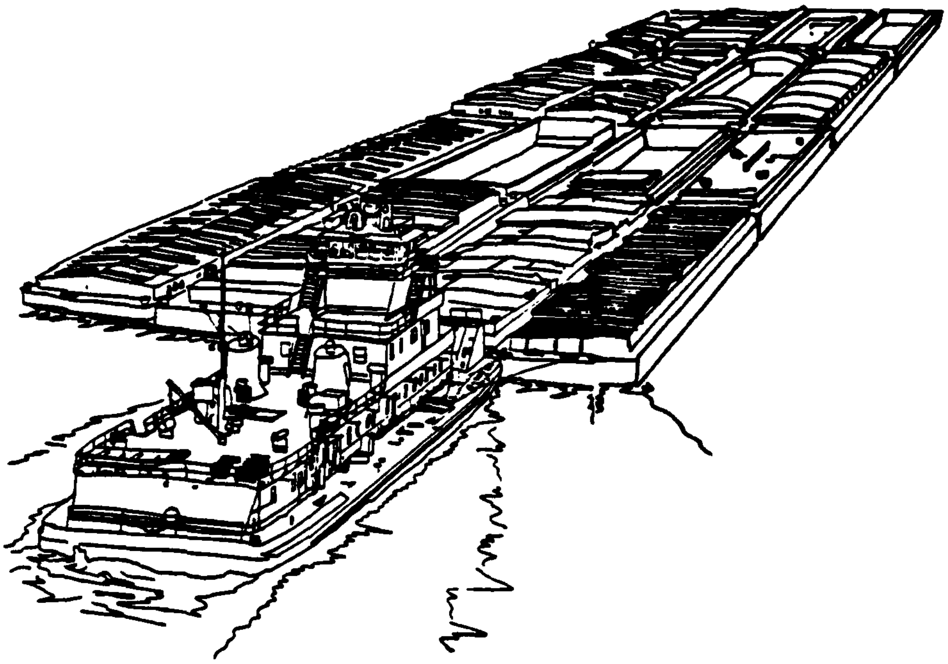
AD-A150 521 A GUIDE TO STRATEGIC PLANNING FOR THE INLAND BARGE AND TOWING INDUSTRY(U) DRAVO MECHLING CORP NEW ORLEANS LA B DIBNER ET AL. DEC 84 3861-4-00 MA-RD-770-85005 1/2

UNCLASSIFIED DTMA91-83-C-30063 F/G 15/5 NL

A Guide to Strategic Planning for the Inland Barge and Towing Industry

AD-A150 521



DTIC FILE COPY

CONTRACT NO. DTMA91-83-C-30063
REPORT NO. MA-RD-770-85005

U.S. Department of Transportation
Maritime Administration

DECEMBER 1984

LEGAL NOTICE

50272-101

REPORT DOCUMENTATION PAGE

1. REPORT NO. MA-RD-770-85005

2.

3. Recipient's Accession No.

4. Title and Subtitle
A Guide to Strategic Planning for the Inland Barge and Towing Industry - Final Report

5. Report Date December 1984

6.

7. Author(s)
B. Dibner, I.B. Jacobson, J. Kryschtal, L.E. Sutton

8. Performing Organization Rept. No. 3861-4-00

9. Performing Organization Name and Address
Dravo Mechling Corporation
400 Poydras Street
New Orleans, LA 70130

Temple, Barker & Sloane, Inc.
33 Hayden Avenue
Lexington, MA 02173

10. Project/Task/Work Unit No.

11. Contract(C) or Grant(G) No.
(C) DTMA91-83-C-30063
(G)

12. Sponsoring Organization Name and Address
U.S. Department of Transportation
Maritime Administration
400 Seventh St., S.W.
Washington, D.C. 20590

13. Type of Report & Period Covered Final

14.

15. Supplementary Notes

Jointly sponsored by Maritime Administration and Dravo Mechling Corporation.

16. Abstract (Limit: 200 words)

This manual provides a structure for strategic planning that has been applied by an inland barge and towing company. It describes the procedures followed, information requirements, and the analysis of the industry, competitors, markets, and other environmental factors. Also included are extensive appendices including: bibliography, commodity classification, historical commodity flows, barge line capabilities, a sample market survey, forecasting methodology, and financial forecasting model.

17. Document Analysis a. Descriptors
Transportation
Inland Waterways
Barge and Towing Industry
Strategic Planning
Traffic Forecasts
Commodity Flows

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement Approved for Release
National Technical Information Service
Springfield, VA 22161

19. Security Class (This Report) Unclassified

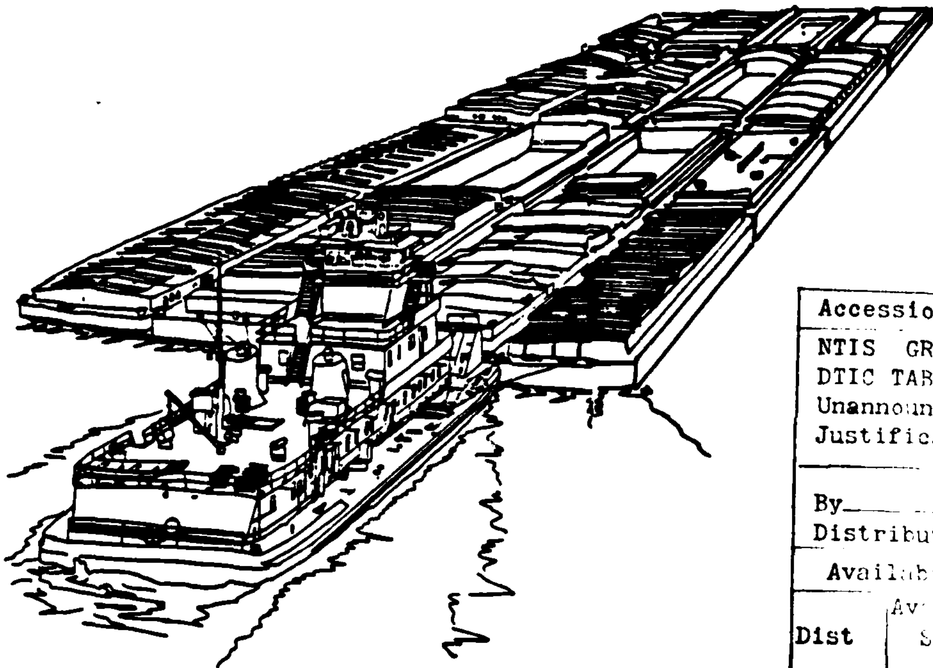
20. Security Class (This Page) Unclassified

21. No. of Pages 203

22. Price

(See ANSI-Z39.18) See Instructions on Reverse OPTIONAL FORM 272 (4-77) (Formerly NTIS-35) Department of Commerce

A Guide to Strategic Planning for the Inland Barge and Towing Industry



CONTRACT NO. DTMA91-83-C-30063
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FOREWORD

Under the sponsorship of the United States Maritime Administration, Dravo-Mechling Corporation (DMC) and Temple, Barker & Sloane, Inc. (TBS), developed and now describe in this document a structure and methodology for strategic planning that has been specifically designed to meet the needs of the inland barge and towing operator.

STATUS OF INLAND BARGE AND TOWING INDUSTRY

From 1940-1980, the U.S. inland barge industry was a growing and relatively stable segment of the bulk marine transportation industry. Compared to the oceangoing subsidized sector of the U.S. merchant marine, it is relatively free from regulations for the majority of its traffic.

For these reasons, the inland barge industry had attracted many corporate owners and investors. In many cases their portfolios had grown to include barge fleets, towboats, fleeting and operating services, bulk and general cargo loading and discharge terminals, new construction, and repair shipyards. In addition, some major customers--including grain companies, coal producers, utilities, agricultural cooperatives and chemical companies--had invested directly in inland barge operations. Many companies expanded their roles in a range of functions from private terminal operators through barge building. In recent years, these companies have been affected by the activities of independent investors and private carriers who have changed the structure and behavior of the industry. The current depression in equipment use and carrier profitability and revenues has led to bankruptcies, mergers, and aquisitions, and has altered customers' relationships with the for-hire carriers. It is critical that carriers understand and respond appropriately to these changes.

The industry also finds itself operating in an increasingly complex and volatile economic and trade environment. In the last decade, barge loadings have expanded significantly as a result of the increased agricultural exports from the Gulf of Mexico ports, where commercial, government-financed, and government-to-government programs have been established. Exports of coal to foreign utilities and steel producers have increased. For the foreign purchasers of these dry bulk commodities, the United States remains a vital, but often the last-choice, supplier that meets the fluctuating year-to-year needs, which are driven by international political, economic, and financial realities. Strong demand during one year is often followed by weak demand during the next. In the domestic arena, the changing levels of energy and natural-resource consumption during economic recessions and expansions have complicated trading conditions and investment decision-making. All these factors lead to erratic fluctuations in demand for barge services, which are difficult to satisfy.

The inland barge and towing industry has also been faced with a changing regulatory environment. Railroad deregulation and the resulting pricing policies will be a fundamental competitive aspect of the 1980s. And it is possible that the barge industry will be eliminated from the Interstate Commerce Commission's (ICC) regulatory realm. Nationwide initiatives for water resource development and waterway user fees for cost recovery will affect both the costs and markets of inland barge operations and could cause other economic effects on the regions served by the industry. Finally, fuel availability, quality, and price must be related to capital and operating decisions concerning towboat investments.

NEED FOR STRATEGIC PLANNING

The business environment for the 1980s and 1990s will place heavy demands on private enterprise for the effective use of assets. Because of the volatility of inland barge conditions, the returns from operations as well as the market value of assets can vary widely from year to year. If individual companies do not make the appropriate decisions, the entire industry as well as the shippers that rely on the barge industry can be profoundly affected.

In this increasingly complex and competitive environment, independent inland barge carriers will face difficult decisions related to the refurbishing of capital assets. If barge line owners cannot forsee future returns on investments that compare favorably to returns in other businesses or that exceed their capital costs, even the more successful companies might consider the divestiture of assets, if they could find buyers. But if they remain in the ring, they may find themselves driven to low cost, low risk, and timid strategies that would ultimately reduce service and industry capability.

Like most sectors of the maritime industry, the inland barge industry has in all too many instances been directed by managers with limited exposure to other industries, who generally have more technical than management training, more operational than analytical experience, and who now find themselves surrounded by complex market issues, legislation, and regulation.

As the inland barge industry's executive decision-making environment has changed, so has the governmental policy makers' framework. To ensure that government programs are tailored to the industry's needs in the new environment, it is crucial to achieve a better understanding of the market conditions that the industry will face in the future.

The following premises state the reasons for recognizing strategic planning as vital to the recovery and future health of the inland barge industry:

- Knowledge of expected market supply and demand is critical to the future of the inland barge and towing industry.
- Planning is fundamental to successful management in what should be an increasingly volatile industry.
- The evaluation of fundamental economic, industrial, regulatory, competitive, and political issues is a critical step in the planning process.
- Managing in a marketplace of excess capacity and/or weak trade levels requires greater care in making investment, operational, sales, and other decisions than managing in a strong market.
- Techniques can be developed to give managers important information to guide them in strategy development and implementation.
- Strategies are composed of various service, price, cost, charter, investment, financial, operating, and organizational elements.

PLANNING REQUIREMENTS FOR BARGE LINES

The planning requirements of an inland barge line must focus on the following:

- Developing an analysis and forecasts of both current and potential markets;

- Assessing the need for new industry and company strategies and structures to better confront competitive and underlying economic realities;

- Matching equipment and technology to the evolving market requirements and competitive conditions;

- Improving the productivity of physical, capital, and human resources;

- Developing the managerial talent and organizational strengths, without which strategic plans remain just unused blueprints;

- Optimizing the industry and company capitalization and capital access; and

- Constructively addressing the legislative, regulatory, and associated inter- and intra-industry practices that impede progress and performance.

During the next decade every inland carrier will be challenged by the constant need to make major equipment decisions against the backdrop of increasing competition. This document provides a mechanism for the inland barge and towing companies to identify likely future market and competitive conditions and develop appropriate strategies using state-of-the-art strategic planning concepts and techniques.

I. INTRODUCTION: A STRUCTURE FOR STRATEGIC PLANNING

SUMMARY

Recent history underscores the unpredictability that the operator of an inland barge line is likely to face over the next decade. The government-imposed export restrictions, changing energy prices, and worldwide recession can play havoc with the most carefully planned company strategy. These shocks to long term trends can not be forecasted. However, effective strategic planning can mitigate much of the destabilizing impact of the unexpected.

This manual develops--and this chapter briefly outlines--a structure for planning that will enable managers of inland barge lines to deal more effectively with the challenges of the future. The planning process consists of three phases: first, an analysis and forecast of the company's business environments, second, the development of company objectives and strategies, third, the implementation of the selected strategy.

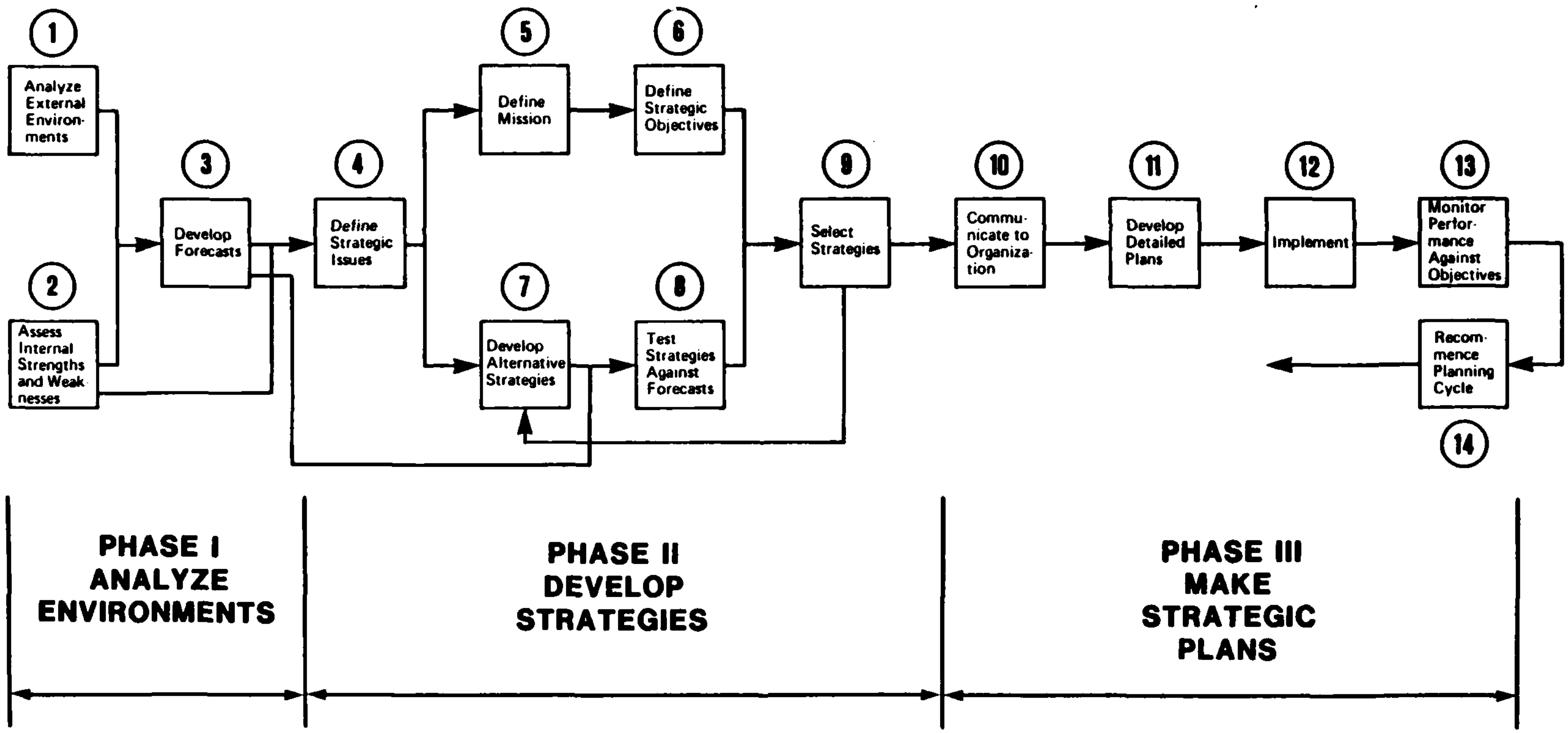
Figure I-1 illustrates the sequence of and interaction among the various steps of the planning process. The process begins with an analysis of the various environments within which the company operates. This analysis provides a basis for projecting the future external factors that will affect the barge line. Given this projection, the company's capabilities are assessed to determine the issues of strategic importance--factors that may play a critical role in the company's future success. Then alternative strategies are then designed to address the challenges of the strategic issues. These strategies are rigorously tested to select those that will be most effective in the future. Finally, the cycle is completed when the strategy selected is implemented. Monitoring performance against strategic objectives leads to the identification of new strategic issues. Then the process begins anew.

Effective planning leads to developing strategies that: (1) align the barge line's resources to use its strengths in areas of opportunity while avoiding vulnerability; (2) ensure enough flexibility to respond to the unforeseen; and (3) provide yardsticks that monitor the company's progress towards its strategic objectives.

An established planning system enables a barge line to respond quickly to meet the challenge of short-term crises as well as long-term planning needs. Quick reactions are built into

FIGURE I-1

STRATEGIC PLANNING PROCESS



ıng sensors that continually
ɔrmation. Additionally, once
: will become experienced in
:ategic information. The exis-
ˌps ensure that short-term deci-
ıny's course in crises so that
ˌight of longer term goals and

:he strategic planning process
of focus, of course, depends on
-term mission. For example, a
ırticular market, such as facing
long haul spot grain movements,
ˌy on that service and later
:porate other services, such as
ɘ other hand, a company that
and services must integrate its
ɔader focus of an overall corpo-
ınd services.

entrate on strategic planning
ı only the barge industry.
:epts and approaches discussed
for a wide range of associated

ular focus of planning, it is
's preliminary concerns. Early
uch as low freight rate levels
termine the type and level of
ɘ planning process must also be
ting and decision-making dead-

tegic planning process are

S

ing process consists of an anal-
ıds that affect the company from
ɜ forms the basis for projecting
ternal influences on the com-
ket, competition, and other

environmental factors. The an
of the company's particular s
number of these topics overlap
and competition), they are dis
and subsequently integrate int
future environment.

Analyze External Environments

The Industry

An analysis of the inland
the strategic planner with a f
can measure the performance of
benefit of an analysis of the
key factors behind the success
produces useful insights into
instance, the planner's compan
tures can be investigated to s
ty are linked. An analysis of
growth over time identifies th
and, consequently, whether or
suppliers of capital. Knowled
equipment available to the ind
about expected rate levels and

The Market

A forecast of demand for
company's market sectors is a
planning exercise. The foreca
and volumes of cargoes as well
destinations.

As a first step, the traf
commodity and shipper group.
any trends and shifts in the r
segments.

Each key commodity shoulc
torical changes in total traff
tant origin/destination pairs.
the following:

- Grain
- Fertilizer

- Coal
- Construction materials
- Ores
- Minerals
- Iron and steel products
- Forest products
- Chemicals
- Clean petroleum products
- Dirty petroleum products

In developing a market forecast, it is necessary to go beyond the analysis of historical trends in commodity movements and look at the underlying economic and other forces that affect the movements. The demand for transportation on the river system comes from the demand for the goods to be moved. Therefore, the need for shipping services is a direct function of the economic conditions surrounding the production and consumption of the commodities. To project the traffic levels on specific waterways requires forecasting the general economic conditions and outlook for the specific sectors of industry, mining, and agriculture. A knowledge of slated industrial projects and commodity export opportunities is also valuable for producing a reliable trade forecast.

This forecasted market for services by the barge industry should not be confused with the market for services of the planner's barge line. Forecasts of the company's markets are based on more specific factors such as equipment availability, rate structure, sales performance, competitors' actions, and other factors, both internal and external to the company.

The Competitors

To analyze competitors, a planner must learn who they are and what are their present and projected strategies. The analysis should identify the competitors' relative strengths and weaknesses, thus indicating potential opportunities for and threats to the company. The planner should seek insights into how specific competitors may react to environmental changes or to specific strategies adopted by the company.

One of the key aspects of this analysis is to use important business attributes to profile a competitor's position as it relates to the company. These attributes include the number and types of towboats and barges in service, market segments served (e.g., by river and commodity), rate activity, and market role (e.g., leader or follower).

Important insights that may be obtained from analyzing competitors include the following:

- Understanding their market interests based on their equipment profiles, deployments of towboats and barges, and access to additional equipment.

- Knowing their marketing strategies as revealed by their activities in public trading of covered barge contracts, and bids offered to shippers.

- Noting their operating efficiencies by observing their fleeting locations, tow makeups, operating areas, and frequency of service.

- Determining whether or not competitors' perceived strategies in specific market segments are compatible with their overall interests.

All markets that each competitor serves should be analyzed to determine its flexibility in equipment deployment, previous actions in similar situations, and the priorities that specific types of traffic hold in the competitor's total sphere of operations.

Other Environmental Factors

The complexity of the business environment in which a barge line operates requires that a number of other factors be analyzed. The primary areas requiring attention are: the legal and regulatory environment, changes in the physical characteristics of the waterways, new technology, availability of resources used by barge lines, and activities of competing inland modes of transportation.

- **Legal and Regulatory**

The objective of an analysis of the legal and regulatory environment is to identify the areas that support or limit the company's operations. With this information, the planner can build strategies that gain the maximum advantage from the environment and support the legislative initiatives that would be to the company's advantage. Examples of these issues are intermodal ownership, waterway user charges, and ICC deregulation.

- Physical Characteristics of the Waterway System

Changes in the inland waterway system can make an important impact on the future operations and markets of a barge line. Lock repairs, low water, and floods can impose delays on particular waterways that could seriously affect the economics of markets. On the other hand, planned improvements to existing waterways, such as the 1,200 foot lock at Alton, IL, or the new waterway connecting the Tennessee and Tombigbee Rivers can improve operating efficiencies or open up entirely new markets.

- New Technology

Improvements in towboat and barge design and materials handling technology can reduce costs significantly or open new market segments to a barge line. While the current state of design and construction of inland vessels is quite advanced, there are some improvements coming, such as more cost-effective diesel engines burning heavier fuels and fuel monitoring systems that permit more efficient engine speed control. The correct timing of new investments in advanced technology should fit into the total financial framework of the company.

- Availability of Resources

The availability of barges, towboats, fuel, manpower, and other key resources that are used in the barge line's operations will affect the cost structure of the company and the industry. Since barge rates are very sensitive to changes in capital and operating costs, knowing the supply and demand in these resource markets is very useful in understanding the dynamics of the barge transportation market.

- Competing Modes of Transportation

Construction, merger, market entry, and pricing activities of railroads and pipelines can seriously affect inland barge line markets and profitability. The barge line strategic planner must be aware of new developments in these competing modes.

Assess Internal Strengths and Weaknesses

The Company

The next step is to conduct an internal assessment of the company's strengths and weaknesses relative to others in the industry. A prime objective of the internal evaluation is to identify areas of competitive advantage, such as fully depreciated barges, that may be used to exploit future opportunities. However, the assessment should also identify areas of weakness, such as high cost terminal operations that may dictate a future strategy of shutting down these facilities to decrease the company's vulnerability. Particular performance criteria that a planner should assess include indicators of service levels, customer satisfaction, market share, cost structure, equipment use, financial performance, information systems, and adequacy of personnel.

Develop Forecasts

The final step in the first phase is to develop forecasts of the markets in which company is currently active or has an interest in entering. The forecasts are primarily focused on the demand side of the market: to determine the future requirements of shippers to use barge services to transport their raw materials and products on the inland waterway system. The supply side is also important, as represented by the expected availability of barges and towboats to transport the commodities. It is the future interactions of these two elements that determine the market for a barge line. The planner should use whatever information that he can obtain to develop useful forecasts of all elements of the markets served by the company.

PHASE TWO: STRATEGY DEVELOPMENT

During the second phase of the planning process, the separate elements of analysis carried out earlier must be combined in order to determine how their interaction shapes the future environment and the barge line's ability to prosper. A number of different analytical approaches may be required to integrate all the components. In creating an understanding of the company's future environment, the planner should identify the issues that are likely to be critical to the company's success. These strategic issues provide the focal point for developing and evaluating alternative strategies.

Corporate Mission and Strategic Objectives

A corporate mission defines what a company plans to be. Strategic objectives are yardsticks that measure the success of the company in fulfilling that mission. The projected future environment provides a frame of reference to express the company's mission and strategic objectives. A statement of corporate mission need only include: (1) what markets the company will serve, (2) what customer needs will be met, and (3) how the company will provide those services. Strategic objectives are more specific and should reflect the company's perceptions of the future business environment and its own ability to prosper within that environment.

Effective strategic objectives provide a basis for allocating resources and evaluating the company's performance. They should provide measurable benchmarks for tracking and controlling performance in order to identify or anticipate a need for mid-course corrections. To successfully meet these objectives, the company's personnel who are responsible for implementing the strategies must be committed.

Strategic objectives must be sufficiently specific to serve as valid measures of performance. However, they must also be varied enough in the criteria they set to preclude manipulating the results through inappropriate tradeoffs, such as boosting growth in revenues at the expense of profits, or delaying vessel replacement in order to maximize short-term ROI.

Strategic Issues

Strategic issues are major changes in the barge line's environment that are considered likely to have a significant impact on the company's future. Early in the process, the environmental analysis may well identify numerous important strategic issues. Others may surface later as the company's ability to perform in the future is projected against the backdrop of the forecast environment. Such issues generally fall into the following areas:

- Changes in the amount or nature of commodities moving on specific waterways
- Towboat and barge availability
- Behavior of competitors, both barge operators and other modes

- Legal and regulatory constraints
- Waterway capacity
- Developments in technology
- Availability of resources
- The company's ability to meet future challenges

The Selection of Strategy

Developing strategy focuses on the means by which the company can meet the challenges posed by the strategic issues and attain its strategic objectives. To avoid preselecting a less than optimal strategy, a number of alternative strategies should be developed. So that a company gains a broad perspective on its problems and their potential solutions, these strategic options should stem from a variety of the company's functional areas. The process of developing several options, which are then subjected to rigorous, unbiased testing, should lead to a vote of confidence for the strategy that is finally chosen.

Each strategic option should possess enough financial detail so that resource requirements, cash flows, and market position are clearly defined over the planning period. Planners should specifically note and resolve the potential conflicts or paradoxes within a strategy, e.g., growth versus short-term profitability.

Computer simulation is very effective in integrating the diverse elements produced by the strategic analysis. Simulation tests the strategic options under the projected environmental conditions. Assumptions on future operating costs and rates can be loaded into an interactive computer model to project the company's financial, market share, and capacity use. The model can also test the sensitivity of strategic options to variations in key assumptions.

Planners should relate the projected performance of each strategic alternative to selected criteria, such as the internal rate of return, consistency with strategic objectives, flexibility of response to unforeseen environmental changes, minimization of downside risk, and effective use of human and capital resources.

In the process of testing and evaluating, it is possible that additional strategic issues may emerge, requiring a loop back to the development or refinement of further strategies to deal with the new issues.

PHASE THREE: THE STRATEGIC PLAN

The third and final phase of the planning process culminates in a plan that is both comprehensive and workable. Of primary importance in this phase is communicating to all those concerned with its implementation the philosophy and details of the strategic decision. Responsibility must be delegated to those expected to carry out the strategy. Because many of these individuals may already have participated in the strategy's development, their commitment should instill confidence in the selected strategy among their colleagues.

Development of Business Plans

A series of detailed business plans transforms the strategy from the abstract to the concrete. Normally integral parts of formal planning documents (such as five-year and annual plans), these plans include the following:

The Sales Plan identifies and prioritizes specific customer needs and, where applicable, the particular customers or market segments where sales efforts should be focused.

The Competitive Plan states assumptions about the competition's behavior and develops the specific actions the organization should take to neutralize any competitive activity that could damage the strategic plan.

The Operations/Service Plan details how the organization will carry out its strategy in terms of vessel and land-based operations in order to meet the strategy's timetable.

The Financial Plan develops short-term financial details that are used to develop budgets and financial controls.

The Organizational/Personnel Development Plan structures the organization to meet the demands of the strategic plan and allocates human resources in order to best carry out the strategy.

The Corporate Development Plan synchronizes the needs and contributions of the barge line with those of the rest of corporation's divisions.

Each business plan can be taken to the appropriate level of detail required to formulate one-year plans and budgets. This final critical step carries the objectives and broad detail of the strategic plan through to the implementation stage.

Monitoring Performance

Along with the strategic plan and its offshoots (the business plans), several yardsticks gauge progress. Should the environment alter so that the original strategic plan becomes unworkable, the yardsticks provide an early indication of any major differences between plan and reality. Such an indication will send the planner back to the appropriate point in the planning process to deal with the new issue.

CONCLUSION

The essence of strategic planning is the process of planning, not the plan. A formalized system as we have described is needed to guide and stimulate the process of strategic planning. In the end, the plan is the product of a series of assumptions about the future, some of which are bound to prove inaccurate. The dynamic process of planning is critical to directing the enterprise through the future's uncertainties.

A strategic planning system offers tremendous decision-making assistance to the managers of a barge line. The principal assets of such a system include: the greater depth and perspective it adds to a company's understanding of the environment; the increased communication it creates between people within the company in the expression of objectives, the sensing of needs, and the development of strategies; and, finally, the coordination of all the company's resources into a consensus-based strategy to position the company to prosper in the future.

II. INFORMATION REQUIREMENTS

Information fuels the strategic planning process. Without accurate and planning-oriented data, the planning process deteriorates to groping in the dark, using just intuition and hearsay. Especially for the analysis of the firm's environments conducted in Phase I, planners should collect data regularly and systematically.

TYPES OF INFORMATION

The strategic planner's information needs are many and varied, but generally fall into the following categories:

- Information on the industry in which the company operates. This information can provide insights into the successes and failures of similar barge lines, the factors behind such events, and major trends on an industrywide basis. Such knowledge can prove useful in determining the market value of firms in the industry and associated problems of capital formation.

- Financial and operational data on the company itself. This information can be used to compare the company's performance to industry yardsticks and help determine the company's unique strengths and weaknesses.

- Environmental information on the applicable laws and regulations, waterway characteristics, new technology, and availability of resources.

- Finally, and of central importance to the identification of future areas of opportunity and threat, information on the supply and demand aspects of the markets in which the company competes or may in the future compete. Essentially, this entails a knowledge of the company's competitors and customers.

Although we will generally deal with these various database areas separately, it must be noted that during the strategic planning process the areas cannot always be analyzed separately but instead must be integrated and synthesized. Because they are interrelated, one must understand how these parts fit the whole in order to project the firm's future environment.

STRATEGIC INFORMATION DATABASE

Figure II-1 provides a summary of the suggested major components of a strategic information database. The means of storing these data may range from collecting hard-copy annual reports or press clippings on competitors to computerizing trade and market-share data. Maintaining such an information base plays a useful function both in regular strategic planning and in crises, when solid, timely, and easily accessible data may be critical to on-the-spot decision making.

The following chapters describe the specific means of storing, retrieving, and analyzing the data. These sections cover the various components of the strategic analysis of a company and the environments in which it operates.

Appendix A is an annotated bibliography that describes a number of governmental and private information sources that are available to the public. References are arranged according to the following topics:

- Commodity flow statistics
- Shipper industry data
- Government studies
- Terminals
- Equipment
- Costs
- Competitors
- Economic factors
- Information sources

CORPS OF ENGINEERS DATA

The Waterborne Commerce Statistics, prepared by the CofE, Waterborne Commerce Statistics Center (WCSC), provide the most consistent, accurate, and meaningful source of historical inland waterways transportation data. Waterborne Commerce of the United

Figure II-1

MAJOR COMPONENTS OF A STRATEGIC INFORMATION BASE FOR THE BARGE OPERATOR

Page 1 of 3

Required Data	Potential Data Source
Industry Data	
Financial and operating data on other barge operators.	Annual reports; SEC Form 10-K; business press.
Current information on competitors, including:	Business/industry publications; MarAd data; Corps of Engineers statistics; contacts with customers and suppliers.
—Fleet configuration, capacity, and use	
—New buildings	
—Market share	
—Intelligence on potential strategic moves	
—Ownership, management	
Company Data	
Detailed operations and financial data on own company, including:	Internal management accounts and reporting systems.
—Tons and ton-miles carried by river and commodity	
—Tons and revenue of movements between origin/destination pairs by commodity	
—Customer revenues and tons by river and commodity	
—Equipment acquisition and operating costs	
—Terminal operating costs	
—Towing capacity and use	
—Barge capacity and use	
—Outside towing expense	
—Overhead expenses	
—Financial statements	

(continued)

Figure II-1 (continued)

MAJOR COMPONENTS OF A STRATEGIC INFORMATION
BASE FOR THE BARGE OPERATOR

Required Data	Potential Data Source
Other Environmental Data	
Current information on political and economic conditions affecting present and potential markets. Particular factors to focus on:	Newspapers, newsletters, and other publications; econometric forecasting organizations (Chase, DRI, Wharton); analyses by banks; local agents/ representatives, government officals.
--Regulatory policies	
--Changes in the waterway system	
--Other mode activities	
Physical characteristics of the waterway system.	Corps of Engineers; U.S. Coast Guard; waterway development associations; State transportation agencies; industry press.
Developments in technology likely to affect the industry.	Technical journals; shipyards; industry press.
Information on suppliers of critical goods and services:	
--Labor costs and availability	Labor contacts; oil company fuel projections; industry publications; economic projections for capital equipment costs; banking publications.
--Fuel costs and availability	
--Capital equipment cost and availability	
--Capital availability	
Activities of competing modes of transportation:	Annual reports; SEC Form 10-K; business press; shippers.
--Regions served	
--Services offered	
--Trends in traffic	
--Planned changes	

(continued)

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RATEGIC INFORMATION
GE OPERATOR

Potential Data Source
Corps of Engineers
Maritime Administration
Department of Agriculture
Department of Energy
Department of Energy
St. Louis Merchants Exchange
Waterways Freight Burea., barge line tariffs
DRI; Chase; Wharton
Market research

States is available to the pub regional data and one volume o 20 months after the end of the covered in the reports. Part Mississippi River System and t of key interest to inland wate national summary, is also impo dered from the U.S. Army Engin Box 60267, New Orleans, LA, 70

Before distributing the p preliminary data in summary fo Outside users asked the WCSC t so that interested parties in as possible. WCSC agreed to a ested companies should contact year to request copies of thes

The commodity forecasting report can be modified and mai contained in the one page summ System internal traffic and th Intracoastal Waterway traffic. possible for managers to updat accurate data for the prior ye year. More detailed forecasts waterways.

The commodities that have way system are reported in fou neers. The Commodity Classifi Commerce is enclosed in Append pal historical commodity flows and the Gulf Intracoastal Wate 1981. The data are displayed segments.

The approach to classifyi way system must include both t tion as well as the forms of a strategic planning is to assis the demand for their equipment data should be displayed accor used, regions served, and spec example, commodities that are barges, such as coal and bauxi from commodities that are norm such as grain and iron ore.

Unfortunately, some of th codes of the CofE have mixed p example, fertilizer and fertilizer materials are reported by the CofE in the following categories:

1471 Phosphate rock
1479 Natural fertilizer materials, n.e.c.
2871 Nitrogenous chemical fertilizers, except mixtures
2872 Potassic chemical fertilizers, except mixtures
2873 Phosphatic chemical fertilizers, except mixtures
2879 Fertilizers and fertilizer materials, n.e.c.
3271 Lime

In addition, fertilizer movements are often reported by barge operators to the CofE as chemicals and are then included in the following categories:

2819 Basic chemicals and basic chemical products, n.e.c.
2891 Miscellaneous chemical products

It is difficult to relate barge types to commodity classifications. For example, nitrogenous chemical fertilizers include both urea, which is carried in covered hopper barges, and anhydrous ammonia, which is carried in temperature controlled tank barges. It is impossible to identify which of the many types of chemicals were carried as dry or liquid bulk cargoes.

While these inaccuracies exist when using the CofE data as a basis for forecasting demand for services of specific barge types, approximations are quite useful and have been used to develop the forecasts shown below.

III. INDUSTRY AND COMPETITOR ANALYSIS

This chapter focuses on two important steps that occur early in the planning process: analyzing the barge and towing industry in which the company competes and analyzing the major strengths and weaknesses of the company's competitors.

INDUSTRY ANALYSIS

As suggested in the Chapter I discussion of the general framework for strategic planning, a knowledge of the industry as a whole is valuable in gaining insights into a particular company's strengths and weaknesses. Not only can the planner measure the company's relative performance, but he can also identify the factors underlying both the success of the industry leaders and the failure of weaker firms.

Barge and Towing Industry

There is a limited amount of publicly available data on individual companies in the industry. Since many barge lines are privately held, they do not publicly disclose annual reports. And because most publicly held barge lines are small parts of large diversified companies, data on the barge line are often reported in a service or product group such as "transportation" so that the barge line information can't be singled out.

Information on the industry as a whole is equally scarce. However, one useful resource is the annual study of financial statements performed by Robert Morris Associates, which uses data provided by banks. In recent years, 50-70 barge line companies have been reported. The information about assets, liabilities, and income, and the calculations of financial ratios are useful for understanding the following:

- The inland barge industry's overall financial performance
- Comparison between the barge and towing industry and other transportation modes
- Comparison between the planner's company and the industry as a whole

In addition to Robert Morris Associates' annual studies, similar data are available from Dun and Bradstreet.

Total Industry Analysis

The industry's financial performance for the years 1979-1983 is shown in Figure III-1. Assets and liabilities are shown as percentages of totals and classified as current or non-current. Income and expense data are shown as percentages of sales. Note the relative increases in operating and other expenses in the 1981 to 1983 period and the concurrent decreases in operating profit and pre-tax profit. The financial ratios are presented in the form of ranges and mean values.

Inter-Industry Analysis

In addition to examining the barge and towing industry as a whole, it is useful to compare the inland transportation system to other modes such as railroads, motor carriers, and pipelines.

In analyzing the barge industry, a critical issue is its ability to attract capital in the future. The question is important both from the perspective of the individual company (its ability to attract the capital needed to meet its growth and asset-replacement requirements) and that of the whole industry (its ability to support additional capacity needs). This issue cannot be addressed without comparing the performance of the inland barge industry with that of the other U.S. transportation industries. In addition to the previously noted resources on the barge industry, Moody's <u>Transportation Manual</u> and TRINC's <u>Blue Book of the Trucking Industry</u> provide data on U.S. rail, air, and road carriers. Figure III-2 provides a time series of data that can be compared to that of the barge industry, as in Figure III-3. It is important to note that the financial analyses of railroads and trucking companies are based on Interstate Commerce Commission accounting methods which can result in understatements of financial ratios such as Return on Equity.

COMPETITOR ANALYSIS

As a starting point, the planner should identify competitors and collect enough detail on their operations to permit a thorough analysis of their strengths, weaknesses, and current strategies. Although the competition generally comes from other for-hire barge operators, the concept of competition must be broad

Figure III-1

INLAND BARGE INDUSTRY FINANCIAL PERFORMANCE[1]

(percent)

	1979	1980	1981	1982	1983
Assets					
Cash	6.9	9.6	7.8	7.5	6.2
Accounts and Notes Receivable	18.0	15.4	19.1	16.0	11.5
Inventory	2.6	4.5	3.9	4.6	2.5
All Other Current	3.4	1.9	2.3	2.2	1.0
Total Current	31.0	31.5	33.0	30.3	21.2
Fixed Assets (net)	58.5	54.5	55.6	61.6	67.1
Intangibles (net)	0.2	1.4	0.4	0.5	0.6
All Other Non-Current	10.3	12.7	11.0	7.6	11.0
Total Non-Current	69.0	68.5	67.0	69.7	78.8
Total Current and Non-Current	100.0	100.0	100.0	100.0	100.0
Liabilities					
Notes Payable--Short Term	3.9	6.2	5.9	7.4	6.0
Current Mat.--LTD	7.1	5.0	5.7	9.8	4.6
Accounts and Notes Payable	12.3	9.2	13.5	9.8	6.2
Accrued Expenses	3.0	3.8	2.8	3.3	2.6
All Other Current	4.9	7.1	7.3	5.0	3.8
Total Current	31.2	31.4	35.2	31.3	23.3
Long-Term Debt	36.2	32.5	35.0	37.5	40.3
All Other Non-Current	2.7	4.9	2.6	4.6	5.5
Net Worth	29.9	31.2	27.2	26.6	30.9
Total	100.0	100.0	100.0	100.0	100.0
Income Data					
Net Sales	100.0	100.0	100.0	100.0	100.0
Operating Expenses	82.8	80.9	85.2	89.2	87.7
Operating Profit	17.2	19.1	14.8	10.8	12.3
All Other Expenses	4.5	4.8	6.0	7.6	9.4
Profit Before Taxes	12.7	14.3	8.8	3.2	2.9

[1]Source: Robert Morris Associates' Annual Statement Studies.

