COORDINATING TRANSPORTATION TO REDUCE COSTS

Possibilities for 14 Regional Cooperatives

FARMER COOPERATIVE SERVICE · U. S. DEPARTMENT OF AGRICULTURE · FCS SERVICE REPORT 132

Farmer Cooperative Service provides research, management, and educational assistance to cooperatives to strengthen the economic position of farmers and other rural residents. It works directly with cooperative leaders and Federal and State agencies to improve organization, leadership, and operation of cooperatives and to give guidance to further development.

The Service (1) helps farmers and other rural residents obtain supplies and services at lower cost and to get better prices for products they sell; (2) advises rural residents on developing existing resources through cooperative action to enhance rural living; (3) helps cooperatives improve services and operating efficiency; (4) informs members, directors, employees and the public on how cooperatives work and benefit their members and their communities; and (5) encourages international cooperative programs.

The Service publishes research and educational materials and issues News for Farmer Cooperatives. All programs and activities are conducted on a nondiscriminatory basis without regard to race, creed, color, sex, or national origin.

PREFACE

This is an exploratory study to determine: (1) Transportation methods and programs that offer the greatest potential for coordinating the inter-cooperative, north-south flows of grain and bulk farm supplies among 14 midwestern regional grain marketing and farm supply cooperatives, and (2) ways of reducing transportation costs for the cooperatives.

These 14 cooperatives are the principal cooperative shippers of grain moving to the Gulf*/ and the principal cooperative receivers of bulk farm supplies moving from the Gulf to the Midwestern States of Ohio, Indiana, Illinois, Minnesota, Iowa, Missouri, and Kansas.

The study examines 1970 methods of transporting grain and bulk farm supplies by rail and barge between the Gulf and the Midwest; economic advantages of shipper-operated versus for-hire carrier transportation equipment; and alternative transportation programs to increase efficiency, reduce costs and improve service for the participating cooperatives.

Need for this study arises from the following: (1) Rapid expansion of cooperative shipments of grain and bulk fertilizer between the Gulf and the Midwest; (2) continuing shortages of railcars and barges; (3) poor utilization of shipper-operated transportation equipment; and (4) an unsatisfactory transportation system to meet the needs of changing grain marketing and fertilizer distribution programs.

Data were obtained for 1970 from 14 regional farm supply and grain marketing cooperatives, showing volumes of commodities moved, means of transport, and transportation costs for specific movements. Shipper-owned and -leased equipment data were assembled. Other information such as rates and operating costs were obtained from the cooperatives and other sources to show comparison by type of commodity, type of equipment, owned or leased versus for-hire transportation, and length of haul.

Traffic managers and others at each of the 14 participating cooperatives were interviewed and either filled out or provided information for filling out a questionnaire. Physical data obtained included: (1) Number of barge and rail shipments and tons of grain, fertilizer ingredients, and other dry bulk farm supplies shipped or received by the cooperatives that originated or terminated in the Midwest or the Gulf; (2) rates and costs associated with such shipments; and (3) owned or leased transportation equipment by type, manufacturer, and capacity with details regarding leases or ownership.

*/ For this study, the Gulf is defined as encompassing the States of Florida, Georgia, Alabama, Mississippi, and Louisiana.

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SUMMARY AND RECOMMENDATIONS

Joint operation of a private fleet of barges and towboats by 14 midwestern grain marketing and farm supply cooperatives shows the greatest potential for reducing their transportation costs. In 1970, the 14 cooperatives paid out more than $9.8 million to ship 1,798 bargeloads of grain and about $1.5 million for 286 bargeloads of fertilizer, or a total of more than $11.3 million. If the cooperatives had shipped the equivalent in their own towboats and barges it would have cost $9.2 million or a possible saving of more than $2 million, despite only a 15-percent backhaul.

If the cooperatives had limited their own barge operation to matching the downriver movement of grain with the total upriver movement of fertilizer (286 bargeloads) they could have saved $900,000 more than the amount they paid to for-hire barge operators in 1970.

If the cooperatives had diverted to barges rail shipments of fertilizer that were destined to points within about 75 miles of the Mississippi River system in 1970, the total barge potential would have been 702 bargeloads. Matching this with an equivalent downriver movement of grain would have saved cooperatives more than $2.2 million compared with the way it was shipped.

The ratio of southbound to northbound barge shipments was 6 to 1. In the same period, the cooperatives shipped 10,675 railcars of grain to the Gulf and received 8,499 carloads of fertilizer from the Gulf. The ratio of southbound to northbound rail shipments was 1.5 to 1.

Louisiana was the destination of 99.5 percent of grain shipments by barge and 64 percent of grain shipments by rail.

Florida and Louisiana originated 99 percent of the fertilizer shipments by barge. Most of this was transloaded from Gulf to river barges at New Orleans. Florida alone accounted for 98 percent of fertilizer shipments by rail.

Seasonally, rail shipments north and south--and barge shipments north--tended to peak in March. Barge shipments south showed an increasing trend from February through October.

Owned or leased transportation equipment of the cooperatives included 10 barges and 1,374 rail hopper cars. Average lease cost for hopper cars was $190 a month.

The total amount paid by the cooperatives for transportation between the Midwest and Gulf for 1970 was $27.7 million. This consisted of $15.5 million for rail and $12.2 million for barge transportation.

Total north-south shipments of the 14 cooperatives amounted to more than 6 billion ton-miles.

The transportation bill for cooperatives on a ton-mile basis by mode and direction of transport were: (1) Barge--2.73 mills southbound and 3.48 mills northbound, and (2) rail--7.46 mills southbound and 10.13 mills northbound.

Information obtained from bargeline operators on the Mississippi River system show total costs of operation to average about 2.11 mills per ton-mile for a towboat and 15 barges operating fully loaded at all times and 2.31 mills per ton-mile if operating with no backhaul.

Other possibilities for reducing transportation costs among the 14 cooperatives through intercooperative coordination and consolidation include:

-- Coordinating the north-south flows of grain and fertilizer in the 1,374 covered hopper railcars leased by the cooperatives. With mileage allowances generally 11 cents a loaded mile, it's important to maximize loaded miles and lower ton-mile costs to shippers.

-- Strengthening the bargaining position of cooperatives with carriers by coordinating their shipments through one agency. If the cooperatives could present package programs to carriers involving two-way loaded movements of railroad or bargeline equipment, with a guaranteed volume, freight rates could probably be reduced accordingly.

-- Centralizing leasing or ownership of hopper cars by a coordinating agency for the 14 cooperatives. This would permit shifting of equipment among cooperatives to match car supply with needs of each cooperative. The cooperative that presently can't justify owning privately operated equipment could obtain needed equipment for short periods of time or for limited movements under such an arrangement.

Based on findings of this study, we recommend that the 14 cooperatives set up a system to: jointly own and operate their own towboats and barges; maximize backhauls by coordinating north-south flows of grain and fertilizer in their own railcars; pool leasing or ownership of their rail equipment; and coordinate and pool shipments to increase their bargaining power with for-hire carriers.

To gain operating experience, the cooperatives could lease towboats and barges initially. However, ownership of such equipment appears to offer the greatest potential for savings.

Study should continue to determine further possibilities for:

-- Coordinating truck movements of fertilizer and grain between river points, terminal elevators, and local cooperatives; and

-- Common sites for grain elevators and fertilizer handling and storage facilities.

COORDINATING TRANSPORTATION TO REDUCE COSTS
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Charles E. Reed
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During the past 10 years, U.S. grain exports through Gulf ports increased almost 250 percent. Exports of grain through Great Lakes ports showed only a modest increase and exports through Atlantic ports declined. Thus, the great expansion of grain exports from the Midwest during recent years has been southbound via rail and barge through Gulf ports.

Midwestern grain marketing cooperatives have shared proportionately in this increased flow of grain to the Gulf for export. A major factor contributing to the increased flow of grain to the Gulf has been the new, modern export grain elevator built by cooperatives at Ama, La. In addition, expansion of poultry and livestock production in the Southeast has required increased feed grain and soybean shipments to that region from midwestern grain cooperatives.

Northbound barge and rail movements by cooperatives of farm supply items, particularly phosphates, from the Gulf to Midwestern States have increased substantially during the past 10 years. That movement has increased at an accelerated rate during the past few years.

An indication of the increased volume and movement of fertilizer handled by cooperatives can be gained from the following:

	1950-51	1969-70	Percent increase
	Million dollars		
Total purchases of lime and fertilizer by U.S. farmers	$ 1,032	$ 2,060	100
Net sales of lime and fertilizer by farmer cooperatives	$ 156	$ 657	421
Percent of total U.S. lime and fertilizer handled by cooperatives	15%	32%	-

Several phosphate fertilizer plants have been acquired and operated by farmer cooperatives in Florida. Much of the output of these plants moves by rail and barge in dry, bulk form to cooperatives in the Midwest.

SHIPMENTS BETWEEN MIDWEST AND GULF

Grain was shipped by the 14 cooperatives to the Gulf in 1,798 barges containing 2,523,839 tons in 1970 (table 1). The cooperatives received fertilizer from the Gulf in 286 barges containing 367,614 tons. The ratio of southbound to northbound barge hauls was more than 6 to 1. Bargeloads in both directions totaled 2,084.

Table 1.--Interstate shipments and receipts of grain and fertilizer ingredients of 14 farmer cooperatives, by mode of transportation, 1970

Mode	Direction	Number	Tons	
			Total	Average per shipment
Rail	South	10,675	905,454	85
Rail	North	8,499	672,816	79
Barge	South	1,798	2,523,839	1,404
Barge	North	286	367,614	1,285

The 14 cooperatives shipped 10,675 carloads (905,454 tons) of grain to the Gulf in 1970. They received 8,499 carloads (672,816 tons) of fertilizer from the Gulf. The ratio of southbound to northbound rail hauls was nearly 1.5 to 1. Rail shipments in both directions totaled 19,174 carloads.

An average carload of grain shipped to the Gulf contained 85 tons. The average carload for northbound fertilizer ingredients was 79 tons. Average loads for barges were 1,404 tons for grain and 1,285 tons for fertilizer ingredients.

Origins and Destinations

Barge shipments and receipts in the Midwest were centered in Illinois, Minnesota, Iowa, and Missouri (figs. 1 and 2). These States accounted for 2½ million tons, or 99.8 percent of grain shipped to the Gulf by barge. These States received 351,000 tons, or 95 percent of the northbound fertilizer shipments.

Louisiana was the major destination of southbound barge shipments, accounting for 99.5 percent of the total. Louisiana originated only 10 percent of northbound barge shipments, but fertilizers from Florida were transloaded to river barges in Louisiana. Combined, Louisiana and Florida accounted for 99 percent of northbound barge shipments.

