and by local governments in waterway terminals and other facilities. Because of the high fixed cost of the railways represented by the cost of maintaining the right-of-way, and amortizing and maintaining rail equipment and facilities, it is the contention of the railroads that the subsidy thus provided to the waterways industry represents an unfair competitive advantage.

Truck. The trucking industry has similarly benefitted from Federal, state, and local construction of highways, and from the Federal Interstate Highway Program in particular. However, economic charges are made against the trucking industry (which go into a highway trust fund) in the form of fuel taxes, license fees, and other taxes. These are estimated to contribute substantially, but not totally defray, the truck transport share of highway costs.

Exclusive Rights and Competition

It is significant to the modal comparison to point out that in regulated traffic movements, exclusive service rights are granted to both rail and truck modes of operation. Thus, while competing services are offered between major points of origin and destination, for the most part these are offered over different routes, thus providing certain monopolistic territorial service advantages. In contrast, the regulated water carriers serving the same destinations operate in competition over the same routes and are also faced with the greatest volume share of unregulated competition within the mode of any of the surface transportation modes - waterway, rail, and highway. Thus, water rates are kept highly competitive. However, the waterway operators must maintain an adequate revenue to insure their continuance in business, because they do not have the benefit of being able

to charge higher rates in non-competitive service areas as do the rails. Further, the regulated common carriers by water are faced not only with the competition of rail but also with the competition of regulated contract carriers and the unregulated carriers of bulk traffic and private carriage.

Environmental Comparisons of Transportation Modes

Environmental impacts associated with transportation vary in degree with the mode of transportation as well as with the location, type of cargo, and use of each type of system. These impacts generally include preempting of land, disruption of topography, creation of noise, use of energy and other resources, emission of air pollutants, and alterations in biological and sociocultural aspects of the area. The modal comparison of environmental impact reflects an overview level approach - final conclusions on the modal impact will require more detailed assessment.

The more sensitive areas and issues involved in these various impacts are presented in matrix form for each type of transportation considered in Tables 5-4 through 5-6. Tables 5-7 and 5-8 present a comparative analysis of the different modes of transportation as they relate to water pollution, safety and air pollution.

The following paragraphs provide a qualitative analysis of the potential impacts as outlined in Tables 5-4 through 5-6.

Construction of Transport Facilities. Construction of terminal structures and preparation of the right-of-way for most transportation modes have similar environmental impacts which vary in intensity with location and with facility size. These impacts include preempting of land for storage and transfer structures, creation of noise, use of energy and other resources, and emission of air pollutants by construction equipment.

1. Highway Transport.

- (a) Highway construction serves to diminish open space, remove natural vegetation, alter terrain, and change drainage patterns and water run-off.
- (b) Cut-and-fill operations contribute to increased erosion potential, particularly at stream and river crossings.
- (c) Other highway construction impacts are similar to those associated with rail transport.

2. Rail Transport.

- (a) Many of the right-of-way preparation activities common to highway construction, such as cut-and-fill, and construction of bridges and overpasses are also potential impacts of rail-road construction.
- (b) Large quantities of land are required for switchyards and fleeting areas. These lands for rail are generally located in one area, while those fleeting and storage areas for trucking may be scattered among several small parcels of land at each shipping point.

3. Waterway Transport.

- (a) Construction of waterway transport systems has a considerable impact on the aquatic environment, through activities such as dredging, bulkheading, and filling operations.
- (b) Removal of habitat and changes in species distributions as well as changes in potential uses of water surface result from such activities.
- (c) Some of these same aquatic impacts might also result from construction of highways, railroads, or pipelines in or near waterways.

Operation of Transport Facilities. Environmental impacts resulting from the location and operation of terminals and transport systems are related to the types of commodities handled as well as to the nature of the transport systems themselves.

1. Highway Transport.

- (a) Cargo spills from trucks have a potential for air, water, and/or land pollution; however, the volume of these potential spills is small compared with that for large barge tows.
- (b) While trucking accounted for 15.9 percent of the 1970 domestic intercity freight hauled in direct competition with railroads and water carriers for medium- and high-value breakbulk commodities, trucking, in conjunction with railroads, accounted for less than 1 percent of the number or volume of water polluting spills in 1972.
- (c) The probability of spills increases with traffic congestion and with deteriorating highway conditions, as does probability of deaths or injury. Traffic deaths attributed to trucking averaged 10.9 per billion ton-miles.
- (d) Truck traffic contributes to highway traffic congestion, to increased degradation of highway conditions and, thus, to the need for increased highway construction and maintenance.
- (e) While automobiles used 55 percent of the transportation energy in 1970 (14 percent of total national energy consumption), and contributed the major portion of air pollutants from gasoline combustion, trucks used 21 percent of the transportation energy and contributed primarily to emissions from diesel fuel combustion.
- (f) Truck noise levels contribute to urban background noise at levels dependent on the speed at which the vehicle is traveling, the weather, and the road conditions. The effect depends upon the time of day and the distance from the source. Trucks at highway speed, at a distance from the vehicle of 50 feet, emit an average of 100 PNdB, and levels drop off at a relatively rapid rate compared to freight trains at 110 PNdB.

- (g) Surface traffic near residential neighborhoods contributes to the creation of visual, physical, and psychological barriers which may contribute to the fragmentation of those neighborhoods. Reduced social interaction, reduced access to other neighborhoods, and increased traffic congestion or changes in traffic patterns are often a result of increased truck traffic.

2. Rail Transport. Railroad transportation accounted for 35.9 percent of domestic intercity freight hauls, carrying low, medium, and high break-bulk commodities. These commodities include over 50 percent of all ton-miles of agricultural produce, mining products, and ordnance, as well as food products, furniture, paper, stone, clay, glass, non-ferrous metals, and transportation equipment. Many of these commodities have the potential to pollute, for example:

- (a) Air pollution from coal dust, ores, and other finely divided solids.
- (b) Air pollution from vapors attributed to petroleum product evaporation.
- (c) Water or land pollution from spills of commodities which have water soluble properties such as metal ores, clay and construction materials, and liquid commodities.
- (d) Rail, in conjunction with trucking, contributed to less than 1 percent of water polluting spills in 1972, and the potential for spills is limited by the capacity of the individual cars (400 barrels of fluid per standard tank car).
- (e) Railroads contributed less than 0.1 percent of the carbon monoxide, 0.2 percent of the particulates, 0.6 percent of the sulfur oxides, 0.2 percent of the hydrocarbons, and 0.4 percent of the nitrogen oxides of the total air pollution emissions for 1969.
- (f) Rail transport utilized less than 16 percent of the nation's energy in 1970 with a fuel utilization efficiency approximately equal to that of waterway traffic, four times that of trucking, and 0.7 times that of pipelines.

- (g) Diesel freight trains at speeds of 30 to 50 miles per hour average 110 PNdB at 50 feet from the vehicle. Noise levels decrease with distance, and the impact varies with time of day and location.
- (h) Operation of rail transport systems acts as visual, physical and psychological barriers to urban and suburban areas and limits access to other areas. Rail traffic also had an impact on highway traffic at road crossings, and a significant number of rail accidents can be attributed to crossings.

3. Waterway Transport.

- (a) In 1970, 28.4 percent of domestic intercity freight traffic was borne by waterways, including domestic deep sea traffic. This transport mode competed with rail and trucking modes for low, medium and high-value break-bulk commodities.
- (b) Principal commodities carried by domestic waterway commerce in 1970 were petroleum and petroleum products, coal and coke, and sand, gravel, and stone. Other cargos included iron ore and products, chemicals, lumber and logs, and grain.
- (c) The major source of water pollution among transportation activities in the United States is oil spills from vessels. Tanker barges may contain as much as 50,000 barrels of oil and the potential for spills resulting from collision, grounding, or deliberate discharge increases with increases in traffic.

Modal Energy Demand Comparison

Transportation accounted for 24.3 percent of all energy and 53.3 percent of all petroleum used in the United States in 1970 - 95.7 percent of the energy used in transportation in 1970 was derived from petroleum.

Table 5-3 shows that commercial transport uses less than half of the total transportation energy. Trucks are indicated to be the major consumer of energy within the transportation industry, using approximately six times as much energy as rail and over 8 times as much as the waterways.

The modal environmental tables, Tables 5-4 through 5-8, give a comparison of the environmental impact of the various transport modes.

Table 5-3
DISTRIBUTION OF ENERGY WITHIN THE U.S.
TRANSPORTATION SECTOR

<u>Transport Modes</u>	<u>Percent of Total Energy - 1970</u>
1. Automobiles	(54.2)
urban	34.2
intercity	20.0
2. Trucks	(21.1)
intercity freight	6.9
other	14.2
3. Railroads	(3.3)
freight	3.1
passenger	0.2
4. Airplanes	(10.8)
passenger	5.6
freight	0.8
general aviation	0.6
military	3.8
5. Buses	(0.8)
urban	0.3
intercity	0.25
school	0.25
6. Non-bus urban mass transit	0.2
7. Waterways, freight	2.5
8. Pipelines	1.2
9. Others	5.9
Total Transportation	
Energy Consumption *	
(1 x 10¹⁵ Btu)	16.5

* As reported by the Bureau of Mines

Table 5-4

- High; long-term, wide-spread or large amount of resources involved
- Moderate; short-term, local or minimum resources involved
- Negligible
- ★ May stimulate indirect resource use

QUALITATIVE MATRICES FOR RANGE OF POSSIBLE ENVIRONMENTAL IMPACTS OF TRANSPORTATION MODES WATERWAY TRANSPORT

IMPACT	CONSTRUCTION OF TRANSPORT FACILITIES					TERMINAL OPERATION			OPERATION OF TRANSPORT FACILITIES	
	Terminal Facility • Buildings • Power, water, waste • Transfer equipment	Channel • Turning basins • Flushing channels	Commodity Storage • Tanks, ware houses, elevators • Stockpile surfaces	Fleet Storage • Docks • Mooring areas	Access to Terminals, Intermodal Facilities • Railway switch yards • Pumping stations • Truck parking areas	Cargo Transfer • Pump stations • Intermodal transfers	Commodity Storage • Liquids • Particulates • Machinery	Channel Maintenance	Navigation Aids, Vessel Maintenance • Warning devices • Traffic controls • Machine shop • Ship supply depot	Fleet Operation • Tow boats
PHYSICAL- CHEMICAL										
Topography	■	○	■	●	■	○	○	○	○	○
Shoreline	●	■	○	■	○	○	○	■	○	■
Erosion	●	●	●	●	●	○	○	●	○	■
Drainage & Circulation Patterns	●	■	●	●	●	○	○	■	○	●
Water Quality	●	■	●	■	●	■	●	■	○	■
Air Quality	●	●	●	●	●	●	●	○	○	●
Noise	●	●	●	●	●	●	○	●	●	●
BIOLOGICAL										
Terrestrial	■	●	■	●	■	○	○	○	○	●
Wetlands	●	■	●	■	●	■	●	■	○	■
Aquatic	●	■	●	■	●	■	●	■	○	■
SOCIAL- CULTURAL										
Land or Water Use	■	●	■	●	■	■	■	○	○	●
Scenic/Aesthetic	■	●	■	●	■	■	■	●	○	○
Access	■	●	■	●	■	●	●	○	○	●
Multiple Use	●	●	●	●	●	●	●	●	○	○
OTHER										
Natural Resources (non-renewable)						★	★	★		
Land	■	○	■	●	■				○	○
Fuel	○	○	○	○	○				○	●
Construction Materials	●	○	●	○	○				○	○

Table 5-5

QUALITATIVE MATRICES FOR RANGE OF POSSIBLE ENVIRONMENTAL IMPACTS OF TRANSPORTATION MODES RAIL TRANSPORT

- High; long-term, wide-spread or large amount of resources involved
- Moderate; short-term, local or minimum resources involved
- Negligible
- ★ May stimulate indirect resource use

IMPACT	CONSTRUCTION OF TRANSPORT FACILITIES					TERMINAL OPERATION			OPERATION OF TRANSPORT FACILITIES	
	Terminal Facility • Buildings • Switch yards	Roadbed • Bridges • Tunnels • Cuts-and-fills	Commodity Storage • Tanks, warehouses, elevators • Stockpile surface	Fleet Storage • Sidings	Access to Terminals, Intermodal Facilities • Parking, roads, docks • Pumping stations	Cargo Transfer Elevators • Pump stations • Intermodal transfers	Commodity Storage • Liquids • Particulates • Machinery	Roadbed Maintenance • Herbicides/burring • Repairs	Signal Controls, Maintenance • Signals • Engine and car servicing	Tram Operation • Propulsion
PHYSICAL - CHEMICAL										
Topography	■	■	■	■	■	○	○	○		○
Shoreline	○	●	○	○	●	○	○	○		○
Erosion	●	●	●	●	●	○	○	●		○
Hydrology	●	●	●	●	●	○	○	○		○
Water Quality	●	●	●	●	●	●	●	●		●
Air Quality	●	●	●	●	●	●	●	●		●
Noise	●	●	●	●	●	●	○	●		■
BOIOLOGICAL										
Terrestrial	■	■	■	■	■	○	○	●		○
Wetlands	○	●	○	○	●	●	●	●		○
Aquatic	○	●	○	○	●	●	●	●	(NOT APPLICABLE)	○
SOCIAL - CULTURAL										
Land or Water Use	■	■	■	■	■	■	■	▲ ■		■
Scenic/Aesthetic	■	■	■	■	■	■	■	■		●
Access	■	■	■	■	■	●	●	■		■
Multiple Use	●	■	●	●	●	●	●	■		■
OTHER										
Natural Resources (non-renewable)						★	★	★		
Land	●	■	■	■	■					○
Fuel	○	○	○	○	○					●
Construction Materials	■	●	●	●	●					○

5-20

Table 5-6

- High; long-term, wide-spread or large amount of resources involved
- Moderate; short-term, local or minimum resources involved
- Negligible
- ★ May stimulate indirect resource use

**QUALITATIVE MATRICES FOR RANGE OF POSSIBLE ENVIRONMENTAL IMPACTS OF TRANSPORTATION MODES
HIGHWAY TRANSPORT**

IMPACT	CONSTRUCTION OF TRANSPORT FACILITIES					TERMINAL OPERATION			OPERATION OF TRANSPORT FACILITIES	
	Terminal Facility • Buildings • Parking lots	Roadbed • Bridges • Tunnels • Cuts-and-fill	Commodity Storage • Tanks, ware-houses, elevators • Stockpile surfaces	Fleet Storage • Parking lots	Access to Terminals, Intermodal Facilities • R.R. switch yards • Pumping stations	Cargo Transfer • Intermodal transfers	Commodity Storage • Liquids • Particulates • Machinery	Roadbed Maintenance • De-icings • Resurfacings	Vehicle Maintenance • Traffic controls • Vehicle servicing	Fleet Operation • Propulsion
PHYSICAL-CHEMICAL										
Topography	●	■	■	●	■	○	○	●		○
Shoreline	○	●	○	○	○	○	○	○		○
Erosion	○	●	●	●	●	○	○	●		○
Hydrology	●	●	●	●	●	○	○	●		○
Water Quality	●	●	●	●	●	●	●	●		●
Air Quality	●	●	●	●	●	●	●	●		■
Noise	●	●	●	●	●	●	○	●		■
BIOLOGICAL										
Terrestrial	●	■	●	●	■	○	○	●		■
Wetlands	○	●	○	○	○	●	●	●		○
Aquatic	○	●	○	○	○	●	●	●	(NOT APPLICABLE)	○
SOCIAL-CULTURAL										
Land or Water Use	■	■	■	■	■	■	■	■		■
Scenic/Aesthetic	●	■	■	■	■	■	■	■		●
Access	■	■	■	■	■	●	●	■		■
Multiple Use	●	■	●	●	●	●	●	●		■
OTHER										
Natural Resources (non-renewable)						★	★	★		
Land	●	■	●	●	■					○
Fuel	○	○	○	○	○					■
Construction Materials	●	●	●	●	●					○

Table 5-7

WATER POLLUTION POTENTIAL OF TRANSPORT MODES: 1971

Mode	Number of Spills	Percent of Total Spills*	Volume Spilled (MGal)	Percent of Total Volume Spilled*	Average Spill Volume (MGal)
Pipeline	1,446	17	912	10	28
Truck		less than			
Railcar	74	1	101	1	-
Barges and other vessels	2,086	25	4,012	45	-
* Totals not shown					

Source: Council on Environmental Quality, Environmental Quality - The Third Annual Report of the Council on Environmental Quality, Aug. 1972

Table 5-8

AIR EMISSIONS FOR TRANSPORT MODES: 1969
(Millions of Tons)

Pollutant	All Sources	Gasoline Vehicles	Diesel Vehicles	Railroads	Vessels
CO	151.5	96.8	1.0	0.1	1.7
Particulates	35.2	0.3	0.1	0.1	0.1
SO _x	33.4	0.2	0.1	0.2	0.3
Hydrocarbons	35.4	16.9	0.2	0.1	0.3
NO _x	23.8	7.6	1.1	0.1	0.2

Source: U.S. Department of Transportation, A Statement on National Transportation Policy, 1971, p.8

ROLE OF GOVERNMENT

Principal agencies affecting the inland waterways include the following:

- 1. Interstate Commerce Commission (ICC)**
- 2. U.S. Army Corps of Engineers**
- 3. Department of Transportation (DOT)**
- 4. Environmental Protection Agency (EPA)**
- 5. Occupational Safety and Health Administration (OSHA)**
- 6. Federal Communications Commission (FCC)**
- 7. Other Federal agencies - including the Federal Energy Authority (FEA) and for multi-purpose projects: Agriculture, Interior, Federal Power Commission (FPC) and the Tennessee Valley Authority (TVA).**

The Department of Justice Anti-trust Division also enforces those anti-trust laws applicable to the transportation industry. Regulated commerce is exempted from many of the anti-trust provisions by law.

While the inland waterways are regulated in matters of economics, operation, and rates, as well as safety, labor, and environmental pollution control, the overall impact of the various regulatory agencies does not at the present time materially impede the satisfactory operation of the waterways industry, nor their capability to earn an adequate rate of return. On the whole, the waterways industry has accommodated itself to regulation - with the exception of the feeling on the part of industry that there is a gross lack of knowledge and consideration of the practical facts of life with respect to the waterway industry in the development, implementation and enforcement of: regulations by OSHA with respect to safety on the land side of operations; establishment by the Coast Guard of safety and operating

practices in marine waters; and in the imposition by the Environmental Protection Agency of regulations and penalties for pollution on the waterways .

Of all the companies now engaged in the barge and towing industry in the United States , only approximately 10 percent of these are regulated under the Interstate Commerce Act and only approximately 15 percent of movements are in regulated commerce; thus , the economic regulation of the inland waterways has relatively little impact . The major roles of the principal federal agencies affecting the waterways are discussed in following text .

Interstate Commerce Commission

The Interstate Commerce Commission passively or actively approves the published rate schedules of the common carriers , and investigates and penalizes those carriers that fail to live up to common carrier obligations . It also provides a certificate of convenience and necessity allowing carriers to enter the trade of common carriage and issues permits for contract carriers . The ICC can also approve or deny mergers and can approve minimum rates for contract carriers .

The authority of the ICC is more fully detailed in the following text .

1. "... to make and amend such general or special rules and regulations and to issue such orders as may be necessary..."
2. Authority to "inquire into and report on the management of the business of water carriers..." and to require necessary information from carriers .
3. To establish categories of carriers such as "common carrier by water" and "contract carrier by water," as well as to promulgate rules, regulations and requirements to be observed by classified carriers .

4. Relief from law may be granted to carriers suffering "undue disadvantage" from foreign competitors.
5. The commission, upon complaint or upon its own initiative "... may investigate whether any water carrier has failed to comply with any provision..." and can issue orders to compel compliance. It can also dismiss a complaint on insufficient grounds.
6. It is authorized to require annual reports; receive copies of contracts, charters and agreements, and inspect accounts, books, correspondence, etc., as well as lands, buildings, and equipment of carriers.

The ICC has had jurisdiction over water carriers since the original 1887 Act to Regulate Commerce, at that time limited in authority to that water service under common arrangement with railroads and further limited, for the most part, to rate matters. Most of the regulatory powers of the Commission over the water carriers stem from the Water Carrier Act of 1940 (part III of Interstate Commerce Act - Chapter 12 of Title 49, United States Code) which transferred most of the jurisdiction over the waterways from what is now the Federal Maritime Commission to the ICC.

The statement of national transportation policy in the 1940 Act said that it was the policy of 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 foster "sound economic conditions in transportation and among the several carriers;" to discourage "unfair or destructive competitive practices;" 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 also added: "All of the provisions of this Act shall be administered and enforced with a view to carrying out the above declaration of policy."

The ICC has the "power to prescribe just and reasonable rates, fares, and charges of common carriers by water, and classifications, regulations, and practices relating thereto," and to prescribe for contract carriers "just and reasonable minimum rates or charge."

The ICC is an independent non-political regulatory agency and is characterized as being quasi-legislative and quasi-judicial in its function. The Commission consists of 11 members appointed by the President of the United States "by and with the advice and consent of the Senate."

The ICC enforces not only the original ICC Act, but other acts adding to its responsibilities or powers, such as: the Elkins Act, 1903 (making the published tariff the only lawful one); the Hepburn Act, 1906 (commission authority to establish through rates and rates for joint rail-water services; the power to fix maximum joint rates and to establish the division of such rates between rail and water carriers); the Mann-Elkins Act, 1910 (limiting railroad departures from long- and short-haul principle to meet water competition); and the Panama Canal Act of 1912 (imposing severe limitations on operation of water carriers by railroads - specifically restricting ownership of barge lines by railroads if the railroad offered competing land service).

ICC modal regulation is summarized in Table 5-9.