Figure III-2

FINANCIAL STATISTICS

U.S. INLAND TRANSPORTATION INDUSTRIES

1976-1981

(dollars in millions)

	1976	1977	1978	1979	1980	1981
Inland Barge Lines[1]						
Revenue	$900.3	$999.7	$1,163.0	$1,288.6	$1,487.9	$1,691.6
Net Income	$29.6	$27.1	$24.6	$40.6	$48.9	$57.5
Total Assets	$857.4	$833.1	$1,047.7	$1,160.9	$1,062.8	$1,691.6
Stockholders' Equity	$327.1	$260.6	$187.1	$259.4	$284.3	$422.9
Profit Margin	3.3%	2.7%	2.1%	3.2%	3.3%	3.4%
ROA	3.5%	3.3%	2.4%	3.5%	4.6%	3.4%
ROE	9.1%	10.9%	13.2%	15.7%	17.2%	13.6%
Class 1 Railroads[2]						
Revenue	$18,836.7	$20,429.9	$21,721.3	$25,219.1	$28,102.9	$30,733.9
Net Income	$(111.6)	$227.1	$306.8	$938.3	$1,191.4	$2,204.5
Total Assets	$36,029.8	$38,377.9	$38,895.2	$41,830.6	$45,888.6	$48,819.8
Stockholders' Equity	$15,183.7	$15,920.9	$16,182.8	$17,796.1	$19,860.0	$21,725.1
Profit Margin	(0.5)%	1.1%	1.4%	3.7%	4.2%	7.2%
ROA	(0.3)%	0.6%	0.8%	2.2%	2.6%	4.5%
ROE	(0.7)%	1.4%	1.9%	5.3%	6.0%	11.1%
Intercity Motor Carriers[3]						
Revenue	$13,208.8	$13,777.94	$18,328.4	$16,384.1	$16,716.5	$18,092.2
Net Income	$364.9	$462.8	$594.6	$359.4	$149.5	$393.5
Total Assets	$6,028.4	$6,385.2	$8,006.9	$7,490.9	$7,307.0	$7,595.0
Stockholders' Equity	$2,821.3	$3,020.9	$3,573.6	$3,283.7	$3,004.1	$3,234.6
Profit Margin	2.8%	3.4%	3.2%	2.2%	0.9%	2.2%
ROA	6.1%	7.2%	7.4%	4.8%	2.0%	5.2%
ROE	12.9%	15.3%	16.6%	10.9%	5.0%	12.2%

[1]Source: TBS analysis of Robert Morris Associates' Annual Statistical Studies (SIC 4441).
[2]Source: Moody's Transportation Manual.
[3]Source: ATA Financial Analysis of the Motor Carrier Industry (Group A, B, & C).

Figure III-3

COMPARATIVE FINANCIAL RATIO ANALYSIS

U.S. INLAND BARGE INDUSTRY VERSUS
OTHER U.S. INLAND TRANSPORTATION INDUSTRIES

(percent)

	1976	1977	1978	1979	1980	1981
Return on Assets						
Barge Lines	3.5	3.3	2.4	3.5	4.6	3.4
Railroads	(0.3)	0.6	0.8	2.2	2.6	4.5
Motor Carriers	6.1	7.2	7.4	4.8	2.0	5.2
Return on Equity						
Barge Lines	9.1	0.4	13.2	15.7	17.2	13.6
Railroads	(0.7)	1.4	1.9	5.3	6.0	11.1
Motor Carriers	12.9	9.3	16.6	10.9	5.0	12.2
Profit Margin						
Barge Lines	3.3	2.7	2.1%	3.2%	3.3	3.4
Railroads	(0.6)	1.1	1.4	3.7	4.2	7.2
Motor Carriers	2.8	3.4	3.2	2.2	0.9	2.2

Source: Figure III-2.

enough to include all existing and potential sources of competition, for example, private barge operators, railroads, and pipelines. The planner should be particularly aware of the threat from potential private competitors--shippers that are presently served by barge lines but may begin private barging of their own traffic and offering available equipment for hire to other shippers.

Once the scope of the competition has been determined, the strategic planner should seek to understand the historical competitive behavior in order to make an overall assessment of the nature of the competition. A database should be developed for each competitor, using such historical data as the following:

- Competitors' financial data such as revenues, assets, short-term and long-term debt
- Ownership and corporate structure of competitors
- Fleet profile by competitor: the total number of barges and towboats, by capacity, type, and use for both the entire river system and the planner's firm's direct competition
- Market activity: the major commodities carried, rivers served, important origin/destination pairs, and key shippers served
- Share of available barge capacity
- Other services offered, such as terminals, fleets, and repairs
- Relationships with other barge lines and vendors

In general, because of the sketchy information available about inland barge operators, it is difficult to assemble a complete picture of competitors' finances. However, it is possible with some effort to collect information about competitors' equipment availability and use active markets (by commodities carried and rivers served), and corporate organization and management styles.

Some of this information is available from governmental sources, such as the U.S. Army Corps of Engineers. Sometimes, individual companies provide information in their annual reports, promotional literature, and press releases to trade journals. Other intelligence can be collected within the planner's own company from competitors' former employees, shipper contacts, and the operating personnel's observations of competitors' tows, fleets, switchings, loadings, and unloadings.

Although much of this information may be floating around the planner's company, it must be assembled and reviewed methodically to provide useful market information and an understanding of competitors' past and future activities.

The figures that follow illustrate examples of information on competitors. Figure III-4 shows TBS's estimates of 1982 revenues and numbers of employees for 25 large barge lines, which used publicly available data and estimates. Appendix D shows the capabilities of 30 large barge lines by identifying their types of equipment, terminals, building and repair facilities, other services offered, and fleet locations.

Major covered hopper fleets are listed in Figure III-5 for 26 barge operators by number of barges, capacity, and average year built. The data are plotted in Figure III-6 to give a visual representation of the barge capacities. Similar information for open hopper barge fleets of 20 companies is listed in Figure III-7 and depicted graphically in Figure III-8.

This information helps the strategic planner gain insight into several aspects of each competitor's behavior so that the following questions may be answered:

- What are the capabilities of the major competitors?
- What are their operating strategies?
- What are their strengths and weaknesses with respect to market coverage and carriage of key commodities on specific rivers?
- What has changed over time?

There are also numerous qualitative issues. Each competitor's fleet profile can help answer the questions below:

- What are the capabilities and financial shape of the competitor's fleet?
- Does the competitor's fleet tend to specialize?
- Does it employ significant scale economies?
- What is its relative market position?

Figure III-4

BARGE LINE 1982 REVENUES AND EMPLOYEE COUNT[1]

Parent Company	Company	$ Revenue (millions)	Employees
IGI	American Commercial Barge	441	1,200
EGFA	Midland	151	1,400
Dravo	Dravo Mechling	67	600
CLC	Wisconsin Barge Line	67	600
TCB	Twin City Barge	60	400
Kirby	Dixie Carriers	59	400
HNG	Federal Barge Line	59	500
Agri-Trans	Agri-Trans	57	400
Chromalloy	Valley Line	52	800
Crounse	Crounse	36	400
U.S. Steel	Ohio Barge Line	36	400
	Consolidated Grain & Barge	26	700
	Sioux City New Orleans	26	200
Nicor	National Marine Service	26	400
U.S. Steel	Warrior & Gulf Navigation	21	700
	Houston Barge Lines Inc.	14	300
Hines	Hines Inc.	10	100
Igert	Igert	10	100
Ingram	Ingram	10	100
Exxon	Exxon Inland	8	300
	Walker Towing	7	100
	Choctaw Towing	5	100
	Gladders	5	100
	Chemical Towing	4	100
	Waxler Towing	4	100

[1] TBS analysis.

Figure III-5

MAJOR COVERED HOPPER BARGE FLEETS
1982

Fleets of More Than 100 Barges

(short ton capacity in thousands)

Agricultural (Private and For Hire)	No.	Tons Capacity	Average Yr. Built
Agri Trans	458	678	70
ARTCO	577	846	75
Bunge	414	605	68
Cargo Carriers	292	430	72
Congra	328	489	75
Consolidated	738	1,092	76
Conticarriers	382	558	78
Fer River	176	262	74
Pillsbury	211	314	77
Subtotal	3,576	5,274	74
Average Barge Size: 1,475 tons			

Major Common Carriers	No.	Tons Capacity	Average Yr. Built
ACBL	753	1,106	72
Valley	1,226	1,811	72
Dravo-Mechling	608	889	70
Federal	695	1,038	72
ORCO	127	182	71
Riverway	458	675	69
SCNO	403	601	71
Subtotal	4,270	6,302	71
Average Barge Size: 1,476 tons			

Independents	No.	Tons Capacity	Average Yr. Built
Alter	141	210	75
Arrow	122	177	71
Gladders	198	295	80
ML Barge	249	375	79
MEMCO	368	546	77
Mid-America	122	177	64
Port City	151	218	77
River Line	97	139	78
TCB	203	294	74
Waterway T&T	174	152	81
Wisconsin	569	848	72
Subtotal	2,394	3,531	76
Average Barge Size: 1,475 tons			

Summary: Total Major Fleets = 10,240 barges
15,107,000 short tons capacity
1973 average year built
34.9% Agriculatural (Private and For Hire)
41.7% Major Common Carriers (and subsidiaries)
23.4% Independents

100.0%

Source: IBS analysis.

Figure III-6

FLEET SIZE AGE DISTRIBUTION
INLAND COVERED HOPPER BARGE FLEET
1982

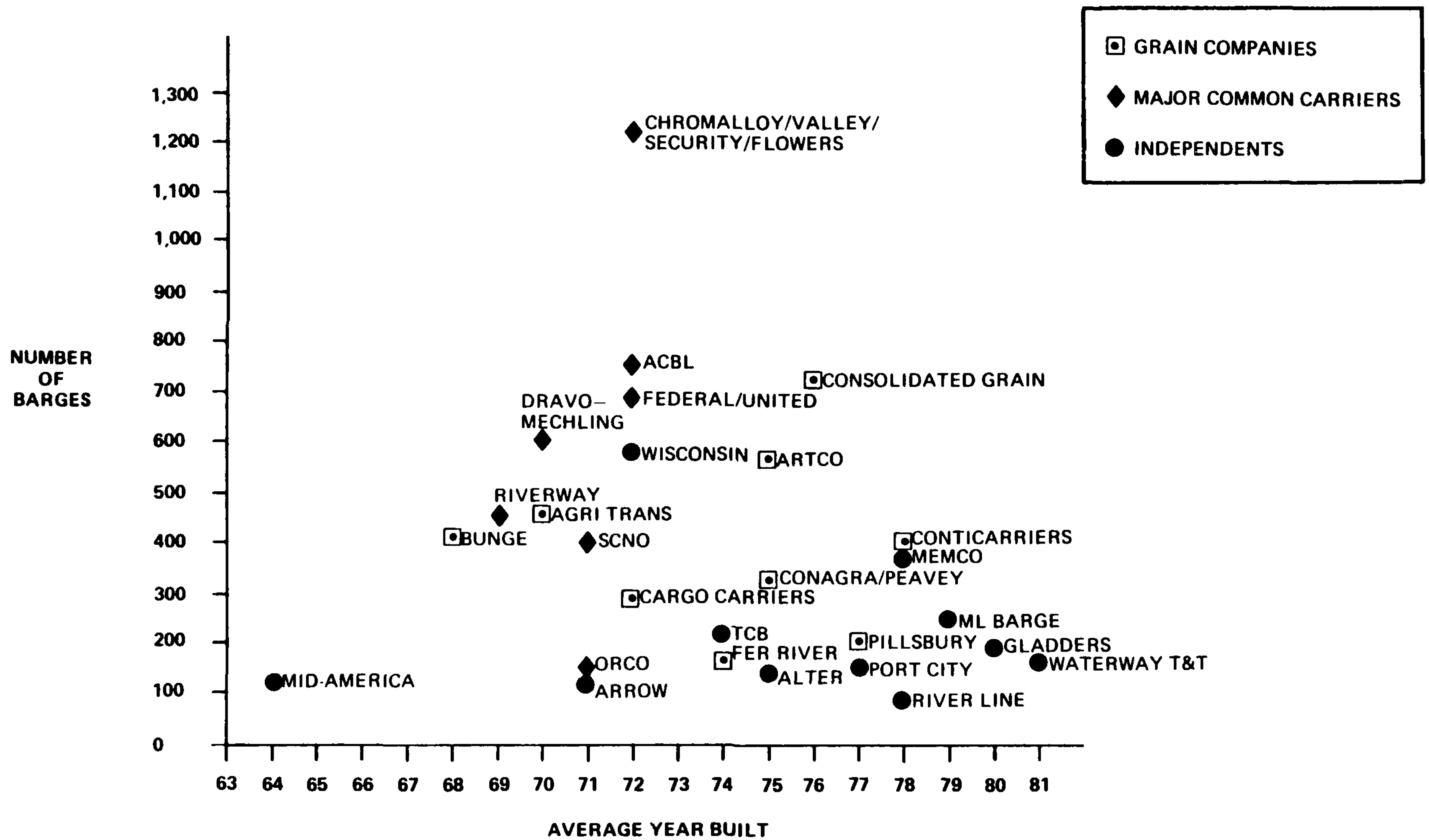


Figure III-7

MAJOR OPEN HOPPER BARGE FLEETS
1982

Fleets of More Than 100 Barges

(short ton capacity in thousands)

Coal Producers

	No.	Tons Capacity	Average Yr. Built
Consolidation	309	309	68
	309	309	68

Average Barge Size: 1,000 Tons

Utilities

	No.	Tons Capacity	Average Yr. Built
AEP/I&M	764	1,017	74
Mid South	221	315	66
	985	1,332	72

Average Barge Size: 1,352 Tons

Steel Companies

	No.	Tons Capacity	Average Yr. Built
US Steel	1,259	1,149	72
	1,259	1,149	72

Average Barge Size: 938 Tons

Major Common Carriers

	No.	Tons Capacity	Average Yr. Built
ACBL	886	1,673	74
Alter	141	216	74
Dravo-Mechling	137	189	64
ORCO	1,312	1,871	72
Valley	154	221	60
	2,630	4,170	72

Average Barge Size: 1,586 Tons

Independents

	No.	Tons Capacity	Average Yr. Built
Campbell	94	100	64
Canal	146	214	78
Central Gulf	113	339	82
Crain Bros.	103	103	51
Crounse	481	685	73
Haney	103	116	69
Harcon	106	155	78
Ingram	162	241	80
M/G	330	479	74
McDonough	183	213	61
Mon River	401	421	60
	2,222	3,066	70

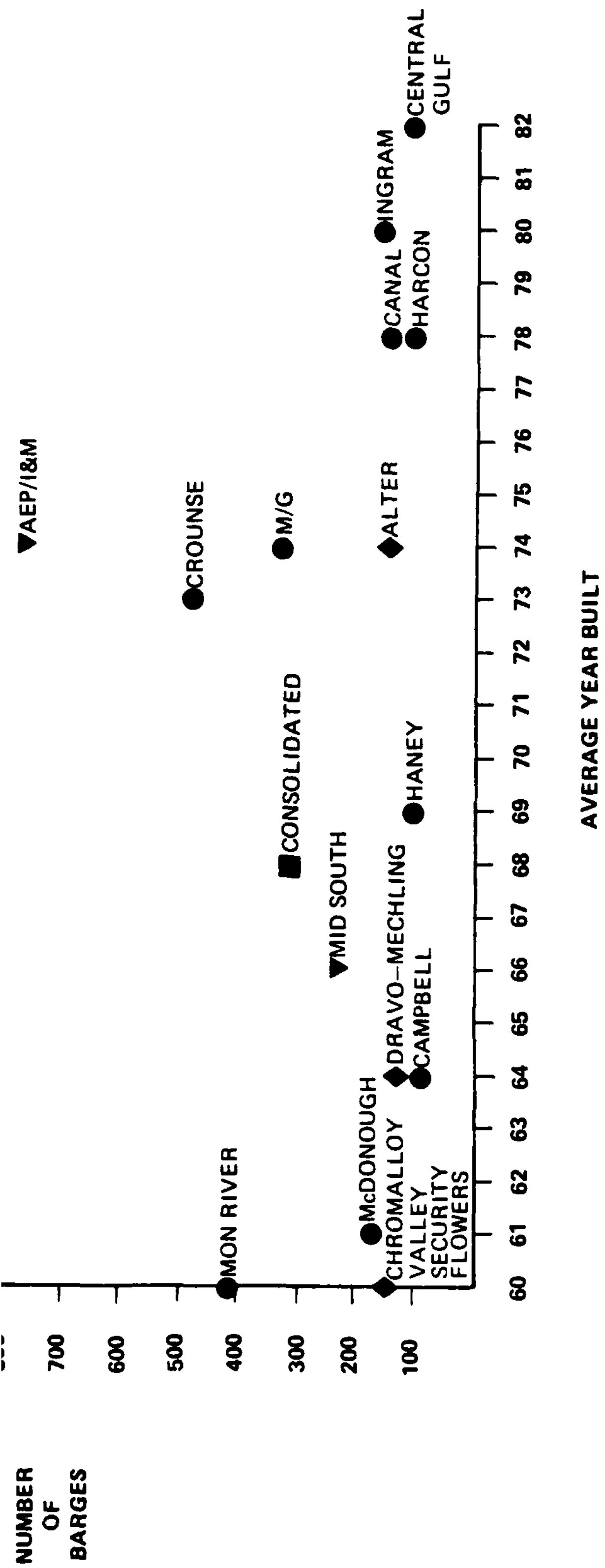
Average Barge Size: 1,408 Tons

Summary: Total Major Fleets 7,405 barges
10,026,000 short tons capacity
1972 average year built

3.1% coal producers
13.3% utilities
13.6% steel companies
41.6% major common carriers
28.4% other independents

100.0%

Source: IBS analysis.



- What is its relative siz
- On what bases does it tr
time, frequency of barge
handling capabilities, s
- Does it possess signific
integration?
- Is it well managed? Wha
- What improvements should
- If a competitor is a sub
what is its relationship
cant resources available
is it likely to play in
parent?

Because of their regular cont
sales personnel can provide good i
and behavior. Appendix E contains
market survey that may prove usefu
comparing a company's services wit

IV. MARKET ANALYSIS

In the context of strategic planning, the aim of market analysis is to develop an understanding of the factors underlying the demand for transportation services within specific market areas in order that a soundly based projection of demand may be made several years into the future. Because of the complex nature of waterborne commerce, this is not an easy task. However, based on several years of experience in market analysis and forecasting, we have set out below the elements of one representative methodology that first identifies the key factors influencing the traffic on the waterways and then, projecting those factors, produces a forecast of waterborne commerce. The projected demand for barge services, in turn, is derived from the projected demand for barge cargoes.

THE NEED FOR FORECASTING MARKETS

All industries rely on forecasts to guide their decision-making process. Implicitly or explicitly, managers accept certain basic operating conditions as the foundation on which their long term, annual, seasonal, and daily plans and directions are made. The implicit use of forecasting can, by default, rely on a continuation of the prevailing market and industry trends. These forecasts may include increasing, decreasing, or stable trends in demand and supply for services. Explicit reliance on forecasting can be as basic in concept as managements acceptance that the economy or an industry's level of activity will change by some percentage on a year to year, or more frequent, basis.

The nature of inland waterways transportation makes the use of forecasts critical for both tactical and strategic decision-making. This is in large part due to the industry's role in transporting basic, raw, and semi-finished commodities whose values fluctuate on a daily and seasonally in response to major national and international market forces. For this reason, carriers have learned to make decisions based on seasonal assumptions of freight rates, cargo availability, operating conditions, costs, and competitive behavior. They have also explicitly or implicitly used forecasts to support decisions to acquire or commit for long term utilization of marine equipment.

The inland waterways industry's reliance on forecasts is comparable to the ocean marine industry's reliance on forecasts with one major exception. The more diverse and international ocean bulk marine transportation industry has fostered a variety of information sources such as magazines, broker services, and economic projections of ocean trade. Since the current depression of the international bulk markets began, the number and importance of these forecasts has increased. By contrast, the inland waterways industry has tended to rely on sporadic forecasts that have been funded in whole or in part by government agencies. The forecasts made for this manual are included in this category. The industry has thus far not found it necessary to develop a public forum to discuss and present forecasts on a regular and consistent basis through commercial initiatives or a deliberate industry program.

It has been the practice of major inland carriers to perform some forecasting as part of their corporate planning responsibilities. However, these forecasts remain confidential and have not been widely disclosed to the industry. Since the forecasts can be an important competitive tool, there are many reasons to keep them confidential. On the other hand, forecasts can serve as important indicators for the industry to confront and discuss the key issues of supply and demand that will impact the profitability of the industry as a whole. It is hoped that in the prevailing market environment the analysis of supply and demand by carriers in industry forums will be more and more frequent and that the quality of these forecasts will thus improve.

MARKET DEFINITION

The first step is to define the markets that barge operators serve. Markets are defined by the geographical areas served and the commodities carried. An alternative method for definition could be by geographical areas and barge types used. This approach is more useful for operational planning than for market analysis because it can mask the driving factors that affect the demand for barge services for each commodity. The preferred approach is to deal with commodities and then aggregate them into commodity categories that match equipment needs such as covered dry bulk, open dry bulk, clean petroleum products, dirty petroleum products, deck cargoes, and special loads such as oversize and overweight, temperature-controlled, or pressure-controlled.

However, too much refinement of the commodity types will lead to too many classifications, which will be more difficult to manage. Each company must decide for itself how to classify its own traffic to provide meaningful categories that are detailed enough but also manageable. A barge operator that specializes in clean petroleum products and chemicals may desire to use very specific chemical types to keep track of and make forecasts of those cargoes. A large multi-service operator may consider all of the chemicals as one market segment.

The geographical areas where the barges are loaded and discharged are also part of the definition of markets. Coal that originates and terminates on the Ohio River or its tributaries is certainly not in the same market as coal that originates in that area but is delivered to a utility on the Gulf Intracoastal Waterway.

The analyst must not lose sight of the true origins and destinations of these commodities in the analysis of market demand. To do so would prevent complete understanding of the factors that determine why the cargoes move over the waterways. It is important to consider the ultimate origins and destinations to see what are the underlying causes for historical and future demands in transportation of the commodity. In addition, alternative modes of transportation may be available closer to the origin or destination of the movement. For example, knowledge of inland rail terminals and rail rates is important for the understanding of barge lines' competitors for movements of Illinois corn to export terminals at the Gulf of Mexico. On the other hand, knowledge of Far East destinations along with rail and ship rates is useful to understand the westward movements of grain by railroad out of Nebraska instead of southward by barge on the Missouri River.

Finally, the analyst should limit forecasting activities to that portion of the overall market that the company can actively serve.

METHODOLOGY SELECTION

The methodology for developing forecasts of industry demand for barge transportation should be accurate, useful, and easily produced. Each of these characteristics is discussed below.

Accuracy

It is impossible to develop exact forecasts of future cargo demand for inland waterway transportation. Contrary to the popular conception of forecasts, they do not, and should not be expected to, portray the future precisely. Their primary purpose is to preserve for future review a company's best thinking about those conditions in the future that can affect its performance and its operating environment. In this way the decisions made by some managers can be understood by all and the insight that is gained by managers over time can be used to enhance the operating strategy and tactics of the company. There is a strong need to have an explicit record of what the company expects in the future when important decisions such as long term investments in equipment are made.

It is possible, however, to develop a forecasting methodology that will identify directions and turning points in trends for demand. No forecasting methodology can anticipate any critical disruptions in demand that are caused by recession, natural disaster, or sudden market shifts due to, for example, an oil import or grain export embargo. The goal of the methodology described herein is to provide a reasonably accurate advance warning of the future impacts of current events and policies that will affect the demand for barge transportation.

Useful Format

The forecasts should be in a form that is useful to the barge line executive when he is making short- and long-term decisions concerning marketing and sales efforts as well as equipment decisions on acquisitions, maintenance, deployments, scheduling, and disposals. This means that the forecasts should focus on the specific waterways and commodity types that the company desires to serve.

The most useful forecasts are those that can be related readily and directly to the current and historical market. This permits forecast users to relate the predicted future trends to past conditions in as meaningful a way as possible. The close relationship of historical data and forecast data also permits users to corroborate, evaluate, and calibrate changes in outlooks with the greatest confidence.

Ease of Production

Ease in producing the forecasts is important if the methodology is to become a practical tool for decision making. Forecasting methodologies should be easy enough so that an employee with a bachelors degree in engineering or accounting can maintain the system. However, ease of operation requires that a tradeoff be made with accuracy. The more sophisticated traffic forecasts that have been developed in the past by government agencies or consultants have used various forms of regression analysis. Use of this type of econometric technique generally requires a level of knowledge that is obtained from graduate degree programs. This capability is infrequently available in an inland barge company.

The methodologies used in these forecasts of river traffic relates economic forecasts to historical parameters that are derived from past traffic levels. A number of economic forecasting firms such as Data Resources, Inc. (DRI), Chase Econometrics, Inc., and Wharton Econometric Forecasting Association, Inc., provide general and industry-specific time series of production and price information on a consistent basis to the public. Using these resources, barge industry managers can relate their industry to the best thinking and effort of economists who are concerned with broad economic trends that directly and indirectly affect the inland industry. Barge industry managers can concentrate on that which they know best and can rely on the cumulative expertise and continuous involvement of economists in the forecasting of national, international, and industrial trends. Wherever there are specific commodities that are particularly important to a carrier, these forecasts can be modified to reflect other available information about those commodities.

It is important that carriers recognize that their specific businesses are driven by specific customer, industrial, competitive, regional, and regulatory issues. In order to perform as well as possible, management should take the time to plan and explore the major trends and factors that affect their business. For example, carriers engaged in the transportation of grain must work hard to identify those issues that most affect their business, their customers, and their competitors and should attempt to find information that bears out their general knowledge of the marketplace. In this way the quality of long-term decision-making can enhance short-term performance. Without this information the quality of short-term performance will be driven only by short-term knowledge.

THE BASIS FOR FORECASTING

Inland waterways forecasts should be performed in a way that is efficient for managers to operate. Its users should guide its development. The first use of a forecast is to identify the most fundamental industry conditions that will prevail. For more than a decade a valuable forecast would have predicted dramatic growth in grain cargoes and stagnation in the petroleum liquid cargo trades. It would have helped identify gradual long-term growth in coal exports.

The fundamental challenge in forecasting is to predict the behavior of those indicators that are most important to a specific manager. In the case of inland waterways traffic, the key needs are the prediction of tons and ton-miles for the commodities that drive overall industry conditions and the specific commodities of concern to an individual carrier. The prediction of trade is most often accurately explained by trends in broader industrial indicators that depend on or use to some degree inland waterways transportation. Because grain, coal, aggregates, and petroleum are by far the main bulk of inland waterway traffic, the planner can rely on their performance to forecast industry trends. He can then predict the behavior of other commodities by tagging their performance to the major commodities.

The most pressing question facing managers today is: when can managers expect conditions to support an increase in rates, revenues, and contribution to fixed costs? In order to do this, forecasts of tons must be translated into forecasts of ton-miles.

Ton-miles serve as the industry's basic measurement of transportation demand. Ton-miles more closely describe barge demand than any other readily available measure. Tons of traffic reflect the economic and industrial conditions of shippers and consignees. To calculate ton-miles from tons, average lengths of haul must be determined and multiplied by the tonnage. This data can be developed from public sources and our forecasts demonstrate how this can be done.

To the extent that the nature of various trades remains relatively constant, and for short periods of time and small variations in tonnage, tons can serve as a useful indicator of transportation demand. However, if growth or decline in a trade is based on significant swings in the amount of cargo traffic that differ widely from the average, these swings should be recognized. For example, the high levels of coal exports from upriver terminals to Baton Rouge and New Orleans represent a very different kind of coal trade than the relatively short-haul coal movements that serve Ohio River utilities. For this reason, a forecast of sharp decreases or increases in export coal tonnage should carry with it a corresponding recognition that this is a very large change in transportation demand as measured in ton-miles. Similarly, a forecaster might predict that a dramatic increase in soybean exports, which tend to load at the Lower River terminals, will account for the majority of grain traffic growth. This will result in relatively fewer additional ton-miles than the increases that would be derived from a similar amount of wheat from river terminals that are located much further north.

In some cases the historical relationship between industry trends and inland waterways traffic will be close. When this occurs there is a strong suggestion that the factors of commodity substitution and modal shifts between barge, rail, pipeline, truck or alternative ports are minimal and that the inland industry experiences in a direct way the trends of the shipping industry. In other cases the industry trends and the waterways traffic levels diverge or have changed in time. When this occurs the analyst must recognize that that creates a strong suggestion that additional factors such as substitution, modal shifts, or alternative routing are at play and will significantly affect the future demand for inland waterways transportation in ways that do not directly parallel the industry's prospects.

An inland waterways forecaster must also use his industry intelligence to recognize discreet one-time changes in traffic that can result from the completion of new industrial projects or events of a legislative or regulatory nature that alter trade levels dramatically in a very short period. Specific examples of events and trends that affect the inland barge industry are identified below:

- The completion of coal-fired electric utility plants in the Florida panhandle and Tampa areas that rely on barge-delivered coal.
- The deregulation of U.S. crude oil prices which altered the production, trading, and import patterns for many Gulf Coast refiners and contributed to the elimination of many small entitlement refiners.
- The prospect of imports of Columbian coal to coastal utilities, such as those located in Florida.
- The completion of petroleum products pipelines that reduce the refiners' reliance on the barge system.
- Crude oil price deregulation in residual oil refining, which has reduced the amount of black oil produced in the lower Mississippi River refining area and therefore its transportation requirements on the river system.

FORECAST STRUCTURE

The relationships between historical and future industry trends and historical and future inland waterways traffic can be reviewed in several ways. These range from sophisticated and rigorous mathematical regressions of one trend against the other to a graphical review of these indicators and qualitative decisions as to their future trends. For the purposes of this forecast, a simple, mathematical relationship. The mathematical relationship between the indicator and the traffic level that is identified by dividing traffic level in tons by the indicator in an appropriate index was used because it is simple, does not require significant investments in software and intepretation time by managers, and provides reasonably accurate assessments and indications of trade/industry relationships. For many commodities in this forecast, the actual mathematical relationships along with the trade levels and industry indicators are presented. In this way, analysts who review these forecasts should be able to understand the trends and processes used to develop these forecasts.

The forecast that has been prepared for this study is divided into ten major commodity groups. These groups have been designed to provide analysts with insights into the developments in the major forehaul and backhaul dry bulk, liquid bulk, and general cargo commodities. To the maximum extent possible, these commodity groups have been assembled in a way that grouped dry bulk, liquid bulk and general cargoes into separate categories. The commodity groups that have been developed are as follows:

- Major agricultural products--including corn, wheat, soybeans, prepared animal feeds, and grain mill products
- Coal
- Crude oil
- Clean petroleum products--including gasoline, jet fuel, distillate, kerosene, lube oils and greases, naptha, solvents, and liquified gases
- Dirty petroleum products--including residual oil, asphalt, tar and pitch, crude tar oil, and gases
- Construction materials--including cement, limestone, sand, stone, gravel, and crushed shell
- Major fertilizers--including phosphate rock, nitrogenous chemical fertilizers, fertilizers and materials, n.e.c., and lime
- Chemicals and aromatics--including sodium hydroxide, alcohol, benzine, toluene, basic chemicals, and products
- Waterway improvement materials
- All other commodities

These groupings are sufficiently detailed to provide an overview of industry prospects and focus attention on the key commodities that underly basic supply/demand balances.

TRAFFIC FORECASTS

Figure IV-1 provides an overview of historical and forecast traffic for the 1970-1990 period for the Mississippi River System. Historical data for the years 1970-1982 is provided by the U.S. Army Corps of Engineers Waterborne Commerce of the United States Statistics. The years 1983-1990 present forecasts prepared for the study using methodology that is discussed in detail below.

It can be seen in Figure IV-1 that historical traffic peaked in 1979 at 370.8 million short-tons and declined 6.3 percent by 1982. The forecast indicates that 1982 will represent the low point in Mississippi River System traffic. It will be followed by a period of slow growth toward traffic levels that will exceed the 1979 peak by 1986. Overall, a 12.6 percent growth is projected between the 1982 tonnage figure and the 1990 forecast of 391.4 million tons. The growth between the 1979 peak and 1990 forecast is 5.6 percent. This projected slow growth reflects the long-term limitations on the growth of agricultural and coal traffic based on forecasts of nationwide agricultural and coal exports. The grain forecast is based on an expected decrease of the barge share of total U.S. grain exports via Mississippi River ports to 42 percent in 1990. If the 1983 barge share of 50 percent is maintained through 1990, the total Mississippi River System tons will grow to 407.4 million tons.

This figure shows that growth is projected largely because of slight increases in coal, construction material, fertilizer, chemical, and miscellaneous commodity activity. Growth is likely to be broadly based, unlike the major increases in agricultural products and coal that characterized the 1970s. This forecast reflects the current conditions in world energy supply, the increasingly competitive international market due to the strong U.S. dollar, and continued foreign impediments to American commerce.

Figure IV-2 summarizes historical and forecast traffic for the Gulf Intracoastal Waterway. The table shows that traffic has generally fluctuated between 95 and 105 million tons between 1970 and 1982 having reached its high in 1972 at 108 million tons and its low in 1982 with 81 million tons. The forecast for the 1983 through 1990 period shows a relatively steady level of traffic

Figure IV-1

SUMMARY OF MISSISSIPPI RIVER SYSTEM TRAFFIC AND FORECAST

ALL COMMODITIES

(millions of short tons)

Year	Mississippi River System	Major Agricultural Products[1]	Coal	Crude Oil	Petroleum: Clean Petro Prod[2]	Petroleum: Dirty Petro Prod[3]	Construction Materials[4]	Major Fertilizers[5]	Chemicals and Aromatics[6]	Waterway Improvement Materials	All Other Commodities
1970	297.3	23.9	102.0	25.8	37.1	10.4	40.5	3.9	15.0	8.9	33.3
1971	303.2	23.9	96.7	26.2	38.1	13.4	44.5	4.5	15.6	8.2	35.1
1972	326.6	30.9	108.7	29.3	37.6	14.6	41.9	6.5	16.3	7.7	36.5
1973	317.6	32.2	104.1	25.1	37.1	16.0	42.5	5.9	15.0	9.2	34.0
1974	330.1	35.6	106.4	19.1	36.3	17.1	43.4	6.5	16.9	11.8	37.1
1975	330.1	39.4	115.7	21.6	36.2	18.7	38.5	6.2	14.8	8.5	33.5
1976	345.5	44.8	116.4	21.1	38.5	22.3	38.2	6.0	15.2	7.4	39.1
1977	352.5	46.7	117.6	18.8	40.9	24.4	40.5	7.0	16.3	6.9	33.0
1978	355.4	51.9	106.0	20.5	37.7	28.1	44.6	7.1	17.1	9.2	35.9
1979	370.8	54.8	121.4	17.6	35.8	27.0	46.3	7.6	19.1	7.9	35.8
1980	365.7	64.3	123.0	15.0	35.9	23.9	37.4	8.4	18.7	5.8	35.5
1981	362.9	66.3	130.6	13.8	33.9	21.8	33.4	7.3	17.8	4.4	35.9
1982	347.5	73.8	121.2	14.0	31.6	20.5	32.0	6.5	15.5	4.7	27.7
1983F	350.4	73.1	118.9	13.2	31.2	17.4	36.3	6.3	17.0	6.0	31.0
1984F	362.0	70.2[a]	122.1	12.7	31.4	17.4	41.1	6.7	18.7	6.0	35.7
1985F	366.1	71.6[a]	121.6	12.0	31.5	17.5	42.1	7.3	19.4	6.0	37.1
1986F	372.6	72.5[a]	123.0	11.4	31.4	17.5	44.8	7.7	20.0	6.0	38.3
1987F	384.0	75.7[a]	124.0	10.8	31.4	17.5	48.6	8.2	21.4	6.0	40.4
1988F	393.8	79.3[a]	125.0	10.3	31.4	17.5	49.5	8.7	23.1	6.0	43.0
1989F	388.4	80.8[a]	126.0	9.8	31.4	17.5	45.2	8.9	21.7	6.0	41.1
1990F	391.4	82.9[a]	127.0	9.3	31.4	17.5	46.6	9.3	20.9	6.0	40.5

[1] Corn, wheat, soybeans, prepared animal feeds, grain mill products.
[2] Gasoline, jet fuel, distillate, kerosine, lube oils and greases, naptha and solvents, liquified gases.
[3] Residual oil, asphalt, tar & pitch, crude tar, oil & gases.
[4] Cement, limestone, sand, stone, gravel, shell.
[5] Phosphate rock, nitrogenous chemical fertilizers, fertilizers and materials, lime.
[6] Sodium hydroxide, alcohol, benzene and toluene, basic chemicals and products.
[a] Grain forecast based on slow drop from current 50 percent of total U.S. grain exports at Mississippi River Gulf ports to 42 percent in 1990.

F = Forecasted

Source: U.S. Army Corps of Engineers Waterborne Commerce of the United States, Part 2.

Figure IV-2

SUMMARY OF GULF INTRACOASTAL WATERWAY TRAFFIC AND FORECAST

(millions of short tons)

	GIWW Total	Coal	Crude Oil	Petroleum Products	Construction Materials	Coke	Non-Metallic Minerals	Chemicals & Aromatics	All Other Commodities
1970	99.2	1.9	31.8	20.2	15.3	.3	4.9	9.2	15.6
1971	105.2	2.9	33.0	23.9	14.9	.4	4.8	9.1	16.2
1972	108.1	4.9	32.3	23.5	14.7	.4	5.0	10.6	16.7
1973	100.1	4.4	27.5	22.6	15.1	.5	4.2	9.9	15.9
1974	103.0	4.9	25.2	25.6	13.7	.7	4.9	5.4	22.6
1975	96.4	4.3	24.6	24.0	12.3	.6	4.7	9.7	10.2
1976	96.5	4.8	24.2	25.4	10.2	.5	5.0	10.8	15.6
1977	104.3	4.2	24.7	30.9	10.2	.8	4.5	11.4	17.6
1978	101.4	4.0	22.9	28.9	9.6	.7	5.0	12.8	17.5
1979	98.6	5.0	20.0	33.3	8.0	.8	4.3	13.3	11.9
1980	94.1	5.1	17.5	29.8	8.4	1.2	4.2	12.0	15.9
1981	90.0	4.6	15.2	30.1	7.3	1.3	3.4	11.9	16.2
1982	80.6	4.0	15.6	29.6	6.6	1.0	4.0	10.0	9.8
1983F	87.1	4.9	14.8	27.3	6.6	1.3	3.9	11.4	16.9
1984F	87.8	4.8	13.6	27.5	6.3	1.3	4.0	12.5	17.8
1985F	88.0	5.0	12.8	27.5	6.0	1.3	4.0	13.0	18.4
1986F	87.8	5.1	12.0	27.5	5.7	1.3	4.0	13.4	18.8
1987F	88.5	5.1	11.3	27.5	5.6	1.3	4.0	14.3	19.4
1988F	89.4	5.2	10.6	27.5	5.3	1.3	4.0	15.5	20.0
1989F	87.9	5.2	10.0	27.5	4.8	1.3	4.0	14.5	20.6
1990F	87.4	5.3	9.4	27.5	4.7	1.3	4.0	14.0	21.2

F = Forecasted

Source: U.S. Army Corps of Engineers Waterborne Commerce of the United States, Part 2.

below 90 million tons. Declines or stagnation in crude oil, petroleum products, construction materials, coke, minerals, and chemicals traffic will offset the slight growth in coal and all other commodities.

