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Double Stack Container Systems: Implications for U.S. Railroads and Ports

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Task III Report

Operational, Organizational and Institutional Issues

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A. INTRODUCTION

The future of double-stack container services, both domestic and international, depends on much more than technological developments and cost comparisons. The greatest challenges to the railroads, and to the emerging intermodal industry of which they are part, are not likely to be technical or economic, but managerial and institutional.

If the emerging intermodal industry can meet those challenges, the rewards will be substantial. Intermodal traffic is the fastest growing segment of the railroad industry. Double-stack technology holds the potential to handle this growth more efficiently and profitably than conventional systems. The largest source of growth, however, is the vast amount of intercity freight traffic moving by truck. In Task II, it was estimated that up to 3.2 million annual truckloads would be divertible to a nation-wide double-stack network under favorable assumptions.

If it is to succeed, large-scale domestic double-stack container service must prosper in a shipping community whose standard of service is the motor carrier. According to NMTDB and ICC data compiled by the AAR, intermodal service accounts for only 15-16 percent of the domestic traffic moving over 500 miles (exclusive of private carriage and team drivers). Intermodal service now accounts for up to 70 percent of those markets in which it is most successful (i.e., dry van truckload traffic between major cities more than 700 miles apart). Nonetheless, much of the shipping community remains openly skeptical of intermodal service. To reach its full potential, domestic double-stack service will have to offer customers more than just cheaper piggyback.

The railroads have the largest stake in domestic container service. Third parties can prosper as well arranging piggyback and truckload service, and leasing companies can supply trailers as easily as containers. Ocean carriers and ports will see their international business grow, and thus their "backhaul" domestic business increase, regardless of whether the railroads succeed at domestic containerization. If double-stack domestic container service or some other intermodal approach does not su-

cceed, however, the railroads will see their remaining merchandise traffic move to trucks, while they become haulers of domestic bulk traffic and international containers.

This report covers operational, organizational, and institutional issues that confront the intermodal industry. The last section of the report addresses two key points: the prospects for industry-wide conversion from piggyback trailers to double-stack containers, and the factors for successful operation of a double-stack domestic and international container system. In essence, this report attempts to answer the question, "How do we get there from here?"

B. ECONOMIC AND FINANCIAL ISSUES

1. Profitability

During the past three decades, there has been much criticism of the rail industry for not devoting more marketing attention and capital investment to its intermodal activities. One explanation is that, while intermodal tends to require major capital resources, it has not been a major net revenue contributor to the industry.

Commencing in 1980-1981 with deregulation of railroad intermodal traffic, and accelerating with the introduction of double-stack capabilities, intermodal traffic has accounted for 20 percent of rail carloadings and an increasing share of railroad revenues. For some railroads it now accounts for 40 percent of their total revenue. For others, it is still less than 10 percent. Even though gross revenues have grown, net revenues remain slim.

In practice, a railroad will continue to offer the service in the short run if it breaks even. This practice cannot continue indefinitely, however, if the railroads and their intermodal partners are to continue making capital investments in intermodal service. Railroads differ in their opinions of intermodal profitability, and in the standards they apply. Some railroads (such as CNW and BN) regard intermodal service as adequately profitable. But although the average profitability of double-stack trains is perceived to be better than that of TOFC trains, it is not yet satisfactory for most railroads.

Improving the profitability of double-stack services is not merely a case of raising rates or cutting costs. Profitability improvement is a vexing problem because most railroads have already cut many costs, yet their rates are constrained by truck rates. If there is a long-term solution, it probably lies in product differentiation and value-added services, which are explored at length in Section E.

Rates. The first constraint on profitability, as discussed in our cost criteria, is the constraint that truckload service imposes on double-stack rates. At present, customers consider intermodal service -- including double-stack service -- inferior to truckload service, and they expect a discount from truckload rates. The discount for TOFC service has typically been around 15 percent. The early emphasis on the cost economies of double-stack service and the persistent "backhaul mentality" have led customers to expect that domestic double-stack service will be priced below piggyback service, and thus even farther -- sometimes as much as 20 percent -- below truckload rates. Although some services are priced closer to truckload rates, heavy discounting is still the rule.

The comparison applies to the total intermodal transportation bill, of which the railroad linehaul rate is only one part. The third-party fee, the drayage expense, the chassis and container per diem, the terminal contractor lift charge, and the Trailer Train or leasing company equipment charges are typically deducted from a total price that is 15 percent below the truckload rate before railroad revenues can be set against operating and overhead costs.

Recent events suggest that the intermodal operators, railroads included, may be able to raise rates and narrow the gap from trucks. Burlington Northern is now attempting to price within 5-10 percent of truck rates for new, expedited double-stack service. Norfolk Southern's Triple Crown Roadrailer service is consistently priced between piggyback and truck rates. In the first quarter of 1990, many truckload carriers announced rate increases of 4-5 percent. Relying on the improving shipper image of double-stack service, Southern Pacific and Santa Fe announced intermodal rate increases averaging about 7 percent, thus narrowing the discount. To the extent that intermodal operators can convince shippers that domestic double-stack service is a superior product, they will be able to price it as something other than cheaper piggyback.

Costs. Reducing the costs of double-stack service is a difficult task. It is widely agreed that too much emphasis was placed on operating cost

savings in the initial period of double-stack expansion, leading to a cost-cutting mentality on the part of operators and shipper expectations that cost reductions would invariably result in lower rates. Many of the costs of double-stack service are outside expenses. While one railroad can negotiate for the lowest terminal contractor costs and the lowest equipment costs, so can all other railroads. Other costs, such as motive power, diesel fuel, and maintenance, are also common to all railroad operations and all railroads. The costs specific to intermodal and double-stack service, such as marketing and customer service, have already been cut and cut again. As discussed in the cost criteria and later in this report, some reductions are possible in labor costs. If cost reductions are to improve profitability, double-stack operators must compete more on service quality and less on price.

The difference between railroad and motor carrier overhead expense is a significant issue in their relative profitabilities. There are two opposing influences: the ability of railroads to spread overhead expense over a large traffic volume, and the ability of truckload carriers to compete without the overhead expenses inherent in the more complex intermodal transaction and in the development of a new intermodal market.

Railroads are essentially movers of volume freight. Railroad technology is based on the ease with which an entire trainload of goods can be moved by a small on-board crew. In order to compete successfully with other modes, railroads must spread their substantial common, fixed, and overhead expenses over a large volume of freight. Nowhere is this more true than in intermodal service, because intermodal service requires terminal services and labor, and more management attention than other major carload commodities such as coal or grain. Thus, there is a compelling need to increase intermodal traffic volume in order to decrease unit costs.

The intermodal transaction is inherently more complex than truckload service. A domestic double-stack movement may involve:

- one or more railroads;

- o two terminal contractors;
- o two draymen;
- o two chassis pools;
- o a container leasing company; and
- o a third party agent.

By comparison, a truckload movement typically involves only a single trucking company and perhaps a third-party agent or broker. There are fewer operating functions and fewer people to manage in truckload carriage. The complexity of intermodal movements also creates more opportunities for costly errors and inefficiencies: the overall profitability of intermodal business can be significantly harmed by poor equipment utilization, low labor productivity, lack of managerial attention, and high claims ratios, to name just a few.

Opportunities. It appears, then, that the best opportunities for improving intermodal profitability lie in rate and revenue increases rather than further cost cutting. The ability to raise rates and increase revenues depends on the ability of double-stack operators to distinguish domestic container service as a separate product more valuable than piggyback, and to increase the perceived value of the product by improving door-to-door service quality. Costs cannot be ignored, but shipper comments invariably suggest that customers are willing to pay more for service that better suits their needs.

2. Capital Needs

Capital investment will be required in double-stack services to expand the fleets of containers, chassis, and double-stack cars, and to expand and improve terminal facilities. That investment could be made by railroads, ocean carrier subsidiaries, third parties, or leasing companies.

Double-Stack Equipment. To date, the railroads themselves have not had to devote much capital to double-stack equipment. Trailer Train has provided the majority of the new cars. Manufacturers and leasing companies also are providing some new double-stack cars directly to

railroads and intermodal operators. Leasing companies and ocean carriers have provided many of the containers and chassis. Drayage operators provide their own tractors, and some chassis.

It appears that non-railroad parties will provide the majority of the capital to invest in domestic containerization. The equipment manufacturers and leasing companies see the capital needs as part of the normal growth of their business. In early 1989, for example, Trailer Train ordered 400 five-platform "all purpose" spine cars that would handle either containers or trailers, and 280 five-well double-stack cars, most of which will accommodate 48-foot domestic containers in all wells. During 1989, Trailer Train added 4,450 intermodal platforms, the vast majority capable of handling containers. Santa Fe was one of the few railroads purchasing intermodal cars in 1989: 100 double-stack cars, 380 Impack cars, and 100 spine cars. In Canada, CP Rail acquired 100 spine cars on a long-term lease in 1989.

Manufacturers see the expansion of the double-stack and container fleets as a welcome sign of more stable business. Gunderson, booked for some 2,355 freight cars and double-stack platforms in 1989, is increasing its work force. The need for domestic containers has revived the domestic container-building industry, after many years in which virtually all general-purpose containers were built overseas. Besides Monon, Freuhauf, Stoughton, and other existing manufacturers, AmeriContainer, Ltd. has revamped the former Pullman-Standard freightcar shops to produce containers.

For the next few years, domestic container traffic is expected to grow faster than overall intermodal traffic growth. In 1989, overall intermodal traffic grew by about 3 percent, but the container segment, which accounts for about 40 percent of the total, grew at about 9 percent. According to estimates made by TrailerTrain, about one fifth of the container traffic is domestic. But the domestic portion is growing faster, up to 30 percent annually over the last few years. The shrinkage of the piggyback trailer fleet, discussed later, suggests that rapid growth will

continue for the near future, although a 30 percent annual rate could not continue for very long.

Table III-1 lists the equipment requirements derived in Task II for the year 2000, and the net annual fleet additions (exclusive of retirements and replacements) required to achieve that fleet size in even increments over the next decade. The total annual cost is approximately $446 million, comparable to the equipment investments made by the railroads to handle the coal boom of the 1970s and early 1980s.

The equipment levels projected in Table III-1 are considered welcome growth for the supply industry, rather than unusual expansion necessitating new capital sources. Although the long term availability of capital for double-stack equipment seems assured, there are limits to the speed at which a conversion to containers could be made. Trailer Train does not believe, for example, that a 2-3 year conversion would be feasible. The ten-year horizon contemplated in Table III-1 is probably more realistic.

There are four other areas in which railroads will have to make capital investments for double-stack service: terminals, line clearances, management systems, and motive power. Although ports and ocean carrier subsidiaries have built a few rail terminals, the railroads themselves own the vast majority of intermodal terminals, and that ownership pattern is not likely to change. Ports and government agencies have helped finance some line clearance improvements, but the burden will fall mostly on the railroads. The railroads will be solely responsible for upgrading their management systems, especially computerized information and communications systems and other electronic technologies. The supply of motive power has, like line clearances, been the subject of innovation.

Overall, the industry as a whole appears capable of and willing to make the required capital investment <u>if</u> the potential volume is there <u>and</u> the required institutional support materializes.

Table III-1

Estimated Equipment Fleet Requirements

	Existing Fleet	Year 2000 Fleet	Net Annual Additions	Annual Cost*
Domestic Containers (1)	28,336	313,485	28,515	$228 M
Double-Stack Cars (2)	2,757	10,373	762	$137 M
Domestic Chassis (3)	32,002	156,743	12,474	$ 81 M
TOTAL ANNUAL COST				$446 M

*In 1989 Dollars

Sources:

(1) 45' - 53' Containers, Official Intermodal Equipment Register, September 10, 1989.

(2) Official Railway Equipment Register, July 20, 1989.

(3) Chassis Capable of carrying 45', 48' or 53' containers, Official Intermodal Equipment Register, September 10, 1989.

Terminals. The capital investment required for rail intermodal terminals does not appear to be a major obstacle to the expansion of the double-stack network. First, there exists substantial excess physical capacity. Only a few terminals -- notably SP's Los Angeles ICTF and CNW's Global One in Chicago -- have become crowded, and the railroads have committed to expanding those terminals (Global Two is expected to open in 1990). Most other terminals either have adequate capacity for near-term growth or are capable of increasing throughput by:

- o removing bottlenecks, such as inadequate gate/facilities
- o adding personnel or shifts; or
- o adding lift equipment.

Removal of bottlenecks does not require the same scale of capital investment as facility expansion. Personnel can be added on short notice, and lift equipment can be leased. The railroads have demonstrated their willingness to improve and expand facilities as needed, often before congestion becomes critical: several expansion plans have been announced beyond those discussed in the Task I report.

One major source of domestic container growth is the conversion of piggyback movements, which will require no additional terminal capacity (except possibly for chassis storage). In fact, double-stack operations will increase the throughput capacity of existing piggyback terminal trackage. Another source of growth is likely to be in secondary markets (as discussed in Task II), where the railroads have more reserve terminal capacity and where terminal expansion, if necessary, will be less expensive.

A small but significant number of rail intermodal facilities are being developed by non-railroad parties, with or without railroad participation. American President Companies (APC) has yards in South Kearny, New Jersey, Woodhaven, near Detroit; and Georgetown, Kentucky. Rail-Bridge, the domestic subsidiary of "K" Line, has facilities in New Jersey (E-Rail) and in La Colle, near Montreal. Intransit Container, Inc.

operates an intermodal yard in Worcester, Massachusetts, developed in cooperation with the Providence & Worcester. Perhaps the most ambitious development of this kind is a cooperative effort of United Parcel Service (UPS) and Santa Fe to build and operate an intermodal yard serving UPS's new sorting facility near Chicago. Although many of these additions are single-user facilities, they add significant capacity to the double-stack network and reduce the railroads' investment in terminals.

Clearances. Double-stack cars require greater clearances than any other type of railcar if loaded with two 9'6" high-cube containers up to 102" wide. Rail routes that have historically restricted piggyback or tri-level auto-rack traffic will likely be closed to double-stacks unless substantial sums are spent to increase clearances in tunnels and under bridges or overpasses. These problems are more serious for domestic traffic than for international traffic because of the greater existing and anticipated use of 9'6" high and 102" wide containers.

Individually, domestic high-cube containers are not a problem, as they can be mated with lower-cube international containers. A railroad could likely afford to handle a lot of high-cube containers in this controlled fashion, or even as one unit on a COFC or spine car, before it could justify the modification costs. When high-cube containers are stacked two high, however, they require roughly 20 feet of clearance over the rails, and a width of nearly 10 feet at that height. The tallest cars previously used, tri-level covered auto-racks, are almost as tall, but are tapered at the top to allow for rounded tunnels.

The clearance problem is more acute in the eastern states, but some major western corridors have clearance problems as well. In the West, there are clearance constraints on individual railroads, mostly in mountain tunnels. In the East, because of the population density and the older infrastructure, there are more constraints. In some corridors with clearance restrictions, one 9'6" container stacked with one 8'6" container can still meet the clearance requirements. The major railroads have reduced these constraints to an acceptable level on their high-volume corridors. Nevertheless, there are numerous places where

double-stacks cannot carry two high-cube containers, or where double-stacks cannot go at all.

The old saying that with sufficient money any obstacle can be removed holds true for clearance problems. For those corridors where a problem has been identified, programs have been developed to improve the clearances. The most notable is the joint venture of the Port of Oakland, American President Lines, and the Union Pacific System. These three organizations contributed funds to reduce the tunnel constraints in the Sierra Nevada. Santa Fe is currently (Fall, 1989) completing a $5 million effort to improve clearances on its route into the San Francisco Bay Area (although the Santa Fe route will still be somewhat restricted by clearances in the Tehachapi Mountains).