U.S. Army Corps of Engineers

The Corps of Engineers has responsibility for planning, improving and maintaining the inland river systems, for flood control, and for recreation on the waterways. It formerly had authority over navigational aids as well, but this

Table 5-9

SCOPE OF FEDERAL ECONOMIC REGULATION OF INTERSTATE TRANSPORT BY MODE*

Mode	Authorizing Statute	Agency	Rates	Carrier Agreement	Functions Regulated						Exemptions
					Entry	Service	Exit	Merger	Finance	Reporting	
Railroads	ICC Act, Part I	ICC	Max-min-precise	Permitted	PCN*	Car service only	PCN*, train discontinued	Controlled	Controlled	Specified	None
Motor trucks	ICC Act, Part II	ICC	Do	Do	PCN*, permit	Not controlled	PCN*	Do	Do	Do	Agricultural commodities, local transport
Buses	ICC Act, Part III	ICC	Do	Do	PCN*	Do	Do	Do	Do	Do	None
Domestic water carriers	ICC Act, Part III	ICC	Do	Do	PCN*, permit	Do	Do	Do	Do	Do	Bulk commodities
Surface freight forwarders	ICC Act, Part IV	ICC	Do	Do	Permit	Do	Not controlled	Do	Do	Do	Shippers associations, minor carrier groups
Petroleum pipelines	ICC Act, Part I	ICC	Do	Do	Not controlled	Do	Do	Not controlled	Do	Do	None

* PCN indicates Certificate of Public Convenience and Necessity

* Source: U. S. Department of Transportation, 1972 National Transportation Report, July 1972, Table III-1 (p. 35).

has now been transferred to the Coast Guard. Under its mandate, the Corps undertakes an evaluation of the need for new waterways facilities and determines costs and benefits in accordance with established federal guidelines prescribed by Congress. It also prepares and issues environmental impact statements for Corps projects, issues discharge permits for discharge of effluents into the navigable waters of the United States, and issues construction permits for any permanent facilities in navigable waters of the United States. The Corps has responsibility for construction and maintenance of the waterways, and performs much of the dredging maintenance with barges owned by the Corps. It operates most of the locks and dams on the inland waterways system.

In its waterways role, the Corps of Engineers also gathers data on the movements of the waterborne commerce for harbors and major waterways reaches and issues annual reports on such movements.

In its planning activities, the Corps employs the following procedures:

1. It analyzes proposed improvements based upon projected future population and economic activities derived from a national-regional program by the Office of Business Economics of the U.S. Department of Commerce, and the Economic Research Service of the Department of Agriculture.

Such information is supplemented by information obtained from the Bureau of Mines of the U.S. Department of Interior and the Federal Power Commission. The potential for waterborne commerce is analyzed further based upon the significant characteristics of each mode - such as transportation costs, frequency of service, size of shipment, handling costs, and anticipated technological developments. In these areas, consultation is carried on with the Maritime Administration regarding present and future fleet composition and liaison is carried on with DOT with respect to analysis within the national framework.

2. A system analysis of the navigation network elements is evaluated through use of a computer model as part of the inland navigation systems analysis. Alternate development schemes are tested under conditions of simulated future traffic to determine the most cost effective sequence of development.
3. Recommendations for future expenditures for navigational improvements are programmed by a planning programming budgeting system at the national level.
4. An analysis of a full range of alternatives is carried on concurrently with the preceding analyses. Such consideration of alternatives commences with a thorough assessment of the environmental impact of each alternative and includes consideration of measures to mitigate any environmental degradation. It is the policy of the Corps of Engineers to give equal value and weight to economic and environmental factors in consideration of new projects during the planning process.

The Department of Transportation

The Department of Transportation is composed of the Office of the Secretary, the National Transportation Safety Board, and the following operating administrations:

1. U.S. Coast Guard
2. Federal Aviation Administration
3. Federal Highway Administration
4. Federal Railroad Administration
5. Urban Mass Transportation Administration
6. The St. Lawrence Seaway Development Corporation
7. National Highway Traffic Administration

The general responsibilities of the Department of Transportation include the following:

- 1. Leadership in formulating and executing well-balanced national and international transportation objectives, policies, and programs**
- 2. Stimulating and promoting research and development in all modes and types of transportation**
- 3. Coordinating the various transportation programs of the federal government**
- 4. Encouraging maximum private development of transportation services**
- 5. Providing responsive, timely, and effective liaison with Congress and public and private organizations in the transportation field.**

Of the various administrations within the Department of Transportation, only the Coast Guard has a direct responsibility for the inland waterways. The Coast Guard is responsible for safety and navigation regulations for waterborne commerce and for water pollution control. The authority of the Coast Guard extends over both regulated and nonregulated carriers on the waterways.

Aside from the safety and pollution aspects of the Coast Guard responsibility, the Department of Transportation has only a liaison and coordination responsibility in planning activities for the inland waterways and has no spokesman for the waterways within the Department. While the DOT was denied an active modal administrative role for the inland waterways, it influences the waterways through its participation on interagency committees and the Water Resources Council. DOT also has a statutory mandate to lead and actively participate in major policy changes to improve transport, and in this role is empowered to intervene with other agencies and commissions.

Maritime Administration

The Maritime Administration (MARAD) is under the U.S. Department of Commerce and, in accordance with the Merchant Marine Act of 1936, MARAD, is charged with the responsibility within government to promote a merchant marine "sufficient to carry its domestic waterborne commerce." MARAD has assumed the role of waterway advocate and the promotion of inland waterway movements. Under its responsibilities to further the development of the entire U.S. shipping industry, MARAD offers assistance to private industry in the areas of financing relating to mortgage insurance, marine insurance construction reserve funds, and capital construction funds.

Federal Maritime Commission

The Federal Maritime Commission is involved in the regulation of LASH and Seabee barges in international movements. The ICC has assumed jurisdiction over LASH and Seabee barges in domestic movements.

The Occupational, Safety and Health Administration

The Occupational, Safety and Health Administration enforces the provisions of the Act by which the Agency was created. It is under the Department of Labor and is concerned primarily with the safety of persons working in industry - in this case, the waterways industry and its terminal operations in particular.

Environmental Protection Agency

The National Environmental Policy Act of 1969 had as its purpose the establishment of a national policy which would encourage productive and enjoyable harmony between man and his environment: to promote efforts which would prevent or eliminate damage to the environment and biosphere; to stimulate the health and

welfare of man; to enrich the understanding of ecological systems and natural resources important to the nation; and to establish a Council on Environmental Quality.

While it was noted that the policies and goals set forth in the Act were supplementary to those set forth in existing authorizations of federal agencies, to the extent that the Environmental Policy Administration (EPA) can establish standards of environmental quality and enforce adherence to them, it supersedes the authority of other federal agencies.

The key factor affecting the waterways, other than establishment of environmental standards, is the requirement by the legislation that a detailed Environmental Impact Statement must be submitted as part of every recommendation or report on proposals for legislation and other major federal actions which would significantly affect the quality of the human environment. The impact statement is required to address the following:

1. The environmental impact of the proposed action
2. Any adverse environmental effect which cannot be avoided should the proposal be implemented
3. Alternatives to the proposed action
4. The relation between local short term use of man's environment and the maintenance and enhancement of long term productivity
5. Any irreversible and irretrievable commitments of resources which should be involved in the proposed action, should it be implemented.

Provision was made for review by affected and interested agencies and divisions of the federal government, and for review and comment by state agencies (the latter customarily correlated through a lead agency for the state). Adverse and irreconcilable differences and negative comments by key affected agencies and

departments necessitate review at higher governmental levels prior to approval of a decision to proceed with a project or issue a permit for construction.

In cases where there is minimum project impact in terms of change or magnitude (such as a replacement or repair effort), a declaration of negative environmental impact may be filed and this will suffice under the Act. However, if conditions are changed by a project, or if it is significantly modified as compared to the one which it replaces, a statement of environmental impact is required.

The relocation and deepening of the lock sill at the Alton Lock and Dam 26 on the Upper Mississippi necessitated a new Environmental Impact Statement in lieu of a declaration of negative impact. This was the reason that the project was stopped in the courts, because the Environmental Impact Statement did not properly address topics of alternatives (in the forms of other transportation modes) to serve the projected volumes upon which the costs and benefits of the project were based. The stopping of major projects in the courts on the basis of environmental matters is almost invariably a result of the failure of the Environmental Impact Statement to satisfactorily address fully and completely the required five elements. As far as is known, the only case in which the quality or competence of an Environmental Impact Statement was questioned was in the case of an assessment of the potential for earthquake damage for one project.

Under Section XII of the Federal Water Pollution Act, as amended, the EPA must administer and enforce the provisions of the foregoing Act. This Act requires that the EPA designate as hazardous substances such elements and compounds which, when discharged in any quantity into or upon the navigable waters of the United States present an imminent and substantial danger to the public health or welfare. They must also establish recommended means and methods for removing such substances. Under these provisions the EPA is establishing a list of designated hazardous substances and providing penalties for their discharge into navigable waters. The waterways industry sees the penalties and

the risk of economic loss from such actions as being of sufficient magnitude to result in a shift in transport of many of the designated hazardous materials from the waterways to other modes of transport - modes which are indicated to be less safe modes than the waterways by a recent report prepared by Arthur D. Little, Inc.

Other Agencies

Other agencies affecting the waterways include; the Federal Communications Commission which has jurisdiction over communications equipment and its use and allocates and controls the use of various types and channels of radio equipment. Additional agencies affecting the waterways include state and regional agencies, which are influential in some cases - including state natural resources agencies, environmental protection agencies, and state departments of transportation. Other federal agencies include the Federal Energy Administration and, as noted, on multipurpose projects, Agriculture, Interior, and Commerce department, the Federal Power Commission and the Tennessee Valley Authority. The Department of Justice Anti-trust Division enforces the anti-trust laws of the Sherman and Clayton Acts.

Section 6

TRANSPORTATION POLICY AND ITS IMPLEMENTATION

DIFFICULTY IN REALIZING A NATIONAL TRANSPORT POLICY

An efficient transport system is vital to the nation, and this need is apparently broadly recognized and strongly supported by government, shippers, producers, the transport industry, and by the general public. However, there is just as broad a lack of agreement on what an efficient transport system is, what it should cost, who should pay for it, whether it can be afforded, and the means by which it should be achieved. These transport system conflicts arise because each interest group has many dissimilar goals and objectives. These dissimilarities and the conflicts with other national policy goals and between interest groups are the root of the problem of developing a realizable national transportation policy.

POLICY BACKGROUND

There is a fundamental problem in the simplistic assumption that a national transportation policy can be developed which will be fair and which will benefit all. Full equity to all can never be achieved because different interests, goals and values preclude agreement or definition of what is equity. Any transportation policy must be a practical tradeoff balance representing the opinion or beliefs of those with the power to make decisions - those who will implement the broad policy guidelines

It is important also to point out that improvements in one transportation mode will almost invariably result in shifts in commodity movements which will

benefit one mode at the expense of another , except for the rare special case where only additional traffic is thereby made available to the mode as the result of particular circumstances . This factor of shifting commodity movements between modes as the result of improvements is recognized by the various transportation modes , and it supplied the primary impetus for the railroad suit to block the construction of Lock and Dam 26 at Alton, Illinois . The railroads contended that the shift of dam location and enlargement and deepening of the sill for the lock removed the proposed construction from the category of simple replacement and thereby necessitated preparation of a full impact assessment -- including evaluation of transportation alternatives .

It is a general tendency of government agencies to attempt to minimize exposure to risk of failure from non-compliance with laws , to try and preclude criticism , to protect and continue the work of the agency , to take a narrow legalistic view , and to attempt to broaden their sphere of influence . As a result , the will of the people and the apparent intent of Congress is often subverted by the interpretations of regulatory agencies and the courts . This effect can result from lack of adequate guidance at the outset by Congress , or from the practical need to establish in the mandate of the agency a broad enough statement of policy to permit functioning on a continuing basis in response to changing times and conditions . As a result , transportation policy has , to a large extent , evolved as a result of the decisions and regulations made by the various independent regulatory agencies and by the interpretations of the courts .

It is generally agreed , as a result of the manner in which the Federal Government has developed , that this nation has an "advocacy form" of government ; thus , departments exist for agriculture , labor , commerce , transportation , etc . Congress exercises control over the various departments by legislation and by the extent and timing of funding . A major problem now exists as a result of the patchwork quilt type of pattern that has developed ; there are many conflicting advocacies

and these lack full and uniform depths of expertise throughout all areas of designated authority. Thus, conflicting and poorly conceived regulations have been promulgated by the various agencies, and many of the regulations do not adequately reflect the industries and the operations to which they apply. As a result, many regulations and laws are not fully complied with because they are either not practical or economically feasible, or because industry does not know of them. Further, there is a needless duplication of government staff, effort, studies, and funding. It is time now for a new look on the basis of the desired dominant objectives.

NEED FOR RATE REGULATION/REGULATORY APPROACH

Today, many in this nation are questioning whether any form of transport regulation is necessary at all. Reasons given for regulation in the past have included the following:

1. To protect the public or shippers against monopoly or cartels in transportation
2. To prevent ruinous competition between modes, and within modes where semi-monopolistic conditions prevail
3. To preserve or develop transport capability in the interests of the Nation and its defense
4. To promote transport efficiency.

The extent of the criticism directed against transport regulation, and the ICC in particular, should not necessarily be taken as proof that the agency is incompetent, that the concept is wrong, nor that the ICC is not carrying out its intended function. Certainly, valid evidence exists to show that new direction is needed and great improvements could be made in regulation by the ICC.

Conversely, the ICC-accepted rate policy of "value-of-service" or charging "what the traffic will bear" has created considerable disparity between the rates for transport of low value raw material bulk commodities and higher value finished goods. There would appear to be some justification to believe that this may have contributed to the present difficulties of the U.S. rail system. Thus, it could be inferred that the low rates for raw materials may have influenced the movement of industry to close proximity to large population centers - thereby lessening the extent of movement of the higher-revenue-producing finished goods. Thus, the railroads lost in terms of revenue rates on the raw materials (for which they had virtually no competition from trucks), and they lessened the volume movements of finished goods and reduced their competitive position vis-a-vis trucking as a result of the higher rates such rail movements had to bear.

In addition to the question of whether regulation is necessary, questions also arise as to the regulatory approach that should be taken. For instance, should the number of regulatory agencies be minimized or should multiple regulatory agencies be encouraged - and should these be independent agencies or part of a larger agency? Further, which of the various regulatory transportation functions should be encompassed within the jurisdiction of a particular agency - including such functions as: planning; rate regulation; service regulation and right of entry; safety regulation; environmental protection; and construction, maintenance, and operation of transportation facilities?

When it comes to the means of accomplishment of transportation objectives, again a choice exists. The most direct approach of accomplishment of transportation objectives is by fiat or law, specifically establishing those things which are not permitted. Indirect approaches can also be employed which bear upon economics and convenience factors; thus, encouragement of a particular mode or practice can be provided by Federal subsidy or by the extension of privileges

or benefits. Discouragement of a mode or practice can be effected by the imposition of taxes, penalties, user charges, or through increased difficulty or inconvenience of provision of the service.

POLICY OBJECTIVES

For any transport regulation to be effective, it is necessary to define transport policy and objectives to the satisfactory understanding of the regulatory agencies. Typical transportation objectives include the following:

1. **Protect shippers - low transportation rates**
2. **Preserve and develop sound transportation industry**
3. **Conserve energy/resources**
4. **Maximize employment**
5. **Increase efficiency**
6. **Protect environment**
7. **Improve export sales/balance of trade**
8. **Increase GNP**
9. **Develop region/areas**
10. **Preserve/develop transportation capability and service (national defense)**
11. **Integrate transport systems/intermodal**

The selection of objectives and the ranking of their degree of importance must be the result of consideration of the desires and goals of the public, the condition of the nation and the present economy, future expectations, and the need to preserve future options. With respect to transportation in particular, the importance of various alternatives will be significantly influenced by the extent of predicted future transportation demand - whether there will be no growth, or slow, moderate or fast growth in traffic movements. Given the foregoing, the timing delay for construction of facilities necessary to meet future needs will further influence the evaluation of alternatives and sequence of implementation.

EXPRESSIONS OF TRANSPORTATION POLICY

An introduction to Federal policy regarding water transportation and the Corps of Engineers role in carrying out that policy is stated in the Corps of Engineers Digest of Water Resource Policies (EP 1165-2-1 Jan 1975).

"General public interest in navigation antedated the writing of the United States Constitution. However, legal analyses usually begin with the Commerce Clause and subsequent Supreme Court decisions defining the Federal interest and rights to regulate navigation and accomplish necessary improvements on our navigable waterways. Navigable waterways remain a major means of commercial transportation. The physical nature of waterways and their importance to the Nation within the overall transportation network structure justifies continuing Federal responsibility for navigation improvements. Navigation improvement is also a phase of development of the Nation's water resources.

"Objectives of navigation improvements include the following: assist in the development, conduct, safety and efficiency of waterborne commerce - interstate and foreign; meet the need of recreational boating; promote the production and harvest of seafood; recreational boating; enhance environmental quality; encourage expansion of existing and development of new industrial and agricultural production; remove regional and sectional handicaps due to poor accessibility; enhance fish and wildlife resources; enhance social well-being.

"Federal practice pertaining to navigation improvements, which has developed over the years on the basis of Congressional actions, extends only to providing waterway channels, locks and dams, harbor areas, protective jetties and breakwater, of dimensions adequate for movement of vessels efficiently and safely between harbors and other areas of use. Federal concern does not extend to providing free and unrestricted use of unlimited, obstructionless water areas. The navigational authorities available to the Corps of Engineers do not cover waterway improvements to provide navigation access to privately owned facilities (including commercial marinas); access to restricted membership yacht clubs and similar establishments not open to the general public on equal terms; or improvements to enhance and primarily benefit land development schemes. Policy and procedures for the development of water resources in the interest of navigation vary with the type of expected use of the improved waterway or harbor."

The national transportation policy is stated in the 1940 ICC act as follows:

"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. All of the provisions of this Act shall be administered and enforced with a view to carrying out the above declaration of policy."

With respect to the appropriateness of the foregoing, many suggest that the policy should not be changed, in spite of its vagueness and internal conflict because it will never be possible to reach agreement between the three competing surface modes of transport and because, as a general statement of national goals, it is effective. The criticism directed towards the policy is primarily to the effect that it has been distorted and its intent circumvented by the interpretation and application of policy through regulation.

The act establishing the Department of Transportation also bears on national transportation policy:

- "(a) The Congress hereby declares that the general welfare, the economic growth and stability of the Nation and its security require the development of national transportation policies and programs conducive to the provision of fast, safe, efficient, and convenient transportation at the lowest cost consistent therewith and with other national objectives, including the efficient utilization and conservation of the Nation's resources.
- "(b) (1) The Congress therefore finds that the establishment of a Department of Transportation is necessary in the public interest and to assure the coordinated, effective administration of the transportation programs of the Federal Government; to facilitate the development and improvement of coordinated transportation service, to be provided by private enterprise to the maximum extent feasible; to encourage cooperation of federal, state, and local governments, carriers, labor, and other interested parties toward the achievement of national transportation objectives; to stimulate technological advances in transportation; to provide general leadership in the identification and solution of transportation problems; and to develop and recommend to the President and the Congress for approval national transportation policies and programs to accomplish these objectives with full and appropriate consideration of the needs of the public, users, carriers, industry, labor, and the national defense.
- (2) It is hereby declared to be the national policy that special effort should be made to preserve the natural beauty of the countryside and public park and recreation lands, wildlife and waterfowl refuges, and historic sites."

Rail policy is set forth in the "Rail Passenger Act of 1970" as follows:

"The Congress finds that modern, efficient, intercity railroad passenger service is a necessary part of a balanced transportation system; that the public convenience and necessity require the continuance and improvement of such service to provide fast and comfortable transportation between crowded urban areas and in other areas of the country; that rail passenger service can help to end the congestion on our highways and the overcrowding of airways and airports; that the traveler in America should to the maximum extent feasible have freedom to choose the mode of travel most convenient to his needs; that to achieve these goals requires the designation of a basic national rail passenger system and the establishment of a rail passenger corporation for the purpose of providing modern, efficient, intercity rail passenger service; that Federal financial assistance as well as investment capital from the private sector of the economy is needed for this purpose; and that interim emergency Federal financial assistance to certain railroads may be necessary to permit the orderly transfer of railroad passenger service to a railroad passenger corporation."

Merchant Marine policy is set forth in Title 46 Section 1101 as follows:

"It is necessary for the national defense and development of its foreign and domestic commerce that the United States shall have a merchant marine (a) sufficient to carry its domestic waterborne commerce and a substantial portion of the waterborne export and import foreign commerce of the United States and to provide shipping service essential for maintaining the flow of such domestic and foreign waterborne commerce at all times, (b) capable of serving as a naval and military auxiliary in time of war or national emergency, (c) owned and operated under the United States flag by citizens of the United States, insofar as may be practicable, (d) composed of the best-equipped, safest and most suitable types of vessels, constructed in the United States and manned with a trained and efficient citizen personnel. It is declared to be the policy of the United States to foster the development and encourage the maintenance of such a merchant marine, and (e) supplemented by efficient facilities for shipbuilding and ship repair."

The duties of the Secretary of Commerce (through MARAD) with respect to the Inland Waterways are set forth in the Title 49 Section 142 as follows:

"It is declared to be the policy of Congress to promote, encourage, and develop water transportation, service, and facilities in connection with the commerce of the United States, and to foster and preserve in full vigor both rail and water transportation.

"It shall be the duty of the Secretary of Commerce, with the object of promoting, encouraging, and developing inland waterway transportation facilities in connection with the commerce of the United States, to investigate the appropriate types of boats suitable for different classes of such waterways; to investigate the subject of water terminals, both for inland waterway traffic and for through traffic by water and rail, including the necessary docks, warehouses, apparatus, equipment, and appliances in connection therewith, and also railroad spurs, and switches connecting with such terminals, with a view to devising the types most appropriate for different locations . . ."

Congressman John J. McFall, Chairman of the Transportation Subcommittee of the House Appropriations Committee, stated in the hearings of March 5, 1974, that the country lacks policy guidance "with respect to the concept for all mode transportation." He also commented "The Transportation Appropriations Subcommittee has become acutely aware of the need to know where these expenditures will lead us and how they will contribute toward a truly integrated national transportation system." He further stated "A pulling together of the fragmented transport modes so that they may function in a coordinated fashion will not be effected until an integrated transportation policy has been developed."

