Prospects for Container-on-Barge Service on the Mississippi River

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Container-on-barge service represents an intermodal transport operation that takes advantage of high-capacity, low-cost inland waterways for the shipment of containers to coastal ports for transfer to ocean-going vessels. The feasibility of container-on-barge service between inland cities in the Midwest and the Port of New Orleans via the Mississippi River system is examined. It is concluded that, because of the significantly longer transit time for containers shipped by barge, relative to rail service, container-on-barge service will be unable to compete for time-sensitive cargoes. To succeed, the container-on-barge service will need to attract neobulk and relatively low-value containerized shipments and reposition empty containers.

This paper is based on the results of research conducted by the Louisiana State University (LSU) Ports and Waterways Institute for the Office of University Research, Maritime Administration. Examined are the possible market size and scope for container-on-barge (COB) services, using the Mississippi River Valley and the Port of New Orleans as an example. The major objective of the analysis was to assist waterway operators who are considering establishing COB services by assessing factors and conditions necessary for successful COB ventures. Intermodal rail rates and COB costs were examined to determine the trade flows that could potentially support COB services on the Mississippi River–Gulf Intracoastal Waterway System. Interviews were conducted with various port and waterway industry personnel to determine their attitudes toward implementation of COB services. A brief review of intermodalism is also presented to indicate the physical distribution requirements that COB must fulfill.

DOMESTIC HINTERLANDS

An assessment of the potential market area for COB services requires analysis of routing possibilities between major inland ports and overseas ports. The geographic scope of COB service was delineated using a transportation cost analysis of inland and ocean routings between major cities adjacent to the domestic shallow-draft waterway network and world trade regions via Atlantic, Gulf, and Pacific coast ports. The Intermodal Transportation Costing Model developed by the LSU Ports and Waterways Institute was used to compute ocean transport costs between major U.S. ports and representative ports in 10 major world trade regions. The following trade regions and representative ports were selected:

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Trade Region	*Representative Port*
Mexico and Central America	St. Tomas, Guatemala
Caribbean	Kingston, Jamaica
East Coast of South America	Santos, Brazil
West Coast of South America	Callao, Peru
Northern Europe	Rotterdam, The Netherlands
Southern (Mediterranean) Europe	Leghorn, Italy
Asia	Singapore, Singapore
Australia and Oceania	Wellington, New Zealand
Western Africa	Dakar, Senegal
Southern and Eastern Africa	Durban, South Africa

Ocean costs for 40-ft containers were computed between representative ports of major world trade regions and the domestic ports of New York, Baltimore, Norfolk, Charleston, Savannah, Miami, New Orleans, Houston, Long Beach, Oakland, and Seattle. Rail rates for marine containers between major U.S. cities contiguous to the Mississippi River system and ports were compiled from published intermodal circulars. Most steamship lines and freight forwarders have privately negotiated lower volume-incentive mini- and microbridge contract rates. To reflect this situation, published nonnegotiated intermodal rail rates were discounted using parameters supplied by large container vessel operators.

The LSU Intermodal Transportation Costing Model selected the lowest combination of inland rail rates and ocean costs between domestic inland cities and world trade regions. The model also computed inland/water freight cost differentials for competing ports. COB service on the Mississippi River system would likely be to New Orleans or possibly Mobile. To assess the geographic scope of the COB hinterland, the model was used to compare transportation costs from inland cities to world trade areas through the Port of New Orleans with those of routings through other U.S. ports.

Table 1 gives the land/water freight cost differentials between New Orleans and competing ports. The land/water freight cost differentials indicate the competitive position of New Orleans for marine containers between domestic cities and world trade regions. For example, containers to and from Cincinnati can be moved through competing ports at costs ranging between $50 and $176 less per box than through New Orleans. Containers between Memphis and world trade regions can be shipped through New Orleans at lower costs than through other ports, however. The competitive advantage of New Orleans ranges between $18 and $140 a container for Memphis traffic, depending on the specific trade area served.

The data in Table 1 indicate that a Mississippi River COB service would encounter significant competition from other

TABLE 1 FREIGHT COST DIFFERENTIALS BETWEEN NEW ORLEANS AND OTHER MAJOR CONTAINER PORTS ($/BOX)

	World Trade Area									
	Central America and Mexico	Caribbean	East Coast of South America	West Coast of South America	Northern Europe	Southern (Mediterranean) Europe	Asia	Australia and Oceania	Western Africa	Southeast Africa
Representative port	St. Tomas	Kingston	Santo	Callao	Rotterdam	Leghorn	Singapore	Wellington	Dakar	Durban
Domestic ports										
St. Paul	68	24	–20	48	–66	–68	–94	82	–48	2
Chicago	68	24	–20	48	–66	–68	–94	82	–48	2
Peoria	100	78	50	110	35	34	–10	98	48	77
St. Louis	110	88	60	120	44	42	–2	106	56	84
Cincinnati	–54	–82	–112	–50	–146	–128	–176	–64	–116	–88
Louisville	46	18	–10	50	–46	–48	–74	36	–28	14
Omaha	0	2	22	18	50	54	–6	38	38	88
Kansas City	30	32	52	48	74	84	44	68	68	118
Chattanooga	–54	–82	–110	–50	–124	–124	–172	–64	–114	–86
Memphis	136	108	80	140	66	66	18	126	76	104

ports in attempting to divert traffic to New Orleans. For example, unless a COB service to Cincinnati could reduce the domestic portion of container transport costs by at least $50, no traffic would be diverted to New Orleans. To attract significant volumes of containers from Cincinnati would require savings in excess of $200 per box. In markets where New Orleans has a relative cost advantage, such as Memphis, the demand for COB service will be a function of total distribution cost savings relative to existing rail and truck service.