Fig. 1 - Barge Shipments of Grain from Midwest to Gulf, 1970

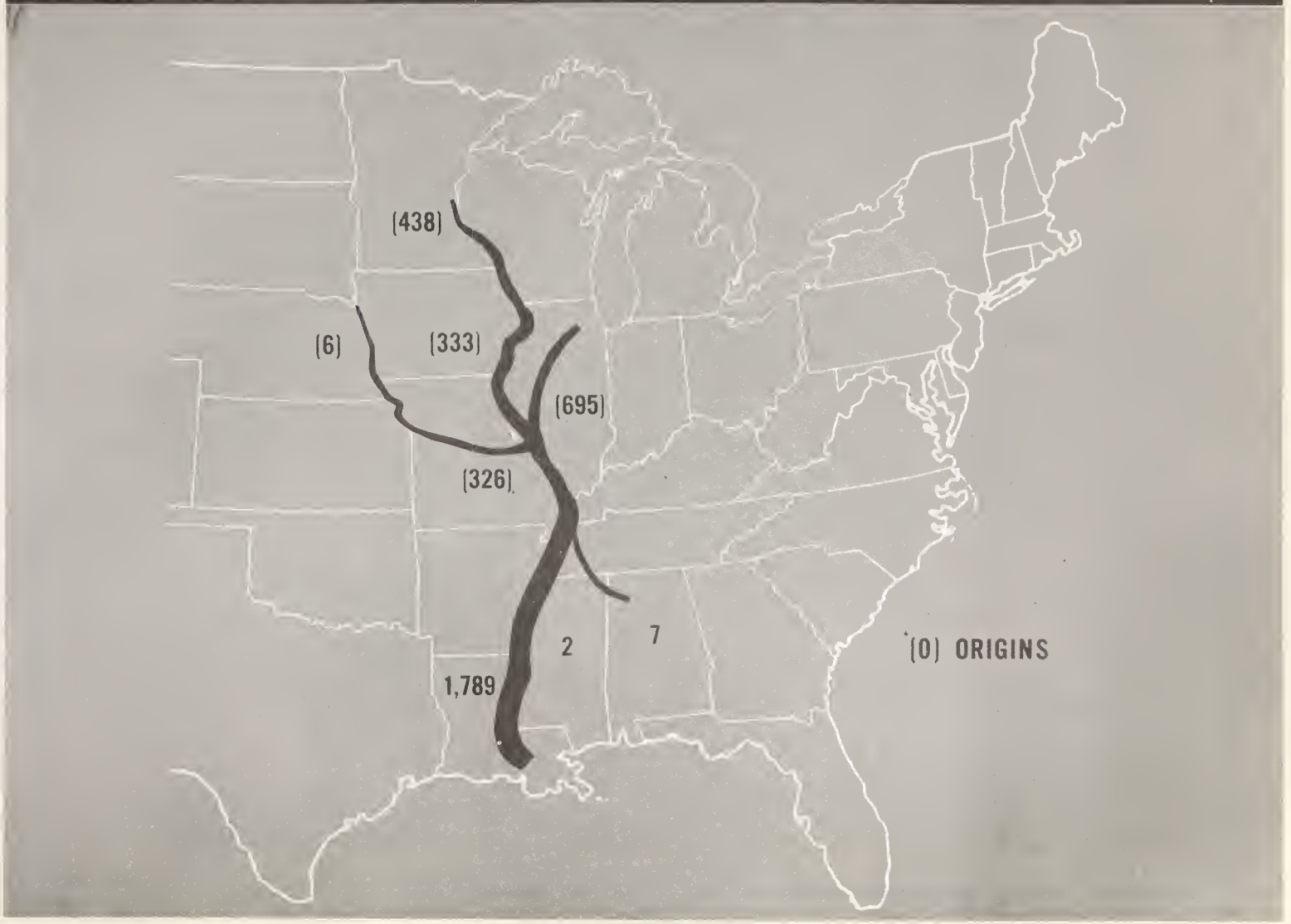
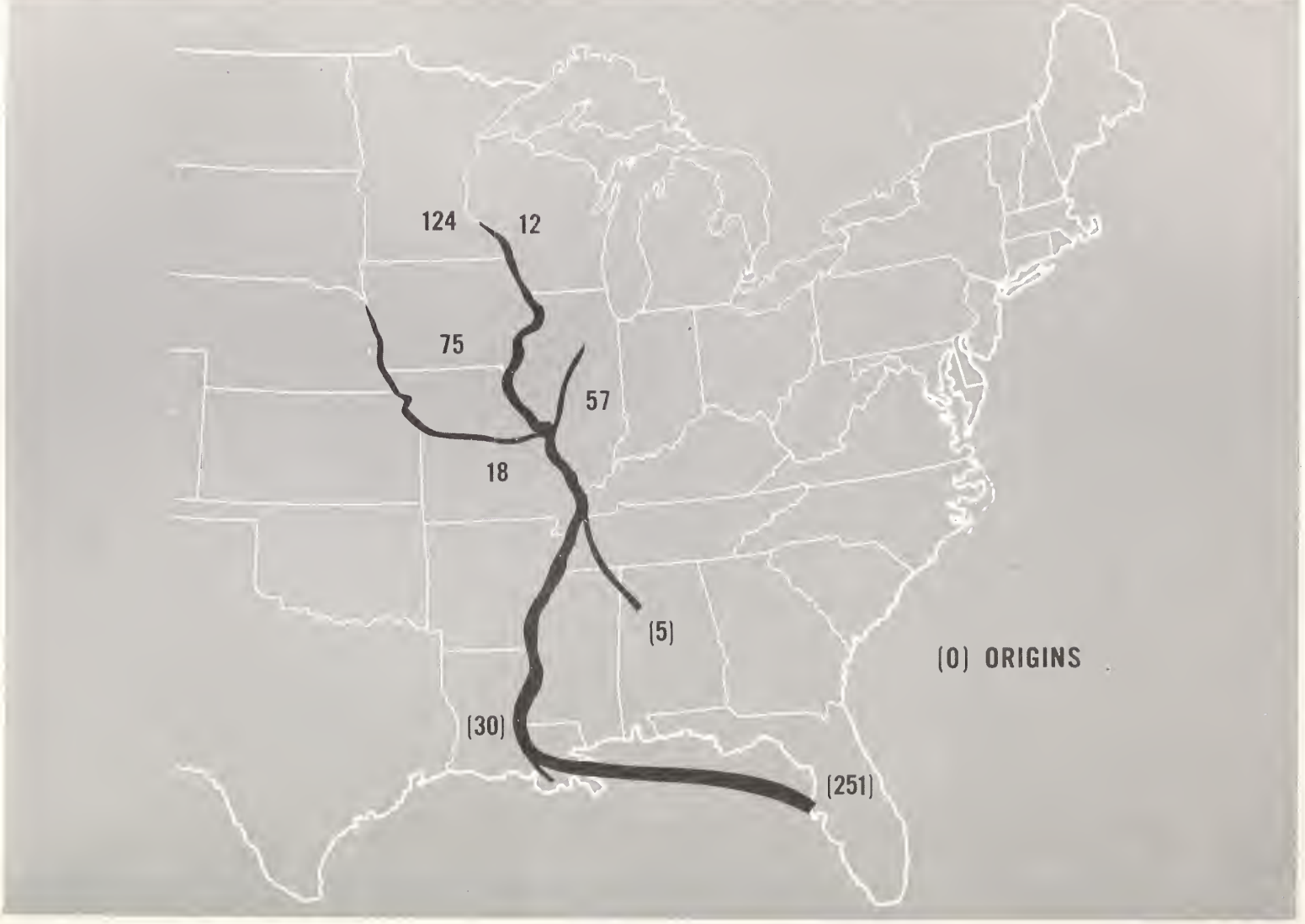


Fig. 2 - Barge Shipments of Fertilizer from Gulf to Midwest, 1970



Iowa, Missouri, and Indiana were the leading Midwestern States of origin for southbound rail shipments (figs. 3 and 4). Iowa, Illinois, and Missouri led in rail fertilizer receipts. Ninety-eight percent of northbound rail shipments originated in Florida; 64 percent of southbound rail shipments went to Louisiana.

Seasonality of Shipments

Rail and barge shipments north and south exhibited similar seasonal patterns, except for barge shipments south. Rail shipments north and south, and barge shipments north increased in tonnage to a peak in March, followed by reduced shipments in the early summer months (fig. 5). Shipments then continued to increase for the rest of the year, except for barge shipments north, which declined sharply after October.

Barge shipments south showed a generally increasing trend from February through October, followed by low levels of shipments in December and January. The number of shipments and tonnages by month are shown in appendix table 1.

Southbound tonnage exceeded northbound tonnage during every month.

TRANSPORTATION EQUIPMENT OWNED OR LEASED

Among them, the 14 cooperatives had transportation equipment they either owned or leased which might be available to a coordinated program.

Rail

The 14 cooperatives leased a total of 1,374 covered hopper railcars. Car capacity ranged from 3,500 cubic feet to 4,427 cubic feet--with more than half being 4,427 cubic feet in size.

Monthly lease rates for cars ranged from $170 to $223 and averaged $190. Rates varied, depending upon lease date and the size and newness of car. Total lease cost amounted to $260,820 a month or $3,129,840 a year.

Only 10 barges were owned by the cooperatives. These were leased to a barge line.

TRANSPORTATION COSTS BETWEEN MIDWEST AND GULF

The total transportation bill of the 14 cooperatives for hauling grain and fertilizer materials between the Midwest and the Gulf area in 1970 was $27,715,000 (table 2). This was made up of $15,483,000 for rail services and $12,232,000 for barge services. Average costs per ton were $9.81 by rail and $4.23 by barge.