These forecasts of future traffic have been developed in terms of tons because the detailed data that is needed to generate the forecasts is recorded and published in tons by the Corps of Engineers.

Ton-miles are a more effective measure of demand because they are more closely related to the utilization of the towing equipment. The Corps of Engineers reports limited information about ton-miles statistics. In Part 5 of the annual Waterborne Commerce of the United States, ton-miles and average lengths of haul are shown for groupings of major commodities. These can be used to develop general measures of ton-miles from the detailed ton data described above. Figure IV-3 shows both historical and forecast average lengths of haul for major commodity groupings. The forecast is based on no major shifts in the lengths of haul during the 1980's. Note that the data are for internal traffic, which includes the Columbia/Snake River System and coastal rivers. This national average will slightly understate midwestern transit distances, but is a reasonable measure for the Mississippi River System and the Gulf Intracoastal Waterway.

The ton data are then aggregated in Figure IV-4 into the same commodity group categories as the lengths of haul in Figure IV-3. The ton-mile products of these columns are displayed in Figure IV-5 to provide the historical and forecast traffic in terms of the ton-mile measure of utilization. The results of this methodology were compared with the total families reported by the Corps of Engineers during the period 1970 to 1982. The calculated totals each year were within three percent of the reported totals.

EQUIPMENT FORECASTS

Equally important for the understanding of the inland barge market is the need for information describing the supply of equipment. Historical information has been collected from the Corps of Engineers' Waterborne Commerce Statistical Center to tabulate the number and capacity of towboats and barges operating on the Mississippi River System and the Gulf Intracoastal Waterway. Forecasts of fleet size and capacity were made through the 1980's. The data are presented in Figure IV-6.

IV-3

FORECAST
GULF INTRACOASTAL WATERWAY[1]

l in miles)

Construction and Waterway Improvement Materials	Chemicals and Fertilizer	All Other Commodities
69	704	514
72	712	539
73	670	520
72	658	487
76	695	515
71	721	511
83	719	532
92	733	540
109	729	578
121	723	567
124	721	610
109	720	573
106	705	591
110	720	580
110	720	580
110	720	580
110	720	580
110	720	580
110	720	580
110	720	580
110	720	580

cludes Columbia/Snake River System and
GIWW traffic.

borne Commerce of the United States, Part 5.

Figur

TRAFFIC A
MISSISSIPPI RIVER SYSTEM AN

(millions o

Year	Total Mississippi River System and GIWW	Major Agriculture Products	Coal and Coke
1970	396.5	23.9	104.2
1971	408.4	23.9	100.0
1972	434.7	30.9	114.0
1973	417.7	32.2	109.0
1974	433.1	35.6	112.0
1975	426.5	39.4	120.6
1976	442.0	44.8	121.7
1977	456.8	46.7	122.6
1978	456.8	51.9	110.7
1979	469.4	54.8	127.2
1980	459.8	64.3	129.3
1981	452.9	66.3	136.5
1982	428.1	73.8	126.2
1983F	437.5	73.1	125.1
1984F	449.8	70.2	128.2
1985F	454.1	71.6	127.9
1986F	460.4	72.5	129.4
1987F	472.5	75.7	130.4
1988F	483.2	79.3	131.5
1989F	476.3	80.8	132.5
1190F	478.8	82.9	133.6

F = Forecasted
Source: U.S. Army Corps of Engineers, Waterborne

Figure IV-5

TRAFFIC AND FORECAST
MISSISSIPPI RIVER SYSTEM AND GULF INTRACOASTAL WATERWAY

(billions of ton-miles)

Year	Total Mississippi River System and GIWW	Major Agriculture Products	Coal and Coke	Crude Oil $ Petroleum Products	Construction and Waterway Improvement Materials	Chemicals and Fertilizers	All Other Commodities
1970	138.6	26.1	26.5	35.8	4.5	19.8	25.9
1971	146.7	25.6	26.4	40.4	4.9	20.8	28.6
1972	161.6	34.6	32.1	39.3	4.7	22.4	28.5
1973	153.0	38.6	29.3	35.4	4.8	20.3	24.6
1974	167.8	42.0	31.4	36.0	5.2	20.0	33.2
1975	166.6	44.5	34.7	34.8	4.2	22.1	26.3
1976	177.7	49.9	33.6	36.7	4.6	23.0	29.9
1977	188.8	52.4	36.3	39.4	5.3	25.4	30.0
1978	195.2	57.3	33.3	38.5	6.9	27.0	32.2
1979	206.1	61.8	42.1	36.6	7.5	28.9	29.2
1980	217.6	72.0	45.6	32.8	6.4	28.2	32.6
1981	219.5	71.6	56.4	29.5	4.9	26.6	30.5
1982	204.6	78.1	47.2	27.6	4.6	22.6	24.5
1983F	211.6	80.4	43.8	27.0	5.4	25.0	30.0
1984F	215.4	77.2	44.9	26.7	5.9	27.3	33.4
1985F	219.0	78.8	44.8	26.3	6.0	28.6	34.5
1986F	222.2	79.8	45.3	25.9	6.2	29.6	35.4
1987F	229.7	83.3	45.6	25.6	6.6	31.6	37.0
1988F	238.2	87.2	46.0	25.3	6.7	34.1	38.9
1989F	237.1	88.9	46.4	25.0	6.2	32.5	38.1
1990F	238.9	91.2	46.8	24.7	6.3	31.8	38.1

Source: Figure IV-3 and IV-4.

Figure IV-6

TOWBOAT AND BARGE FLEET
MISSISSIPPI RIVER SYSTEM AND GULF INTRACOASTAL WATERWAY HISTORICAL AND FORECAST

Year	Towboats			Dry Cargo Barges			Tank Barges		
	Number of Vessels	Total Horsepower	Average Horsepower	Number of Vessels	Total Capacity (short tons)	Average Capacity (short tons)	Number of Vessels	Total Capacity (short tons)	Average Capacity (short tons)
1970A	2,344	2,305,305	983	13,318	14,863,812	1,116	2,581	4,753,480	1,842
1971A	2,427	2,548,578	1,050	13,985	15,934,718	1,139	2,788	5,591,111	2,005
1972A	2,293	2,654,112	1,157	14,904	17,293,167	1,160	2,697	5,841,980	2,166
1973A	2,332	2,848,674	1,222	15,765	18,583,511	1,178	2,751	5,653,353	2,055
1974A	2,404	3,226,545	1,342	17,345	21,031,652	1,212	2,903	6,117,768	2,107
1975A	2,541	3,574,850	1,407	18,049	22,255,050	1,233	2,979	6,295,236	2,113
1976E	2,578	3,739,951	1,451	18,709	23,270,565	1,244	3,042	6,646,957	2,185
1977C	2,614	3,905,052	1,494	19,368	24,286,079	1,254	3,105	6,998,678	2,254
1978C	2,632	4,072,634	1,547	19,809	25,149,335	1,270	3,250	6,717,435	2,067
1979C	2,722	4,224,297	1,552	21,042	27,110,036	1,288	3,332	6,884,322	2,066
1980A	2,945	4,637,667	1,575	22,586	29,261,091	1,295	3,445	7,147,532	2,074
1981E	3,107	4,901,527	1,578	24,000	31,800,000	1,325	3,950	8,100,000	2,050
1982D	3,161	4,989,480	1,578	24,331	32,590,978	1,339	4,183	8,557,207	2,046
1983E	3,165	4,985,000	1,575	24,400	32,940,000	1,350	4,200	8,610,000	2,050
1984F	3,165	4,985,000	1,575	24,400	32,440,000	1,350	4,200	8,610,000	2,050
1985F	3,165	4,985,000	1,575	24,400	32,940,000	1,350	4,200	8,610,000	2,050
1986F	3,165	4,985,000	1,575	24,400	32,940,000	1,350	4,200	8,610,000	2,050
1987F	3,175	4,984,750	1,570	24,400	32,940,000	1,350	4,200	8,610,000	2,050
1988F	3,190	4,976,400	1,560	24,400	32,940,000	1,350	4,200	8,610,000	2,050
1989F	3,205	4,983,775	1,555	24,400	32,940,000	1,350	4,200	8,610,000	2,050
1990F	3,220	4,990,000	1,550	24,400	32,940,000	1,350	4,200	8,610,000	2,050

Source: Army Corps of Engineers, Waterborne Commerce Statistical Center.

A As of December 31
C As of October 1
D As of May 1
E TBS estimate
F TBS forecast

The towboat fleet will probably remain at current capacity for the next few years until traffic recovers sufficiently to use up current excess capacity. It is estimated that the fleet will not expand until 1987, unless there is a significant jump in utilization prior to that year. This could be brought about through a major foreign grain crop failure or other disruption to normal transportation flows. The average horsepower of the towboat fleet will be reduced over time as operators adjust their equipment to economical fuel operations and replace overpowered boats with vessels using smaller engines.

Dry hopper barges are currently in excess supply. Demand for their services is expected to increase over the next six years. This will primarily be driven by traffic increases in coal, grain, fertilizer, sand and gravel, and coal. The current excess capacity will slowly be eliminated as open and covered hopper barges are used more intensively through the decade.

Tank barges are also in excess. There will also be changes in cargoes carried during the 1980's as less crude oil and more petroleum products and petrochemicls are moved over longer distances. This will improve the utilization of the tank barge fleet but will not support increases in the number of tank barges.

In all of the above fleets, there will be some specialized construction during the 1980 's, but most of this expansion in fleet size will be compensated with selective scrappings and casualty losses.

MAINTENANCE OF THE FORECASTING SYSTEM

The forecasts of the inland waterways can be updated as necessary by industry analysts. Actual historical data will become available only once per year and it is reasonable to expect that a review of the overall forecast validity would be accomplished at least once per year. However, the forecast can be modified for any commodity, at any time, formally or informally, and will continue to be a useful reference for managers. Industries where data is more timely, such as the grain or coal industry, can update their data more frequently.

V. OTHER ENVIRONMENTAL FACTORS

The strategic analysis of the barge line's internal and external environments should not be restricted to examining the market demand for barge services and the availability of competing equipment. In order to develop a comprehensive projection of the firm's operating environment, the analysis should include an examination of the current situation and possible changes in the legal and regulatory environment, physical characteristics of the waterway, new technology, availability of necessary resources, and activities of competing transportation modes.

LEGAL AND REGULATORY ENVIRONMENT

A planner must analyze the present and projected legal and regulatory environment of the inland barge industry. Congressional and regulatory activity can make a big impact, particularly from the following federal agencies:

- Department of Transportation (DOT)
- U.S. Maritime Administration (MarAd)
- U.S. Coast Guard (USCG)
- National Transportation Safety Board (NTSB)
- Department of Labor (DOL)
- Occupational Safety and Health Administration (OSHA)
- U.S. Army Corps of Engineers (CofE)
- Department of Justice (DOJ)
- Department of Agriculture (USDA)
- Environmental Protection Agency (EPA)
- Interstate Commerce Commission (ICC)
- Federal Maritime Commission (FMC)

Through their taxing and spending powers, as well as by changing laws and regulations governing barges, other forms of transportation, and shipping customers, other segments of the federal government, such as the Office of Management and Budget (OMB) and various committees of the Senate and House of Representatives, directly affect the industry.

A feel for the relevant developing issues allows the barge line to adopt an action-oriented goal of trying to obtain favorable legal and regulatory changes. Small operators have been able to expand their effectiveness by joining industry associations on both a long-term basis and for specific threatening issues. Some effective barge industry associations include: the National Waterways Conference, Inc., the American Waterways Operators, Inc., and the Water Transport Association. In addition to their lobbying and public information activities, each organization publishes a member newsletter that collects and distributes useful informaticn.

In addition to federal activities, barge lines are affected by state and local governments. These governments can increase costs and restrictions through zoning, taxation, permitting for use, and eminent domain. On the other hand, these governmental activities can encourage and support economic development when state and local policymakers perceive that inland river transportation is economically beneficial.

The strategic planner should assess the likely direction of all regulatory and legislative programs. Examples of issues to look out for include the following:

- Waterway user charges
- Port user charges
- Fleeting regulations
- Channel and lock improvements
- Regional development programs
- Economic regulation of all domestic modes of transportation
- Safety and environmental regulations
- Agricultural subsidy and export programs
- Embargoes on international trade

- Energy programs affecting coal and petroleum transportation
- Tax policy

Each policy area can affect the cost structure of towing operations or the market demand for towing services.

One example of the regulatory impact on costs is a Coast Guard consideration of requirements to eliminate single-hull tank barges. The towing industry showed that this proposed regulation would require $2.8 billion in additional capital and operating costs. Other industry-generated information showed that the proposed regulation would reduce pollution only slightly. As a result, the Coast Guard modified the proposal extensively. As another example, four successive embargos on export grain shipments severely reduced the demand for southbound covered hopper services.

PHYSICAL CHARACTERISTICS OF THE WATERWAYS

The conditions of the various waterways should be monitored for both short-term operational needs and for longer term market impact. In the first case, delays caused by high or low water, lock maintenance, or vessel casualties detrimentally affect the flow of traffic on a waterway. For the longer term, the occurrence affects decisions by shippers on preferred shipping origins or destinations, modal choices, or terminal locations. For instance, a shipper who has frequent problems with delivery interruptions due to ice on the Illinois Waterway may decide to locate his next plant further south on the upper Mississippi near St. Louis. A choice such as this lessens the aggregate demand for barge services on specific waterways. Of course, improvements in the physical characteristics of waterways (such as a new dam with expanded lock capacity at Locks and Dam 26 on the upper Mississippi or the waterway connecting the Tennessee and Tombigbee Rivers) expand the demand for barge services or create entirely new markets.

The strategic planner should always be aware of river conditions and should attempt to acquire additional information from existing and potential shippers to gauge the potential impact on the demand for the barge line's and its competitors' services.

NEW TECHNOLOGY

With the availability of new technology to improve towboat and barge design and operations, it is important that the strategic planner takes these changes into account. However, deciding to use new technology cannot be done on an engineering basis alone. The planner should consider the context of the entire operation's cost profile, including manning levels and other operating and maintenance expenses. Thus, an investment in more efficient engines that burn lower cost, higher viscosity oil must be made at the appropriate time for retrofitting older towboats or building new vessels.

Advancements in materials handling technology often makes barges for special cargoes obsolete. One example was the shift from dry sulphur to liquid sulphur loadings. Another was the introduction of pneumatic cement barges. New barge designs can give the company a strategic advantage if investments are made early when the technology is still new. Although this can preclude competitors from making similar investments if they can identify the market's limited size, it can be risky, since this industry has a recent history of overinvesting in equipment.

BARGE LINE RESOURCES

Planning for the economical operation of the barge line requires an understanding of the markets for resources that the company uses. These resources can be grouped as follows:

- Barge and towboat equipment
- Labor
- Equipment supplies and maintenance
- Fuel
- Port services

Each category includes a number of elements that affect the cost and availability of the company's barge and towing services.

Equipment

The availability and costs of barges and towboats are the major considerations affecting the decision for bidding on any barge traffic. This factor applies to operating costs in the short term when comparing the company's equipment to that available to competitors. For a longer term, a company can decide to offer its own equipment or it can go after the business when no company-controlled equipment is available. It can choose to charter, lease, or otherwise contract for outside vessels for the operation. This decision can be made for both barges and towboats. In the case of towboats, the power necessary for the move can usually be divided between the linehaul portion and the pickup or delivery portions. In some cases, it will be more economical to contract out part of the move to another carrier or to contract in equipment that is more suitable and efficient.

Labor

The labor rates and availability of personnel used to operate the towboats is an important component of vessel operations costs. At present, there is an oversupply because of the current downturn in the industry. Therefore, labor cost reduction is now possible. The availability of good management talent at competitive prices is also important. A new emphasis on innovative marketing and implementing information and planning systems has created a demand for new executive talent.

Equipment Supplies and Maintenance

Equipment supplies and vessel maintenance absorb a large part of the operating costs of the company's vessels. Planners must decide how to preposition critical parts, inventory levels, and whether to use in-house or contract personnel and facilities to service and maintain the floating equipment. For the use of outside vendors, it is important to identify high-cost regions where limited competition exists. Operating and maintenance and repair policies should be established to minimize these costs. Important tradeoffs are often made between higher M&R costs and higher revenues received from traffic that can prove more harmful to the equipment, operating personnel, or the public. These are not always apparent, but often involve analyses of potential risks. For example, many barge lines hesitate to enter chemical and petroleum trades due to the higher costs and risks involved. On the other hand, other barge lines have been financially successful specializing in these fields. Thus, it's important to know the costs and understand the risks that are associated with targeted markets.

Fuel

Fuel availability has been a problem in the past. Except for those towboats operating on heavier blends of diesel oil, there are now numerous places to buy fuel at market prices. However, a number of barge lines have considered developing hedges against fuel price fluctuations and shortages by entering the futures market. This can provide stability to permit more careful planning of costs for future operations.

Port Services

Port services include fleeting, shifting, cleaning, loading/unloading, and other miscellaneous tasks such as dewatering and steam heating. A similar decision process to that for M&R services can be used to determine which of these activities should be done in-house and which through vendors. This is principally determined by location, volume of use, frequency of need, and cost and availability of outside vendors. Since these costs are often a large proportion of the total movement cost, it is important to have accurate cost accounting systems for both internal and external expenditures.

* * * * *

In summary, the planner should know the company's resource requirements. Information should be assembled about the availability and costs of resources both in the company and the marketplace. By tracking these resource costs and using them appropriately vis-a- vis the company's objectives, the planner can make better strategic decisions. For example, if the company is a low cost linehaul operator, it should be careful in assessing the development of cost centers in the company to provide ancillary services. On the other hand, if the company emphasizes the quality of its service and needs to use in-house resources to maintain a guaranteed standard, then its objective is different. In either case, the planner needs to understand the dynamics of the resource markets to intelligently analyze these options.

OTHER MODAL ACTIVITIES

Barge lines compete extensively with railroads, pipelines, truck lines, and coastal ship and barge lines. The competition is not only head to head on a daily basis, but is also long term and subtle. The competition develops when shippers make decisions about locations for new plants, sources of raw materials, or markets. Their transportation costs are only part of that decision. For many high-volume and low-unit value commodities, transportation is a major portion of the total delivered cost. Barge line planners should learn about customers' existing and future locations and other marketing decisions in order to understand their own lines' markets. Equally important for a complete understanding of the competitive marketplace is the knowledge of changes in competing modes' services to these customers.

VI. THE DEVELOPMENT AND IMPLEMENTATION OF THE STRATEGY

Having undertaken a thorough analysis of the company's present and probable environments--both internal and external--the planner can turn to the development of strategies designed to meet the future challenges. The first step is to focus strategic development on the most critical issues.

STRATEGIC ISSUES

With a projection of the future environment in hand, the strategic planner is in a position to overlay an analysis of the company's strengths and weaknesses on that projection. This analysis should focus on the company's ability to prosper in the future environment. Inevitably, the planner finds several key factors, which we shall call strategic issues. Strategic issues are factors that are likely to create opportunities for and threats to the company. The following scenarios are examples of such issues:

- The Tennessee-Tombigbee waterway will soon be opened for navigation from the Tennessee River to Mobile. New markets may or may not develop for short- and long-haul shipments. To develop a major share of any potential markets, companies should commit themselves early to assign resources, position equipment and develop relationships with local towboat operators, vendors, and especially shippers.

- Overcapacity plagues the inland barge industry. Towboats and barges are tied up and their future is uncertain. Slow recovery in demand for their services is forecasted. An industry proposal has been developed to scrap excess hopper barges. The company can contribute to the relief of an industrywide problem. On the other hand, some of the excess equipment can be useful when business picks up.

- The company specializes in the long-haul affreightment of grain and other dry bulk commodities. A number of towboats are tied up and crews laid off. An opportunity arises to acquire a bankrupt company's tank barges and towboats. The industry's liquid trade is improving faster than the dry bulk trade.

CORPORATE MISSION

Provided with an assessment of the future environment and the identification of strategic issues, senior management can define a mission for the company. Essentially, this entails answering three straightforward questions:

- Who are the company's customers?
- What are the customers' needs?
- How may these needs be met?

A corporate mission statement should answer these questions broadly. For example:

> "Achieve and maintain the position of market leader in providing barge transportation service on the Mississippi River System through innovative responses to shippers' needs and a rigorous emphasis on management and control."

The mission may be broadened or narrowed depending on the level of horizontal or vertical integration desired in the company and the market areas served. Remember that the mission statement guides strategic planning, rather than constrains it.

PLANNING PERIOD

For the capital-intensive barge industry, in which the major assets (vessels) often operate for more than 20 years, the strategic planning period should cover a minimum of 10 years. Of course, the accuracy of forecasts decreases over time because of the cumulative uncertainties and unforeseen events that are beyond the scope of even the most brilliant mortal to forecast. Even so, it is valuable to assess the impact of future events (such as energy shortages) because a longer term perspective provides a sense of the timing and sequence of strategic moves. Effective strategies tend to be opportunistic in that they are sufficiently flexible so that they may be adjusted to deal with unforeseen opportunities and threats.

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STRATEGIC ALTERNATIVES

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Timing is central to developing an effective strategy. A "strategic window" may be identified--that is, an area of opportunity that is a unique alignment of environmental conditions and the company's special capabilities. However, the pace of change, both in- and out-side the company, may leave the strategic window open for only a brief period. Inaction or mistiming damages the company's ability to exploit the opportunity.

TESTING AND EVALUATION OF STRATEGIC ALTERNATIVES

Alternative strategies should be tested objectively by developing forecasts of the range of results that can be expected from each alternative. The results should be stated in quantitative terms, such as revenues and costs. *Pro forma* financial calculations can then be developed to determine the potential impact of the alternatives on the company's balance sheets.

Computer simulation is efficient for evaluating alternative operating strategies. A computer simulation takes a strategy with its inherent assumptions on traffic demand, fleet use, rates, and costs, and projects the results of the strategy over the planning period in the form of income and cash flow statements and capacity use tables. Various mainframe and personal computers spreadsheet packages can be used to develop the computer simulation. A sample model was developed using EPS Incorporated's FCS-EPS spread sheet program and is described in Appendix H. As each company has a unique mix of customers, equipment, and operating patterns, the model can be modified for a company's operations and for the type of spreadsheet available to the planner.

The benefits of using a computer model to evaluate a long-range strategy are twofold: it tests the effectiveness of alternative strategies in dealing with a projected set of environmental conditions and provides a framework to help structure operational strategies. Broadly speaking strategic planning entails making general assumptions. The computer model aids the planner by forcing him to state these assumptions explicitly. Computer simulation also enables the planner to vary the assumptions, such as growth projections and rate and cost forecasts, to test alternative strategies for sensitivity to the variations.

STRATEGY SELECTION

The *pro forma* financial statements that are calculated either by hand or by a computer model enable the planner to rank alternative strategies on the basis of the internal rate of return, the demand on scarce resources, the timing and impact of positive and negative cash flows, and effects on the company's financial statements. Other factors to consider when selecting are these:

- Consistency with the company's goals and priorities
- Compatibility with projected environmental conditions
- Adaptability to internal and external changes
- Level of risk
- Use of the company's personnel, knowledge, technology, and financial resources
- Ability to generate a consensus on its future direction as measured by morale level
- Consistency of logic and actions

IMPLEMENTATION

Successful implementation is the final test of the effectiveness of strategic planning. Management will not tolerate a process that does not bear fruit.

The most important first step in turning the abstraction into action is to communicate it to those responsible for implementation. These individuals must be party to the overall corporate mission, strategic objectives, and assumptions and rationale underlying the strategy. Without a thorough understanding of the strategy's details and the reasons behind it, the implementers' attempts may flop. A full understanding of the planning process gives them the information they need to make the plan work.

One method to ensure effective communication is to involve several implementers in developing and selecting the strategy, so they can appreciate the benefits of the process and the plan itself.

BUSINESS PLANS

An effective strategy implementation must bridge the gap between the abstract, long-range focus of strategic planning and the concrete, short-term policies and directives needed for implementation, which requires a detailed analysis. The short-term plans or "business plans" can range from formal five-year plans and annual budgets to monthly sales targets and barge trip results. These business plans should cover the following:

- Marketing
- Competition
- Operations/service
- Finance
- Organization/personnel development
- Corporate development

A comprehensive scope and sufficient detail to allow implementation of the strategic plan are essential to the business plans at this stage of the process.

The Sales Plan should identify and prioritize specific customer needs and, where applicable, particular market segments to target.

The Competitive Plan should state assumptions about competitors' activities and develop the specific responses that the organization should take to neutralize the damage. Such actions might include forming coalitions or pre-empting the competition.

The Operations/Service Plan should detail how the organization will carry out its strategy in terms of vessel and terminal operations in order to meet the level and phased development of services called for in the strategy.

The Financial Plan should include short-term detail from which budgets and financial controls can be developed. It should detail cash flows in specific revenue and cost areas and identify cash requirements and surpluses. It should also address investment policy for surplus cash reserves.

The Organization/Personnel Development Plan should help structure the organization to meet the demands of the strategic plan. The organizational structure should reflect the priorities and objectives of the company's strategy. Also, plans should develop the organization's human resources to best carry out the strategy.

The Corporate Development Plan should synchronize the needs and the contributions of the barge line and those of the rest of the company's units. The barge line must progress in a direction and at a pace that fits the overall corporate goals and resources.

MONITORING PERFORMANCE

By establishing strategic objectives and projecting results at a service level over an extensive planning period, the strategic planning process provides a number of yardsticks with which to measure the company's effectiveness in carrying out the chosen strategy. Explicit assumptions concerning future environmental conditions are another product of the strategic planning process. Any divergence of the company is performance from the plan or of real environmental conditions from projections are detected by these yardsticks. A continued monitoring process thus provides an early warning system that can identify unforeseen areas of opportunity or threat to the company. These may be addressed as the strategic issues in an ongoing strategic planning process.

STRATEGIC PLANNING

The company strategy is developed, implemented, and monitored in Phase II and III of the planning process. The cycle is then renewed on an annual or more frequent basis by first updating the information that was collected and analyzed in Phase I. As each successive cycle is developed, new issues and strategies are developed, implemented, and then monitored. With very few iterations the strategic planning process will become an integral part of the company decision making process.

APPENDIX A

BIBLIOGRAPHY

APPENDIX A

BIBLIOGRAPHY

Reference materials have been categorized into 9 groups by subject matter as follows:

- Commodity flow statistics
- Shipper industry data
- Government studies
- Terminals
- Equipment
- Costs
- Competitors
- Economic factors
- Information sources

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22	Port Arthur, Beaumont, and Orange, TX
23	Galveston and Texas City, TX
24	Houston, TX
25	Corpus Christi, TX
26	Freeport, Port Lavaca, Port Isabel, and Brownsville, TX
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63	Louisville, KY, and Ports on Ohio River Miles 580-980 and Cumberland and Green Rivers
65	Illinois Waterway, IL
69	Minneapolis-St. Paul, MN, and Ports on Upper Mississippi River Miles 300-860 AOR
70	St. Louis, MO and Ports on Upper Mississippi River Miles 0-300 AOR

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APPENDIX B

COMMODITY CLASSIFICATION FOR DOMESTIC WATERBORNE COMMERCE

APPENDIX B

COMMODITY CLASSIFICATION FOR DOMESTIC WATERBORNE COMMERCE

Code No.	Item Name
	Group 01-Farm Products
0101	Cotton, raw
0102	Barley and rye
0103	Corn
0104	Oats
0105	Rice
0106	Sorghum Grains
0107	Wheat
0111	Soybeans
0112	Flaxseed
0119	Oilseeds, not elsewhere classified
0121	Tobacco, leaf
0122	Hay and Fodder
0129	Field crops, not elsewhere classified
0131	Fresh fruits
0132	Bananas and plantains
0133	Coffee, green and roasted (including instant)
0134	Cocoa beans
0141	Fresh and frozen vegetables
0151	Live animals (livestock) except zoo animals, cats, dogs, etc.
0161	Animals and animal products, not elsewhere classified
0191	Miscellaneous farm products
	Group 08-Forest Products
0841	Crude rubber and allied gums
0861	Forest products, not elsewhere classified
	Group 09-Fresh Fish and Other Marine Products
0911	Fresh fish, except shellfish
0912	Shellfish, except prepared or preserved
0913	Menhaden
0931	Marine shells, unmanufactured
	Group 10-Metallic Ores
1011	Iron ore and concentrates
1021	Copper ore and concentrates
1051	Bauxite and other aluminum ores and concentrates
1061	Manganese ores and concentrates
1091	Nonferrous metal ores and concentrates, not elsewhere classified
	Group 11-Coal
1121	Coal and lignite
	Group 13-Crude Petroleum
1311	Crude petroleum
	Group 14-Nonmetallic Minerals, Except Fuels
1411	Limestone flux and calcareous stone
1412	Building stone, unworked
1442	Sand, gravel and crushed rock
1451	Clay, ceramic and refractory materials
1471	Phosphate rock
1479	Natural fertilizer materials, not elsewhere classified
1491	Salt
1492	Sulphur, dry
1493	Sulphur, liquid
1494	Gypsum, crude and plasters
1499	Nonmetallic minerals, except fuels, not elsewhere classified
	Group 19-Ordnance and Accessories
1911	Ordnance and accessories
	Group 20-Food and Kindred Products
2011	Meat, fresh, chilled, or frozen
2012	Meat and meat products prepared or preserved, including canned meat products
2014	Tallow, animal fats and oils
2015	Animal by-products, not elsewhere classified
2021	Dairy products, except dried milk and cream
2022	Dried milk and cream
2031	Fish and fish products, including shellfish, prepared or preserved

Code No.	Item Name
	Group 20-Food and Kindred Products
2034	Vegetables and preparations, canned and otherwise prepared and preserved
2039	Fruits, and fruit and vegetable juices, canned and otherwise prepared or preserved
2041	Wheat flour and semolina
2042	Animal feeds
2049	Grain mill products, not elsewhere classified
2061	Sugar
2062	Molasses
2081	Alcoholic beverages
2091	Vegetable oils, all grades; margarine and shortening
2092	Animal oils and fats, not elsewhere classified, including marine
2094	Groceries
2095	Ice
2099	Miscellaneous food products
	Group 21-Tobacco Products
2111	Tobacco manufactures
	Group 22-Basic Textiles
2211	Basic textile products, except textile fibers
2212	Textile fibers not elsewhere classified
	Group 23-Apparel and Other Finished Textile Products Including Knit
2311	Apparel and other finished textile products, including knit
	Group 24-Lumber and Wood Products Except Furniture
2411	Logs
2412	Rafted logs
2413	Fuel wood, charcoal, and wastes
2414	Timber, posts, poles, piling, and other wood in the rough
2415	Pulpwood, log
2416	Wood chips, staves, moldings, and excelsior
2421	Lumber
2431	Veneer, plywood, and other worked wood
2491	Wood manufactures, not elsewhere classified
	Group 25-Furniture and Fixtures
2511	Furniture and fixtures
	Group 26-Pulp, Paper and Allied Products
2611	Pulp
2621	Standard newsprint paper
2631	Paper and paperboard
2691	Pulp, paper and paperboard products, not elsewhere classified
	Group 27-Printed Matter
2711	Printed matter
	Group 28-Chemicals and Allied Products
2810	Sodium hydroxide (caustic soda)
2811	Crude products from coal tar, petroleum, and natural gas, except benzene and toluene
2812	Dyes, organic pigment, dyeing and tanning materials
2813	Alcohols
2816	Radioactive and associated materials, including wastes
2817	Benzene and toluene, crude and commercially pure
2818	Sulphuric acid
2819	Basic chemicals and basic chemical products, not elsewhere classified
2821	Plastic materials, regenerated cellulose and synthetic resins, including film, sheeting, and laminates
2822	Synthetic rubber
2823	Synthetic (man-made) fiber
2831	Drugs (biological products, medicinal chemicals, botanical products and pharmaceutical preparations)
2841	Soap, detergents, and cleaning preparations; perfumes, cosmetics, and other toilet preparations
2851	Paints, varnishes, lacquers, enamels, and allied products
2861	Gum and wood chemicals
2871	Nitrogenous chemical fertilizers, except mixtures
2872	Potassic chemical fertilizers, except mixtures
2873	Phosphatic chemical fertilizers, except mixtures

Code No.	Item Name
	Group 28-Chemicals and Allied Products
2876	Insecticides, fungicides, pesticides, and disinfectants
2879	Fertilizers and fertilizer materials, not elsewhere classified
2891	Miscellaneous chemical products
	Group 29-Petroleum and Coal Products
2911	Gasoline, including additives
2912	Jet fuel
2913	Kerosene
2914	Distillate fuel oil
2915	Residual fuel oil
2916	Lubricating oils and greases
2917	Naphtha, mineral spirits, solvents, not elsewhere classified
2918	Asphalt, tar, and pitches
2920	Coke, including petroleum coke
2921	Liquefied petroleum gases, coal gases, natural gas, and natural gas liquids
2951	Asphalt building materials
2991	Petroleum and coal products, not elsewhere classified
	Group 30-Rubber and Miscellaneous Plastics Products
3011	Rubber and miscellaneous plastic products
	Group 31-Leather and Leather Products
3111	Leather and leather products
	Group 32-Stone, Clay, Glass and Concrete Products
3211	Glass and glass products
3241	Building cement
3251	Structural clay products, including refractories
3271	Lime
3281	Cut stone and stone products
3291	Miscellaneous nonmetallic mineral products
	Group 33-Primary Metal Products
3311	Pig iron
3312	Slag
3313	Coke (coal and petroleum), petroleum pitches and asphalts, and naphtha and solvents
3314	Iron and steel ingots, and other primary forms, including blanks for tube and pipe, and sponge iron
3315	Iron and steel bars, rods, angles, shapes and sections, including sheet piling
3316	Iron and steel plates and sheets
3317	Iron and steel pipe and tube
3318	Ferroalloys
3319	Primary iron and steel products, not elsewhere classified including castings in the rough
3321	Nonferrous metals primary smelter product, basic shapes, wire castings and forgings, except copper, lead, zinc and aluminum
3322	Copper and copper alloys, whether or not refined, unworked
3323	Lead and zinc including alloys, unworked
3324	Aluminum and aluminum alloys, unworked

Code No.	Item Name
	Group 34-Fabricated Metal Products, Except Ordnance, Machinery and Transportation Equipment
3411	Fabricated metal products, except ordnance, machinery, and transportation equipment
	Group 35-Machinery, Except Electrical
3511	Machinery, except electrical
	Group 36-Electrical Machinery, Equipment and Supplies
3611	Electrical machinery equipment and supplies
	Group 37-Transportation Equipment
3711	Motor vehicles, parts and equipment
3721	Aircraft and parts
3731	Ships and boats
3791	Miscellaneous transportation equipment
	Group 38-Instruments, Photographic and Optical Goods, Watches and Clocks
3811	Instruments, photographic and optical goods, watches and cloc
	Group 39-Miscellaneous Products of Manufacturing
3911	Miscellaneous products of manufacturing
	Group 40-Waste and Scrap Materials
4011	Iron and steel scrap
4012	Nonferrous metal scrap
4022	Textile waste, scrap, and sweepings
4024	Paper waste and scrap
4029	Waste and scrap, not elsewhere classified
	Group 41-Special Items
4111	Water
4112	Miscellaneous shipments not identifiable by commodity
4113	LCL freight
4118	Materials used in waterway improvement, Government materials
4119	Empty containers
9999*	Department of Defense controlled cargo and special category items

*Cargoes exported on Department of Defense controlled vessels (other than goods for the use of U.S. Armed Forces abroad) and non-Department of Defense shipments of military component items (abbreviated SCi) for which commodity detail is not furnished to the Corps of Engineers.

Source: U.S. Army Corps of Engineers, Waterborne Commerce of the United States.