In the East, CSX has undertaken clearance improvements on its route between South Atlantic ports and the New Orleans gateway. Norfolk Southern has recently announced a $4.6 million clearance project in Western Virginia to permit the passage of double-stacked high-cube containers between Norfolk and the Midwest. In the West, Burlington Northern has undertaken less ambitious but equally effective programs to ease clearance restrictions between Seattle and the Midwest. Southern Pacific is operating double-stack trains over the Sierra Nevada by combining the best clearances on either side of its double-track line, and contemplating the means of a more permanent solution.

Since 1985, Conrail has spent $40-$50 million on clearance projects, and expects to spend a total of $90 million by the end of 1990 (Figure III-1). Conrail recently completed a project that has allowed double-stack service on the Chicago-Boston corridor. The cost of improving clearances from 19'4" to 19'6" was estimated at over $13 million. Clearances between Chicago and New Jersey terminals will be raised to 20'6". In conjunction with Conrail's clearance improvement program, the Providence & Worcester improved clearances under a Conrail bridge near Boston to allow unrestricted interchange of double-stack cars with Conrail.

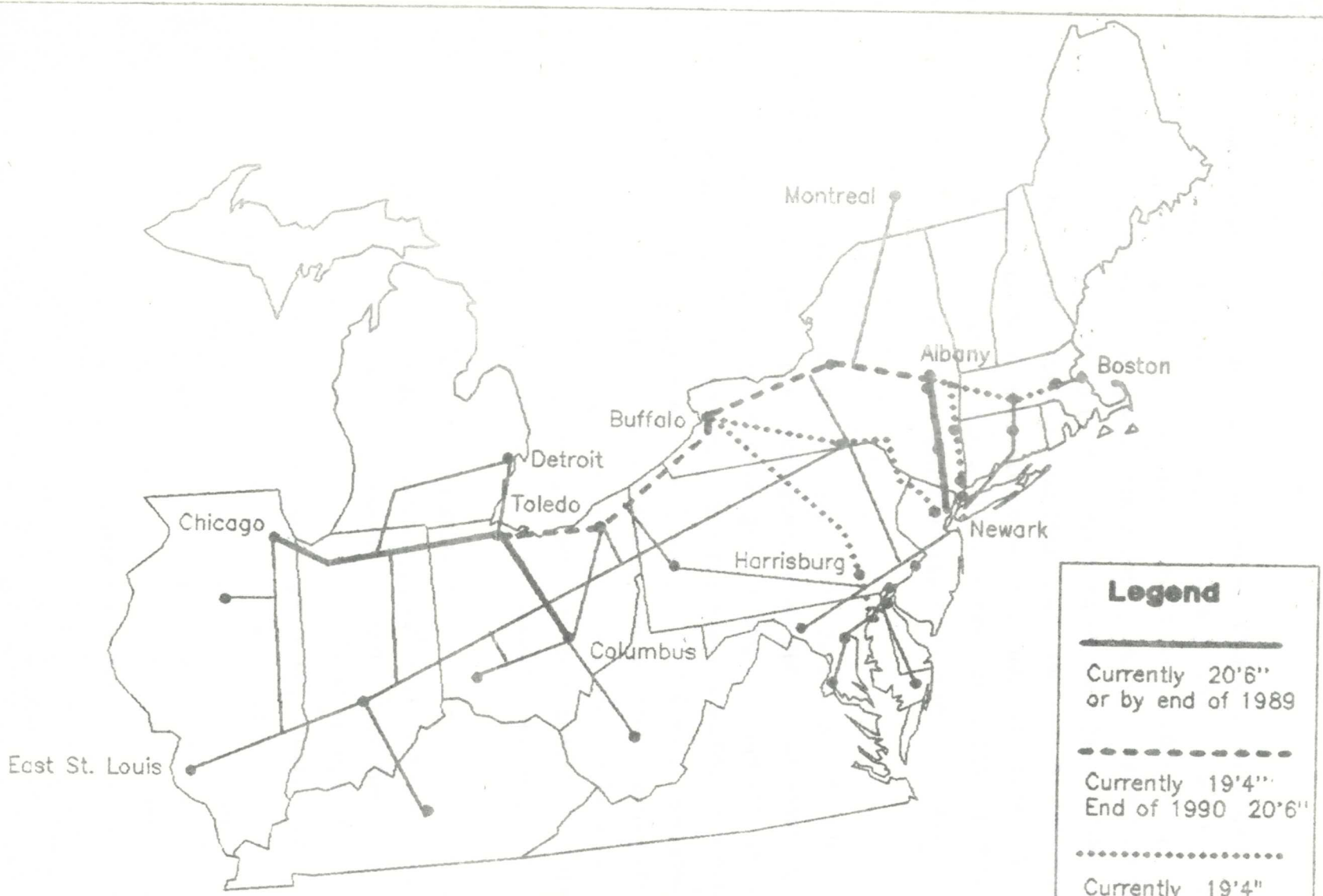


Figure III-1
Conrail Clearance Improvements Since 1985

The short-term net revenue from a railroad's double-stack train service may not cover the required clearance modifications. With significant commitments for long-term volume, the railroad can realistically fund these modifications. Strategic partnerships, discussed later, will encourage the required long-term commitments.

One near-term approach to clearance problems is the use of spine cars, which achieve some of the line-haul economies of double-stacks. CSL Intermodal has recently announced a container service using spine cars between Chicago and Baltimore, where there are long-standing clearance problems. The use of spine cars also allows the railroad to start a premium domestic container service at a lower minimum volume, and consider clearance improvements as traffic volumes rise.

Overall, it appears that restricted clearances may delay the development of a domestic double-stack network only slightly. Matching high-cubes with shorter containers and the use of spine cars will allow railroads to introduce domestic container service in restricted corridors without making an all-or-nothing decision on expensive tunnel and bridge modifications. It may be several years before two high-cube domestic containers can travel together over the whole network, and there may be some routes into metropolitan areas that will always have clearance restrictions. This process may lead to uneven network development in the near term, particularly in the Northeast. Nationwide, the routes with the greatest potential for domestic container movements are being be cleared first, with lower-volume routes to follow.

Management Systems. Most discussions of capital needs in transportation focus on equipment and facilities. As later sections explain at length, however, the biggest challenges in intermodal and double-stack services are operational reliability, fragmentation of responsibility, and customer service. These service quality improvements require improved management systems, calling for capital investment in computerized information systems and advanced communications technologies. (Electronic technologies related to operations and Electronic Data Interchange (EDI) are discussed more completely in Section C.)

Information and communications systems play a central role in coordinating the activities of decentralized organizations such as railroads. Properly implemented, they can also assist in coordinating activities between two or more firms in the intermodal industry, thus mitigating fragmentation. With careful design, such systems can greatly improve customer service and responsiveness by giving marketing, sales, and traffic personnel the information they need, or even making direct connections with the customers' computers.

The railroads were among the earliest users of computers to process routine paperwork, payrolls, etc. Computers were also introduced in railroad operations, notably in hump yard control. But, like many other industrial users, railroad use of computers became compartmentalized, with different departments using different systems and little real-time sharing of information. Because intermodal marketing and operations often have different information needs than other railroad departments, those needs are often poorly served by corporate information systems. For example, most railroad operations require a system capable of tracing cars, while the intermodal operating personnel and their customers need to trace trailers and containers.

The situation is improving. As railroads have created separate business units for intermodal traffic, those business units have begun either to seek accommodation for intermodal needs within corporate systems, or to develop their own management systems devoted to intermodal traffic.

The provision of improved information and communications systems may be less an issue of capital needs than one of institutional will. Railroads and other intermodal participants have repeatedly demonstrated their willingness to invest in systems and software that promise concrete productivity improvements or marketing advantages. The question is whether the intermodal participants are willing to make a comparable investment in systems to support a (so far) marginal net revenue producer, intermodal, and an intangible function, customer service.

Motive Power. It appears that there will be a definite need for new locomotives. Most current railroad equipment investment is in high-horsepower, four-axle locomotives suitable for high-speed intermodal service. The exceptions have been railroads, like Union Pacific and Conrail, that have ordered six-axle units to be used for intermodal service on mountainous routes as well as for other traffic. Even in this most traditional of railroad fields, however, railroads are exploring options to conserve capital. Burlington Northern (BN) has been a leader in the "power by the hour" motive power leasing and maintenance concept. Santa Fe has recently announced a similar program based on "power by the mile". Other railroads have not yet followed, although many of them have relied on short-term leased units to ease temporary motive power shortages.

Locomotives now being ordered are basically general purpose types, rather than units designed from the ground up for intermodal service. Some are still ballasted (that is, extra non-functional weight has been added) for maximum tractive effort on heavy carload trains. Aerodynamic improvements, which may only pay off at the higher sustained speeds of intermodal service, have not been made. It is possible that motive power operating costs, particularly fuel use, could be reduced if the manufacturers and railroads developed and deployed a specially built intermodal locomotive.

3. Labor Issues

The central labor issues in the railroad industry are crew consist and work rules, which affect all rail operations to some extent. Railroads and rail unions have cooperated in running "sprint" trains and other "new" rail business with reduced crews (two crewmen instead of three or four). In some respects, double-stack container business is "new". The labor issue cannot be dismissed, however, especially if domestic containerization results in a major conversion of existing intermodal traffic. The cost requirements for successful penetration of the truck market will determine whether reduced crews are necessary for a viable do-

mestic container service, or for an already viable service to expand its market share.

Train Crew Costs. Most carriers operating in the heavy intermodal corridors have three-person crew arrangements for at least part of their operations, with productivity pay. These include ATSF, SP, DRGW, Conrail, CSX, and NS. Norfolk Southern now operates most double-stack trains with two person crews. BN has three-person crew agreements on the former NP, SLSF, CB&Q, and SP&S lines, but has been unable to procure such an agreement on the former Great Northern lines, over which much of its Pacific Northwest intermodal traffic flows between St. Paul and Seattle. UP recently reported that it had three-person crews on 55 percent of its trains.

In a few instances, the Class I railroads have negotiated two-person crews (who generally receive productivity payments) for certain intermodal service. Examples are shown below:

Intermodal Services With 2-Person Crews

Santa Fe	Quality Service Network intermodal service. Texas and Coast Lines (no productivity pay)
Burlington Northern	Expeditor service operating in major corridors on the former Frisco, NP, SP&S, and CB&Q.
Norfolk Southern	"Triple Crown" RoadRailer service. Double-stack service between Buffalo and Chicago, and Chicago and Atlanta.
Grand Trunk Western	Intermodal trains of less than 35 cars.
Southern Pacific Lines	Certain selected intermodal trains operating in major corridors. DRGW "Railblazer" service between Denver and Salt Lake City
Conrail	Selected intermodal trains.

Illinois Central, Kansas City Southern, Grand Trunk Western, and other established regional carriers have fairly standard Class I three-person crew agreements, although GTW has a new agreement permitting two people on trains of up to 35 cars that do not set out or pick up enroute.

Chicago and North Western, through an Act of Congress in September 1988, finally obtained three-person crews on intermodal trains, and the right to seek, through arbitration, two-person crews on assignments that management deems appropriate. CNW probably will attempt to obtain two-person crews on double-stack trains. By contrast, most new regional railroads operate their trains with two-person crews. They change and pay crews based on an 8-hour to 10-hour day, as opposed to the Class I mileage concept, and their work rules are more flexible.

Labor costs have made it difficult for some railroads to compete in certain intermodal corridors. For example, in 1988 BN attempted to establish "Winona Bridge" intermodal services between the Twin Cities and the Pacific Northwest because its existing intermodal costs (with three-person and, in some cases, four-person crews) were deemed too high. The labor organizations fought such efforts in the courts, finally forcing BN to drop those plans in December 1988. CNW, with three-person and four-person crews between Chicago and the Twin Cities, could not easily compete with trucks or other railroads for intermodal traffic, and ended all intermodal operations in that corridor.

The cost criteria used in Task II were based on the use of reduced crews and longer crew districts. These conditions are still not the norm for intermodal service, but they are becoming more common. The three-person crew is now common on most major railroads, and recent labor negotiations seem to center on the terms of crew size reduction rather than on whether or not such reductions will be made. A recent agreement on the Santa Fe reduced the productivity pay for engineers on reduced crews, and a series of agreements on CSX has brought three-person crews to most of its predecessor lines.

Intermodal price competitiveness could be improved, and intermodal's underlying efficiency potential more closely approached, if double-stack trains could be routinely operated with two-person crews over larger distances without incurring heavy overtime, excess mileage, or

productivity expenses. Although the goal is still distant, the prospects for improvement are good.

Terminal and Drayage Labor Costs. Because of the historic railroad-owned truck line exclusion from the Railroad Retirement and Railway Labor Act provisions, railroads have operated their intermodal terminals with personnel from their truck subsidiaries or outside contractors with lower overall wage and benefit costs. Thus, the ability of the railroads to lower terminal labor costs further has been marginal. Similarly, most drayage is done by outside trucking companies, and it has been difficult for railroad-owned, unionized truck lines to compete.

The railroads do have an opportunity to reduce terminal and drayage labor costs by increasing terminal efficiency and reducing the labor time per unit, regardless of the labor pay rate. The critical problem is gate inspections and documentation, which use up the time of both terminal personnel and draymen. Both the costs and the delays involved in gate operations are significant factors in the ability of railroads to compete with truckers. Within the context of total door-to-door cost, a $10 per container savings in drayage or terminal labor is equivalent to a $2000 line-haul savings on a 20-car double-stack train.

Draymen set rates according to the time they expect to spend in a given movement, at about $35 per hour. The hourly expense of drayage is much the same whether the hour is spent driving at 55 miles per hour to reach a more distant customer, or spent waiting to complete a bill of lading and an Equipment Interchange Report (EIR), or spent just waiting in line.

In the leading facilities, railroads and their contract operators have made substantial improvements, particularly in streamlining gate procedures. The use of EDI has enabled gate clerks to simply verify equipment serial numbers and the integrity of the door seal rather than collecting information from the driver. The use of neutral chassis pools has reduced the time spent matching containers and chassis. Improved computer systems and management practices have made for a more orderly and efficient transfer of containers from incoming trucks to outbound

railcars, with less waiting and more opportunities for a two-way loaded dray. These techniques are spreading to more of the high-volume intermodal hubs. The use of Automatic Equipment Identification (AEI), now being tested by railroads and ocean carriers, promises further opportunities for decreasing unit terminal and drayage labor costs.

C. OPERATIONAL ISSUES

1. Operating Scenarios

Operating Methods. There are three possible operating methods for implementing domestic rail container service:

a) As dedicated double-stack train service in high-volume corridors;

b) As part of existing intermodal train service, using double-stack cars; or

c) As part of existing intermodal train service using conventional intermodal cars or spine cars (i.e., as COFC service).

In recent years, double-stack operations have been increasingly integrated with other rail intermodal operations to the point that a "double-stack train", except for a few trains dedicated to ocean carriers, has become an abstraction. Where sufficient volume is not available to run full double-stack trains, blocks of double-stack cars are added to existing intermodal trains. It is technically possible to provide double-stack service by adding double-stack cars to non-intermodal freight trains, but that is likely to be a rare occurrence: the switching required to make up and break up an ordinary freight train would increase cost, transit time, and freight damage, thereby negating many of the advantages of double-stacks. Burlington Northern is now (Fall, 1989) testing a special hitch to join RoadRailers to double-stack cars, permitting the operation of combined trains, but the extent to which combined double-stack/RoadRailer trains will actually operate is unknown.