Unless COB can offer very low rates for low-value neobulk commodities, the overall weak competitive position of the Port of New Orleans in major midwestern river cities such as St. Paul and Chicago will remain unchanged. With the exception of a few markets located close to the port, such as Memphis, New Orleans does not have a large "captive" hinterland. This situation is even more extreme for other potential COB coastal ports such as Mobile. Moreover, existing containerized marine traffic that moves between major river cities and the Port of New Orleans is quite limited. Interviews with representatives of major railroads serving New Orleans indicate that the number of marine containers moved through the port from the major Mississippi River cities is relatively small. Almost 80 percent of the marine containers between the major river cities and world trade regions that pass through New Orleans originates or terminates in Chicago, St. Louis, or Memphis. The estimated numbers of marine containers handled annually by railroads through the Port of New Orleans are as follows: St. Paul, 500; Chicago, 5,400; Peoria, 400; St. Louis, 14,200; Cincinnati, 50; Louisville, 2,000; Omaha, 200; Kansas City, 5,000; Chattanooga, 50; and Memphis, 13,700.

MARKET AGENTS

A major determinant of the success of COB in Europe and the Pacific Northwest has been the ability of transportation agents to structure COB as an intermodal service. The perceptions of steamship lines, towing companies, and port and terminal operators are summarized for each market participant.

Representatives of steamship lines are generally quite skeptical about the feasibility of COB service:

- The speed, frequency, and cost of rail service were regarded as overwhelming any potential line-haul transportation cost savings that might arise from COB. Conventional container traffic is not regarded as divertible to slow and infrequent COB service.
- Low-value neobulk cargo volumes are perceived to be insufficient to justify regular COB service. Infrequent flows can be unprofitable for steamship lines because of expenses associated with maintaining a chassis pool at interior ports.
- COB was not viewed as a viable alternative to rail unless large steady flows of non-time-sensitive cargo could be containerized.

Towing companies are enthusiastic about establishing COB services:

- Operators believe that COB can be conveniently accommodated with existing equipment and within existing operational practices of towing companies.
- Towing companies are reluctant to accept any responsibility for cargo damage or for any non-line-haul cost components associated with COB, an attitude that goes against the trend toward intermodal pricing.
- Operators expect to be reimbursed for barge line-haul costs and all associated expenses such as tow makeup and breakup, regardless of the number of boxes available.
- The time-sensitive nature of most containerized cargoes and the importance of non-line-haul logistics costs, particularly terminal expenses, are not readily perceived by towing companies.
- Consequently, towing companies are the most vigorous supporters of an intermodal COB service sponsored by steamship lines or third parties.

Port and terminal operators familiar with COB are primarily concerned with loading and unloading sequences for containers:

- Adequate supply of chassis, yard space, damage control, and inspection of marine containers are important considerations. These activities result in perceptions of low productivity and high labor costs to load containers on and unload containers from barges.

- In some instances terminal operators do not have adequate equipment to efficiently handle marine containers of different sizes.
- Estimates of cost to load and unload marine containers varied widely among terminal operators. Quotations exceeded $100 a box to load or unload at coastal ports. Interior ports quoted handling rates of between $50 and $100 a container per move. These estimates do not include chassis costs.
- It appears that traditional public port and terminal operator container-handling practices cannot be used if COB service is to be economically viable.

INTERMODAL REQUIREMENTS

To fully comprehend the challenges faced in implementing a COB service, it is important to understand the nature of intermodal services and pricing. Although these challenges are not insurmountable, as evidenced by successful COB services in the Pacific Northwest and Europe, any new services must employ competitive intermodal service practices and pricing policies. Significant institutional changes have occurred in domestic and offshore transportation since 1980. Railroad transportation of trailers and containers has been completely deregulated. Interstate motor freight transportation is almost totally deregulated. The Shipping Act of 1984 allows steamship lines to quote through intermodal rates to interior points without distinguishing between domestic and water rates.

These sweeping institutional changes characterize a most competitive market in which railroads have a great deal of pricing flexibility for intermodal traffic. Steamship lines have contracted with railroads to obtain low volume-incentive rates. Steamship lines are increasingly moving containers on a single through bill-of-lading, bypassing freight forwarders and other third parties. Shippers increasingly expect to deal with one party for a complete service package, including responsibility for loss and damage and meeting delivery commitments. COB can only fit into emerging integrated domestic-foreign intermodalism if it is supported by steamship lines or is able to independently offer shippers sufficient real cost savings to entice them to forgo delivered prices and door-to-door service commitments of one party under the rail-water minibridge and microbridge rates quoted by steamship operators.