APPENDIX C

PRINCIPAL HISTORICAL COMMODITY FLOWS

Appendix C[1, 2, 3]

PRINCIPAL HISTORICAL COMMODITY FLOWS

MISSISSIPPI RIVER SYSTEM AND GULF INTRACOASTAL WATERWAY

COMMODITY	NUM.	ORIGIN	DESTINATION	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
OTHER GRAINS	102	ARK	MISS-BR2ND	0	0	0	14	9	6	71	30	5	23	77	139
OTHER GRAINS	102	MIN	MISS-MN2ND	80	24	49	1	1	14	1	0	1	4	3	1
OTHER GRAINS	102	MISS-MN2ND	MISS-BR2ND	10	27	11	55	1	37	24	13	25	18	49	68
OTHER GRAINS	102	MISS-MO2OH	MISS-BR2ND	0	17	43	0	3	0	3	10	5	1	9	72
OTHER GRAINS	102	MISS-MO2OH	MISS-NO2MP	0	23	156	3	5	0	1	0	5	13	8	4
OTHER GRAINS	102	MISS-OH2BR	MISS-BR2ND	3	10	39	15	0	27	81	164	119	137	369	744
OTHER GRAINS	102	MISS-OH2BR	MISS-NO2MP	28	16	62	10	46	43	14	37	38	33	51	103
OTHER GRAINS	102	OH-LOUD	MISS-BR2ND	1	13	17	0	0	0	9	13	3	1	33	109
OTHER GRAINS	102	WOLF	MISS-BR2ND	0	4	7	0	0	0	4	38	13	55	31	151
CORN	103	CHIC	MISS-BR2ND	84	75	67	58	71	41	132	288	381	182	274	316
CORN	103	ILL	GIW-MOB2ND	120	27	92	2	2	5	81	22	200	69	186	19
CORN	103	ILL	MISS-BR2ND	2818	2339	4345	3941	4229	5903	7810	7739	8034	6666	9312	9737
CORN	103	ILL	MISS-NO2MP	1391	1690	3396	3868	2721	3601	3815	3000	2278	2382	1868	1534
CORN	103	ILL	TENN	830	767	540	392	342	226	162	230	385	360	370	355
CORN	103	ILL	WOLF	51	62	64	23	20	10	54	117	151	151	283	79
CORN	103	MIN	MISS-BR2ND	680	491	587	1000	1041	526	693	437	387	178	693	725
CORN	103	MISS-BR2MP	DOWN INBOUND	5597	4783	7632	8819	9712	11400	15231	14606	17856	20524	23048	24854
CORN	103	MISS-BR2ND	EXPORT	6756	5006	8770	12203	11612	13622	19671	19533	23213	26683	27584	28112
CORN	103	MISS-MN2ND	GIW-MOB2ND	54	15	3	42	3	14	25	23	85	48	176	13
CORN	103	MISS-MN2ND	MISS-BR2ND	1755	1546	2289	3381	3632	4010	5065	3873	6689	9699	10774	11461
CORN	103	MISS-MN2ND	MISS-NO2MP	833	729	1588	2254	2531	2651	2624	1874	2021	2155	2614	2483
CORN	103	MISS-MN2ND	TENN	450	393	187	212	165	91	34	55	174	230	274	230
CORN	103	MISS-MO2OH	MISS-BR2ND	76	128	219	231	285	96	93	439	806	641	466	700
CORN	103	MISS-MO2OH	MISS-NO2MP	43	82	193	194	186	71	67	353	199	261	154	111
CORN	103	MISS-NO2MP	COASTWISE	73	60	34	45	44	4	13	62	10	28	22	71
CORN	103	MISS-NO2MP	DOWN INBOUND	2987	3325	6423	8470	6557	7697	8342	7117	5494	5581	5202	4648
CORN	103	MISS-NO2MP	EXPORT	3578	3639	6770	10004	7980	7614	7775	7132	5107	5151	5324	5064
CORN	103	MISS.R.SYS.	ALL POINTS	11227	10002	15817	18883	17543	20201	20047	23013	25206	27699	30347	31112
CORN	103	NATIONAL	EXPORT	15398	14177	24425	35950	32049	35976	48327	44152	54869	65014	67815	58950
CORN	103	OH-LOUD	MISS-BR2ND	62	90	60	87	218	493	929	1400	1523	2611	1366	1495
CORN	103	OH-LOUD	MISS-NO2MP	61	198	224	370	285	633	1057	1065	652	618	388	236
WHEAT	107	ARK	MISS-BR2ND	0	0	11	7	30	49	72	189	118	63	240	264
WHEAT	107	ARK	MISS-NO2MP	3	10	2	9	31	4	14	42	138	182	272	607
WHEAT	107	ILL	MISS-BR2ND	18	73	81	18	78	102	123	130	57	74	174	86
WHEAT	107	ILL	MISS-NO2MP	29	71	83	51	79	116	151	158	38	115	122	159
WHEAT	107	MIN	MISS-BR2ND	53	45	51	186	538	416	345	421	227	57	112	350
WHEAT	107	MIN	MISS-NO2MP	234	233	319	32	213	293	322	335	115	72	267	253
WHEAT	107	MISS-BR2MP	DOWN INBOUND	339	504	931	590	1802	1646	2891	3099	2440	2229	3145	4627
WHEAT	107	MISS-BR2ND	EXPORT	637	743	1026	1630	1819	1806	2672	2765	2507	1932	3121	4474
WHEAT	107	MISS-MN2ND	MISS-BR2ND	65	51	61	136	368	562	681	575	718	930	764	1064
WHEAT	107	MISS-MN2ND	MISS-NO2MP	229	179	281	126	223	573	643	413	583	714	734	745
WHEAT	107	MISS-MN2ND	TENN	173	224	262	182	128	161	185	120	162	149	121	184
WHEAT	107	MISS-MO2OH	MISS-BR2ND	23	65	188	16	204	79	74	396	387	279	485	496
WHEAT	107	MISS-MO2OH	MISS-NO2MP	43	133	173	57	108	35	77	352	340	255	548	772
WHEAT	107	MISS-NO2MP	COASTWISE	0	1	10	7	14	37	8	55	86	57	53	26
WHEAT	107	MISS-NO2MP	DOWN INBOUND	669	954	1303	954	1148	1605	2654	2134	1829	2207	3015	4425
WHEAT	107	MISS-NO2MP	EXPORT	1235	1426	1801	1102	1154	1711	2452	1903	1722	2499	3611	5276
WHEAT	107	MISS-OH2BR	MISS-BR2ND	149	114	224	61	241	305	518	339	284	434	404	1284
WHEAT	107	MISS-OH2BR	MISS-NO2MP	78	182	164	62	93	128	234	222	177	131	392	737

Appendix C (continued)

COMMODITY	NUM.	ORIGIN	DESTINATION	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
WHEAT	107	MISS.R.SYS.	ALL POINTS	2500	3030	3839	2322	4455	5850	6834	6719	5398	5585	7335	10570
WHEAT	107	MO	MISS-BR2NO	2	114	207	112	120	88	326	334	294	20	227	125
WHEAT	107	MO	MISS-NO2MP	5	53	125	68	210	96	107	135	173	489	111	75
WHEAT	107	MO	TENN	325	396	293	159	249	236	277	312	327	332	397	365
WHEAT	107	NATIONAL	EXPORT	19209	17710	23229	40756	27448	34036	29198	26237	37466	36449	39103	4801
WHEAT	107	OH-LOUD	MISS-BR2NO	1	24	40	5	120	146	238	252	179	153	239	432
WHEAT	107	OH-LOUD	MISS-NO2MP	5	72	121	22	150	275	427	264	159	218	347	509
WHEAT	107	WOLF	MISS-BR2NO	11	8	21	1	5	19	182	146	75	43	107	283
WHEAT	107	WOLF	MISS-NO2MP	33	9	29	7	21	33	107	138	70	73	121	316
SOY BEANS	111	ARK	MISS-BR2NO	63	37	56	91	114	112	151	188	258	214	251	238
SOY BEANS	111	CHIC	MISS-BR2NO	86	68	85	34	71	15	33	114	44	43	106	184
SOY BEANS	111	ILL	MISS-BR2NO	784	667	997	1111	970	1118	1167	1346	1872	1426	1977	2069
SOY BEANS	111	ILL	MISS-NO2MP	391	667	764	852	616	648	532	628	468	274	416	600
SOY BEANS	111	MIN	MISS-BR2NO	481	255	236	192	207	104	180	104	197	53	393	350
SOY BEANS	111	MISS-BR2MP	DOWN INBOUND	4762	3586	4197	4099	5487	5079	6557	6999	9791	9652	12038	10379
SOY BEANS	111	MISS-BR2NO	EXPORT	5475	4040	5105	5689	6503	5794	7804	8373	12686	12524	13464	11615
SOY BEANS	111	MISS-MN2MO	MISS-BR2NO	1365	1099	1136	890	1443	1303	1919	1443	2630	2562	3481	2606
SOY BEANS	111	MISS-MN2MO	MISS-NO2MP	382	613	667	533	846	787	740	523	745	329	531	781
SOY BEANS	111	MISS-MN2MO	OH-LOUD	0	2	0	0	0	0	0	2	44	111	110	76
SOY BEANS	111	MISS-MO2OH	MISS-BR2NO	209	195	238	320	396	212	206	648	861	731	658	676
SOY BEANS	111	MISS-MO2OH	MISS-NO2MP	165	186	226	233	230	105	133	371	199	159	178	373
SOY BEANS	111	MISS-NO2MP	DOWN INBOUND	1777	2855	3090	2777	3041	2854	2920	2810	2366	1579	2263	3399
SOY BEANS	111	MISS-NO2MP	EXPORT	2507	3400	3056	3053	3397	2748	2795	2610	1912	1489	1906	3749
SOY BEANS	111	MISS-OH2BR	MISS-BR2NO	1063	713	931	872	1302	1188	1521	1629	1766	2171	2207	1280
SOY BEANS	111	MISS-OH2BR	MISS-NO2MP	354	668	515	414	479	580	607	522	386	407	582	676
SOY BEANS	111	MISS.R.SYS.	ALL POINTS	7920	8275	8697	8205	9737	8944	10085	11033	13581	12575	15470	14797
SOY BEANS	111	MO	MISS-BR2NO	113	97	60	63	68	49	84	64	216	180	144	190
SOY BEANS	111	NATIONAL	EXPORT	12888	12590	13174	14524	15170	13728	16851	17797	23073	22844	23534	23750
SOY BEANS	111	OH-LOUD	MISS-BR2NO	110	145	170	194	309	380	423	474	797	672	1203	1231
SOY BEANS	111	OUCH/BLK	MISS-BR2NO	55	68	83	42	212	141	207	202	252	224	221	166
SOY BEANS	111	TENN	MISS-BR2NO	4	50	7	13	21	20	20	55	83	108	154	96
SOY BEANS	111	WARR	WARR	117	46	129	139	168	231	214	393	309	262	239	234
SOY BEANS	111	WHITE	MISS-BR2NO	308	170	104	165	260	245	343	349	317	375	532	89
SOY BEANS	111	WOLF	MISS-BR2NO	1	0	3	5	1	3	128	109	125	324	324	262
SOY BEANS	111	YAZOO	MISS-BR2NO	111	36	36	66	85	89	125	210	201	376	268	194
MARINE SHELLS	931	GIW	ALL POINTS	13776	12909	12311	12789	11526	9807	7467	7861	6976	5603	5931	5149
MARINE SHELLS	931	MISS.R.SYS.	ALL POINTS	3404	3687	3639	3515	4252	3700	2939	3096	1694	1704	1799	1690
COAL	1121	ALL	OH-PITTD	895	657	572	488	534	648	868	897	761	1224	551	52
COAL	1121	GIW	ALL POINTS	1904	2890	4933	4350	4871	4298	4754	4220	4015	4971	5066	4646
COAL	1121	GREEN	MISS-NO2MP	3061	2890	3683	2720	2890	2761	2648	2410	1531	1872	2354	2379
COAL	1121	GREEN	MISS-OH2BR	201	222	557	1051	795	1000	542	748	414	502	9	154
COAL	1121	GREEN	OH-LOUD	9124	7389	7975	7872	7476	8074	7723	6842	5358	6742	4939	5354
COAL	1121	GREEN	TENN	2785	2350	2539	2174	1850	2398	612	464	285	478	209	17
COAL	1121	ILL	CHIC	4851	4476	4280	4975	4815	5089	4544	4036	2764	3133	4767	4400
COAL	1121	KANA	KANA	1951	2508	2331	1972	1582	2732	2701	2384	2317	2654	1871	941
COAL	1121	KANA	MON	29	26	136	612	397	568	862	1001	1002	1113	882	737
COAL	1121	KANA	OH-HUND	3218	3525	3479	3091	2921	1995	2248	1167	618	1062	2763	3730
COAL	1121	KANA	OH-LOUD	1809	945	923	586	443	264	107	64	454	793	1373	934
COAL	1121	KANA	OH-PITTD	119	115	282	341	178	110	241	132	731	1343	1387	1316

Appendix C (continued)

COMMODITY	NUM.	ORIGIN	DESTINATION	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
COAL	1121	MISS-BR2NO	EXPORT	0	0	0	1	12	10	12	0	0	52	382	6032
COAL	1121	MISS-MN2MO	MISS-MN2MO	39	46	86	146	486	1804	1900	719	855	987	1478	1364
COAL	1121	MISS-MN2MO	STRCX	4	1	6	140	240	972	1012	894	805	1004	1215	935
COAL	1121	MISS-MO2OH	ILL	386	340	650	770	1117	532	535	1175	126	77	125	115
COAL	1121	MISS-MO2OH	MISS-MN2MO	2782	2375	3157	2030	2221	2620	2106	2892	2469	2859	2538	2274
COAL	1121	MISS-MO2OH	MISS-MO2OH	1611	1657	1305	899	1630	67	90	829	417	317	323	700
COAL	1121	MISS-MO2OH	MISS-OH2BR	85	531	1329	1456	1286	25	529	1512	1686	2445	5832	6116
COAL	1121	MISS-MO2OH	STCRX	1175	1000	1433	794	992	600	337	234	16	56	211	0
COAL	1121	MISS-MO2OH	TENN	0	0	0	0	42	4	134	301	730	1375	2755	2013
COAL	1121	MISS-NO2MP	COASTWISE	3704	3512	3585	3470	3480	3095	2659	2899	2857	2740	2946	3555
COAL	1121	MISS-NO2MP	DOWN INBOUND	3839	4056	4693	3093	4250	4371	3883	3388	2239	2883	5544	11603
COAL	1121	MISS-NO2MP	EXPORT	258	656	775	657	937	1218	1116	1312	1387	1357	3491	7555
COAL	1121	MISS.R.SYS.	ALL POINTS	101907	96749	100722	104096	106395	115695	116444	117570	106016	121423	122983	130641
COAL	1121	MON	MON	22208	17354	19242	18123	18169	19193	16958	15607	13379	17877	15030	12062
COAL	1121	MON	OH-PITTD	7339	5484	6554	6859	7287	6149	7068	7612	6742	7080	7287	5510
COAL	1121	NATIONAL	EXPORT	71275	56802	55914	53011	61581	65273	59765	53937	40328	65731	91340	112206
COAL	1121	OH-HUND	MON	3218	3459	2737	2374	1993	2328	3303	2877	2345	3915	3823	4137
COAL	1121	OH-HUND	OH-HUND	1400	4256	4654	4072	4835	6461	7018	6635	7299	3527	2933	3218
COAL	1121	OH-HUND	OH-LOUD	638	1175	493	413	1071	917	1832	2332	2560	3356	4202	4188
COAL	1121	OH-HUND	OH-PITTD	3480	3723	2359	2021	2124	1945	3608	4335	4876	3741	4791	5654
COAL	1121	OH-HUND	TENN	3	7	4	8	2	28	309	593	504	1093	1004	85
COAL	1121	OH-LOUD	CUMB	0	133	2247	3860	4005	5694	4513	4934	3558	6701	5246	4488
COAL	1121	OH-LOUD	ESCAM	0	50	207	603	996	717	1419	1023	660	1229	1407	1586
COAL	1121	OH-LOUD	GIW-MOB2NO	530	490	619	780	517	929	799	1045	612	577	766	452
COAL	1121	OH-LOUD	MISS-NO2MP	425	495	25	167	466	504	274	379	138	398	1167	4136
COAL	1121	OH-LOUD	OH-HUND	412	81	1	93	123	2	1816	4484	4637	3900	2815	7737
COAL	1121	OH-LOUD	OH-LOUD	2838	3587	4102	3553	4691	5271	6504	6888	7444	6293	6395	6129
COAL	1121	OH-LOUD	WOLF	0	0	0	0	0	0	423	172	397	1293	1106	1084
COAL	1121	OH-PITTD	OH-HUND	2574	2359	2701	2939	4929	4471	3837	4181	1900	3094	2672	2100
COAL	1121	OH-PITTD	OH-LOUD	689	1124	1302	1066	1153	1436	1277	1247	1936	2874	1328	1337
COAL	1121	OH-PITTD	OH-PITTD	4870	4054	5629	6422	4891	4547	5941	6285	4099	4504	4736	4929
COAL	1121	OH-PITTD	TENN	0	0	0	0	0	1933	465	983	1905	2511	2542	2207
COAL	1121	TENN	TENN	3931	4200	4544	3612	2700	2124	3273	3058	3430	3501	1509	3684
COAL	1121	WARR	GIW-FLA2ALA	0	10	3	0	36	289	717	613	1021	726	736	801
COAL	1121	WARR	WARR	3853	3927	5553	4377	5067	5344	5895	6761	5769	5727	8457	824
CRUDE	1311	CALC	MISS-BR2NO	132	40	3	96	51	7	18	30	132	331	503	612
CRUDE	1311	GIW	ALL POINTS	31806	32990	32297	27456	25169	24572	24242	24746	22929	20000	17459	15191
CRUDE	1311	GIW-COR2MEX	GALV	328	397	1721	899	795	1452	622	1744	1962	1330	374	378
CRUDE	1311	GIW-MISS2SAB	CALCAS	3961	3881	2944	2699	2763	2188	1755	1909	1685	1461	1570	943
CRUDE	1311	GIW-MISS2SAB	GALV	4021	4953	3820	2791	2245	1529	1561	1603	817	760	568	421
CRUDE	1311	GIW-MISS2SAB	MISS-BR2NO	765	1223	1632	1515	1395	1723	1104	697	348	344	576	369
CRUDE	1311	GIW-MISS2SAB	MISS-NO2MP	2206	2264	2225	2672	2159	2095	2119	1934	1805	1437	876	815
CRUDE	1311	GIW-MISS2SAB	MISS-OH2BR	45	6	0	111	0	0	0	0	0	164	319	42
CRUDE	1311	GIW-MISS2SAB	SAB-NECH	2152	2170	2152	1818	1045	784	704	662	479	473	1060	845
CRUDE	1311	GIW-MOB2NO	MISS-NO2MP	75	163	241	367	168	160	255	453	592	513	335	292
CRUDE	1311	GLFMEXI	MISS-BR2NO	248	276	1044	234	221	114	154	619	814	676	361	446
CRUDE	1311	GLFMEXI	MISS-NO2MP	1249	798	1077	1242	1139	859	836	914	664	820	601	948
CRUDE	1311	MISS-BR2MP	DOWN INBOUND	112	89	19	118	82	93	57	52	191	157	248	258
CRUDE	1311	MISS-BR2NO	EXPORT	0	0	0	0	0	0	0	0	1	0	0	0

Appendix C (continued)

COMMODITY	NUM.	ORIGIN	DESTINATION	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
CRUDE	1311	MISS-BR2ND	IMPORT	182	229	1034	5506	14194	25775	43063	64446	69195	73544	62504	53995
CRUDE	1311	MISS-BR2ND	MISS-BR2ND	199	191	151	312	410	392	715	400	740	522	467	760
CRUDE	1311	MISS-BR2ND	MISS-MIN2MD	0	0	0	0	210	0	452	331	432	159	456	390
CRUDE	1311	MISS-BR2ND	WOLF	0	0	0	0	0	0	1031	1458	2097	1111	938	1222
CRUDE	1311	MISS-MO2MP	COASTWISE	18991	18417	6952	3941	3971	2424	367	36	260	0	148	703
CRUDE	1311	MISS-MO2MP	DOWN INBOUND	1224	1002	2491	3156	2954	3273	3357	3063	2788	2215	1051	1000
CRUDE	1311	MISS-MO2MP	IMPORT	0	188	267	1053	3555	4382	5928	13462	9182	12272	10139	6970
CRUDE	1311	MISS-MO2MP	MISS-BR2ND	4999	5490	5386	6255	3748	3445	3114	1886	1632	1607	981	747
CRUDE	1311	MISS-MO2MP	MISS-MO2MP	815	458	1281	841	961	1438	1192	825	621	1150	1130	749
CRUDE	1311	MISS-MO2MP	MISS-OH2BR	1786	1766	2395	1246	1395	1739	1020	206	1450	1995	1058	636
CRUDE	1311	MISS-MO2MP	WOLF	0	0	0	0	0	0	307	163	176	76	379	596
CRUDE	1311	MISS.R.SYS.	ALL POINTS	25798	26232	29267	25141	19147	21627	21061	18843	20464	17753	14990	13753
CRUDE	1311	NATIONAL	EXPORT	612	320	417	420	129	0	194	253	145	2	1	26
CRUDE	1311	OH-LOUD	OH-HUND	5555	6361	6220	3092	0	0	0	0	0	0	0	0
CRUDE	1311	OH-LOUD	OH-LOUD	1008	1207	1202	742	0	0	0	0	15	0	0	19
CRUDE	1311	SAB-NECH	CALC	21	11	90	150	69	96	24	579	2008	235	230	261
CRUDE	1311	SAB-NECH	SAB-NECH	358	302	353	289	326	501	763	939	451	867	1291	636
CRUDE	1311	WARR	MISS-MO2MP	0	1	24	138	591	729	957	1041	855	506	317	164
CRUDE	1311	WARR	WOLF	0	0	0	0	0	0	570	346	280	514	359	13
LIMESTONE	1411	MISS.R.SYS.	ALL POINTS	1901	1757	1384	1002	2368	1779	1307	1022	1870	2426	3199	2537
SAND, GRAVEL, CRUSHED ROCK	1442	GIW	ALL POINTS	1503	1966	2410	2304	2167	2510	2725	2293	2626	2356	2490	2152
SAND, GRAVEL, CRUSHED ROCK	1442	MISS.R.SYS.	ALL POINTS	32147	35668	33129	34061	33606	30105	31042	33004	37838	38846	29402	25641
FERTILIZERS & MTLS	1471	ARK	MISS-MO2MP	0	0	0	0	0	0	0	6	0	60	162	11
FERTILIZERS & MTLS	1471	GALV	GIW-MOB2ND	112	165	205	209	147	66	147	278	222	275	330	278
FERTILIZERS & MTLS	1471	GIW-MOB2ND	MISS-OH2BR	22	15	33	47	85	65	74	90	110	88	131	109
FERTILIZERS & MTLS	1471	MISS-BR2ND	ARK	6	40	75	49	68	117	94	136	100	100	109	130
FERTILIZERS & MTLS	1471	MISS-BR2ND	ILL	137	140	277	491	522	615	476	376	462	392	633	443
FERTILIZERS & MTLS	1471	MISS-BR2ND	MISS-BR2ND	326	690	1267	1362	1447	679	80	49	59	155	179	45
FERTILIZERS & MTLS	1471	MISS-BR2ND	MISS-MN2MD	184	152	140	264	232	428	420	389	591	651	705	989
FERTILIZERS & MTLS	1471	MISS-BR2ND	MISS-MO2OH	132	212	163	99	25	0	0	134	199	337	333	299
FERTILIZERS & MTLS	1471	MISS-BR2ND	MISS-OH2BR	66	78	116	78	85	116	68	85	89	97	196	110
FERTILIZERS & MTLS	1471	MISS-BR2ND	MO	180	183	173	129	300	215	243	199	194	256	196	206
FERTILIZERS & MTLS	1471	MISS-BR2ND	OH-LOUD	141	167	162	201	347	367	437	672	674	676	644	585
FERTILIZERS & MTLS	1471	MISS-BR2ND	WHITE	0	11	21	20	23	15	37	21	51	26	155	7
FERTILIZERS & MTLS	1471	MISS-MN2MD	MISS-MN2MD	25	46	43	40	29	43	60	86	103	92	113	104
FERTILIZERS & MTLS	1471	MISS-MO2OH	ILL	10	8	32	11	3	21	28	24	44	61	130	28
FERTILIZERS & MTLS	1471	MISS-MO2OH	LAKE MICH	0	0	0	0	0	0	0	0	23	38	103	18
FERTILIZERS & MTLS	1471	MISS-MO2MP	ILL	378	312	373	489	460	487	511	533	397	453	350	347
FERTILIZERS & MTLS	1471	MISS-MO2MP	MISS-MN2MD	810	933	972	823	833	983	700	932	589	685	599	478
FERTILIZERS & MTLS	1471	MISS-OH2BR	OH-LOUD	6	5	0	1	4	16	61	51	81	106	103	69
FERTILIZERS & MTLS	1471	MISS.R.SYS.	ALL POINTS	750	830	1227	1461	1378	1395	908	1003	1041	1211	1177	982
SULPHUR, LIQUID	1493	MISS.R.SYS.	ALL POINTS	2393	2423	2579	2670	2993	2825	2372	2399	2270	2752	2634	2279
NON-METALLIC MIN.	1499	GIW	ALL POINTS	4896	4814	4971	4187	4892	4714	4985	4500	5003	4260	4246	3364
NON-METALLIC MIN.	1499	MISS-BR2MP	DOWN INBOUND	15	59	178	153	247	232	194	195	112	133	40	70
NON-METALLIC MIN.	1499	MISS-BR2ND	EXPORT	7	3	6	0	0	0	1	4	2	1	3	2
NON-METALLIC MIN.	1499	MISS-BR2ND	IMPORT	105	83	129	193	76	106	255	421	136	172	60	6
NON-METALLIC MIN.	1499	MISS-MO2MP	COASTWISE	195	142	56	18	30	6	4	1	0	2	1	0
NON-METALLIC MIN.	1499	MISS-MO2MP	DOWN INBOUND	106	64	11	0	8	9	10	40	35	7	1	0
NON-METALLIC MIN.	1499	MISS-MO2MP	EXPORT	64	46	38	60	54	29	27	74	43	51	44	16

Appendix C (continued)

COMMODITY	NUM.	ORIGIN	DESTINATION	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
NON-METALLIC MIN.	1499	MISS-NO2MP	IMPORT	35	8	44	85	36	72	53	116	11	121	37	82
NON-METALLIC MIN.	1499	MISS.R.SYS.	ALL POINTS	5000	4926	5020	4196	4972	4762	4877	4929	5429	4792	4655	3802
NON-METALLIC MIN.	1499	NATIONAL	EXPORT	926	915	910	841	923	891	874	950	600	1027	1038	985
PREPARED ANIMAL FEED	2042	MISS-BR2MP	DOWN INBOUND	15	23	52	9	5	114	348	339	381	2614	3360	2950
PREPARED ANIMAL FEED	2042	MISS-BR2NO	EXPORT	13	7	16	18	6	154	340	442	6811	7190	8987	8300
PREPARED ANIMAL FEED	2042	MISS-NO2MP	DOWN INBOUND	8	1	22	15	46	11	47	77	54	158	641	837
PREPARED ANIMAL FEED	2042	MISS-NO2MP	EXPORT	137	78	60	75	81	54	69	85	1273	1512	2099	2253
PREPARED ANIMAL FEED	2042	MISS.R.SYS.	ALL POINTS	102	141	195	95	161	158	501	514	545	2901	4221	4035
PREPARED ANIMAL FEED	2042	NATIONAL	EXPORT	1116	983	933	940	764	790	1080	1183	10718	11849	14289	13145
GRAIN MILL PRODUCTS	2049	MISS.R.SYS.	ALL POINTS	2115	2352	2494	2722	3701	4205	5786	5470	7237	5957	7017	5812
VEGETABLE OILS, MARG. SHORT	2091	MISS.R.SYS.	ALL POINTS	693	834	794	595	682	453	802	872	1106	1226	1284	1083
SODIUM HYDROXIDE	2810	CALC	GALV	24	23	52	44	53	38	65	87	120	139	69	68
SODIUM HYDROXIDE	2810	CALC	GIW-CC2MEX	41	27	34	30	32	23	29	35	73	9	0	0
SODIUM HYDROXIDE	2810	CALC	GIW-GAL2CC	0	10	22	38	35	56	56	51	60	94	105	110
SODIUM HYDROXIDE	2810	CALC	MISS-MO2OH	114	43	53	56	66	0	0	64	74	57	55	48
SODIUM HYDROXIDE	2810	CALC	OH-PITTD	38	59	49	0	0	0	1	0	0	0	1	1
SODIUM HYDROXIDE	2810	CALC	WARR	113	128	90	118	118	86	104	128	72	49	117	60
SODIUM HYDROXIDE	2810	GALV	GALV	75	140	149	115	135	101	47	53	51	84	90	66
SODIUM HYDROXIDE	2810	GALV	WARR	193	144	167	187	160	158	255	257	203	150	151	150
SODIUM HYDROXIDE	2810	GIW	ALL POINTS	1565	1543	1661	1734	1993	1517	1804	1935	1981	1945	1722	1338
SODIUM HYDROXIDE	2810	GIW-GAL2CC	GIW-CC2MEX	178	225	190	242	246	121	172	134	154	202	206	178
SODIUM HYDROXIDE	2810	GIW-GAL2CC	GIW-GAL2CC	249	275	263	306	303	222	236	137	172	156	132	49
SODIUM HYDROXIDE	2810	GIW-GAL2CC	SAB-NECH	45	44	56	39	34	44	22	25	32	19	27	10
SODIUM HYDROXIDE	2810	KANA	KANA	110	128	150	155	168	93	134	120	110	97	17	8
SODIUM HYDROXIDE	2810	MISS-BR2NO	ARK	79	92	100	132	134	125	126	121	135	187	134	102
SODIUM HYDROXIDE	2810	MISS-BR2NO	CHIC	53	57	80	83	82	94	154	207	178	192	163	155
SODIUM HYDROXIDE	2810	MISS-BR2NO	GALV	15	10	1	0	0	29	30	82	114	98	90	53
SODIUM HYDROXIDE	2810	MISS-BR2NO	GIW-APP2MOB	59	64	92	121	132	132	177	153	167	160	146	7
SODIUM HYDROXIDE	2810	MISS-BR2NO	MISS-BR2NO	19	289	319	403	513	294	363	389	271	291	302	289
SODIUM HYDROXIDE	2810	MISS-BR2NO	MISS-MN2MO	46	48	49	48	48	106	37	76	80	99	54	58
SODIUM HYDROXIDE	2810	MISS-BR2NO	MISS-MO2OH	27	31	53	47	57	0	0	46	53	65	69	57
SODIUM HYDROXIDE	2810	MISS-BR2NO	OH-LOUD	45	44	40	24	9	23	46	60	86	93	103	97
SODIUM HYDROXIDE	2810	MISS-BR2NO	WARR	59	73	76	73	96	119	104	103	97	91	61	64
SODIUM HYDROXIDE	2810	MISS-BR2NO	WOLF	0	0	0	0	0	0	3	7	10	23	59	36
SODIUM HYDROSIDE	2810	MISS.R.SYS.	ALL POINTS	1604	1788	2032	2125	2511	2119	2547	2815	2571	2813	2406	1915
SODIUM HYDROXIDE	2810	TENN	CHIC	36	37	60	67	72	69	80	73	59	61	64	44
SODIUM HYDROXIDE	2810	TENN	OH-LOUD	17	26	43	52	54	59	58	54	58	51	31	39
SODIUM HYDROXIDE	2810	TENN	WOLF	0	0	0	0	0	0	72	78	30	54	43	42
SODIUM HYDROXIDE	2810	WARR	CALC	3	0	5	6	21	41	46	19	29	75	51	91
SODIUM HYDROXIDE	2810	WARR	MISS-BR2NO	48	54	13	0	0	0	0	1	1	3	7	12
ALCOHOLS	2813	GALV	CHIC	42	52	70	96	117	59	73	70	65	58	59	73
ALCOHOLS	2813	GALV	GALV	9	80	273	206	113	91	238	348	248	218	301	313
ALCOHOLS	2813	GALV	KANA	256	218	186	146	130	109	135	214	157	187	168	177
ALCOHOLS	2813	GIW	ALL POINTS	1066	1166	1550	1531	1452	1167	1296	1299	1350	1501	1267	1329
ALCOHOLS	2813	GIW-CC2MEX	GALV	7	12	1	4	1	0	21	150	0	136	126	157
ALCOHOLS	2813	GIW-GAL2CC	GALV	20	12	35	21	23	9	16	14	32	46	69	72
ALCOHOLS	2813	MISS-BR2NO	CHIC	89	73	84	105	136	107	100	143	157	134	160	91
ALCOHOLS	2813	MISS-BR2NO	GALV	100	98	56	91	67	66	65	103	87	66	92	109
ALCOHOLS	2813	MISS-BR2NO	MISS-MN2MO	32	35	46	38	43	60	31	38	41	41	51	43

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COMMODITY	NUM.	ORIGIN	DESTINATION	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
ALCOHOLS	2813	MISS-BR2NO	OH-LOUD	54	60	63	119	114	98	112	109	104	146	172	148
ALCOHOLS	2813	MISS.R.SYS.	ALL POINTS	1479	1585	1854	1838	1897	1715	1691	1628	1750	1676	1485	1403
ALCOHOLS	2813	SAB-NECH	GALV	51	57	49	98	70	15	33	14	52	155	100	58
ALCOHOLS	2813	SAB-NECH	KANA	137	186	183	161	155	173	152	117	162	205	90	101
ALCOHOLS	2813	SAB-NECH	SAB-NECH	59	13	44	31	35	0	2	14	30	112	120	66
CHEMICALS	2816	BIG SANDY	OH-HUND	0	1	0	0	58	43	134	119	131	157	151	106
CHEMICALS	2816	GALV	CHIC	178	155	153	143	138	141	156	200	203	193	176	209
CHEMICALS	2816	GALV	ESCAM	122	128	139	126	149	130	159	146	127	129	100	43
CHEMICALS	2816	GALV	GALV	209	324	484	460	381	335	364	583	710	846	702	835
CHEMICALS	2816	GALV	GIW-CC2MEX	13	37	52	54	42	6	8	133	169	222	129	22
CHEMICALS	2816	GALV	GIW-GAL2CC	100	102	133	159	161	134	153	178	225	242	169	243
CHEMICALS	2816	GALV	KANA	219	239	185	141	135	98	148	134	153	159	111	151
CHEMICALS	2816	GALV	MISS-BR2NO	176	154	136	135	235	194	137	217	228	446	534	510
CHEMICALS	2816	GALV	OH-HUND	41	60	75	117	175	86	102	64	52	138	114	77
CHEMICALS	2816	GALV	OH-LOUD	131	96	185	153	143	188	207	293	244	426	328	417
CHEMICALS	2816	GALV	OH-PITTD	42	37	48	39	73	40	41	96	166	165	146	237
CHEMICALS	2816	GALV	TENN	13	24	87	94	97	141	190	734	757	574	407	291
CHEMICALS	2816	GIW-CC2MEX	GALV	149	205	210	167	155	134	202	252	301	319	267	356
CHEMICALS	2816	GIW-CC2MEX	GREEN	0	0	0	0	181	0	0	0	0	221	380	319
CHEMICALS	2816	GIW-CC2MEX	OH-LOUD	0	1	0	0	0	2	0	0	0	250	224	131
CHEMICALS	2816	GIW-GAL2CC	CHIC	11	38	42	41	74	60	97	114	320	235	112	71
CHEMICALS	2816	GIW-GAL2CC	GALV	265	347	394	445	425	373	327	415	547	616	557	546
CHEMICALS	2816	GIW-GAL2CC	OH-LOUD	8	33	91	31	30	236	322	188	316	233	430	551
CHEMICALS	2816	GIW-GAL2CC	TENN	72	67	65	147	153	100	171	121	332	303	164	154
CHEMICALS	2816	MISS-BR2NO	CHIC	102	170	189	171	234	210	154	167	140	191	238	207
CHEMICALS	2816	MISS-BR2NO	GALV	84	109	174	172	185	174	156	291	364	406	367	432
CHEMICALS	2816	MISS-BR2NO	ILL	324	339	385	204	307	328	344	354	429	1124	581	518
CHEMICALS	2816	MISS-BR2NO	KANA	123	146	149	81	78	69	64	122	122	157	124	103
CHEMICALS	2816	MISS-BR2NO	MISS-BR2NO	103	143	208	170	152	554	1158	1159	1309	1401	1360	1435
CHEMICALS	2816	MISS-BR2NO	MISS-MN2MO	315	356	316	219	273	325	203	205	130	154	210	221
CHEMICALS	2816	MISS-BR2NO	MISS-OH2BR	7	91	164	179	208	173	159	289	212	286	354	400
CHEMICALS	2816	MISS-BR2NO	OH-HUND	98	136	260	230	234	224	265	328	397	653	574	564
CHEMICALS	2816	MISS-BR2NO	OH-LOUD	361	553	606	702	461	347	418	322	619	596	620	596
CHEMICALS	2816	MISS-BR2NO	OH-PITTD	502	492	573	651	610	347	389	538	502	662	684	620
CHEMICALS	2816	MISS-BR2NO	TENN	196	270	443	484	656	432	486	470	459	445	479	475
CHEMICALS	2816	MISS-MN2MO	MISS-MN2MO	33	94	121	123	101	118	148	103	111	92	105	103
CHEMICALS	2816	OH-HUND	KANA	2149	2225	1956	2097	2046	1481	312	28	47	1022	1299	1027
CHEMICALS	2816	SAB-NECH	GALV	16	20	23	14	35	25	69	65	88	149	189	325
CHEMICALS	2816	SAB-NECH	GIW-GAL2CC	59	37	67	78	106	88	74	50	129	139	130	37
CHEMICALS	2816	WARR	TENN	15	19	18	14	24	19	19	119	31	38	119	30
BENZENE & TOLUENE	2817	GALV	GALV	221	234	511	424	361	370	563	585	524	504	804	671
BENZENE & TOLUENE	2817	GALV	GIW-CC2MEX	11	8	4	10	22	1	11	0	23	90	50	16
BENZENE & TOLUENE	2817	GALV	GIW-GAL2CC	24	90	100	138	124	197	194	248	168	166	163	77
BENZENE & TOLUENE	2817	GALV	OH-PITTD	14	13	13	14	30	14	25	28	31	61	99	30
BENZENE & TOLUENE	2817	GALV	SAB-NECH	13	14	39	54	58	44	65	95	88	47	69	83
BENZENE & TOLUENE	2817	GIW	ALL POINTS	1777	1443	1710	1740	1933	1843	2159	2127	1952	1928	1677	1615
BENZENE & TOLUENE	2817	GIW-CC2MEX	GALV	72	17	82	86	83	83	116	102	89	212	187	222
BENZENE & TOLUENE	2817	GIW-CC2MEX	GIW-CC2MEX	19	5	0	25	19	56	95	98	84	186	137	91
BENZENE & TOLUENE	2817	GIW-CC2MEX	GIW-GAL2CC	154	82	88	100	55	36	96	75	120	121	90	10

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COMMODITY	NUM.	ORIGIN	DESTINATION	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
BENZENE & TOLUENE	2817	GIW-GAL2CC	GALV	99	18	25	31	112	120	203	118	125	71	82	160
BENZENE & TOLUENE	2817	MISS-BR2NO	GIW-GAL2CC	26	14	11	49	101	45	67	34	8	41	131	17
BENZENE & TOLUENE	2817	MISS-BR2NO	MISS-BR2NO	142	151	169	83	74	71	62	107	119	124	131	205
BENZENE & TOLUENE	2817	MISS-MN2MO	MISS-MO2OH	8	4	0	29	70	0	42	3	1	15	78	67
BENZENE & TOLUENE	2817	MISS.R.SYS.	ALL POINTS	1421	1151	1472	1434	1824	1437	1560	1663	1462	1496	1397	1305
BENZENE & TOLUENE	2817	MON	OH-PITTD	7	8	48	40	86	53	84	77	73	83	63	70
BENZENE & TOLUENE	2817	SAB-NECH	GALV	148	134	220	92	127	129	97	150	174	148	172	323
BENZENE & TOLUENE	2817	SAB-NECH	MISS-BR2NO	33	48	61	33	77	72	89	116	109	83	85	46
BENZENE & TOLUENE	2817	SAB-NECH	SAB-NECH	32	39	16	36	68	41	51	64	55	52	63	79
BASIC CHEMICALS & PROD.	2819	GIW	ALL POINTS	4735	4994	5630	4964	5815	5175	5501	6116	7375	7993	7297	7655
BASIC CHEMICALS & PROD.	2819	MISS.R.SYS.	ALL POINTS	10450	10959	10065	9707	10700	9574	9368	10072	11243	13145	13401	13176
NITROGENOUS CHEM. FERTILIZERS	2871	MISS.R.SYS.	ALL POINTS	1013	1148	1312	1339	1349	1825	2195	2719	2664	2878	3185	3022
FERTILIZER AND MATERIALS	2879	MISS.R.SYS.	ALL POINTS	1444	1881	2950	2459	3096	2470	2224	2428	2509	2485	2911	2447
GASOLINE	2911	ATCH	MISS-BR2NO	0	20	11	14	25	22	13	0	13	8	196	57
GASOLINE	2911	ATCH	MISS-OH2BR	0	0	0	0	0	17	12	0	261	309	160	69
GASOLINE	2911	ATCH	OH-LOUD	0	0	0	0	0	0	0	0	0	140	122	9
GASOLINE	2911	GALV	MISS-BR2NO	129	200	205	285	215	343	279	0	232	215	358	523
GASOLINE	2911	GIW	ALL POINTS	9874	10551	8856	7076	6911	7296	6757	7948	7302	7060	7423	7927
GASOLINE	2911	GIW-MOB2NO	GIW-APAL2MOB	496	652	996	1096	1027	933	764	1064	1433	842	556	470
GASOLINE	2911	ILL	ILL	0	0	12	274	484	391	43	0	460	420	456	330
GASOLINE	2911	ILL	MISS-MO2OH	3	0	10	326	170	24	34	0	27	41	134	34
GASOLINE	2911	MISS-BR2NO	GALV	160	113	54	27	66	65	152	812	326	522	522	1108
GASOLINE	2911	MISS-BR2NO	KANA	255	234	230	263	223	267	281	266	296	343	288	184
GASOLINE	2911	MISS-BR2NO	MISS-BR2NO	174	363	230	369	432	668	465	1090	365	266	358	295
GASOLINE	2911	MISS-BR2NO	MISS-MO2OH	186	327	205	87	70	51	74	238	372	119	104	170
GASOLINE	2911	MISS-BR2NO	MISS-NO2MP	54	259	283	416	324	404	394	392	271	173	241	253
GASOLINE	2911	MISS-BR2NO	MISS-OH2BR	915	862	1001	1178	963	962	944	1093	1353	1353	1121	1003
GASOLINE	2911	MISS-BR2NO	OH-LOUD	463	387	665	704	663	514	506	485	525	461	358	261
GASOLINE	2911	MISS-BR2NO	SAB-NECH	0	101	38	46	58	48	48	71	36	23	158	53
GASOLINE	2911	MISS-BR2NO	WARR	190	236	141	233	182	153	176	149	158	153	125	128
GASOLINE	2911	MISS-BR2NO	WOLF	0	0	0	0	3	0	227	342	425	281	319	181
GASOLINE	2911	MISS-MN2MO	ILL	362	350	493	416	241	613	475	333	362	254	290	125
GASOLINE	2911	MISS-MN2MO	MISS-MN2MO	1194	1350	1471	1436	1223	1822	1552	1274	1186	976	938	889
GASOLINE	2911	MISS-MN2MO	OH-LOUD	280	395	447	633	818	1031	980	462	599	312	188	141
GASOLINE	2911	MISS-NO2MP	GIW-APL2MOB	578	343	288	265	258	214	185	119	137	311	298	162
GASOLINE	2911	MISS-NO2MP	OH-LOUD	464	269	293	334	452	461	313	499	503	493	414	107
GASOLINE	2911	MISS-NO2MP	TENN	24	16	47	69	80	81	135	126	96	102	143	132
GASOLINE	2911	MISS-NO2MP	WARR	254	213	309	118	47	72	48	71	140	218	154	240
GASOLINE	2911	MISS-NO2MP	WOLF	0	0	0	0	0	0	267	278	263	179	152	24
GASOLINE	2911	MISS-OH2BR	MISS-OH2BR	317	376	497	537	507	433	273	0	107	112	110	180
GASOLINE	2911	MISS-OH2BR	WOLF	0	0	0	0	0	0	65	0	120	147	174	350
GASOLINE	2911	MISS.R.SYS.	ALL POINTS	24017	24849	22609	21227	20099	20642	19827	20318	18739	17386	17647	16679
GASOLINE	2911	OH-HUND	KANA	81	82	94	79	62	109	134	0	229	207	295	241
GASOLINE	2911	OH-HUND	MON	310	282	311	347	370	365	397	0	368	339	299	323
GASOLINE	2911	OH-HUND	OH-HUND	257	293	261	335	368	339	464	0	766	543	725	619
GASOLINE	2911	OH-HUND	OH-LOUD	1068	1257	1189	1161	901	1037	1172	920	876	1115	1585	1466
GASOLINE	2911	OH-HUND	OH-PITTD	318	[illegible]	168	95	76	112	50	0	138	130	251	140
GASOLINE	2911	OH-LOUD	MISS-MO2OH	187	221	131	149	102	0	2	44	48	37	130	67
GASOLINE	2911	OH-LOUD	OH-HUND	403	457	478	409	459	454	392	392	411	366	276	292