International Versus Domestic Trains. There has been considerable discussion in the intermodal field regarding international versus domestic double-stack trains. In the future, however, there will be few operational distinctions between international and domestic trains, and few trains will be purely one or the other.

The only trains that might remain purely international are some eastbound trains from the West Coast, and some westbound trains from the East Coast, that are scheduled to receive inbound containers from specific vessel calls. Other trains from the coasts, even those run for the domestic subsidiaries of ocean carriers, will carry a mix of international and domestic containers that fluctuates according to the daily traffic situation. These will be dedicated double-stack trains if volume is sufficient, or mixed double-stack/TOFC/COFC trains if not.

The service criteria established in Task II contemplate six-day-per-week service with trains of at least 15 double-stack cars. A review of the likely pattern of international and domestic traffic indicates that the available mixture will lead railroads and their major customers to run mixed international and domestic trains most of the time. Both domestic and international movements follow what has been termed a "transcontinental calendar". Wherever possible, departures are scheduled to provide weekday arrivals at destination.

Vessel calls in Southern California, for example, are now clustered between Friday and Monday in order to position intermodal containers for mid-week delivery in Midwest markets. Eastbound international movements will therefore typically peak between Friday afternoon and Monday morning. Domestic shippers, however, avoid the weekends: eastbound domestic shipments generally begin Monday morning and end Friday afternoon. The top half of Figure III-2 illustrates a sample weekly eastbound traffic pattern for Southern California.

Westbound traffic patterns in Southern California are different. Although westbound international containers move all during the week, containers begin arriving in greater numbers at the rail terminal late Wednesday in preparation for Friday vessel calls, and to free up double-stack cars for priority eastbound imports. Westbound exports and empty container movements taper off Sunday and Monday, as vessel calls decline. Domestic arrivals increase on Sunday for local delivery on Monday, and taper off later in the week: Friday afternoon and evening arrivals would not be delivered until Monday, and neither the railroads

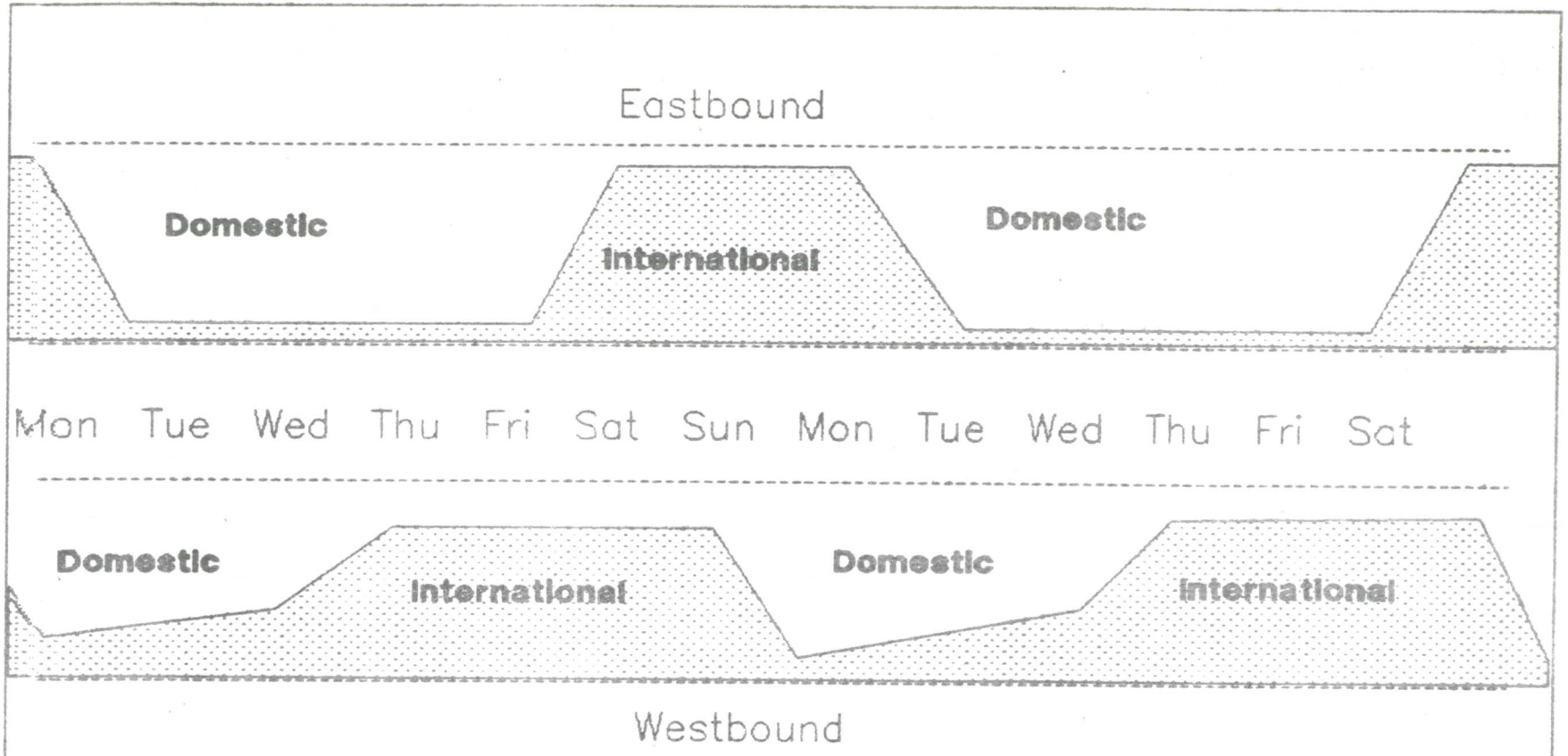


Figure III-2

Sample Southern California

Double-Stack Traffic Patterns

nor the shippers want to store loaded containers. The westbound pattern is shown in the bottom half of Figure III-2.

A comparison of the top and bottom of Figure III-2 suggests that it would be inefficient, or even futile, to attempt to segregate international and domestic operations completely in Southern California. To be sure, there are multiple trains on most days, but those trains are divided between three railroads. A 20-car double-stack train incurs $1,400 per day in per-diem or ownership costs. Achieving high utilization dictates that arriving westbound cars be unloaded and reloaded with eastbound containers as quickly as possible.

Figure III-2 indicates that some purely international round trips might be made routinely on Friday, Saturday, or Sunday. Some domestic round trips might be made routinely on Monday, Tuesday, and Wednesday. The rest of the trains (and there are, as of late 1989, more than 80 trains per week from Southern California) will be mixed. Many existing double-stack departures from Southern California are, in fact, blocks of double-stack cars on otherwise conventional intermodal trains.

Each major port and inland city will have a distinct traffic pattern based on its place in vessel rotations, the transit times between ports and major markets, and the commodities shipped and received. Produce arrivals in the New York metropolitan area, for example, are timed to coincide with grocery chain advertising and promotions, which normally appear on Wednesday. Domestic produce from Florida, Texas, California, and Washington must be shipped according to the expected transit times from the growing areas.

International and domestic containers generally will travel on the same trains. Domestic and international traffic volumes will probably not combine neatly to produce an even double-stack volume over days, weeks, and months. The weekend lulls in domestic movements may be particularly troublesome. For example, an empty eastbound train may be required on

Saturday to receive imports landed Friday night and Saturday morning. But will domestic shippers provide westbound backhauls for that train, knowing that they will arrive Friday night and sit in the yard over the weekend? It appears likely that train operations will be varied as needed to minimize transit times and maximize equipment utilization.

2. Infrastructure Issues

Aside from the need to improve or expand rail intermodal terminals and increase clearances, there are two outstanding infrastructure issues.

Train Length. The first issue is the adequacy of rail mainline sidings and yard trackage for the largest potential double-stack trains. Most early double-stack cars were about 265 feet long and were operated in trains of up to 20 cars, for a total length of 5,300 feet (excluding locomotives). Some railroads, notably the Union Pacific in the Feather River Canyon, had to lengthen sidings at considerable expense to accommodate such trains. Double-stack cars now being built are about 305 feet long, and they are being operated in trains of up to 28 cars, for a total length of 8,540 feet (excluding locomotives), which is more than half a mile longer than early double-stack trains. Trains of such length will cause operating problems on most single-track railroads. As is the case with clearance constraints, there may be some routes that will not be able to handle the largest trains until volume increases sufficiently to justify the cost of lengthening sidings. Multiple-track mainlines will be an advantage.

Highway and Street Access. The second and more difficult infrastructure problem is highway and street access to rail intermodal yards and ports. Drayage is a major cost issue in the ability of double-stacks to compete with trucks, and a major source of delay and unreliability. Where drayage is impeded by poor access and traffic congestion, costs rise and reliability drops. The problem is most serious in major metropolitan areas (which are often port cities as well) and at inland cities where "rubber-tired" interchange takes place (particularly Chicago, but also Memphis and New Orleans).

The intermodal access problem in port cities is complicated by the container drayage peaks associated with the arrival of large container ships, some of which may discharge and load upwards of 1,000 containers in a single call. Intermodal containers have to compete with local customers for drayage service, and compete with other port and urban traffic for highway access. At peak periods, the intermodal volume can strain the system. During the worst traffic conditions in Southern California, ocean carriers pay as much as $120 for the 20-25 mile dray to UP and Santa Fe facilities.

The extent of the urban congestion problems traceable to rubber-tired interchange is largely unknown, although those in the intermodal field regard it as serious in Chicago and potentially serious elsewhere. Most railroad-to-railroad interchange on through bills of lading are "steel-wheeled" interchanges: the containers or trailers remain on the railcars, and the cars themselves are interchanged. Rubber-tired interchanges, where the containers or trailers are unloaded, drayed, and reloaded, result in large part from third-party movements that are billed separately over two rail segments.

ALK Associates estimated the number of "rubber-tired" Chicago interchanges in 1987 by comparing records of terminated trailers or containers with records of originated trailers or containers in the same fifteen-day period. Routes were checked to ensure that the unit was not reloaded and returning, but was indeed extending the movement after interchange. By this means, ALK estimated that slightly more than 1000 trailers or containers per day, six days per week, were being interchanged over the streets of Chicago.

Railroads will probably be able to fund necessary improvements to their mainline trackage, even though siding length restrictions may continue for some time on difficult or low-volume corridors. The highway and urban access problem, however, is beyond the authority of the railroads, even if they had the required funds. Some observers feel that government participation may be required. Suggestions range from exclusive drayage roads on abandoned rail rights-of-way, to improved highway exits and en-

trances for intermodal yards. The upcoming renewal of the Highway Trust Fund is seen as a forum for discussion of urban infrastructure problems, as well as a potential source of funds.

The drayage traffic generated by intermodal service is essentially an urban problem, and may best be approach through the same urban planning techniques used to address other sources of congestion. Specific examples of intermodal congestion sites include the Long Beach Freeway, the Atlanta Beltway, the Huey P. Long Bridge in New Orleans, and the Eisenhower Expressway in Chicago. On these highways intermodal containers and trailers converge with other trucks and private autos to crowd the raods, pollute the air, and hinder the door-to-door reliability so critical for intermodal success.

Among the specific suggestions is the establishment of an "Urban Intermodal Fund" within the contemplated 1991 Highway Act. Among the purposes of such a fund would be the consolidation and rationalization of intermodal facilities, and the development of means to separate urban intermodal truck traffic from city street and commuter traffic. At $35 per hour for drayage, the benefits to the intermodal industry could be substantial. The benefits to urban areas in terms of air quality improvement, reduced noise and congestion, and fewer accidents could likewise be significant.

3. Payload Penalties and Overweight Containers

While an empty container may have a listed net capacity greater than a piggyback trailer, when the weights of the empty container and the chassis are combined it will usually produce a lower net capacity. This raises two issues: the "payload penalty" associated with the use of containers rather than trailers, and the potential aggravation of overweight problems.

As Table III-2 demonstrates, a 48-foot long 102-inch wide domestic container on its chassis can weigh 16,700 pounds, 21 percent more than a comparable piggyback trailer and 40-45 percent more than a highway

Table III-2

Domestic Container Payload Penalty

	48' x 102" Container	48' x 102" TOFC Trailer	48' x 102" Highway Trailer
Highway Weight Limit	80,000 lbs.	80,000 lbs.	80,000 lbs.
Tare Weight	8,100	13,800	12,000
Chassis Weight	8,600	--	--
Tractor Weight	15,000	15,000	15,000
Payload Limit	48,300	51,200	53,000
Container/TOFC Payload Penalty	2,900	--	--
Container/Highway Payload Penalty	4,700	--	--

Source: Official Intermodal Equipment Register, September 20, 1989
Tractor weight is representative.

trailer. (Not shown in Table III-2 is a current disadvantage due to heavier framing in containers: a smaller door opening.) Domestic containers are therefore somewhat less attractive than trailers to those shippers that can use the full payload capacity of a trailer. Both intermodal technologies impose a penalty compared to highway trailers.

The payload penalty will affect shippers of heavier goods that reach the weight capacity before filling the space ("weighing out" before "cubing out"). If priced on a containerload or trailerload basis, containers will be able to move about 6 percent less heavy freight, raising the equivalent unit rate by 6 percent. With existing technology this payload penalty must be dealt with in pricing and marketing. Equipment manufacturers are working to reduce the penalty, and have had considerable success in lowering the tare weights of containers and chassis, and in improving other aspects such as the height and width of door openings.

The payload penalty may aggravate the overweight problem. There were problems with overweight piggyback trailers and truck trailers long before domestic containers were introduced, and there is little reason that overweight containers should be more prevalent. If container customers overload the container to get the same payload as a trailer, or for any other reason, however, there may be a more widespread problem with overweight domestic containers.

4. Equipment Balance and Logistics.

Equipment Balance. One operating issue created by specialized equipment such as the double-stack car is equipment balance. Heavy peak demand often requires repositioning of containers and cars. It can also create the need for chassis repositioning. The cost criteria used in Task II assumed 100 percent utilization of containers and double-stack cars, a standard that is now approached by only the most efficient intermodal operators. Double-stack utilization is much higher than utilization of conventional piggyback cars: Trailer Train double-stack cars average 360 miles per day, versus 225 miles per day for TOFC cars. If extensive

empty equipment repositioning is required, equipment utilization and the economies of double-stack service will be significantly reduced.

Intermodal has been the mode of imbalance; many industries have institutionalized low backhaul rates and used them to penetrate markets that would not be accessible at full cost. As carriers come closer to balancing international and domestic flows, aggressive backhaul pricing is disappearing, and shippers and consignees who used low backhaul rates will have to adjust.

Chassis Logistics. Chassis logistics has been an operating problem in the past, and may persist -- even worsen -- if it is not solved through contracting or other institutional means. For efficient operation, a rail terminal must always have chassis available for incoming containers (to avoid grounding and rehandling), but at the same time valuable terminal space cannot be occupied by empty chassis. Unless a neutral chassis pool is used, containers must also be matched with the correct firm's chassis. This is a significant problem even when one train contains containers from several different ocean carriers; it will become a much larger problem if the railroad has to match chassis for several shippers or third parties as well.

There has been a resurgence of ocean carrier interest in triangular double-stack services; e.g., Los Angeles to Chicago, Chicago to Oakland, and then repositioning to Los Angeles. Triangular services require chassis and containers in three locations, not just two. Multiple intermodal terminals can increase the administrative, inventory control, and maintenance management costs as well as the capital costs necessary to ensure adequate equipment availability.