In a report prepared for the Senate Commerce Committee under the direction of Major General John P. Doyle, titled "National Transportation Policy", there were nine directives for implementation by federal promotional and regulatory programs of a transportation policy which suggested provision of flexible coordinated and impartial promotion and regulation of transportation in interstate

commerce "to the end that the needs of the commerce of the United States, of the Postal Service, and of the national defense be met." The first of the implementation directives called for the fostering of "a safe, adequate and coordinated national transport system composed of carriers of all economically suitable modes, operating singly and in combination with each other, and having as its nucleus privately owned and operated common carriers."

Former ICC Commissioner, A. R. Arpaia, testified at the McFall hearings that "The main thrust of regulation should be to promote efficient, low-cost common carriage to make it so attractive that only exceptional reasons would induce shippers to perform the service themselves."

The National Resources Planning Board in 1942 proposed, in addition to the establishment of a national transportation agency to coordinate all federal development activity in transportation, "public ownership or leasing of all basic transport facilities, with the railroad fixed plant placed in the same category as public highways, waterways and airways and paid for according to use" so as to establish a "basis of equality in the provision of all transportation facilities."

Representative Brock Adams in testimony before the McFall Committee on March 6, 1974, suggested the establishment of one transportation budget, a common trust fund and a new transport committee. He also offered his version of a national transport policy as follows:

"The nation's transportation policy should be directed toward creating and maintaining a privately owned and operated intermodal, interstate system regulated by the federal government in the public interest. The regulations should be uniform for all modes and the degree of regulation should vary with the degree of monopolization existing at any particular point in the system. Government regulations should thus take into account the importance of both transportation and shipping units in a particular market, with competition allowed to set individual prices above cost where neither shippers nor the industry have power to control rates and quality of service.

Otherwise the rates will all be set publicly by governmental regulation. The ICC should be given a period of time to demonstrate whether it can overcome its present regulatory lag; if not, then the regulatory system should be restructured so as to produce prompt and fair regulation."

The then Secretary of Transportation, Mr. Brinegar, testified before the Committee that:

"the National Transportation Policy is really a series of policies that change with changing times and changing conditions and that Congress itself is continually making transportation policy through its actions."

He made the point that transportation is not an end in itself but rather a means to contribute to the economic well-being and quality of life in the country. Thus, he said, "transportation policy is developed to serve national goals."

He stated that:

"almost any meaningful statement of policy will be seen as a threat by some interests. Moreover, the very concept of a national transportation policy is inherently vague and elusive. But progress toward a useful policy statement is possible - provided we recognize its limitations and stay away from indefinable platitudes."

Secretary Brinegar proposed the following basic principles as guidelines to be employed in meeting the nation's transportation needs:

- "1. Federal policy should be directed to see that the nation has an overall transportation system that reasonably meets its essential needs. To the maximum feasible extent, this system should provide transportation that is efficient, safe, fast, convenient, and limits negative impacts on the environment.

- "2. To the extent possible, the transportation system of the nation should be provided through the competitive forces of the private sector or, if private sector is inappropriate, by state and local governments.
- "3. Federal expenditures used to finance transportation investments or operations should be recovered from users and other beneficiaries in a manner that is appropriate to the degree of benefits received, unless widely accepted national policy directs otherwise.
- "4. Economic regulation of interstate transportation should be reexamined thoroughly at frequent intervals to determine which parts are necessary and the minimum degree of regulation necessary to protect the public interest. Those which have been a burden or not necessarily in the public interest should be discontinued.
- "5. Transportation issues involving conservation of scarce energy resources, the provision of safe transportation, protection of the environment and the availability of satisfactory transportation for the poor, the handicapped and the elderly must be dealt with aggressively.
- "6. Special federal effort should be directed to the severe transportation problems present in the nation's large urban areas and to the relationship of these problems to other urban issues.
- "7. World public transportation policy should be studied with the intent of developing appropriate policy guidance applicable to this area of transportation.
- "8. Close coordination between passenger and freight transportation among the various modes should be effected to remove major causes of inefficiency.
- "9. Federal research and development work in transportation should be carried on and directed into a limited number of programs with a high potential payoff to the nation as a whole and into those areas of research in which it is likely that they could not be adequately carried out without some degree of federal support.
- "10. The overall level of knowledge about the national transportation system, its capabilities and its problems should be enhanced and the information disseminated."

With respect to criticisms of national transportation policy, Dwight Blood in a report to the National Water Commission, entitled "Inland Waterway Transport Policy in the United States", pointed to the principal deficiencies in waterway transportation policy as follows:

1. A major weakness of the present program stems from the deficiencies in the procedures by which it is determined whether or not a proposed waterway project would result in a justified addition to the national transportation system.
2. A major weakness of the legislative policies governing the present program is that they do not require beneficiaries to share in the cost of constructing, operating and maintaining federal waterway projects.
3. The inland waterway system is inescapably an element of the national transportation system yet the waterways are not planned, evaluated or regulated as part of the national transportation system.

A 1960 report of the Department of Commerce describes national policy in the following words:

"National transportation is presently out of balance. It is less a national system than a loose grouping of individual industries. We have built a vast network of highways, railways, inland waterways and seaports, airways and airports, and pipelines, with little attention to conflict among these expanding networks. Economic regulation has been administered in rigid compartments although many basic problems are common to many areas of transportation. Total capacity is not closely geared to total need."

The National Water Commission report emphasized that in the development of an effective national transportation policy it was impossible to separate water policy and transportation policy insofar as the inland waterways are concerned.

Principal recommendations of the National Waterway Commission were that estimates should be made of the true economic cost and benefit to the nation of providing contemplated transportation service, and comparisons should be made with the true economic cost of providing the service by the least cost alternative. They also recommended user charges and regulation of rates of competing modes to encourage the use of the waterways for traffic that could move at the least economic cost to the nation by the waterways. They also recommended that the Department of Transportation should develop a plan which would "bring into being an integrated national transportation system in which all modes of transportation, including inland waterways, are utilized in such a way as to reduce to a practical minimum the cost to the nation of meeting the demands for transportation."

This nation has established national goals with respect to the preservation of the environment, the promotion and development of domestic and foreign trade, self-sufficiency in energy, and protection of life, property and almost every interest group in the nation. Transportation is affected by myriad national goals, objectives, laws and regulations - examples include: truck axle limits on interstate highways and limitations on the number of trailers; regulation restricting pooling of shipments between competing rail lines by the Interstate Commerce Commission; establishment of conflicting jurisdictions for various agencies and commissions such as OSHA, Coast Guard, DOT, MARAD, etc.; denial to the ICC of regulatory rate jurisdiction over shipments in which movements are both by regulated and exempt carriers; many suggested policies with respect to evaluation of new federal investment projects such as discount rates, benefits, etc.; and a need for decisions with respect to imposition of user charges and the extent of federal subsidies, grants, and taxation.

POLICY IMPACT MATRIX ANALYSIS

Waterway and transportation policy are also influenced by such pragmatic factors as stimulation of the economy, regional development, and the need for

recognition by local constituents of the value of members of Congress in conferring federal benefits and largesse upon the areas of such constituencies .

From the foregoing , it is clearly evident that while the nation has a statement (or several statements) of national transportation policy , it has no actual transportation policy - because of the lack of understanding of such a policy by Congress , the general public , and those affected by transportation policy . Because of this , and to point out the conflicts and range of policy and goal objectives which impinge upon the transportation industry , a matrix analysis has been developed presenting some of the policy goal and event occurrences which by their implementation in varying degrees could significantly affect the size , capability , configuration , degree of intermodal movements , and position of the various transportation modes in a national transportation system for the United States . This matrix analysis is presented in Table 6-1 as an open matrix .

ANALYSIS OF POLICY AND GOAL FACTORS AFFECTING THE WATERWAYS

A policy is normally considered as a guide for the government decision-making processes to assist in the attainment of established goals by the selection and development of specific action programs . DOT in "A Progress Report on National Transportation Policy" in May 1974 stated the following: "Policy development is thus seen as the decision-making process by which we select from available alternatives those courses of action which are best calculated to attain certain goals and at the same time be most compatible - or least inconsistent - with other , sometimes conflicting , goals . The policies thus selected are those best suited to the problems and resources at hand . In this perspective , policy is the necessary link in the never-ending process of translating the many and often conflicting national goals into specific action programs . Policy should address the large issues that affect all or major parts of the system rather than small pieces of the system ."

Policy , irrespective of the manner in which it is defined , is generally best identified and interpreted by the actions taken toward the fulfillment of goals ,

however specified. Implicit in goal attainment or performance measurements is the notion that evaluation takes place. Without evaluation, it is impossible to say which policies will lead to greater goal satisfaction or which policies and their related program departures will lead to more efficient goal attainment, i. e., the same output mix in terms of quantity and quality but produced with fewer resources. Efficient goal attainment thereby is contingent upon the selection and proper application of evaluation methods.

Waterway policy presently consists of an uncertain mixture of transport and water resource goals, to the extent that our nation has operationally definable goals in these fields. Thus, both transport and water resource policies must be considered as they pertain to the waterways. National water policy, is at best fragmented and elusive. The goals of water resource management, setting aside the substantive areas of irrigation, navigation, flood control, and recreation, are imperfectly specified to the extent that, if any goal structure exists at all, it has been set forth by the Water Resources Council as follows:

"The overall purpose of water and land resource planning is to promote the quality of life by reflecting society's preferences for attainment of the objectives defined below:

- a. (To enhance national economic development by increasing the value of the nation's output of goods and services and improving national economic efficiency
- b. To enhance the quality of the environment by the management, conservation, preservation, creation, restoration or improvement of the quality of certain natural and cultural resources and ecological systems. "

The complexity and multi-dimensional nature of various goals and alternate courses of action requires the employment of an approach which will place these

on a common denominator for evaluation. The analytical approach most commonly employed to evaluate multiple alternatives today is a benefit-cost framework. Given alternatives, such an approach, properly implemented, can produce a "correct" ranking of alternatives. Such a ranking, however, is contingent on the development and use of objective measurements of the underlying costs and benefits.

Aside from the factors of multiple use there are two primary justifications employed by policy makers to support approval of waterway investment expenditures. These benefits consist of regional economic growth induced by low cost water transport, and transport costs savings to the present and potential shippers of commodities that would be expected to utilize the improved water facilities. Present transportation policy is at best a compendium of fragments of legislation and history. This view is reflected in the DOT statement on national transportation policy:

"Much transportation policy already exists, some made consciously by legislation, some by continuing interpretation and evolution, and this 'existing policy' must be consciously made the point of departure when developing new policies."

Some policy exists which is less formally stated but just as real. Other policy was consciously wrought at its inception but its evolutionary development has varied from its original intent.

While there are many aspects of transportation that have been covered by existing or evolving policy, either explicit or implicit, there are others where policy to all intents and purposes is absent or at best unclear. What, for example, is the national policy on support of transportation by federal sources of funding... no coherent transportation policy can justify the uneven treatment of the various modes.

There exists at the present time no clear concise statement of national transportation policy. In this respect, it must be recognized that transportation policy statements, to have a broad acceptable base, must, out of necessity, retain a degree of flexibility. In addition, changes in policy will tend to be viewed by some interests as threats to their entrenched positions. The result is that many transport policies are conflicting and ill-defined. Within this broad spectrum such a thing as "a waterway transport policy" simply does not exist.

With respect to the place of transportation in national goals, it is recognized that there have been significant changes in goals and priorities of the nation and this has resulted in inevitable conflict between the traditional forces and the concerns of a broadening class of citizens interested in transport and its associated impact on their life-style and environment. Transportation has come increasingly to be recognized as a major ingredient in social goal achievement. Included within this list of social goals are such diverse ends as national defense, regional growth and employment, energy conservation, safety, environmental protection, urban and rural development, human development, civil rights, etc. As stated by DOT in "A Progress Report on National Transportation Policy," "To the extent the different goals and priorities exist, and these elements are continually changing, policies designed to satisfy such diversities must be flexible." It is within this framework that the evolution of a national water policy or national transport policy becomes rather meaningless.

Section 7

ECONOMIC AND SOCIAL IMPACTS OF THE INLAND WATERWAYS

The economic and social impacts of the inland waterways can only be appreciated within the context of the position of the inland waterways in the transportation industry, and the function of transportation as a whole in its contribution to economic and social well being. Transportation may be defined as an economic activity which provides the capacity to move persons or things from one place to another. It is an essential element of the production process and its function is to bring together resources from places of origin to production and to provide for distribution of goods from production to market. Efficient transport reduces the combination of time and distance costs to a minimum. Efficient social use of transportation makes the optimum employment of transportation capability in conjunction with production of raw materials and manufactured goods to produce these commodities at the lowest cost to the nation.

Transportation needs arise from differences between areas in terms of displacement of raw materials, manufacturing capability, labor supply, etc., which create a demand in one area for commodities produced in another - whether in the form of raw materials or finished goods, or services. Bulk raw materials movements presently account for almost 70 percent of the total transportation ton-miles for all modes. Further, the raw materials that make up these traffic flows are highly localized.

The function of transport is to bring materials together from non-self-contained regions for further processing and/or consumption. Transport forms a physical framework of a community, and transport routes are decisive factors in the location of economic activity; the foremost factor in development of traffic routes is traffic potential. Improved and lower cost transport has widened markets, encouraged the division of labor and geographic specialization, and has thereby brought about increased competition and a reduction of prices. For transportation movements, if the difference in price between comparable competing goods produced in different location equals the marginal cost of transportation between areas, an inter-regional commodity flow will take place. If the rates charged for transport services do not reflect long run marginal costs, inter-regional trade will not be efficient. In the latter case, there will be excessive demand for transportation services, which in their satisfaction will waste scarce resources.

Transportation is of major importance in national development because in its own right it represents a major investment in resources and thereby is a contributing factor to regional development and availability of employment. It is estimated that at least one-third of the national wealth of the country is devoted directly to transportation.

REGIONAL DEVELOPMENT

Regional economic growth is increasingly dependent on the performance of the national economy. National economic growth is shaped by basic market forces and governmental policies. Development of waterways and inland ports and related industrial developments is a potential means of improving regional growth. The National Water Commission commented in regard to water policy related to future regional development:

"Water must be increasingly viewed as a scarce resource, one to be developed for regional economic growth only when:

- " (a) market demands indicate that the goods and services that would be produced are needed by a growing economy .**
- " (b) substitutes for water-related goods and services are not economically competitive in meeting these demands , and only where:**
- " (c) the competitive advantage is favorable , and**
- " (d) the region is willing and economically able to undertake complementary development activities"**

It was the conclusion of the Commission that:

"Use of existing developments to achieve increased regional gains has the twofold advantage of being more efficient and reducing the otherwise long lead time required for (new) project planning and construction."

Charles Rivers Associates concluded that:

". . .in order to capitalize on the trend toward regionalism of industry , a region must have a good intraregional transportation system."

Because of the importance of transport in total production cost , it is one of the most important factors dictating industry location . Economic development ,

and particularly development on a scale which will be attractive economically, is contingent thereby upon the availability of transportation and upon the rates charged for transportation. Discrimination, if any, between the rates charged for various classes and types of commodities, will further dictate the type of production to be undertaken within a region and whether it will devote its resources to the production of raw materials or manufacture or both. Thus, "value of service" pricing tends to locate productive capability for manufactured items closer to major markets, as distinguished from production nearer raw material resources.

The characteristics of the inland waterways also tend to influence the nature of area or regional development which they will encourage. As heretofore noted, the inland waterways are slower in speed of traffic movements than other modes of surface transport and have large tonnage or bulk requirements for tender. They are thus primarily directed towards the transportation of raw materials or intermediate goods which move in large commodity movements or flows, rather than the movement of discrete packaged units of higher value commodities. Thus, the extension of an inland waterway into a less developed area or region never previously served will tend to encourage the production of raw materials or items which are of such size as to render rail or highway transport impractical. Conversely, for a developed region they will tend to increase manufactures by lowering the costs of raw materials. Waterways also contribute increased access for bulk movement of agricultural products, such as grain.

Waterways also are looked upon as a favorite means of regional development because of the prevailing idea that they offer a means of natural transport that is less expensive than rail. Waterway transportation rates are frequently referred to as "base rates" and are viewed as a means of reducing or keeping down rail rates.

There also is a prevailing notion that the benefits of low-cost water transportation should be extended to all parts of the nation. This has led to the development of waterways with ever-decreasing economic benefits and return to the nation. The costs of increasing the capacity of the waterways and extending the service area is rising by virtue of the extent of the facilities required, and the inflation in costs to provide such facilities. Such new developments are also frequently less efficient than the previously developed waterways because of the lesser water volumes available, the number of locks and dams required, the narrower channels, and the more convoluted routes which such waterways frequently must follow.

Transport is required to bring in the goods and services necessary for the initial developments of a new area or region and to sustain its continued economic health after initial development, as well as to provide a means to bring production to market. Low-cost transportation permits service of a broader market (raw materials or finished goods). Water transport, because of its low cost, is a favorite method of promoting area development. Low-cost transport in any form promotes economic development.

Balanced regional growth is the dream of politicians in general, and economic growth within the constituency of each selected official is vital to his continued success in public service. This, it must be recognized that forces acting towards optimum development of national well-being are often in practical conflict with forces acting to promote limited regional or industrial development. Balanced regional growth is also rendered more difficult by the fact that the resources of the nation are not equally dispersed, and equal benefits cannot be realized for the same investments made in facilities for production or transport in the various regions.

The inland waterways have been, and are, major contributors to the economic well-being of significant segments of our national economy and of the economic health of many regions of the nation. They have provided the transportation capability for the movement of bulk materials and have provided the low freight rates to render such bulk movements economically possible. These same low freight rates have driven down freight rates in competing modes within their service area, and have provided a means by which markets could be broadened and/or profit margins increased. This has been particularly evident in the area of improved competitive position in this country. The waterways have also extended their benefits to those manufacturers producing semi-finished products, such as strip steel, employed in the manufacture of finished goods (washing machines, etc.). Thus, there can be no question but that those regions employing and having the availability of adequate water transportation networks are favored in economic development over those which do not have similar access.

The potential for the extension of the inland waterways system is strictly limited: adequate water quantities must be available for navigation (after competing uses of higher priority have been satisfied); the waterway must be available for a sufficient portion of the year to render its use desirable; the economic cost and the potential environmental damage must be offset by the economic benefits and other social benefits realized; and finally, sufficient existing or potential traffic must be available to warrant the construction, operation, and maintenance of the facility and for the waterways industry to provide the necessary service to that waterway. Another factor of importance in waterway development is the need to have traffic volumes available for movement spread out over the transportation year. It is not economically attractive to have to provide excessive surplus transportation capability to meet peak transportation requirements of short duration. Thus, short peak seasonal movements or movements

confined to a few days per week would not make sound economics and efficient use of facilities not otherwise required. In recent years, the movement of grain on the waterways has been levelled over much of the year by putting grain into storage and shipping it in more equal movements over a greater portion of the year.

The improvement of an inland waterway immediately increases the value of land in a reasonable proximity to the waterway and the value of the waterfront sites for industry. Waterway terminals contribute to local area development as well, but their role is to make available the benefits of water transportation to industry and to the economy in general.

Providing an efficient price mechanism exists, investment will not be attracted to locations where economic activity is less profitable. However, decisions to provide for the availability of low-cost transportation systems will influence the location of industry - irrespective of whether the social costs of subsidy will render it less attractive to the nation as a whole. For example, the efficient use of locally available inputs may be bypassed in favor of less efficient substitutes which require transportation. The distortions in best economic use of the nation's wealth caused by inefficient transport policies are, to some degree, irreversible. Badly located plants tend to stay and may attract further investments which will be ill-suited to the neighborhood. However, such irreversibility has meaning only in the short run, and efficient policies should motivate regional growth toward balanced development.

Deepwater ports are a key link with the inland waterways and the development of inland regions because of their provision of an interface with foreign trade. Thus, they provide the benefits of transshipment to ocean-going vessels - enabling the costs of inland water transport to apply to foreign trade; they also provide a site at which barge carrying vessels may discharge their barges for movement on the inland waterways (LASH and Seabee).

SOCIAL WELL-BEING

Social Costs

It can be expected that in the future social costs will be as important a project cost consideration as the direct economic costs of the facilities themselves. Under the National Environmental Policy Act, benefits and costs must be determined on social, environment, and political, as well as on economical and technical, factors. As a premise, the Council of Economic Advisors in its 1972 annual report stated:

"...if our economic system is to make its maximum contribution of national well-being...success... requires that the full social cost be paid for the use of resources...This means that resources may not always be allocated in a way which best serves national welfare.

. . .

"...The transportation industry is a case where special care must be taken to assure that government policies do not promote inefficiency by permitting private costs to diverge unnecessarily from social costs."

Distribution of Population and Industry

Distribution of Population. Government policy on population distribution is stated in the report by the Commission on Population Growth and the American Future to be:

"...The United States has no explicit overall population distribution policy, nor does it have any programs whose primary intent is to influence major migration trends. However, many public programs; such as economic development of rural and depressed areas, urban renewal of central

cities, and open space acquisition, have the modification of settlement trends as a secondary intent. Such programs have had relatively greater impact within metropolitan areas than between regions. Their indifferent success in affecting broad geographic distribution has been attributed to the fact that they were neither designed, administered, nor funded of the private sector which induces population distribution trends."

Distribution of Industry. Saunders, although not conclusive as to the correlation of economic growth and population growth, projected economic growth as follows:

"In the context of economic growth, the growth center would be expected to contribute and exchange resources and manpower with the region it is supposed to serve. These inter-relationships should include a transportation system that will serve not only industry, but also residents of the growth center and the region it serves. This would result in the exchange of manpower and services to and from the center with the center providing educational, cultural, social professional, and governmental services."

Federal economic policies can be expected to have an influence on nationwide economic growth in each of the component regions of the nation. The national economic policy "to promote maximum employment, production, and purchasing power" will have a dominant influence.

To the extent that inland waterways are favorably located geographically their use in continuing to serve industry can be assumed, either as a separate mode or as a part of an integrated intermodal natural transport system.

Land Use. There is a growing national commitment to the restoration and/or preservation of our environment, including the conservation of natural resources, and focus on better land use has been a major target of many group actions.