Appendix C (continued)

COMMODITY	NUM.	ORIGIN	DESTINATION	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
GASOLINE	2911	OH-LOUD	OH-LOUD	1053	1076	1131	1359	1480	1319	1374	1069	1107	1013	917	1261
GASOLINE	2911	OH-LOUD	OH-PITTD	123	42	98	208	146	198	119	56	94	205	102	38
GASOLINE	2911	OH-LOUD	TENN	277	429	467	298	259	275	212	68	0	0	101	171
GASOLINE	2911	OH-LOUD	WOLF	0	0	0	0	0	0	294	144	52	106	161	75
GASOLINE	2911	OH-PITTD	MON	266	260	229	217	206	238	234	0	253	238	276	273
GASOLINE	2911	SAB-NECH	MISS-BR2NO	251	484	134	109	118	177	149	0	134	39	215	117
GASOLINE	2911	WARR	MISS-BR2NO	0	0	0	0	0	0	13	0	20	152	131	25
JET FUEL	2912	GIW	ALL POINTS	647	645	819	605	751	532	784	782	706	650	1249	1603
JET FUEL	2912	MISS.R.SYS.	ALL POINTS	1579	1672	1634	1539	1652	1336	1636	1709	1394	1451	1854	1924
DISTILLATE	2914	CALC	GIW-GAL2CC	0	17	14	13	2	0	0	2	2	0	105	416
DISTILLATE	2914	CHIC	CHIC	329	362	439	0	517	279	234	77	352	253	273	299
DISTILLATE	2914	GALV	GALV	218	234	361	531	378	301	544	722	481	437	649	592
DISTILLATE	2914	GALV	MISS-BR2NO	0	59	61	72	134	143	281	85	115	230	168	244
DISTILLATE	2914	GALV	SAB-NECH	248	483	608	512	697	276	370	469	265	200	177	189
DISTILLATE	2914	GIW	ALL POINTS	2741	4039	4656	4374	6020	5421	4342	5026	3791	4234	4624	5589
DISTILLATE	2914	GIW-CC2MEX	GALV	84	68	23	585	1221	269	114	352	194	558	472	468
DISTILLATE	2914	GIW-CC2MEX	GIW-CC2MEX	104	70	147	238	454	673	315	459	229	359	518	343
DISTILLATE	2914	GIW-MISS2SAB	GLFMEXI	25	40	87	54	60	49	62	103	126	145	105	78
DISTILLATE	2914	ILL	ILL	0	0	13	0	255	390	244	298	259	162	161	115
DISTILLATE	2914	MISS-BR2NO	ARK	0	0	0	60	80	91	97	88	103	158	165	94
DISTILLATE	2914	MISS-BR2NO	GIW-GALV	54	157	49	31	53	28	133	385	93	300	508	341
DISTILLATE	2914	MISS-BR2NO	KANA	64	57	66	77	71	73	80	94	91	112	106	66
DISTILLATE	2914	MISS-BR2NO	MISS-BR2NO	47	39	80	147	258	291	972	984	721	432	545	523
DISTILLATE	2914	MISS-BR2NO	MISS-NO2MP	108	271	329	409	477	434	420	438	365	327	416	567
DISTILLATE	2914	MISS-BR2NO	MISS-OH2BR	173	208	198	416	369	364	353	952	1051	882	522	688
DISTILLATE	2914	MISS-BR2NO	OH-LOUD	0	0	50	160	215	184	346	672	556	573	448	84
DISTILLATE	2914	MISS-BR2NO	TENN	2	0	59	63	63	245	289	123	236	67	154	31
DISTILLATE	2914	MISS-MN2MO	ILL	195	220	252	198	129	279	286	159	204	133	237	103
DISTILLATE	2914	MISS-MN2MO	MISS-MN2MO	579	509	584	552	548	784	697	633	548	86	335	172
DISTILLATE	2914	MISS-MN2MO	OH-LOUD	99	115	152	172	250	363	382	247	202	21	109	142
DISTILLATE	2914	MISS-MO2OH	MISS-MO2OH	79	33	44	34	42	0	0	95	117	48	104	46
DISTILLATE	2914	MISS-NO2MP	GIW-MISS2SAB	201	206	221	209	213	133	118	122	140	121	157	175
DISTILLATE	2914	MISS-NO2MP	MISS-NO2MP	68	45	60	120	154	53	111	81	325	204	168	136
DISTILLATE	2914	MISS-NO2MP	OH-LOUD	10	126	133	246	235	100	159	255	262	227	126	18
DISTILLATE	2914	MISS-OH2BR	MISS-OH2BR	229	251	280	376	481	440	314	183	117	124	115	235
DISTILLATE	2914	MISS-OH2BR	WOLF	0	0	0	0	0	0	113	88	70	62	167	138
DISTILLATE	2914	MISS.R.SYS.	ALL POINTS	6475	7327	8791	9707	10219	10343	12543	13198	11732	11039	10024	10200
DISTILLATE	2914	OH-HUND	KANA	1	3	56	40	49	73	105	23	38	71	142	113
DISTILLATE	2914	OH-HUND	MON	5	10	192	185	161	258	294	170	118	193	128	179
DISTILLATE	2914	OH-HUND	OH-HUND	1	13	179	248	233	279	247	222	210	299	335	300
DISTILLATE	2914	OH-HUND	OH-LOUD	7	10	330	323	231	201	231	108	14	409	422	430
DISTILLATE	2914	OH-HUND	OH-PITTD	14	2	165	182	242	210	243	191	94	152	222	144
DISTILLATE	2914	OH-LOUD	OH-HUND	121	170	186	200	244	170	153	244	205	212	184	161
DISTILLATE	2914	OH-LOUD	OH-LOUD	300	367	407	492	488	499	620	693	730	606	537	664
DISTILLATE	2914	OH-LOUD	SAB-NECH	0	17	32	7	38	0	4	0	0	0	0	39
DISTILLATE	2914	OH-LOUD	TENN	10	26	26	8	0	2	5	19	52	62	121	101
DISTILLATE	2914	OH-PITTD	MON	17	25	36	51	63	116	88	127	228	177	239	207
DISTILLATE	2914	OH-PITTD	OH-PITTD	3	2	0	0	20	42	6	24	96	115	163	129
DISTILLATE	2914	SAB-NECH	GALV	39	143	147	282	28	419	387	372	220	202	403	707

AD-A150 521 A GUIDE TO STRATEGIC PLANNING FOR THE INLAND BARGE AND TOWING INDUSTRY(U) DRAVO MECHLING CORP NEW ORLEANS LA B DIBNER ET AL. DEC 84 3861-4-00 MA-RD-770-85005 2/2

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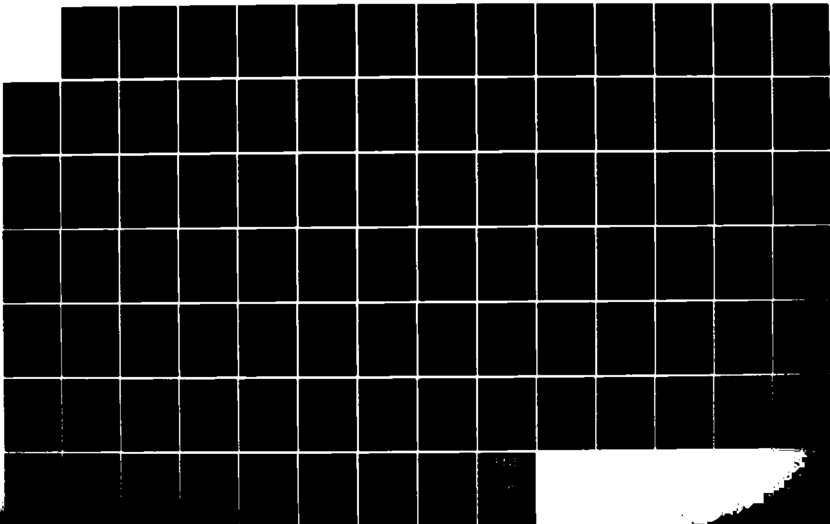

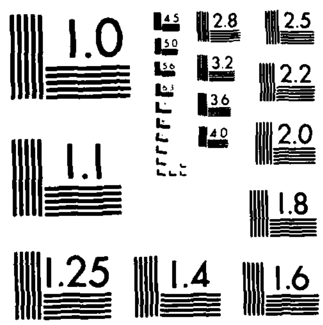

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

COMMODITY	NUM.	ORIGIN	DESTINATION	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
DISTILLATE	2914	TENN	TENN	0	0	0	0	0	0	0	7	38	115	120	102
RESID	2915	ARK	MISS-BR2ND	0	0	0	0	0	0	0	27	0	278	602	934
RESID	2915	ARK	MISS-OH2BR	0	0	0	0	0	5	196	163	200	140	179	140
RESID	2915	CHIC	MISS-BR2ND	74	10	10	42	42	109	334	18	55	122	308	393
RESID	2915	GALV	BR2ND	0	12	19	63	57	71	44	115	65	331	204	73
RESID	2915	GALV	GALV	1015	565	850	1240	1328	1494	1710	2493	3259	3169	3506	3334
RESID	2915	GALV	MISS-BR2ND	461	497	581	609	734	468	767	1145	721	1090	800	1005
RESID	2915	GALV	MISS-NO2MP	100	65	154	236	519	420	320	600	841	586	770	418
RESID	2915	GALV	MISS-NO2MP	6	40	27	0	0	13	11	0	15	16	120	20
RESID	2915	GALV	MISS-OH2BR	28	93	177	262	347	321	567	574	487	238	106	6
RESID	2915	GIW	ALL POINTS	5423	6402	6599	8024	9094	8338	10437	12944	12898	12679	12209	11403
RESID	2915	MISS-BR2MP	DOWN INBOUND	76	39	28	178	247	369	423	406	393	1406	2922	3270
RESID	2915	MISS-BR2ND	EXPORT	150	107	59	0	0	0	0	0	0	0	1	1540
RESID	2915	MISS-BR2ND	GALV	640	961	568	118	174	56	73	360	238	421	357	461
RESID	2915	MISS-BR2ND	GIW-MISS2SAB	42	68	36	69	94	81	115	141	105	140	146	102
RESID	2915	MISS-BR2ND	IMPORT	1	12	59	115	257	238	264	13	35	416	692	1105
RESID	2915	MISS-BR2ND	MISS-BR2ND	6	2	15	118	278	400	1027	2112	2695	2773	1833	1958
RESID	2915	MISS-BR2ND	MISS-NO2MP	34	43	141	18	26	328	775	1283	1147	1359	1464	1714
RESID	2915	MISS-BR2ND	MISS-OH2BR	21	122	372	302	400	494	571	1492	1543	1130	663	176
RESID	2915	MISS-BR2ND	SAB-NECH	11	5	88	12	28	44	120	51	41	76	139	84
RESID	2915	MISS-BR2ND	WARR	0	53	108	74	45	47	151	273	195	53	126	214
RESID	2915	MISS-MIN2ND	MISS-BR2ND	0	0	1	0	0	0	87	30	46	282	611	828
RESID	2915	MISS-MIN2ND	MISS-OH2BR	0	9	5	0	80	69	124	22	42	30	175	81
RESID	2915	MISS-NO2MP	COASTWISE	53	128	803	324	655	437	485	504	229	874	966	500
RESID	2915	MISS-NO2MP	DOWN INBOUND	37	54	161	34	357	544	965	1345	1260	1600	2040	2158
RESID	2915	MISS-NO2MP	EXPORT	0	2	79	19	0	0	0	0	0	0	0	236
RESID	2915	MISS-NO2MP	IMPORT	716	1017	630	1177	844	437	98	0	0	49	409	1068
RESID	2915	MISS-NO2MP	MISS-BR2ND	121	176	42	85	443	351	267	560	1059	1252	1033	738
RESID	2915	MISS-NO2MP	MISS-NO2MP	541	681	688	911	1261	1099	1008	1878	1283	2061	2633	2342
RESID	2915	MISS-OH2BR	MISS-BR2ND	0	0	0	0	0	0	0	0	10	153	169	176
RESID	2915	MISS.R.SYS.	ALL POINTS	6156	8763	10022	11500	14783	14025	17848	23439	24067	23052	20854	18673
RESID	2915	NATIONAL	EXPORT	3390	2432	2085	1910	813	1416	626	319	827	492	1065	5667
RESID	2915	OH-HUND	MISS-BR2ND	0	0	9	0	0	0	0	0	0	3	248	331
RESID	2915	OH-HUND	MISS-NO2MP	0	0	0	0	0	0	0	0	0	19	173	87
RESID	2915	OH-LOUD	MISS-BR2ND	0	4	0	0	9	14	12	33	0	69	231	145
RESID	2915	OH-LOUD	OH-PITTD	94	79	47	35	133	220	200	245	228	378	157	87
RESID	2915	SAB-NECH	MISS-BR2ND	30	86	26	31	99	261	345	518	615	402	289	215
RESID	2915	SAB-NECH	MISS-MISS2SAB	125	100	0	112	106	72	62	84	110	117	121	86
RESID	2915	SAB-NECH	MISS-NO2MP	15	18	14	117	163	112	137	270	373	314	404	171
RESID	2915	SAB-NECH	SAB-NECH	79	24	60	107	158	106	146	152	169	352	1028	365
LUBRICATING OILS & GREASES	2916	GIW	ALL POINTS	1457	1378	1527	1504	1793	1394	1706	1938	1730	1669	1423	1268
LUBRICATING OILS & GREASE	2916	MISS.R.SYS.	ALL POINTS	1566	1554	1513	1638	1836	1603	1733	2020	2048	2040	1904	1700
NAPHTHA, PETROLEUM SOLVENTS	2917	GIW	ALL POINTS	938	920	1007	980	1020	1092	1261	2220	2457	2941	2912	2236
NAPHTHA, PETROLEUM SOLVENTS	2917	MISS.R.SYS.	ALL POINTS	999	959	1064	1163	1255	889	1159	2199	2245	2493	2360	2101
ASPHALT, TAR & PITCHES	2918	MISS.R.SYS.	ALL POINTS	3126	3304	3163	2929	3380	3218	2693	2914	3030	2822	2131	2127
COKE, PETROLEUM COKE	2920	GIW	ALL POINTS	312	415	386	544	652	642	576	811	738	605	1193	1331
COKE, PETROLEUM COKE	2920	MISS.R.SYS.	ALL POINTS	752	821	1054	1029	1692	1771	1498	1883	2781	3203	3164	3494
BUILDING CEMENT	3241	MISS.R.SYS.	ALL POINTS	3059	3302	3759	3065	3107	2833	2992	3422	3152	3424	3029	3597
LIME	3271	MISS.R.SYS.	ALL POINTS	652	733	967	602	666	470	702	871	814	1034	1128	1206

Appendix C (continued)

COMMODITY	NUM.	ORIGIN	DESTINATION	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
STEEL & STEEL SEMI-FINISHED	3314	ILL	MISS-NO2MP	13	6	3	0	25	12	11	10	12	14	53	24
STEEL & STEEL SEMI-FINISHED	3314	LAKE MICH	MISS-NO2MP	47	0	0	5	0	5	3	0	0	0	25	0
STEEL & STEEL SEMI-FINISHED	3314	MISS-MN2MO	MISS-NO2MP	25	0	0	0	0	0	0	0	1	0	35	0
STEEL & STEEL SEMI-FINISHED	3314	MISS-NO2MP	OH-LOUD	0	2	0	0	2	19	35	14	15	59	10	7
STEEL & STEEL SEMI-FINISHED	3314	MON	OH-PITTD	12	28	2	19	0	1	25	22	49	151	104	210
STEEL & STEEL SEMI-FINISHED	3314	OH-HUND	GALV	0	12	10	0	1	0	0	0	4	0	56	30
STEEL & STEEL SEMI-FINISHED	3314	OH-HUND	MISS-NO2MP	5	0	0	0	3	0	0	0	0	0	33	2
STEEL & STEEL SEMI-FINISHED	3314	OH-HUND	OH-PITTD	0	17	0	7	2	25	4	12	28	9	35	42
STEEL & STEEL SEMI-FINISHED	3314	OH-PITTD	MISS-MO2OH	11	0	0	24	0	0	0	0	37	122	0	0
STEEL & STEEL SEMI-FINISHED	3314	WARR	WARR	142	10	11	1	0	0	5	20	34	32	9	9
IRON & STEEL FINISHED PROD.	3315	CHIC	GALV	97	70	54	63	72	70	63	50	51	53	55	53
IRON & STEEL FINISHED PROD.	3315	CHIC	MISS-NO2MP	104	17	25	82	114	22	46	22	42	55	51	17
IRON & STEEL FINISHED PROD.	3315	GALV	GIW-MISS2SAB	42	49	59	63	105	80	35	41	54	65	111	115
IRON & STEEL FINISHED PROD.	3315	LAKE MICH	ARK	13	28	17	4	24	15	31	40	42	45	73	99
IRON & STEEL FINISHED PROD.	3315	LAKE MICH	CUMB	7	14	17	24	28	31	36	34	27	21	62	120
IRON & STEEL FINISHED PROD.	3315	LAKE MICH	GALV	58	49	45	67	112	40	89	60	57	55	142	270
IRON & STEEL FINISHED PROD.	3315	LAKE MICH	ILL	70	56	112	101	71	52	51	50	41	73	41	37
IRON & STEEL FINISHED PROD.	3315	LAKE MICH	MISS-MN2MO	13	21	16	35	17	107	110	35	33	52	53	67
IRON & STEEL FINISHED PROD.	3315	LAKE MICH	MISS-NO2MP	335	38	35	81	96	36	69	67	33	15	74	46
IRON & STEEL FINISHED PROD.	3315	LAKE MICH	MISS-NO2OH	63	104	120	114	139	0	0	75	57	41	72	35
IRON & STEEL FINISHED PROD.	3315	LAKE MICH	OH-LOUD	6	15	25	23	34	11	27	18	39	72	79	114
IRON & STEEL FINISHED PROD.	3315	LAKE MICH	TENN	29	29	51	86	91	60	55	55	45	33	77	104
IRON & STEEL FINISHED PROD.	3315	LAKE MICH	WOLF	44	47	38	22	8	1	53	53	32	43	47	55
IRON & STEEL FINISHED PROD.	3315	MISS-BR2NO	GALV	0	37	122	86	102	45	13	0	8	35	68	110
IRON & STEEL FINISHED PROD.	3315	MISS-NO2MP	CHIC	130	262	110	144	292	381	305	294	282	232	103	104
IRON & STEEL FINISHED PROD.	3315	MISS-NO2MP	CUMB	54	84	84	43	52	38	65	87	167	100	77	34
IRON & STEEL FINISHED PROD.	3315	MISS-NO2MP	MISS-OH2BR	102	177	110	96	124	86	25	43	57	63	35	39
IRON & STEEL FINISHED PROD.	3315	MISS-NO2MP	OH-LOUD	143	171	154	145	127	170	120	217	173	134	85	69
IRON & STEEL FINISHED PROD.	3315	MON	GALV	203	45	70	33	47	35	32	11	27	51	40	55
IRON & STEEL FINISHED PROD.	3315	MON	MISS-NO2MP	306	47	87	115	115	22	32	30	28	28	27	4
IRON & STEEL FINISHED PROD.	3315	MON	MON	810	137	25	40	102	36	26	14	3	16	1	0
IRON & STEEL FINISHED PROD.	3315	MON	OH-LOUD	216	143	170	274	291	209	254	173	200	322	258	265
IRON & STEEL FINISHED PROD.	3315	OH-PITTD	ARK	27	50	74	35	56	34	36	44	50	68	55	60
IRON & STEEL FINISHED PROD.	3315	OH-PITTD	GALV	109	74	116	100	124	56	69	53	64	62	73	67
IRON & STEEL FINISHED PROD.	3315	OH-PITTD	MISS-NO2MP	82	8	21	24	49	18	9	16	14	40	34	20
IRON & STEEL FINISHED PROD.	3315	OH-PITTD	MISS-NO2OH	95	111	140	123	120	113	0	71	61	62	24	22
IRON & STEEL FINISHED PROD.	3315	OH-PITTD	OH-LOUD	201	227	217	180	241	166	160	125	118	150	87	82
IRON & STEEL FINISHED PROD.	3315	OH-PITTD	TENN	75	81	113	96	114	45	70	60	55	72	40	62
IRON & STEEL FINISHED PROD.	3315	OH-PITTD	WOLF	16	6	10	17	6	6	50	39	55	84	64	64
IRON & STEEL FINISHED PROD.	3315	WARR	GALV	51	46	35	30	27	37	51	13	21	22	16	59
IRON & STEEL FINISHED PROD.	3315	WARR	WARR	83	84	110	125	87	21	31	13	24	8	21	14
IRON & STEEL PLATES, SHEETS	3316	MISS.R.SYS.	ALL POINTS	1920	2479	2337	2460	3152	2252	2401	2672	2536	2624	2116	1726
IRON & STEEL PIPE	3317	GALV	GALV	2	75	3	34	75	44	43	65	89	83	58	132
IRON & STEEL PIPE	3317	GIW-GAL2CC	MISS-MN2MO	0	0	0	0	0	0	0	0	12	0	30	0
IRON & STEEL PIPE	3317	GIW-MISS2SAB	GULF-MEX	182	143	218	183	184	221	220	214	163	179	180	174

Appendix C Footnotes

[1]Table of Abbreviations for Commodity Flows

Abbreviations	Origin or Destination
ALL	All rivers
MISS.R. SYS.	Mississippi River System
MISS	Mississippi River
MISS-MN2NO	Mississippi River-Minnesota River to New Orleans
MISS-MN2MO	Mississippi River-Minnesota River to Missouri River
MISS-MO2NO	Mississippi River-Missouri River to New Orleans
MISS-MO2OH	Mississippi River-Missouri River to Ohio River
MISS-OH2BR	Mississippi River-Ohio River to Baton Rouge
MISS-BR2NO	Mississippi River-Baton Rouge to New Orleans
MISS-NO2MP	Mississippi River-New Orleans to Mouth of Passes
MIN	Minnesota River
STCRX	St. Croix River
CHIC	Chicago
LAKE MICH	Lake Michigan
ILL	Illinois Waterway
MO	Missouri River
OH-PITD	Ohio River-Pittsburgh District
OH-HUND	Ohio River-Huntington District
OH-LOUD	Ohio River-Louisville District
MON	Monongahela River
KANA	Kanawha River
BIG SANDY	Big Sandy River
GREEN	Green and Barren Rivers
CUMB	Cumberland River
TENN	Tennessee River
WARR	Warrior, Black Warrior, Tombigbee, Alabama and Mobile Rivers
WOLF	Wolf River
ARK	Arkansas River
WHITE	White River
YAZOO	Yazoo River
OUCH/BLK	Ouchita/Black River
ATCH	Atchafalaya River
GIW	Gulf Intracoastal Waterway
GIW-FLA2ALA	Gulf Intracoastal Waterway-Florida to Alabama River
GIW-APP2MOB	Gulf Intracoastal Waterway-Appalachicola to Mobile
GIW-MOB2NO	Gulf Intracoastal Waterway-Mobile to New Orleans
GIW-MISS2SAB	Gulf Intracoastal Waterway-Mississippi River to Sabine River
GIW-GAL2CC	Gulf Intracoastal Waterway-Galveston to Corpus Christi
GIW-CC2MEX	Gulf Intracoastal Waterway-Corpus Christi to Mexico
GLFMEX	Gulf of Mexico
ESCAM	Escambia River
CALC	Calcasieu River
SAB-NECH	Sabine and Neches Rivers
GALV	Galveston

[2]Commodity descriptions:

Other Grains includes Barley and Rye (0102), Oats (0104), Rice (0105), and Sorghum Grains (0106).

Fertilizers and Materials includes Phosphate Rock (1471), Natural Fertilizer Materials, NEC (1479), Nitrogeneous Chemical Fertilizers (2871), Potassic Chemical Fertilizers (2872), Phosphoric Chemical Fertilizers (2873), and Fertilizers and Fertilizer Materials, NEC (2879).

Chemicals includes Radioactive and Associate Materials (2816), Basic Chemicals and Basic Chemical Products, NEC (2819), Plastic Mateirals (2821), and Insecticides, Fumicides, Pesticides, and Disinfectants (2876).

Iron and Steel Finished Products includes Iron and Steel Bars, Rods, Angles, Shapes, and Sections, Including Sheet Piling (3315), Iron and Steel Plates and Sheets (3316), and Primary Iron and Steel Products, NEC, including Castings (3319).

[3]Source: U.S. Army Corps of Engineers Waterborne Commerce of the United States, Part 5.

APPENDIX D

BARGE LINE CAPABILITIES

Appendix D

BARGE LINE CAPABILITIES

	Regulated										Grain	
	ACBL	OHC	ORCO	Valley	FBL	TCB	SCNO	Dixie	Riverway	OBL	Consolidated	Wisconsin
Towboats	x	x	x	x	x	x	x	x	x	x	x	x
Dry Barges	x	x	x	x	x	x	x	x	x	x	x	x
Covered	x	x	x	x	x	x	x		x	x	x	x
Open	x	x	x	x	x		x	x		x		x
Deck		x										
Heavy		x										
Tank Barges							x	x	x	x		
Clean	x	x	x		x			x				
Dirty	x	x	x					x				
Pres./Temp. Controlled												
Terminals												
General		x				x						
Grain						x					x	
Liquid												
Coal-Onload	x		x		x							
Coal-Transload	x	x			x							
Building												
Towboats	x	x			x							
Barges	x	x	x		x	x				x		
Repair												
Drydock—Upper River	x				x		x					x
Drydock—Lower River	x		x									x
Fleet Repair—Upper River	x	x	x	x	x	x	x		x			x
Fleet Repair—Lower River	x		x				x		x			x
Midstream												
Fuel—Upper River						x						
Fuel—Lower River			x									
Stores—Upper River						x						
Stores—Lower River			x									
Fleeting												
Upper Mississippi						x	x		x			
Illinois	x	x		x			x					
St. Louis	x	x		x	x		x		x		x	x
Ohio	x	x	x							x		
Cairo	x	x	x	x	x		x		x			x
Baton Rouge		x	x	x		x						
New Orleans	x	x	x	x			x		x	x		x

(continued)

Appendix D (continued)

BARGE LINE CAPABILITIES

	Grain—Private					Coal					Coal-Private		
	Agri-Trans	ARTCO	Cargo Carriers	Conagra/ Peavey	Conti-Carriers	Campbell	Crounse	M/G	McDonough	Mon River	AEP	Mid-South	Mid-Amer[illegible]
Towboats	x	x	x	x	x	x	x	x	x	x	x	x	[illegible]
Dry Barges	x		x	x	x	x	x	x	x	x	x	x	x
Covered	x		x	x	x				x			x	
Open			x	x		x	x	x	x	x	x	x	
Deck									x				
Heavy													
Tank Barges	x	x	x						x	x			
Clean													
Dirty													
Pres./Temp. Controlled													
Terminals													
General													
Grain	x	x	x	x	x								
Liquid	x												
Coal-Onload											x		
Coal-Transload												x	x
Building													
Towboats													
Barges			x										
Repair													
Drydock—Upper River								x		x			
Drydock—Lower River	x				x								
Fleet Repair—Upper River			x					x		x			
Fleet Repair—Lower River	x	x	x	x	x						x		
Midstream													
Fuel—Upper River													
Fuel—Lower River													
Stores—Upper River													
Stores—Lower River													
Fleeting													
Upper Mississippi													
Illinois													
St. Louis	x		x	x	x								
Ohio						x							
Cairo													
Baton Rouge			x	x			x						
New Orleans	x	x	x	x	x						x		

(continued)

Appendix D (continued)

BARGE LINE CAPABILITIES

	Liquid				
	Brent	Canal	Scott Chotin	Gladders	Hines
Towboats	x	x	x	x	x
Dry Barges		x	x	x	
Covered			x	x	
Open		x		x	
Deck		x			
Heavy					
Tank Barges	x	x	x	x	x
Clean					
Dirty					
Pres./Temp. Controlled					
Terminals					
General					
Grain					
Liquid		x			
Coal-Onload					
Coal-Transload					
Building					
Towboats	x				
Barges					
Repair					
Drydock—Upper River					
Drydock—Lower River	x				
Fleet Repair—Upper River					
Fleet Repair—Lower River	x				
Midstream					
Fuel—Upper River					
Fuel—Lower River					
Stores—Upper River					
Stores—Lower River					
Fleeting					
Upper Mississippi					
Illinois					
St. Louis					
Ohio					
Cairo					
Baton Rouge					
New Orleans					

Source: TBS/DMC data.

APPENDIX E

SAMPLE TELEPHONE
MARKET SURVEY

Company ______________________________ Date ____________________

TELEPHONE SURVEY OF RIVER SHIPPERS

Hello, my name is ____________________, from the economic and management consulting firm of Temple, Barker & Sloane, Inc., in Lexington, Massachusetts. We are conducting a survey for an inland barge line client to learn how they can improve their services to shippers on the inland waterways.

1. Do you select barge companies to move freight on the inland waterways?

   If NO:

   Who should I speak to? ______________________________

   What is the telephone number? ______________________________

2. Are you responsible for:

Grain	____	Go to page 2
Coal	____	Go to page 3
Other Dry Bulk Cargoes	____	Go to page 4
Liquid Cargoes	____	Go to page 5
Regulated or breakbulk cargo?	____	Go to page 6

GRAIN

	ACBL	ARTCO	BUNGE	CARGO CARRIERS	CONSOLIDATED	DRAVO-MECHLING	FEDERAL	RIVERMEN
1. Of the following barge lines, which do you think gives the best overall service? (Write 1 for Best, 2 Next Best, etc.)	___	___	___	___	___	___	___	___
2. Which do you think best delivers the barges for loading where and when you need them? (Best, next best, etc.)	___	___	___	___	___	___	___	___
3. Which barges do you think provides the best quality barges? (Best, next best, etc.)	___	___	___	___	___	___	___	___
4. Which do you think best keeps you advised of barge locations and problems? (Best, next best, etc.)	___	___	___	___	___	___	___	___
5. Which do you think is best in solving problems of accounting, claims, and other aspects of the move? (Best, next best, etc.)	___	___	___	___	___	___	___	___
6. Which do you think is the most cost competitive? (Best, next best, etc.)	___	___	___	___	___	___	___	___

7. Is there any barge line that you think is better than __________ (Name best):

   1. for overall service? ____________________
   2. for delivering empty barges? ____________________
   3. for quality barges? ____________________
   4. for keeping you advised? ____________________
   5. for solving problems? ____________________
   6. for cost competitiveness? ____________________

7. How can barge line service be improved for your cargo? ____

____

____

____

____

COAL

	ACBL	CROUNSE	DRAVO-MECHLING	FEDERAL	ORCO
1. Of the following barge lines, which do you think gives the best overall service? (Write 1 for Best, 2 Next Best, etc.)	___	___	___	___	___
2. Which do you think best delivers the barges for loading where and when you need them? (Best, next best, etc.)	___	___	___	___	___
3. Which barges do you think provides the best quality barges? (Best, next best, etc.)	___	___	___	___	___
4. Which do you think best keeps you advised of barge locations and problems? (Best, next best, etc.)	___	___	___	___	___
5. Which do you think is best in solving problems of accounting, claims, and other aspects of the move? (Best, next best, etc.)	___	___	___	___	___
6. Which do you think is the most cost competitive? (Best, next best, etc.)	___	___	___	___	___

7. Is there any barge line that you think is better than __________ (Name best):

   1. for overall service? ____________
   2. for delivering empty barges? ____________
   3. for quality barges? ____________
   4. for keeping you advised? ____________
   5. for solving problems? ____________
   6. for cost competitiveness? ____________

7. How can barge line service be improved for your cargo? ____

____

____

____

____

OTHER DRY BULK

	ACBL	CONSOLIDATED	CONTI-CARRIERS	DRAVO-MECHLING	MEMCO	VALLEY
1. Of the following barge lines, which do you think gives the best overall service? (Write 1 for Best, 2 Next Best, etc.)	___	___	___	___	___	___
2. Which do you think best delivers the barges for loading where and when you need them? (Best, next best, etc.)	___	___	___	___	___	___
3. Which barges do you think provides the best quality barges? (Best, next best, etc.)	___	___	___	___	___	___
4. Which do you think best keeps you advised of barge locations and problems? (Best, next best, etc.)	___	___	___	___	___	___
5. Which do you think is best in solving problems of accounting, claims, and other aspects of the move? (Best, next best, etc.)	___	___	___	___	___	___
6. Which do you think is the most cost competitive? (Best, next best, etc.)	___	___	___	___	___	___

7. Is there any barge line that you think is better than __________ (Name best):

   1. for overall service? ____________________
   2. for delivering empty barges? ____________________
   3. for quality barges? ____________________
   4. for keeping you advised? ____________________
   5. for solving problems? ____________________
   6. for cost competitiveness? ____________________

7. How can barge line service be improved for your cargo? ____

____

____

____

____

LIQUID

	ACBL	DIXIE	DRAVO-MECHLING	NATIONAL MARINE	ORCO (CHOTIN)
1. Of the following barge lines, which do you think gives the best overall service? (Write 1 for Best, 2 Next Best, etc.)	___	___	___	___	___
2. Which do you think best delivers the barges for loading where and when you need them? (Best, next best, etc.)	___	___	___	___	___
3. Which barges do you think provides the best quality barges? (Best, next best, etc.)	___	___	___	___	___
4. Which do you think best keeps you advised of barge locations and problems? (Best, next best, etc.)	___	___	___	___	___
5. Which do you think is best in solving problems of accounting, claims, and other aspects of the move? (Best, next best, etc.)	___	___	___	___	___
6. Which do you think is the most cost competitive? (Best, next best, etc.)	___	___	___	___	___

7. Is there any barge line that you think is better than ___________ (Name best):

   1. for overall service? ______________
   2. for delivering empty barges? ______________
   3. for quality barges? ______________
   4. for keeping you advised? ______________
   5. for solving problems? ______________
   6. for cost competitiveness? ______________

7. How can barge line service be improved for your cargo? ____

____

____

____

____

REGULATED (OR BREAKBULK)

	ACBL	DRAVO MECHLING	FEDERAL	ORCO	SCNO	VALLEY
1. Of the following barge lines, which do you think gives the best overall service? (Write 1 for Best, 2 Next Best, etc.)	___	___	___	___	___	___
2. Which do you think best delivers the barges for loading where and when you need them? (Best, next best, etc.)	___	___	___	___	___	___
3. Which barges do you think provides the best quality barges? (Best, next best, etc.)	___	___	___	___	___	___
4. Which do you think best keeps you advised of barge locations and problems? (Best, next best, etc.)	___	___	___	___	___	___
5. Which do you think is best in solving problems of accounting, claims, and other aspects of the move? (Best, next best, etc.)	___	___	___	___	___	___
6. Which do you think is the most cost competitive? (Best, next best, etc.)	___	___	___	___	___	___

7. Is there any barge line that you think is better than __________ (Name best):

   1. for overall service? ____________________
   2. for delivering empty barges? ____________________
   3. for quality barges? ____________________
   4. for keeping you advised? ____________________
   5. for solving problems? ____________________
   6. for cost competitiveness? ____________________

7. How can barge line service be improved for your cargo? ____________________

____

____

____

____

Thank you for your assitance, we know that this information will help our client be more responsive to the needs of you and other barge shippers.

Verify Name______________________________

Phone Number______________________________

Address______________________________

____

____

____

Appendix F

EXAMPLES OF FORECASTING METHODOLOGY

Appendix F

EXAMPLES OF FORECASTING METHODOLOGY

The forecasting procedures are explained below with two examples of fertilizer and grain.

FERTILIZER

Tons of fertilizer movements on the Mississippi River System were forecasted and are displayed in Figure F-1. The table shows historical and forecasted fertilizer barge traffic, national fertilizer production, and the nondimensional parametric explanatory factor. Note that 1982 is the last year in which complete data were available. The figure is separated after that year to single out forecasted data. The analysis begins from left to right for the historical data and then continues from right to left for the forecasted data. Each column will be explained below in that order.

Data Sources for 1970-1982

Column 1. Historical Mississippi River System fertilizer movements in short tons were available in Part 2 of the U.S. Army Corps of Engineers (CofE) Waterborne Commerce of the United States.

Column 2. All U.S. fertilizer consumption is found in the Statistical Abstract of the United States.

Column 3. Data Resources, Inc. (DRI) publishes an historical fertilizer production index in its U.S. Long Term Review.

Column 4. An explanatory factor showing the relative quantities of barge traffic to national consumption was calculated by dividing Column 1 by Column 2.

Forecasting Methodology for 1983-1990

Column 1. The forecasts of Mississippi River System traffic were calculated by multiplying the explanatory factors in Column 4 by the forecasted national consumption figures in Column 2.

Figure F-1

MISSISSIPPI RIVER SYSTEM TRAFFIC AND FORECAST FERTILIZER

Year	1 Mississippi River System Fertilizer Movements[1] (millions of short tons)	2 All U.S. Fertilizer Consumption[2] (millions of tons)	3 DRI Index of Production for Agricultural Chemicals (1967 = 1.000)	4 Explanatory Factor (1÷3)
1970	3.9	39.6	1.079	.098
1971	4.5	39.9	1.035	.113
1972	6.5	39.9	1.089	.163
1973	5.9	41.8	1.270	.141
1974	6.5	47.1	1.447	.138
1975	6.2	42.5	1.641	.146
1976	6.0	49.2	1.854	.122
1977	7.0	51.6	2.012	.136
1978	7.1	47.5	2.118	.149
1979	7.6	51.5	2.216	.148
1980	8.4	52.8	2.307	.159
1981	7.3	54.0	2.415	.135
1982	6.5	48.7	2.087	.133
1983F	6.3	45.1	1.932[a]	.14
1984F	6.7	48.0	2.056[a]	.14
1985F	7.3	51.9	2.223[a]	.14
1986F	7.7	55.0	2.357[a]	.14
1987F	8.2	58.7	2.514[a]	.14
1988F	8.7	62.0	2.657[a]	.14
1989F	8.9	63.8	2.734[a]	.14
1990F	9.3	66.6	2.855[a]	.14

[1]Source: U.S. Army Corps of Engineers, Waterborne Commerce of the United States, Part 2 (phosphate rock, nitrogenous chemical fertilizers, fertilizers and materials, n.e.c., and lime).
[2]Data Resources, Inc., U.S. Long Term Review, Winter 1983-84, p. 11.47.
[3]Source: DOC, Statistical Abstract of the United States, (FEA), p. 670.
[a]DRI, op. cit., CYCLELONG1283, p. 1.127.