Fig. 3 - Rail Carload Shipments of Grain from Midwest to Gulf, 1970

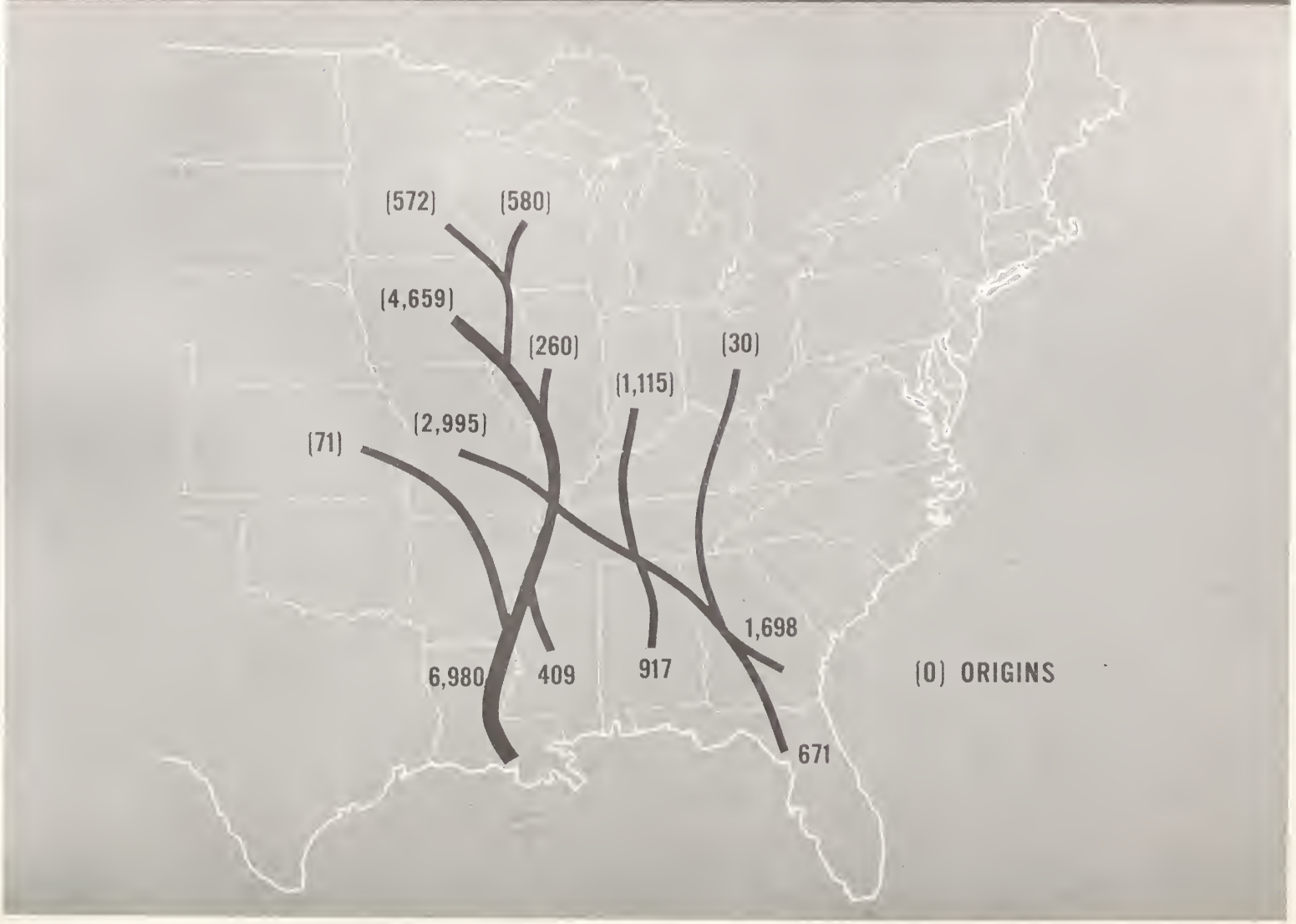


Fig. 4 - Rail Carload Shipments of Fertilizer from Gulf to Midwest, 1970

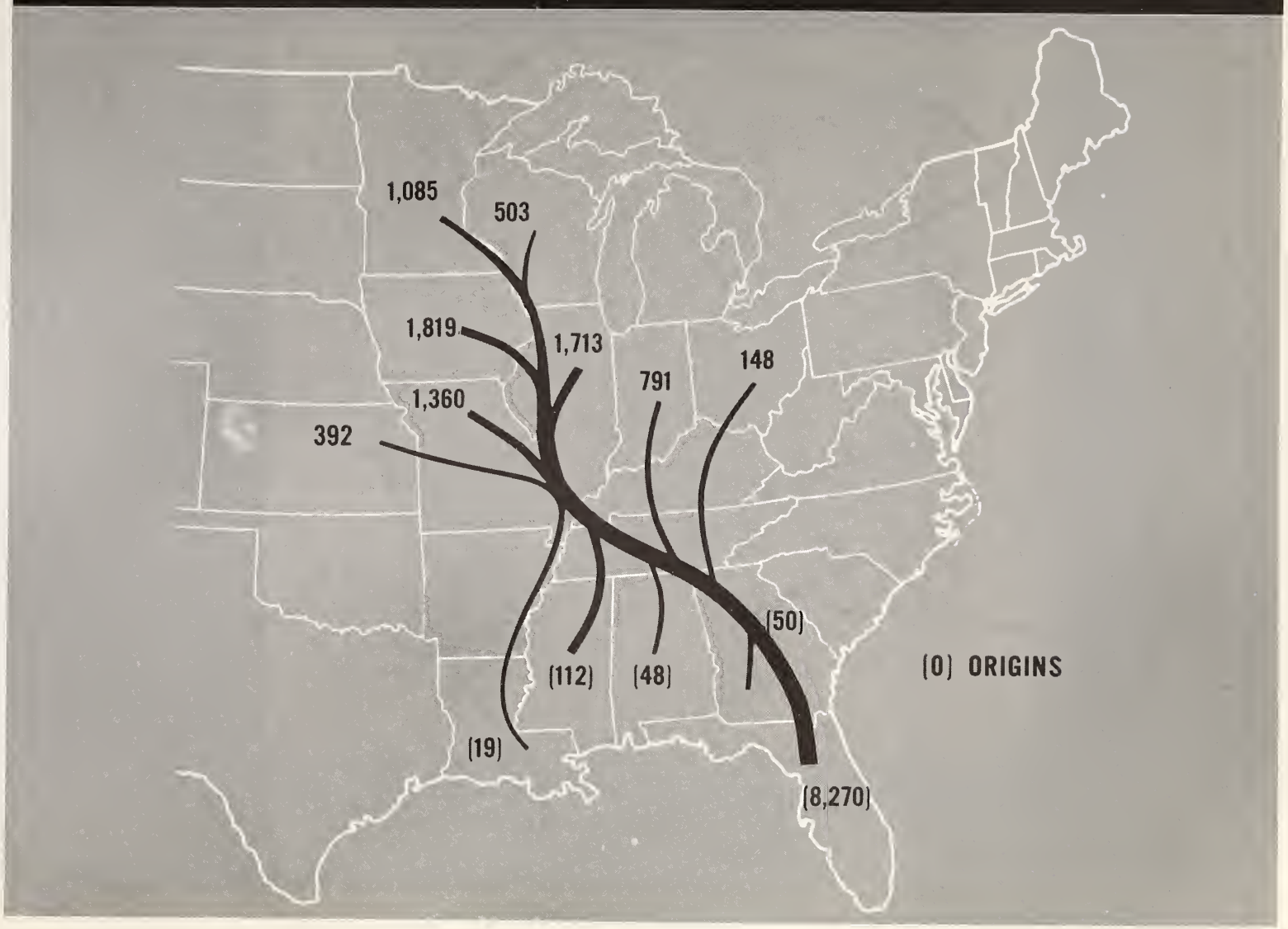


Fig. 5 - Interstate Shipments of Grain and Fertilizer Ingredients by 14 Farmer Cooperatives, 1970

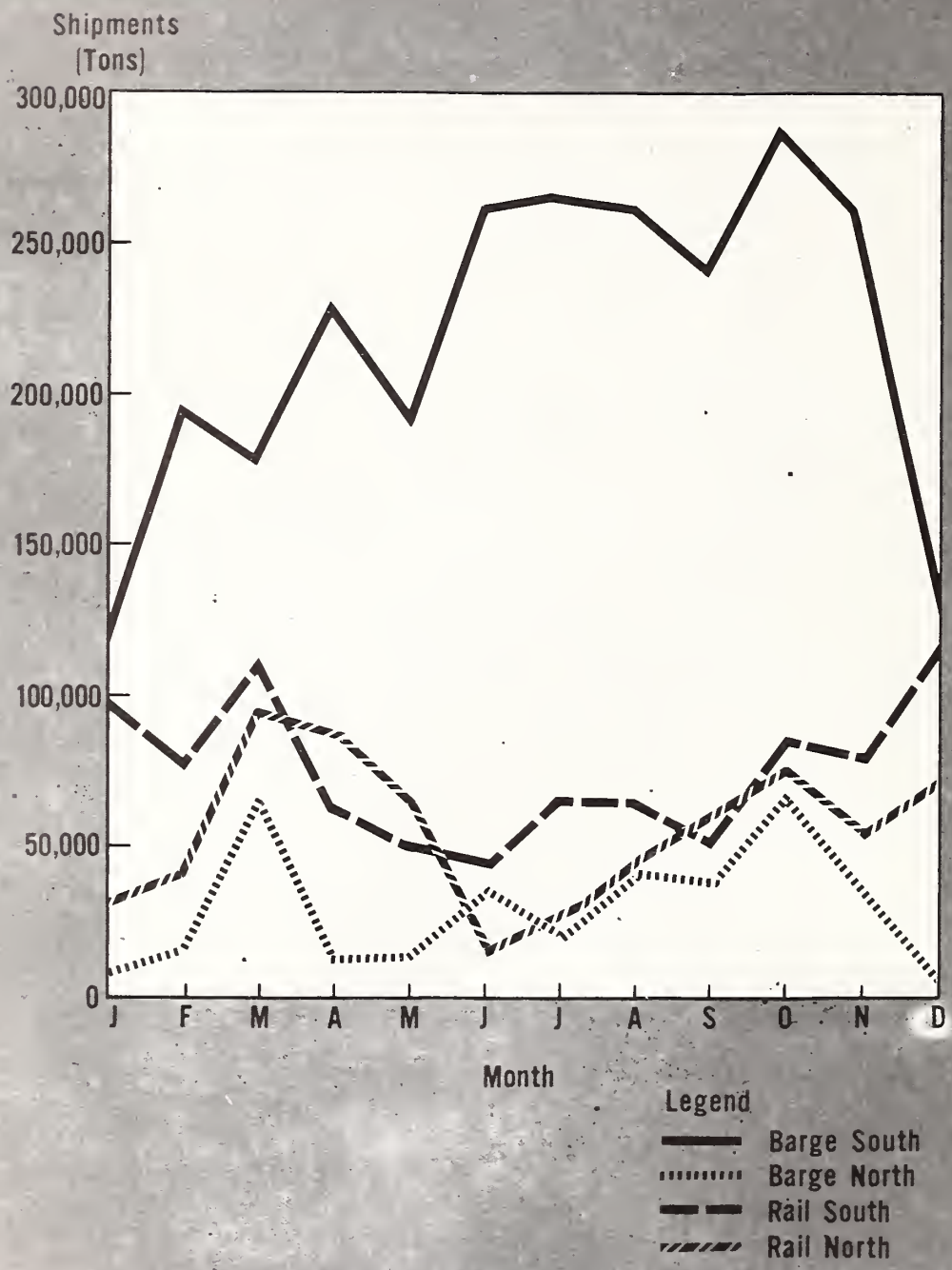


Table 2.--Total costs and cost per ton-mile for shipments between Midwestern and Gulf States by 14 cooperatives, 1970

Mode	Direction	Ton-miles	Cost	Cost per ton-mile
		Number	Dollars	Dollars
Rail	South	858,579,000	6,405,000	0.00746
Rail	North	896,150,000	9,078,000	0.01013
Barge	South	3,571,062,000	9,749,000	0.00273
Barge	North	713,506,000	2,483,000	0.00348 1/
Total or average		6,039,297,000	27,715,000	0.00458

1/ Includes trans-Gulf shipments. Excluding trans-Gulf shipments and costs to reflect only river barge shipments and costs resulted in a ton-mile cost of $.00336 (3.36 mills).

Cost Per Ton-Mile

Total ton-miles for all north-south shipments of the 14 cooperatives during 1970 was 6,039,297,000 ton-miles (table 2). More than half this total came from barge shipments of grain to the Gulf.

Cost per ton-mile to the cooperatives was determined by dividing cost by the number of ton-miles. For all shipments, this averaged $0.00458 (read as 4.58 mills). Cost per ton-mile of northbound movements was higher than for southbound movements.

Transportation cost per ton-mile to shippers for materials carried by rail was higher than those carried by barge. In table 2, for example, southbound movements per ton-mile cost shippers 7.46 mills by rail and 2.73 mills by barge. Similar costs for northbound shipments were 10.13 mills and 3.48 mills for rail and barge, respectively. 1/

Rail rates or costs to shippers, as found in the study, varied according to number of cars in a shipment. Single-car shipments carried a higher rate than multiple-car shipments.

1/ Caution should be used in comparing ton-mile costs of the two modes, especially because distances between points differ; for example, from St. Louis to New Orleans, the distances are 699 miles by rail and 1,049 miles by water. A direct comparison of ton-mile costs, for example, of 9.0 mills for rail and 3.0 mills for barge gives the appearance that rail is three times more costly. But the effective shipping rates based on relevant ton-mile costs and distances would be $6.29 per ton by rail and $3.15 per ton by barge. In this case, the charge to shippers would be only twice as costly by rail.