With respect to the social well-being objective of land and water resources, the Water Resources Council in its report stated that:

"The social well-being objective is enhanced by the equitable distribution of real income, employment, and population, with special concern for the incidence of the consequences of a plan on affected persons or groups; by contributing to the security of life and health; by providing educational, cultural, and recreational opportunities; and by contributing to national security.

"Components of the well-being objective include:

- (a) Increasing the real income of disadvantaged persons or groups defined as being relevant to program evaluation...
- (b) Achieving desirable population dispersal and urban-rural balance through distribution of population and employment opportunities in accordance with specified national goals...
- (c) Improving conditions contributory to attainment of economic stability."

As related to transportation, the Council of Economic Advisers in its annual report, transmitted to Congress in February 1971, contended in this regard that:

"The application of the value-of-service rate structure to all modes also contributed to the problems of rural depopulation and metropolitan congestion. . . Under the value-of-service rate structure, rates on finished goods tend to be higher than those on raw materials. These higher rates on finished goods give manufacturers an incentive to locate close to or in the metropolitan areas where their major consumer markets are found, rather than in the areas where raw materials are produced.

. . .

"...with cost-based competitive rates, some of the manufacturing activity now carried on in the large population centers, because of the high finished-goods rates in the current value-of-service rate structure, would then shift to the smaller towns and generate increased incomes there."

Environmental/Recreational Factors. The basic causes of our environmental problems were set out in a report of the Council on Environmental Quality, as follows:

"The basic causes of our environmental troubles are complex and deeply imbedded. They include: our past tendency to emphasize quantitative growth at the expense of qualitative growth; the failure of our economy to provide full accounting for the social costs of environmental pollution; the failure to take environmental factors into account as a normal and necessary part of our planning and decision making; the inadequacy of our institutions for dealing with problems that cut across traditional political boundaries; our dependence on conveniences, without regard for their impact on the environment; and, more fundamentally, our failure to perceive the environment as a totality and to understand and to recognize the fundamental interdependence of all its parts, including man himself."

One of today's primary concerns is the extent to which land, water, and air can absorb our generated wastes. According to the Council in a subsequent report, adherence to a "polluter pays" principle will contribute to a more efficient allocation of productive resources. With respect to transportation, the inland waterways are one of the least polluting modes, thus, it can be concluded that the application of the "polluter pays" principle will not work to the detriment of inland waterway transport relative to the other modes, and will even improve its competitive position as compared to rail and highway trucking.

Recreational uses of waterways include boating, sport fishing, and body-contact recreational activities such as swimming. The intensity of recreational use of a waterway system depends on water quality, water quantities, accessibility, and demand/supply characteristics of the recreation facilities in the area.

Water quality may be degraded for recreational use by commercial traffic and terminal operations, especially through spills or discharge of polluting materials. Use of waterways for other activities such as waste assimilation may also limit or eliminate recreational activity through degradation of water quality. Recreation potential may also be eliminated in a water body by the establishment of water quality criteria too high (public water supply) for recreation to be allowed.

Water quantities required for navigation generally exceed those needed for recreational activities. However, heavy waterway traffic and terminal operations may limit activities on the water surface and may also restrict access to potential recreational sites. Noise, fumes and appearances of terminal operations may also discourage recreational activity in the terminal area. Construction of impoundments and canals for the enhancement or initiation of navigation preempts one or more forms of recreation for others. Recreational activities common to rivers or streams are not completely equivalent to those activities common to reservoirs, for example, fish and wild life species differ, boating preferences vary, and water contact sports change. Navigational improvements, therefore, may limit the recreational activities of some individuals and expand the activities of others.

Labor Aspects. In framing the Employment Act of 1946, Congress declared in Section 2 that the objective of national economic policy was, among other things, "...to promote maximum employment..."

As between transport modes, each carries a substantial portion of the nation's intercity freight. In terms of ton-miles, during 1970 the modal portions were: rail - 40 percent, truck - 21-1/2 percent, inland waterways - 16 percent, and pipeline - 22-1/2 percent.

Overall, gains or losses in the volume and movement of goods by one transport mode are generally offset by gains or losses in one or more of the other modes. This would also be true for an integrated intermodal national transport system. However, greater modal efficiency or a lower rate of modal manpower utilization would tend to reduce the total amount of employment unless the reduced transport costs contributed to increased production and thereby resulted in greater employment. Thus, it would generally appear that employment in transportation would be maximized by increasing traffic volumes of surface modes in accordance with the following priority: truck, rail, water. However, the focus of an integrated transport system should be on efficiency - no single sector of the economy should bear the burden of maximizing employment if achieved by reduced efficiency.

Waterway Contribution. Providing that the desirability of the premise of spreading the growth of the industry of the nation throughout the country and broadening areas of development are accepted as being desirable, then the waterways contribute significantly to the social well-being of the country. The low transportation rates which they provide, or induce in other transportation modes, have permitted the dispersion of industry from coastal areas and have opened up large areas to agricultural production which would perhaps not otherwise have had economic markets. The waterways have also permitted the broader development of land use by a greater segment of the population, and have permitted land

uses otherwise economically impractical. They have further made possible the economic development of resources which could not otherwise have been made available to satisfy the productive demands of the country.

Corollary aspects of the developments of the inland waterways include the provision of recreational facilities by the large water pools contained behind the dams, the provision of flood control protection, and the equalization of flow throughout the calendar year. These same water pools have also provided year-around water sources for other development uses such as public water supply, agricultural irrigation, and industrial uses. The canalization of the waterways has also acted to protect property values and human life by containing flows within stream or canal banks.

The contributions of the waterways to regional economic growth have also produced social benefits of increased employment in the areas which they serve.

It is important to note that much of the foregoing has been based upon the benefits of the waterways and of transportation in terms of regional development. To the extent that such regional development contributes to the most efficient utilization of the resources of the nation as a whole, or to the extent that it contributes to recognized need for development (transcending economic cost factors), then regional development is of great benefit to the nation. However, if the interests of the nation as a whole are the dominant force in policy decisions, then regional development which does not make the most efficient use of national resources, which represents a reallocation of benefits, or which results solely in a dislocation or transfer between regions must be recognized as conferring benefits to one region at the expense of another - and as not being in the best interests of the nation as a whole.

Section 8
THE INLAND WATERWAYS SYSTEM

DESCRIPTION

The Waterways

The inland waterways system, as shown in the frontispiece, includes the Upper and Lower Mississippi River and its tributaries such as the Ohio, Tennessee, Illinois, Arkansas, and Missouri Rivers; such other southern and eastern waterways as the Alabama-Coosa and the New York State Barge Canal; and the Columbia and Sacramento Rivers in the West. Of these, only the Lower Mississippi and the Missouri are open rivers (without dams and locks for navigation).

The Mississippi River system is the main artery of the inland waterways network and with the Gulf Intracoastal system makes up 58 percent of the navigable inland waterway mileage. The Mississippi system includes the following segments:

1. Upper Mississippi River (Minneapolis/St. Paul to St. Louis)
2. Lower Mississippi River (St. Louis to the Gulf of Mexico)
3. Illinois River
4. Ohio River (including the Allegheny, Monongahela, Kanawha and Greene Rivers)
5. Missouri River
6. Tennessee River

7. **Arkansas River**
8. **Alabama River (including the Black Warrior, Warrior, and Tombigbee Rivers)**

The Gulf Intracoastal Waterway is linked directly to the Mississippi system and stretches eastward 1,800 miles from Brownsville, Texas to St. Mark's, Florida.

The more northerly inland waterways are subject to seasonal limitations in that they are shut down by ice for approximately four months of the year. Characteristics of principal waterways are summarized in Table 8-1 and Figures 8-1 through 8-10. Studies of the movement of typical commodities on the waterways indicate an average circuitry factor of approximately 38 percent as compared to a direct great circle route between origin and destination; this is greater than for other modes.

Most of the major inland waterways (60 percent) are presently maintained at a 9-foot project depth, accommodating an 8-1/2-foot barge draft; however, 12-foot depths are available on the Lower Mississippi approximately 70 to 80 percent of the year, and in much of the length of many of the individual pools of the Ohio River system.

The Locks and Dams

Many of the major waterways are "canalized" by systems of locks and dams which permit year around operation with respect to water level availability, and improved transportation economics by virtue of barge movement in a "slack water" system. The locks of these dams provide some of the more significant restrictions and limitations upon the flow of traffic through the inland waterways.

The barge tows of the inland waterways traverse the canalized rivers by a series of locks in which the tow is raised or lowered to the water level of the

Table 8-1
**NAVIGABLE LENGTHS AND DEPTHS
 OF UNITED STATES WATERWAY ROUTES**

GROUP	LENGTH IN MILES OF WATERWAYS					TOTAL
	UNDER 6 FT.	6 TO 9 FT.	9 TO 12 FT.	12 TO 14 FT.	14 FT. AND OVER	
Atlantic Coast Waterways (exclusive of Atlantic Intracoastal Waterway from Norwalk, Va., to Key West, Fla., but including New York State Barge Canal System)	1,426 1,487	1,241 1,445	584 589	938 965	1,581 1,544	5,770 6,030
Atlantic Intracoastal Waterway from Norfolk, Va., to Key West, Fla.	---	65 160	65 65	1,104 1,104	---	1,234 1,329
Gulf Coast Waterways (exclusive of Gulf Intracoastal Waterway from St. Marks River, Fla., to Mexican Border)	2,055 2,174	647 812	1,133 2,095	79 269	378 388	4,292 5,738
Gulf Intracoastal Waterway from St. Marks River, Fla., to Mexican Border (including Port Allen-Morgan City Alternate Route)	---	---	---	1,137 1,180	---	1,137 1,180
Mississippi River System	2,020 4,365	969 1,457	4,957 5,062	740 755	268 268	8,954 11,907
Pacific Coast Waterways	730 733	498 515	237 237	26 27	2,084 792	3,575 2,304
Great Lakes	45 100	89 148	---	8 8	348 369	490 639
All Other Waterways (exclusive of Alaska)	76 76	7 7	---	1 1	7 7	91 91
GRAND TOTAL	6,352 8,935	3,516 4,544	6,976 8,062	4,033 4,309	4,666 3,368	25,543 29,218

The mileages shown in this table in **bold type** represent the lengths of all navigable channels of the United States including those improved by the Federal Government, other agencies, and those which have not been improved but are usable for commercial navigation.

The mileages shown in this table in **light type** represent the lengths authorized for improvement by the Congress of the United States in legislation known as Rivers and Harbors Acts.

The sources for these tabulations are publications of the Corps of Engineers, United States Army.

Figure 8-1

LOWER MISSISSIPPI RIVER

This section of the waterway extends from Cairo, Illinois, at the mouth of the Ohio River to Baton Rouge, La. The Atchafalaya and Old Rivers from Mississippi River to Morgan City are included as part of this project.

Total Mileage: 957

Project Depth: 12 feet

Project Width: 300 feet

Lock Dimensions:

Mississippi River
open river navigation

Atchafalaya and Old River
Old River 75 by 1,200 feet

Authorizations: Original project: 1824
Existing project: 1928 and 1944

Navigation Season: 12 months

Commodities and Tonnage: Total commerce for 1973 was 100,396,000 tons and 59,256,286,000 ton-miles with an average length of haul of 590 miles. The principal commodities and tons transported on the waterway were: grain (27,339,900); petroleum and petroleum products (17,645,900); chemicals and products (11,740,800); coal (10,567,600); and nonmetallic minerals (3,785,676).

Condition of Waterway: The 9-foot project is complete to Cairo. No work has been done on the 12-foot project.



Figure 8-2

MIDDLE MISSISSIPPI RIVER

This section of the Mississippi extends from the mouth of the Missouri River to the mouth of the Ohio River.

Total Mileage: 185

Project Depth: 9 feet

Project Width: 300 feet

Lock Dimensions:

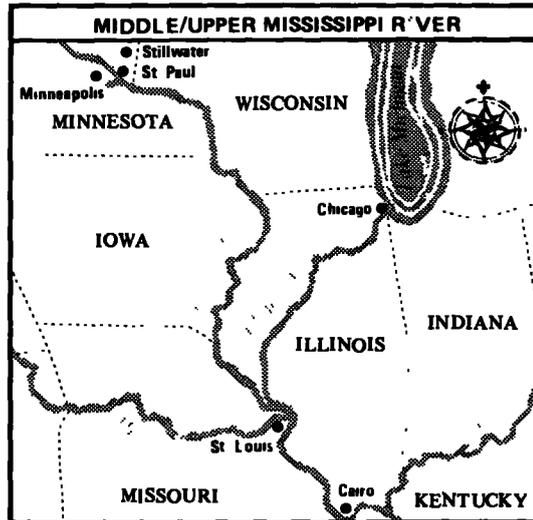
Lock 27 - 110 by 1,200 feet and
110 by 600 feet

Authorizations: Original project: 1881
Existing project: 1927 and 1945

Navigation Season: 12 months

Commodities and Tonnage: Total commerce for 1973 was 63,386,000 tons and 10,434,821,000 ton-miles with an average length of haul of 187 miles. The principal commodities on the waterway consisted of: grain (23,596,142); coal (9,742,747); petroleum products (8,935,400); chemicals and products (3,680,431); and nonmetallic minerals (2,045,000).

Condition of Waterway: The project has been in beneficial use practically from its conception in 1881. A study is underway to determine whether project criteria need to be revised to assure a dependable 9-foot project depth.



UPPER MISSISSIPPI RIVER

Navigation on the Upper Mississippi River starts at Minneapolis, Minnesota and flows southward to the mouth of the Missouri River, just north of St. Louis, Missouri.

Total Mileage: 663

Project Depth: 9 feet

Project Width: 300 to 1,000 feet

Lock Dimensions:

- 56 by 400 feet
- 110 by 600 feet
- 110 by 1,200 feet
- (28 locks and dams)

Authorizations: Original project: 1878
Existing project: 1930

Navigation Season: 9 months

Commodities and Tonnage: Commerce from Minneapolis to the mouth of the Missouri River consisted of 58,064,000 tons and 10,879,201,000 ton-miles in 1973 with an average length of haul of 187 miles. The principal commodities moved on the Upper Mississippi River consisted of: grain (23,644,800); petroleum products (11,163,314); coal (6,483,200); chemicals and products (4,571,400); and sand, gravel, and crushed rock (2,649,036).

Condition of Waterway: The project is completed except for replacement of existing Locks and Dam No. 26 at Alton, Illinois, with a new dam and two 110 by 1,200-foot locks; construction of guidewall extensions at Locks No. 24 and 25; and construction of dikes and revetments upstream of the mouth of Missouri River.

Studies are authorized to determine the practicability and economic justification of providing both a 12-foot waterway and year-round navigation on the Upper Mississippi River.

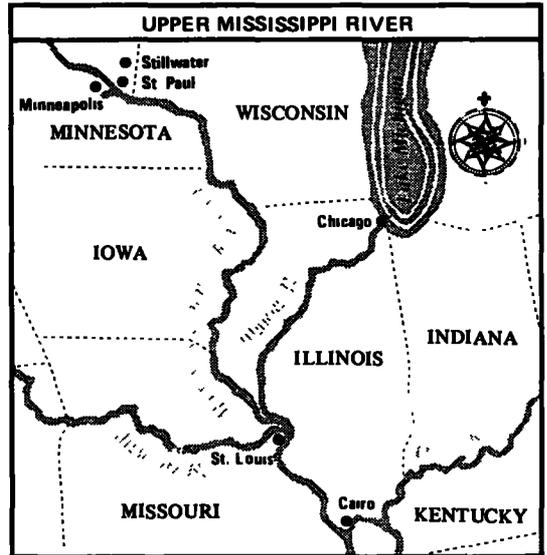


Figure 8-4

OHIO RIVER

The Ohio River is formed at Pittsburgh by the junction of the Allegheny and Monongahela Rivers and flows southwesterly to Cairo, Illinois, and its confluence with the Mississippi River.

Total Mileage: 981

Project Depth: 9 feet

Project Width: 400 to 600 feet

Lock Dimensions: A navigation system of 21 locks and dams is in operation. Construction has been completed for a 110 by 600-foot lock and an auxiliary

lock 56 by 360 feet at Emsworth, Dashields, Montgomery, and McAlpine locks and dams with an auxiliary lock at Gallipolis being 110 by 360 feet. At Locks and Dams 50 and 51 there is presently one 110 by 600-foot lock. Modifications to existing project under purview of Section 6, 1909 Act, has provided for two locks (110 by 600 feet and 110 by 1,200 feet) at New Cumberland, Pike Island, Hannibal, Willow Island, Belleville, Racine, Greenup, Captain Anthony Medlahl, Markland, Cannelton, Newburgh, and Uniontown; 110 by 1,200-foot temporary locks in addition to the existing locks at Locks and Dams 52; and reconstruction and construction to add a 110 by 1,200-foot lock at McAlpine.

Authorizations: Original project: 1824
Existing project: 1910 and 1918

Navigation Season: 12 months

Commodities and Tonnage: Total commerce for 1973 was 135,724,000 tons and 29,925,213,000 ton-miles with an average length of haul of 221 miles. The principal commodities on the waterways consisted of: coal (65,136,800); petroleum and products (25,251,300); sand, gravel, and crushed rock (17,704,100); chemicals and products (10,201,100); and metal products (3,800,000).

Condition of Waterway: Work is underway at Smithland Locks and Dam to construct two 110 by 1,200-foot locks to replace Lock and Dam 50 and 51. An additional temporary 110 by 1,200-foot lock is being constructed at Lock and Dam 53. Studies are in final stages of completion for the addition of two 110 by 1,200-foot locks at Gallipolis.

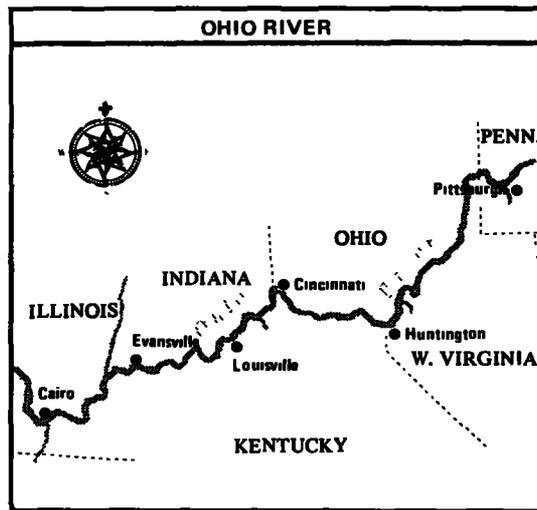


Figure 8-5

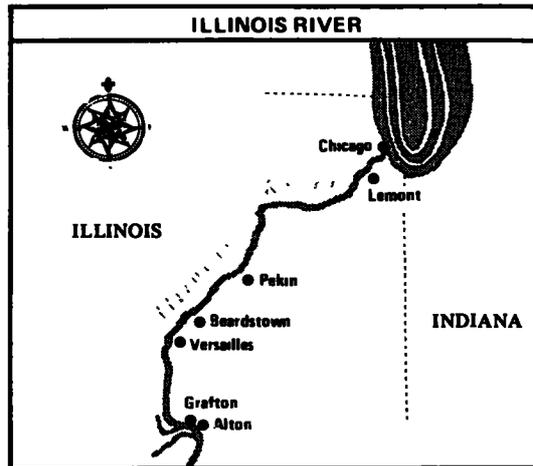
ILLINOIS WATERWAY

The Illinois Waterway extends from Chicago Harbor at Lake Michigan to Grafton, Illinois, and its confluence with the Mississippi River. In the Chicago area it includes the Calument-Sag Channel and the Chicago Sanitary and Ship Canal.

Total Mileage: 326 miles, Grafton to Chicago; 23.8 miles, Calument-Sag Channel

Project Depth: 9 feet

Project Width: 300 feet width from Grafton to Lockport, 175 to 300 feet Lockport to Chicago, 225-300 feet Cal-Sag to Turning Basin 5



Lock Dimensions:

Grafton to Lockport:	Marseilles	110 by 600 feet
Lockport	Starved Rock	110 by 600 feet
Brandon Road	Peoria	110 by 600 feet
Dresden Island	LaGrange	110 by 600 feet
Cal-Sag:		
Thomas J. O'Brien		110 by 600 feet

Authorizations: Original project: 1852
Existing project: 1962

Navigation Season: 12 months

Commodities and Tonnage: Commerce for 1973 consisted of 44,510,000 tons and 8,451,000,000 ton-miles with an average length of haul of 190 miles. The principal commodities (and tons) moved on the Illinois Waterway were: grain (11,554,400); petroleum products (7,913,900); coal (7,144,100); sand, gravel, and crushed rock (4,338,779); and chemicals and products (3,174,900).

Condition of Waterway: The existing project is complete except for project modification to provide for supplemental locks, 110 feet wide and 1,200 feet long from Grafton to Lockport. Cal-Sag modifications have been reclassified to inactive and deferred. A study is authorized to determine the economic justification of 12-foot navigation on the Illinois Waterway.

Figure 8-6

TENNESSEE RIVER

The Tennessee River is formed at Knoxville, Tennessee by the junction of the Holston and French Rivers, flowing south and southwest to its confluence with the Ohio River at Paducah, Kentucky.



Total Mileage: 650

Project Depth: 9 feet

Project Width: 300 to 500 feet

Lock Dimensions:

Kentucky	110 by 600 feet		
Pickwick	110 by 600 feet		
Chickamauga	60 by 360 feet		
Watts Bar	60 by 360 feet	Wilson	110 by 600 feet and 60 by 292 feet
Fort Loudon	60 by 360 feet	Wheeler	110 by 600 feet and 60 by 400 feet
Melton Hill (Clinch River)	75 by 400 feet	Nickajack	110 by 800 feet and 110 by 600 feet

Authorizations: Original project: 1852
Existing project: 1930

Navigation Season: 12 months

Commodities and Tonnage: Commerce for 1973 was 28,173,000 tons and 3,928,000,000 ton-miles with an average length of haul of 139 miles. The principal commodities moved on the Tennessee River consisted of coal (11,572,200); sand, gravel, and crushed rock (4,284,500); petroleum products (2,542,400); chemicals and products (2,395,400); and grains (1,806,400).