F = Forecasted.

Column 2. The forecast of total U.S. fertilizer consumption was calculated with the ratio of the DRI index to the U.S. consumption for the last year of actual data (1982). This factor of 23.33 (48.7 divided by 2.087) was then multiplied by the DRI index in Column 3 to get forecasted U.S. consumption in Column 2.

Column 3. The DRI forecasts of national fertilizer production were obtained for recent years from the U.S. Long Term Review.

Column 4. An average of .14 for the explanatory factor was calculated and used for future years. This represents a constant ratio for Mississippi River System traffic compared to total U.S. consumption.

GRAIN

The mechanism that is used to determine expected barge demand for grain transportation focuses on export demand. Grain export demand forecasts have been developed by DRI for both short and long terms. Historical data describing exports is available from the U.S. Department of Agriculture (USDA) and historical data describing river movements is available from the CofE. As we proceed through the analysis tabulated in Figure F-2, specific sources will be cited.

As before, the analysis begins from left to right for the historical data and then generally from right to left for the forecasted data. Each column will be explained below in that order.

Data Sources for 1970-1982

Column 1. Historical Mississippi River System grain movements in short tons are available in Part 2 of CofE's Waterborne Commerce of the United States.

Column 2. The number of bushels of Mississippi River grain exported through ports on the Gulf of Mexico was found in USDA's Grain and Feed Market News.

Column 3. An explanatory factor showing the relative proportion of barge movements to Gulf exports was calculated by dividing Column 1 by Column 2. Note that the different units, short tons and bushels, were ignored.

Figure F-2

MISSISSIPPI RIVER SYSTEM TRAFFIC AND FORECAST
GRAIN

Year	1 Mississippi River System Grain Movements[1] (millions of short tons)	2 Mississippi River Gulf Exports[2] (millions of bushels)	3 (1÷2) Gulf Export Share of MRS Traffic Explanatory Factor	4 Total U.S. Grain Exports[2] (millions of bushels)	5 (2÷4) Mississippi River Gulf Exports as Percent U.S. Exports (%)	6 FFB Percent Value Change[3] 1967 = 100	7 DRI Unit Index of FFB Export by Volume	8 DRI FFB Exports[4] (billions of current $)	9 (8÷7) Export Volume Index	10 (4÷9) Volume Explanatory Factor
1970	23.9	684.0	.0349	1826.2	37.5	3.4	.999	5.9	5.91	309.0
1971	24.6	635.6	.0387	1705.7	37.3	6.9	1.068	6.1	5.72	298.2
1972	30.9	957.0	.0324	2318.8	41.3	4.1	1.112	7.5	6.74	344.0
1973	32.2	1172.7	.0275	3511.9	33.4	56.3	1.738	15.1	8.69	404.1
1974	35.6	1135.8	.0313	2880.1	39.4	27.0	2.207	18.5	8.38	343.7
1975	39.4	1165.4	.0338	3159.4	36.9	5.1	2.319	19.1	8.24	383.4
1976	48.8	1514.7	.0322	3560.5	42.5	-9.2	2.106	19.7	9.35	380.8
1977	46.8	1486.8	.0315	3367.4	44.2	-0.3	2.100	19.6	9.33	360.9
1978	55.0	1645.2	.0334	4197.2	39.2	5.1	2.207	25.0	11.33	370.5
1979	54.7	1750.4	.0313	4561.8	38.4	11.9	2.469	29.6	11.99	380.5
1980	64.4	1947.1	.0331	4929.8	39.5	5.8	2.613	35.3	13.51	367.1
1981	66.3	2092.1	.0317	4940.9	42.3	5.0	2.743	37.9	13.82	357.5
1982	73.8	2284.5	.0323	4757.9	48.0	-11.9	2.417	31.4	12.95	367.4
1983F	73.1	2283	.032	4566	50.0	3.8[a]	2.509	31.4[b]	12.51	365
1984F	70.2	2194	.032	4570	48.0	12.4[a]	2.820	35.3[b]	12.52	365
1985F	71.6	2239	.032	4763	47.0	3.8[a]	2.927	38.2[b]	13.05	365
1986F	72.5	2267	.032	4928	46.0	5.0[a]	3.073	41.5[b]	13.50	365
1987F	75.7	2367	.032	5260	45.0	7.5[a]	3.304	47.6[b]	14.41	365
1988F	79.3	2479	.032	5632	44.0	12.6[a]	3.720	57.4[b]	15.43	365
1989F	80.8	2524	.032	5869	43.0	12.5[a]	4.185	67.3[b]	16.08	365
1990F	82.9	2591	.032	6169	42.0	4.9[a]	4.390	74.2[b]	16.90	365

[1] U.S. Army Corps of Engineers, Waterborne Commerce of the United States, Part 2.
[2] U.S. Department of Agriculture, Grain and Feed Market News.
[3] Data Resources, Inc., U.S. Long Term Review, Winter 1983-1984, p. 11.27. (Exports of goods: Foods, Feeds, and Beverages [FFB]).
[4] Ibid., p. 11.25.
[a] Ibid., p. 1.87. Cyclelong 1283.
[b] Ibid., p. 1.85.

F - Forecasted

Column 4. Total U.S. grain exports from all coastal areas were also found in USDA's Grain and Feed Market News.

Column 5. The percent of Mississippi River Gulf Coast grain exports compared to total U.S. grain exports was calculated by dividing Mississippi River exports of Column 2 by total U.S. exports in Column 4.

Column 6. In DRI's Long Term Review, historical annual changes in a unit value index for exports of Foods, Feeds, and Beverages (FFB) were found. The base year was established in 1967. The percentages of change for each successive year is then shown.

Column 7. Beginning with an index value of 1.0, the percentages of change in Column 6 were multiplied by the previous year's index in Column 7 value to determine each year's actual value.

Column 8. The total value of FFB exports in current dollars for each year were also found in DRI's history tables.

Column 9. In order to eliminate variations caused by annual changes of average unit costs for bushels of grain, current export values in Column 8 were divided by the unit value indexes of Column 7 to give a new measure of food volume exported in each year.

Column 10. The volume index in Column 9 was divided into the total U.S. grain exports in Column 4 to obtain a volume explanatory factor.

Forecasting Methdology for 1983-1990

Column 10. An average of the volume explanatory factor was calculated at 365 and applied to all forecast years.

Column 9. The forecasts of the export volume index were calculated by dividing the forecasts of FFB exports in Column 8 by the unit value index in Column 7.

Column 8. Forecasts of FFB exports in current dollars were found in DRI's U.S. Long Term Review.

Column 7. The unit index of FFB exports by volume were calculated by multiplying the previous year's index in Column 7 by the percentages of change in Column 6.

<u>Column 6</u>. Forecasts of FFB percentages of value changes were also in DRI's <u>U.S. Long Term Review</u>.

<u>Column 5</u>. Estimates of share of Mississippi River exports as a percentage of national exports were made for future years. The share is estimated to drop from 50 percent in 1983 to 42 percent in 1990.

<u>Column 4</u>. The forecasts for total U.S. grain exports were calculated by multiplying the export volume index of Column 9 by the volume explanatory factor of Column 10.

<u>Column 3</u>. The export share explanatory factor of Mississippi River traffic was averaged and applied to all forecast years.

<u>Column 2</u>. The forecasted amounts of Mississippi River Gulf exports were calculated by multiplying the Mississippi River percent of U.S. exports in Column 5 by the total U.S. exports in Column 4.

<u>Column 1</u>. The Mississippi River grain movement forecasts were then finally determined by multiplying the Mississippi River Gulf exports in Column 2 by the explanatory factor in Column 3.

Appendix G

FORECAST OF BARGE TRANSPORTATION DEMAND BY COMMODITY

Appendix G

FORECAST OF BARGE TRANSPORTATION DEMAND BY COMMODITY

GRAIN FORECAST

Because the inland waterways industry transports more ton-miles per year of grain than any other commodity, the grain forecast is the largest and most important component of the industry's forecast. Although more tons of coal per year move through the inland waterways, grain represents more ton-miles because of the longer average trips of grain cargoes.

The category grain is composed of corn, wheat, soybeans, prepared animal feeds, and grain mill products, but this forecast analyzes it as an aggregate of these commodities.

Summary Forecast

Figure G-1 summarizes the historical and forecast traffic for grain. Note that this forecast provides more than one possible outcome. The reasons are: the barge services' rate levels are a question mark, and equally uncertain is the barge industry's ability to compete for the grain market.

To reflect these uncertainties, two outcomes are forecast. The base case assumes that the rates recover and the barge share of total U.S. exports declines from its 1983 peak (50 percent of all U.S. exports) to a 1990 share of 42 percent. The second case is a high-traffic scenario, in which the rivers' share of U.S. exports remains at a constant 50 percent. The outcome would be increased traffic but severely depressed rates. This high-traffic forecast is presented in parentheses in Figure G-1 and was not used in the example forecast of total traffic that was shown in Figure F-2.

The figure's Column 1 presents the historical and forecast grain traffic on the Mississippi River System. After the traffic rose dramatically from 23.9 million short tons in 1970, it peaked at 73.8 million tons in 1982. Under a scenario of rising rates and reduced river share of national exports (the base case), the forecast calls for a slow decline, followed by a slow increase from a low of 70.2 million tons in 1984 to 82.9 million tons in 1990.

Figure G-1

MISSISSIPPI RIVER SYSTEM TRAFFIC AND FORECAST
GRAIN

Year	1 Mississippi River System Grain Movements[1] (millions of short tons)	2 Mississippi River Gulf Exports[2] (millions of bushels)	3 (1÷2) Gulf Export Share of MRS Traffic Explanatory Factor	4 Total U.S. Grain Exports[2] (millions of bushels)	5 (2÷4) Mississippi River Gulf Exports as Percent U.S. Exports (%)	6 FFB Percent Value Change[3] 1967 = 100	7 DRI Unit Index of FFB Export by Volume	8 DRI FFB Exports[4] (billions of current $)	9 (8÷7) Export Volume Index	10 (4÷9) Volume Explanatory Factor
1970	23.9	684.0	.0349	1826.2	37.5	3.4	.999	5.9	5.91	309.0
1971	24.6	635.6	.0387	1705.7	37.3	6.9	1.068	6.1	5.72	298.2
1972	30.9	957.0	.0324	2318.8	41.3	4.1	1.112	7.5	6.74	344.0
1973	32.2	1172.7	.0275	3511.9	33.4	56.3	1.738	15.1	8.69	404.1
1974	35.6	1135.8	.0313	2880.1	39.4	27.0	2.207	18.5	8.38	343.7
1975	39.4	1165.4	.0338	3159.4	36.9	5.1	2.319	19.1	8.24	383.4
1976	48.8	1514.7	.0322	3560.5	42.5	-9.2	2.106	19.7	9.35	380.8
1977	46.8	1486.8	.0315	3367.4	44.2	-0.3	2.100	19.6	9.33	360.9
1978	55.0	1645.2	.0334	4197.2	39.2	5.1	2.207	25.0	11.33	370.5
1979	54.7	1750.4	.0313	4561.8	38.4	11.9	2.469	29.6	11.99	380.5
1980	64.4	1947.1	.0331	4929.8	39.5	5.8	2.613	35.3	13.51	367.1
1981	66.3	2092.1	.0317	4940.9	42.3	5.0	2.743	37.9	13.82	357.5
1982	73.8	2284.5	.0323	4757.9	48.0	-11.9	2.417	31.4	12.95	367.4
1983F	73.1 (73.1)[c]	2283 (2283)[c]	.032	4566	50.0 (50.0)[c]	3.8[a]	2.509	31.4[b]	12.51	365
1984F	70.2 (73.1)	2194 (2285)	.032	4570	48.0 (50.0)	12.4[a]	2.820	35.3[b]	12.52	365
1985F	71.6 (76.2)	2239 (2382)	.032	4763	47.0 (50.0)	3.8[a]	2.927	38.2[b]	13.05	365
1986F	72.5 (78.8)	2267 (2464)	.032	4928	46.0 (50.0)	5.0[a]	3.073	41.5[b]	13.50	365
1987F	75.7 (84.2)	2367 (2630)	.032	5260	45.0 (50.0)	7.5[a]	3.304	47.6[b]	14.41	365
1988F	79.3 (90.1)	2479 (2816)	.032	5632	44.0 (50.0)	12.6[a]	3.720	57.4[b]	15.43	365
1989F	80.8 (93.9)	2524 (2935)	.032	5869	43.0 (50.0)	12.5[a]	4.185	67.3[b]	16.08	365
1990F	82.9 (98.7)	2591 (3085)	.032	6169	42.0 (50.0)	4.9[a]	4.390	74.2[b]	16.90	365

[1] U.S. Army Corps of Engineers, Waterborne Commerce of the United States, Part 2.
[2] U.S. Department of Agriculture, Grain and Feed Market News.
[3] Data Resources, Inc., U.S. Long Term Review, Winter 1983-1984, p. 11.27. (Exports of goods: Foods, Feeds, and Beverages [FFB]).
[4] Ibid., p. 11.25.
[a] Ibid., p. 1.87. Cyclelong 1283.
[b] Ibid., p. 1.85.
[c] Numbers in parenthesis represent forecast of constant 50 percent share of total U.S. grain exports at Mississippi River Gulf ports.

F - Forecasted

Under the alternative scenario (of a constant 50 percent for U.S. export share), the forecast projects a faster increase in tonnage to 98.7 million short tons in 1990.

The relationship between the Mississippi River System's agricultural traffic and total exports from Mississippi River served Gulf ports has been relatively close throughout the 13 years of historical data.

The percentage of Mississippi River Gulf port's export grain tonnage share versus the total of U.S. grain exports shows variations in Column 5 between 33.4 percent in 1973 to an all-time high of 53 percent in 1983. These shares reflect a developing transportation infrastructure and fluctuating barge rates that can increase or decrease the competitiveness of barge transportation from the grain belt, thus making direct rail delivery to Atlantic, Gulf, Pacific, and Great Lakes ports more or less attractive.

The year-to-year changes in agricultural prices forecast by DRI in Column 6 show that in certain years, such as 1973 and 1974, sharp price increases occurred. In other years, smaller increases and even decreases have been evident. DRI's cumulative changes in value, calculated by altering a 1967 index of 1.0 for the year-to-year price changes, in Column 7, show that slight increases in prices are forecast for the remainder of the 1980s.

Column 9's volumes were derived from a combination of Column 8's values and Column 6's information. To check the data's reliability, the actual U.S. exports for 1970-1982 were divided by the imputed volumes (Column 9). With a few exceptions (which may in fact reflect changes in the composition of exports) the relationships have been fairly close, particularly for 1974-1982. On this basis, exports were projected (presented in Column 4), by multiplying the DRI volume index by an explanatory factor of 365, which was developed in Column 10. This shows a very gradual increase in U.S. exports for 1983-1990.

Figure IV-1 is the basic working document for assessing grain traffic to 1990. In addition to this document, managers and planners should seek other solid data for analyzing year-to-year changes. The numerous figures that follow are good places to start.

Figure G-2

GRAIN[1] INSPECTED FOR EXPORT BY REGION

1970-1982

1,000 bushels
(figures in parentheses are regional shares of total)

Year	Lakes	Atlantic	Gulf				Total Gulf	Pacific	Total
			Mississippi River	Mobile and East Gulf	North Texas Gulf	South Texas Gulf			
1970	319,529 (17)	102,354 (6)	683,973 (37)	37,442 (2)	344,142 (19)	81,584 (4)	1,147,141 (62)	257,217 (14)	1,826,241 (100)
1971	304,298 (18)	94,297 (6)	635,595 (37)	33,254 (2)	381,389 (22)	64,051 (4)	1,114,289 (65)	192,781 (11)	1,705,665 (100)
1972	336,871 (15)	226,920 (10)	957,034 (41)	62,548 (3)	387,740 (17)	93,706 (4)	1,501,028 (65)	253,944 (11)	2,318,813 (100)
1973	474,670 (14)	389,091 (11)	1,172,672 (33)	122,110 (3)	764,959 (22)	190,426 (5)	2,250,167 (64)	397,954 (11)	3,511,882 (100)
1974	271,917 (9)	362,410 (13)	1,135,813 (39)	81,871 (3)	525,567 (18)	141,682 (5)	1,884,933 (65)	360,869 (13)	2,880,129 (100)
1975	320,444 (10)	430,836 (14)	1,165,418 (37)	119,566 (4)	582,661 (18)	174,162 (5)	2,041,807 (65)	366,361 (12)	3,159,448 (100)
1976	309,063 (9)	534,495 (15)	1,514,749 (43)	149,518 (4)	528,752 (15)	139,006 (6)	2,329,025 (65)	387,887 (11)	3,560,470 (100)
1977	366,102 (11)	462,066 (14)	1,486,776 (44)	99,808 (3)	514,318 (15)	121,566 (4)	2,222,468 (66)	316,757 (9)	3,367,393 (100)
1978	554,963 (13)	507,763 (15)	1,645,207 (34)	189,982 (5)	616,194 (15)	165,913 (4)	2,617,296 (62)	517,143 (12)	4,197,165 (100)
1979	507,500 (11)	585,742 (12)	1,750,409 (38)	174,628 (4)	696,038 (15)	158,322 (3)	2,779,397 (61)	689,133 (15)	4,561,772 (100)
1980	573,373 (12)	528,809 (13)	1,947,061 (39)	188,460 (4)	669,987 (14)	104,137 (2)	2,909,645 (59)	917,925 (19)	4,929,752 (100)
1981	491,748 (10)	516,614 (11)	2,092,131 (42)	127,308 (3)	736,765 (15)	78,162 (2)	3,034,366 (61)	898,207 (18)	4,940,935 (100)
1982	391,195 (8)	606,384 (10)	2,284,534 (48)	94,874 (3)	690,485 (15)	49,386 (1)	3,119,279 (66)	628,345 (13)	4,757,932 (100)
1983	346,923 (6)	376,380 (13)	2,192,837 (53)	34,437 (1)	662,305 (16)	34,013 (1)	3,928,279 (71)	583,939 (14)	4,126,854 (100)

[1] Wheat, corn, sorghum, soybean, and all other (including sunflower seeds for 1980-1981).

Source: USDA *Grain Market News*; Agricultural Marketing Service/Federal Government Inspection Service.

Figure G-3

WORLD GRAIN EXPORTS

(millions of metric tons)

Year	U.S.	Canada	Argentina	Australia	Other	Total	U.S. Share in Percent
1970	29.7	13.8	7.8	8.5	13.5	73.2	40.5%
1971	28.4	17.1	7.0	10.7	12.6	75.8	37.5
1972	43.2	18.3	4.1	9.1	14.3	89.0	48.5
1973	92.9	15.6	9.0	5.1	16.9	139.4	66.6
1974	77.7	13.0	9.3	9.6	20.1	129.7	59.9
1975	83.8	14.9	7.7	11.6	19.2	137.2	61.1
1976	92.1	15.3	8.1	11.9	19.0	146.4	62.9
1977	87.7	17.4	14.8	16.6	14.8	147.3	59.5
1978	110.3	18.6	13.6	9.6	17.3	169.3	65.2
1979	120.2	16.0	15.0	14.5	16.4	182.2	66.0
1980	128.3	20.8	11.7	16.2	21.1	198.1	64.8
1981	128.8	21.5	20.1	11.6	23.8	205.9	62.6
1982	121.2	25.7	16.2	15.5	21.1	200.0	60.6
1983e	119.6	18.7	18.2e	15.5e	21.0e	193.0e	62.0e

E = Estimated.

Source: Organization for Economic Development and Cooperation Maritime Statistics and Fearnley and Egars World Bulk Trades and Review.

Grain Exports

Figure G-2 provides a historical overview of grains that were inspected for export. World grain exports (in metric tons) are presented in Figure G-3. The figure shows that the United States has faced sharp competition from Canada, Argentina, Australia, and other nations. Although the United States' share continues to far outstrip the rest, dramatic improvements are unlikely.

Figure G-4 shows U.S. grain exports by world area destinations. It suggests that the westbound trade from Pacific, Gulf, and Atlantic ports to nations in the Pacific Rim is both more resilient and stable than the eastbound trade to the United Kingdom, Mediterranean, Eastern Europe, Africa, and the Americas.

For example, the United States' eastbound exports have been severely hampered by the declining Eastern European commerce, which fell from a high of 27 million metric tons (1979) to a low of 15 million (1982). Eastbound shipments to the United States and Europe stagnated at 20 million metric tons and then gradually declined through 1982. In addition, the world's neediest areas, India and Africa, are unlikely to increase their imports because of economic constraints. As for westbound traffic, its stability is shown by the case of the Japanese imports of American grain, which should remain around 20-23 million metric tons.

Information Sources

Figure G-5 provides one example of publicly available information. The CofE publication discloses the major grain trade routes for corn, soybeans, wheat, and grain mill products for selected years during 1970-1981. Tonnage for origin and destination pairs are shown.

In general, the greatest amount of inland transportation industry data are available for agricultural commodities. The U.S. Department of Agriculture and private companies generate hourly grain quotations and daily barge rates, grain transportation, sales, and inspection data, as well as weekly and monthly statistics. This strategic forecast has not used these for presentation to the industry, but they can provide additional timely information on the mechanics and forces of the grain transportation industry. Barge operators should analyze this information regularly.

Figure G-4

U.S. GRAIN EXPORTS BY WORLD AREAS

1970-1981

(in thousand metric tons)

Year	Eastbound							Westbound					Other	Totals		
	UK/ Continent	Mediter- ranean	Eastern[1] Europe	Other Europe	Africa	Americas	Subtotal	Near East	Indian Ocean	Japan	Other Far East	Subtotal	Not Specified	Total Tons	Percent Eastbound	Percent Westbound
1970	7,332	2,482	564	915	1,284	2,577	15,154	724	3,516	9,829	-[2]	14,069	482	29,705	51.0%	47.4%
1971	6,913	3,074	1,430	1,120	1,285	3,120	16,942	680	2,248	7,782	-	10,710	796	28,448	59.6	37.6
1972	7,934	4,586	7,975	1,376	1,437	4,205	27,513	513	2,667	6,097	4,079	13,356	2,361	43,230	63.6	30.9
1973	9,630	6,540	14,306	2,300	2,067	6,632	41,476	666	3,718	10,748	9,373	24,505	7,507	73,488	56.4	33.3
1974	15,026	8,015	4,281	2,159	2,861	7,760	40,102	1,625	5,757	14,736	7,684	29,802	7,789	77,693	51.6	38.4
1975	17,791	8,096	9,995	3,915	3,656	8,303	51,756	2,270	7,146	13,172	5,400	27,988	4,032	83,776	61.8	33.4
1976	21,798	8,329	16,056	2,718	4,502	6,782	60,185	2,027	5,468	15,234	6,216	28,945	2,959	92,089	65.4	31.4
1977	20,326	7,239	10,130	4,099	4,908	8,674	55,377	2,300	2,412	17,010	7,391	29,113	3,213	87,703	63.1	33.2
1978	19,899	8,852	18,513	3,342	7,685	13,191	71,482	2,367	4,560	18,004	12,442	37,373	1,396	110,251	64.8	33.9
1979	20,539	9,996	27,013	3,593	5,974	12,027	79,142	2,333	2,682	19,485	15,376	39,876	1,209	120,227	65.8	33.2
1980	16,968	12,174	16,610	4,597	6,516	20,670	77,535	2,358	2,257	23,255	20,658	48,528	2,270	128,333	60.4	37.8
1981	16,972	13,322	17,040	5,316	9,167	17,806	79,623	3,078	3,561	22,579	19,208	48,426	791	128,840	61.8	37.6
1982	16,908	14,119	15,011	5,118	7,996	12,614	71,766	3,344	3,168	20,581	21,941	49,034	465	121,205	59.2	40.8

[1]U.S.S.R. included in Eastern Europe.
[2]All Far East assigned to Japan in 1970 and 1971.

Source: OECD Maritime Transport (through 1981) original data compiled by Fearnley and Egers.

Figure G-5

MAJOR TRADE PATTERNS FOR
MISSISSIPPI RIVER SYSTEM GRAIN MOVEMENTS

(millions of tons carried)

1970	1975	1980	1981	From	To
Corn					
1.8	4.0	10.8	11.5	MISS-MN2MO	MISS-BR2NO
2.8	5.9	9.3	9.7	ILL	MISS-BR2NO
0.8	2.7	2.6	2.5	MISS-MN2MO	MISS-NO2MP
1.4	3.6	1.9	1.5	ILL	MISS-NO2MP
0.1	0.5	1.4	1.5	OH-LOUD	MISS-BR2NO
0.1	0.1	0.5	0.8	MISS-MO2OH	MISS-BR2NO
0.7	0.5	0.7	0.7	MIN	MISS-BR2NO
3.4	2.9	3.1	4.4	All Other	All Other
11.2	20.2	30.3	31.1	Total	Total
Soybean					
1.4	1.3	3.5	2.6	MISS-MN2MO	MISS-BR2NO
0.8	1.1	2.0	2.1	ILL	MISS-BR2NO
1.1	1.2	2.2	1.3	MISS-OH2BR	MISS-BR2NO
0.1	0.4	1.2	1.2	OH-LOUD	MISS-BR2NO
0.4	0.8	0.5	0.8	MISS-MN2MO	MISS-NO2MP
0.4	0.6	0.4	0.7	ILL	MISS-NO2MP
0.2	0.2	0.7	0.7	MISS-MO2OH	MISS-BR2NO
0.4	0.6	0.6	0.7	MISS-OH2BR	MISS-NO2MP
3.1	2.7	4.4	4.7	All Other	All Other
7.9	8.9	15.5	14.8	Total	Total
Wheat					
0.1	0.1	0.4	0.7	MISS-OH2BR	MISS-NO2MP
0.1	0.3	0.7	1.3	MISS-OH2BR	MISS-BR2NO
-	-	0.5	0.8	MISS-MO2OH	MISS-NO2MP
-	0.1	0.5	0.5	MISS-MO2OH	MISS-BR2NO
0.2	0.6	0.7	0.7	MISS-MN2MO	MISS-NO2MP
0.1	0.6	0.8	1.1	MISS-MN2MO	MISS-BR2NO
-	0.3	0.3	0.5	OH-LOUD	MISS-NO2MP
2.0	4.0	3.4	4.9	All Other	All Other
2.5	5.9	7.3	10.5	Total	Total
Other Grains					
-	-	0.1	0.1	MISS-OH2BR	MISS-NO2MP
-	-	0.4	0.7	MISS-OH2BR	MISS-BR2NO
-	-	0.1	0.1	ARK	MISS-BR2NO
-	-	-	0.2	WOLF	MISS-BR2NO
-	-	-	0.1	OH-LOUD	MISS-BR2NO
0.5	0.3	0.3	0.4	All Other	All Other
0.5	0.3	0.9	1.6	Total	Total

Source: U.S. Army Corps of Engineers, Waterborne Commerce of the United States, Part 5.

COAL

Coal is the largest commodity moving on the inland river system in terms of tonnage, with grain exceeding coal in ton-miles. Figure G-6 provides an overview for 1980-1990. Columns 1 through 5 of this exhibit summarize the composition of exports from the river and Column 4 presents the total Mississippi River System traffic. Column 5 traces the domestic inland traffic net of exports, showing the relative stability of domestic traffic by excluding the volatile and rapid development of the export coal market in 1980 and 1981.

The figure shows that coal tonnage for the system peaked in 1981 at 130 million short tons and declined to a low of an estimated 119 million in 1983. The forecast shows that the system will recover from its currently depressed state over the remainder of the decade, so that by 1990 the traffic should reach its 1981 level, thanks to greater coal exports. By contrast, the projection for domestic coal movements to domestic consumers shows both stable and fluctuating levels of traffic that reflect the gradually increasing domestic coal consumption in the wake of the loss of coke and coal traffic and certain utility coal traffic.

Domestic and Export Trends

Although many industry-watchers assumed that the utilities' increased coal consumption would bring prosperity to the inland industry, the coal commerce patterns of the 1970s suggests that the river system may not benefit from growth in U.S. coal consumption. The reasons are twofold: first, the river system operates in a mature industrialized region that traditionally relied on coal to produce electricity, so that the level of coal demand should be unchanged. Second, in addition to serving the utility market, the inland waterway industry provided coke and coal to steel mills, which are now declining markets because of the domestic steel industry's overall malaise.

The influential role of export coal in 1980-1981 is evident, because total export levels from the Mississippi broke the record of 1.5 million tons for 1975-1979. Exports peaked in 1981 at 13.6 million tons. After 1981, traffic declined sharply both in New Orleans and Baton Rouge. Nonetheless, increased exports were projected on the assumption that even as metallurgical coal exports declined, steam coal exports from the United States to Scandinavian and Mediterranean nations will see some recovery, once the deep draft in topping off schemes get working. However, if export coal levels do not recover along with the projected economic recovery of Europe, then the system's traffic levels will probably stagnate at 120 million tons.

Domestic Consumption

Columns 7 and 8 of Figure G-6 present the relationships between domestic traffic going to domestic consumers and the U.S.'s total consumption. In 1970-1972, approximately one ton in five that was consumed in the United States moved by barge. By 1982, this ratio had fallen to one ton in 6.3. This trend is forecast to continue, so that by 1990 only one ton in 7.1 will move to its domestic consumer by Mississippi System barge. Column 8 refines the historical ratio and carries it into the future, using a three-year rolling average.

Column 9 of this exhibit summarizes the behavior of one component of domestic consumption that moves by barge. This component is the movement of coal by inland barge to lower Mississippi ports for transloading and shipment by ocean barge to utilities in Tampa and elsewhere. As Column 9 indicates, this trade has remained relatively stable. Although the inland barge industry has won some new contracts for moving Florida-bound coal from the Ohio River to points on the Gulf Intercoastal Waterway, this will probably be offset by competition from low-cost Colombian coal, which should displace U.S. suppliers at Florida ports at some point in the 1980s. Whenever the Colombian competition gains a foothold, it is likely that the inland barge traffic levels will not stagnate.

Figure G-7 presents the historical and forecast data for U.S. coal consumption. The information covers 1970-1983 on an actual basis and is forecast through 1990. The composition of coal consumption should remain constant, with electrical utility coal slowly increasing through the end of the decade, coal plant activity recovering from its 1982 low, but coke demand not reaching the levels achieved before 1982. In addition, other industrial, residential, and commercial coal demand will probably remain stable because of stable or slowly increasing real prices of petroleum.

Figure G-6

MISSISSIPPI RIVER SYSTEM TRAFFIC AND FORECAST
COAL

(millions of tons)

Year	1 Exports[1] New Orleans	2 Exports[1] Baton Rouge	3 Exports[1] Total	4 Mississippi River System Traffic[1] (millions of tons)	5 Domestic Inland Net of Exports (4-3)	6 Total U.S. Coal Consumption[1]	7 Domestic Inland Explanatory Factors (5+6)	8 Explanatory Variable Three-Year Rolling Average of Col. 7	9 Domestic Coastwise Coal Shipments from Mississippi River Terminals[1]
1970	0.3	0.0	0.3	102.0	101.7	515	.197	.200	3.7
1971	0.7	0.0	0.7	96.7	96.0	494	.194	.200	3.5
1972	0.8	0.0	0.8	108.7	107.9	520	.208	.195	3.6
1973	0.7	0.0	0.7	104.1	103.4	563	.184	.194	3.5
1974	0.9	0.0	0.9	106.4	105.5	558	.189	.192	3.5
1975	1.2	0.0	1.2	115.7	114.5	563	.203	.194	3.1
1976	1.1	0.0	1.1	116.4	115.3	604	.191	.193	2.7
1977	1.3	0.0	1.3	117.6	116.3	625	.186	.181	2.9
1978	1.4	0.0	1.4	106.0	104.6	625	.167	.176	2.9
1979	1.4	0.1	1.5	121.4	119.9	681	.176	.171	2.7
1980	3.5	0.4	3.9	123.0	119.1	703	.169	.168	2.9
1981	7.6	6.0	13.6	130.6	117.0	733	.160	.163	3.6
1982	4.3	2.3	7.4	121.2	113.1	707	.160	.160	N/A
1983F	2.7	2.0	4.7	118.9	114.2	737	.154	.155	-
1984F	-	-	7.8	122.1	114.3	762A	.150	.150	-
1985F	-	-	7.7	121.6	113.9	780A	.146	.146	-
1986F	-	-	11.7	123.0	111.3	784A	.141	.142	-
1990F	-	-	17.7	127.0	109.3	781A	.140	.140	-

[1]U.S. Army Corps of Engineers, Waterborne Commerce of the United States. Part 2.
[2]Department of Energy, Monthly Energy Review.
E = Estimated
F = Forecasted
A = Forecast from Figure G-7

Figure G-7

U.S. COAL CONSUMPTION BY USERS AND FORECAST

1970-1990

(in thousand short tons)

Year	Electric Utility		Coke Plants		Other Industrial		Residential and Commercial		Total
	Tons	Percent (%)	Tons	Percent (%)	Tons	Percent (%)	Tons	Percent (%)	
1970	319,000	61.9	95,600	18.6	88,400	17.2	12,000	2.3	515,000
1971	326,000	66.0	83,200	16.8	73,800	14.9	11,000	2.2	494,000
1972	352,000	67.7	87,700	16.9	71,300	13.7	9,000	1.7	520,000
1973	389,212	69.2	94,101	16.7	68,154	12.1	11,117	2.0	562,584
1974	391,811	70.2	90,191	16.2	64,983	11.6	11,417	2.0	558,402
1975	405,962	72.2	83,598	14.9	63,670	11.3	9,410	1.7	562,641
1976	448,371	74.3	84,704	14.0	61,799	10.2	8,916	1.5	603,790
1977	477,126	76.3	77,739	12.4	61,472	9.8	8,954	1.4	625,291
1978	481,235	77.0	71,394	11.4	63,085	10.1	9,511	1.5	625,225
1979	527,051	77.4	77,368	11.4	67,717	10.0	8,388	1.2	680,524
1980	569,274	81.0	66,657	9.5	60,347	8.6	6,451	0.9	702,730
1981	596,797	81.5	61,014	8.3	67,395	9.2	7,421	1.0	732,627
1982	593,666	84.0	40,908	5.8	64,097	9.1	8,240	1.2	706,911
1983	625,211	84.9	43,800	5.9	65,980	9.0	8,448	1.1	736,672
1984F	632,500	82.9	49,500	7.2	67,000	8.8	8,000	1.1	757,000
1985F	643,900	82.5	53,000	7.5	70,000	9.0	8,000	1.0	774,900
1986F	645,700	82.3	54,500	7.7	70,000	8.9	8,000	1.0	778,200
1990F	644,100	82.4	59,500	7.6	70,000	9.0	8,000	1.0	781,200

F = Forecast

Source: DOE Monthly Energy Review; Energy Information Administration (1970-1983).
TBS analysis of Data Resources Inc. data (1984-1990).

Coal Indicators

As background information for the inland barge industry, this Appendix provides several key coal indicators. Figure G-8 summarizes the U.S. coal industry for 1970-1983. Domestic production peaked in 1982 at 838 million tons, declining to 784 million tons in 1983. Exports grew steadily between 1978-1981 from 41 to 113 million short tons, while stocks fluctuated by as much as 100 million tons, ranging between a low of about 63 days in late 1974 and a high of 106 days in late 1980. Stocks of coal will continue to fluctuate with every new United Mine Workers agreement and each export contract.

Figure G-9 examines the composition of U.S. electrical generation by primary energy source, showing coal's historical high of 54.5 percent of the total kilowatts generated in 1983. Coal generation is forecast to remain stable over the rest of the decade. By contrast, petroleum generation should grow although petroleum's performance will be significantly below its percentage and absolute volume of kilowatts generated during the late 1970s. This reflects the maturity of the coal generating power plant inventory and the utilities' use of petroleum and alternative sources of power to meet the forecasted, slowly increasing demand for electric power.

Figure G-10 examines coal's efficiency in producing electricity. Since 1977, the industry has produced approximately 2,000 kilowatt hours of electricity per ton of coal. It is assumed that this level will continue through the end of the 1980s.

Figure G-11 examines the roles of coke and coal in domestic steel production. The tonnage of coke and coal required declined sharply, from .7 coking tons per production ton in 1970 to .48 in 1983. The reasons are: (1) the increased use of more modern furnaces, (2) the introduction of regional electric furnaces, and (3) the steel industry's reliance on the most efficient, lowest cost mills during the recent recession.

For the remainder the 1980s, it is assumed that the rate of consumption will stay at a half ton of coking coal per ton of steel production. Column 4 of Figure G-11 presents the DRI forecast index of steel production and compares it to that of the Statistical Abstract of the United States. Since the two sources are very close, clearly the DRI index has an enviable track record, and should be a worthwhile resource.

Figure G-8

SUMMARY OF U.S. COAL SITUATION

1970-1983

(in thousand short tons)

Year	Production	Domestic Consumption	Imports	Exports	Export Percentage of Production	Stocks	Days[1] Stock
1970	613,000	515,000	36	71,000	11.6	NA	NA
1971	561,000	494,000	111	57,000	10.2	NA	NA
1972	602,492	520,000	--	55,997	9.3	117,442	82
1973	598,568	562,584	127	53,587	9.0	104,335	68
1974	610,023	558,402	2,080	60,661	9.9	96,323	63
1975	654,641	562,641	940	66,309	10.1	128,050	83
1976	684,913	603,790	1,203	60,021	8.8	134,438	81
1977	697,205	625,291	1,647	54,312	7.8	157,098	92
1978	670,164	625,225	2,953	40,714	6.1	145,551	85
1979	781,134	680,524	2,059	66,042	8.5	181,646	97
1980	829,700	702,730	1,194	91,742	11.1	204,028	106
1981	823,775	732,627	1,043	112,541	13.7	185,274	92
1982	838,112	706,911	742	106,277	12.8	195,254	101
1983	784,865	736,672	1,271	77,772	9.3	168,654	84

Source: Department of Energy, Monthly Energy Review.

Figure G-9

ELECTRICITY GENERATION BY PRIMARY ENERGY SOURCES
U.S. HISTORY AND FORECAST

1970-1990

(million kilowatt-hours)

Year	Coal	Petroleum	Other	JQIND49&G All Fuel Total	Coal[1] Percentage (%)	Petroleum[2] Percentage (%)
1973	847,651	314,343	698,716	1,860,710	45.6%	16.9
1974	828,433	300,931	737,776	1,867,140	44.4	16.1
1975	852,786	289,095	775,768	1,917,649	44.5	15.1
1976	944,391	319,988	773,317	2,037,696	46.3	15.7
1977	985,219	358,179	780,925	2,124,323	46.4	16.9
1978	975,742	365,060	865,529	2,206,331	44.2	16.5
1979	1,075,037	303,525	868,810	2,247,372	47.8	13.5
1980	1,161,562	245,994	878,883	2,286,439	50.8	10.8
1981	1,203,203	206,421	885,188	2,294,812	52.4	9.0
1982	1,192,004	146,797	902,410	2,241,211	51.8	6.4
1983	1,259,424	144,499	906,362	2,310,285	54.5	6.3
1984F	1,265,049	146,987	997,583	2,407,619	52.5	6.1
1985F	1,287,731	145,270	1,029,199	2,462,200	52.3	5.9
1986F	1,291,400	135,151	1,076,249	2,502,800	51.6	5.4
1990F	1,288,161	194,691	1,184,148	2,667,000	48.3	7.3

[1]DRI EUF % COAL.
[2]DRI EUF % PET.

F = Forecasted

Source: Coal, Petroleum, and Other Consumption by TBS analysis of DOE <u>Monthly Energy Review</u>, Energy Information Administration (1970-1983). JQIND49&G time series from Data Resources Inc. (1984-1990).