The study also showed that rates for shipments which followed the river system were lower than those with origins and destinations well removed from the river system. Ton-mile costs to shippers ranged from 7.0 to 7.5 mills, where barge competition was effective, to 15.0 mills where barges did not compete. For the rail shipments included in this study, costs for moving fertilizer were higher than for moving grain because a smaller proportion of fertilizer shipments had effective barge competition.

Cost per ton-mile for northbound barge shipments were higher than for southbound barge shipments. This relationship came about for at least two reasons: (1) Northbound movements were upstream, requiring longer transit times and therefore raising costs for carriers, and (2) a larger proportion of northbound shipments, compared with southbound, was loaded lightly for movement on the shallow-draft Missouri River. The lighter loads caused higher costs per ton and per ton-mile for carriers and therefore, higher negotiated rates.

RAIL OPERATING COSTS

Railroads can obtain lower hauling costs for themselves through large-volume movements and better utilization of equipment. A few cooperatives in the study already have enough grain or fertilizer volume to take advantage of large-volume rail rates. Other opportunities might be possible through combining shipments from several cooperatives.

One possibility available to cooperatives to reduce rail transportation costs is the unit train. Obtaining agreements with railroads on this type of transportation service may be one area in which cooperatives might bargain effectively if they could assure a railroad of a steady large-volume movement.

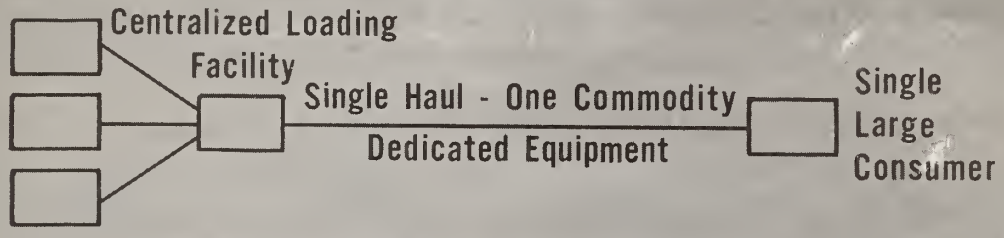
Unit Train

A unit train is a set of dedicated rail equipment loaded at one point of origin, unloaded at one destination each trip, and moving both directions on a predetermined schedule. Unit train rates are established on the basis of a minimum tonnage per year and per shipment (fig. 6). Dedication of equipment makes for more efficient and intensive use of cars by the carrier and reductions in terminal costs.

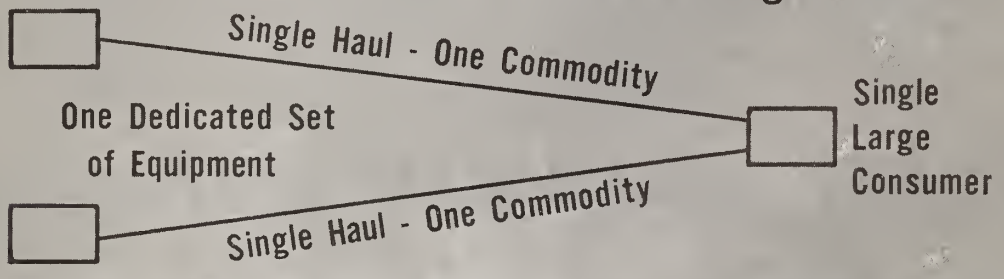
The usual movement is loaded one-way with empty return. We have not encountered a unit train operation with loads in both directions. As far as we know, no package deal involving a two-way haul has been attempted with railroads.

Fig. 6 - Unit Train Rates are Presently Negotiated for the Following Type of Movements

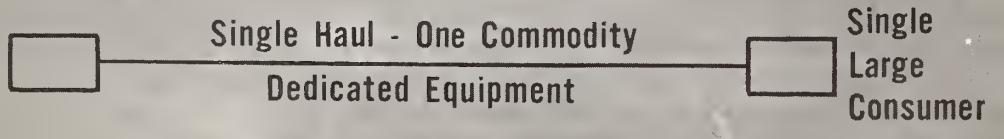
Several Small Producers



Two Producers with Unit Train Loading Facilities



Single Large Producer



Source: Adapted from Unit Train Transportation of Coal, Information Circular 8444, Department of the Interior, 1970, p. 4.

Unit train costs on a ton-mile basis can be about half those incurred in operating a conventional train. Thus, a railroad can reduce the freight rate with a unit train and still increase its profits. The carrier may not be inclined to agree to such an operation on a particular run. A review of a number of cases in which unit train agreements have been made indicate that competition may be needed. Competition may be by mode of transportation--that is, the possibility for barge service to replace rail service. Or it may be competition against a material being hauled. Competition among railroads does not appear to be sufficient to induce one of them to initiate a unit train service.

A number of unit train rates have been negotiated. The following is a partial listing of ton-mile rates, in effect in 1971, in terms of who owned or leased the hopper cars:

Owned or leased by railroad		Owned or leased by receiver or shipper	
Grain	Coal	Grain	Coal
(Dollars per ton-mile)		(Dollars per ton-mile)	
0.00725	0.00780	0.00569	0.00520
0.00827	0.00770		0.00540
0.00809	0.00540		0.00440
	0.00780		0.00520
			0.00830

Minimum shipments of coal ranged from 7,000 to 12,600 tons (70 to 126 cars per train). For grain unit trains, the range was 5,000 to 6,500 tons, or 50 to 65 cars per train.

Consistently higher rates were associated with railroad owned or leased equipment compared with shipper or receiver controlled equipment. The rates shown for receiver or shipper controlled equipment included the mileage allowances.

The above unit train rates may be compared with the average for those charged cooperatives for rail shipments during 1970--$.00746 southbound and $.01013 northbound. All the unit train rates were lower than those charged for northbound co-op shipments during 1970. However, the southbound cooperative rate compared favorably with most of the unit train rates associated with railroad owned or leased equipment. Unit train rates applying on movements in shipper or receiver owned cars were considerably lower than in railroad owned or leased cars.

Rent-A-Train

The rent-a-train concept offers a greater opportunity for shippers to reduce their transportation costs than does the unit train. As a general rule, the rent-a-train agreement involves a larger number of cars per shipment and greater annual tonnage.

One rent-a-train operation of the Illinois Central Railroad required a minimum of 86 cars (8,600 tons) of grain per shipment and an annual minimum of 430,000 tons. The cost to shippers for service was $.00480 per ton-mile. In addition to lower cost, the rent-a-train provides rapid and reliable service. Like the unit train, it involves the use of dedicated equipment.

Multiple Car

An example of out-of-pocket costs to a railroad for multiple car shipments is shown in table 3. The table also indicates how costs climb when additional services are included.

While these costs apply to a geographic area outside the study area, the table does show the importance of terminal costs which unit trains and rent-a-trains are designed to reduce to a minimum.

BARGE OPERATIONS AND COSTS

Data on operations and costs of barges and towboats were obtained from barge manufacturing companies and bargelines. Information in this section of the report is based on that data.

Equipment Costs

Barge towing equipment is highly specialized. Towboats are designed to do a specific job--to push barges. They are equipped with navigational aids, communications systems, and all the accouterments needed to accommodate a crew in some degree of comfort.

Towboat costs for several sizes most commonly used or ordered are as follows:

3,200 horsepower (to push 15 barges)	$ 1,100,000
4,200 horsepower (to push 15 barges)	$ 1,300,000
5,000 horsepower (to push 30 barges)	$ 1,500,000

The expected life for these boats ranged from 12 to 15 years, with 15 years most commonly estimated.

Table 3.--Out-of-pocket costs developed by the Milwaukee Railroad for its movement of wheat in 10-car shipments from Rosalia to Seattle, Wash., 1/ (estimated distance 300 miles), 1970

Cost and return item	Wheat	Cost per ton-mile
	Dollars	
Net tons per shipment 1,000:		
Revenue at $2.40 per ton	2,400.00	0.00800
Terminal expenses-origin:		
Switching	79.01	0.00026
Station-clerical	73.48	0.00024
Train supplies	17.78	0.00005
General office-claims	9.83	0.00003
Total	180.10	0.00060
Line haul expenses:		
Running	1,082.95	0.00360
Car costs	452.50	0.00150
Intra or inter-train switching	49.32	0.00016
Helper service	61.84	0.00020
Total	1,646.61	0.00548
Terminal expenses-destination:		
Switching	64.84	0.00021
Station-clerical	73.48	0.00024
Train supplies	17.78	0.00005
General office-claims	9.83	0.00003
Total	165.93	0.00055
Loss and damage	18.99	0.00006
Total out-of-pocket costs	2,011.63	0.00670
Excess revenue over total out-of-pocket costs	388.37	0.00129

1/ Source: Kaplan, Jair S., I & S No. 8422 Multiple Car Grain Rate, Rosalia, Wash., to Seattle and Tacoma, Wash., ICC Examiners Report, served January 26, 1970 (partial extract).

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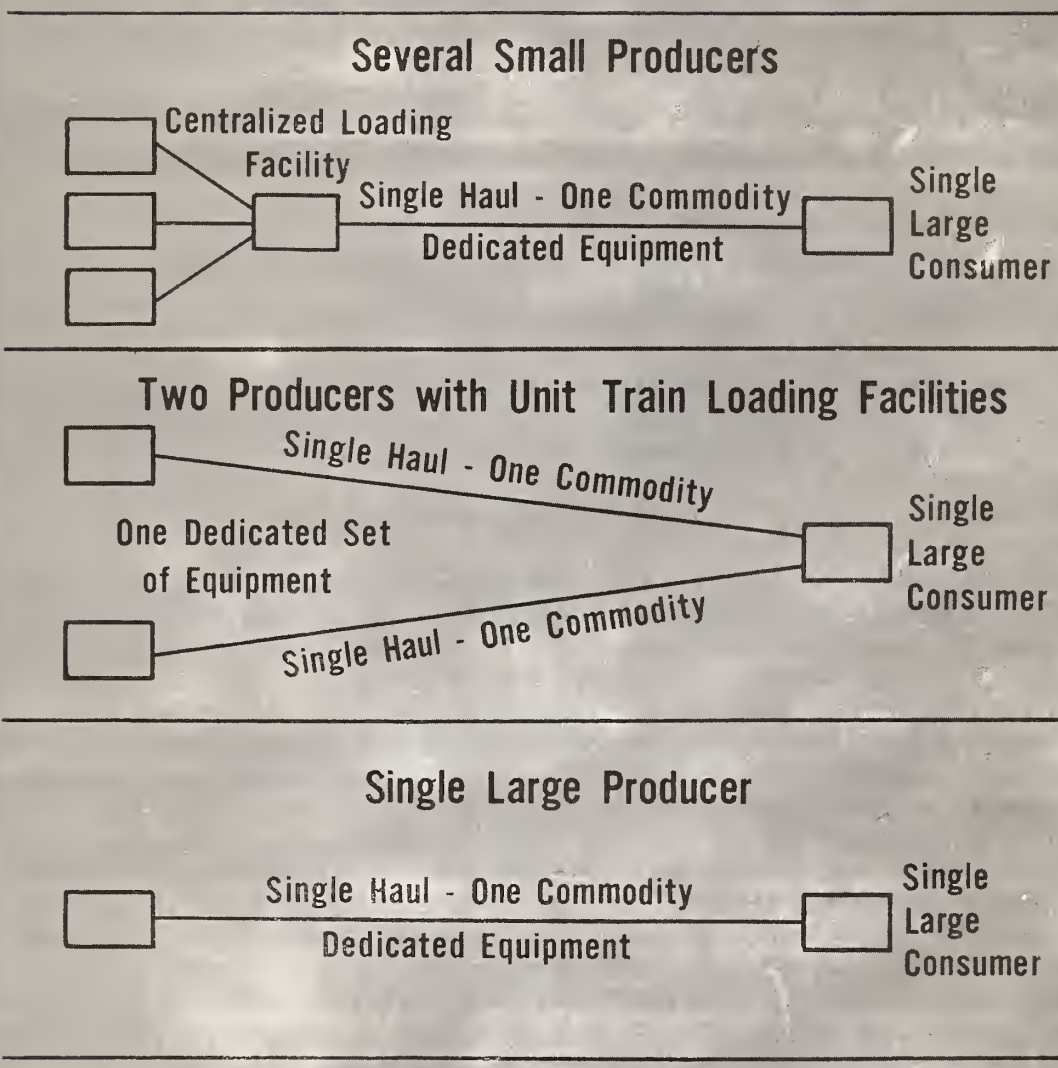