Condition of Waterway: The existing project is complete. The only work performed by the Corps of Engineers was Wilson Dam with original locks and Wheeler Lock and Dam. The Tennessee Valley Act of 1933 gave the TVA power to construct a project to provide a nine-foot channel and maintain a water supply from Knoxville to the mouth of the river. The Corps of Engineers maintains and operates the navigation system.

Figure 8-7

ALABAMA-COOSA RIVERS

From Rome, Georgia, the Coosa River flows southwesterly through Georgia and Alabama joining with the Tallapoosa River near Montgomery, Alabama, to form the Alabama River. The Alabama River flows southwesterly through Alabama to the Tombigbee River about 45 miles north of Mobile, Alabama.

Total Mileage: 314 miles to junction of Coosa River

Project Depth: 9 feet

Project Width: 200 feet

Lock Dimensions:

Alabama River:

Clairborne	84 by 600 feet
Millers Ferry	84 by 600 feet
Jones Bluff	84 by 600 feet

Authorizations: Existing project: 1945

Navigation Season: 12 months

Commodities and Tonnage: Total commerce for 1973 was 2,149,000 tons and 151,318,000 ton-miles with an average length of haul of 70 miles. Principal commodities moving on the waterway were: sand, gravel, and crushed rock (1,803,000); wood and wood products (177,000); grains (32,800); and petroleum products (31,800).

Condition of Waterway: The Alabama River project was completed for navigation in 1972 to Montgomery, Alabama. The Coosa River navigation project which will provide seven 84- by 600-foot locks and a channel improvement 9 feet deep and 150 feet wide extending 280 miles to Rome, Georgia, is being restudied to determine economic justification.

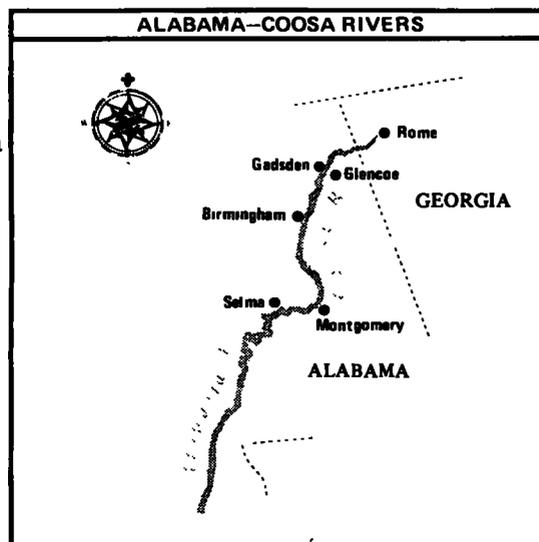


Figure 8-8

MISSOURI RIVER

The head of navigation on the Missouri River is Sioux City, Iowa flowing southeast to its confluence with the Mississippi River, 17 miles above St. Louis, Missouri. The project is of open river regulation type.

Total Mileage: 735

Project Depth: 9 feet

Project Width: 300 feet

Authorizations: Original project: 1876
Existing project: 1945

Navigation Season: 8 months



Commodities and Tonnage: Commerce in 1973 consisted of 6,371,000 tons and 884,406,000 ton-miles or an average length of haul of 139 miles. The principal commodities moved on the Missouri River were: sand, gravel, and crushed rock (2,751,397); grains (816,500); chemicals and products (307,600); nonmetallic minerals (160,307); and building cement (138,400).

Condition of Waterway: During the 1974 navigation season, the project provided the following channel dimensions: from Sioux City to Omaha, Nebraska, a limiting depth of 8.5 feet and a limiting width of 250 feet; from Omaha to Kansas City, a limiting depth of 8 feet and a limiting width of 220 feet; and from Kansas City to the mouth a limiting depth of 7.5 feet and a limiting width of 220 to 250 feet. Additional dikes and revetments are required to attain full project dimensions.

Figure 8-9

**McCLELLAN-KERR ARKANSAS RIVER
NAVIGATION SYSTEM**

Arkansas River rises in the Rocky Mountains and flows southeastward through Colorado, Kansas, Oklahoma, and Arkansas to join the Mississippi River, 584 miles above Head of Passes, La. The head of navigation is at Catoosa, Oklahoma, on the Verdigris River, 50 miles upstream with its confluence with the Arkansas River.

Total Mileage: 441

Project Depth: 9 feet

Project Width: 150 to 300 feet

Lock Dimensions:

17 locks 110 by 600 feet

Authorizations: Existing project: 1946

Navigation Season: 12 months

Commodities and Tonnage: Total commerce for 1973 was 4,956,000 tons and 338,624,000 ton-miles with an average length of haul of 68 miles. The principal commodities moving on the waterway were: sand, gravel, and crushed rock (1,993,000); petroleum products (660,400); grains (556,000); chemicals and products (361,800); and iron and steel products (161,300).

Condition of Waterway: The last increment of the Arkansas River navigation system was placed in operation in 1970.

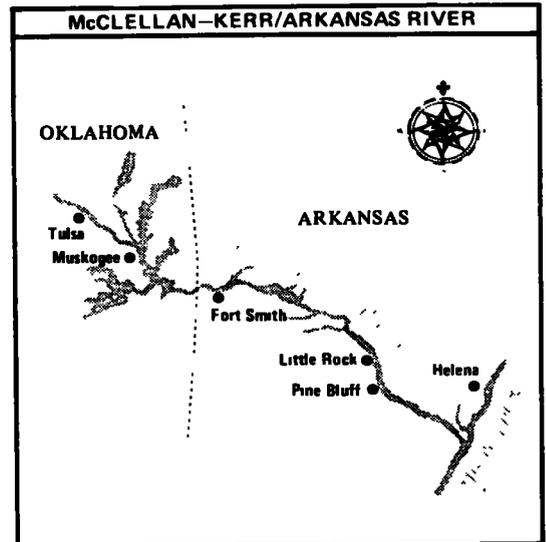


Figure 8-10

GULF INTRACOASTAL WATERWAY

The Gulf Intracoastal Waterway extends from Apalachee Bay (St. Marks), Florida to Brownsville, Texas. The waterway includes alternate connections with the Mississippi River via Algiers Lock and Harvey Lock and also between Morgan City and Port Allen, La.

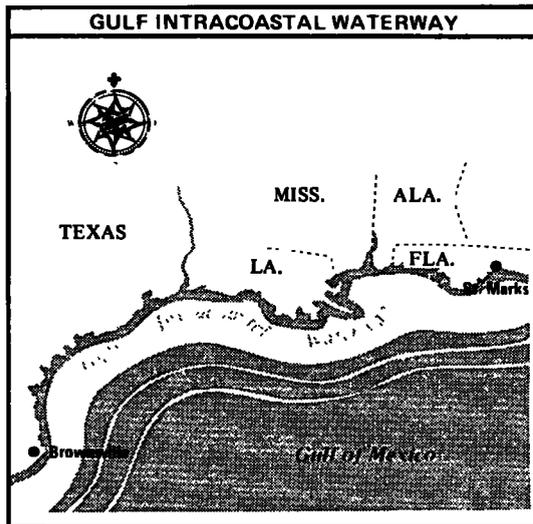
Total Mileage: 1,113

Project Depth: 12 feet and 16 feet

Project Width: 125-150 feet

Lock Dimensions:

Algiers	75 by	760 feet
Bayou Boeuf	75 by	1,160 feet
Bayou Sorrel	56 by	760 feet
Calcasieu	75 by	1,180 feet
Harvey	75 by	425 feet



Port Allen	84 by	1,200 feet
Vermilion	56 by	1,182 feet
Inner Harbor	75 by	640 feet

Authorizations: Original project: 1925
Existing project: 1946 and 1962

Navigation Season: 12 months

Commodities and Tonnage: Total commerce for 1973 was 100,767,000 tons and 16,578,105,000 ton-miles with an average length of haul of 165 miles. The principal commodities on the waterway were: petroleum and petroleum products (53,434,000); chemicals and products (13,542,000); marine shells (12,789,000); coal (4,358,000); and nonmetallic minerals (4,187,000).

Condition of Waterway: Work remaining to complete the project consists of enlarging the waterway as provided by the 1962 Act and replacement of Vermilion Lock. A 110- by 1,200-foot lock is proposed at Vermilion under the 1909 authority. The 1962 Act authorized enlargement of the present 12- by 125-foot project to 16 by 150 feet from the Mississippi River via Algiers Canal to Atchafalaya River and to 16 by 200-feet from the Atchafalaya River to the Sabine River. Local interests have not furnished assurances required by the terms of local cooperation. Main objection to participation is the requirement that local interests be responsible for availability of utilities. In addition, the Inner Harbor Navigation Lock has been authorized for replacement under the Mississippi River Gulf Outlet project. Lock sizing and location studies are underway.

ongoing waterway by changing the water level in the lock. The inland waterway system contains approximately 150 locks. The two most typical lock sizes established by the Corps of Engineers are 110-foot by 600-foot and the more recent 110-foot by 1200-foot size.

Single tows which are too large to pass through a lock in a single operation require "double locking". The average lock is designed to allow the passage of vessels in 20 to 30 minutes. Breakup and reassembly of the tows, together with the two locking operations takes about an hour and a half. Double lockage imposes a considerable cost penalty to other operators who may be delayed at a congested lock and imposes added costs to shippers. However, the economies of scale to the individual waterway carrier as a result of large tows are such that many operate tows in excess of existing lock capacity and this is the source of much of the pressure for larger locks and "twinning" of locks.

System Improvements

The locks and dams indicated to be the most required for the enhancement of capacity for waterways movements, aside from those now under construction, are: Lock and Dam 26 at Alton, Illinois, on the upper Mississippi River; the Industrial Lock at New Orleans going eastwards on the Gulf Intracoastal Waterway; Gallipolis Lock and Dam on the Ohio River; a second set of locks on the Illinois River; and Vermillion and Calcasieu Locks on the Gulf Intracoastal Waterway toward Texas. In addition the existing Gulf Intracoastal Waterway to Texas needs to be increased in width, and the industry would benefit from provision of the authorized 12-foot channel in the Lower Mississippi River and the availability of 12-foot depths on the Ohio River. In particular, certain segments of the Ohio River would benefit from deepening at an early date to accommodate local movements within that system.

PERCEIVED BENEFITS/DISBENEFITS OF THE WATERWAYS

The benefits of the existing waterways may be broadly described as providing for efficient use of national resources and environment. Waterways offer the benefits of economy and efficiency of operation, conservation of energy, plus environmental benefits of low noise and air pollution. Waterways are also characterized by dependability and flexibility and possess the ability to handle heavy oversized cargo not suitable for transport by other modes - such as large nuclear vessels, etc. Compared to other modes of surface transport, they are generally operationally preferable from an environmental standpoint and are indicated to have less risk in transport of hazardous materials, and they produce less in-transit goods damage for friable materials such as clay pipe. They conserve materials and manpower by requiring less tonnage of steel for construction of a given cargo-carrying capacity than other modes, and they require less manpower per ton-mile of transit. They also assist in expansion of export sales, are relatively more inflation-proof than other modes, and are the slowest of the surface transport modes.

The waterways are essential to the farmer to provide a low cost means of transportation of grain for export and for backhaul transport of fertilizer to the farmlands; to the oil and chemical industry for distribution of their products; to the utility power plants and other large plants for provision of fuel in the form of coal and fuel oil; to heavy industry for transportation of large manufactures; to the steel industry for distribution of semi-finished products; and to the country as a whole to allow the dispersal of heavy industry from coast to interior, and to provide low transport rates permitting broader distribution of products.

A survey by mail questionnaire of a selected cross-section of manufacturing and distributing firms in areas potentially served by the inland waterways, revealed that the waterways are viewed in a similar light by both shippers and carriers. Of those responding and completing the questionnaire, virtually all viewed the waterways as necessary to both the nation and to industry - over half

of the shippers said they were necessary to their firm, and half said they made significant use of the waterways. Approximately 1/3 of those questioned made no use of the waterways, assuming non-response as a non-user. Shippers sampled were predominantly interested in the waterways and viewed them as a growing segment of the transportation industry. The greatest single benefit of the waterways to shippers was seen as economy, with availability, convenience, and the concept of the waterways serving as a "materials pipeline" also of interest.

Shippers were shown to view the problems and limitations of the waterways in order of frequency of reference as: don't operate all year; don't go where needed; cost of intermodal transfer in many cases offsets waterway transport savings; and poor service. Over half of those responding to the questionnaire saw the role of the waterways limited solely to large shipments, and almost half felt the waterways were limited to bulk alone.

STRUCTURE OF THE WATERWAYS INDUSTRY

The inland waterways transport industry is a highly competent and efficient industry composed of individualistic elements. There are two classes of commodity movement on the waterways - "exempt" and "regulated". Regulated carriers include "common" and "contract" carriers, and non-regulated carriers include "exempt" and "private". Descriptions of the classes of carriers follow:

1. **Regulated Carriers.** Two types of regulated carriers operate under Interstate Commerce Commission jurisdiction.
 - (a) **Common Carriers.** Common carriers hold themselves out for public service and must provide transportation service to shippers without discrimination. They receive their operating authority from an ICC "certificate of public convenience and necessity." The following benefits and obligations accrue to common carriers:

Benefits

Limits on entry into regulated field through certification.

Limits on degree of competition by carrier/route commodity restrictions
(Not truly applicable to water transport except in a general sense)

Immunity from general anti-trust laws in collective carrier ratemaking

Prevention of excessive carrier rate competition by rate regulation

Obligations

Must serve general public, including many marginal and unprofitable services

Regulation of rates: public notice of changes, suspension, final approval

Proof of carriers' financial ability to provide service, handle liability, reports, etc.

Prohibited from undue discrimination or preference in either rates or services.

Must provide adequate level of service and obtain approval to discontinue it

(b) Contract Carriers. Contract carriers provide transportation service exclusively to customers with whom they have a written agreement. They operate under authority of an ICC permit which specifies their range of service for individual shippers.

2. Unregulated Carriers. Unregulated carriers are those who transport exempt commodities or who are engaged in private carriage.

(a) Exempt Carriers. Exempt carriers transport commodities not regulated by the ICC. These are commodities which were transported in bulk (that is, without count) by common practice of the trade at the time of the addition of Title 3 to the Interstate Commerce Act - which extended the dominion of the ICC to regulation of the inland waterways. Exempt commodities include: coal, grain, fertilizer, oil, chemicals, sand and gravel, etc.

(b) Private Carriers. Private carriers transport goods for their own account (goods to which they have the title). The private carrier may engage in the transportation of exempt commodities as well.

Of the approximately 1,850 companies operating barges and towing vessels on the waterways, most of the smaller carriers are individual companies engaged in transportation of exempt commodities. There has been a trend within the industry to consolidation of barge companies and to the purchase of the major lines in regulated commerce by large corporations not formerly engaged directly in water transportation. Ownership of a barge line by a railroad which would offer service in areas in which the railroad would offer competing service is now prohibited by the Panama Canal Act unless deemed in the public interest.

Regulated carriers represent approximately 10 percent of the number of firms in the industry, of which less than 10 firms transport most of the volume, and the regulated portion of the goods which they transport represents approximately 15 percent of total waterways ton-mile movements. Regulated carriers may also transport exempt cargo in the same tow with regulated commerce.

WATERWAY OPERATIONS

The concept of "integrated tows" originated on the U.S. waterways, and it represents the dominant method of movement today. Such tows are pushed by towboats ranging typically from 5,000 to 10,000 hp in size and pushing up to 48 barges on the Lower Mississippi, and a 3 x 5 tow of 15 barges (195 feet x 35 feet of 89,000 cu. ft. capacity) for a single locking in a 1,200-foot lock on the Ohio. Maximum tow size is limited by such factors as the capability of the towboat; current velocity; width, curvature, and depth of channel; navigational impediments (such as bridges); and number of lockings required to transit a segment of the waterways system. Normally, tows are limited by the lockmaster at a lock to a "double lockage" (tow split into two segments for lock transit).

Tows/Barges

Freight moves on the inland waterways in unmanned barges lashed together into tows and propelled by a towboat. The most popular dry cargo barge is the

"jumbo" - 35 feet wide and 195 feet long, with a draft of 9 feet and a capacity of 1,500 short tons. These hopper barges may be "open" or "covered" - the latter have watertight hatch covers. Barges are now being built with sides up to 14 feet for use wherever 12-foot water depths are available, and in anticipation of channel deepening. Bulk liquid commodities move in tank barges ranging in capacity from 1,000 tons to 3,000 tons. Double hull(or skin) barges are now employed to a large extent on the waterways to lessen the potential of sinking of barges and to prevent escape of cargo in the event the barge is holed. Many barge operators transporting volatile liquid products favor a single skin barge because it has no entrapped void areas where explosive vapors could concentrate.

Towboats have nearly square sterns and upright posts ("towing knees") to which the barge tow is lashed. They are usually propelled by two propellers driven by two to four diesel engines.

Barges may be added to or removed from a tow at intermediate stops during a voyage - sometimes without even stopping the tow. Typical origin to destination speed is about six miles per hour with about a mile per hour difference between upstream and downstream tows, but speed will vary with size of tow and direction and speed of the current.

While tows have been made up of 48 barges; this is about the maximum controllable tow size. Forty-barge tows are common on the lower Mississippi River where river width is sufficient for this type of operation; however, such large barge tows frequently cannot pass at river bends. Tows on other rivers are smaller due to river width or locking restrictions. Typical maximum tow sizes for various rivers are shown in Table 8-2.

Manpower

The inland waterways fleet employs approximately 80,000 highly skilled men. While crew sizes range from 7 to 14 men for line haul service, the present

Table 8-2

AVERAGE MAXIMUM TOW SIZE-
SELECTED INLAND RIVERS

<u>River</u>	<u>Number of Barges (1)</u>	<u>Total Number Navigation Locks (2)</u>
Allegheny River	11	9
Calumet-Sag Canal	3	0
Gulf Intracoastal Waterway	6	9
Illinois River	15	7
Kanawha River	4	3
McClellan-Kerr Arkansas River	2	17
Mississippi River - Upper and Middle	15	29
Mississippi River - Lower	40	0
Missouri River	8	0
Monongahela River	15	11
Ohio River	20	43
Tennessee River	4	9

Notes:

- (1) Consolidation of data from interviews with inland waterways operators for largest size tow
- (2) Lock information from U.S. Army Corps of Engineers

typical manning on an integrated tow on the inland waterways consists of a 12-man crew quartered aboard the towboat, of which 6 men are on watch and 6 men off watch in alternate 6-hour watches. Some lines employ an additional "steersman" as a trainee for a waterways pilot position. The men normally work either 20 or 30 days with an ensuing equal period of time off. They are paid for both on- and off-duty periods.

Discussions with the barging industry brought forth no indication of a significant union labor problem, forestalled in part by the action of some firms in making ship's officers members of management.

Domestic Waterway Terminals

Existing terminals exhibit the following general characteristics:

1. Large Grain Operations - utilize highly mechanized equipment for unloading grain from rail cars and loading it into barges.
2. Petroleum Products - are concentrated at oil company installations and utilize large efficient facilities under oil company ownership or contract.
3. Construction Aggregates - are handled by diverse operators located according to competitive advantage.
4. General Cargo - is handled by private terminals for the most part, many operated and owned by regulated carriers. Smaller bulk movements, such as fertilizer, are often moved through such terminals. Warehousing or open stockpiling of materials, as appropriate, is part of each such terminal operation.

Ample warehouse operations exist for interfacing truck and railroad trans-shipment. The mechanical materials handling equipment now being utilized is presumably as efficient as can be justified by the current volume of traffic.

These inland ports or terminals require relatively large contiguous land areas and adequate fleeting areas for makeup and storage of tows. The railroad access to such ports often is limited to the existing city street system, with connections to State and U.S. highways usually within 2 to 3 miles.

Control of terminal facilities varies from complete private ownership and operation, through leasing of space and/or equipment by individual operators from local government, to complete operations of all facilities by an overall public port authority. Private terminals exceed public terminals both in number and volume; however, various port authorities, municipalities, and other agencies are engaged in acquiring land for development of ports. Private single product ports often are fairly close together, frequently even adjacent. These private terminals usually handle a limited range of cargo of a particular type geared to an operation in the area or supplied through the terminal. This concentration permits the terminal to operate more efficiently.

A partial listing of cargos most often handled at private terminals includes:

1. Oil, gasoline, and other petroleum products
2. Sand, gravel, crushed stone, and rock
3. Grain and flour - corn, wheat, rice, soybeans, and feed mill products
4. Bituminous materials - asphalt, tar, pitches, creosote
5. Chemicals, crude and refined - either dry, or liquid, including acids, sodium hydroxide, etc.
6. Cement and gypsum
7. Coal, coke, lignite, and ash
8. Commercial solvents
9. Cotton, cotton seed, cotton-seed oil, and other vegetable oils

10. Fertilizer
11. Iron and steel - products and scrap
12. Lead
13. Liquid methane
14. Molasses, sugar - refined and raw
15. Ore and pelletized ore
16. Paper, pulp, and paper products
17. Refractory materials, silica, ceramic clays, and salt
18. Sulphur - dry and liquid

COSTS

The threshold cost of entry into the industry is relatively low, although rising costs of barges and towboats are increasing the barrier of entry. Current costs for 35-foot x 195-foot barges with 14-foot sides run approximately \$165,000, and a barge requires approximately five months to complete. A large towboat takes about nine months to construct, and costs approximately \$350-400 per horsepower for the larger sized boats. The present construction backlog ranges from 1 to 3 years within the industry. The industry is facing a major problem in inflation although it is relatively more inflation-proof than other modes due to the lower labor intensiveness and lower cost of barges and towboats as compared to rail rolling stock. As an example, fuel costs for 5,000-hp boats rose from approximately \$600/day in 1969 to approximately \$1,800/day in 1974. For a 5,000-hp "fully found" towboat, charter costs have risen from approximately \$1,800/day five years ago to about \$3,800/day at the present time.

The cost to the shipper for barge transport is typically less than 5 mills per ton-mile.

Representative annual costs for typical inland waterways vessels as derived by the Kearney study for Marad are shown in Table 8-3.