Railroads and steamship lines are exploiting economies of scale by building volume at a limited number of interior hub terminals and load-center ports. Volume-incentive intermodal contract rates negotiated by steamship lines and freight forwarders are between 10 and 30 percent less than nonnegotiated intermodal rates. Volume-incentive intermodal rates between selected inland cities and coastal ports are given in Table 2. The spread between nonnegotiated and estimated volume-incentive rail rates is significant relative to projected cost savings for COB. For example, the Leaseway Transportation Corporation's COB concept of saving shippers approximately $100 per container appears to be viable compared with nonnegotiated rail intermodal rates. The lower volume-incentive rates for large shippers, however, erase any appreciable COB line-haul rate savings.

New developments in rail intermodal equipment have resulted in lightweight articulated flatcars capable of handling two tiers of containers. Double-stack rail cars reduce line-haul costs between 25 and 40 percent depending on train size, length of haul, and route characteristics. Table 3 gives a projection of potential double-stack rail rates for the COB hinterland of major Mississippi River cities. Although double-stack service may never be instituted in some of these markets because of insufficient unit train volumes of containers, the overall thrust of double-stacking is negative for COB and ports not served by this technology. The absence of double-stack service between the Midwest and the Port of New Orleans is also indicative of the low volumes of containers, particularly 40-ft boxes, handled between Chicago and St. Louis and the Gulf. Existing volumes of container flows through the Gulf ports are inadequate to justify double-stack rail service notwithstanding COB. Steamship lines are repositioning their vessels to minimize port calls. Larger fourth-generation jumbo container ships are now calling at Atlantic and Pacific Coast ports. Together with steamship companies' double-stack rail cars, these vessels are pulling cargo away from small ports, aided by through rates and faster service. If COB is to be successfully interjected into the emerging intermodal hub and load-center operations, it must offer substantial savings to both steamship lines and shipprs. Discussions with representatives of steamship lines indicate that total COB logistics costs will need to be significantly lower than rail rates in order to induce shippers to forgo fast, frequent, dependable rail service. Moreover, unless COB can be operated as an extension of liner service, as is double-

TABLE 2 INTERMODAL RAIL VOLUME-INCENTIVE RATES ESTIMATED FOR MINI- AND MACROBRIDGE

	New Orleans	Houston	Savannah	Norfolk	Baltimore	New York	West Coast
St. Paul	630	750	800	650	730	780	1,160
Chicago	400	600	570	420	500	550	1,050
Peoria	350	440	450	480	550	600	1,125
St. Louis	350	440	450	480	550	600	1,125
Cincinnati	460		390	420	530	570	1,125
Louisville	350		380	390	390		1,090
Omaha	580	560	760				900
Kansas City	460	470	610	700			1,010
Chattanooga	290		220	360			
Memphis	250	400	370	540			1,125

NOTE: Plan III for single-container shipments between major COB river cities and domestic ports ($/box).
SOURCE: Compiled by LSU Ports and Waterways Institute.

TABLE 3 INTERMODAL RAIL VOLUME-INCENTIVE RATES ESTIMATED FOR DOUBLE-STACK MINI- AND MACROBRIDGE

	New Orleans	Houston	Savannah	Norfolk	Baltimore	New York	West Coast
St. Paul	470	560	600	490	550	585	1,000
Chicago	300	450	430	315	375	410	900
Peoria	260	500	340	360	410	450	975
St. Louis	260	500	340	360	410	450	975
Cincinnati	350		300	315	375	425	975
Louisville	280		300	300	300		975
Omaha	435	420	570				810
Kansas City	350	360	450	520			900
Chattanooga	230		180	180			
Memphis	200	300	300	390			975

NOTE: Plan III for single-container shipments between major COB river cities and domestic ports ($/box).
SOURCE: Compiled by LSU Ports and Waterways Institute.

stack rail intermodal equipment, shippers' commitments to use COB will not be obtainable for modest cost savings at the expense of single billings and centralized responsibility for delivery.

CONTAINER-ON-BARGE COSTS

Successful COB services in the Pacific Northwest and Europe have rate structures and service patterns that are competitive with other intermodal alternatives. To assess the prospects of implementing additional COB services on the U.S. inland waterways, an examination of towing costs and operating practices on the Mississippi River–Gulf Intracoastal Waterway (MR-GW) was conducted. This assessment formed the basis for estimating COB line-haul costs. Although the costs are based on operations centered at the Port of New Orleans, the results should have general applicability at least to the extent of providing basic information on relative competitive conditions and volumes necessary for a profitable COB service.

To provide a basis of comparison with existing intermodal services, COB line-haul costs were converted into per box costs, based on different levels of barge capacity utilization, and terminal costs (both inland and ocean). COB costs per box were then compared with rail intermodal rates to determine possible operational savings. A parametric analysis of other factors that would influence the actual costs of COB service was conducted. An evaluation of dedicated versus general towing was conducted to determine the volumes for which a high-speed, reliable COB service could be established. In-transit inventory carrying costs were examined to determine their effect on the break-even number of boxes that COB service would require to provide sufficient cost savings to attract shippers. Overhead costs were computed and combined with estimated COB operating costs to determine the volumes of containers necessary to sustain service and possible vessel itineraries.