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Train supplies	17.78	0.00005
General office-claims	9.83	0.00003
Total	180.10	0.00060
Line haul expenses:		
Running	1,082.95	0.00360
Car costs	452.50	0.00150
Intra or inter-train switching	49.32	0.00016
Helper service	61.84	0.00020
Total	1,646.61	0.00548
Terminal expenses-destination:		
Switching	64.84	0.00021
Station-clerical	73.48	0.00024
Train supplies	17.78	0.00005
General office-claims	9.83	0.00003
Total	165.93	0.00055
Loss and damage	18.99	0.00006
Total out-of-pocket costs	2,011.63	0.00670
Excess revenue over total out-of-pocket costs	388.37	0.00129

1/ Source: Kaplan, Jair S., I & S No. 8422 Multiple Car Grain Rate, Rosalia, Wash., to Seattle and Tacoma, Wash., ICC Examiners Report, served January 26, 1970 (partial extract).

Maintenance and Repair

Expenses for maintenance and repair on towboats is likely to vary among operators, depending on policy and age of the boat. Most of the maintenance is preventive in nature. Some engine parts are replaced periodically to keep power efficiency at a maximum. Also there are electrical, plumbing, communications, and other systems aboard that need to be kept in good working order.

Total costs for maintenance and repair on a 3,200-horsepower towboat, including labor, amounts to about $700 a day. Labor costs include those for all the time for engineers and about half the time for deckhands. Also included in the total cost is $25,000 to $30,000 for engine reconditioning which occurs every 2 years.

Excluding the labor involved, maintenance and repair cost for the 3,200-horsepower towboat would amount to about $400 a day. For a 5,000-horsepower towboat the cost would be about $600 a day.

Practically no expense for upkeep is needed for barges during the first 10 years of use. As they get older, however, maintenance costs can become relatively high. For purposes of this report, assuming new barges would be used, no maintenance cost is charged.

Administrative Costs

Administrative expenses include office salaries, utilities, building rents, workmen's benefits and other expenses incurred in managing and administering the affairs of a barge towing activity. Administration expense will vary considerably among companies.

An estimate we obtained from a barge operator is that administration expenses are approximately 10 percent of revenues. Since we are working with cost estimates, we made our estimate at 12.5 percent of towboat operating costs. This procedure allows for a moderate margin of earnings above expenses.

Administration expense estimates for the 3,200-horsepower towboat are $97,946 a year and for the 5,000-horsepower towboat, $126,560. Barge expenses are not included in the calculations.

Summary of Ownership and Operating Costs

Costs of owning and operating two sizes of towboats and one barge are accumulated in table 4. All towboat costs are relatively fixed; they are not greatly effected by addition of barges to a tow. They continue at about the same rate whether the boat is actively engaged in towing or waiting for a tow.

Barge costs are fixed as they relate to a single barge. However, in total amount, they change with the number of barges in a tow.

Other Costs

Other costs are incurred with a tow which are not a part of towboat or barge operation. These costs may be internal to the company, but in most instances arise from the performance of services by outsiders. Among such services are fleeting, shifting, and cleaning of barges.

Fleeting

Fleeting refers to taking a barge out of tow for loading and unloading and returning it to the tow. A barge may be handled for fleeting about four times during a trip. Occasionally more handling may be needed. The operation is usually done by a small boat (about 200-horsepower) with a two-man crew. A typical charge for fleeting service is $35 an hour. In some cases, a flat charge of about $50 per barge is assessed. An average cost for fleeting is about $160 a trip.

Shifting

Shifting refers to the re-positioning of barges within a tow. A need for shifting may occur when dropoffs disrupt an integrated tow and it becomes necessary to reintegrate the tow. We are not including shifting costs in this report, since we assume the tow will remain integrated from origin to destination.

Cleaning

Barges which have been emptied of fertilizers, coal, or other possible contaminants must be cleaned thoroughly before they can be loaded with grain. It takes four men about 2 hours to clean a barge. Total charge for the service depends on barge size, type of cover, and whether performed on a weekday, Saturday, or Sunday or holiday. For a barge of 200 feet or less with roll-type cover, the costs are:

Weekdays	$ 115
Saturdays	142
Sundays or holidays	170

Table 4.--Annual, daily, and hourly costs of owning and operating a 3,200-horsepower and 5,000-horsepower towboat, and a covered dry-cargo barge

Item	Towboats						Barge		
	3,200-horsepower			5,000-horsepower					
	Annual	Daily	Hourly	Annual	Daily	Hourly	Annual	Daily	Hourly
	Dollars								
Depreciation	69,667	199.05	8.29	95,000	271.42	11.30	6,175	17.65	.73
Interest	44,000	125.71	5.22	60,000	171.42	7.14	5,200	14.85	.62
Insurance	110,000	314.28	13.10	150,000	428.57	17.85	13,000	37.15	1.55
Taxes	5,500	15.71	.65	7,500	21.42	.89	650	1.85	.08
Crew labor	245,000	700.00	29.17	245,000	700.00	29.16	-	-	-
Fuel	134,400	384.00	16.00	210,000	600.00	25.00	-	-	-
Supplies	35,000	100.00	4.17	35,000	100.00	4.17	-	-	-
Maint. & repair	140,000	400.00	16.67	210,000	600.00	25.00	-	-	-
Administrative	97,946	279.85	11.66	126,560	361.60	15.06	-	-	-
Total	881,513	2,518.60	104.93	1,139,060	3,254.45	135.60	25,025	71.50	2.98

- = Not applicable.

Revenues

Income or revenue from barge operations depends on the rate charged shippers and the amount of tonnage hauled.

Rates

Generally, barge rates are negotiated between shipper and carrier. There are published rates, at least for grain, and occasionally these are effective. But in many instances, the published rate appears to serve as a starting point for negotiations.

Discounts below or premiums above a published rate depend on how many barges are available relative to the need for them. For example, the current published rate for grain from St. Louis to New Orleans is $3.25 per ton. If barges are in oversupply, an initial step by the carrier may be to make an offer at 90 percent of $3.25 or $2.92. Further bargaining may push the charge still lower. On the other hand, if barges are in tight supply, the carrier may begin his offers at 125 percent of the $3.25 or about $4.06.

Normally, we would expect that barge rates for commodities shipped upstream would be higher than for similar shipments downstream. Upstream costs for carriers are certainly higher. However, the effective barge rates are not tied to hauling costs; but to the demand-supply situation. Generally, covered dry-cargo barges are in heavy supply in the Gulf area--hence rates upstream are more heavily discounted.

Rates charged differ according to commodity characteristics, cubic displacement, and load size as dictated by river depths. For example, rate levels on the shallower Missouri River are generally higher than on the Mississippi where deeper draft barges can carry larger payloads.

Tonnage Hauled

Tonnage hauled depends on load weight per barge and the total number of barges involved, whether this be for a trip or for a season's operation.

The size barge under consideration here is usually specified as 1,500 ton capacity, but there is also cubic capacity to be considered. Less than 1,500 tons of grain generally fill a barge.

A barge may not be loaded to full capacity because part of its anticipated trip includes shallow draft water. Loads on the Missouri River, for example, will average 900 to 1,000 tons.

Tonnage hauled also depends on number of barges in a tow. Average number per tow has been estimated at between 20 and 30 on the lower Mississippi and between 10 and 15 on the upper part. Generally, more than 15 barges per tow is not considered good practice where a number of locks are involved.

For an operating season, tonnage hauled reflects how heavily barges have been loaded and the total number of them used during the period. For our purposes, the operating season consists of 350 working days a year as an average--allowing a 30-day shutdown every 2 years for reconditioning the engines.

Utilization of Equipment

Moving cargo from one place to another is what barge towing is all about. But not all the working schedule is a matter of transit time. Events in barge towing may be summarized as follows:

1. Placement date--the day barges are in place ready for loading.

2. Loading date--the day all barges in a tow are loaded and ready to be moved.

3. Arrival date--the day the tow reaches its destination.

4. Unloading date--the day on which all barges in a tow are unloaded.

5. Replacement date--the day barges are in place ready for receiving the return load.

Two examples of events in grain hauls were cited to us, as follows:

Placement date	April 4	March 26
Loading date	April 17	March 28
Arrival date	April 30	April 11
Unloading date	May 2	April 13
Replacement date	May 9	April 24
Days hauled	36	30
Miles	1,507	1,703

The time from placement to replacement constitutes the costing period for a haul. A similar costing period for the backhaul begins with the replacement date and goes through its own succession of events to a replacement date.

Cooperatively Operated Barge Equipment

Ownership of bargelines by firms who haul only their own goods has become an established practice. Of approximately 1,700 companies engaged in barge operations on the inland waterways of the United States in 1965, about 400 were engaged in the private transportation of their own commodities. 2/

Two methods of analysis were used to examine the potential of a cooperatively owned barging operation. The first method measured the productivity of capital invested in barging equipment. In other words, it measured the capability of equipment to produce a return without considering depreciation or interest on borrowed capital. The second method was an accounting analysis to arrive at savings potential of a cooperatively owned barge operation.

Productivity of Capital Invested in Equipment

Productivity of invested capital was measured by means of a discounted cash flow analysis in which the internal rate of return (IRR) was calculated. An IRR is a compound interest expression of the earning rate of capital over the operating life of a project.

One way of evaluating an IRR is to compare it with the current rate of interest on money. If a 6-percent compound interest rate can be obtained by depositing money in a bank and an IRR of 15 percent is estimated for a particular activity, then an additional 9-percent return may be realized by investing in the activity. In addition, if money is borrowed to finance the capital investment, the interest expense must be considered.

The IRR concept was applied to three basic models. All models had the following characteristics in common:

1. The term "standard tow" was used to describe a 3,200-horsepower towboat with fifteen 195-by-35-foot barges with rolling covers. A standard tow had the following characteristics:

   Estimated purchase price:

Towboat	$ 1,100,000
15 barges	1,950,000
	3,050,000

   Estimated annual operating cost (cash outlay) was:

	$ 972,596

2/ The American Waterways Operators, Inc., Big Load Afloat, Washington, D.C. 1966, p. 3.