MOVEMENTS

The total inland waterway traffic in 1973 amounted to 503,000,000 tons, which was 51 percent of the domestic waterborne commerce of the United States, and 9 percent of the total ton-miles of intercity commerce. Nearly 60 percent of the barge movements are represented by energy; almost 40 percent of total barge commerce in 1973 was represented by petroleum products and petroleum, and over 20 percent by coal. In order of decreasing volume movements, these were followed by sand and gravel, grain and grain products, sea shells, logs, industrial chemicals, iron and steel products, limestone, sulphur, cement, coal tar products, soybeans, bulk wood, fertilizer, and paper and paper products. Over the last 40 years tonnage moved on the inland waterways has more than tripled, and the average length of haul has increased from 50 to 375 miles. Correspondingly, the output of a typical barge tow has grown from 150,000 to more than 3,000,000 ton-miles per day.

The shipper survey indicated shippers saw the most important waterway commodities to be liquid bulk and raw materials, followed in order by dry bulk, intermediate products and finished goods, and a poor last by general cargo. The latter is reflected by the fact that the two large mail order houses who responded to the questionnaire made no use of the inland waterways.

While approximately 15 percent of the ton-mileage movements on the inland waterways is in regulated commerce, there are very few intermodal through rail/water rates.

Table 8-3

ANNUAL COSTS FOR TYPICAL
INLAND WATERWAYS VESSELS

Cost Elements of a Towboat
(5,000 Horsepower/12-Man Crew)

	<u>Average Annual Cost</u>	<u>Percentage of Total</u>	
<u>Towboat-Related</u>			
Fuels and Lubricants	\$264,000	32	
Maintenance and Repairs	60,000	7	
Insurance - Hull, Protection & Indemnity, Property	48,000	6	
Depreciation	132,000	16	
Supplies	21,600	3	
Telephone and Radar	<u>1,200</u>	<u>1</u>	
Subtotal	\$526,800		65
<u>Crew-Related</u>			
Wages and Fringe	\$254,760	31	
Transportation	9,000	1	
Food and Staples	19,200	2	
Miscellaneous	<u>2,640</u>	<u>1</u>	
Subtotal	<u>285,600</u>		<u>35</u>
Total	<u>\$812,400</u>		<u>100</u>

Cost Elements of a Barge
(Jumbo-Covered)

Depreciation	\$ 8,275	67
Repairs and Maintenance	2,500	20
Insurance	1,650	13
Total	<u>\$ 12,425</u>	<u>100</u>

Source: A. T. Kearney, based on field interviews

Much of the waterways traffic is intermodal in the broad sense that its origin is away from or it is destined to, points off the waterways. Economics (rates, terminal costs, etc.) limit destination movements to motor carriers for the most part, with a probable maximum, under favorable conditions, of approximately 250 miles off the waterway.

Virtually all of the intermodal movements of containers are on Seabee barges in export/import trade. LASH and Seabee are only a small fraction of the share of regulated commerce on the waterways but are viewed as having a fair degree of potential in the export/import trade. Only a limited interest in LASH or Seabee was indicated by the shipper survey.

Virtually all inland waterways movements are in barge-load shipments ranging in size from 600 to 1,500 tons, although regulated tariffs provide for shipments as small as 300 tons, and consolidation services offered by regulated carriers will accept shipments as small as 15 tons. However, "less-than-barge-load" shipments are insignificant on the waterways traffic. Movements are not balanced in upstream and downstream directions, and many movements are local or confined to certain segments of the waterway, as indicated by Figure 8-11.

Passenger traffic on the inland waterways is small in proportion to other movements; in 1970 it was 4 billion passenger miles of intercity traffic. This traffic was primarily recreational traffic, but did not include unreported small craft movements. Ferry and commuter services supplied part of these movements - such as those on Puget Sound and San Francisco Bay. There appears to be growth potential in both recreational travel and commute traffic, but not to the point that they will ever be a dominant factor in intercity movements on the waterways.

FACTORS OF FUTURE GROWTH

Future growth of the inland waterways traffic will depend upon such factors as the following:

Figure 8-11

INLAND FREIGHT TONNAGE BY DIRECTION OF MOVEMENT - 1971

MISSISSIPPI RIVER AND SELECTED TRIBUTARIES AND THE GULF INTRACOASTAL WATERWAY

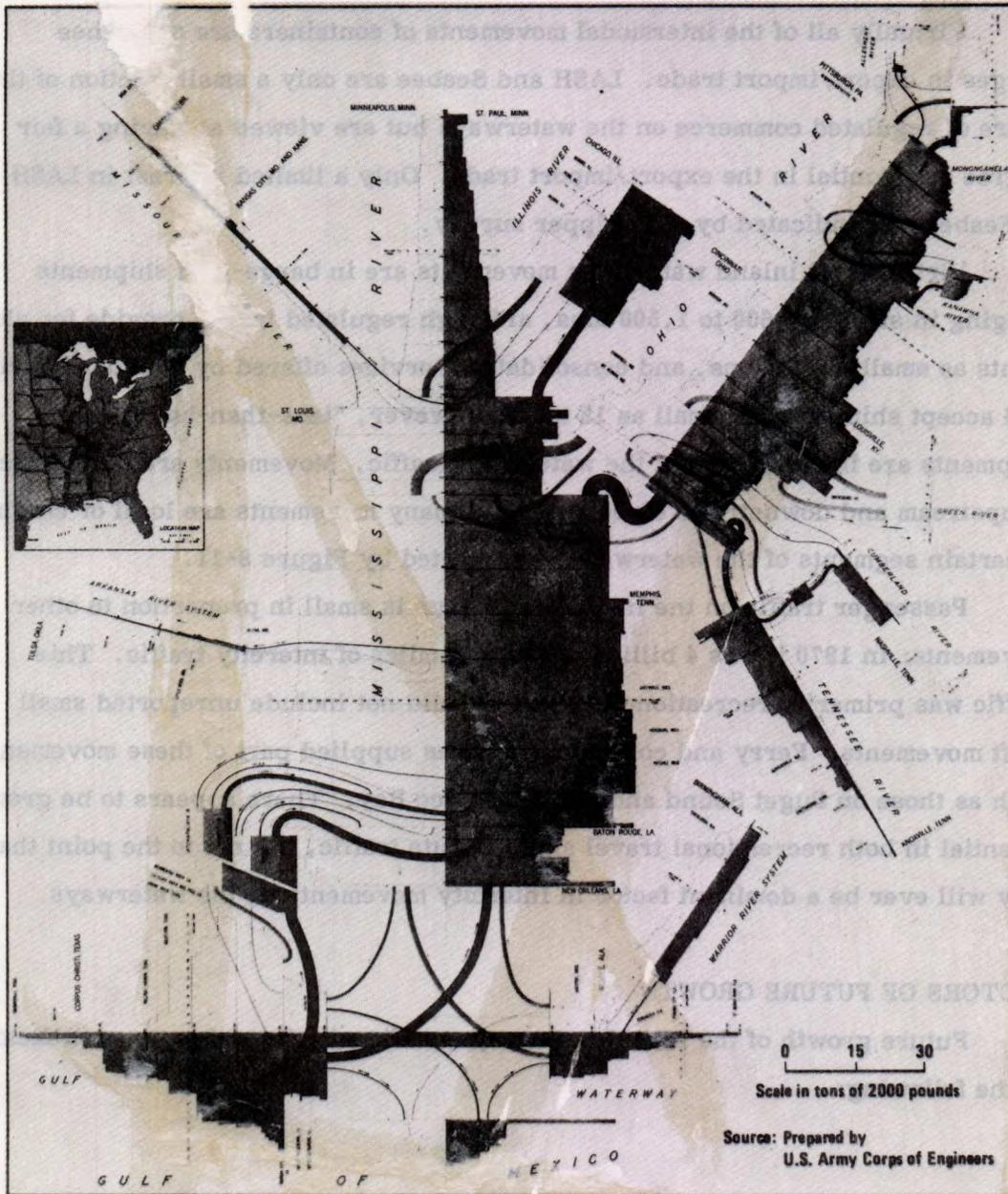
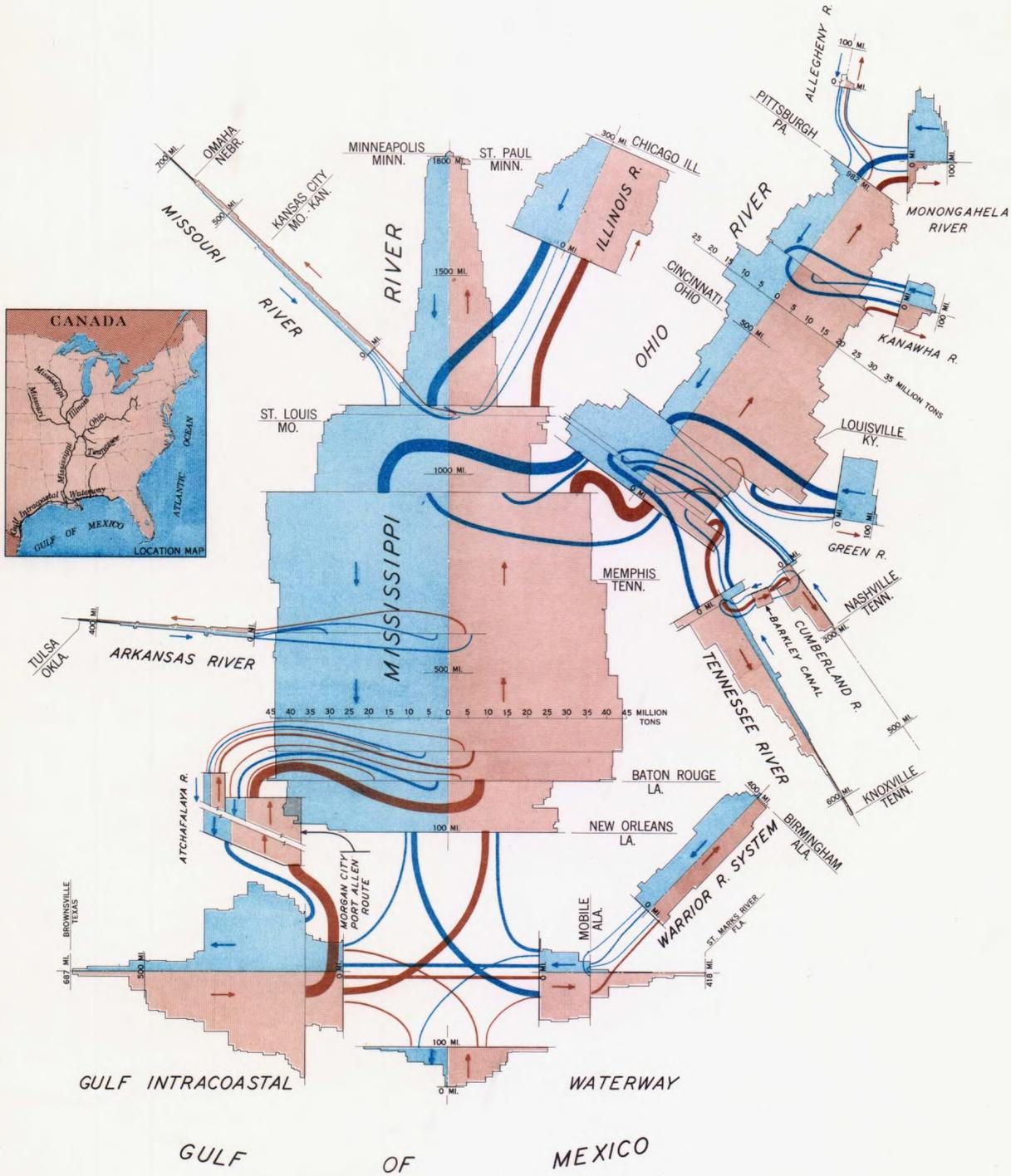


Figure 8-11



INLAND FREIGHT TONNAGE ON THE MISSISSIPPI RIVER SYSTEM AND THE GULF INTRACOASTAL WATERWAY 1972

1. **Availability of waterfront sites for industry**
2. **Export/import trade volume**
3. **Competitive posture of rail vs. barge (regulation and rates)**
4. **Degree of integration with other modes**
5. **Pattern of energy development**
6. **Development and maintenance of waterway, terminal facilities, and tow equipment**
7. **Availability of capital - including cash flow from depreciation (depending upon allowable depreciation)**
8. **Restrictions imposed on the waterways and other surface transport - economic regulation and environmental and safety regulation**

Other factors affecting growth of waterways traffic include population growth and GNP increases and availability of fleeting areas for the inland transport fleets. Potential factors affecting growth are more fully developed in the matrix analysis in Section 6, Transportation Policy and Its Implementation.

The ultimate growth and utilization of the inland waterways are limited by strictly physical factors. The ultimate waterway development is limited by the amount of water available, and the practical maximum width and depth of the channel. The waterways are also limited in market by the prevalent north-south orientation of land relief - while major U.S. transport routes have an east-west orientation. Further, they are limited by economics of those types and sizes of commodity movement which they can efficiently transport - primarily large bulk movements of low cost commodities, for the most part raw materials and semi-finished goods.

INLAND WATERWAYS TECHNOLOGY AND POTENTIAL IMPROVEMENTS

Technological developments are limited by the present state of the art, the economic incentive to employ developments, and the physical and social conditions

under which they are to be employed. Technological developments within the waterways have tended to be evolutionary, with gradual developments taking place over a period of years - in the competitive atmosphere in which the waterways operate, there was considerable economic incentive to operate efficiently. Further, the economic return earned from waterway operations was sufficient to enable funds to be secured to implement such improvements. As a result of the foregoing, the present waterway industry is both efficient and technologically advanced, and the combination of the physical constraints of the locks and dams and of the waterways themselves in conjunction with the diminishing returns for future improvements, would appear to be constraints to the achievement of significantly higher levels of waterway technology in the future.

As evidence of the state of present waterway technology, river tows up to 48 barges in size have been employed; 10,000-hp towboats are now entering service on the waterways; and barges with 14-foot sides are in service. It is not expected that significant impetus exists for the use of either larger sized towboats or larger tows - as the latter are limited by constraints of the waterways and the locks which they must traverse. The use of higher speed as a technological improvement is not viewed as being likely because of the increased fuel consumption per ton-mile of movement at faster speeds, and because of the conflicts in river usage between recreation and navigation.

With respect to terminals, greatly improved materials handling technology exists and could be applied to the waterways. However, physical improvements in transfer of materials from barge to dockside at the terminal are rendered difficult by the extreme differences in water level at various times of the year, and the lack of sufficient volumes through the individual terminals to warrant the expenditure of the large sums of money to improve and render more efficient terminal materials handling. A low utilization factor is often more than sufficient to offset the increased efficiency of more technologically advanced handling equipment.

Great improvements have been made in water carrier productivity over the last 20 years. Barge tows now carry approximately three times the cargo they formerly did, and barge lengths of haul have materially increased.

Vessel Technology

Vessel technology improvements contributing to increased waterway efficiency have included the use of Kort nozzles to increase the efficiency of the propellers, the employment of tunnel hulls to permit use of larger propellers, and use of high speed diesel engines to drive the towboats.

The larger tows on the waterways have been the driving force leading to the employment of the larger towboats and to the improvement of controls and maneuvering devices to provide requisite maneuvering capability. Bow steering in the lead barge remotely controlled from the towboat, the use of flanking rudders forward of the propellers, and location of the propellers a greater distance apart, have all contributed to increase maneuverability.

The efficiency of tows has been increased by the integrated tow concept utilizing barges with raked fronts and sterns, fore and aft respectively, and square-end barges in the middle of the tow. This permits the complete tow to have approximately the same resistance as a single vessel of the same shape. The box-end barges in the mid-portion of an integrated tow also contribute to greater cargo carrying capacity as compared to barges with raked bow and stern; the increase in cargo capacity so obtained is approximately 15 percent. Double skin barges, costing about 50 percent more than single skin barges, are also becoming common on the waterways - for increased safety of the barge and protection against loss of transported cargo.

LASH and Seabee barges are a relatively recent technological innovation on the waterways. Both types of barges are intended to be transported in foreign trade by mother ships between deepwater ports, and to continue travel to an inland destination by way of inland waterways. The LASH barge system is intended to

traverse the more limited size locks of the European waterways. The Seabee barge was designed in consultation with the American waterways industry and is designed for the American waterway. The Seabee barge is one-half the size of a conventional inland waterway barge of the United States.

There is greater reluctance to transport LASH barges as part of a mixed tow in the inland waters of the United States because of the problem in integrated tow makeup. There is also an economic problem in employment of both of these types of barges in the inland waterways because of the need to limit the length of time the barges spend away from the mother ship. The barges themselves are a major portion of the investment required for the two systems.

The LASH lighters are 61 feet 6 inches long by 31 feet 2 inches wide, and have a hold depth of 13 feet. Their capacity is over 400 short-tons with a draft of approximately 9 feet. Seabee barges are 97 feet 6 inches long (exactly one-half the length of a standard jumbo barge) by 35 feet wide (exactly the same width as a standard jumbo barge). The hold depth is 14 feet 7 inches and the barge will carry more than 930 short-tons of cargo at a draft of 10 feet 6 inches.

Other vessel technology developments include the following:

1. Mini-ships. These are 9-foot draft vessels employed in foreign trade which are capable of carrying up to 1,000 tons of general cargo, or 80 to 100 containers. They operate primarily between U.S. and foreign ports without transshipment to inland waterway carriers. They appear to be of declining importance and have never been significant in the trade.
2. Skimmercraft. These include air bubble vessels (CAB) and hydrofoil craft. They are restricted to use in moderate seas, and hydrofoils are subject to damage if they run into surface debris. Their higher cost of operation, as compared to other modes of surface transport, has caused them to be employed primarily for passenger transport.

- 3. R/O-R/O. Roll-on/Roll-off vessels permit driving wheeled vehicles directly aboard and putting containers aboard with wheeled materials handling equipment. They have little impact on inland waterway movements as they are employed in deep sea transport.**

Terminal Technology

Providing the volume would sustain the improvement, bulk handling could be improved by more advanced material handling equipment such as catenary unloaders, bucket wheel stacker-reclaimers and by use of conveyors and elevator systems. These could supplant the more archaic and inefficient "stiff-legged" cranes and clamshell buckets commonly employed. Should it be possible to develop adequate container or piggyback movements, the use of portside container cranes would greatly improve the efficiency of handling of non-bulk items in containers. However, such container cranes now cost between \$2-1/2 and \$3 million apiece.

Deep Draft Ports

Deep draft ports, meaning those capable of serving vessels in the 200,000-dwt class and upwards, are not expected to have significant impact on U.S inland waterways. Environmental and cost factors seem to be generally favoring the use of single buoy moorings as the preferred concept for service of Very Large Crude Carriers (VLCC's), and, without the volumes from such movements, offshore island dry bulk terminals cannot be economically justified. Further use of VLCC-class vessels for dry bulk movements usually cannot be justified by the volumes, and they usually cannot be served by the available water depths of the ports of the exporting nations. Crude oil brought into deep draft ports will be expected to go directly from the marine terminal to refining centers by pipeline.

Modal Impacts

With respect to the technological potential for improvements of the various modes of surface transport, the waterways industry, as noted, appears to have

relatively limited additional technological potential at this time. The motor trucking industry is in a similar advanced technological stage of development. However, there is apparently great potential for improvement in rail efficiency by means of greater implementation and broader application of available technological advances, and by improvements in labor practices. Such technological improvements could be expected, if made, to change the competitive position of the modes of surface transport and might detract from the volumes presently transported by waterway and truck.

Improved Waterway Utilization

While not entirely a technological innovation, increased efficiency would be possible for the waterways through better utilization of locks. Studies made as part of the INSA program of the Corps of Engineers indicate that scheduling of movements of tows through the locks can produce improvements in the lock capability and decrease congestion and delays. Further, the use of "switch boats" to speed the transit of tows requiring double locking will also increase efficiency. Improvements are also possible in the efficiency of operation of the locks themselves - with local computer control to optimize sequencing and timing of lock operations eminently practicable.

Section 9
WATERWAY CONSTRAINTS

This section discusses the constraints on the waterways as they may affect the present operation of the waterways, their future growth, and the potential for intermodal movements. It should be noted that, in addition to the constraints discussed hereunder, ensuing policy changes and regulation may also induce additional restraints. Many of the constraints discussed hereunder are addressed in greater detail, and additional background and analysis are presented, in other sections of this report. The listing which follows is a result of the discussions held with members of the waterway industry and government, and research investigations of other studies and reports.

While each of the following items was considered by some to represent a constraint on the waterways, it is important that these constraints be considered in the light of the views predominantly held by those in the waterways industry and in government. The consensus of opinion would appear to be that there are short-term difficulties and problems which are faced by the waterways but these may all be overcome if the industry is not precluded, by outside forces, from taking steps necessary to their solution. Thus, while regulation of safety and rates and environmental restrictions are significant problems at the present time, it is anticipated that these can all be overcome.

Water limitations for navigational purposes are problems on the Missouri and may be potential problems in the future on the Upper Mississippi. The closure

of the Missouri to navigation as a result of consumptive uses could require one or more locks and dams on the Lower Mississippi below St. Louis. The major physical constraints on the waterways, in the opinion of the waterways industry, are the locks and dams on the Upper Mississippi and Illinois, and Lock 23 on the Ohio, plus locks on the Gulf Intracoastal Canal and at New Orleans. The other two physical constraints of the greatest concern to the industry are the lack of 12-foot depths on the Ohio River and for portions of the year on the Lower Mississippi, plus the need for widening of the Gulf Intracoastal Canal between New Orleans and Texas. Terminal operation, fleeting areas, communications and manpower problems are all viewed as capable of solution by the industry.

PHYSICAL CONSTRAINTS

Physical constraints may be classified into four general areas, those which are inherent within the waterways and those imposed by locks and dams, channels and waterway operations.

Inherent Constraints

The inherent constraints of the waterways include their slow speed, the circuitry of the waterway route, the predominately north-south orientation of the waterways as compared to the predominantly east-west flow of traffic movement, and the limitations in service areas imposed by the physical location of the waterways.