COB LINE-HAUL TOWING COSTS

General towing charges for COB were estimated on the basis of quotations from operators between New Orleans and the inland ports of St. Paul, Chicago, St. Louis, Cincinnati, Memphis, and Houston. General COB towing costs for a jumbo barge (195 × 35 ft) are given in Table 4. The costs include fleeting, switching, and tow makeup and breakup charges of $900 per barge for movements to and from St. Paul and Chicago, and $600 per barge for the other inland ports. On the lower Mississippi, south of St. Louis, towing costs vary by direction. The costs in Table 4, however, reflect average one-way charges for round-trip barge movement.

Towing costs will not change as a function of the number of boxes carried by the barge. Average line-haul towing costs per container will, therefore, be determined by the number of boxes loaded on each barge. General towing costs per barge are divided by three levels of barge capacity utilization in Table 4:

1. Full capacity—72 containers,
2. Three-quarter capacity—54 containers, and
3. One-half capacity—36 containers.

Although average line-haul towing costs per container appear relatively low, barge utilization is very important in determining the cost per box. The estimated capacity of 72 containers is based on three tiers of 20-ft boxes. Each tier would accommodate 24 boxes in a 195- × 35-ft jumbo open-hopper river barge.

COMPARATIVE RAILROAD INTERMODAL RATES

Railroad intermodal rates are normally quoted on a ramp-to-ramp basis, which includes loading, unloading, and line-haul services. To compare COB costs per box with railroad intermodal rates for marine containers, it is necessary to add loading and unloading costs to COB line-haul costs. COB terminal costs for loading and unloading will be heavily influenced by labor rates, work rules, and productivity. To account for the prospective variability in terminal costs, COB line-haul costs in Table 4 were increased to incorporate three projected levels of per move container loading and unloading costs:

- Low cost—$30 at interior ports and $30 at coastal ports,
- Moderate cost—$30 at interior ports and $55 at coastal ports, and
- High cost—$55 at interior ports and $55 at coastal ports.

COB dock-to-dock costs per box were then compared with rail intermodal ramp-to-ramp rates for single-container shipments in Tables 5 and 6. Rail intermodal rates are specified for two

TABLE 4 LINE-HAUL GENERAL TOWING COSTS FOR BARGES BETWEEN INLAND PORTS AND NEW ORLEANS

		Average Container Cost ($/box)		
	Towing Cost ($)	Full Capacity (72 boxes)	Three-Quarter Capacity (50 boxes)	One-Half Capacity (36 boxes)
St. Paul	10,000	139	185	278
Chicago	7,800	108	144	217
St. Louis	5,100	71	94	142
Cincinnati	7,100	99	131	197
Memphis	3,000	42	56	83
Houston	4,000	56	74	111

SOURCE: Computed by LSU Ports and Waterways Institute.

TABLE 5 COB DOCK-TO-DOCK LINE-HAUL COSTS VERSUS VOLUME-INCENTIVE RAIL MINI- AND MICROBRIDGE INTERMODAL RATES

	Volume-Incentive Rail Rate	Low Terminal	Savings	Moderate Terminal	Savings	High Terminal	Savings
72 Boxes per Barge ($/box)							
St. Paul	630	199	431	224	406	249	257
Chicago	400	168	232	193	207	218	182
St. Louis	350	131	219	156	194	181	169
Cincinnati	460	159	301	184	276	209	251
Memphis	250	102	148	127	123	152	98
Houston	250	116	134	141	109	166	84
54 Boxes per Barge ($/box)							
St. Paul	630	245	385	270	360	295	335
Chicago	400	204	196	229	171	254	146
St. Louis	350	154	196	179	171	204	146
Cincinnati	460	191	269	216	244	241	219
Memphis	250	116	134	141	109	166	84
Houston	250	134	116	159	91	184	66
36 Boxes per Barge ($/box)							
St. Paul	630	338	292	363	267	388	242
Chicago	400	277	123	302	98	327	73
St. Louis	350	202	148	227	123	252	98
Cincinnati	460	257	203	282	178	307	153
Memphis	250	143	107	168	82	193	57
Houston	250	171	79	196	54	221	29

SOURCE: Computed from Tables 2 and 4 and assuming low, moderate, and high terminal costs of $60, $85, and $110 per box.

levels: (a) volume-incentive minibridge and microbridge rates developed from interviews with people from steamship lines and railroads (Table 5) and (b) estimated double-stack rates if 100 platform unit trains (200 forty-foot containers per train) were feasible between the COB hinterland and New Orleans (Table 6).

COB dock-to-dock costs per box were subtracted from rail ramp-to-ramp container rates to indicate the operational cost advantage between water and rail service. Neither COB nor rail includes drayage costs. The operational cost advantage also does not include any allowance for increased inventory costs associated with slower, less frequent water service or COB overhead costs. Table 5 (volume-incentive rail rates) provides the best indication of current COB potential cost savings for non-time-sensitive freight (zero inventory holding costs). If barges can be loaded to at least one-half capacity, 36 boxes, COB offers the potential for substantial savings to shippers from distant interior points, such as Cincinnati and St. Paul, if inventory costs are negligible.