2. Additional barging costs included a $320 round-trip fleeting charge and a $142 cleaning charge per barge.

3. The estimated life of all towboats and barges was 15 and 20 years, respectively.

4. While almost all barge fertilizer shipments were trans-Gulf, the models applied only to river barging. After the Gulf segment was eliminated, average distance and load of southbound grain shipments were 1,415 miles and 1,404 tons per barge and 1,264 miles and 1,285 tons for northbound fertilizer shipments.

5. Estimated tow speeds were:

	Northbound	Southbound
	Miles per hour	
Loaded	4.3	7.5
Empty	8.6	-

6. Estimated time required to load one barge was 3 hours; to unload, 3 hours; and to clean, 4 hours.

7. Revenue was derived from a charge of $3.86 per ton of grain and $4.25 per ton of fertilizer, which reflected the average charge paid by the 14 cooperatives, excluding an estimated $2.50 per ton trans-Gulf charge on fertilizer shipments.

8. The first year represented an investment period with no resulting revenue and no costs related to normal activity. This amount included an initial working capital requirement equal to 2 months' operating costs.

9. Each activity was considered to cover 20 years. The depreciated value of equipment on hand at the end of that time was treated as a revenue.

These characteristics applied to all models included in this section.

Model I measured the productivity of a single standard tow (1 towboat and 15 barges) fully utilized during a 20-year period. This model was not concerned with the transportation of a given amount of cargo, but served as a simplified transportation system which performed in a manner similar to the more complex models that follow.

The amount of time required to complete a voyage was a basic estimate in each of the models since all costs with the exception of barge fleeting and cleaning costs may be expressed on an hourly basis. The estimated number of hours required to complete a round-trip was taken as a function of tow speeds; distance; and time required to load, unload, and clean barges. An initial time estimate of 740.2 hours based on the calculations below allowed a standard tow to complete 11.34 round-trips each year. The number of trips was a major determinant of tonnage hauled and estimated revenue.

$$\text{Hours per round-trip} = \frac{1,415}{7.5} + \frac{1,264}{4.3} + \frac{151}{8.6} + 240 \simeq 740.2 \text{ hours (30.8 days)}$$

$$\text{Estimated number of round-trips per year} = \frac{8,400}{740.2} = 11.34$$

$$\text{Estimated annual tonnage} = (15)\ (11.34)\ (1,404 + 1,285) = 457,398$$

These values were used to develop the cash flow presented in table 5.

Table 5.--Model I: Condensed annual cash flow

Year	Investment	Operating cost	Revenue	Net revenue
		Dollars		
1	-3,225,197	-	-	-3,225,197
2-16	-	-1,051,182	1,850,802	799,620
17	-1,100,000 1/	-1,051,182	1,905,802 2/	- 245,380
18-20	-	-1,051,182	1,850,802	799,620
21	-	-1,051,182	2,699,969 3/	1,648,787

1/ Reinvestment in towboat.
2/ Increased revenue due to salvage value of towboat.
3/ Increased revenue due to salvage value of barges and depreciated value of towboat.
- = Not applicable.

An IRR of 24.4 percent was calculated from the cash flow in table 5. Since most of the costs and revenues were associated with time, the same analysis was used with 10- and 20-percent time error factors, which resulted in IRR's of 19.1 percent and 14.4 percent, respectively (see appendix tables 2 and 3).

Table 10.--Barging costs by 14 co-ops in 1970 versus three alternative levels of operation

Item	As reported by 14 co-ops in 1970 1/	Alternative 1 4/	Alternative 2 8/	Alternative 3 10/
Southbound barge:				
Distance (average miles)	1,415	1,415	1,415	1,415
Tonnage	2,523,839	2,523,839	401,544	985,608
Ton miles	3,571,066,000	3,571,066,000	568,184,760	1,394,635,320
Number of barges	1,798	1,798	286	702
Tons per barge (average)	1,404	1,404	1,404	1,404
Rate per ton (dollars)	3.86	3.86	3.86	3.86
Charge to shippers (dollars)	9,749,464.00	9,749,464.00	1,551,144.00	3,807,354.00
Northbound barge:				
Distance (average miles)	1,941 2/	1,264 5/	1,264	1,264
Tonnage	367,614	367,614	367,614	902,231
Ton miles	713,538,744	464,664,096	464,664,096	1,170,419,984
Number of barges	286	286	286	702
Tons per barge	1,285	1,285	1,285	1,285
Rate per ton (dollars)	6.75 3/	4.25 6/	4.25	4.25
Charge to shippers (dollars)	2,483,115.00	1,561,171.00	1,561,271.00	3,831,811.00
Combined charge (dollars)	12,232,579.00	11,310,735.00	3,112,415.00	7,639,165.00
Charge per ton mile (dollars)	.00285	.00280	.00301	.00301
Combined cost (dollars)	-	9,201,843.00	2,179,311.00	5,348,966.00
Cost per ton mile (dollars)	-	.00228 7/	.00211 9/	.00211 9/
Combined savings (dollars)	-	2,108,892.00	933,104.00	2,290,199.00
Savings as percent of charge to shipper	-	18.6	29.9	29.9

1/ Based on a summarization of data from the 14 cooperatives for 1970.
2/ Distance includes both river and trans-Gulf.
3/ Rate applied to combined river and trans-Gulf shipments.
4/ Cooperative ownership of barging equipment sufficient to handle all grain (southbound) with backhauls in 286 barges, or backhauls at 15 percent level.

Continued

Footnotes continued--

5/ River distance only; trans-Gulf segment of 677 miles deleted from study findings total of 1,941 miles.
6/ An estimated $2.50 per ton charge for trans-Gulf hauls was subtracted from the average charge of $6.75 for combined river and trans-Gulf shipments to obtain the $4.25 rate.
7/ Ton-mile cost used here was interpolated for the 15-percent backhaul level; table 14.
8/ Cooperative ownership of barge equipment to handle amount of fertilizer barged in 1970 with equivalent backhauls of grain.
9/ Ton-mile cost obtained from table 14 for the 100-percent backhaul level.
10/ Cooperative ownership of barging equipment to haul fertilizer barged in 1970 plus diversion of fertilizer shipped by rail within 75 miles of the river system.
- = Not applicable.

Operating Effects of Speed, Time, Distance, and Utilization

This section was designed to show the sensitivity of barging costs to operating considerations such as time, distance, and backhauls. Accrual accounting procedures in estimating barging costs were used to facilitate presentation of a large number of alternatives. Basically, this meant including depreciation and interest expense in the operating cost of a standard tow (see table 7).

Operational characteristics of estimates presented in this section were:

1. The term "standard tow" was used to describe a 3,200-horsepower towboat with fifteen 195-by-35-foot barges with rolling covers. A standard tow was estimated to cost $149.63 per hour to operate.

2. Additional barging costs included a $320 round-trip fleeting charge per barge and $142 charge for cleaning.

3. Average loads of grain and fertilizer shipments were 1,404 and 1,285 tons, respectively; one-way distances were 1,415 miles.

4. Estimated tow speeds were:

	Northbound	Southbound
Loaded	4.3	7.5
Empty	8.6	-

5. Estimated time per barge for loading and unloading was 3 hours for each operation. Cleaning time was estimated at 4 hours per barge.

6. All shipments had 100-percent backhaul.

These characteristics applied to each situation unless specific exceptions were indicated.

Assumed fertilizer shipments from New Orleans to St. Louis, Peoria, Minneapolis, and Kansas City with backhauls of grain were based on the following parameters:

Distances from New Orleans to--

St. Louis	1,049 miles
Peoria	1,249 miles
Minneapolis	1,722 miles
Kansas City	1,430 miles

Average tow speeds between New Orleans and--

	Northbound	Southbound
	Miles per hour	
St. Louis	4.7	8.8
Peoria	3.9	5.2
Minneapolis	3.9	6.2
Kansas City	3.9	6.2

Costs were developed on the concept of a standard tow except for shipments to Kansas City which were reduced to 900 tons to reflect river conditions. Costs presented in table 11 were based on the following procedures:

$$\text{Hours (round-trip)} = (\text{distance})\left(\frac{1}{\text{(northbound speed}} + \frac{1}{\text{southbound speed)}}\right) + 240$$

$$\text{Total cost} = (\text{hours per round-trip})\ (\$149.63) + \$6,930$$

$$\text{Cost per ton} = \frac{\text{total cost}}{\text{total tonnage}}$$

$$\text{Cost per ton-mile} = \frac{\text{total cost}}{\text{Distance}\ (\ (15)\ (1{,}404 + 1{,}285)\ )}$$

Table 11.--Estimated cost of barging fertilizer from New Orleans to 4 river points and returning with grain 1/

River points	Hours per round trip	Total cost	Cost per ton 2/	Cost per ton-mile 2/
		Dollars		Mills
St. Louis	582.3	94,060	2.33	2.22
Peoria	800.4	126,694	3.14	2.52
Minneapolis	959.3	150,470	3.73	2.17
Kansas City	837.3	132,215	4.90	3.42

1/ Estimates based on 1 round trip for 1 standard tow.
2/ Average costs of the complete voyage.

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Rate per ton (dollars)	6.75 3/	4.25 6/	4.25	4.25
Charge to shippers (dollars)	2,483,115.00	1,561,171.00	1,561,271.00	3,831,811.00
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7/ Ton-mile cost used here was interpolated for the 15-percent backhaul level; table 14.
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1. The term "standard tow" was used to describe a 3,200-horsepower towboat with fifteen 195-by-35-foot barges with rolling covers. A standard tow was estimated to cost $149.63 per hour to operate.

2. Additional barging costs included a $320 round-trip fleeting charge per barge and $142 charge for cleaning.

3. Average loads of grain and fertilizer shipments were 1,404 and 1,285 tons, respectively; one-way distances were 1,415 miles.

4. Estimated tow speeds were:

	Northbound	Southbound
Loaded	4.3	7.5
Empty	8.6	-

5. Estimated time per barge for loading and unloading was 3 hours for each operation. Cleaning time was estimated at 4 hours per barge.

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Costs were developed on the concept of a standard tow except for shipments to Kansas City which were reduced to 900 tons to reflect river conditions. Costs presented in table 11 were based on the following procedures:

$$\text{Hours (round-trip)} = (\text{distance})\left(\frac{1}{\text{(northbound speed} + \text{southbound speed)}} + \frac{1}{}\right) + 240$$

Total cost = (hours per round-trip) ($149.63) + $6,930

$$\text{Cost per ton} = \frac{\text{total cost}}{\text{total tonnage}}$$

$$\text{Cost per ton-mile} = \frac{\text{total cost}}{\text{Distance } ((15) (1,404 + 1,285))}$$

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Kansas City	837.3	132,215	4.90	3.42

1/ Estimates based on 1 round trip for 1 standard tow.
2/ Average costs of the complete voyage.

Time Per Round trip.--Barging costs, including cost per ton-mile, were directly related to the time required to complete a round trip (table 12). Generally, an increase (or decrease) in time per round trip caused an equivalent increase (or decrease) in costs.

Table 12.--Estimated barging costs and time relationships for a standard tow 1/

Time index	Hours per round-trip	Total cost	Cost per ton	Cost per ton-mile
Percent		Dollars		Mills
90	681.9	108,963	2.70	1.91
95	719.8	114,634	2.84	2.01
100	757.7	120,305	2.98	2.11
105	795.6	125,976	3.12	2.21
110	833.5	131,647	3.26	2.31
115	871.4	137,318	3.40	2.41
120	909.2	142,974	3.54	2.51

1/ Based on one-way distance of 1,415 miles.