Neutral chassis pools appear to be a workable solution to chassis logistics problems. Although they are not yet universally accepted, and pool chassis utilization could still be improved, there are some 50 railroad and port chassis pools with over 15,000 chassis in service. Strick Intermodal has the most pools in operation, with nearly 20 at rail terminals, inland cities, and ports. The largest single pool, and the

oldest railroad pool, is the BN pool in Cicero (Chicago) operated by Transamerica ICS. This pool, started in 1985, now has over 1,500 chassis of all types, available for use by any BN customer. Resistance to using chassis pools comes largely from the few major ocean carriers whose traffic volume can support their own chassis fleets, and who can therefore manage chassis logistics internally.

5. Double-Stack Car Supply

Since Trailer Train began acquiring its fleet of double-stack cars in 1985, many of those cars have been assigned to specific railroads for periods of three to five years. Those railroads guarantee all per diem and mileage charges for the assignment period, and they manage those cars essentially as though they were their own (including the use of the UMLER and TRAIN II systems for monitoring their activity). Railroads could, in turn, reserve those cars for the use of specific customers, principally the major steamship lines and their intermodal subsidiaries. Under this system, both the railroads and their customers obtain the cars they needed without direct capital investment and without long-term obligation. This car supply mechanism reduced the risk of starting new double-stack services and encouraged expansion of the double-stack network.

The recent ICC decision extending Trailer Train's anti-trust immunity prohibited Trailer Train from assigning cars in this manner. In the future, Trailer Train's double-stack cars will be in a free-running pool. If railroads and ocean carriers deem it necessary to have a supply of double-stack cars under their own control, they will have to acquire cars from manufacturers (via purchase or long-term lease), use short-term cars from leasing companies, or devise an alternative to the previous assignment system.

Since the early days of double-stack trains, some railroads have acquired small numbers of cars to accommodate customers. Maersk, in order to have its own colors and identity, uses a series of cars that were acquired by the Union Pacific System and which carry the reporting marks of the

Chicago Heights Terminal Transfer Railroad, a Missouri Pacific subsidiary. Sea-Land acquired a series of cars which carry New York, Susquehanna & Western reporting marks, but has not acquired other cars since its merger with CSX. Double-stack cars are expensive, however, and railroads and ocean carriers are likely to conserve their capital wherever possible. One possible outcome is that railroads could follow the same strategy with double-stack cars that they have with other specialized types: acquire enough cars to protect the core traffic of long-term, high-volume customers, and use leased, pool, or off-line cars for the remaining traffic.

Among the car leasing companies, only Greenbrier Intermodal (the leasing arm of car manufacturer Gunderson, Inc.) currently offers double-stack cars. This situation could change rapidly, however, as there are three manufacturers eager to sell cars, and a number of leasing companies with access to capital. Some small double-stack operators, such as Interdom, regularly use leasing company cars.

Trailer Train is likely to provide the majority of the double-stack cars, just as it provides the majority of the intermodal flat cars. The railroads themselves will have to take more responsibility for the management and control of the Trailer Train cars they are using. Cars in a free-running pool can stay on the same railroad or in the same service indefinitely, as long as they are in active use. Once pool cars are idled for some specified period, however, they can be redistributed for use by other carriers. It will thus be incumbent on the railroads to utilize pool cars fully, rather than treating them as a reserve.

To achieve this end, specific cars may be "dedicated" to specific customers or services. This mechanism is widely used to create pools of cars for major shippers of commodities as diverse as automobiles and beer. The most extensive pools are probably those for auto-rack cars, which generally consist of Trailer Train flatcars with railroad-owned superstructures. Separate pools of such cars are set up for the major automakers, with numerous railroads contributing cars to the pools.

By using this well-established control mechanism, railroads may be able to establish a stable supply of cars for the principle double-stack customers and corridors. Creation and management of a dedicated car system for single-line movements poses no special difficulties; it is essentially the same as any internal car management task. Interline service, however, can create problems. Under pressure for timely departures and while coping with traffic surges, one interline partner may be tempted to divert dedicated cars to its own single-line services. When car supply is short, those pressures can be intense -- witness an isolated, but verified instance of containers moving in coal hoppers in 1988.

The maintenance of dedicated double-stack car pools for services involving multiple railroads may require bilateral agreements among the partners. Such agreements could also form the basis for purchasing or leasing decisions by the railroads involved. The most critical issues in such bilateral agreements will likely be the provisions for car tracing and information flow. Under the assignment system, individual railroads trace their assigned cars through UMLER and TRAIN II. For the near future, they will have to rely on Trailer Train to trace dedicated Trailer Train cars. Management of dedicated car pools will require some railroads to refine their own systems and communications links.

6. Domestic Container Supply

The supply of containers for domestic traffic does not appear to be any barrier to the expansion of domestic double-stack service. As the preceding discussion of capital needs indicated, the container-building industry is producing a growing number of domestic containers.

In the near future, most domestic traffic will continue to travel in international containers drawn from a worldwide pool of over 5 million units. Despite slightly faster growth in exports, there will continue to be an imbalance of import containers available at inland points for domestic backhauls through the next decade. As domestic fronthauls grow, double-stack operators will either have to devote more international containers to domestic use or supply more domestic containers.

Ownership of the domestic container fleet will be mixed, just as ownership of the piggyback trailer fleet and the international container fleet is mixed. The major sources of containers for domestic service will be intermodal operators such as API and CSL, and major leasing ownerships such as ITEL. Railroads, notably BN and ATSF, have acquired some domestic containers, and will continue to do so. The decision on whether to acquire containers through purchase or long-term lease will depend, like any such decision, on financial and tax considerations rather than on operating criteria. If operators do not acquire containers, they will have the options of short-term leases or using pool containers on a per-diem basis.

Shippers are unlikely to acquire general purpose containers in any significant number. Any shipper acquisitions would probably be specialized equipment.

7. Domestic Refrigerated Containers.

There is one major domestic market segment that has not been penetrated at all by containerization: refrigerated or insulated commodities. Refrigerated containers are well established in international trades, but they seldom move far inland, and, until recently, rarely by rail. Many international refrigerated movements were transloaded to trucks or refrigerated box cars instead. Until the railroads can provide or support a refrigerated double-stack container system, that market will remain in the hands of refrigerated trucks and piggyback trailers.

The market now being served by refrigerated truck and piggyback is larger than just the movements of refrigerated produce, frozen foods, meat products, etc. Numerous products, such as beer, pharmaceuticals, and photographic supplies, require protection from temperature extremes, even if they do not require mechanical refrigeration. Moreover, refrigerated trucks handle substantial quantities of dry backhaul freight. TRAM estimates that roughly half of all westbound refrigerated trucks carry non-refrigerated, non-temperature-sensitive dry freight. Because the dry freight is carried at low backhaul rates, it would be difficult for do-

mestic container services to attract that freight as long as refrigerated trailers provide the fronthaul. The railroads therefore have a double incentive to capture refrigerated movements.

There are a number of obstacles to be overcome in establishing a domestic refrigerated container service, and many of them correspond closely to the reasons why international refrigerated containers do not usually move inland by rail.

The first and most obvious obstacle is the need for electrical power aboard trains. So-called "integral" refrigerated containers incorporate refrigeration units, but they still require an external power source. There are four basic approaches to supplying power, all of which have been tested with some degree of success:

- large power supplies capable of supporting nine or more containers, which would be carried in one well of a stack car;
- smaller power supplies capable of supporting five to ten containers, which would be temporarily or permanently mounted on the end platform of a stack car;
- individual "nose-mount" power supplies for each container; and
- totally self-contained refrigerated containers.

SP, in conjunction with Sea-Containers, is testing the first system. APC has a small number of stack cars with permanently mounted power supplies. Sea-Land is testing a small number of end platform units. Nose-mount ("clip-on") power supplies are used on some international containers for inland movement, and manufacturers have designed and tested models intended for double-stack use. Besides the expense of providing power supplies, adding another piece of equipment to the intermodal fleet raises numerous questions of logistics, maintenance, and management.

The second obstacle is the need for electrical power from chassis-mounted or nose-mounted "gensets" once refrigerated containers are taken off the train. Gensets and compatible chassis would have to be available at inland terminals. Gensets are probably not a problem in port cities,

where they are available for international containers, but they may be expensive to stock at inland points.

Third, refrigerated containers require monitoring, and perhaps servicing, in transit to ensure consistent performance and product quality. Truckers can and do monitor the temperature and condition of a refrigerated load, and take corrective action if needed. It is far more difficult to monitor loads on a double-stack train, and, if correction is required, more costly.

Fourth, fast and consistent transit time is critical for refrigerated commodities. To date, neither boxcar service nor refrigerated piggyback service has provided the required consistency, even if the scheduled transit times are acceptable. Double-stack trains have a better record of on-time performance than other railroad operations, particularly in the critical perceptions of customers.

There is considerable interest in domestic refrigerated container service on the part of railroads, equipment suppliers, and some major shippers. There will likely be further test movements and pilot projects in the next few years. While success is by no means certain, the improved efficiency and line-haul performance of double-stack trains offer the best chance yet for railroads and other intermodal participants to enter the refrigerated market.

8. Other Container Types.

Tank Containers. The possibility of moving bulk liquids in domestic tank containers has attracted considerable interest, especially from tank container manufacturers. Another source of interest is the potential for change in hazardous materials regulations. Although tank containers are used widely in international trade, they are still rare in the U.S.

Short-term expansion of domestic movements may come through domestic use of international tank containers. At least three U.S. trucking firms

(Chemical Leaman, Matlack, and DSI Transports) are heavily involved in tank container movements.

The most prominent domestic tank container operation at present is Union Pacific's "BulkTainer" service, established in the early 1980's and purchased by UP in 1987. The BulkTainer fleet, although still small, was doubled through purchases in 1989. The BulkTainer system includes special high-capacity chassis operated by contract truckers at selected terminals.

The use of domestic tank containers is one field where legislative and regulatory actions will have a major impact. The specifications, construction, and use of tank containers is the subject of proposed legislation and DOT regulations. The movement of tank containers on double-stack cars is currently prohibited by DOT regulations. Although there may be a substantial market for domestic double-stack tank container service, in the near term the expansion of such service may be determined more by institutional and regulatory factors than by market demand or technology.

Auto Containers. Imported auto parts have been a mainstay of international double-stack traffic, particularly since the opening of U.S. plants for Nissan, Mazada, Honda, et al. Domestic auto parts have been a major source of RoadRailer traffic. Auto parts are beginning to move domestically in substantial quantities on double-stack trains, and such traffic is the basis for API's Detroit-Texas service.

Set-up autos, however, have yet to move in quantity in either international or domestic double-stack service. The existing transportation system for set-up autos uses multi-level auto-rack cars for long distances between the factory (or port) and distribution center, and motor carriers between distribution center and dealer. Because auto movements are lucrative and controlled by a few large shippers, railroads have invested heavily in automobile cars and facilities, and offer premium service: auto-rack cars are often added to intermodal trains, and vice versa.

There have been numerous innovations and attempts to move autos in trailers or containers. Among the current candidates are Greenbrier's Auto-Stack (a rack system for containers) and the IVT (Intermodal Vehicle Transport, a trailer) developed in cooperation with Southern Pacific. Matson Navigation Company has been using special 12-foot high containers to carry autos to and from Hawaii, but those containers do move inland by truck and are used strictly from port to port.

Opinions differ on the potential of domestic containers for set-up autos. The existing system is a formidable competitor, and railroads are heavily committed to it. A major opportunity could come about, however, if auto producers or importers shift to a factory-to-dealer distribution system in smaller shipments (as opposed to a factory-to-distributor system using tri-level auto racks which hold up to 18 autos each), for which containers would be well suited.

Municipal Waste Containers. Railroads have begun hauling significant volumes of municipal solid wastes (trash), mostly from Eastern cities. Thus far, service has been provided in boxcars, but some observers see a significant potential market for containerized shipments. The recent, well-publicized incidents of truckers hauling municipal wastes as back-hauls to food products movements has given the railroads extra impetus to step forward with an intermodal alternative.

Market research and existing proposals have focused on the use of specialized containers, either packed at transfer stations or used in municipal pickups, to move municipal wastes to dumpsites that are increasingly distant from major cities. Indeed, it is the perceived need for more distant disposal sites that makes rail intermodal service a potential candidate. ITEL has acquired a municipal waste disposal company and is using containers on chassis to haul trash, with possible later conversion to rail line-haul.

Flat-rack Containers. Like the tank container, the flat-rack container (a flat-bed platform, often with collapsible end bulkheads) is relatively common in international movements but rare in domestic. The flat-rack

container holds considerable promise for some domestic commodities, especially lumber and other building materials. Collapsible flat-rack containers can be stacked compactly, several in one well, thereby reducing the need for two-way loaded movement (which is sometimes difficult to achieve for lumber and building materials due to the location of producers).

BN has introduced a small number of 24-foot collapsible flat-rack containers for domestic use. Depending on BN's experience, such containers (and flat-rack containers in other lengths) may become a regular feature of domestic service.

9. Electronic Technologies

Three emerging electronic technologies promise to aid the development of an effective domestic double-stack network. All three electronic technologies hold the potential for improving the reliability and precision of intermodal transportation, reducing operating and overhead costs, and improving customer service and responsiveness. All three, however, are being delayed by the lack of agreement on standards.

The first is Automatic Equipment Identification (AEI, also known as Automatic Vehicle Identification, or AVI). Current AEI technology consists of radio transponder tags mounted on containers, chassis, tractors, railcars, locomotives, and any other equipment a carrier wishes to identify. When "queried" by a stationary reader, these tags respond with up to 19 characters of digital information, at least part of which is the ownership and identifying numbers of the equipment. A railroad can thus determine which units pass a reader through a yard, through a terminal gate, or over a section of track, and when. An ocean carrier can determine which units are loaded or discharged from a vessel, or are processed through the terminal gates, and when. All parties in the intermodal movement should be able to keep more accurate, real-time records of equipment movements and inventory.

Carriers, both ocean and rail, are almost universally in favor of some form of AEI. The U.S. Maritime Administration has supported such technology within the maritime industry by its sponsorship of the Cargo Handling Cooperative Program, begun in 1983. No standards for data and transmission specifications have yet been adopted, however, and most carriers are reluctant to invest in AEI until these are universal standards. Railroads are particularly leery of new AEI technologies after abandonment of the optical Automatic Car Identification system in the 1970's. Periodic attempts to use bar codes similar to the Uniform Product Code labels have also been disappointing.

One AEI system, manufactured by Amtech, is being used or tested by APC, Sea-land, BN, and NS. The Amtech system is a candidate for standardization, and the results from initial usage have been encouraging. APC and Sea-Land are using Amtech equipment on containers and chassis at several locations, and have made major commitments to the system in advance of any standardization. BN is using the same system on 1200 ore hoppers in the Mesabi Range, and on a chassis pool in St. Paul. NS is using the system on 100 coal hoppers at export ports, and is expanding its use to locomotives.

Near-term adoption of AEI seems almost certain, although the specifications of standards are still in dispute. Some major rail carriers have included AEI expenditures in their capital budgets in anticipation of standardization within the next few years.