With incremental transit times approaching 10 and 20 days between these two ports and New Orleans, respectively, even low-valued commodities with inventory costs of $10 per day would largely negate any line-haul savings. Based on the comparative port analysis given in Table 1, Cincinnati and St. Paul are outside the market area for New Orleans except for southern hemisphere traffic. Only limited amounts of containerized traffic and a small amount of break-bulk traffic move between these cities and the Port of New Orleans. Although the cost analysis indicates that savings could be used to attract non-time-sensitive freight to COB for these two areas, existing volumes for these two ports are unlikely to be sufficient to support COB services.

As the number of containers per barge is increased, the COB competitive advantage expands to cities closer to the Port of

TABLE 6 COB DOCK-TO-DOCK LINE-HAUL COSTS VERSUS ESTIMATED DOUBLE-STACK RAIL INTERMODAL RATES

	Double-Stack Rail Rate	Low Terminal	Savings	Moderate Terminal	Savings	High Terminal	Savings
72 Boxes per Barge ($/box)							
St. Paul	470	199	271	224	246	249	221
Chicago	300	168	132	193	107	218	82
St. Louis	260	131	129	156	104	181	79
Cincinnati	350	159	191	184	166	209	141
Memphis	200	102	98	127	73	152	48
Houston	200	116	84	141	59	166	34
54 Boxes per Barge ($/box)							
St. Paul	470	245	225	270	200	295	175
Chicago	300	204	96	229	71	254	46
St. Louis	260	154	106	176	81	204	56
Cincinnati	350	191	159	216	134	241	109
Memphis	200	116	84	141	59	166	34
Houston	200	134	64	159	41	184	16
36 Boxes per Barge ($/box)							
St. Paul	470	338	132	363	107	388	82
Chicago	300	277	23	302	(2)	327	(27)
St. Louis	260	202	58	227	334	252	8
Cincinnati	350	257	93	282	68	307	43
Memphis	200	143	57	168	32	193	7
Houston	200	171	29	196	4	221	(21)

SOURCE: Computed from Tables 3 and 4 and assuming low, moderate, and high terminal costs of $60, $85, and $110 per box.

New Orleans. A threshold savings of approximately $100 per box is definitely feasible at between 50 and 72 containers per barge between Chicago and St. Louis and New Orleans if inventory and COB overhead costs are disregarded. Although this result is at odds with the short length-of-haul evidenced by existing COB operations, it reflects the more intense level of competition at inland points such as St. Louis and Memphis and the disregard of inventory and overhead costs.

PARAMETRIC ANALYSIS

One of the key features of intermodal service is the provision of rapid, reliable service that provides flexibility to shippers. Existing intermodal alternatives for shippers normally include 1- or 2-day transit times between coastal ports and inland cities at competitive rates. Relatively fast and frequent service also affects other physical distribution costs such as insurance and inventory carrying costs. As evidenced by existing COB services in Europe and on the Columbia-Snake system, the success of COB hinges not only on developing a competitive rate structure but also on functioning as a truly intermodal operation. In this section operational and cost parameters that would influence COB services and costs are examined. Of particular concern are the potential for establishing a regularly scheduled, dedicated COB tow service, the impact of in-transit inventory carrying costs, and overhead costs associated with establishing and maintaining COB services.

Dedicated Versus General Towing

As an alternative to general towing, the costs for dedicated tows providing rapid and reliable service were examined. Dedicated tows would allow a tightly scheduled operation. One advantage of a dedicated tow is the possibility of using a large towboat to increase tow speed and increase the number of trips per week. However, speed restrictions (obstacles and channel depth) limit the potential of dedicated tows on the lower Mississippi and Gulf Intracoastal Waterway. To provide a basis of comparison with costs of general towing, towing costs for dedicated COB tows were computed for New Orleans–Memphis and New Orleans–Houston itineraries.

Average one-way costs per barge based on weekly service with a two-barge dedicated tow were $7,300 between New Orleans and Memphis and $6,000 between New Orleans and Houston. Line-haul costs per box for dedicated tows are given in Table 7. If volume is sufficient, the higher cost of dedicated towing may be justified when multiple barges of containers can be moved in one tow (compared with the one-way general towing cost of multiple barges of containers in one tow). For example, the one-way general towing cost (Table 4) for two barges between Memphis or Houston and New Orleans would be $6,000 (2 × $3,000) and $8,000 (2 × $4,000), respectively. The line-haul cost of dedicated two-barge tows would remain greater than that of general towing on the Mississippi to Memphis. Dedicated two-barge tows could be as much as 25 percent less costly than general towing, however, on the Gulf Intracoastal Waterway between New Orleans and Houston (Table 4 versus Table 7).

Overhead Costs

Although COB appears to have some significant cost savings over conventional intermodal service, the previous analysis

TABLE 7 COB LINE-HAUL DEDICATED TOWING COSTS PER BOX FOR TWO-BARGE TOWS: ONE ROUND TRIP A WEEK BETWEEN MEMPHIS–NEW ORLEANS AND HOUSTON–NEW ORLEANS

	Memphis–New Orleans	Houston–New Orleans
Full capacity (144 boxes)	51	42
Half capacity (72 boxes)	101	83

SOURCE: Computed by LSU Ports and Waterways Institute.

excluded two important cost components, overhead and inventory costs. The overhead costs associated with conventional intermodal service are reflected in the pricing structure. To provide an accurate comparison, overhead costs must be added to COB charges.