Distance.--Ton-mile barging costs were inversely related to one-way distance of a haul. Generally, an increase (or decrease) in distance caused a less than proportionate decrease (or increase) in costs.

Tow speeds used in this analysis were constant and did not reflect lower speeds experienced in the upper river systems.

Table 13.--Estimated barging costs and distance relationships for a standard tow

One-way distance	Hours per round trip	Total cost	Cost per ton	Cost per ton-mile
Miles		Dollars		Mills
800	532.7	86,638	2.15	2.68
900	569.3	92,114	2.28	2.54
1,000	605.9	97,591	2.42	2.42
1,100	642.5	103,067	2.56	2.32
1,200	679.1	108,544	2.69	2.24
1,300	715.7	114,020	2.83	2.17
1,400	752.2	119,482	2.96	2.12
1,500	788.8	124,958	3.10	2.06
1,600	825.4	130,435	3.23	2.02
1,700	862.0	135,911	3.37	1.98
1,800	898.6	141,388	3.51	1.95

Backhauls.--Barging costs per ton-mile declined as the percentage of loaded returns increased--that is, the relationship was inverse (table 14).

Table 14.--Estimated barging cost relationship with varying levels of backhauls for a standard tow 1/

Loaded backhauls	Total cost	Cost per ton	Cost per ton-mile
Percent	Dollars		Mills
0	68,716	3.26	2.31
10	73,875	3.23	2.29
20	79,034	3.20	2.27
30	84,193	3.18	2.25
40	89,352	3.15	2.23
50	94,510	3.12	2.21
60	99,669	3.09	2.19
70	104,828	3.06	2.17
80	109,987	3.04	2.15
90	115,146	3.01	2.13
100	120,305	2.98	2.11

1/ The backhaul was assumed to be the northbound shipment. A linear interpolation was made between calculated values with 0 and 100 percent backhauls.

Cost reductions from increased backhauls were less than may be expected, due to the increased northbound speed with empties, reduced loading and unloading time, and the elimination of cleaning costs when tows return empty.

Load relationships.--Cost per ton-mile varies inversely with changes in tonnage per tow. In table 11, for example, the cost per ton-mile for shipments between Peoria and New Orleans was 2.52 mills; between Kansas City and New Orleans it was 3.42 mills, or 36 percent higher. The time and distance elements were not the same, but relatively close. The big difference was in tonnage--40,335 tons total between Peoria and New Orleans, while between Kansas City and New Orleans it was 27,000 tons or 33 percent lower.

Cost Comparison of Owned and Leased Barge Equipment

Data obtained from shipbuilding firms show that a 3,200-horsepower towboat leases for $1,000 a day, and a 5,000-horsepower towboat leases for $1,500 a day. We estimate that barges would lease on an annual basis for about 15 percent of cost or $55 a day.

In comparing annual costs to operate cooperatively owned versus leased equipment, we use three towboat-barge combinations; one 3,200-horsepower towboat with 15 barges; two 3,200-horsepower towboats with 30 barges; and one 5,000-horsepower towboat with 30 barges.

Annual costs of owning and operating a 3,200-horsepower towboat, as shown in table 4, amount to $881,513, and for one barge, $25,025. The total annual cost for a towboat and 15 barges is $1,256,888. For the same equipment, lease cost is $657,000; operating expenses (excluding depreciation, interest, and property taxes) are $957,346. For leasing and operating combined, the total is $1,614,346. Thus, the annual cost for operating leased equipment exceeds the cost of operating owned equipment by $357,458 or approximately 28 percent (table 15).

A combination of two 3,200-horsepower towboats and 30 barges would cost $2,513,776 a year if owned and operated. The annual cost to lease and operate this same equipment would be $3,228,692--exceeding owner-operator cost by $714,916. Again, this is about 28 percent more than the cost to own and operate.

One 5,000-horsepower towboat with 30 barges costs $1,889,810 a year to own and operate. To lease and operate the same equipment would cost $2,500,560. Thus, leasing and operating costs $610,650, or 32 percent more than owning and operating.

Based on this analysis, it is evident that it costs more to lease and operate than to own and operate barge equipment. As an example, for one 3,200-horsepower towboat and 15 barges, we found the cost of leasing and operating exceeded the cost of owning and operating by $357,458. If this amount alone was made available for capital expenditures, the total equipment cost ($3,050,000) could be paid off in less than 9 years.

Compared with owning equipment, leasing has the advantage of lower initial capital outlay. Leasing may also be the more expeditious way of getting started in the barging business, especially if equipment is available. The purchase of new equipment would probably involve a delay for building after the order is placed and possibly a further delay while the shipbuilding firm catches up on back orders.

COORDINATION AND CONSOLIDATION

We've just examined what we believe offers the best opportunity for reducing cooperative transportation costs--joint operation of barge equipment. Here we will explore some other possibilities for reducing such costs through intercooperative transportation coordination and consolidation.

Table 15.--Comparative annual costs of owned versus leased barge equipment

Item	3,200-Horsepower towboat		5,000-Horsepower towboat
	15 Barges	30 Barges	30 Barges
		Dollars	
Owned equipment:			
Investment--towboats	1,100,000	2,200,000	1,500,000
Investment--barges	1,950,000	3,900,000	3,900,000
Total investment	3,050,000	6,100,000	5,400,000
Annual cost to own and operate	1,256,888	2,513,776	1,889,810
Leased equipment:			
Annual lease--towboat	360,000	720,000	540,000
Annual lease--barges	297,000	594,000	594,000
Total lease cost	657,000	1,314,000	1,134,000
Annual operating cost	957,346	1,914,692	1,366,560
Total lease and operate	1,614,346	3,228,692	2,500,560
Ratio--lease-operate to own-operate	1.28	1.28	1.32

Some form of organization or formal coordinating arrangement among the 14 cooperatives would be required before an effective program of transportation coordination could be initiated. The previously suggested program of joint operation of barge equipment and the following possibilities for reducing transportation costs through joint action are predicated on the formation of a coordinating agency to implement such programs.

Backhauls

Backhauls or two-way movements of commodities generally assure economical and successful operation of transportation equipment.

Information developed in this study shows there are possibilities for reducing transportation costs and improving service through better use of transportation equipment owned or leased by the cooperatives. A promising opportunity appears to be in coordinating the north-south flows of grain and fertilizer by rail.

As indicated earlier, the 14 cooperatives leased 1,374 covered hopper railcars. Average lease rate per car was $190 per month. Except for one back-to-back leasing arrangement between two of the cooperatives, no cooperation on leased equipment was evident.

Usually shippers receive mileage allowances on their leased cars at a rate of 11 cents per loaded mile. To break even on a car costing $190 a month to lease, 1,727 loaded car-miles must be accumulated in a month's time. To break even for a year's leasing at that rate, 20,727 loaded car-miles are needed. A coordinating agency could bring about higher use of leased equipment.

One effect of mileage allowances is to effectively lower ton-mile costs to shippers. A rebate of 11 cents per mile is equivalent to 1.1 mills per ton-mile.

Under a coordinated system in which leased cars would be dedicated to cooperative hauls, all 1970 rail shipments (10,675 cars south and 8,499 cars north) could have been handled by the leased equipment in 14 round trips during the year. This would not involve any backhauls.

In addition to southbound rail shipments exceeding northbound by about 1½ times, these shipments also followed widely separated routes from their respective origins to their respective destinations.

Figure 7 shows how divergent the routes were in 1970. The weighted origin of southbound grain shipments was southwest of Des Moines, Iowa--roughly in the vicinity of Creston. The weighted destination for grain was in the New Orleans area. A line connecting the two points represents the concentrated flow path of southbound grain. For the northbound movement of fertilizer, the weighted origin was a little north of central Florida and the weighted destination east of Des Moines in the approximate vicinity of Iowa City. The line connecting these two points represents the concentrated flow path of fertilizer shipped north by rail.

There was an exchange of grain and fertilizer shipments involving Indiana and Ohio with the Southeast in which limited backhaul arrangements could be effected. As another possibility, most fertilizer shipments could be hauled across the Gulf for transfer to rail in the New Orleans area. However, economies appear to favor diversion to river barges rather than rail for the haul north.

The grain and farm supply cooperatives might also consider locating a facility for transloading phosphates from Gulf barges to river barges adjacent to the co-op export elevator at Ama, La. This would reduce barge turnaround time and could offer opportunities for reducing transloading costs if management and administrative costs were shared.

Carpool

A method to facilitate backhauls and coordination of rail car operations among the cooperatives would be to set up a central carpool. Maintaining a pool of hopper cars by centralized leasing or ownership through a coordinating agency of 14 cooperatives offers possibilities for better utilization of equipment and reducing costs.

In addition to hopper cars, the cooperatives studied also operate substantial numbers of tank cars, anhydrous ammonia, and other specialized cars to haul their products. These should also be included in the pool. This would permit shifting mileage allowances for any excess mileage from one type of equipment to another.

Equipment could also be shifted among the 14 cooperatives to meet specific needs. Cooperatives that presently can't justify ownership or leasing of cars could obtain needed equipment for short periods of time at peak shipping periods or for limited movements under such an arrangement. Quite often the peak shipping needs of one cooperative coincide with the slack shipping period of another cooperative.