The second promising electronic technology is the Advanced Train Control System (ATCS) now under development as a replacement for traditional railroad signalling, dispatching, and train communications systems. ATCS is expected to combine computer-aided dispatching, improved on-board information systems, and advanced train location technology (such as the ARES satellite system). The use of ATCS is expected to yield increased economy and safety in train operations. More significantly, from the double-stack service perspective, ATCS is expected to yield increased precision, reliability, and real-time confirmation of train status and location. Combined with AEI, ATCS should improve the predictability of

train and container arrivals at intermodal hubs, currently a sore point with customers and draymen. Currently, customers have poor expectations of precise arrivals, and therefore build expected delays into their scheduling. This practice often results in on-time containers or trailers being left for a day or more in the terminal.

The third electronic technology, and the one that has received the most attention throughout the transportation industry, is Electronic Data Interchange (EDI). EDI consists basically of computer-to-computer transmission of bills of lading, invoices, equipment status and tracking information, and other items routinely managed in the past by the exchange of paper documents. Different segments of the industry have taken different approaches to EDI.

The railroads have pursued EDI as a means of improving customer service and reducing paperwork costs. Southern Pacific has been an industry leader with its "Liberator" communications software provided free to customers, and was the first railroad to process more than 50 percent of its shipments via EDI. Other railroads have followed with comparable EDI systems. Railroad EDI systems generally conform to the "TDCC" format, but they are not fully compatible with each other. Ocean carriers have also embraced EDI for the same reasons, but tend to conform instead to the international "EDIFACT" standards. Domestic third parties and motor carriers are also using EDI, but have yet a third format, the domestic "X-12" standard. Some progress has been made in getting TDCC systems to conform to the X-12 format, but industry-wide compatibility is still some years away.

10. The Operational Challenge

Current Operating Performance. There is a significant gap between what is technologically possible in intermodal operations and what is now being reliably achieved. Double-stack operations have improved on conventional piggyback operations in many areas, primarily in transit time, schedule reliability, and damage prevention. On that basis, double-stacks have been more successful than piggyback in attracting and re-

taining traffic. Intermodal operations of all kinds, however, generally fall short of the operational standard set by trucks. Every marketing survey taken in this field has determined that service characteristics, not cost, are the primary basis of modal choice. Unless the railroads and their intermodal partners achieve and maintain a substantially higher standard of performance, domestic double-stack service will achieve only a tenuous market share, subject to constant erosion from improved truck economics.

One instructive example of what is possible is the Florida East Coast Railroad, which offers a highly successful TOFC/COFC service between Jacksonville and Miami. The route is roughly 350 miles long, much shorter than estimates of the minimum distance required for intermodal success, yet the route carried 419,354 units in 1988, ranking it among the ten largest intermodal corridors.

FEC schedules seven daily departures from Miami, plus extra trains as needed. The railroad stresses flexibility to meet customer needs: FEC has a 3:00 a.m. departure from Miami for Jacksonville to enable UPS to deliver trailers at 5:00 p.m. in Atlanta. The 350-mile trip is usually non-stop: the intermediate points of West Palm Beach and Fort Lauderdale are served separately. All trains are caboooseless, and are operated by two-person crews.

FEC performs several functions that other railroads do not. FEC deliberately makes yard space available to store empty trailers and containers. FEC has invested in a substantial trailer fleet, including a recent purchase of specialized aluminum flatbed trailers for building materials and lumber (commodities not previously considered prime candidates for intermodal). It not only calls customers in advance of train arrival, but it has tractors waiting for high-priority trailers or containers. FEC also provides drayage through a subsidiary that contracts with some 35 owner-operators.

The result is that FEC has successfully attracted large volumes of truck traffic from parallel highways. Long-haul truckers give trailers to FEC

at Jacksonville for the movement to Miami, and the railroad returns empties north because there is little backhaul freight from Miami. Despite the short haul, FEC has substantial business from UPS. At least one trucker has taken advantage of the short haul to forge a unique partnership with the railroad: on Mondays, a driver takes one trailer north from Miami to Jacksonville while other trailers move by rail; the driver then uses his tractor to perform drayage from Jacksonville during the week, and he returns to Miami with one trailer on Friday.

The success of the Florida East Coast demonstrates that precise, flexible, and responsive intermodal operations are not inherently impossible for railroads, even with conventional equipment. Some of FEC's success can be attributed to its flexible work rules, consistent fast service, and the unique features of the Jacksonville-Miami corridor, but much more of it is attributable to initiative and a strong customer orientation.

Door-to-Door Reliability. The biggest shortcoming in current intermodal and double-stack operations is the lack of door-to-door reliability. Poor door-to-door transit time and reliability are the reasons most often cited by shippers for using trucks rather than intermodal. Railroads monitor on-time performance of ramp-to-ramp train movements. Industry and shipper sources indicate that double-stacks have a better record than piggyback trains in this regard, although there is still much room for improvement. Performance monitoring and service quality control drops off in the terminal however, and stops entirely at the terminal gate. Railroads know when a given container or trailer leaves and re-enters the terminal, but generally have no idea what has happened on the trips to and from the customer's door.

Some railroads have taken tentative steps to monitor what goes on in and beyond the terminal. BN surveyed Seattle-Chicago movements and found that a consistent 2.5 day ramp-to-ramp movement frequently produced 12-15 day door-to-door times because of long dwell times at terminals and drayage delays. While service-sensitive customers let trailers or containers set for just a few hours, others sat in the terminal for days.

Rail intermodal transportation is a complex process involving, at a minimum, five steps:

- Origin drayage;
- Origin terminal handling;
- Rail line-haul;
- Destination terminal handling; and
- Destination drayage.

Each party responsible for a step may have achieved 95 percent on-time performance, comparable to truckload carriers. But 95 percent reliability in each of five steps yields only 78 percent reliability for the system (.95 x .95 x .95 x .95 x .95), so more than one in five shipments will be early, or, more often, late. If more steps are required for railroad interchanges or equipment positioning, reliability drops further. To achieve 95 percent overall reliability, a five-step process has to average 99 percent reliability in each step.

Lapses in reliability are magnified by the operating practices and coping mechanisms of third parties and shippers. In order to maintain overall reliability, schedules are padded. If a container needs to depart on a train by Friday, a third party or shipper may have it drayed on Tuesday or Wednesday to make sure it gets out in time. If a container is due to arrive at the rail terminal on Sunday, the agent may not plan to pick it up until Tuesday. Thus, a 3-day Friday-Sunday rail linehaul quickly becomes a 6-day Wednesday-Tuesday door-to-door trip.

Surveys have consistently shown that shippers value consistency and reliability over fast transit time. Reliable systems substitute information for inventory, and save money. Unreliable systems substitute inventory for information, and cost money. Unreliable systems must offer substantial discounts or make do with low-value, low-revenue freight. This is exactly the current status of rail intermodal service, including domestic double-stacks.

Trucking offers shippers flexibility in addition to reliability. Trucks are atomistic: they can make real-time adaptations to changing circumstances. Trains are aggregates: they are part of a system that can never achieve atomistic flexibility. The best that trains, and systems that use trains, can be is precise and reliable. If they fall short of that, they are giving away an additional and unnecessary competitive advantage to trucks.

Getting There From Here. All of the major railroads have, from time to time, demonstrated an ability to achieve and maintain reliable, precise service, whether in fast freight or passenger service, with technology inferior to today's. Railroads know how to make operations more reliable, but it requires sustained management commitment and cooperation from both carrier and outside employees. Terminal operations and drayage are the best near-term target for improving reliability. Railroads have some control over terminal operations, but little direct control over drayage unless it is performed by a railroad subsidiary.

The control that railroads can exert over terminal operations depends on whether it is a railroad terminal operated by railroad or subsidiary employees, a railroad terminal operated by a contractor, or a terminal owned and operated by another party. In the first case, the railroad may have to invest in equipment, training, and personnel to achieve a greater degree of reliability, accountability, and responsiveness. In the case of contract operation, railroads may have to concentrate more on building service quality incentives and measurements into contractual relationships and less on achieving the lowest lift cost. Not surprisingly, however, the most efficient operators are also the most reliable. Terminals operated by non-railroad parties (ocean carrier subsidiaries, for example) will be operated to the standards of those parties, and the railroads are essentially delivering cars to an on-line customer.

The newest rail intermodal terminals, notable SP's ICTF in Los Angeles, have set new standards for terminal operations. The differences have relatively little to do with lift equipment or track configuration, and a great deal to do with computer support, training, and management commit-

ment. Railroads can also learn from the best marine terminals, such as Mitsui's TRAPAC terminal in Los Angeles, which face similar issues of reliability and efficiency, and have generated numerous innovative responses.

Drayage is in some ways the most problematical portion of intermodal operations. Drayage operators include multimodal subsidiaries (CMX, American President Trucking), well-organized contract operations (Florida East Coast Highway Dispatch, or SP's new Container Bridge), established regional truckers (Pennsylvania Truck Lines), and hundreds of local owner-operators. The drayman is most often chosen by the shipper or third party, and he is not under the supervision or control of the railroad.

Drayage would appear to be a prime candidate for application of the "supplier quality partnership" concept. The essence of the concept is a mutual commitment between a supplier of services and a purchaser or re-seller, and a recognition that they have a common interest in superior performance in the marketplace. Most railroads have sold their trucking operations, and unless they establish partnerships with drayage operators they will have little control over a critical portion of their intermodal service. Simply put, a shipper does not care about on-time train performance, only about door-to-door reliability.

The shipper also cares about door-to-door cost, of which drayage is a large part. As is explained at length in the Task II report, double-stack services cannot reach out for long distances (e.g., 100-200 miles) beyond intermodal hubs on both ends of a line-haul and remain cost-competitive with trucks. Extending the drayage reach will require cost savings combined with high service quality and tight control -- an ambitious goal, but one with large potential returns from access to untapped markets.

FEC uses a group of some 35 owner-operated trucking firms in a partnership with FEC's subsidiary, Florida East Coast Highway Dispatch. Even though some or even most customers may choose other draymen, FEC can offer a high-quality, door-to-door service under its control. Where it

uses CMX, CSL Intermodal can offer the same thing. SP is apparently taking a partnership approach with its Container Bridge drayage program in Southern California. BN has also begun to use contract draymen, via competitive bidding. Strick Lease Intermodal has developed a national network of drayage companiesin conjunction with its trailer and chassis leasing business.

The partnership approach is discussed at greater length in Section F, tying together marketing and operating issues, and as an approach to resolving fragmentation. It has immediate application, however, to one serious question that plagues intermodal operations: who is in charge? Partnerships or strategic alliances provide a means of establishing who is in charge and, if properly structured, a means of letting the party in charge bring the whole intermodal operating system up to the standard of door-to-door reliability that will be required if domestic double-stacks are to reach their full potential.

D. MOTOR CARRIER DEVELOPMENTS

1. Sensitivity of Double-Stack Traffic

The major external developments that could significantly affect the emerging network of double-stack services lie in motor carrier transportation:

- o changes in truck size and weight limits;
- o changes in truck labor and fuel costs; and
- o changes in LTL motor carrier operations.

There is no longer any question that domestic double-stack services have penetrated the market for dry truckload freight in the major double-stack corridors. Truckload operators have apparently shifted at least some of their activity into other markets: regional trucking, refrigerated trucking, or multiple-stop service, for example.

Cost criteria developed for Task II derived a relationship between truckload operating costs, double-stack operating costs, drayage distance, and the minimum length of haul over which double-stacks could be price-competitive with truckload carriers. This relationship is, of course, sensitive to changes in truckload operating costs, which in turn could be affected by industry trends or public policy decisions. The competitive balance between double-stacks and truckload carriers would also be affected by changes in trucking overhead costs, but changes in overhead costs (except for new taxes or fees) are highly company-specific and difficult to predict.

This section discusses the major potential changes listed above and their likely impact on the domestic double-stack network. Increases in truck size and weight limits would decrease the cost of truckload operations and shrink the domestic double-stack network. Increases in truck labor and fuel costs would increase the cost of truckload operations and expand the double-stack network. Increases in the use of intermodal trans-

portation by less-than-truckload (LTL) motor carriers may not expand the domestic double-stack network itself, but they would provide higher volumes and lower unit costs.

2. Truck Size and Weight

Potential Increases. The most significant potential development from the view of double-stack operations is the possibility of substantial increases in truck size and weight limits. At issue is, first, the permissible configuration of truck combinations moving over interstate highways; second the gross vehicle weight limit, and related axle loading limits and bridge formulae; and third the access such larger vehicles will have to cities and roads off the Interstate highway system.

The Surface Transportation Assistance Act (STAA) of 1982 permitted the use of 48-foot trailers and twin 28-foot trailers, both 102 inches wide, on designated highways. These so-called "STAA" vehicles quickly began to dominate long-haul trucking. According to a survey of new truck trailers shipped in 1987, about 70 percent were 48 to 53 feet long, 17 percent were 28's, only 9 percent were 45's, and none were 40's. About 81 percent were 102 inches wide, and the remainder were 96 inches wide.

Proposals for increases in truck sizes mainly concern Large Combination Vehicles (LCVs). Figure III-3 illustrates the combinations under consideration. The triple 28-foot combination is already legal in some states and it has great appeal to LTL carriers, who now base their operations on twin 28-foot trailers. The most attractive combinations to truckload carriers, and the greatest threats to railroads, are the Turnpike Doubles and Twin 48's. Either combination, but especially the Twin 48's, would markedly reduce truckload operating costs (all other things being equal).

Increases in the gross vehicle weight from the present 80,000 pounds would also be of concern to the railroads. Railroads have long had an advantage for heavy commodities that reach the highway weight limit before filling a trailer. The boxcar traffic considered potentially containerizable and divertible to double-stacks includes a number of such

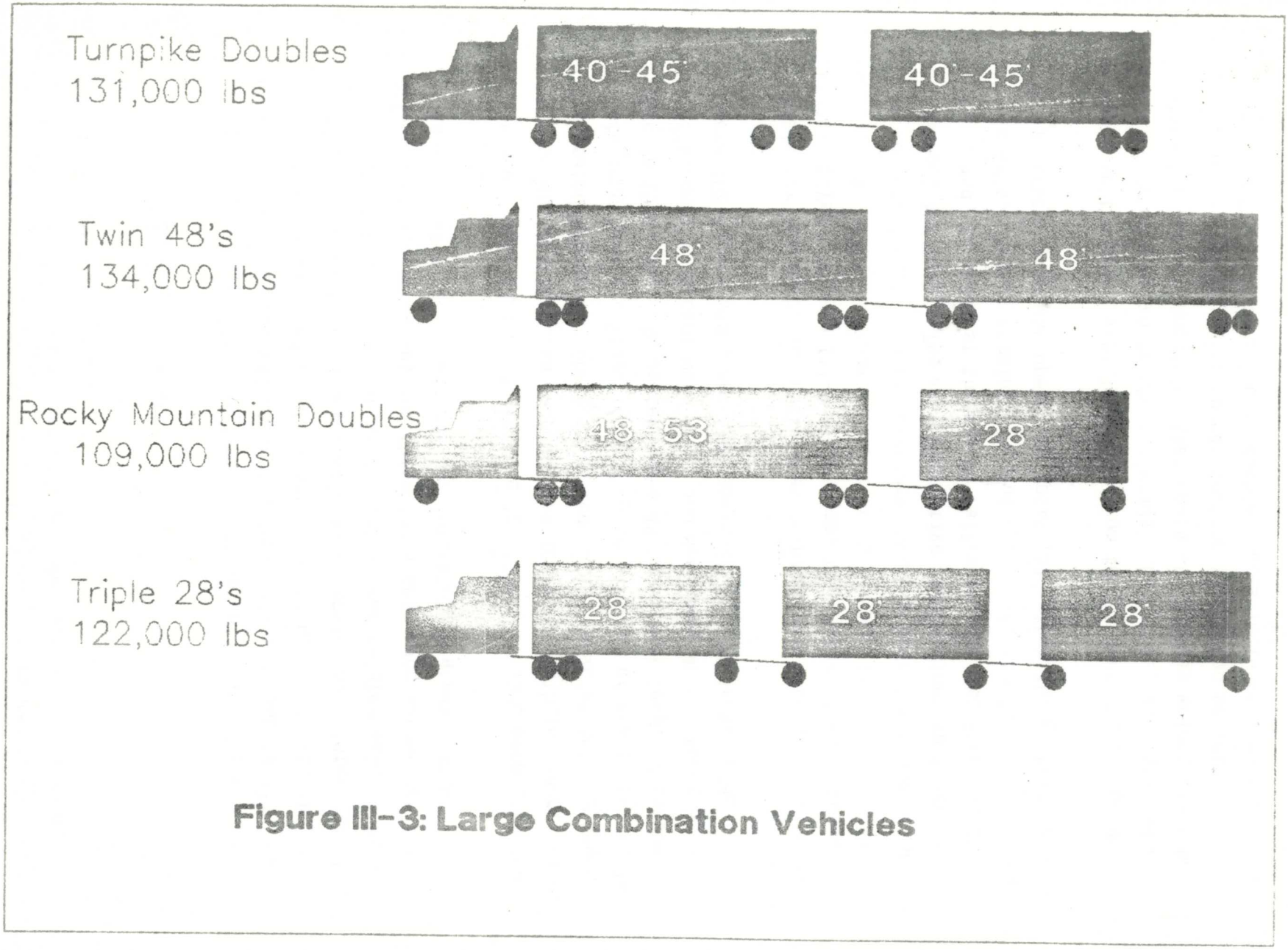


Figure III-3: Large Combination Vehicles

commodities. Even if truck sizes were not increased, an increase in the gross vehicle weight limit would increase the ability of truckload carriers to compete for such traffic.