COB overhead costs were estimated for a single interior port service assuming a manager, coastal port captain, interior port director, and two clerical personnel. COB overhead costs were estimated to be $6,000 per week. The break-even number of boxes for scheduled general COB towing service between one hinterland port and New Orleans is given in Table 8. Break-even volumes reflect low container-handling costs for volume-incentive rail mini- and microbridge rates and potential double-stack rail intermodal rates. (With moderate and high terminal costs, break-even volumes would increase between 5 and 20 percent and 11 and 55 percent, respectively.) COB break-even volumes for conventional rail intermodal rates increase from 40 percent of barge container capacity to 70 percent as the distance between hinterland ports and New Orleans decreases. If railroads initiated double-stack intermodal service or reduced existing volume-incentive rates, COB single-barge service would not be feasible for Chicago and Houston.

It should be noted, however, that, if COB could deliver directly to the marine terminal, additional cost savings vis-à-vis rail-truck delivery would be available and a higher COB rate would be possible. Also, as was previously noted, St. Paul and Cincinnati are not prime markets for New Orleans. When prospective COB rates are adjusted to reflect competition from other ports (Table 1), break-even utilization increases to 56 and 65 percent, respectively, for the two ports. With double-stack rail rates, COB break-even utilization increases to 86 and 126 percent, respectively.

The overhead costs of COB at New Orleans were shared with two inland ports (Table 9) to indicate the impact of direct service between two ports and New Orleans. The overall impact of multiple-port service on break-even volumes is rather substantial. Break-even volumes range between 32 and 50 percent of barge capacity under conventional rail service and rates. Table 10 gives the impact of direct service to three inland ports. Overall, only a small decline in break-even volumes is evidenced vis-à-vis two-port service. The data in Tables 9 and 10 indicate that COB service should be between multiple inland ports in order to spread the overhead costs associated with the ocean port connection. Moreover, the data indicate that a successful COB service will require high levels of capacity utilization.

In-Transit Inventory Carrying Costs

The last major cost element that has not been evaluated is the time value of the container and cargo. It has been generally assumed that COB must be oriented toward non-time-sensitive cargoes. However, the previous analysis assumed that the container itself had no associated time costs. Given the cost of containers and the effective lower utilization that will result from COB transport, this assumption has a tendency to bias the earlier analysis in favor of COB services.

To examine the effects of line-haul transit time on the relative competitive position of COB, per day carrying costs of $10, $20, and $30 per box were assumed. Transit time by barge was estimated on the basis of tow speeds and distances. Rail transit time to and from New Orleans was estimated to be 3 days for St. Paul; 2 days for Chicago and Cincinnati; and 1 day for St. Louis, Memphis, and Houston. This resulted in incremental line-haul transit times of 17 days for St. Paul, 11 days for Chicago, 7 days for St. Louis, 9 days for Cincinnati, 3 days for Memphis, and 2 days for Houston. The speed disadvantage of COB does not include reduced service frequency (biweekly or weekly), implicitly assuming shippers are able to schedule to

TABLE 8 COB BREAK-EVEN VOLUMES OF BOXES: WEEKLY SERVICE BETWEEN A SINGLE PORT AND NEW ORLEANS

Port	COB Rate[a]	Break-Even Boxes per Week	Percentage Barge Utilization per Trip[b]	COB Rate[c]	Break-Even Boxes per Week	Percentage Barge Utilization per Trip[d]
St. Paul[e]	520	35	48	360	51	70
Chicago[f]	290	51	71	190	78	108
St. Louis[g]	240	68	45	150	109	76
Cincinnati[g]	350	58	40	240	85	59
Memphis[g]	140	87	60	90	135	94
Houston[g]	140	101	70	90	157	109

[a]Volume-incentive rail rates less $110 per box, $50 per box savings to attract shippers, and $60 per box terminal costs.
[b]Based on one barge per trip.
[c]Estimated double-stack rail rate less $110 per box.
[d]If utilization is greater than 100 percent, service is not feasible.
[e]Biweekly service for 9-month navigation season.
[f]Biweekly service for 10½-month navigation season.
[g]Weekly service for 12-month navigation season.

SOURCE: Computed by LSU Ports and Waterways Institute.

TABLE 9 COB BREAK-EVEN VOLUMES OF BOXES: WEEKLY SERVICE BETWEEN TWO PORTS AND NEW ORLEANS

Port	COB Rate[a]	Break-Even Boxes per Week	Percentage Barge Utilization per Trip[b]	COB Rate[c]	Break-Even Boxes per Week	Percentage Barge Utilization per Trip[d]
St. Paul[e]	520	27	38	360	39	54
Chicago[f]	290	39	54	190	59	82
St. Louis[g]	240	55	38	150	89	61
Cincinnati[g]	350	49	34	240	72	50
Memphis[g]	140	64	45	90	101	70
Houston[g]	140	79	54	90	123	85

[a]Volume-incentive rail rates less $110 per box, $50 per box savings to attract shippers, and $60 per box terminal costs.
[b]Based on one barge per trip.
[c]Estimated double-stack rail rate less $110 per box.
[d]If utilization is greater than 100 percent, service is not feasible.
[e]Biweekly service for 9-month navigation season.
[f]Biweekly service for 10½-month navigation season.
[g]Weekly service for 12-month navigation season.
SOURCE: Computed by LSU Ports and Waterways Institute.