Locks and Dams

The waterways of greatest concern with respect to the constraints imposed on operations include the Upper Mississippi and Illinois Rivers and the Gulf

Intracoastal Canal east of New Orleans. Waterway locks and dams of specific concern include Lock 26 on the Upper Mississippi, Gallipolis Lock and Dam on the Ohio, and the need for twinning of the locks on the Illinois River. Other locks requiring replacement or improvement include the Vermillion and Calcasieu Locks on the Gulf Intracoastal Waterway and the Industrial Lock at New Orleans. Present lock constraints include the inefficient operation of many locks and lack of scheduling of traffic flow through the locks.

Channels

Channel constraints include the limited seasonal availability of the northern inland waterways due to winter freezing, and the limited season on the Missouri River because of water shortfalls in the summer and fall. In the future, water limitations may be constraints on the Upper Mississippi River. Water pool and channel depths are also problems - with need for deeper water most apparent on the Ohio River, plus extension of the availability of 12-foot water depths on the Lower Mississippi to the entire year. Selective segment deepening of portions of the Ohio River to 12-foot depths could significantly benefit certain short haul traffic movements on the Ohio, particularly coal. Many feel that the channels are presently approaching their capacity to handle traffic, particularly at low-water levels. Some bridges are seen as constraints to waterway traffic movements.

Operations

Operational constraints mentioned include limitations of river terminals and material handling equipment (particularly on the Arkansas River), aids to navigation, availability and quality of fleeting areas and fleeting services, and communications. The Arinc Study of communications requirements on the waterways performed for MARAD concluded that waterway communications requirements

could be met by a VHF-FM radio contact between river vessels and a shore station with subsequent transmission of messages by leased telephone lines through 13 regional centers in key cities along the river system. The major waterway operators do not foresee a major communications problem and it is generally recognized that ship-to-ship communication is adequate.

Other operational constraints include the large size of minimum required tender (dictated by barge capacity), interference by pleasure boats, and the availability of manpower to the waterways industry. Captains and engineers are presently in short supply to man newly commissioned vessels and there are some problems in getting and keeping help on the waterways. The River Academy, established at Helena, Arkansas, is getting a good response and is expected to be able to supply an adequate number of trained licensed and unlicensed personnel for waterway operation.

Other constraints include the cost of intermodal transfer where the shipments may move by more than one mode, and the fact that the LASH barges are not consistent with the dimensions of barges normally employed on the inland waterways of the United States and are, therefore, difficult to make up into integrated tows with conventional barges.

CONSTRAINTS IMPOSED ON THE WATERWAYS BY THE GOVERNMENT

The principal problems of an institutional nature pertaining to government and other agencies are the lack of consistency and conflict between the regulations imposed upon the waterways, the lack of knowledgeable people to develop and enforce regulations, and the conflicts and barriers between government agencies such as the Corps of Engineers, Coast Guard, MARAD, EPA, and others. Another factor of present importance concerns legal conflicts between state and federal governments. The lack of an integrated approach to regulation of the waterways

and coordination of effort by people knowledgeable and interested in the waterways is seen as a major problem restricting development of an integrated system by both the waterways industry and by government as well. The Interstate Commerce Commission, contrary to what might be expected, is generally deemed by the regulated carriers on the inland waterways to be fairly knowledgeable of the waterways and to administer and develop regulations which can be "lived with" by the waterways industry. While the Interstate Commerce Commission directly affects only 15 percent of the total volume of traffic movements on the waterways, the influence of the Interstate Commerce Commission is greater in terms of the impact of competition between modes and in integration of modal transport moving in intermodal traffic.

The waterways are affected by ICC regulation and decisions, primarily by decisions affecting railroad water competitive rates, and provisions under which railroad ownership of barge lines may be allowed. Thus, the decision as to the extent to which the railroads may lower their rates to meet water competition significantly affects the ability of the waterways industry to capture various traffic movements. The Interstate Commerce Commission is charged with preservation of the inherent advantages of each mode and with a requirement that the railroad rates be compensatory. However, considerable judgment is involved in decisions as to whether proposed rail rates are adequate to provide coverage for costs. Arguments over the proper basis of rail costs range from short-run variable costs, through long-run variable costs, up to (as advocated by the waterways industry) full costs. The current investigations within the ICC under ex parte 270 and 271 should allow more rational determination of the basis for rail costs and their appropriate amounts. Some regulated carriers would advocate putting all waterways movements under regulation by the Interstate Commerce Commission to provide regulation of railroad and barge modes on the same basis. The Interstate

Commerce Commission would then have full authority (which it does not now have) to establish rates over all barge movements. This would allow the ICC to establish joint and through rates between rail and barge for all movements and to enforce cooperation between the modes in intermodal movements. The ICC cannot now establish rates between regulated and unregulated carriage. However, the present lack of rate regulation on the waterways is felt by many to be a positive factor contributing to the health of the waterways industry.

Specific legal and regulatory constraints include the following:

1. Congressional mandate to preserve various modes of transportation
2. Absence of uniform regulation and jurisdiction of regulatory powers as applied to the various transportation modes
3. Conflicts in regulation and jurisdictions of agencies in the fields of environment and safety in the area of federal vs. state and between various federal departments and agencies
4. Restraints to through and joint rates
5. Limitations on the formulation of transportation companies by barriers imposed to railroad ownership of barge lines and trucking lines
6. Limitations on use of foreign equipment and crews on the waterways (dredges and vessels) - Jones Act
7. Customs services on export-import shipments (LASH and Seabee)
8. High discount rates for evaluation of costs and benefits for water projects
9. Rate regulation
 - a. Delay in approval of rate changes
 - b. Railroad discriminatory rates allowed by anti-trust exemption of regulated carriers. Rate discrimination may take the form of

"water-depressed rates", "Chinese Wall", "sharpshooting", and discrimination in rates to coastal ports for export-import shipments as compared to rates for export-shipments to inland ports. "Water-depressed" rates are those in which railroads lower rates below fully allocated costs to divert traffic from the waterways. "Chinese Wall" rates are those which are excessively high for the transport of commodities to or from a port when the commodity has arrived at, or will leave, a port, by water. "Sharpshooting" is rate reduction on specific commodities to drive water carriers out of competition for those commodity movements.

10. Imposition of operational controls (such as Coast Guard control over traffic movements)
11. Lack of intermodal joint/through rates and difficulties in establishment of through bills of lading
12. Safety regulation and conflicts over jurisdiction between OSHA and the Coast Guard
13. Environmental constraints
 - a. Conflicts in state vs. federal regulation
 - b. Environmental impact statements and delays occasioned by court suits brought over such statements
 - c. Restrictions and penalties with respect to spills on the navigable waters in the transport of hazardous materials
 - d. Restrictions on dredging of the waterways
 - e. Requirements for land spoils disposal areas. Many new projects are being delayed because of the problems in finding and providing suitable areas for the disposal of spoils expected to be dredged during the entire life of the project.

14. Depreciation rates - the industry is handicapped in generating funds because of the rising costs of waterways equipment and the fact that depreciaton is on original cost rather than replacement value and is based upon a 14-year service life. The waterways industry would like a 5-year depreciation period.

Potential constraints or restraints to the future potential of the waterways include the possibilities of the imposition of "user charges" which could substantially change the competitive position of rail and water, and the possibility that railroads will be allowed to have floating rates which would allow them to make rate reductions to the detriment of the waterways industry without securing prior approval by the Interstate Commerce Commission.

OTHER CONSTRAINTS

Other constraints affecting the waterways and intermodal potential include the following:

1. Lack of published barge rates for the majority of waterway movements.
2. High cost of money for waterways industry expansion
3. Lack of availability of and competition for federal funds
4. Lack of consistent long-term transportation policy which would have equitable application to all modes
5. Stretch out and delay of projects deemed vital to the waterways industry
6. Inflation
7. Lack of an advocate for the waterways industry within the Department of Transportation

8. Problems of the Corps of Engineers in completing waterway studies
9. Opposition of the railroads to the waterways industry

Potential restrictions to the waterways industry may soon occur in the form of energy restrictions, although the impact of such energy restrictions might well be to favor the waterways mode because of the fact that it is least energy intensive of all forms of surface transportation.

Section 10
BIBLIOGRAPHY

Aadland, Tor, BSc, The Ship Research Institute of Norway, "The Total Transportation Cost Concept", ICHCA Journal, (London, England: International Cargo Handling Coordination, Trade News Limited), December 1969, Volume 3, No. 12, pages 6 - 7.

"ACV - Go-Anywhere, Carry-Anything Machine", The Oil and Gas Journal, September 10, 1973, page 106.

"AEP Plans Coal-Transfer Facility on Ohio River", Coal News, National Coal Association, August 17, 1973.

"Air Cushion Vehicle Undergoes Arctic Winter Test in Canada", Alaska Industry, March - April, 1973, pages 50 - 51.

Air Cushion Vehicle, brochures:

1. Voyageur, High Speed Multi-Purpose Amphibious Air Cushion Vehicle (brochure)
2. Model 7501 Viking Air Cushion Vehicle
3. Rendezvous, Volume XII, Voyageur/Viking Today, August 1973
4. Rendezvous, Volume XII, September 1973

The American Association of Port Authorities, Committee on Ship Channels and Harbors, Merchant Vessel Size in United States Offshore Trades by the Year 2000, June 1969.

The American Association of Port Authorities, Committee on Ship Channels and Harbors, National Channel Capability Study through the Year 2000, September 1970.

The American Waterways Operators, Inc.:

1. Weekly Letter, issues of November 11, 1972 and November 18, 1972
2. 1971 Waterside Plant Locations and Expansions, April 1972.
3. Tables -
 - a. Principal Commodities Transported on the Inland Waterways of the United States (Exclusive of the Great Lakes) in net tons of 2,000 pounds, Calendar years 1971 and 1972
 - b. Freight Traffic in the United States by Railways, Motor Trucks, Great Lakes, Inland Waterways and Pipelines, Calendar Years 1968, 1969, 1970, 1971 and 1972 and Percentages of Total

"A New Concept in Expendable Pallets", ICHCA Journal, (London, England: International Cargo Handling Coordination Association, Trade News Limited), May 1972, pages 21-22.

Armstrong, Armour and John Pisni, U.S. Department of Commerce, Maritime Administration, Division of Ports, Office of Ports and Intermodal Systems, Deep-Draft Vessel Port Capability on the U.S. North Atlantic Coast, (draft), 1972.

Barber-Greene Company, Aurora, Illinois, Sundry Conveyor Manuals.

Bertlin, D. P., Consulting Engineer, London, General Report, Section I - Inland Navigation - Subject 6, XXIIIrd International Navigation Congress.

Bertlin, D. P., Consulting Engineer, London, compilation of the several papers presented to Section I - Inland Navigation - Subject 6, XXIIIrd International Navigation Congress, Ottawa, 1973 (English and French).

Boeing Jetfoil brochures:

1. Boeing Jetfoil, 45 Knots in 12-foot waves
2. Jetfoil - A New Dimension in Transportation
3. Passenger Acceptance
4. Environmental Compatibility
5. Coming Soon
6. Model 929-100 Jetfoil
7. Boeing, Potential Boeing Jetfoil Operations, New York Metropolitan Area Tri-State Region

Carlson, C. M. and J. R. MacKrell, University of Michigan, Great Lakes Unitized Transportation System, presented before The Society of Naval Architects and Marine Engineers, New Orleans, Louisiana, sponsored by Armco Steel Corporation, April 10, 1970.

Carroll, Joseph L. and Michael S. Bronzini, Pennsylvania Transportation and Traffic Safety Center, The Pennsylvania State University, Planning for Coastal Ports on a Systems Basis: Preliminary Methodological Design, prepared for U. S. Army Corps of Engineers, Institute for Water Resources, (final report), May 1972, IWR Report 72-7.

Chicago Regional Port District:

1. Annual Report for Fiscal Year July 1, 1971 to June 30, 1972.
2. Chicago Regional Port District Act, June 6, 1951, L. 1951, page 256.
3. Harbor Tariff, Port Information, - Rules and Regulations, amended February 14, 1969.
4. Calumet - Sag Navigation Project, Chicago District, U. S. Army Corps of Engineers, 1959.
5. The St. Lawrence Seaway (brochure)
6. Illinois Waterway, Illinois and Indiana, Calumet-Sag Navigation Project, authorized by R & H Act of 1946, plate 2.
7. Lake Calumet Harbor (map)
8. Metropolitan Chicago Food Center, (brochure).

Commonwealth Edison Co., and the Richard B. Cross Company,
Proceedings - 13th Annual Meeting - November 8, 9, 10, 1972,
Brown Palace Hotel Denver, Colorado:

1. The Transportation Research Forum - 1972, Volume XIII,
Number 1.
2. Jensen, H. M., Senior Engineer, Commonwealth Edison, Co.,
and R. W. Patterson, Partner, Sargent & Lundy, "CECO Auto-
mates Coal-Handling Facilities at Joliet", reprinted from the
issue of Electric Light and Power, Cahners Publishing Company,
Inc., November 1964.
3. Jensen, Harry M., Senior Engineer, Commonwealth Edison Co.,
Unit Train Coal Delivery.

Computer Identics Corporation, Westwood, Massachusetts and
Transocean Gateway Corporation, New York, Design and Development
of a Pilot Terminal Control System (TCS) With Automatic Container
Identification, prepared for Maritime Administration, U.S. Depart-
ment of Commerce, (Contract No. 1-35434), May 27, 1971.

Cooke, Robert, Modern Concepts of Ocean Transportation of Petro-
leum, American Society of Mechanical Engineers, August 1967.

Coutinho, John de S., Program Chairman, Transportation: A Service,
Sesquicentennial Forum on Transportation Engineering, (New York,
New York: New York Academy of Sciences) 1967.

"The Cross-Channel Ferry Business is Booming", Shipbuilding and
Shipping Record, (London, England: Transport and Technical Pub-
lications Limited), June 1969, Volume 113, No. 26, pages 876-877.

Decker, J.L., "Surface-Effect Ships Approach A New Beginning", Astronautics and Aeronautics, (New York: American Institute of Aeronautics and Astronautics), Volume 8, No. 6.

Dupree, Jr., Walter G., and James A. West, U.S. Department of the Interior, United States Energy Through the Year 2000, December 1972.

Economic Commission for Europe, Inland Transport Committee, Economic Study of the Rhine-Main-Danube Connexion, August 4, 1970.

Economic Report of the President, transmitted to the Congress, January 1972, together with the Annual Report of the Council of Economic Advisers, 1972.

Economic Report of the President, transmitted to the Congress, January 1973, together with the Annual Report of the Council of Economic Advisers, January 1973.

Eda, Haruzo, and A. Ljone, Stevens Institute of Technology, New Jersey, Barge Trains in a Coastal Seaway: Part I. Model Tests in Oblique Seas, prepared for the Office of Research and Development, U.S. Maritime Administration, Contract MA-2701, T/O-11 (DL Project 3616/474), June 1970.

Eda, Haruzo, Stevens Institute of Technology, New Jersey, Barge Trains in a Coastal Seaway: Part II. Predictions of Lateral Motions and Bending Moments, prepared for the Office of Research and Development, U.S. Maritime Administration, Contract MA-2701, T/O-11 (DL Project 3616/474), June 1970.

Eda, Haruzo, Stevens Institute of Technology, New Jersey, Barge Trains in a Coastal Seaway: Part III. Directional Stability and Control, prepared for the Office of Research and Development, U.S. Maritime Administration, Contract MA-2701, T/O-11, (DL Project 3616/474), June 1970.

Evans, A. A., Technical and Social Changes in the World's Ports, (Geneva, Switzerland: International Labour Office), 1969, studies and reports, New Series No. 74.

Finlay, Patrick, Jane's Freight Containers (Jane's Yearbooks), London, second edition, 1969-1970.

Fitch, Lyle C., and Associates, Urban Transportation and Public Policy, (San Francisco: Chandler Publishing Company).

Fletcher - Morris, J., "Why LASH Makes Economic Sense", ICHCA Journal, (London, England: International Cargo Handling Coordination Association), August 1970, Volume 4, No. 8, pages 6-11.

Fraize, W. E., The Mitre Corporation, U.S. Transportation - Some Energy and Environmental Considerations, Report No. MITRE 72-164, prepared for the U.S. Department of Commerce, September 1972.

German & Milne, et al, coordinated by Andrew German, Ltd., Canada, Air Cushion Vehicles: Their Potential for Canada, prepared for the Government of Canada, Catalog No. NRCC 10820, December 1969.

Gilbert, Ken, projects director, Toronto Harbour Commissioners, The St. Lawrence Seaway, The Quiet, Efficient, Marine Highway, Report of the Engineering Committee of the International Association of Great Lakes Ports, presented at the Annual Meeting held on June 22, 1972.

Goldman, Jerome L., "How LASH Was Born - LASH Inventor Describes His System to ICHCA", ICHCA Journal, (London, England: International Cargo Handling Coordination Association), April 1970, Volume 4, No. 4, page 16.

Hanson, Melvin A., Jehiel Novick, Wm. A. Rabiega and Roger H. Yaeger, Transportation Institute, Southern Illinois University, Carbondale, Illinois, Great Lakes Port & Shipping Systems Research Report for Office of Ports and Intermodal Systems, U. S. Maritime Administration, Part II, October 1969.

Hinote, Hubert, Tennessee Valley Authority, Benefit-Cost Analysis For Water Resource Projects, (a selected annotated bibliography), June 1969.

Hirst, Eric, Oak Ridge National Laboratory, and Robert Herendeen, University of Illinois, Total Energy Demand for Automobiles, International Automotive Engineering Congress, Society of Automotive Engineers, January 8 - 12, 1973.

IMF Survey, November 23, 1973.

Indiana University, Institute for Research in Public Safety, Bloomington Indiana, "A Systems Analysis of the Traffic Law System" Ref. Vol. I, Final Report, prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, Contract No. FH-11-7270, January 1972.

Inland River Guide, (St. Louis, Missouri: The Waterways Journal, Inc.), first edition, 1972.

Interstate Commerce Commission, Bureau of Accounts:

1. "Investigation of Railroad Freight Service", Interstate Commerce Commission Reports, Ex Parte No. 270 (Sub. - No. 2), November 5, 1971.
2. Cost of Transporting Freight by Class I and Class II Motor Common Carriers of General Commodities, Pacific Region - 1969, Statement No. 2C13-69, September 1971.
3. Cost of Transporting by Class I and Class II Motor Common Carriers of General Commodities, Southern Region - 1970, Statement No. 2C5-70, August 1972.
4. Cost of Transporting Freight by Class I and Class II Motor Common Carriers of General Commodities, East - South Territory 1970, Statement No. 2C6-70, August 1972.
5. Cost of Transporting Freight by Class I and Class II Motor Common Carriers of General Commodities, Middlewest Region - 1969, Statement No. 2C10-69, August 1971.
6. Cost of Transporting Freight by Class I and Class II Motor Common Carriers of General Commodities South-Central Territory - 1970, Statement No. 2C7-70, August 1972.
7. Cost of Transporting Freight by Class I and Class II Motor Common Carriers of General Commodities, Middle Atlantic Region - 1970, Statement No. 2C4-70, August 1972.
8. Freight Commodity Statistics - Class I Railroads in the United States, Annual Reports.

"Is the User Really Benefiting from Containerization", Shipbuilding and Shipping Record, (London, England: Transport and Technical Publications Limited), August 1, 1969, Volume 114, No. 5, pages 29-30.

Jacobsen, Willis E., The Mitre Corporation, "Automotive Emissions", A Technology Assessment Methodology, prepared in cooperation with and for the Office of Science and Technology, Executive Office of the President, June 1971, Volume 2.

Jones, Martin V., The Mitre Corporation, "Some Basic Propositions", "Project Summary", A Technology Assessment Methodology, prepared in cooperation with and for the Office of Science and Technology, Executive Office of the President, June 1971, Volume 1.

Jordan, Richard H., et al, Technical Analysis Division, Institute for Applied Technology, National Bureau of Standards, Systems Analysis of Inland Consolidation Centers for Marine Cargo, November 1970.

Kates, J. and Associates, St. Lawrence Seaway Tolls and Traffic - Analyses and Recommendations, prepared for The St. Lawrence Seaway Authority, December 1965.

Kearney, A.T. & Co., A.D. Little, Inc., et al, "Scope of Work", "Study Requirements", Market Study of Domestic Shipping, and Domestic Waterborne Shipment Market Analysis, Six-Month Review, prepared for Maritime Administration, U.S. Department of Commerce.

Kearney, A.T., & Company, Inc., Study of Container Interchange and Pooling Facilities in United States Export-Import Traffic, prepared for the Office of Facilitation, Assistant Secretary for Policy and International Affairs, U.S. Department of Transportation, May 1971.

Kelly, James L., Brigadier General, Deputy Director of Civil Works Office, Chief of Engineers, Department of the Army, statement before the Special Joint Committee of the Senate Interior, Commerce and Public Works Committee, August 1973.

Koch, D.A., U.S. Army Corps of Engineers, "Implications of Systems Analysis to Inland Navigation", ASCE Journal of Waterways and Harbors Division, (New York: American Society of Civil Engineers), August 1971, Volume 97, WW3, Paper 8302, pages 559-566.

Kresge, David T., Paul O. Roberts, et al, "Systems Analysis and Simulation Models", Techniques of Transport Planning, (Washington D.C.: The Brookings Institution Transport Research Program), September 1972, Volume 2.

Krzyczkowski, Roman, Interplan Corporation (3 volumes):

1. Over-The-Water Program Design, Volume I: Summary
2. Over-The-Water Program Design Volume II: Technology and Operating Experience
3. Over-The-Water Program Design Volume III: Estimation of Potential National Demand

prepared for Systems Analysis and Evaluation Division, Office of Research, Development and Demonstration Urban Mass Transportation Administration, Department of Transportation, Report No. UMTA-INFR-DC, 8-71-1, December 1971.

Kurz, Johannes W., Puget Sound Governmental Conference, Commercial Air Carrier Operations Forecast in the Central Puget Sound Region for 1970 - 2000, March 5, 1973.

LaBorde Simat Ltd., Calgary, Canada, Arctic Island Supply Study, (an examination of the various methods for transporting equipment and supplies into oil, gas, and mineral exploration sites in the Arctic Islands), May 9, 1971; and supplement of August 31, 1972.

Landis, Robert C., The Mitre Corporation, "Mariculture-Sea Farming", A Technology Assessment Methodology, prepared in cooperation with and for the Office of Science and Technology, Executive Office of the President, June 1971, Volume 5.