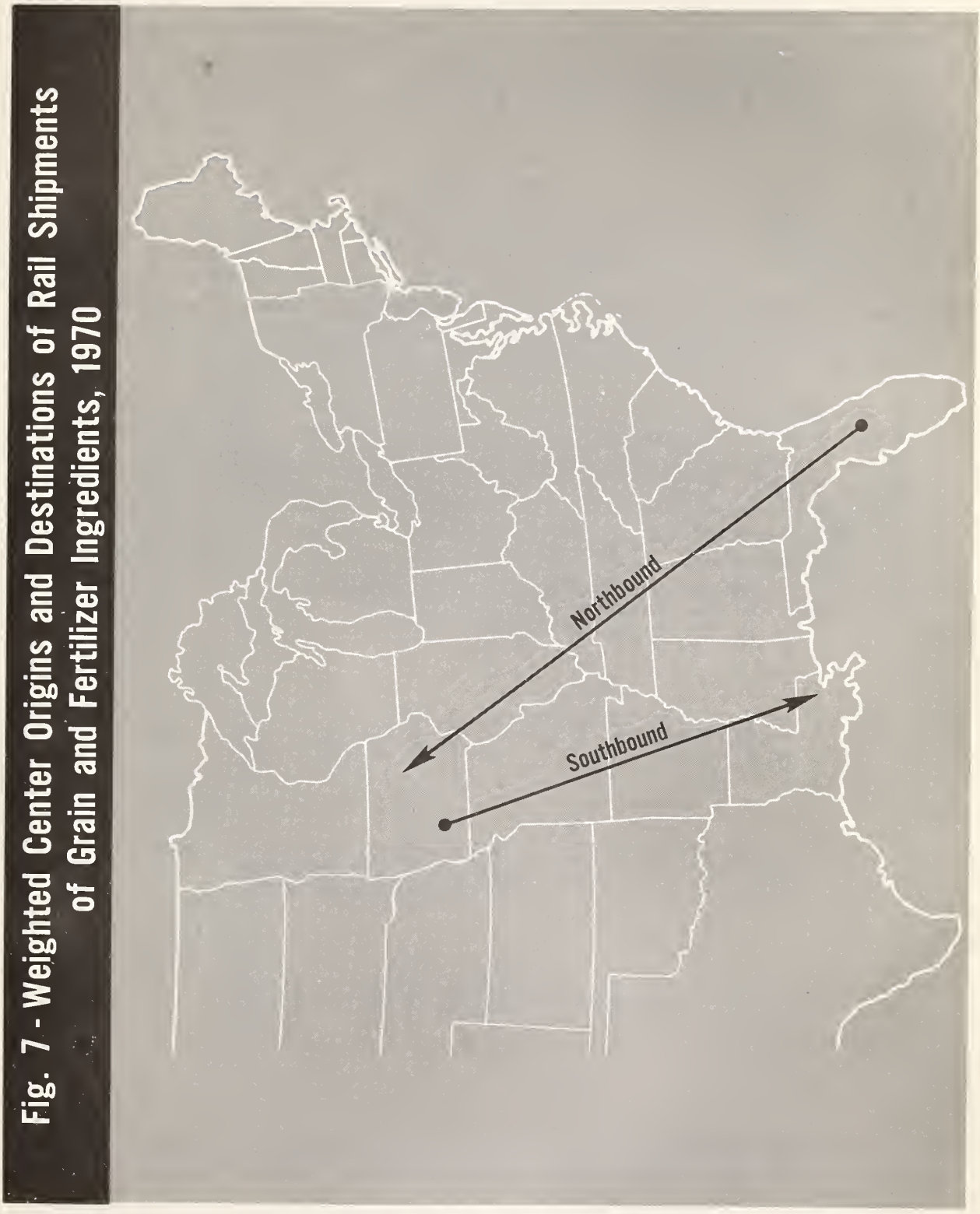

Fig. 7 - Weighted Center Origins and Destinations of Rail Shipments of Grain and Fertilizer Ingredients, 1970

Better leasing rates or lower costs to the cooperatives if the cars are purchased should be possible because of the concentration of negotiating or purchase power. Car leasing companies would probably reflect back lower costs to cooperatives participating in such a pool or administering a single large account instead of several accounts if cars are leased.

Bargaining

The bargaining position of cooperatives with carriers could be improved by coordinating their shipments through one agency. Certainly, bargaining on a consolidated basis can confer more muscle for negotiating than can individual efforts of the cooperatives. But the main advantage of coordination would probably lie in the opportunities to effect economies mutually beneficial to cooperatives and carriers.

If the cooperatives could present package programs involving two-way loaded movements of owned rail or barge equipment, with a guaranteed volume, freight rates could probably be reduced accordingly. For example, a grain regional in the Midwest shipping grain by rail or barge to the Gulf could coordinate this movement with a farm supply cooperative shipping fertilizer from Florida to the Midwest. By coordinating these two movements, rail or barge equipment could be better utilized in a two-way operation, loaded both ways, which could be reflected in lower rates on the products hauled.

APPENDIX TABLES

Appendix Table 1.--Interstate shipments of grain and fertilizer ingredients of 14 farmer cooperatives, by month, 1970

Month	Rail				Barge			
	Southbound		Northbound		Southbound		Northbound	
	Number	Tons	Number	Tons	Number	Tons	Number	Tons
January	1,120	98,020	416	32,218	88	119,626	6	8,400
February	868	75,338	537	41,832	140	196,943	13	17,475
March	1,232	110,940	1,198	93,896	128	178,791	52	66,728
April	733	61,146	1,090	86,586	167	232,204	9	11,900
May	632	51,137	838	67,227	134	192,038	11	14,531
June	541	45,016	215	16,779	177	262,057	27	34,733
July	778	65,611	309	25,365	187	264,869	18	22,496
August	809	64,297	578	46,639	151	211,215	33	41,324
September	666	52,233	740	58,935	142	191,142	32	39,587
October	1,082	87,508	952	75,371	204	288,842	51	67,540
November	931	78,152	709	55,770	179	258,851	29	36,000
December	1,283	116,056	917	72,198	99	127,261	5	6,900
Total	10,675	905,454	8,499	672,816	1,798	2,523,839	286	367,614

Appendix Table 2.--Model I: Condensed annual cash flow with a 10-percent time estimate error factor 1/

Year	Investment	Operating cost	Revenue	Net revenue
		Dollars		
1	-3,224,019	-	-	-3,224,019
2-16	-	-1,044,114	1,684,330	640,216
17	-1,100,000 2/	-1,044,114	1,739,330 3/	- 404,784
18-20	-	-1,044,114	1,684,330	640,216
21 4/	-	-1,044,114	2,533,497 4/	1,489,383

1/ IRR = 19.1 percent. Hours per round-trip: 740.2 hours X 1.1 = 814.2 hours. Trips per year: 8,400 ÷ 814.2 = 10.32. Annual operating cost: $972,596 + (10.32) ($6,930) = $1,044,114. Annual tonnage: grain, 217,339, and fertilizer, 198,918.
2/ Reinvestment in towboat.
3/ Increased revenue due to salvage value of towboat.
4/ Increased revenue due to salvage value of barges and depreciated value of towboat.
- = Not applicable.

Appendix Table 3.--Model I: Condensed annual cash flow with a 20-percent time estimate error factor 1/

Year	Investment	Operating cost	Revenue	Net revenue
		Dollars		
1	-3,223,026	-	-	-3,223,026
2-16	-	-1,038,154	1,543,974	505,820
17	-1,100,000 2/	-1,038,154	1,598,974 3/	- 539,180
18-20	-	-1,038,154	1,543,974	505,820
21 4/	-	-1,038,154	2,393,141 4/	1,354,987

1/ IRR = 14.4 percent. Hours per round trip: 714.2 hours X 1.2 = 888.2 hours. Trips per year: 8,400 ÷ 888.2 = 9.46. Annual operating cost: $972,596 ÷ (9.46) ($6,930) = $1,038,154. Annual tonnage: grain, 199,228, and fertilizer, 182,342.

2/ Reinvestment in towboat.

3/ Increased revenue due to salvage value of towboat.

4/ Increased revenue due to salvage value of barges and depreciated value of towboat.

- = Not applicable.

Appendix Table 4.--Model II: Condensed annual cash flow with a 10-percent time estimate error factor 1/

Year	Investment	Operating cost	Revenue	Net revenue
		Dollars		
1973	-6,448,038	-	-	-6,448,038
1974-78	-	-2,088,228	3,368,660	1,280,432
1979	-3,050,000 2/	-3,132,342	5,052,990	-1,129,352
1980-88	-	-3,132,342	5,052,990	1,920,648
1989	-2,200,000 3/	-3,132,342	5,162,990 4/	- 169,352
1990-92	-	-3,132,342	5,052,990	1,920,648
1993	-	-3,132,342	7,366,948 5/	4,234,606

1/ IRR = 19.8 percent. Hours per round trip: 740.2 hours X 1.1 = 814.2 hours. Trips per year: 8,400 ÷ 814.2 = 10.32.
2/ Purchase an additional standard tow.
3/ Reinvestment in 2 towboats.
4/ Increased revenue due to salvage value of towboats.
5/ Increased revenue due to salvage value of barges and depreciated value of towboats.
- = Not applicable.

Appendix Table 5.--Model II: Condensed annual cash flow with a 20-percent time estimate error factor[1/]

Year	Investment	Operating cost	Revenue	Net revenue
		Dollars		
1973	-6,446,051	-	-	-6,446,051
1974-76	-	-2,076,308	3,087,948	1,011,640
1977	-3,050,000[2/]	-3,114,462	4,631,922	-1,532,540
1978-81	-	-3,114,462	4,631,922	1,517,460
1982	-3,050,000[2/]	-4,152,616	6,175,896	-1,026,720
1983-88	-	-4,152,616	6,175,896	2,023,280
1989	-2,200,000[3/]	-4,152,616	6,285,896[4/]	- 66,720
1990-91	-	-4,152,616	6,175,896	2,023,280
1992	-1,100,000[3/]	-4,152,616	6,230,896[4/]	978,280
1993	-	-4,152,616	10,312,771[5/]	6,160,155

1/ IRR = 15.3 percent. Hours per round trip: 714.2 hours X 1.2 = 888.2 hours. Trips per year: 8,400 ÷ 888.2 = 9.46.
2/ Purchase an additional standard tow.
3/ Reinvestment in towboat (s).
4/ Increased revenue due to salvage value of towboat(s).
5/ Increased revenue due to salvage and depreciated values of barges and towboats.
- = Not applicable.

Appendix Table 6.--Model III: Condensed annual cash flow with a 10-percent time estimate error factor 1/

Year	Investment	Operating cost	Revenue	Net revenue
		Dollars		
1973	-12,896,076	-	-	-12,896,076
1974-75	-	-4,176,456	6,737,320	2,560,864
1976	- 3,050,000 2/	-5,220,570	8,421,650	151,080
1977-78	-	-5,220,570	8,421,650	3,201,080
1979	- 3,050,000 2/	-6,264,684	10,105,980	791,296
1980-81	-	-6,264,684	10,105,980	3,841,296
1982	- 3,050,000 2/	-7,308,798	11,790,310	1,431,512
1983-88	-	-7,308,798	11,790,310	4,481,512
1989	- 4,400,000 3/	-7,308,798	12,010,310 4/	301,512
1990	-	-7,308,798	11,790,310	4,481,512
1991	- 1,100,000 3/	-7,308,798	11,845,310 4/	3,436,512
1992	-	-7,308,798	11,790,310	4,481,512
1993	-	-7,308,798	18,078,852 5/	10,770,054

1/ IRR - 20.2 percent. Hours per round trip: 740.2 hours X 1.1 = 814.2 hours. Trips per year: 8,400 ÷ 814.2 = 10.32.
2/ Purchase 1 additional standard tow.
3/ Reinvestment in towboat (s).
4/ Increased revenue due to salvage value of towboat(s).
5/ Increased revenue due to salvage and depreciated values of barges and towboats.
- = Not applicable.

Appendix Table 7.--Model III: Condensed annual cash flow with a 20-percent time estimate error factor 1/

Year	Investment	Operating cost	Revenue	Net revenue
		Dollars		
1973	-12,892,103	-	-	-12,892,103
1974	-	-4,152,616	6,175,896	2,023,280
1975	- 3,050,000 2/	-5,190,770	7,719,870	- 520,900
1976-77	-	-5,190,770	7,719,870	2,529,100
1978	- 3,050,000 2/	-6,228,924	9,263,844	- 15,080
1979-80	-	-6,228,924	9,263,844	3,034,920
1981	- 3,050,000 2/	-7,267,078	10,807,818	490,740
1982-88	-	-7,267,078	10,807,818	3,540,740
1989	- 4,400,000 3/	-7,267,078	11,027,818 4/	- 639,260
1990-92	-	-7,267,078	10,807,818	3,540,740
1993	- 1,100,000 3/	-7,267,078	15,494,817 4/ 5/	7,127,739

1/ IRR = 15.3 percent. Hours per round trip: 714.2 hours X 1.2 = 888.2 hours. Trips per year: 8,400 ÷ 888.2 = 9.46.
2/ Purchase 1 additional standard tow.
3/ Reinvestment in towboat (s).
4/ Increased revenue due to salvage value of towboat (s).
5/ Increased revenue due to salvage and depreciated values of barges and towboats.
- = Not applicable.

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