TABLE 10 COB BREAK-EVEN VOLUMES OF BOXES: WEEKLY SERVICE BETWEEN THREE PORTS AND NEW ORLEANS

Port	COB Rate[a]	Break-Even Boxes per Week	Percentage Barge Utilization per Trip[b]	COB Rate[c]	Break-Even Boxes per Week	Percentage Barge Utilization per Trip[d]
St. Paul[e]	520	24	34	360	35	49
Chicago[f]	290	35	48	190	53	74
St. Louis[g]	240	51	35	150	82	57
Cincinnati[g]	350	46	32	240	68	47
Memphis[g]	140	58	40	90	89	62
Houston[g]	140	72	50	90	81	78

[a]Volume-incentive rail rates less $110 per box, $50 per box savings to attract shippers, and $60 per box terminal costs.
[b]Based on one barge per trip.
[c]Estimated double-stack rail rate less $110 per box.
[d]If utilization is greater than 100 percent, service is not feasible.
[e]Biweekly service for 9-month navigation season.
[f]Biweekly service for 10½-month navigation season.
[g]Weekly service for 12-month navigation season.
SOURCE: Computed by LSU Ports and Waterways Institute.

meet COB sailings as they do to meet daily rail service. It was also assumed that the rate a COB service could charge would have to be decreased to cover increased carrying costs associated with only the differences in transit time, ignoring service frequency.

The results of the evaluation of transit time differentials, disregarding service frequency, are given in Table 11 for the three levels of terminal costs and for carrying costs of $10 and $20 per day. As should be evident from the table, carrying costs of $30 per day would totally negate any line-haul savings that might be achieved by a COB service. In most cases the COB rate would need to be less than $50 per box (and in some cases the rate would have to be negative) in order to attract cargo—a rate at which COB cannot be self-sustaining. As should be expected, the introduction of in-transit carrying costs substantially increases the break-even levels. Even in the case of $10 per box carrying costs, a cost that corresponds to empty container insurance and opportunity costs, break-even utilization rates greater than 50 percent are required. At $20 per box, a cost that would reflect relatively low-value merchandise, the feasibility of COB largely disappears. Except in the case of low terminal costs, the utilization rates required for a profitable service are probably not achievable on any sustained basis. As a result, it is concluded that implementation of COB service is not feasible except where there are significant volumes of very low-valued shipments that are not sensitive to transit time and service frequency.

ASSESSMENT OF COB POTENTIAL

The evaluation of the cost and operational aspects of Mississippi River COB services indicates that COB can be economically and technically feasible only if certain market conditions exist. For example, scheduled, weekly general towing service on the Mississippi River system would require a minimum of 3,000 to 6,000 boxes a year to break even, depending on vessel itinerary. The volume of boxes needed to break even is sensitive to the distances between interior ports and New Orleans. The further upriver, the lower the annual COB break-even threshold, approaching 3,000 boxes a year at St. Paul. As river distances increase, however, COB

TABLE 11 COB BREAK-EVEN LEVELS WITH IN-TRANSIT INVENTORY CARRYING COSTS

	$10 per Box Break-Even Boxes per Week	Carrying Cost Percentage Barge Utilization[a]	$20 per Box Break-Even Boxes per Week	Carrying Cost Percentage Barge Utilization[a]
Low Terminal Costs				
St. Paul	52	72	101	140
Chicago	82	114	210	293
St. Louis	96	67	164	114
Cincinnati	78	54	120	83
Memphis	110	77	152	106
Houston	118	82	142	98
Moderate Terminal Costs				
St. Paul	56	78	117	163
Chicago	95	132	327	455
St. Louis	113	78	218	151
Cincinnati	115	80	140	97
Memphis	143	99	221	153
Houston	149	103	189	131
High Terminal Costs				
St. Paul	61	84	140	194
Chicago	100	139	738	1,024
St. Louis	136	95	327	227
Cincinnati	197	67	170	118
Memphis	203	141	405	281
Houston	202	140	283	197

[a]If utilization is greater than 100 percent, service is not feasible.

becomes almost unacceptable for any time-sensitive traffic, because of the long transit times, variability of transit times, and winter closure of the waterways system.

Although the absolute number of containers necessary for profitable service appears to be relatively small, COB break-even volume is substantial in comparison with the current levels of container traffic moving by rail and truck between inland river cities and the Port of New Orleans. COB threshold break-even volumes would almost certainly necessitate diverting non-time-sensitive traffic away from other ports. Because almost all containerizable general cargo has already been diverted from break-bulk, except in lesser developed nations, COB would need to secure substantial commitments of relatively non-time-sensitive cargoes before a service could be feasibly initiated.