Lash:

1. Sembler, Eugene L., F. Asce, Dames and Moore, San Francisco, California, U.S. Get First LASH Ship Terminal, April 1973, pages 48-51.
2. "Teething Problems Snag the LASH", Business Week, April 7, 1973, page 60.
3. "Prudential - Grace Sails in More Placid Waters", Business Week, April 7, 1973, page 24.
4. "LASH Coming to Melbourne", Australia Newsletter, March, 1973, page 2.

Little, Arthur D., Inc., Combating Pollution Created by Oil Spills, Volume I: Methods, prepared for the U.S. Department of Transportation, U.S. Coast Guard, June 30, 1969.

Lykes Bros. Steamship Co., Inc.:

1. Scheduled liner services
2. Lykes Seabee Barge (picture of its design and general construction characteristics)
3. Henry, J.J. Co., Inc., Naval Architects - Marine Engineers, Lykes Seabee Barge, September 1971.
4. The Route of the Seabee
5. Lykes Seabee (brochure)
6. "The Doctor Lykes", Maritime Reporter and Engineering News, March 1, 1972.
7. Lykes Fleet Flashes, October 1972.
8. Lykes Seabee System (picture of its design and general construction characteristics)

Manalytics, Inc., A Feasibility Study of the Great Lakes / St. Lawrence Seaway Feeder Systems, prepared for the Office of Policy Review and the St. Lawrence Seaway Development Corp., Department of Transportation, Contract #DOT-OS-00066, March 1972.

May, Edwin B., Alabama Department of Conservation and Natural Resources, Environmental Effects of Hydraulic Dredging in Estuaries, Alabama Marine Resources Bulletin, #9, April 1973.

McLeavy, Roy, Jane's Surface Skimmer Systems (Jane's Yearbook) third edition, 1969-70, London.

Mead Johnson Terminal Corporation brochure, Evansville, Indiana.

Merchant Marine Council, "Proceedings of the Merchant Marine Council", Handling of Intermodal Freight Containers, May 1970, Volume 27, No. 5, pages 87-94.

Meyer, John R., Mahlon R. Straszheim, et al, "Pricing and Project Evaluation", Techniques of Transport Planning, (Washington, D.C.: The Brookings Institution Transport Research Program), January 1972, Volume 1.

Miller, Vance E., Jr., Stanford Research Institute, Air Cushion Vehicles (working draft), March 1973.

Mississippi River Commission, Public Affairs Office, and U.S. Army Engineer Division, Lower Mississippi Valley, U.S. Army Corps of Engineers, Mississippi River Navigation, October 1971.

Mitchell, T.R., L.S. Cohan, C.H. Heider, Center for Naval Analyses, University of Rochester, Arlington, Virginia, Office of Research and Development, Department of Transportation, U.S. Coast Guard, The Utility of High-Performance Watercraft for Selected Missions of the United States Coast Guard, prepared for Commandant (GDST), U.S. Coast Guard Headquarters, Washington, D.C., (final report), November 1972.

Moore, C.G. and H.P. Ponrehn, University of Southern California, Technological Forecast of Marine Transportation Systems, 1970 to 2000, presented at The Society of Naval Architects and Marine Engineers, Los Angeles Section, February 1971.

Mooz, William E., Energy In The Transportation Sector, presented before the Florida Governor's Conference on Energy Supply and Use, Tallahassee, Florida, March 13-14, 1973.

Nathan, Robert R., Associates, Inc., Institutional Implications of U.S. Deepwater Port Development for Crude Oil Imports, U.S. Army Corps of Engineers, IWR Report 73-4, June 1973.

Nathan, Robert R., Associations, Inc., U.S. Deepwater Port Study, prepared for the U.S. Army Corps of Engineers, Institute for Water Resources, August 1972 (5 volumes):

- Volume I - Summary and Conclusions
- Volume II - Commodity Studies and Projections
- Volume III - Physical Coast and Port Characteristics, and Selected Deepwater Port Alternatives
- Volume IV - The Environmental and Ecological Aspects of Deepwater Ports
- Volume V - Transport and Benefit-Cost Relationships

National Coal Association:

a) Brochures:

1. Clearing the Air - Some Facts About Pollution
2. Smog and Weather

3. Bagge, Carl E., President, National Coal Association, Coal- An Overlooked Energy Source, 1972 Gabrielson Lecture, March 2, 1972.
4. Impact of Surface - Mined Bituminous Coal and Lignite on U.S. Energy Sector.

b) Booklets:

1. Coal - A reprint from the World Book Encyclopedia.
2. Coal in Today's World
3. Coal Traffic Annual, July 1971.
4. World Coal Trade, October 1971.
5. Potta, Harold J., Mesabi Range Iron Ore Transportation - Feasibility and Estimated Cost of Pipelining, U.S. Department of the Interior, Bureau of Mines, 1971.

c) News:

1. "Burlington Northern Expects Coal Haul Gains", Coal News, August 24, 1973.
2. "Decker Coal Signs Big Contract With Detroit Edison", Coal News, National Coal Association, August 17, 1973.

National Goals Research Staff, Toward Balanced Growth: Quantity with Quality, July 4, 1970.

National Petroleum Council's Committee on U.S. Energy Outlook, U.S. Energy Outlook: An Initial Appraisal 1971 - 1985, summaries of task group reports, November 1971, Volume two.

National Petroleum Council's Committee on Oil & Gas Transportation Facilities, U.S. Petroleum and Gas Transportation Capacities, September 15, 1967.

National Research Council, National Academy of Sciences, Highway Research Board of the Division of Engineering and Industrial Research, Highway Capacity Manual 1965, 1965, Special Report 87.

Norris, John T., Jr., Chief, Transport Systems Division, Office of Facilitation, of the Office of Assistant Secretary for Policy and International Affairs, "The Role of our Ports in a Modern Society", News, Office of the Secretary, U.S. Department of Transportation, remarks delivered before the Northeastern Regional Conference, Baltimore Post Society of American Military Engineers, Baltimore, Maryland, October 21-23, 1971.

Norris, John T. Jr., Chief, Transport Systems Division, Office of Facilitation, of the Office of Assistant Secretary for Policy and International Affairs, "Intermodal Containers Take Wings", News, Office of the Secretary, U.S. Department of Transportation, remarks delivered before the Intermodal Distribution Conference, Bangor, Maine, January 18, 1972.

Norris, John T. Jr., Chief, Transport Systems Division, Office of Facilitation, of the Office of Assistant Secretary for Policy and International Affairs, "Intermodal Transportation", News, Office of the Secretary, U.S. Department of Transportation, remarks delivered before the Mark Mainers and Officials of the State of Maine Department of Economic Development, Hotel Sonesta, Washington, D.C. May 1, 1972.

Norris, John T. Jr., Chief, Transport Systems Division, Office of Facilitation, of the Office of Assistant Secretary for Policy and International Affairs, "Agriculture and Systematized Transportation - The Big Challenge or Notes of A Transportation Professional Concerning the U.S. Agri-Business Industry", News, Office of the Secretary, U.S. Department of Transportation, remarks delivered before the Executive Transportation Committee, National Council of Farmer Cooperatives, Williamsburg, Virginia, May 11, 1972.

Norris, John T. Jr., Chief, Transport Systems Division, Office of Facilitation, of the Office of Assistant Secretary for Policy and International Affairs, "The New Transport Option", News, remarks delivered before the Houston Chamber of Commerce, World Trade Club, The Port of Houston, May 17, 1972.

Norris, John T. Jr., Chief, Transport Systems Division, Office of Facilitation, of the Office of Assistant Secretary for Policy and International Affairs, "Minibridge in Focus", News, remarks delivered before the 'Game Plan for Profitable Containerization' Conference, sponsored by the Railway Systems and Management Association, Fripp Island Inn, South Carolina, July 17-18, 1972.

Northern Waterway Terminals Corporation, Minneapolis and St. Paul Terminal (brochure).

Olson, Howard E., U.S. Army Corps of Engineers, Institute for Water Resources, Navigation as Part of Water Resource Development Planning Today, for presentation at Panel No. 1, Operators and Facilities of the National Conference on Domestic Shipping, sponsored by Maritime Administration, U.S. Department of Commerce, St. Louis, Missouri, May 1, 1972.

O'Neal, G. and J. Sceva, The Effects of Dredging on Water Quality in the Northwest, prepared for Environmental Protection Agency, Region X, July 1971, (157 pages).

O'Neill, Hugh V., The Mitre Corporation, "Computers - Communications Networks", A Technology Assessment Methodology, prepared in cooperation with and for the Office of Science and Technology, Executive Office of the President, June 1971, Volume 3.

Ortolano, Leonard (ed.), Analyzing the Environmental Impacts of Water Projects, U.S. Army Corps of Engineers, IWR Report 73-3, March 1973.

Petroleum Press Service, April 1973, pages 131 through 133;
based on Jacobs, John I., World Tanker Fleet Review, (London,
England: Winchester House), December 31, 1972.

"Plans Advance for Gulf Oil Superports", The Oil and Gas Journal,
April 9, 1973.

Posthuma, Ir. F., Managing Director, Port of Rotterdam,
"Restricted-Draft Tankers are Favored", The Oil and Gas Journal,
June 18, 1973.

"Principles and Standards Published for Water and Related Land
Resources Planning", The Waterways Journal (weekly), September
15, 1973.

Port of New Orleans' Board of Commissioners:

1. Board of Commissioners of the Port of New Orleans, 76th Annual Report, Fiscal 1971 - 1972.
2. New Orleans Port Record, February 1973, Volume XXXI No. 5
3. Port of New Orleans, 1973 Annual Directory.
4. "New Orleans' Grain Exports Lead the World", reprinted from New Orleans Port Record, courtesy of the Board of Commissioners of the Port of New Orleans, by Public Grain Elevator of New Orleans, Inc.

Port of Oakland brochures:

1. "Oakland: Coming up like thunder 'cross the bay", Fortune,
December 1972.
2. The Sea-Land Story at the Port of Oakland
3. Port of Oakland, Marine Terminal Facilities (pictures)

4. Port of Oakland's Northern California Area Map
5. "The Midwest Begins in Oakland", Transport Monthly, August 1, 1972, Volume 1, No. 9.
6. On Time Distribution (An Importer's Guide to Distribution Cost Savings)
7. Port of Oakland
8. Port of Oakland Terminal Facilities Guide

Port of Rotterdam, Rotterdam - Europort - Delta (magazine), March 1972, Volume 11.

Port of Sacramento, Facts from The Port of Sacramento.

Port of Stockton (brochures)

Protasov, L. and M. Khabenskiy, Central Scientific-Research Institute of Economics & Operation of Water Transportation, Flexible Containers for Shipping Bulk Cargo (translation from Russian, N.I.C. Translation No. 2706), Source - Rechnoy Transport, No. 11, 1965, pages 14 - 16.

Puget Sound Governmental Conference, Air Carrier Passenger and Cargo Demand Forecasts for the Central Puget Sound Region 1970 - 2000, October 8, 1972.

Pusey, Peter S. and K. Wreghitt, AVCO Systems Division, Modular Intermodal Container Parametric Study (for final report) prepared for Air Force Packaging Evaluation Agency Wright-Patterson Air Force Base, Ohio, Technical Report AVSD-0513-69-CR, January 1970.

1972 Rental Compilation, Twenty-Third Edition Nationally Averaged Rental Rates and Model Reference Data for Construction Equipment, (Oakbrook, Illinois: Associated Equipment Distributors), June 1972.

"Report of the Committee on Commerce, United States Senate by its Special Study Group on Transportation Policies in the United States", National Transportation Policy, U.S. Senate, 87th Congress, 1st Session, Report No. 445, June 26, 1971.

Rincon Industrial Park, Corpus Christi, Texas (brochure).

River, Charles, Associates, Inc., A Study of the Inland Waterway Use Charge Program, prepared for the U.S. Department of Transportation, Contract #DOT-OS-00072, December 1970.

River Services Corporation, Minneapolis and St. Paul, Minnesota (brochure).

Rocks, Lawrence and Richard P. Runyon, The Energy Crisis, (New York: Crown Publishers, Inc.), 1972.

Roseman, Donald P., Geoffrey W. Peters, Horton W. Lain, Hydronautics Incorporated, Concept Design and Cost Analysis of Restricted Draft Dry Bulk Carriers, prepared for U.S. Army Engineer Institute for Water Resources, Department of the Army, Corps of Engineers, Contract No. DACW 73-73-C-0043, September 1973.

Rubin, David H., The Mitre Corporation, "Enzymes - Industrial", A Technology Assessment Methodology, prepared in cooperation with and for the Office of Science and Technology, Executive Office of the President, June 1971, Volume 4.

Sabin, Alfred B., Trends in Intermodal Refrigerated Container Systems, for presentation before the Northern California Society of Naval Architects & Marine Engineers, San Francisco, California, January 8, 1970.

Schubert, J. and R. Delmelt, A New Pallet System Increases the Effectiveness of Container Transport and Permits the Use of Standardized Packages, published by Seewirtschaft, East Germany, April 1970, Volume 2, No. 4, pages 333-336.

Sharp, George G., Inc., Integrated Tug-Barge Systems--Background and Design Services, February 1972.

Sharp, George G., Inc., Giblon, Robert P. and Robert J. Tapscott, Design and Economics of Integrated Tug-Barge Systems, for presentation before the New York Metropolitan Section, The Society Of Naval Architects and Marine Engineers, December 12, 1972.

"Shipboard and Shoreside Conveyor System", Shipbuilding and Shipping Record, (London, England: Technical Publications Limited), May 29, 1970, Volume 115, No. 21, page 40.

The St. Lawrence Seaway Authority, Report as to the Sufficiency of Seaway Tolls and Proposed Changes Related to the Financial Requirements of the St. Lawrence Seaway Authority, June 30, 1966.

The St. Lawrence Seaway Authority, Summary of Future Traffic Estimates and Toll Requirements, April 13, 1966.

The St. Lawrence Seaway Authority, Tolls Committee, Report of Tolls Committee, June 12, 1958.

The St. Lawrence Seaway Authority and the Saint Lawrence Seaway Development Corporation, Traffic Report of the St. Lawrence Seaway, 1966.

Snavely, King & Tucker, Inc., economic consultants, A Study of the Effects of Inland Freight Rates and Services on the St. Lawrence Seaway, prepared for the Secretary of Transportation, Contract #DOT-OS-10019, December 15, 1971.

Thielhelm, H.W., Bechtel Corporation, U.S. Organization for Environmental Matters and Water Quality Improvement Act of 1970, May 24, 1972.

Todd Daily Maritime (weekly), (New York: Todd Shipyards Corporation).

Torget, William E. and Rowena Funston, "Innovations in Barge Transportation on Columbia River", Journal of the Waterways and Harbors Division, Proceedings of the American Society of Civil Engineers, May 1970, Volume 96, Number WW2.

Texas Gas Transmission Corporation:

a) TXG:

1. "Jeffboat-Builder of a New Queen", 1973, Volume 4, Number 5, pages 12-16.
2. "Port of New Orleans and ACBL - Growing Together", Volume 4, Number 2, pages 1 - 5.

b) "Inland Waterways Services Division", Texas Gas Transmission Corporation 1972 Annual Report, 1972.

Tozzoli, Anthony J., manager, Marine Planning & Construction Division, The Port of New York Authority. "Containerization and Its Impact on Port Development", ASCE Journal of the Waterways, Harbors and Coastal Engineering Division, proceedings of the American Society of Civil Engineers, August 1972, Volume 98, NWW3, pages 333-342.

"Training Tomorrow's River Pilots", Surveyor, quarterly publication of the American Bureau of Shipping, August 1973, Volume VII, Number III.

Translations on U.S.S.R. Trade and Services No. 120, May 14, 1970.

Transportation Information Systems Project Group Urban Systems Laboratory, Massachusetts Institute of Technology, Summary of National Transportation Statistics, prepared for the U.S. Department of Transportation, Assistant Secretary for Policy and International Affairs, Office of Systems Analysis and Information, November 1972.

Transportation Institute, Southern Illinois University, A Study of River Ports and Terminals, submitted to Maritime Administration, Department of Commerce, June 1968.

Tudor Engineering Company, Report On The Operations of the Washington State Ferry System, During the Period 1966- 1972.

Ullman, G.H., "The Role of the American Ocean Freight Forwarder in Intermodal Containerized Transportation", Journal of Maritime Law and Commerce, (Washington D.C.: Jefferson Law Book Company), April 1971, Volume 2, No.3, pages 625-643.

U.S. Army Corps of Engineers, Buffalo District, Dredging and Water Quality Problems in the Great Lakes, June 1969, (Summary and several other volumes).

U.S. Army Corps of Engineers, San Francisco District, Final Environmental Impact Statement: Operation and Maintenance of Humboldt Harbor and Bay, Jetties and Dredging, Humboldt County, California, June 1973, (58 pages).

U.S. Army Corps of Engineers, San Francisco District, Draft Final Environmental Impact Statement: San Leandro Creek Small Flood Control Project, Alameda County, California, November 1971.

U.S. Army Corps of Engineers, San Francisco District, Final Environmental Impact Statement: Oakland Inner Harbor, Alameda County, California, February 1973, (41 pages).

U.S. Army Corps of Engineers, Southwestern Division, Dallas, Texas, Water Resources Development, January 1971.

U.S. Army Corps of Engineers, "Title 33 - Navigation and Navigable Waters", Federal Register, September 9, 1972, Volume 37, No. 176.

U.S. Army Corps of Engineers, Gulf Intracoastal Waterway, December 1964.

U.S. Army Corps of Engineers, Institute for Water Resources, Operations Plan for Comprehensive Development - The Arkansas - Verdigris Waterway in the Ozarks Regional Commission Area, prepared as provided in the Memo of Agreement between the Ozarks Regional Commission and the Corps of Engineers, December 1969.

U.S. Army Corps of Engineers, Waterways Experiment Station, Dredged Material Research, Miscellaneous Paper D-73-2, June 1973.

U.S. Department of Commerce, Bureau of Census, Transportation Division, Domestic and International Transportation of U.S. Foreign Trade: 1970, sponsored jointly by the U.S. Army Corps of Engineers and U.S. Department of Transportation, September 1972.

U.S. Department of Commerce, Maritime Administration, Environmental Impact Statement: Maritime Administration Tanker Construction Program (draft), NTIS Report No. EIS 730392D, undated.

U.S. Department of the Interior, The Population Challenge, What It Means to America, Conservation Yearbook No. 2, 1966.

U.S. Department of Transportation, Office of the Secretary, News:

1. July 10, 1972.
2. July 20, 1972.
3. February 21, 1973.
4. June 7, 1973.
5. June 8, 1973.

U.S. Department of Transportation, Coast Guard, "Pollution Prevention - Proposed Vessel and Oil Transfer", Federal Register, December 24, 1971, Part II, Volume 36, Number 248.

U.S. Department of Transportation, Office of High Speed Ground Transportation, Northeast Corridor Transportation Project Report, April 1970.

Voyageur Project, Bell Aerospace Canada, fifth progress report, December 1972 (brochures).

Washington, State of, Department of Highways:

1. 1973 Cross-Sound Transportation Study Ferry User Questionnaires
2. Presenting Washington State Ferries (brochure)
3. Washington State Highway (map)

Washington Public Ports Association, 1973 Port Directory (brochure).

Washington State Ferries, Ferry Schedule, Summer 1973.

Wenk, Victor D., The Mitre Corporation, "Water Pollution: Domestic Wastes", A Technology Assessment Methodology, prepared in cooperation with and for the Office of Science and Technology, Executive Office of the President, June 1971, Volume 6.

Winger, John G., John D. Emerson, Gerald D. Grunning, Richard C. Sparting and Arthur J. Zraly, Energy Economics Division, The Chase Manhattan Bank, Outlook For Energy in the United States to 1985, June 1972.

Woodward, III, J.B., Harry Benford and Horst Nowacki, University of Michigan, Systems Analysis in Marine Transport, published by The Society of Naval Architects and Marine Engineers, New York, paper was presented at its Diamond Jubilee International Meeting, June 18-21, 1968, No. 7, pages 7-1 to 7-15.

Young, Robert A., S. Lee Gray, R. Burnell Held, and Richard S. Mack, Colorado State University, Economic Value of Water, Concepts and Empirical Estimates, (Final Report), prepared for the National Water Commission.

Zlobin, G.P. and Y.A. Simanov, Air Cushion Vehicles, Technical Translation #FSTC-HT-23-1586-71, (Charlottesville, Virginia: Army Foreign Science and Technology), October 28, 1971.

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER IWR Contract Report 75-5	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) An Overview of the Potential Role of the Inland Waterways in an Integrated US Transportation System		5. TYPE OF REPORT & PERIOD COVERED Final
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Henry M. Ferree and Bechtel Incorporated Staff and Consultants		8. CONTRACT OR GRANT NUMBER(s) DACW31-73-C-0082
9. PERFORMING ORGANIZATION NAME AND ADDRESS Bechtel Incorporated Fifty Beale St. San Francisco, California 94119		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS USA Engineer Institute for Water Resources, Kingman Bldg., Ft. Belvoir, VA 22060 and US Department of Transportation, Office of Facilitation, Washington, DC 20590		12. REPORT DATE August 1975
		13. NUMBER OF PAGES 236
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Prepared under the joint sponsorship of US Army Engineer Institute for Water Resources and the U. S. Department of Transportation, Office of Facilitation.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Inland Waterways, transportation, navigation, integrated transportation system, transport modes, intermodal movements, transportation policy, transportation planning, transportation regulation, modal institutional and economic factors, Government aid, recommendations for transportation planning, regulation and environmental considerations.		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report examines present physical, operational, and institutional conditions of the waterways industry of the United States and evaluates constraints; considers what might be done to improve efforts to produce an integrated U.S. transport system; explores national goals and policy alternatives as well as recent legislative trends affecting transport; and presents the author's conclusions and recommendations. This report presents a Bechtel viewpoint for consideration. It relies heavily upon current information derived from an		

intensive program of field interviews with key executives in the waterways industry and in government - supported by specialist consultants in inland waterways transportation and institutional matters, a shipper survey, and a review of current and recent literature relative to the inland waterways.