Figure G-10

ANALYSIS OF ELECTRIC UTILITY
COAL CONSUMPTION EFFICIENCY AND FORECAST

Year	Coal Kilowatt-Hours Millions[1]	Coal Tons for Electricity[2]	Kilowatt-Hours Per Ton
1973	847,651	389.2	2,180
1974	828,433	391.8	2,110
1975	852,786	406.0	2,100
1976	944,391	448.4	2,110
1977	985,219	477.1	2,070
1978	975,742	481.2	2,030
1979	1,075,037	527.1	2,040
1980	1,161,562	569.3	2,040
1981	1,203,203	596.8	2,020
1982	1,192,004	593.7	2,010
1983	1,259,424	625.2	2,014
1984F	1,265,049	632.5	2,000
1985F	1,287,731	643.9	2,000
1986F	1,291,400	645.7	2,000
1990F	1,288,161	644.1	2,000

[1]Source: Figure G-9.
[2]Source: Figure G-7.

F = Forecasted.

Figure G-11

U.S. COKING COAL
HISTORY AND FORECAST

	1 Coking Tons Coal (millions)	2 U.S. Steel[1] Production (millions short)	3 (1÷2) Coking Tons per Production Ton	4 DRI Iron[2] and Steel Production Index[1]	5 (2÷4) Explanatory Factor
1970	95.6	132	.72	1.065	123.9
1971	83.2	120	.69	.951	126.2
1972	87.7	133	.66	1.072	124.1
1973	94.1	151	.62	1.231	122.7
1974	90.2	146	.62	1.217	120.0
1975	83.6	117	.71	.967	121.0
1976	84.7	128	.66	1.052	121.7
1977	77.7	125	.62	1.021	122.4
1978	71.4	137	.52	1.140	120.2
1979	77.4	136	.57	1.147	118.6
1980	66.7	112	.60	.945	118.5
1981	61.0	121	.50	1.023	118.3
1982	40.9	74	.55	.622	118.5
1983F	43.8	92	.48	.739	118.5
1984F	49.5	99	.50	.839	118.5
1985F	53.0	106	.50	.897	118.5
1986F	54.5	109	.50	.916	118.5
1990F	59.5	119	.50	1.003	118.5

[1]Source: Statistical Abstract of the United States.
[2]DRI indicator JQIND331.

F = Forecasted.

Origins and Destinations

Finally, Figure G-12 presents the summary of coal origins and destinations, drawn from CofE statistics. It identifies the major port piers so that operators can examine both actual traffic and long-term trends.

CRUDE OIL

Figure G-13 presents the historical and forecast information on crude oil traffic on the Mississippi River System. The figure reveals a close correlation betwen Mississippi crude oil traffic and the volume of crude oil production in Petroleum Area Defense District III (PADD III), which comprises the Gulf states and their offshore regions. Between 1970-1979 this relationship was extremely close. Since then, however, the demand for river traffic dropped faster than PADD III crude production, primarily because of the increasing use of pipelines to carry crude oil.

The figure shows that PADD III crude production has been declining steadily since 1972, despite the crude oil price increases, deregulation of crude oil prices, and record levels of offshore drilling during the late 1970s. This decline should continue at the rate of approximately five percent a year. The forecasted ratio of barge traffic to PADD III production, which is the average of 1981-1982, will remain constant. Therefore, as production declines, so will the associated barge traffic.

PETROLEUM PRODUCTS

Refinery Overview

To analyze properly the petroleum products trade for the inland waterways, one must examine the nation's energy policy, rate of energy consumption, and other specific indicators. The petroleum products trade is segmented into two major categories: dirty products (residual fuel oil, asphalt, tar, pitch, and crude tars) and clean products (all other basic petroleum fuels).

Figure G-12

MAJOR TRADING PATTERNS FOR MISSISSIPPI RIVER SYSTEM COAL MOVEMENT

(millions of tons)

1970	1975	1980	1981	From	To	Primary	Secondary
22.2	19.2	15.0	12.1	MON	MON	Steel	Utility
0.4	-	2.8	7.7	OH-LOUD	OH-HUND	Utility	Industry
2.8	5.3	6.4	6.1	OH-LOUD	OH-LOUD	Utility	Industry
0.1	-	5.8	6.1	MISS-MO2OH	MISS-OH2BR	Utility	Industry
3.5	1.9	4.8	5.7	OH-HUND	OH-PITD	Steel	Industry
7.3	6.1	7.3	5.5	MON	OH-PITD	Steel	Utility
9.1	8.1	4.9	5.4	GREEN	OH-LOUD	Utility	Industry
4.9	4.5	4.7	4.9	OH-PITD	OH-PITD	Steel	Utility
-	5.7	5.2	4.5	OH-LOUD	CUMB	Utility	Industry
4.9	5.1	4.8	4.4	ILL	CHIC	Utility	Industry
0.6	0.1	4.2	4.2	OH-HUND	OH-LOUD	Utility	Industry
3.2	2.3	3.8	4.1	OH-HUND	MON	Steel	Utility
0.4	0.5	1.2	4.1	OH-LOUD	MISS-NO2MP	Export	Utility
3.9	2.1	1.5	3.7	TENN	TENN	Utility	Industry
3.2	2.0	2.8	3.7	KAN	OH-HUND	Utility	Industry
1.4	6.5	2.9	3.2	OH-HUND	OH-HUND	Utility	Industry
3.1	2.8	2.4	2.4	GREEN	MISS-NO2MP	Export	--
2.8	2.6	2.5	2.3	MISS-MO2OH	MISS-MN2MO	Utility	Industry
-	1.9	2.5	2.2	OH-PITD	TENN	Utility	Industry
2.6	4.5	2.7	2.1	OH-PITD	OH-HUND	Utility	Industry
-	-	2.8	2.0	MISS-MO2OH	TENN	Utility	Industry
-	0.7	1.4	1.6	OH-LOUD	ESCAM	Utility	--
-	1.9	1.5	1.4	MISS-MN2MO	MISS-MN2MO	Utility	Industry
0.7	1.4	1.3	1.3	OH-PITD	OH-LOUD	Utility	Steel
0.1	0.1	1.4	1.3	KAN	OH-PITD	Steel	Utility
-	-	1.1	1.1	OH-LOUD	WOLF	Utility	Industry
24.8	24.3	25.3	27.5	All Others	All Others	--	--
102.0	115.7	123.0	130.6	Totals			

Source: U.S. Army Corps of Engineers, Waterborne Commerce of the United States, Part 5.

Figure G-13

MISSISSIPPI RIVER SYSTEM TRAFFIC AND FORECAST
CRUDE OIL

Year	1 Mississippi River Crude Oil Traffic (millions of short tons)	2 PADD III Crude Oil Production[2] (millions of BBls)	3 1 ÷ 2 Explanatory Factor[3]
1970	25.8	2375.2	.0109
1971	26.2	2366.7	.0111
1972	29.3	2393.6	.0122
1973	25.1	2313.0	.0109
1974	19.1	2178.8	.0088
1975	21.6	2044.1	.0106
1976	21.1	1967.0	.0107
1977	18.8	1869.5	.0106
1978	20.5	1772.3	.0116
1979	17.6	1662.8	.0106
1980	15.0	1594.3	.0094
1981	13.8	1539.3	.0090
1982	14.0	1558.0	.0090
1983F	13.2	1480	.0090
1984F	12.7	1406	.0090
1985F	12.0	1335	.0090
1986F	11.4	1268	.0090
1987F	10.8	1205	.0090
1988F	10.3	1144	.0090
1989F	9.8	1087	.0090
1990F	9.3	1032	.0090

[1]U.S. Army Corps of Engineers, Waterborne Commerce of the United States, Part 2.
[2]Source: DOE Monthly Petroleum Supply Annuals to 1982. After 1982, 5% annual decrease forecasted.
[3] = Forecasted factor is average of 1981 and 1982.

F = Forecasted.

Dirty Products

Figure G-14 summarizes the production and transportation of dirty fuels on the Mississippi River System. The traffic increased from 10 million short tons in 1970 to a peak 28 million short tons in 1978. It then declined to 20 million short tons in 1982. This fluctuation mirrored PADD III refinery production. Runs increased to a peak of 2.6 billion barrels per year in 1978 (shown in Column 5). As shown by PADD III production of residual and asphalt products (Column 7), the production of these heavy, dirty-fuels products increased from 96 million barrels in 1970 to 300 million barrels in 1978, before declining by more than one third to 174 million barrels in 1983.

Although the correlation between Mississippi River dirty traffic and PADD III residual and ashpalt production has varied, it is a better basis for predicting traffic levels than total refinery activity. It is assumed that crude oil traffic will continue at its current level of 175 million barrels and on this basis forecast the traffic level of 17.5 million tons. Although this is below the historical 1982 level, it reflects the belief that dirty fuel production will decrease, even though overall refinery production will increase.

Clean Products

Clean products constitute the majority of U.S. and PADD III refinery output. As Figure G-15 shows, during 1970-1983, clean fuels ranged between 68-80 percent of the total refinery runs in PADD III. In recent years, clean fuels have increased from 68 to 74 percent of the total refinery production, as residual oil declined from 10 to 6 percent of the total.

Overall, the composition of refinery activity has remained remarkably stable. Gasoline continues to make up approximately 45 percent of the total production, and distillates (diesel and home heating oil) account for another 20 percent. Jet fuel and kerosene together comprise another nine percent, with all other products (including basic petrochemical feed stocks) remaining fairly constant at about 17 percent.

Because substantial refinery refittings have occurred over the last decade to accommodate the increased volumes of imported crudes, it is unlikely that the composition of refining activity will remain stable.

Figure G-14

DRAVO MECHLING

MISSISSIPPI RIVER SYSTEM TRAFFIC AND FORECAST
DIRTY PETROLEUM PRODUCTS

(thousands of short tons)

	1	2	3	4	5	6	7	8
	Missippissi River System Traffic							
Year	2915 Residual Fuel	2918 Asphalt Tar & Pitch	2811 Crude Tar Oil & Gas	Total[1]	PADD III[2] Refinery Runs (million bbls.)	4÷5 Explanatory Factor	PADD III[2] Residual and Asphalt Production (million bbls.)	4÷7 Explanatory Factor
1970	6,156	3,128	1,111	10,395	1,825	5.69	96	108.3
1971	8,764	3,305	1,367	13,436	1,831	7.34	100	134.4
1972	10,022	3,163	1,391	14,576	2,002	7.28	105	138.8
1973	11,501	2,929	1,610	16,040	2,098	7.65	129	124.3
1974	14,783	3,380	1,898	17,061	2,102	8.12	173	98.6
1975	14,025	3,219	1,431	18,675	2,082	8.97	138	135.3
1976	17,849	2,694	1,745	22,288	2,308	9.66	215	103.7
1977	20,319	2,914	1,124	24,357	2,547	9.56	292	83.4
1978	24,067	3,038	992	28,147	2,575	10.93	300	93.8
1979	23,052	2,823	1,128	27,003	2,533	10.66	295	91.5
1980	20,853	2,131	867	23,851	2,372	10.06	263	90.7
1981	18,672	2,128	994	21,794	2,232	9.76	219	99.5
1982	17,140	2,660	691	20,491	2,269	9.03	202	101.4
1983F	-	-	-	17,400	2,300	9.8	174	100
1984F	-	-	-	17,500	2,300	9.8	175	100
1985F	-	-	-	17,500	2,300	9.8	175	100
1990F	-	-	-	17,500	2,300	9.8	175	100

[1]Source: USACE:WCUS-Part 2.
[2]Source: DOE, Monthly Petroleum Supply. (1970-1982)

E = Estimated.
F = Forecasted.

Figure G-15

PADD III REFINERY SLATE (WITH PERCENT OF TOTAL)

(millions of barrels)

Year	Gasoline	Distillates	Residual	Jet Fuel	Kerosine	Asphalt	All Other	Total	Clean Fuels
1970	845 (46)	392 (21)	60 (3)	132 (7)	55 (3)	36 (2)	305 (17)	1,825 (100)	1,460 (80)
1971	848 (46)	388 (21)	61 (3)	132 (7)	52 (3)	39 (2)	311 (17)	1,831 (100)	1,420 (78)
1972	950 (47)	424 (21)	65 (3)	139 (7)	48 (2)	40 (2)	336 (17)	2,002 (100)	1,561 (78)
1973	979 (47)	440 (21)	88 (4)	142 (7)	49 (2)	41 (2)	359 (17)	2,098 (100)	1,610 (77)
1974	959 (46)	429 (20)	132 (6)	143 (7)	34 (2)	41 (2)	364 (17)	2,102 (100)	1,565 (74)
1975	995 (48)	432 (21)	104 (5)	146 (7)	33 (2)	34 (2)	338 (16)	2,082 (100)	1,606 (77)
1976	1,035 (45)	475 (21)	186 (8)	157 (7)	34 (1)	29 (1)	392 (17)	2,308 (100)	1,701 (74)
1977	1,073 (42)	544 (21)	258 (10)	165 (6)	38 (1)	34 (1	435 (17)	2,547 (100)	1,820 (71)
1978	1,094 (42)	507 (20)	261 (10)	168 (7)	33 (1)	39 (2)	473 (18)	2,575 (100)	1,802 (70)
1979	1,033 (41)	488 (19)	260 (10)	174 (7)	43 (2)	35 (1)	500 (20)	2,533 (100)	1,738 (69)
1980	990 (42)	415 (17)	229 (10)	168 (7)	36 (2)	34 (1)	500 (21)	2,372 (100)	1,609 (68)
1981	974 (44)	423 (19)	183 (8)	157 (7)	29 (1)	36 (2)	428 (19)	2,232 (100)	1,583 (71)
1982	1,029 (45)	448 (20)	169 (7)	174 (8)	29 (1)	33 (1)	387 (17)	2,269 (100)	1,680 (74)
1983E	1,011 (46)	416 (19)	130 (6)	185 (8)	30 (1)	44 (2)	394 (18)	2,210 (100)	1,642 (74)

Source: DOE Petroleum Supply Annual (1970-1983).

E = Estimated.

Figure G-16 summarizes the prospects for Mississippi River System clean fuels traffic. Here, the total volume of clean fuel is represented by gasoline, jet fuel, kerosene, distillate fuel oil, lube oil, naptha solvents, and liquified gases. Clean fuel volume ranged betwen 32 million short tons in 1982 to nearly 41 in 1977, after which the traffic declined steadily. What's more, PADD III's production of clean fuel products also fell, although not as dramatically. The forecast predicts that clean fuel production will remain relatively stable for the rest of this decade: despite the continuing conservation and conversion to alternative fuel sources, the economy should also keep expanding, thereby forestalling any decreases in the demand for clean fuels.

CHEMICAL AND AROMATICS TRAFFIC

Figure G-17 displays the historical and forecast data on traffic for chemical and aromatic trades. This category includes sodium hydroxide, the petrochemical products alcohol, benzine, toluene, and basic chemicals and products. The forecast relied on the DRI basic chemicals production index, which has proven itself an accurate indicator of chemical traffic. Because the outlook for chemical production and, consequently, traffic is strong the forecast calls for a recovery in 1984-1990, leading to a net growth above the 1979 peak.

Despite the recent growth in the chemical industry, the forecast predicts that trade will outstrip the peak historical levels, but not until the mid-1990s, so that growth between 1985-1990 will be slight.

The exhibit alsc shows that between 1970-1982, the last of which was a recession year, the net increase in traffic in this category was three percent. Between 1970-1979, the last of which was the peak year, growth was 27 percent, compared to the growth in the chemical industry's output, an impressive 63 percent. Since the barge industry's growth was less spectacular, its future increases will continue as the chemical industry expands but at a slower pace.

FERTILIZER TRAFFIC REPORT

Figure G-18 presents a forecast for fertilizer traffic on the Mississippi River System. The historical data show significant growth between 1970 and the peak year, 1980. During this period, the system's fertilizer tonnage more than doubled, in line with a 33 percent increase in fertilizer tonnage.

Figure G-16

MISSISSIPPI RIVER SYSTEM TRAFFIC AND FORECAST
CLEAN PETROLEUM PRODUCTS

Millions of Short Tons

	Mississippi System Traffic								2 PADD III Refinery Runs[2] (millions of barrels)	3 1÷2 Explanatory Factors	PADD III Clean Fuels (millions of barrels)	Explanatory Factor
Year	2911 Gasoline	2912 Jet Fuel	2913 Kerosene	2914 Distillate Fuel	2916 Lube Oil	2917 Naptha & Solvents	2921 Liquefied Gases	1 Total[1]				
1970	24,017	1,579	1,613	6,476	1,566	999	850	37,100	1,825	20.33	1,460	25.4
1971	24,849	1,672	990	7,327	1,554	959	756	38,107	1,831	20.81	1,420	26.8
1972	22,609	1,634	828	8,791	1,513	1,064	1,208	37,647	2,002	18.80	1,561	24.1
1973	21,227	1,539	581	9,707	1,638	1,163	1,208	37,063	2,098	17.67	1,610	33.0
1974	20,099	2,652	480	10,217	1,836	1,255	766	36,305	2,102	17.27	1,565	23.2
1975	20,642	1,336	357	10,343	1,603	889	1,029	36,199	2,082	17.39	1,606	22.5
1976	19,827	1,636	415	12,543	1,773	1,159	1,167	38,517	2,308	16.69	1,701	22.6
1977	20,318	1,709	483	13,198	2,020	2,199	984	40,911	2,547	16.06	1,820	22.5
1978	18,739	1,394	560	11,732	2,048	2,245	990	37,708	2,575	14.64	1,802	20.6
1979	17,386	1,451	541	11,039	2,040	2,493	827	35,777	2,533	14.12	1,738	20.6
1980	17,647	1,854	417	10,825	1,904	2,360	917	35,924	2,372	15.15	1,609	22.3
1981	16,679	1,924	349	10,200	1,708	2,101	988	33,949	2,232	15.11	1,583	21.4
1982	15,208	2,048	555	9,397	1,725	1,712	953	31,598	2,269	13.93	1,680	18.8
1983E	-	-	-	-	-	-	-	31,190	2,210	14.11	1,642	19.0
1984F	-	-	-	-	-	-	-	31,350	2,300	14.90	1,680	19.0
1985F	-	-	-	-	-	-	-	31,350	2,300	14.80	1,650	19.0
1990F	-	-	-	-	-	-	-	31,350	2,300	14.80	1,650	19.0

[1]Source: USACE:WCUS-Part 2.
[2]Source: DOE, Monthly Petroleum Supply.
E = Estimated.
F = Forecasted.

Figure G-17

MISSISSIPPI RIVER SYSTEM TRAFFIC AND FORECAST

CHEMICALS AND AROMATICS

Year	1 Mississipi System Chemical Tons[1] (millions-short)	2 U.S. Dept. Commerce Chemical Production Index[2]	3 DRI Basic Chemicals[4]	4 (1÷2) Explanatory Factor 1	5 (1÷3) Explanatory Factor 2
1970	15.0	120	1.179	.125	12.7
1971	15.6	126	1.236	.124	12.6
1972	16.3	144	1.377	.113	11.8
1973	15.0	155	1.477	.097	10.2
1974	16.9	159	1.533	.106	11.0
1975	14.8	147	1.360	.101	10.9
1976	15.2	171	1.617	.089	9.4
1977	16.3	186	1.718	.088	9.5
1978	17.1	197	1.818	.087	9.4
1979	19.1	212	1.921	.090	9.9
1980	18.7	207	1.875	.090	10.0
1981	17.8	216	1.869	.082	9.5
1982	15.5	196	1.573	.080	9.9
1983F	17.0	-	1.750	-	9.7
1984F	18.7	-	1.928	-	9.7
1985F	19.4	-	1.999	-	9.7
1986F	20.0	-	2.064	-	9.7
1987F	21.4	-	2.203	-	9.7
1988F	23.1	-	2.385	-	9.7
1989F	21.7	-	2.235	-	9.7
1990F	20.9	-	2.158	-	9.7

[1]Source: USACE-WCUS Part 2.
[2]Source: DOE <u>Statistical Abstract of the United States</u>. (1970-1982)
[3]Source: DOE/TBS forecast 1983 onward.
[4]DRI JQIND281 and March 1984 CycleLong.

E = Estimated.
F = Forecasted.

Figure G-18

MISSISSIPPI RIVER SYSTEM TRAFFIC AND FORECAST

FERTILIZER

Year	1 Mississippi River System Fertilizer Movements[1] (millions of short tons)	2 All U.S. Fertilizer Consumption[2] (millions of tons)	3 DRI Index of Production for Agricultural Chemicals (1967 = 1.000)	4 Explanatory Factor (1÷3)
1970	3.9	39.6	1.079	.098
1971	4.5	39.9	1.035	.113
1972	6.5	39.9	1.089	.163
1973	5.9	41.8	1.270	.141
1974	6.5	47.1	1.447	.138
1975	6.2	42.5	1.641	.146
1976	6.0	49.2	1.854	.122
1977	7.0	51.6	2.012	.136
1978	7.1	47.5	2.118	.149
1979	7.6	51.5	2.216	.148
1980	8.4	52.8	2.307	.159
1981	7.3	54.0	2.415	.135
1982	6.5	48.7	2.087	.133
1983F	6.3	45.1	1.932[a]	.14
1984F	6.7	48.0	2.056[a]	.14
1985F	7.3	51.9	2.223[a]	.14
1986F	7.7	55.0	2.357[a]	.14
1987F	8.2	58.7	2.514[a]	.14
1988F	8.7	62.0	2.657[a]	.14
1989F	8.9	63.8	2.734[a]	.14
1990F	9.3	66.6	2.855[a]	.14

[1]Source: U.S. Army Corps of Engineers, Waterborne Commerce of the United States, Part 2 (phosphate rock, nitrogenous chemical fertilizers, fertilizers and materials, n.e.c., and lime).
[2]Data Resources, Inc., U.S. Long Term Review, Winter 1983-84, p. 11.47.
[3]Source: DOC, Statistical Abstract of the United States, (FEA), p. 670.
[a]DRI, op. cit., CYCLELONG1283, p. 1.127.

F = Forecasted.

The forecast indicates that the river system will experience gradual increases as national fertilizer production increases. For the purposes of this forecast, the United States' tonnage was used with the assumption that one ton of fertilizer in seven will move on the Mississippi River System. This ratio has been relatively stable for more than a decade. Despite changes in the pricing structure and regulation of the railroad industry, fertilizer traffic on the Mississippi System should not feel their effects. Thus, the historically stable ratio should remain so for the long term.

Other factors contribute to the traffic's stability. Although, for instance, the increasing efficiencies of fertilizer production tend to reduce tonnages, these reductions should be offset to some degree by the increasing demands for fertilizer. Since fertilizer plays a significant role as a northbound backhaul commodity from the lower Mississippi River, the continued stability of fertilizer traffic will ensure that the barge industry retains this source, which amounts to one ton for every ten downbound tons of export grain. However, because of this ratio imbalance, it is unlikely that fertilizer growth will give carriers an opportunity to use fertilizer to absorb all their northbound-cycle costs.

CONSTRUCTION MATERIALS

This category includes cement, limestone, stone, sand stone, gravel, and shell. The majority of this tonnage traditionally moved short distances in private barge fleets because sand and stone is dredged from certain rivers and transported by deck barge to riverside terminals. For this reason, the ton-miles associated with these materials tend to be smaller in relation to total ton-miles than the tonnage has been in relation to total system tons.

Historical and Forecast Traffic

Figure G-19 presents the historical and forecast Mississippi System construction material tonnage and the key DRI combined structures expressed in 1972 dollars for 1970-1990. Construction materials commerce should recover from a 1982 low of 32 million tons to a 1988 high of 49.5 million tons.

Figure G-19 also demonstrates the cyclical nature of this traffic. Between 1970-1982, it varied between 46 million tons in 1978 and 32 million tons in 1982. This range of traffic levels strongly correlates with the indices of overall construction activity, but it tends to be more volatile than the key indicators suggest.

In developing this forecast, the historical data was analyzed for the key states in the river system as well as the national construction information. The detailed information on the key states generally indicated somewhat of a correlation to river traffic.

Key states construction (presented in Column 2) is expressed in 1972 dollars and ranged between 34.8 billion dollars in 1978 and 20.6 billion dollars in 1982. By contrast, total U.S. construction (also in 1972 dollars) ranged from a high of 108 billion dollars in 1973 to a low of 78.8 billion dollars in 1975.

The relationship between Mississippi System construction and national construction is slightly closer than between the rivers and the key states. The reasons include fluctuating patterns, sand and gravel recovery from both rivers and shoreside locations, changing patterns and locations of construction sites, and varying levels of shell, cement, and limestone transportation traffic, which responds to commodity prices.

Note that limestone is classed as a construction material, although the utility and agricultural industries also use it. Because the CofE data make no distinctions for different uses, it is impossible to make accomodations other than by including limestone here, as a mine mineral.

Construction Activity

Because construction activity affects barge traffic in construction materials, it is important to keep abreast of the construction industry's history and be on the lookout for new trends. Column 3 of figure G-20 calculates the total value of residential and nonresidential structures built in the United States (in 1972 dollars). This total was compared to the MacGraw Dodge historical total construction levels, which appears in the Statistical Abstract of the United States. Using the information in Column 5, it is easy to see that DRI's and MacGraw Dodge's values do not coincide precisely. However, the DRI nonresidential and residential structural forecasts were used. As Column 3 indicates, construction should recover in 1983-1984 and grow slowly from 1985 onward.

Figure G-19

MISSISSIPPI RIVER SYSTEM TRAFFIC AND FORECAST

CONSTRUCTION MATERIALS

	1 Miss. Systems Construction National Tons (millions)	2 Key States Construction $1972 (billions)	3 1 ÷ 2 Explanatory Factor	4 Combined DRI Structure $1972 (billions)	5 1 ÷ 4 Explanatory Factor
1970	40.5	23.6	1.72	83.7	.484
1971	44.5	27.7	1.61	95.2	.467
1972	41.9	27.5	1.52	106.4	.394
1973	42.5	30.4	1.40	108.0	.394
1974	43.4	26.0	1.67	90.0	.482
1975	38.5	22.4	1.72	78.8	.489
1976	38.2	28.0	1.36	89.0	.429
1977	40.5	29.6	1.37	99.2	.408
1978	44.6	34.8	1.28	105.1	.424
1979	46.3	32.3	1.43	106.2	.436
1980	37.4	23.3	1.61	93.7	.399
1981	33.4	20.7	1.61	94.5	.353
1982	32.0	20.6	1.55	91.5	.350
1983F	36.3	-	-	100.7	.360
1984F	41.1	-	-	111.0	.370
1985F	42.1	-	-	110.9	.380
1986F	44.8	-	-	114.8	.390
1987F	48.6	-	-	121.4	.40
1988F	49.5	-	-	123.7	.40
1989F	45.2	-	-	113.1	.40
1990F	46.6	-	-	116.6	.40

E = Estimated.
F = Forecasted.

(Note: Col. 1 forecast is col. 4 x col. 5. See Figure G-20 for derivation of col. 4.)

Source: DOC Statistical Abstract of the U.S., F.W. Dodge original data.

Figure G-20

UNITED STATES

HISTORICAL AND FORECAST CONSTRUCTION

	1 Non-Residential[1] Structures (billion $ 1972)	2 Residential[2] Structures (billion $ 1972)	3 1 + 2 Total Structures (billion $ 1972)	4 McGraw Dodge[3] (billion $ 1972)	5 4 ÷ 3 Percent
1970	43.9	39.8	83.7	74.6	89.1
1971	42.8	52.4	95.2	77.0	80.9
1972	44.1	62.3	106.4	83.3	78.3
1973	47.4	60.6	108.0	93.9	86.9
1974	43.6	46.4	90.0	81.3	90.3
1975	38.2	40.6	78.8	71.5	90.7
1976	39.5	49.5	89.0	83.2	93.5
1977	40.4	58.8	99.2	99.8	100.6
1978	44.6	60.5	105.1	105.3	100.2
1979	49.1	57.1	106.2	102.9	96.9
1980	48.5	45.2	93.7	83.0	88.6
1981	51.6	42.9	94.5	78.6	83.2
1982	53.1	38.4	91.5	74.8	81.7
1983F	49.8	50.9	100.7	--	84.0
1984F	52.4	58.6	111.0	--	84.0
1985F	55.5	55.4	110.9	--	84.0
1986F	58.1	56.6	114.8	--	84.0
1987F	60.5	60.9	121.4	--	84.0
1988F	63.0	60.7	123.7	--	84.0
1989F	65.4	47.7	113.1	--	84.0
1990F	67.7	48.[illegible]	116.6	--	84.0

F = Forecasted.
[1]DRI-ICNR72.
[2]DRI-ICR72.
[3]Source Figure G-22.

Figure G-21 covers 1970-1982 construction activity in the key states (Illinois, Ohio, and Pennsylvania) of the Mississippi River System. When adjusted to 1972 dollars, strong cyclical forces are evident. 1982 activity was more than 50 percent below the peak of 1978. The figure also shows where the majority of construction occurred. Figure G-22 compares the construction levels in the key states to the national level. These key states' share of national activity has been fairly stable, at about 30 percent, with recession year decreases to a bottom of 26 percent.

WATERWAY IMPROVEMENT MATERIALS FORECAST

Waterway improvements materials represent significant amounts of tonnage but proportionally a very small share of river ton-miles. The historical and forecast information (Figure G-23) shows an overall decline in waterway improvement tonnage over 1970-1982. The tonnage varies and largely depends on the amount of CofE dredging and riprap operations. It is assumed that the tonnages for the remainder of the decade will be about six million short tons, but also recognized that this tonnage could fluctuate. Because much of this tonnage is transported on flat deck barges and constitutes heavy riprap, the impact of this commodity's traffic on most carriers is minimal.

PROJECTION OF ALL COMMODITY TRAFFIC

In addition to the commodities discussed above, the river system moves a volume of miscellaneous commodities that includes ores, minerals, paper, lumber, steel products, sugar, salt, and a variety of other commodities. It is difficult to forecast each of these without a great deal of research into the individual factors affecting each commodity. In many cases, these commodities move from import or export locations for a small number of shippers. However, despite the diversity, the aggregate pattern for the the past 13 years is a reasonably accurate basis for this forecast.

Figure G-24 compares the river system's total tons and all other tons to those of the U.S. Gross National Product (GNP) (both historical and forecast). The relationship between the river system and GNP is clearly declining. Between 1970-1983, the ratio fell by approximately 17 percent at a steady rate. In addition, the relationship between all other tonnage and the river system dropped even faster. Between 1970 to 1982, the relationship between all other tonnage and the GNP decreased by 39 percent, which suggests that the river system has not shared in the wealth.

Figure G-21

CONSTRUCTION CONTRACTS IN KEY INLAND RIVER STATES

(billions of dollars)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Arkansas	0.5	0.6	0.8	1.0	0.8	1.3	1.2	1.2	1.5	1.7	1.3	1.2	1.6
Illinois	3.6	4.0	4.8	4.9	4.3	3.9	8.5	5.8	7.3	7.0	5.3	4.8	4.7
Indiana	1.5	1.8	2.2	2.5	2.2	2.2	2.5	4.3	6.4	3.4	2.8	2.4	2.9
Iowa	0.7	0.8	0.8	1.1	1.1	1.3	1.4	1.5	2.2	2.4	1.5	1.3	1.3
Kansas	0.5	0.7	0.8	0.8	0.9	1.3	1.5	3.1	1.6	1.8	1.9	1.3	1.4
Kentucky	1.2	1.7	1.5	1.5	1.5	1.4	1.8	2.3	3.5	3.0	2.2	3.4	2.7
Louisiana	1.4	1.7	2.0	1.9	2.0	1.8	3.7	3.6	4.6	3.5	3.3	3.8	5.7
Minnesota	1.1	1.3	1.3	1.7	2.1	1.7	2.0	2.6	3.2	3.3	2.7	2.7	2.5
Mississippi	0.6	0.9	0.9	2.1	1.0	1.0	1.0	1.4	1.6	3.9	1.6	1.3	1.1
Missouri	1.2	1.7	1.4	2.0	1.8	1.6	1.6	2.7	2.8	3.1	2.6	2.6	2.4
Ohio	3.0	4.0	3.9	4.2	4.4	3.9	3.9	4.2	6.5	6.2	5.2	4.8	4.8
Oklahoma	0.7	0.9	1.3	1.4	1.4	1.2	1.4	2.4	2.4	2.9	2.3	2.8	3.1
Pennsylvania	3.2	4.4	3.4	4.3	3.9	3.0	3.9	3.8	4.8	4.6	5.2	4.8	4.5
Tennessee	1.6	1.5	1.8	2.2	2.1	1.7	1.7	1.8	3.1	4.9	2.8	2.6	2.6
West Virginia	0.8	0.6	0.6	0.6	0.5	0.9	1.0	0.7	0.8	1.2	0.9	0.7	0.8
Current $	$21.6	26.6	27.5	32.2	30.0	28.2	37.1	41.4	52.3	52.9	41.6	40.5	42.5
$1972	23.6	27.7	27.5	30.4	26.0	22.4	28.0	29.6	34.8	32.3	23.3	20.7	20.6
$1972 Adjust-ment Factors	.915	.961	1.00	1.058	1.152	1.258	1.324	1.400	1.504	1.637	1.787	1.952	2.068

Source: Statistical Abstract of the United States tables drawn from McGraw Hill F. W. Dodge data on Construction Potentials.

Figure G-22

ANALYSIS OF KEY INLAND STATES AND NATIONAL CONSTRUCTION

	1 Key States Construction (billion $ 1972)[1]	2 Total U.S. (billion $)	3 Total U.S. (billion $1972)	4 1 ÷ 3 Key States as % Total U.S.
1970	23.6	68.3	74.6	31.6
1971	27.7	80.2	77.0	36.0
1972	27.5	91.0	83.3	33.0
1973	30.4	99.3	93.9	32.4
1974	26.0	93.7	81.3	32.0
1975	22.4	90.0	71.5	31.3
1976	28.0	110.1	83.2	33.7
1977	29.6	139.7	99.8	29.7
1978	34.8	158.4	105.3	33.0
1979	32.3	168.4	102.9	31.4
1980	23.3	148.4	83.0	28.1
1981	20.7	153.5	78.6	26.8
1982E	20.6	154.6	74.8	27.5

[1]Source Figure G-21.

E = Estimated.
F = Forecasted.

Figure G-23

MISSISSIPPI RIVER SYSTEM TRAFFIC AND FORECAST
WATERWAYS IMPROVEMENT MATERIALS

	Water Improvement Tons (millions)	Three-Year Rolling Average Tons (millions)
1970	8.9	-
1971	8.2	8.3
1972	7.7	8.4
1973	9.2	9.6
1974	11.8	9.8
1975	8.5	9.2
1976	7.4	7.6
1977	6.9	7.8
1978	9.2	8.0
1979	7.9	7.6
1980	5.8	6.0
1981	4.4	-
1982	4.7	-
1983E	6.0	-
1984F	6.0	-
1985F	6.0	-
1990F	6.0	-

Source: USACE WCUS Part 2.

E = Estimated.
F = Forecasted.

Figure G-24

MISSISSIPPI RIVER SYSTEM TRAFFIC AND FORECAST

ALL OTHER COMMODITIES

Year	1 Mississippi[1] System Tons (millions-short tons)	2 GNP $1972[2] Billions	3 1÷2 Total Mississippi Systems Tons/$GNP	4 All Other Commodities (millions)	5 4÷2 All Other Tons/$GNP	6 DRI Index of Industrial Production	7 4÷6 All Other/ Industrial Production
1970	297.3	1,088	.273	33.3	.0306	1.078	30.0
1971	303.2	1,122	.276	35.1	.0313	1.096	32.0
1972	326.6	1,186	.275	36.5	.0308	1.197	30.5
1973	317.6	1,255	.253	34.0	.0271	1.297	26.2
1974	330.1	1,248	.265	37.1	.0297	1.293	28.7
1975	330.1	1,234	.268	33.5	.0271	1.178	28.4
1976	345.5	1,298	.266	39.1	.0301	1.304	30.0
1977	352.5	1,370	.257	33.0	.0241	1.381	23.9
1978	355.4	1,439	.247	35.9	.0249	1.461	24.6
1979	370.8	1,479	.251	35.8	.0242	1.525	23.5
1980	365.7	1,474	.248	35.5	.0241	1.470	24.2
1981	362.9	1,503	.241	35.9	.0239	1.509	23.8
1982	347.5	1,485	.234	27.7	.0187	1.386	20.0
1983	348.2	1,536	.227	31.0	.0221	1.478	21.0
1984F	360.2	1,619	.222	35.7	.0227	1.624	22.0
1985F	36766	1,671	.217	37.1	.0227	1.686	22.0
1986F	366.3	1,713	.214	38.3	.0224	1.739	22.0
1987F	375.4	1,762	.213	40.4	.0229	1.838	22.0
1988F	382.6	1,818	.201	43.0	.0240	1.954	22.0
1989F	377.2	1,872	.201	41.1	.0220	1.867	22.0
1990F	387.1	1,929	.201	40.5	.0210	1.839	22.0

[1]Source: USACE WCUS Part 2.
[2]Source: DRI-12/83.

E = Estimated
F = Forecasted

To what extent will the river system continue to lose its share as the economy expands? One potential answer lies in DRI's forecast and historical data that describe industrial production in the United States (see Column 6). Industrial production increased significantly, reaching a peak in 1979 that was nearly 40 percent above the 1970 level. Comparison of industrial production to the river systems' all other tons reveals that the system's decrease here mirrors its decline in relation to the GNP. However, the decrease occurred primarily in the first half of the 1970s and since then it has shrunk. It is also possible that the 1982-1983 recession caused a temporary sharp decrease in river traffic in all other commodities, as U.S. exports and imports of basic commodities dropped in response to reduced factory orders. However, the continuation of the recession should stimulate the barge industry to improve marketing efforts to attract the shippers. Thus the river system should be able to snare a slight increase in its share. Furthermore, regulatory changes could promote intermodal transshipping of certain cargoes.

For the purposes of this forecast, it was assumed that a stable relationship will continue between the GNP and the river system. On this basis, traffic will recover along with industrial production, seeing slight growth so that by 1987 the all other category will somewhat exceed the 1976 peak. Although this forecast may prove optimistic, it is based on sound data and analysis.

FORECAST OF THE GULF INTERCOASTAL WATERWAY TRAFFIC

The Gulf Intercoastal Waterway represents an additional 10 percent of ton-miles compared to the Mississippi River System. Much of the tonnage that moves on the Gulf Intercoastal also moves on the Mississippi River System and very little of the tonnage on the Gulf Intercoastal originates and terminates on the system itself. Rather, this waterway is a conduit between major Texas ports and the Mississippi System, and between Mobile and tributaries in the Mississippi System. Traffic on the waterway is nevertheless important to the industry for several reasons. First, many carriers have specialized in providing transportation on this river system because the physical lock and channel width and depth constraints on this waterway the system absorb more equipment than its tons or ton-miles would suggest. Secondly, the Gulf Intercoastal System is particularly significant for transporating tank cargoes.

There are several obstacles to forecasting trade on the Gulf Intercoastal. Most important, it does not produce or consume significant amounts of the cargo that it carries. Secondly, its traffic does not correspond directly to the nation's economic development. However, these obstacles are not insurmountable.

Traffic Overview

Figure G-25 provides a summary of the historical and forecast traffic for the Gulf Intercoastal Waterway. Between 1970-1982, traffic declined by nearly 20 percent, largely led by the declines in crude oil transportation. The decreases in tonnage over this period were also affected by sharp swings in traffic, following a peak demand in 1972 when 108 million tons were transported. In contrast to the inland system, the transportation of petroleum products has remained relatively strong and is forecast to do so through the end of the 1980s. Also, a decrease in the production of marine shell, which is used in concrete production along the Gulf Coast, accounted for significant tonnage declines. Coke and chemical aromatics traffic increased, as did the tonnages of coal, which should increase further with the startup of power stations in the Florida panhandle.

The forecasting of Gulf Intercoastal traffic is presented in a series of exhibits (Figures G-26-G-34) that cover the major traffic categories. The forecast is conservative by not acknowledging that net increases in coal consumption could occur in response to decisions by Texas and Florida utilities to increase conversions and therefore would rely on riverborne delivery.