Implementation of new COB services entails significant risk in the absence of guaranteed, steady, balanced traffic flows. COB costs for line-haul, terminal, and overhead on a per unit basis are relatively constant over a wide range of volumes and vessel itineraries. Only the labor costs for loading and unloading have some variability. As a result, unless traffic commitments can be secured to underwrite the fixed costs of the service, a COB venture should be regarded as speculative. This assertion reflects both the analysis conducted in this study and the failures of recent COB endeavors.

The break-even projections for COB are quite sensitive to assumptions about terminal costs, rail rates, inventory costs, and overhead costs. Terminal costs will be a function of capital intensity, volume, and productivity. Terminal costs have assumed the use of nonunion labor or modified union manning levels. If union-scale wages and crew sizes were used, terminal costs would be almost doubled. For example, terminal costs at Memphis would be between $90 and $100 per box (lift-on or lift-off), and terminal costs at New Orleans would be about $125 per box (lift-on or lift-off). Conventional terminal costs of this magnitude would prohibit a COB venture.

Rail rates used in this analysis were for single shipments of 20-ft containers. The intermodal rates given in Tables 2 and 3 reflect a single 20-ft container tendered by one shipper on one bill-of-lading. The realities of the rail intermodal pricing structure allow shippers to tender two 20-ft containers on one bill-of-lading for slightly more than the price for a single 20-ft container. Therefore, unless individual COB shippers cannot aggregate pairs of 20-ft containers, the rail rates used for comparative analysis are approximately two times those that steamship lines or freight forwarders would incur for multiple shipments of 20-ft containers on one bill-of-lading. The result is that the data in Tables 2 and 3 represent the theoretical maximum rates for individual shippers of single 20-ft containers without any combination of containers by freight forwarders or shipper consolidators.

Unless shipments have zero or quite low time sensitivity, a weekly COB service, which potentially could increase average transit times between 10 and 20 days for midwest ports, will not be economically attractive because of high inventory costs. All indications are that time-sensitive cargoes, which comprise the bulk of containerized cargoes, would be unable to use COB and derive any significant transportation savings. Therefore, COB would have to attract neobulk and relatively low-value container shipments, such as repositioning empty marine containers, in order to be successful.

COB break-even projections are also sensitive to assumptions about drayage expenses and chassis utilization. If drayage costs between COB interior river terminals are significantly less than those of rail because of shorter distances or less congestion, COB break-even thresholds will be lower. If container chassis utilization is reduced, however, COB costs will increase. Of particular importance in this regard is an operational structure that will attract streamship lines as active promoters of COB services.

Nonetheless, COB has significant attractive features. The cost analysis indicates that a competitive pricing structure is possible only if sufficient volume of single 20-ft containers not subject to consolidation for lower rail rates exists and if productivity is high. Depressed conditions in the towing industry, characterized by an oversupply of equipment, should enable prospective COB operators to lease all equipment at nominal rates. Moreover, towing services can be negotiated at levels that are significantly lower than published tariff rates. With small terminal crew sizes, COB dock-to-dock line-haul and transshipment costs could be competitive with rail for non-time-sensitive cargoes.

Implementation of COB service requires several steps if the service is to be profitable for the inland and ocean carriers, and sufficiently cost competitive to attract the necessary volumes to achieve high levels of equipment utilization and terminal productivity. The successful examples of COB indicate that a signigicant amount of market research was conducted before implementation. This research indicated the levels of cargoes that might be available as well as the pricing and quality-of-service that COB would need to provide to be a viable alternative to existing intermodal shipment patterns. Perhaps as important as the market research is the ability to transform the market information into commitments on the part of shippers, ports, and other carriers. These commitments provide the base cargoes that underwrite initial COB services.

There must also be a commitment to structure COB as an intermodal service. This means that COB must provide an intermodal rate and service package beyond a towing charge. By definition this requires that, in addition to towing companies, other transportation entities be involved in developing an intermodal COB service. COB potential will be limited if the service is marketed as a dock-to-dock, for-hire towing alternative to land-based line-haul services that are part of an intermodal distribution system. The integration of railroads, ports, and steamship lines, including trucking and drayage, is resulting in a new one-stop shopping dimension to intermodalism.

COB must be conceived and executed as part of a through intermodal service, not a fragmented alternative to one component of an integrated intermodal package. The service cannot simply be integrated into existing towing operations. It will require adaptation of inland towing operations to intermodal operations. COB must be a scheduled, reliable service if it is to be operationally competitive with the land-based modes. Reliability includes not only the towing operation but also container and chassis availability, yard security, loss and damage control, and other physical distribution characteristics. Without integration of COB into an intermodal service, the lack of necessary operational features, such as container pools and high productivity levels at inland terminals, will effectively block implementation of new COB services.

To be successful, COB must be structured as a distribution package, and barge and towing companies must be able to effectively market an intermodal COB service. Intermodal COB can be an extension of a shipping line, a consortium of shipping lines, a port agency, or a shipper cooperative. The formal organization of COB is not particularly important, however; unless COB has a through rate and intermodal service package that can be incorporated into ocean service tariffs and service contracts, COB has relatively limited prospects and potential. In spite of impressive potential savings for long-distance cargoes and competitive rates for short-haul cargoes, COB must reduce total distribution costs to present a successful alternative to emerging intermodal systems.

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