The so-called STAA vehicles, 48-foot and 28-foot trailers 102 inches wide, are presently restricted in their movements beyond the designated highways. State governments have the power to restrict the movements of such vehicles to terminals and other points off the Interstate system, and many do so. Twenty-five states have stricter limits than a "5 mile rule" proposed in 1987, or require special access permits. The major restrictions are in the Northeast and Southeast. There is continuing, often heated, discussion regarding federal versus state jurisdiction over wider access for STAA truck combinations.

Access questions for LCVs are even more serious. Ordinary highways and streets, particularly the intersections, cannot handle the largest combinations. Where triple 28's are legal, many are operated as triples only between terminals or customers adjacent to Interstates, and moved as doubles or singles over ordinary highways. The access problem may be more serious for truckload operators trying to provide door-to-door service.

Truck size and weight issues are inescapably linked to the condition of the highway infrastructure. Existing highways are deteriorating, and motor carriers are among those most seriously affected. Controversy has raged for years over the motor carriers' "proper" share of highway construction and maintenance expense. That controversy is not likely to be resolved, but it is likely that any increase in truck size, truck weight, or truck access, will be accompanied by increases in fuel taxes, user fees, or other governmentally imposed costs. In other words, all other things will not be equal. The amount and incidence of such cost increases will be an outcome of the political process and, as such, cannot be predicted.

Impact on Railroad Traffic. Increases in truck size, weight, and access would affect the double-stack network in three ways:

- indirectly, through reductions in total railroad revenue;
- indirectly, through increased competition for containerizable boxcar traffic; and
- directly, through increased competition for intermodal and truckload traffic.

At least two studies have been done of the potential effects of LCVs on railroad traffic.

The first study, by the U.S. DOT Transportation Systems Center, was completed in May, 1986. Using an elaborate modeling methodology, that study found that a 1990 LCV network would divert rail traffic worth $5.1 billion in annual rail revenues, and reduce revenues on retained rail traffic by another $1.8 billion annually.

The second study, by the Association of American Railroads (AAR), was released in June, 1989. It considered the impact of a nationwide network of twin 48's on railroad traffic, both traffic diverted and revenues reduced because rates would have to be held down to prevent further diversions. The AAR study concluded that a nationwide network of twin 48's would have reduced 1986 revenues by $3.7 billion from a total of $26.2 billion. Moreover, the AAR study estimated that net operating revenues would decline by $1.6 billion from a base of only $3.1 billion, a 52 percent loss of net revenue. Of the revenue loss estimated by AAR, $156 million was in intermodal traffic.

The AAR study also estimated the loss from a nationwide network of twin 48's operated with Advanced Truckload Firm (ATLF) economies. The estimated gross revenue loss was $8.3 billion, similar to the DOT result if a discount is assumed. The net revenue loss would be $1.9 billion, or 63 percent of the industry total. About $370 million in gross revenue, and $78 million in net revenue, would come from intermodal.

It is abundantly clear from either study that nationwide use of LCVs -- either as a network or in selected lanes -- would seriously challenge the

financial and economic strength of the railroads. Besides any direct diversion of double-stack traffic, revenue losses of this magnitude could jeopardize the railroads' ability to maintain the infrastructure required for high-quality intermodal service.

Effect on Length of Haul. The AAR undertook an analysis of the estimated 1986 operating costs of a 134,000 lb, twin 48-foot truck combination (the so-called Bridge Formula B truck). Table III-3 uses the percentage increases estimated by the AAR for the three truck operating cost categories used in our Task II cost criteria to estimate the current (1989) operating costs of a twin 48. The resulting estimate is $.98 per mile. Assuming the same utilization as was employed in our cost criteria (80 percent), the cost per loaded mile would be $1.23 for the combination, or $.62 per mile per trailer, versus $.89 per mile for a single trailer.

Substituting this cost in the length-of-haul relationship developed for Task II yields:

$$393.49 + .158\ M_R + .71(2)D = .85(.62)\ .926M_R$$

$$\text{or}\quad 1{,}192.39 + 4.30D = M_R$$

Where M_R = Rail Length of Haul
and D^R = Drayage distance beyond 30 miles

The result of the operating cost difference alone would increase the minimum competitive rail haul from 725 miles (Task II) to 1,192 miles. Table III-4 lists the double-stack network links and volumes that would be jeopardized. For all practical purposes, there would be no double-stack operations in the eastern United States, except trains from the West Coast.

The AAR analysis also derived estimates for twin 48's operated with the very favorable economies of Advanced Truckload Firms (ATLF's). The ATLF percentage reductions, as in Table III-3, yield an estimated cost of $.54 per trailer mile at 80 percent utilization. The operating cost would raise the minimum double-stack length of haul, under the best conditions,

Table III-3

Estimated 1989 Operating Costs Per Mile
Twin 48-Foot Trailers

	1989 One 48-Foot	Percent Increase*	1989 Twin 48-Foot
Equipment	$.31	50.6	$.47
Fuel	.20	36.7	.27
Labor	.20	22.2	.24
	$.71	38.5	$.98

* "Analysis of Truck Size and Weight Increases", Intermodal Trends, Association of American Railroads, Volume I, Number 12, June 30, 1989. Estimates do not account for utilization.

Table III-4

Potential Rail Double-Stack Flows Jeopardized
By a National Network of Twin 48's

(725 - 1,192 Miles)

Origin BEA	Destination BEA	Rail Miles	Annual Container Equivalents
Chicago	New York	848	159,045
New York	Chicago	848	144,595
Chicago	Philadelphia	780	79,559
Chicago	Boston	986	56,220
Chicago	Baltimore	778	49,160
Chicago	Dallas	905	45,016
Quebec	Chicago	802	40,220
Boston	Chicago	986	37,699
Philadelphia	Chicago	780	34,806
Portland	Los Angeles	1,073	32,390
Baltimore	Chicago	778	32,147
Eugene	Los Angeles	948	27,371
St. Louis	Dallas	730	22,713
Chicago	Hartford	922	17,206
Dallas	Chicago	905	16,086
Los Angeles	Portland	1,073	11,651
Dallas	St. Louis	730	10,747
Hartford	Chicago	922	10,508
Detroit	Dallas	1,157	7,778
Salt Lake City	San Francisco	803	6,887
San Francisco	Salt Lake City	803	4,993
Portland	Fresno	800	4,653
San Francisco	Phoenix	854	3,064
Chicago	Albany	800	3,025
Los Angeles	El Paso	812	2,751
Los Angeles	Albuquerque	878	2,530
Ontario	Kansas City	906	2,348
Toledo	Boston	765	2,067
Houston	El Paso	813	1,745
Richland	Los Angeles	996	1,738
Kansas City	Albuquerque	917	1,688
Kansas City	Cleveland	751	1,598
Total			874,004

Source: 1987 Carload Waybill Sample.

to 1,473 miles. Table III-5 gives a list of the corridors and traffic volumes that would be jeopardized. The incremental change would primarily affect the Southwest.

In addition, the AAR analysis estimates that overhead and other costs per trailer-mile would be reduced by 37.8 percent, principally by dividing a slightly larger overhead between two trailers. This overhead reduction will further improve the competitive position of the twin 48's.

The estimates derived in this section are just that: estimates. Moreover, they rely on a large number of assumptions and approximations, some of which are bound to prove inaccurate. For one thing double-stacks have not yet converted all the piggyback and boxcar traffic at stake. Nonetheless, they are sufficiently reliable to gauge the order-of-magnitude impact on the projected double-stack network.

Unless the economics of twin 48-foot trailers are offset by substantial increases in fuel costs, labor costs, fuel taxes, staging, or other costs, double-stack services will find it very difficult to compete with twin 48's on any but the longest transcontinental routes and still offer shippers the 15 percent discount they have come to expect.

The reason that railroad double-stack services are so vulnerable to reductions in motor carrier costs is that they compete on price. If double-stack services could charge the same prices as average motor carriers using twin 48's, the minimum rail length of haul would drop from 1,192 to 946 miles. If the railroads could charge as much as ATLF's using twin 48's, they could compete with ATLF's at 1,150 miles, rather than 1,473.

3. Driver Shortages and Labor Costs

After a long period in which real trucking labor costs declined, due in part to reduced union representation, they have begun to rise. According to the Department of Labor, average trucking industry hourly wages rose from $7.92 in 1978 to only $10.96 in 1987. (Traffic World, December 5, 1988). The Teamsters Union had higher wages, $14.85 per hour in 1987,

Table III-5

Potential Double-Stack Flows Jeopardized
By a National Network of ATLF Twin 48's

(1,192-1,473 miles)

Origin BEA	Destination BEA	Rail Miles	Annual Container Equivalents
Portland	Phoenix	1,458	4,847
Eugene	Phoenix	1,333	4,585
Kansas City	Phoenix	1,439	4,482
Chicago	Albuquerque	1,350	2,977
Ontario	Dallas	1,379	2,488
El Paso	Chicago	1,439	2,368
New York	Kansas City	1,273	1,870
Albuquerque	Chicago	1,350	1,840
Detroit	Amarillo	1,240	1,742
New York	Minneapolis	1,261	1,725
Total			28,924

Source: 1987 Carload Waybill Sample.

but had lost 116,633 jobs since 1980 and now represented only two-thirds as many drivers. A report by Data Resources, Inc. in the first half of 1989 found that the trucking labor costs rose 7 percent over the 1988 averages. The recent increase in real labor costs has been attributed to a nationwide shortage of qualified truck drivers. Although truckers have not yet had to turn away business, the shortage has had perceptible effects. Not only have trucking firms had to pay higher wages, but their recruitment and training expenses have risen as well.

The reasons for driver shortages are complex, and beyond the scope of this study. The trucking industry has, as noted, stepped up recruitment and training. Manufacturers and operators are also cooperating in the development of improved automatic transmissions that will reduce the demands on truck drivers and improve operating efficiency.

An ongoing shortage of drivers would definitely increase truck labor costs, although it is not possible to say by how much. One indication of the possible impact is the difference that truck labor cost increases would have in the minimum length of competitive double-stack haul estimated in Task II. Table III-6 shows the impact of various hypothetical labor cost increases. In this simplified model, each additional penny per mile in truck labor costs drops the minimum length of a competing double-stack haul by 11 miles.

4. Fuel Costs and Fuel Taxes

Fuel costs are a larger part of truckload operating costs than they are of double-stack operating costs. Double-stack costs also include equipment costs, lift costs, and other factors that are only slightly affected by fuel costs. Even drayage is primarily a time cost, with fuel playing only a small part. Thus, long-haul trucking costs will be affected more than double-stack costs by increases in fuel costs or fuel taxes.

Over the last decade, diesel fuel costs (as all energy costs) have defied most attempts at forecasting, and the study team did not make forecasts

Table III-6

Impact of Truck Labor Cost Increases
On Minimum Competitive Double-Stack
Length of Haul

Average Truck Labor Cost Per Mile	Percent Increase	Minimum Double-Stack Length of Haul (miles)
$.20	-	725
.21	5	714
.22	10	701
.24	20	678
.30	50	615

Source: Calculated from formula in Task II Cost Criteria.

or gather forecasts for this study. There seems to be a consensus, however, that oil prices will increase in the long run.

Factors other than oil prices can also affect diesel fuel costs to truckers. Truck emissions standards for 1994 are expected to require a "cleaner" fuel at an additional cost of 3-4 cents per gallon, as well as increasing other operating and maintenance costs.

Fuel consumption in the long-haul truckload segment has gradually improved over the last few years, and it now stands at about 5.6 miles per gallon (according to ATA figures). An increase of 4 cents per gallon would raise the estimated fuel cost per mile from $.20 to $.21. As with a penny per mile labor cost increase, this increased fuel cost would reduce the minimum length of haul for double-stacks by 11 miles.

A more dramatic change would result from increased fuel taxes, which have been proposed as a means of funding highway repairs and improvements or reducing the federal deficit. The range of increase under consideration runs from 5 cents to 25 cents per gallon. Table III-7 shows the effect of various taxes, with and without the effect of emission standards, on the minimum length of haul for a competitive double-stack service. The most drastic increase, a 25 cent per gallon tax and a 4 cent per gallon emissions cost, would increase trucking costs by 5 cents per mile, and reduce the competitive length of haul for double-stacks by 55 miles, from 725 to 670.

Table III-8 lists city BEA pairs and 1987 rail intermodal (or equivalent) traffic volumes that might become accessible to truck-competitive double-stack service were truck fuel or labor costs to rise and minimum lengths of haul to shrink. The potential importance of such corridors is unclear, as the existing rail intermodal volumes are mostly small and little is known about divertible truck traffic. Much of the volume between BEA pairs in Table III-8 is presently moving in boxcars, and it is by no means certain that it could be diverted to double-stacks.

Table III-7

Impact of Fuel Tax Increases
and Emissions Standards
on Minimum Competitive Double-Stack
Length of Haul

Fuel Tax Increase	Minimum Double-Stack Length of Haul	
	Without Emission Standards (Miles)	With Emission Standards (4¢/gal.) (Miles)
None	725	717
$.05	715	707
.10	705	697
.15	696	683
.20	686	678
.25	676	668

Source: Calculated from formula in Task II Cost Criteria.