Figure G-25

SUMMARY OF GULF INTRACOASTAL WATERWAY TRAFIC AND FORECAST

ALL COMMODITIES

(millions of short tons)

	GIWW Total	Coal	Crude Oil	Petroleum Products	Construction Materials	Coke	Non-Metallic Minerals	Chemicals & Aromatics	All Other Commodities
1970	99.2	1.9	31.8	20.2	15.3	.3	4.9	9.2	15.6
1971	105.2	2.9	33.0	23.9	14.9	.4	4.8	9.1	16.2
1972	108.1	4.9	32.3	23.5	14.7	.4	5.0	10.6	16.7
1973	100.1	4.4	27.5	22.6	15.1	.5	4.2	9.9	15.9
1974	103.0	4.9	25.2	25.6	13.7	.7	4.9	5.4	22.6
1975	96.4	4.3	24.6	24.0	12.3	.6	4.7	9.7	10.2
1976	96.5	4.8	24.2	25.4	10.2	.5	5.0	10.8	15.6
1977	104.3	4.2	24.7	30.9	10.2	.8	4.5	11.4	17.6
1978	101.4	4.0	22.9	28.9	9.6	.7	5.0	12.8	17.5
1979	98.6	5.0	20.0	33.3	8.0	.8	4.3	13.3	11.9
1980	94.1	5.1	17.5	29.8	8.4	1.2	4.2	12.0	15.9
1981	90.0	4.6	15.2	30.1	7.3	1.3	3.4	11.9	16.2
1982	80.6	4.0	15.6	29.6	6.6	1.0	4.0	10.0	9.8
1983F	87.1	4.9	14.8	27.3	6.6	1.3	3.9	11.4	16.9
1984F	87.8	4.8	13.6	27.5	6.3	1.3	4.0	12.5	17.8
1985F	88.0	5.0	12.8	27.5	6.0	1.3	4.0	13.0	18.4
1986F	87.8	5.1	12.0	27.5	5.7	1.3	4.0	13.4	18.8
1987F	88.5	5.1	11.3	27.5	5.6	1.3	4.0	14.3	19.4
1988F	89.4	5.2	10.6	27.5	5.3	1.3	4.0	15.5	20.0
1989F	87.9	5.2	10.0	27.5	4.8	1.3	4.0	14.5	20.6
1990F	87.4	5.3	9.4	27.5	4.7	1.3	4.0	14.0	21.2

F = Forecasted

Source: U.S. Army Corps of Engineers Waterborne Commerce of the United States Part 2.

Figure G-26

GIWW TRAFFIC AND FORECAST

COAL

Year	1 GIWW Coal[1] (millions tons)	2 U.S. Coal[2] Consumption (millions tons)	3 1 ÷ 2 Explanatory Factor
1970	1.9	515.0	.0037
1971	2.9	494.0	.0059
1972	4.9	520.0	.0094
1973	4.4	562.6	.0078
1974	4.9	558.4	.0088
1975	4.3	562.6	.0076
1976	4.8	603.8	.0079
1977	4.2	625.3	.0067
1978	4.0	625.2	.0064
1979	5.0	680.5	.0073
1980	5.1	702.7	.0073
1981	4.6	732.6	.0063
1982	4.0	707.0	.0057
1983F	4.9	736.7	.0066
1984F	4.8	757.0	.0063
1985F	5.0	774.9	.0064
1986F	5.1	778.2	.0065
1990F	5.3	781.2	.0068

[1]Source: USACE WCUS Part 2 (through 1981).
[2]Source: Figure G-7.

E = Estimated
F = Forecasted

Figure G-27

GIWW TRAFFIC AND FORECAST

CRUDE OIL

Year	1 GIWW Crude[1] (million tons)	2 PADD III Crude[2] Production (million bbls)	3 1 ÷ 2 Explanatory Factor
1970	31.8	2,375.2	.0134
1971	33.0	2,366.7	.0139
1972	32.3	2,393.6	.0135
1973	27.5	2,313.0	.0119
1974	25.2	2,178.8	.0116
1975	24.6	2,044.1	.0120
1976	24.2	1,967.0	.0123
1977	24.7	1,869.5	.0132
1978	22.9	1,772.3	.0129
1979	20.0	1,662.8	.0120
1980	17.5	1,594.3	.0110
1981	15.2	1,539.3	.0099
1982	15.6	1,558.0	.0100
1983E	14.8	1,480	.0100
1984F	13.6	1,406	.0097
1985F	12.8	1,335	.0096
1986F	12.0	1,268	.0095
1987F	11.3	1,205	.0094
1988F	10.6	1,144	.0093
1989F	10.0	1,087	.0092
1990F	9.4	1,032	.0091

[1]Source: USACE WCUS Part 2 (through 1982).
[2]Source: DOE Petroleum Supply Monthly (through 1982). After 1982, 5% annual decrease forecasted.

E = Estimated.
F = Forecasted.

Figure G-28

GIWW TRAFFIC AND FORECAST

PETROLEUM PRODUCTS

Year	1 GIWW Product Traffic[1] (million tons)	2 PADD III Refinery Runs[2] Distillate and Residual	3 1 + 2 Explanatory Factor
1970	20.2	452	.045
1971	23.9	449	.053
1972	23.5	489	.048
1973	22.6	528	.043
1974	25.6	561	.046
1975	24.0	536	.045
1976	25.4	661	.038
1977	30.9	802	.039
1978	28.9	768	.038
1979	33.3	748	.045
1980	29.8	644	.046
1981	30.1	584	.052
1982	29.6	617	.048
1983E	27.3	546	.050
1984F	27.5	550	.050
1985F	27.5	550	.050
1990F	27.5	550	.050

[1]Source: USACE Part 2 (through 1981).
[2]Source: DOE Petroleum Supply Monthly (through 1982).

E = Estimated.
F = Forecasted.

Figure G-29

ANALYSIS OF GULF COAST CONSTRUCTION AND FORECAST

Year	1 Total Const. Alabama[1] (billion $)	2 Total Const. Texas[1] (billion $)	3 1 + 2 Total (billion $)	4 Adj. Factor (billion $1972)	5 3 ÷ 4 Adjusted Construction (billion $1972)	6 DRI Total U.S. Structures[2] ($1972)	7 5 ÷ 6 Explanatory Factor
1970	1.0	4.1	5.1	.915	5.6	83.7	.067
1971	1.2	5.0	6.2	.961	6.5	95.2	.068
1972	1.4	5.8	7.2	1.00	7.2	106.4	.068
1973	1.6	6.2	7.8	1.058	7.4	108.0	.069
1974	1.3	6.5	7.8	1.152	6.8	90.0	.076
1975	3.1	6.4	9.5	1.258	7.6	78.8	.096
1976	1.9	7.9	9.8	1.324	7.4	89.0	.083
1977	2.0	10.7	12.7	1.400	9.1	99.2	.092
1978	2.6	13.8	16.4	1.504	10.9	105.1	.104
1979	2.5	13.1	15.6	1.637	9.5	106.2	.089
1980	1.9	13.6	15.5	1.787	8.7	93.7	.093
1981	1.8	16.2	18.0	1.952	9.2	94.5	.097
1982E	-	-	-	-	8.7	91.5	.095
1983F	-	-	-	-	9.6	100.7	.095
1984F	-	-	-	-	10.5	111.0	.095
1985F	-	-	-	-	10.5	110.9	.095
1986F	-	-	-	-	10.9	114.8	.095
1987F	-	-	-	-	11.5	121.4	.095
1988F	-	-	-	-	11.8	123.7	.095
1989F	-	-	-	-	10.7	113.1	.095
1990F	-	-	-	-	11.1	116.9	.095

[1]Source: DOC Statistical Abstract of the U.S., F.W. Dodge original data.
[2]Source: Forecast DRI.

E = Estimated.
F = Forecasted.

Figure G-30

GIWW TRAFFIC AND FORECAST

MARINE SHELLS

Year	1 GIWW Marine Shells[1] (million tons)	2 3 Year Average (million tons)	3 3 Year Average Ratio to Prior Year
1970	13.8	--	--
1971	12.9	13.0	--
1972	12.3	12.7	.98
1973	12.8	12.2	.96
1974	11.5	11.4	.93
1975	9.8	9.6	.84
1976	7.5	8.4	.88
1977	7.9	7.5	.89
1978	7.0	6.8	.91
1979	5.6	6.2	.91
1980	5.9	5.0	.89
1981	5.2	--	.90
1982	3.9	--	.90
1983E	4.2	--	.90
1984F	3.8	--	.90
1985F	3.4	--	.90
1986F	3.1	--	.90
1987F	2.8	--	.90
1988F	2.5	--	.90
1989F	2.2	--	.90
1990F	2.0	--	.90

[1]Source: USACE WCUS Part 2.

E = Estimated.
F = Forecasted.

Figure G-31

GIWW TRAFFIC AND FORECAST

SAND, STONE, AND GRAVEL

Year	1 GIWW Sand, Stone, and Gravel (million tons)	2 Alabama & Texas Construction[2] (million $ 1972)	3 1 ÷ 2 Explanatory Factor
1970	1.5	5.6	.27
1971	2.0	6.5	.31
1972	2.4	7.2	.33
1973	2.3	7.4	.31
1974	2.2	6.8	.32
1975	2.5	7.6	.33
1976	2.7	7.4	.36
1977	2.3	9.1	.25
1978	2.6	10.9	.24
1979	2.4	9.5	.25
1980	2.5	8.7	.29
1981	2.2	9.2	.24
1982	1.8	8.7	.21
1983F	2.4	9.6	.24
1984F	2.5	10.5	.24
1985F	2.6	10.5	.24
1986F	2.6	10.9	.24
1987F	2.8	11.5	.24
1988F	2.8	11.8	.24
1989F	2.6	10.7	.24
1990F	2.7	11.1	.24

[1]Source: USACE WCUS Part 2.
[2]Source: Statistical Abstract of U.S.

E = Estimated.
F = Forecasted.

Figure G-32

GIWW TRAFFIC AND FORECAST

CONSTRUCTION MATERIALS

Year	1 GIWW Marine Shell[1]	2 GIWW Sand, Stone Gravel[1]	3 Total
1970	13.8	1.5	15.3
1971	12.9	2.0	14.9
1972	12.3	2.4	14.7
1973	12.8	2.3	15.1
1974	11.5	2.2	13.7
1975	9.8	2.5	12.3
1976	7.5	2.7	10.2
1977	7.9	2.3	10.2
1978	7.0	2.6	9.6
1979	5.6	2.4	8.0
1980	5.9	2.5	8.4
1981	5.2	2.2	7.4
1982	3.9	1.1	5.7
1983E	4.2	2.4	6.6
1984F	3.8	2.5	6.3
1985F	3.4	2.6	6.0
1986F	3.1	2.6	5.7
1987F	2.8	2.8	5.6
1988F	2.5	2.8	5.3
1989F	2.2	2.6	4.8
1990F	2.0	2.7	4.7

[1]Source: USACE WCUS Part 2.

E = Estimated.
F = Forecasted.

Figure G-33

GIWW TRAFFIC AND FORECAST

CHEMICALS AND AROMATICS

Year	1 GIWW Chemicals Traffic[1] (million tons)	2 PADD III Aromatic and Petrochemical Runs[2] (million bbls)	3 1 ÷ 2 Explanatory Factor	4 DRI Chemical Production Index[3]	5 2 ÷ 4 Explanatory Factor
1970	9.2	305	.030	1.179	258.7
1971	9.1	311	.029	1.236	251.6
1972	10.6	336	.932	1.307	244.0
1973	9.9	359	.028	1.477	243.1
1974	5.4	364	.015	1.533	237.4
1975	9.7	338	.029	1.360	248.5
1976	10.8	392	.028	1.617	242.4
1977	11.4	435	.026	1.718	253.2
1978	12.8	473	.027	1.818	260.2
1979	13.3	500	.027	1.921	260.3
1980	12.0	500	.024	1.875	266.7
1981	11.9	428	.028	1.869	229.0
1982E	10.0	386	.026	1.573	245.4
1983F	11.4	438	.026	1.750	250
1984F	12.5	482	.026	1.928	250
1985F	13.0	500	.026	1.999	250
1986F	13.4	516	.026	2.064	250
1987F	14.3	551	.026	2.203	250
1988F	15.5	596	.026	2.385	250
1989F	14.5	559	.026	2.235	250
1990F	14.0	540	.026	2.158	250

[1] Source: USACE WCUS Part 2.
[2] Source: DOE Petroleum Supply Monthly.
[3] DRI JQIND281.

E = Estimated.
F = Forecasted.

(Note: Col. 1 forecasts are Col. 2 x Col. 3. Col. 2 based on Col. 4 x Col. 5 (forecast).)

Figure G-34

GIWW TRAFFIC AND FORECAST

ALL OTHER COMMODITIES

Year	1 GIWW All Other[1] (million tons)	2 GNP[2] (billion $ 1972)	3 1 ÷ 2 Explanatory Factor
1970	15.6	1,088	.014
1971	16.2	1,122	.014
1972	16.7	1,186	.014
1973	15.9	1,255	.013
1974	22.6	1,248	.018
1975	16.2	1,234	.013
1976	15.6	1,298	.012
1977	17.6	1,370	.013
1978	17.5	1,439	.012
1979	11.9	1,479	.008
1980	15.9	1,474	.011
1981	16.2	1,503	.011
1982	9.8	1,485	.0007
1983E	16.9	1,536	.011
1984F	17.8	1,619	.011
1985F	18.4	1,671	.011
1986F	18.8	1,713	.011
1987F	19.4	1,762	.011
1988F	20.0	1,818	.011
1989F	20.6	1,872	.011
1990F	21.2	1,929	.011

[1]Source: USACE WCUS Part 2.
[2]Source: Forecast DRI.

E = Estimated.
F = Forecasted.

However, the conservative forecast is justified because it takes into account the hard competition from railroads for this traffic, as well as greater coal imports from Colombia.

HISTORICAL TON-MILE ANALYSIS

Figures G-35, 36, and 37 summarize ton-miles on the Mississippi River System and other connecting tributaries. Figure G-35 summarizes this information as billions of ton-miles. This exhibit shows that the most dramatic growth occurred on the Mississippi River between Baton Rouge and New Orleans, because of increased grain exports, while traffic on other rivers grew at varying rates. Figure G-36 measures this relative growth on an index basis (with 1970 as the baseline year) and Figure G-37 examines the composition of this traffic on a ton-miles basis (as a percentage of total traffic). The Mississippi System's traffic between the Ohio River and Baton Rouge increased from 36 to 43 percent, while traffic on the Mississippi between Minneapolis and the Missouri remained relatively constant.

BARGE TRAFFIC SUMMARY

This series of exhibits (Figures G-38 - G-47) summarizes the historical barge traffic using CofE data from the Part II of the Waterborne Commerce Statistics volumes. It is intended to provide a snapshot view of the composition of trade of various waterways, showing the imbalances between loaded and empty, dry and tank barges, upbound/downbound or eastbound/westbound, as applicable. The information is intended to help carriers assess their tows versus overall traffic averages. This traffic includes movements of dredged materials aboard deck barges. Therefore, the traffic shown is slightly higher than the norm for linehaul carriers. In general, barge trips and drafts under four feet are considered empty, with the exception of the Gulf Intercoastal Waterway and the Mississippi River between the Ohio River and Baton Rouge, where trips under six feet are considered empty.

Figure G-35

GREATER WESTERN RIVER SYSTEM
INTERNAL TRAFFIC

(billions of ton miles)

	Total	Mississippi Minn. to Mo. River	Mississippi Mo. to Ohio	Mississippi Ohio to Baton Rouge	Mississippi Baton Rouge to New Orleans	Mississippi New Orleans to Mouth of Pass	McClellan Arkansas	Illinois River	Missouri River	Tennessee River	Ohio River	GIWW Mexico-Florida	Black/Warrior Tombigbee
1970	139.1	10.4	9.1	49.8	6.7	1.9	0.2	7.0	1.2	3.7	30.2	16.1	2.8
1971	144.9	10.2	9.1	52.5	7.2	2.1	0.3	6.7	1.3	4.0	30.9	17.5	3.1
1972	159.9	11.6	10.6	60.3	8.7	2.3	0.5	7.7	0.9	3.8	32.1	17.6	3.8
1973	154.3	10.8	10.4	59.0	8.9	2.3	0.3	7.8	0.9	3.9	29.9	16.4	3.7
1974	166.3	11.7	11.4	65.2	9.5	2.1	0.5	8.1	1.2	3.6	31.9	16.9	4.2
1975	164.4	11.3	11.8	64.9	9.5	2.2	0.4	8.3	1.1	3.9	32.3	15.4	3.3
1976	180.1	11.7	13.2	73.2	10.4	2.1	0.8	8.4	1.5	3.7	34.4	16.3	4.4
1977	184.1	11.4	12.4	73.3	10.6	1.9	1.3	8.0	1.6	3.7	37.4	18.0	4.5
1978	193.1	12.9	13.4	78.9	11.1	1.8	1.7	7.6	1.5	4.4	38.8	17.1	3.9
1979	200.5	13.3	13.6	80.8	11.2	1.7	1.5	7.0	1.5	5.1	43.4	17.0	4.4
1980	210.3	15.2	16.0	88.3	12.1	1.8	1.8	8.3	1.3	5.3	38.7	16.3	5.2
1981	215.1	15.8	15.9	92.1	13.2	1.9	1.9	8.0	1.1	4.8	39.6	15.8	5.0

Source: Waterborne Commerce of the United States; Dept. of the Army Corps of Engineers Part 2.

Figure G-36

GREATER WESTERN RIVER SYSTEM
INTERNAL TRAFFIC
GROWTH INDICES

1970 = 100

	Total	Mississippi Minn. to Mo. River	Mississippi Mo. to Ohio	Mississippi Ohio to Baton Rouge	Mississippi Baton Rouge to New Orleans	Mississippi New Orleans to Mouth of Pass	McClellan Arkansas	Illinois River	Missouri River	Tennessee River	Ohio River	GIWW Mexico-Florida	Black/Warrior Tombigbee
1970	100	100	100	100	100	100	100	100	100	100	100	100	100
1971	104	98	100	105	107	111	150	89	108	108	102	109	111
1972	115	112	116	121	130	121	250	110	75	103	106	109	136
1973	111	104	114	118	133	121	150	111	75	105	99	102	132
1974	120	113	125	131	142	111	250	116	100	97	106	105	150
1975	118	109	130	130	142	116	200	119	92	105	107	96	118
1976	129	113	145	147	155	111	400	120	125	100	114	101	157
1977	132	110	136	147	158	100	650	114	133	100	124	112	161
1978	139	124	147	158	166	95	850	109	125	119	128	106	139
1979	144	128	149	162	167	89	750	100	125	138	144	106	157
1980	151	146	176	177	181	95	900	119	108	143	128	101	186
1981	155	152	175	185	197	100	950	114	92	130	131	98	179

Source: Waterborne Commerce of the United States; Dept. of the Army Corps of Engineers Part 2.

Figure G-37

GREATER WESTERN RIVER SYSTEM
INTERNAL TRAFFIC
PERCENTAGE

	Total	Mississippi Minn. to Mo. River	Mississippi Mo. to Ohio	Mississippi Ohio to Baton Rouge	Mississippi Baton Rouge to New Orleans	Mississippi New Orleans to Mouth of Pass	McClellan Arkansas	Illinois River	Missouri River	Tennessee River	Ohio River	GIWW Mexico-Florida	Black/Warrior Tombigbee
1970	100.0	7.5	6.5	35.8	4.8	1.4	0.1	5.0	0.9	2.7	21.7	11.6	2.0
1971	100.0	7.0	6.3	36.2	5.0	1.4	0.2	4.6	0.9	2.8	21.3	12.1	2.1
1972	100.0	7.3	6.6	37.7	5.4	1.4	0.3	4.8	0.6	2.4	20.1	11.0	2.4
1973	100.0	7.0	6.7	38.2	5.8	1.5	0.2	5.1	0.6	2.5	19.4	10.6	2.4
1974	100.0	7.0	6.9	39.2	5.7	1.3	0.3	4.9	0.7	2.2	19.2	20.3	2.5
1975	100.0	6.9	7.2	39.5	5.8	1.3	0.2	5.0	0.7	2.4	19.6	9.4	2.0
1976	100.0	6.5	7.3	40.6	5.8	1.2	0.4	4.7	0.8	2.1	19.1	9.1	2.4
1977	100.0	6.2	6.7	39.8	5.8	1.0	0.7	4.3	0.9	2.0	20.3	9.8	2.4
1978	100.0	6.7	6.9	40.9	5.7	0.9	0.9	3.9	0.8	2.3	20.1	8.9	2.0
1979	100.0	6.6	6.8	40.3	5.6	0.7	0.7	3.5	0.7	2.5	21.6	8.5	2.2
1980	100.0	7.2	7.6	42.0	5.8	0.9	0.9	3.9	0.6	2.5	18.4	7.8	2.5
1981	100.0	7.3	7.4	42.8	6.1	0.9	0.9	3.7	0.5	2.2	18.4	7.3	2.3

Source: Waterborne Commerce of the United States; Dept. of the Army Corps of Engineers Part 2.

Figure G-38

BARGE TRAFFIC SUMMARY

RIVER SECTION: MISSISSIPPI RIVER-MINNEAPOLIS TO MISSOURI RIVER

Year	Upbound					Downbound					Total Downbound Barges
	Dry Barge		Tank Barge		Total	Dry Barge		Tank Barge		Total	
	Empty	Full	Empty	Full	Full	Empty	Full	Empty	Full	Full	
1970	11634	13295	1032	6340	19635	7123	17802	5553	1817	19619	32295
1971	12612	12638	1063	6249	18887	6485	18752	5312	1999	20751	32548
1972	16121	13349	1305	6150	19499	7454	21954	5488	1973	23927	36869
1973	16656	11367	1291	5212	16579	5250	22760	4490	2028	24788	34528
1974	17679	12574	1616	5589	18163	4501	26326	4852	2330	28656	38009
1975	18522	12419	1758	5073	17492	5866	24968	4689	2227	27195	37750
1976	21629	11742	1910	5343	17085	5428	27862	4685	2680	30542	40655
1977	20436	12561	1716	5344	17905	5859	27138	4655	2385	29523	40037
1978	20562	13010	1701	4810	17820	7076	27551	4121	2234	29785	40982
1979	22039	13043	1419	4168	17211	6003	29658	3328	2255	31913	41244
1980	27386	12119	1927	3840	15959	5503	34947	3129	2596	37543	46175
1981	27286	11342	1872	3555	14897	5246	33336	2774	2579	35915	43935

Note: 6' and less are treated "empty."

Source: U.S. Army Corps of Engineers Waterborne Commerce of the United States Part 2.

Figure G-39

BARGE TRAFFIC SUMMARY

RIVER SECTION: MISSISSIPPI RIVER--MISSOURI RIVER TO OHIO RIVER

Year	Upbound					Downbound					Total Downbound Barges
	Dry Barge		Tank Barge		Total Full	Dry Barge		Tank Barge		Total Full	
	Empty	Full	Empty	Full		Empty	Full	Empty	Full		
1970	12722	14394	1018	5991	20385	6407	20704	5055	1951	22655	34117
1971	12650	14638	898	6351	20989	6579	20705	5190	2035	22740	34509
1972	17286	15491	1171	5980	21471	8032	24726	5113	2022	26748	39893
1973	19047	12763	1164	4611	17374	4727	27037	3724	2049	29086	37537
1974	20105	14254	1669	5137	19391	5665	28862	4102	2477	31339	41106
1975	20817	13897	1887	4779	18676	6250	29047	4316	2361	26686	41974
1976	25076	13539	2022	5144	18653	5598	33017	4117	2963	35980	45695
1977	22548	14355	1689	4767	19122	6447	30456	3752	2684	33140	43339
1978	27449	12992	1697	4373	17365	4240	35595	3418	2567	38162	45820
1979	30445	12167	1366	3919	16086	3090	38442	2702	2367	40809	46601
1980	38332	10766	1857	3581	14347	2210	46849	2652	2720	49569	54431
1981	37976	10365	1833	3597	13962	3031	45352	2658	2629	47981	53670

Note: 6' and less are treated "empty."

Source: U.S. Army Corps of Engineers Waterborne Commerce of the United States Part 2.

Figure G-40

BARGE TRAFFIC SUMMARY

RIVER SECTION: MISSISSIPPI RIVER--OHIO RIVER TO BATON ROUGE

Year	Upbound					Downbound					Total Downbound Barges
	Dry Barge		Tank Barge		Total Full	Dry Barge		Tank Barge		Total Full	
	Empty	Full	Empty	Full		Empty	Full	Empty	Full		
1970	24936	16240	1080	12403	28643	10187	30963	11288	2184	33147	54622
1971	28808	14434	1433	13835	28269	9336	33882	12506	2748	36630	58472
1972	35307	14772	872	14569	29341	5615	44550	13399	2002	46552	65566
1973	33004	11798	527	13697	25495	4508	40388	12431	1742	42130	59069
1974	36358	13834	1173	13895	27729	6778	43937	12439	2042	45979	65196
1975	34570	13344	1264	13006	26350	5360	43161	12253	1717	44878	62491
1976	42019	12888	1257	14160	27048	5682	50669	13204	2170	52839	71725
1977	40431	13643	984	15044	28687	4957	48950	13673	2075	51025	69655
1978	40833	16918	1113	15263	32181	5186	53274	13520	2563	55837	74543
1979	46095	14774	1609	13230	28004	4389	56355	11023	3258	59613	75025
1980	55065	12748	2692	11219	23967	4386	64441	8921	4374	68815	82122
1981	62542	11384	2581	9329	20713	3907	69508	7775	3858	73366	85048

Note: 6' and less are treated "empty."

Source: U.S. Army Corps of Engineers Waterborne Commerce of the United States Part 2.

Figure G-41

BARGE TRAFFIC SUMMARY

RIVER SECTION: ILLINOIS RIVER

Year	Upbound					Downbound					Total Downbound Barges
	Dry Barge		Tank Barge		Total Full	Dry Barge		Tank Barge		Total Full	
	Empty	Full	Empty	Full		Empty	Full	Empty	Full		
1970	5992	10522	252	4084	14606	7980	8535	3472	868	9403	20855
1971	6012	9890	634	3763	13653	8020	7939	3426	968	8907	20353
1972	8672	9569	1248	4079	13648	7559	10726	3579	1734	12460	23598
1973	8081	10248	1428	3594	13842	7674	10684	3043	1991	12675	23392
1974	7059	10593	1162	4326	14919	7319	10350	3259	2248	12598	23176
1975	8473	11198	1046	4104	15302	8146	11576	2875	2215	13791	24862
1976	10119	9968	1797	3332	13300	7070	13366	2878	2221	15587	25535
1977	10030	9920	987	3234	13154	6925	13016	2793	1389	14405	24123
1978	9501	7382	1197	2972	10354	5424	12688	2540	1554	14242	22206
1979	8961	7141	802	2565	9706	5267	11964	2004	1242	13206	20477
1980	12133	7399	2059	2405	9804	5351	15022	1854	2800	17822	25027
1981	10354	8223	2584	2264	10487	5456	13249	1709	3170	16419	23584

Note: *6' and less are treated "empty."*

Source: U.S. Army Corps of Engineers Waterborne Commerce of the United States Part 2.

Figure G-42

BARGE TRAFFIC SUMMARY

RIVER SECTION: MCCLELLAN-KERR ARKANSAS RIVER

Year	Upbound					Downbound					Total Downbound Barges
	Dry Barge		Tank Barge		Total Full	Dry Barge		Tank Barge		Total Full	
	Empty	Full	Empty	Full		Empty	Full	Empty	Full		
1970	2703	4821	4	48	4869	5002	2522	45	3	2525	7572
1971	2206	5529	21	95	5624	4804	2934	80	26	2960	7844
1972	4468	4646	24	171	4817	3018	6093	162	32	6125	9275
1973	3134	5121	13	365	5486	4315	3664	343	17	3681	8339
1974	3762	5499	18	378	5877	4590	4332	357	13	4345	9292
1975	3779	4765	29	272	5037	4366	4224	231	28	4455	8849
1976	4337	5094	262	393	5487	4493	4932	330	273	5205	10028
1977	4680	6522	396	515	7037	4221	6981	451	406	6595	12059
1978	5580	5182	364	570	5752	5860	7405	519	388	7793	14192
1979	5301	4711	512	430	5141	3221	7330	359	493	7823	11403
1980	3517	4347	673	261	4608	2747	6733	210	718	7451	10408
1981	4419	3569	527	215	3784	2281	5535	213	568	6103	8597

Note: 6' and less are treated "empty."

Source: U.S. Army Corps of Engineers Waterborne Commerce of the United States Part 2.

Figure G-43

BARGE TRAFFIC SUMMARY

RIVER SECTION: MISSOURI RIVER

Year	Upbound					Downbound					Total Downbound Barges
	Dry Barge		Tank Barge		Total Full	Dry Barge		Tank Barge		Total Full	
	Empty	Full	Empty	Full		Empty	Full	Empty	Full		
1970	14359	8313	41	369	8682	9448	13212	299	107	13319	23066
1971	11288	7023	205	402	7425	6872	11461	466	144	16605	18943
1972	10322	8356	58	404	8760	8403	10433	342	157	10590	19335
1973	5882	10126	111	219	10345	7405	8651	220	97	8748	16373
1974	8244	11467	28	252	11719	6929	11244	227	87	11331	18487
1975	8534	6823	34	274	7097	7364	7918	259	47	7965	15588
1976	10035	5973	104	285	6258	6855	9378	176	180	9558	16589
1977	9910	4868	137	270	5138	5055	9717	159	198	9915	15129
1978	8788	8157	74	269	8426	8043	10357	221	256	10613	18877
1979	10977	5713	80	261	5914	3957	12708	182	153	12861	17000
1980	10008	4295	84	204	4499	2101	9451	147	123	9574	11822
1981	5946	4474	171	159	4633	2515	8560	115	120	8680	11310

Note: 6' and less are treated "empty."

Source: U.S. Army Corps of Engineers Waterborne Commerce of the United States Part 2.

Figure G-44

BARGE TRAFFIC SUMMARY

RIVER SECTION: TENNESSEE RIVER

Year	Upbound					Downbound					Total Downbound Barges
	Dry Barge		Tank Barge		Total Full	Dry Barge		Tank Barge		Total Full	
	Empty	Full	Empty	Full		Empty	Full	Empty	Full		
1970	6955	12973	354	1777	14750	12618	7302	1672	458	7760	22050
1971	5810	14638	283	1999	16637	13628	6820	1768	509	7329	22725
1972	6017	14919	332	1949	16868	13807	7125	1761	515	7640	23208
1973	5551	15724	271	1683	17407	14399	6881	1451	498	7379	23229
1974	6344	14254	367	1586	15840	12997	7602	1494	460	8062	22553
1975	5664	14655	486	1656	16311	12307	7926	1588	494	8420	22315
1976	6653	12950	473	2071	15021	11192	8116	1957	580	8696	21845
1977	6182	11410	460	2167	13577	9969	7873	1943	587	8460	20372
1978	6347	15027	462	1972	16999	13157	8751	2037	662	9413	24607
1979	7040	15325	546	1413	16738	14031	8024	1647	733	8937	24435
1980	5120	15752	552	1417	17169	14021	6459	1361	568	7027	22409
1981	6367	13236	438	1110	14346	12239	7497	1050	469	7966	21255

Note: 6' and less are treated "empty."

Source: U.S. Army Corps of Engineers Waterborne Commerce of the United States Part 2.

Figure G-45

BARGE TRAFFIC SUMMARY

RIVER SECTION: OHIO RIVER

Year	Upbound					Downbound					Total Downbound Barges
	Dry Barge		Tank Barge		Total Full	Dry Barge		Tank Barge		Total Full	
	Empty	Full	Empty	Full		Empty	Full	Empty	Full		
1970	51748	44153	3676	12552	56705	40547	55347	11716	4514	59861	112124
1971	49742	45943	4586	13042	58985	40971	54726	12193	5443	60169	113336
1972	50328	45601	4402	13223	58824	40467	55450	12374	5257	60707	113548
1973	55008	45340	3411	12401	57741	39828	61032	10929	4599	65631	116388
1974	54584	42277	4115	10689	52966	36593	60268	10064	4740	65008	111665
1975	50135	43181	4170	10066	53247	34473	58819	9907	4257	63076	107456
1976	49285	51513	3445	10663	62176	43024	57850	10335	3736	61586	114945
1977	55439	47918	2600	10849	58767	39813	63290	10392	3260	66550	116755
1978	53029	54783	2635	10214	64997	44266	62850	10458	4585	67435	122159
1979	79194	48349	3810	9936	58285	43805	85571	9245	4816	90387	143437
1980	66480	48230	4911	8880	57110	42767	72261	8065	5585	77846	128678
1981	62617	51533	4174	7503	59036	43949	67132	6858	4720	71852	122659

Note: 6' and less are treated "empty."

Source: U.S. Army Corps of Engineers Waterborne Commerce of the United States Part 2.

Figure G-46

BARGE TRAFFIC SUMMARY

RIVER SECTION:
GULF INTRACOASTAL WATERWAY - BETWEEN APALACHEE BAY AND THE MEXICAN BORDER

Year	Eastbound					Westbound					Total Westbound Barges
	Dry Barge		Tank Barge		Total Full	Dry Barge		Tank Barge		Total Full	
	Empty	Full	Empty	Full		Empty	Full	Empty	Full		
1970	16040	14000	20192	18439	32439	21054	8665	21315	17335	31335	68704
1971	15994	17191	21856	20072	37263	22164	11001	23471	18503	29504	75139
1972	14402	19962	18093	21756	41718	24160	10111	23659	17107	27218	75037
1973	14061	15900	14822	20357	36257	19230	10625	20679	14590	25215	65124
1974	14551	16218	13702	20185	35403	17963	11733	21024	13526	25259	64246
1975	15130	13398	14655	20795	34194	17622	10139	21997	13323	23462	63081
1976	14446	13687	15293	18675	32362	19566	8529	20173	13840	22369	62108
1977	13964	13098	13941	19913	33011	16593	8723	20395	14988	23711	60699
1978	13081	13454	12899	19751	33205	15972	8705	19499	14279	22984	58455
1979	11133	12440	12869	17490	29930	15844	8268	17098	14270	22538	55480
1980	12002	12277	13403	15688	27962	14076	9501	15956	14170	23671	53703
1981	11742	11540	14607	15548	27088	13582	9896	15915	14035	23931	53428

Note: 6' and less are treated "empty."

Source: U.S. Army Corps of Engineers Waterborne Commerce of the United States Part 2.

Figure G-47

BARGE TRAFFIC SUMMARY

RIVER SECTION:
BLACK WARRIOR AND TOMBIGIBEE RIVERS

Year	Upbound					Downbound					Total Downbound Barges
	Dry Barge		Tank Barge		Total Full	Dry Barge		Tank Barge		Total Full	
	Empty	Full	Empty	Full		Empty	Full	Empty	Full		
1970	4948	176.	157	869	2637	925	5796	839	189	5985	7749
1971	4697	2527	150	879	3406	1554	5677	817	210	5887	8258
1972	5445	3019	111	989	4088	2380	6090	916	178	6298	9564
1973	4800	3159	129	896	4055	2194	5771	868	152	5923	8985
1974	5028	3660	274	523	4183	2322	6367	471	318	6685	9478
1975	5390	2468	248	437	2905	1678	6195	392	277	6472	8542
1976	5966	3208	210	471	3679	2123	7053	433	241	7294	9850
1977	5887	3147	247	445	3592	2013	7021	389	280	7301	9703
1978	5396	3081	259	502	3583	1848	6796	374	306	6490	9324
1979	6171	2738	345	402	3140	1564	7421	282	493	7914	9760
1980	7559	2259	237	397	2656	1112	8457	192	648	9105	10409
1981	7957	2256	233	296	2552	1144	9025	201	407	9432	10777

Note: 6' and less are treated "empty."

Source: U.S. Army Corps of Engineers <u>Waterborne Commerce of the United States</u> Part 2.

APPENDIX H

FINANCIAL FORECASTING MODEL

FINANCIAL FORECASTING MODEL FOR AN INLAND BARGE AND TOWING COMPANY

The financial forecasting model is based on revenue and cost parameters which are unique to each barge and towing company. Forecasted revenue is based upon expected market share, available equipment, utilization and freight rates. Expected costs are dependent upon fixed and variable towing costs, annual barge costs, port expenses, and sales, general and administrative expenses. The model used is the FCS-EPS[1] computer spread sheet package.

PARAMETERS

Each of the parameters must be estimated for the forecast period. For example, market share is determined from an analysis of historical market shares and estimations of whether the shares for each commodity group are expected to increase, decrease, or remain constant. The historical shares are calculated by dividing the company's actual tonnages by the industry tonnages described in Chapter IV and Appendix G. The expected market share percentages are then multiplied by the forecasted industry tonnages to get forecasted company tonnages. In the model, the commodity tonnages are grouped by equipment type: open, covered, and tank barges.

MODEL SECTIONS

The model is developed in three sections. The Logic Section describes all of the company parameters (C.P.) and their mathematical relationships. The Data Section provides the inputs values for the parameters for all time periods used in the model. The Report Section formats the outputs for presentation of the forecast results.

The Logic Section is described below in detail. Other standard spreadsheet packages can also be used by applying these equations. The company data can then be entered on each line for the desired time periods.

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[1]FSC-EPS is copyrighted by EPS Incorporated.

LOGIC SECTION

Revenue

1) Annual Tonnage:Covered Hoppers (Based on Market Share)

2) Number of Covered Hoppers (Company Parameters--C.P.)

3) Annual Tonnage Per Covered Hopper (= Line 1/Line 2)

4) Average Tonnage per Trip:Covered Hoppers (C.P.)

5) Number of Loads Per Year Per Covered Hopper (= Line 4/ Line 5)

6) Averaged Loaded Trip Miles:Covered Hoppers (C.P.)

7) Cargo Ton Miles:Covered Hoppers (= Line 2 x Line 4 x Line 5 x Line 6)

8) Revenue Per Cargo Ton Mile:Covered Hoppers (C.P.)

9) Total Revenue:Covered Hoppers (= Line 7 x Line 8)

10-19) Repeat for Open Hoppers

20-29) Repeat for Tank Barges

30) Demurrage Revenue (C.P.)

31) Other Income (C.P.)

32) Total Revenue (= Line 9 + Line 19 + Line 29 + Line 30 + Line 31)

Towing Costs

33) Fixed Towing Cost (C.P.)

34) Cost Per Cargo Ton Mile (C.P.)

35) Variable Towing Cost (= Line 34 x (Line 7 + Line 17 + Line 27))

36 Total Towing Cost (= Line 35 + Line 33)

Barge Expense

37) Annual Cost Per Barge:Covered Hoppers (C.P.)

38) Annual Cost:Covered Hoppers (= Line 2 x Line 37)

39) Annual Cost Per Barge:Open Hoppers (C.P.)

40) Annual Cost:Open Hoppers (= Line 12 x Line 39)

41) Annual Cost Per Barge:Tank Barges (C.P.)

42) Annual Cost:Tank Barges (= Line 22 x Line 41)

43) Total Annual Barge Cost (= Line 38 + Line 40 + Line 42)

Port Expenses

44) Port Expenses Per Barge Load (C.P.)

45) Port Expenses:Covered Barge (= Line 2 x Line 5 x Line 44)

46) Port Expenses:Open Hoppers (= Line 12 x Line 15 x Line 44)

47) Port Expense:Tank Barges (= Line 22 x Line 25 x Line 44)

48) Total Port Expenses (= Line 45 + Line 46 + Line 47)

Other Expenses

49) Other Expense (C.P.)

50) Total Operating Expense (= Line 36 + Line 43 + Line 48 + Line 49)

51) Gross Operating Profit (= Line 32 - Line 50)

52) Sales, General and Administration Expense (C.P.)

Earnings

53) Earning Before Interest and Taxes = Line 51 - Line 52

APPLICATION

Using a financial forecasting model, the planner can determine the potential effects upon earnings due to changes in market share, freight rates, equipment configuration or operating patterns.

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