Table III-8

Potential Rail Double-Stack Flows Accessible
With Increased Truck Labor or Fuel Costs

(615 - 725 Miles)

Origin BEA	Destination BEA	Rail Miles	Annual Container Equivalents
Atlanta	Miami	707	31,743
Chicago	Harrisburg	674	24,701
Chicago	Atlanta	701	23,695
Detroit	New York	691	14,275
Detroit	Philadelphia	623	13,107
Detroit	Baltimore	620	12,433
Atlanta	Chicago	701	11,448
Harrisburg	Chicago	674	11,267
Atlanta	Washington, D.C.	638	11,078
Portland	San Francisco	722	9,347
Kansas City	Denver	654	8,433
Washington, D.C.	Atlanta	638	8,293
Kansas City	Houston	721	7,138
Detroit	Atlanta	684	7,070
Miami	Charleston	637	7,040
San Francisco	Portland	722	6,943
Detroit	Greensboro	671	6,717
Toledo	New York	644	6,508
Detroit	Minneapolis	682	6,338
Savannah	New Orleans	675	6,283
Charleston	Nashville	666	5,847
Chicago	Syracuse	621	5,505
Nashville	Charleston	666	5,480
Syracuse	Chicago	654	5,447
Charleston	Miami	637	5,335
Columbus	New York	661	5,065
Detroit	Memphis	706	4,748
Houston	Kansas City	721	4,746
New Orleans	St. Louis	715	4,638
Jacksonville	Memphis	666	4,503
St. Louis	New Orleans	715	4,377
Detroit	Kansas City	616	4,287
New Orleans	Savannah	675	4,240
New York	Toledo	644	4,058
Memphis	Detroit	706	3,987
Miami	Atlanta	707	3,907
Cincinnati	Baltimore	677	3,878

Table III-8
(Continued)

Origin BEA	Destination BEA	Rail Miles	Annual Container Equivalents
Portland	Stockton	683	3,748
Cincinnati	Norfolk	682	3,720
Kansas City	Birmingham	714	3,273
Memphis	Jacksonville	666	3,256
New York	Detroit	691	3,193
Charlotte	Memphis	653	3,187
Philadelphia	Detroit	623	3,153
New York	Columbus	661	3,067
Pittsburgh	St. Louis	625	3,048
Baltimore	Detroit	620	2,995
Kansas City	Detroit	718	2,990
Birmingham	Kansas City	714	2,957
Jacksonville	Richmond	663	2,898
Baton Rouge	St. Louis	713	2,823
Birmingham	Dallas	624	2,781
Tyler	St. Louis	659	2,760
Florence	New York	615	2,698
Lansing	Memphis	675	2,585
Fargo	Chicago	656	2,585
Sacramento	Salt Lake City	719	2,580
St. Louis	Pittsburgh	625	2,573
Chicago	Fargo	656	2,560
Memphis	Savannah	672	2,512
Norfolk	Cincinnati	682	2,488
Tulsa	Chicago	681	2,480
Memphis	Charlotte	653	2,457
Ashville	New York	676	2,432
Lansing	Philadelphia	699	2,417
Mobile	Florence	723	2,412
Baltimore	Cincinnati	677	2,407
Cleveland	Atlanta	712	2,406
Portland	Sacramento	638	2,318
Chattanooga	Washington, D.C.	617	2,280
Wichita	Chicago	629	2,247
Cincinnati	Philadelphia	691	2,241
Ontario	St. Louis	702	2,215
St. Louis	Buffalo	698	2,133
Birmingham	Chicago	626	2,077
Atlanta	Baltimore	681	2,043
Charleston	Philadelphia	636	2,013
Cleveland	Boston	659	1,975
Memphis	Grand Rapids	647	1,943
Boston	Cleveland	659	1,928

Table III-8
(Continued)

Origin BEA	Destination BEA	Rail Miles	Annual Container Equivalents
Birmingham	Tulsa	683	1,863
Norfolk	Jacksonville	653	1,778
Salt Lake City	Sacramento	729	1,757
Sacramento	Portland	638	1,723
Wausau	Kansas City	699	1,698
Mobile	Charleston	639	1,678
Columbus	Norfolk	649	1,640
Little Rock	Cincinnati	640	1,588
Kansas City	Cincinnati	628	1,565
Chicago	Tulsa	681	1,563
Total			443,612

Source: 1987 Carload Waybill Sample.

5. LTL Trucking.

The potential of double-stack services to provide economical linehauls for Less-Than-Truckload (LTL) truckers may be limited by institutional constraints within the motor carrier industry, or between motor carriers and railroads. While there is a strong trend toward non-union trucking, many major LTL trucking firms still operate under the National Master Freight Agreement with the Teamsters, which may constrain the volume or portion of linehaul movements that can move by rail. Despite numerous public proclamations of "partnership" over the years, only a few railroads and motor carriers (other than UPS) have substantial cooperative traffic. The question remains, however, whether multi-modal ownership or other measures can achieve the full potential of double-stack operations for cooperative rail/truck service.

The intermodal share of LTL truck traffic is small, but growing: 2.66 percent in 1986, and 3.64 percent in 1988. Some of the largest LTL firms use intermodal services significantly more often: Roadway currently moves about 8.7 percent of its traffic intermodally. The use of intermodal service by LTL firms is not well publicized, because those firms do not want to share in intermodal's poor service reputation among shippers. Rail intermodal service in any form, however, is not likely to supplant highway carriage for the bulk of the LTL business. In 1987, the average length of haul for Class I and Class II LTL and TL motor carriers was just 489 miles, well below the Task II estimate of the competitive range for double-stacks.

Class I LTL motor carriers use intermodal service, almost always piggyback, as:

- a substitute or supplementary service in main corridors, often when the supply of drivers is tight:
- a means of penetrating new markets, especially where backhauls are difficult to obtain; or
- a separate service provided through partnership or subsidiaries.

Roadway is an example of the first and second uses, Carolina Freight is an example of the second use, and Consolidated Freightways and its subsidiary Con-Way is an example of the third use. UPS is actually the nation's largest LTL carrier, and the largest piggyback customer. UPS generates a great deal of very service-sensitive traffic, so much so that some railroads schedule premium piggyback trains according to the needs of UPS.

For the most part, however, LTL motor carriers seem to consider cooperation with the railroads on intermodal traffic as a necessary evil. The tight control that LTL carriers maintain over their operations will require real, functioning partnerships with the railroads, not merely a public relations handshake, if a substantial part of their traffic is ever to move intermodally. Some motor carriers also see potentially serious safety and reliability problems with local drayage companies.

One barrier to the use of domestic double-stack container service by LTL motor carriers is the container itself. Many LTL carriers have standardized on 28-foot "pup" trailers, which, when run on the highways in pairs, maximized the cubic capacity for a "go anywhere" truck combination while also maximizing flexibility. These same 28-foot trailers are used intermodally. LTL carriers would be reluctant to introduce another size or type of equipment, such as a 48-foot domestic container, into their operations. (A 40-foot container, which has nearly the same cubic capacity as a 28-foot trailer, may be acceptable between terminals where it need not be married with other trailers for highway movement.) Railroads or stack-train operators would have to provide LTL motor carriers with a powerful incentive, and a high standard of service to attract significant portions of LTL traffic.

E. INSTITUTIONAL ISSUES

As was stated at the outset, many of the most important challenges to double-stack operators are institutional rather than technical. The issues with system-wide importance include internal organization, marketing, and the role of third parties. This section describes the status of each issue, and the directions in which progress must be made by domestic double-stack operators to achieve double-stack's commercial potential.

1. Internal Organization

Domestic container services have tended to compete with railroad carload, trailer, and RoadRailer operations first, and trucks second. Their success may be limited by the reluctance of individual railroads to promote the new services wholeheartedly in competition with their other services. Corporate conflict has already surfaced in domestic backhaul solicitation for international containers, which is often viewed by TOFC salespeople from the same railroad as competition. A railroad's internal organization can reveal whether authority for container, trailer, and carload marketing can merge and share incentives, or whether separate lines of authority are likely to produce internal conflict.

Many railroads are now combining their intermodal businesses as separate profit centers. Shifting the responsibility for intermodal business to higher levels of management should result in fewer internal conflicts among the TOFC and container segments.

The creation of separate intermodal profit centers or business units could be a very positive development if it is backed by an enduring top management commitment to the intermodal business. Railroads, like most major businesses, have repeatedly re-organized over the years, usually with little in the way of concrete results in operations, marketing, or traffic. Customers are quick to determine whether the personnel they deal with have new authority and accountability, or merely new titles.

Organizations have their true existence in the minds of employees and customers, and in the way they interact, rather than on organization charts. Indeed, if a customer has a detailed knowledge of a railroad's internal organization, it is probably because that customer has had to go through that organization repeatedly to get his questions answered and his problems solved -- a bad sign.

Once an intermodal business unit has been created, it must be granted authority to resolve intermodal marketing, sales, and operating issues quickly. To a customer used to dealing with truckers, "quickly" means within hours, not after a series of departmental and inter-departmental meetings over the next few weeks. This ability to respond requires decentralized decision making, a concept honored by the railroads more in theory than in practice. Decentralizing authority may be a difficult step in the railroad industry, which has used modern communications and information systems to centralize decision making in other spheres.

A functional and productive commitment to double-stack transportation may require another counter-institutional step for the railroads: hiring more people, and investing heavily in their training. Over the last few years, virtually every major railroad has sharply cut back its staff through attrition, layoffs, and buyouts. Ironically, many of the experienced intermodal personnel quickly found positions with ocean carrier subsidiaries and third parties.

Railroad intermodal departments are often spread thinly. Shipper survey data reveal that railroad intermodal salesmen make fewer calls, are less prepared and informed, and have less authority to resolve customer service issues than their third-party or trucking counterparts. Intermodal traffic is the most service-sensitive business on the railroad. The railroads' competitors increasingly offer shippers well-trained customer service representatives with real-time access to the information they need and authority to resolve problems on the first phone call.

If the railroads are not willing to invest in that kind of customer service, they will have to leave day-to-day sales, marketing, and operating

control to intermodal partners. Increasingly, the ocean carrier subsidiaries and major intermodal agents are willing to provide customer service where the railroads have defaulted. One executive of a major intermodal company mentioned that one of their major jobs is managing the railroads.

2. Marketing Issues

Customer Perceptions. Perception may be one of the biggest obstacles to be overcome in domestic double-stack growth. From the perspective of many potential customers, rail intermodal services suffer from association with bad experiences those shippers have had with other rail services. TOFC service, in particular, suffers from customers' memories of the higher loss and damage, unreliable service, and poor organization that plagued piggyback operations a decade and more ago. Marketing efforts by American President Intermodal and other double-stack operators have encountered resistance from shippers who had bad experiences with intermodal service in years past and are reluctant to try it again.

This perception problem could be a formidable barrier. A survey by the consulting firm of A.D. Little found that the sources of information most often relied upon for transportation decisions were, in order:

1. Experience and word of mouth within the company;
2. Direct sales calls by carriers or third parties; and
3. Experience of other companies.

Advertising and publicity ranked lowest on the list. Since railroads have reduced direct sales calls, they may be handicapped in attempting to change the perceptions of non-users. The A.D. Little survey also confirmed the criteria for modal choice: transit time, reliability, and customer service were ranked highest, with price fourth and equipment availability fifth.

From a marketing perspective, perception is reality. Potential customers with strongly negative perceptions have no incentive to try intermodal service, or to solicit information that might change their perceptions. For the vast majority of domestic shippers and consignees, trucking is a well-established, familiar, and satisfactory means of transportation. By comparison, intermodal transportation, conventional or double-stack, is a risky, unfamiliar alternative with a poor reputation. Shippers must be sold on the concept of intermodal movements, while trucks are the accepted norm.

The consulting firm of Temple, Barker & Sloane has undertake periodic surveys of shipper attitudes towards intermodal transportion. The results of the most recent survey, taken in 1989, confirm the existence of perception problems. Figure III-4 shows that shippers rate intermodal transportation well below trucks on eight key aspects of service. Less than half of the respondents rated intermodal excellent or nearly excellent in any service category. In contrast, at least 60 percent of the respondents rated trucks excellent or nearly excellent in every service category, and in most categories trucks were rated highly by more than 75 percent.

The perceptions of non-users are particularly critical, since non-users account for much of the potential market. Figure III-5 shows points of agreement and disagreement between users (40 percent) and non-users (60 percent). There is some good news for intermodal operators: users consistently rate intermodal service higher than non-users. But intermodal operators have not gotten their message across on some very basic points: non-users rate intermodal price, equipment availability, and service reliability much lower than users do. The better rating that users give intermodal on the ease of doing business may reflect their greater progress up a "learning curve" that constitutes a barrier to non-users. The top half of Figure III-5 illustrates the "halo" problem, the areas in which intermodal service has improved, but still suffers from a bad reputation earned in the past. The existence of this negative "halo" (perhaps "horns" would be a better term) has been demonstrated repeatedly

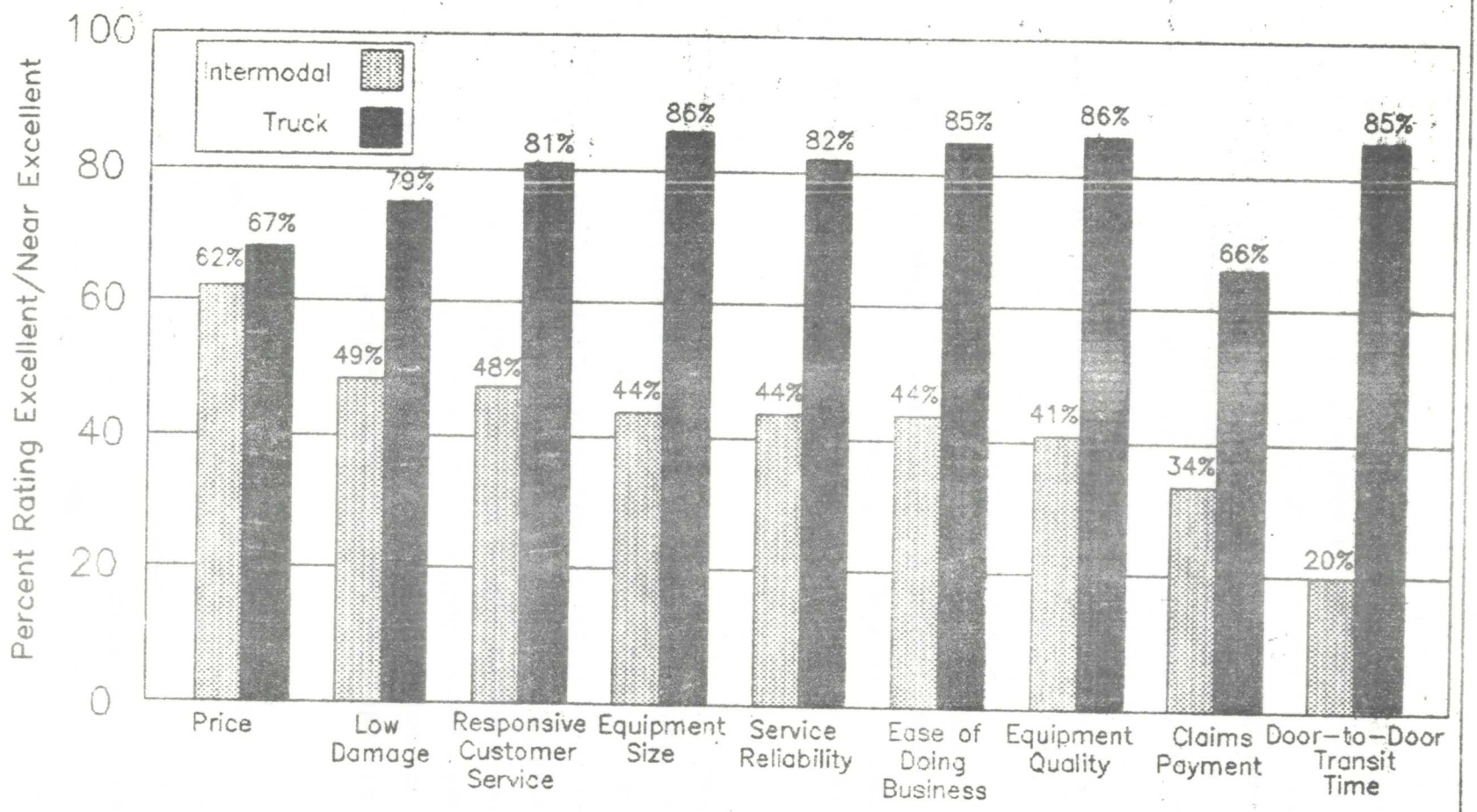
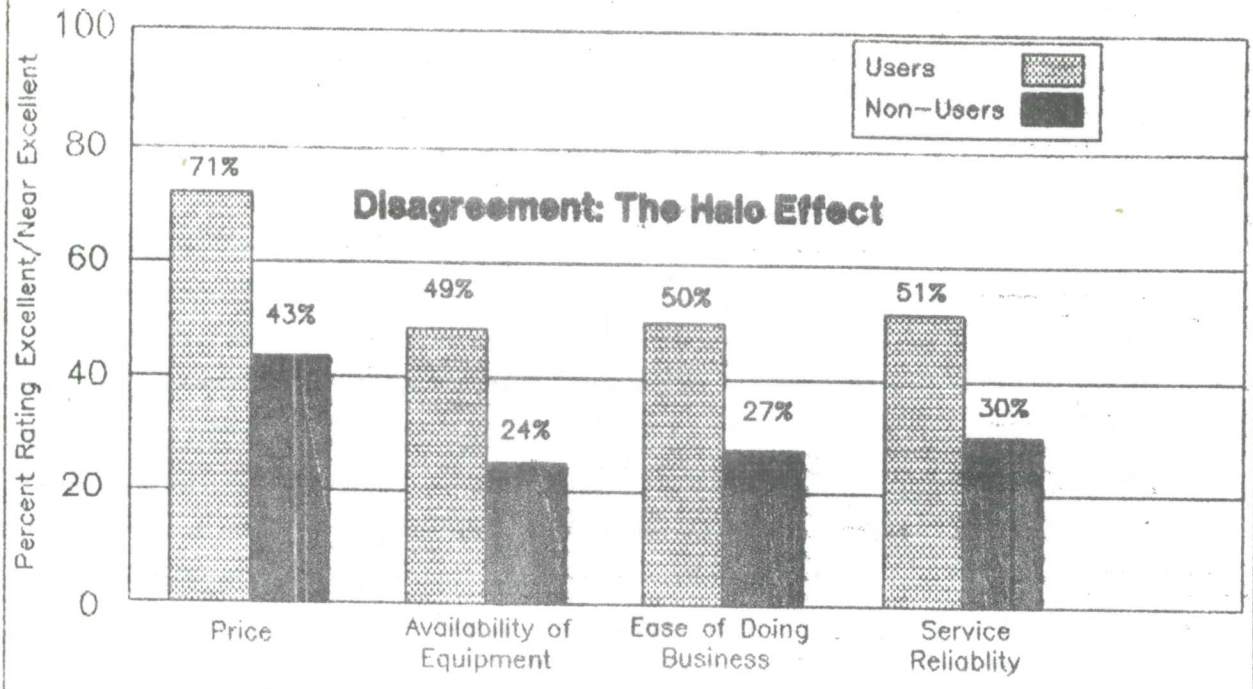


Figure III-4: Shipper Perceptions of Intermodal vs. Truck

Source: Temple, Barker & Sloane
Traffic Management, June 1989



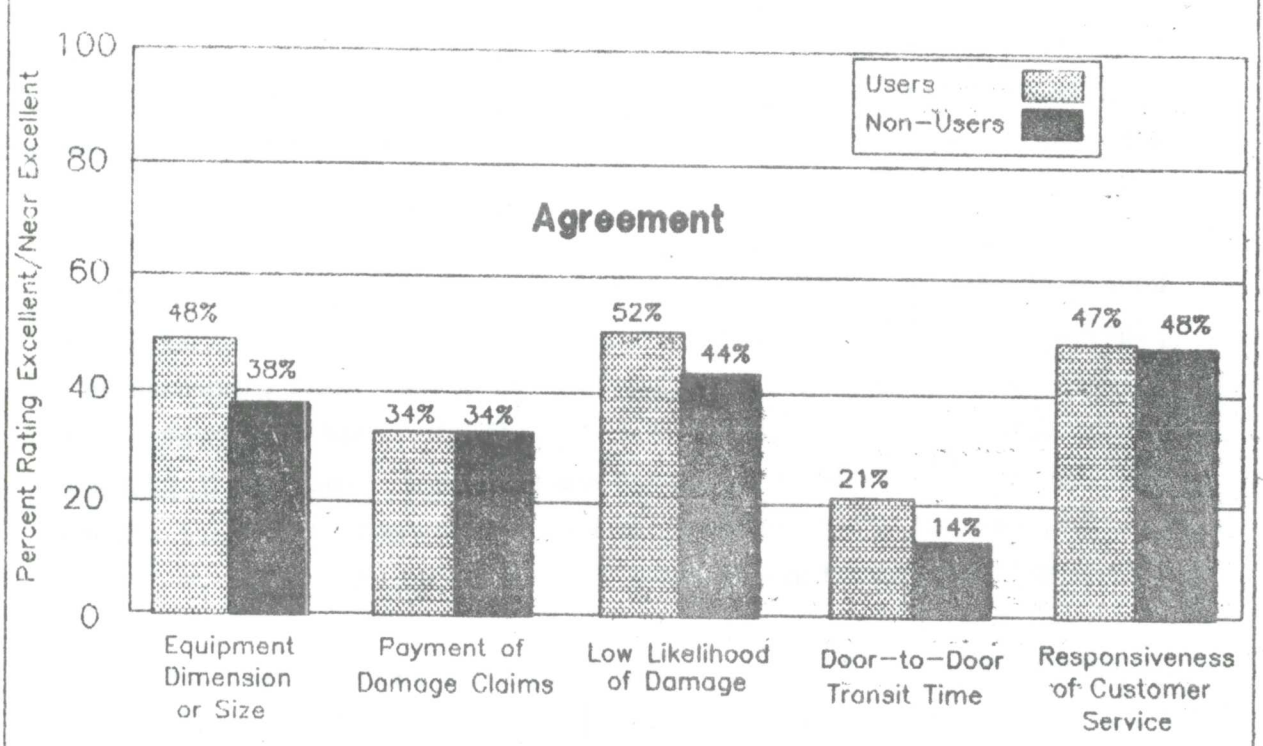


Figure III-5

User and Non-User Perceptions of Intermodal

Source: Temple, Barker & Sloane

Traffic Management, June 1989

by market surveys and in focus group discussions sponsored by major intermodal operators.

The bottom half of Figure III-5 contains some sobering findings: non-users rate intermodal poorly on five major aspects of service, and users agree with them. The responses on damages and claims are particularly striking. Intermodal operators have congratulated themselves publically on the reduction in loss and damage achieved by articulated cars, but a large portion of intermodal traffic still travels on conventional cars, and it is still damaged too often. Moreover, prompt handling of damage claims remains a serious failing of intermodal transportation, reflecting both the poor historical performance of railroads in handling claims and the fragmentation of intermodal responsibility.

Both users and non-users have low opinions of intermodal door-to-door transit time, and the survey found that poor door-to-door transit times were the reason most often given for not using intermodal service, or not using it more.

Double-stacks, as a line-haul technology, have improved on the image of piggyback in some key operational areas. Figure III-6 shows that many shippers view double-stacks as superior to conventional piggyback in price, damage control, reliability, transit time, and equipment. Double-stacks have little or no perceived advantage, however, in customer service, ease of doing business, and claims payment, three areas where intermodal transportation in general is handicapped.

Marketing Efforts. Domestic containerization presents railroads with a major marketing challenge. Railroads, despite individual innovations and successes, have a poor record of producing a marketable intermodal product, or marketing it well. For many years, the main target for railroad intermodal marketing has been the intermodal traffic of other railroads.

Railroads market intermodal services to ocean carriers with some success. But ocean carriers constitute a small number of high-volume customers, with well-organized, concentrated traffic. The success of domestic dou-

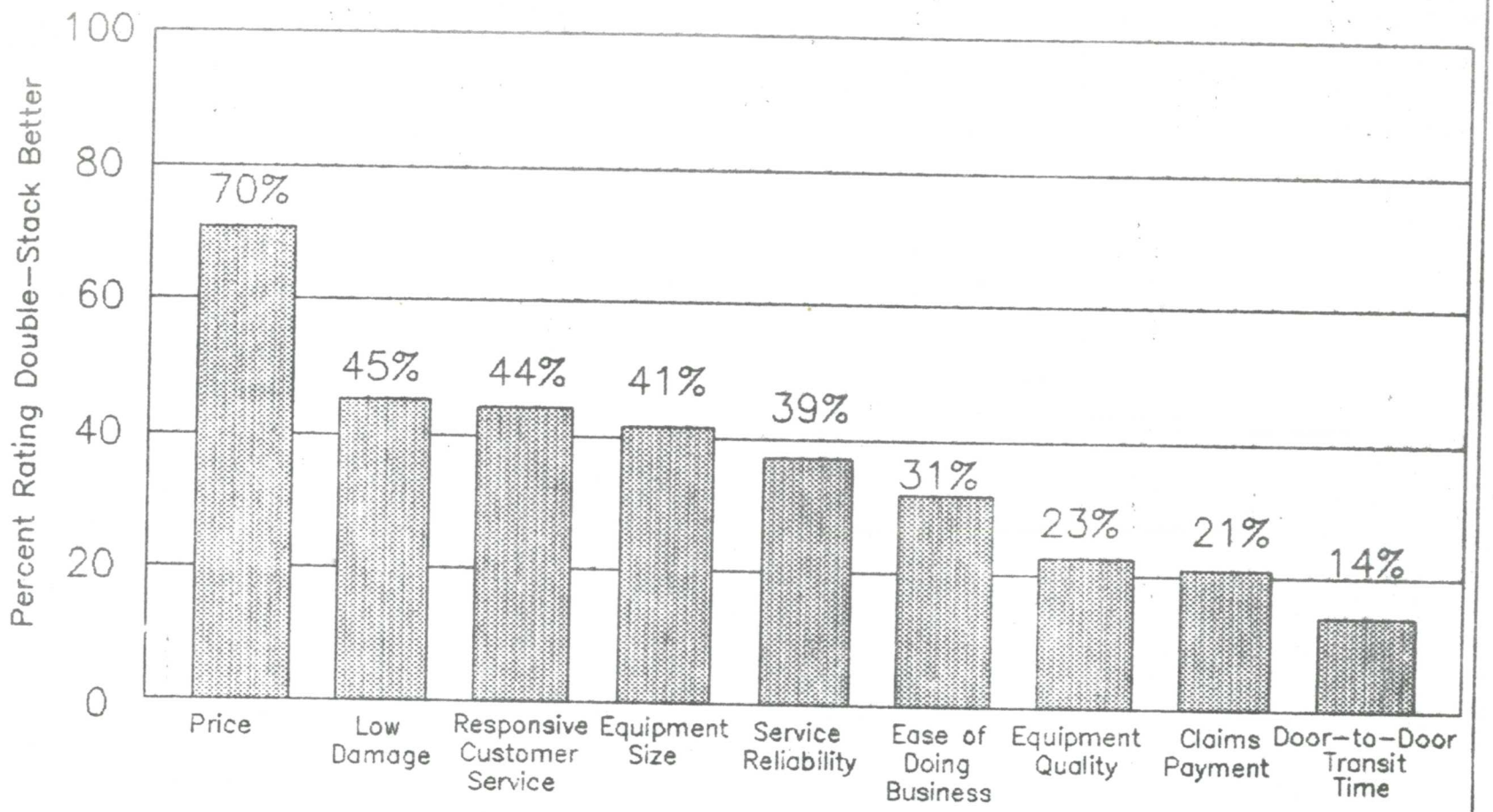


Figure III-6: Shippers Preferring Double-Stack to Piggyback

Source: Temple, Barker & Sloane
Traffic Management, June 1989

ble-stack service lies with an enormous number of potential domestic container shippers, whose traffic is unorganized and diffuse. Railroads can justify substantial marketing and sales expenses to pursue major ocean carrier accounts. Few domestic accounts, other than UPS and the largest third parties, could justify the same level of effort, especially when railroads are trying to minimize overhead. Who will undertake the required marketing effort for domestic double-stacks, and what will it cost?

The experience of firms that have solicited domestic container freight has demonstrated the need for substantial marketing and sales efforts. The locus of these efforts depends on whether the railroads adopt a retail strategy and sell domestic container service directly to shippers, or rely on a wholesale strategy and sell service primarily to shippers' agents, shipper associations, and other third parties. In the first case, the marketing and sales efforts would be supported from railroad revenue; in the second case, they would be supported from agents' commissions or the spread between wholesale and retail rates. In both cases, the price must be paid, and a portion of the retail price must be allocated for sales and marketing. The likely cost of sales and marketing will affect overall profitability and the ability of double-stack services to compete with trucks.

Rail industry sources estimate that a new salesperson costs approximately $28,000 in salary, plus fringe benefits, expenses, etc. The median sales representative is likely to cost around $45,000, plus the same additions. One major third party estimates that it costs $50,000 per year to keep a salesman in the field. Most railroads do not have a clear picture of the cost of a sales call, or the cost to keep and attract an individual account or shipment, but they do know that the total cost is high. While the railroad that adopts a wholesale strategy will reduce its staff, and consolidate and centralize its customer service function, it will still have some marketing costs. And the <u>total</u> marketing cost, whether incurred by the railroads, ocean carriers, or third parties, will still affect the competitiveness of double-stack service.

Direct sales efforts by the railroads have been minimized, and the sales efforts that are made are not highly regarded by potential customers. The TBS shipper survey found that railroad salespeople were consistently rated below third-party salespeople on six attributes (Figure III-7). Both railroad and third-party salespeople were rated below truck sales people. This superior sales effort gives motor carriers an advantage that cannot be attributed to the technology or federal support for highways.

By reducing direct sales efforts and relying more on third parties for marketing and sales, the railroads are relinquishing one means of controlling and improving the intermodal and double-stack market image. As noted earlier, direct sales presentations are a major source of information for non-users. At the same time, railroads are giving up a major source of intermodal market knowledge through customer feedback. Although third-party feedback and market surveys are valuable, the railroads are taking a significant risk in letting those become the principal sources of market information. In particular, there is a risk of confusing easily measured operational attributes (ramp-to-ramp transit times, number of claims filed) with authentic but more elusive customer benefits (reliable door-to-door transit times, prompt claims settlement).

The railroads' existing double-stack marketing strategy was successful in attracting, largely through third parties, price-conscious shippers of dry truckload freight in the major intermodal corridors. What steps must railroads take to penetrate other markets?

Some railroads, notably Santa Fe and Southern Pacific, have recently stepped up international marketing efforts, working directly with foreign consolidators in Asia. Southern Pacific has also taken the opposite direction, marketing to European ocean carriers. Neither effort, however, addresses the domestic market. Norfolk Southern's Triple Crown Roadrailer service is marketed directly to shippers and receivers, as well as to agents. Conrail's Mercury program will likewise involve retail marketing to some extent. Although many railroads market directly

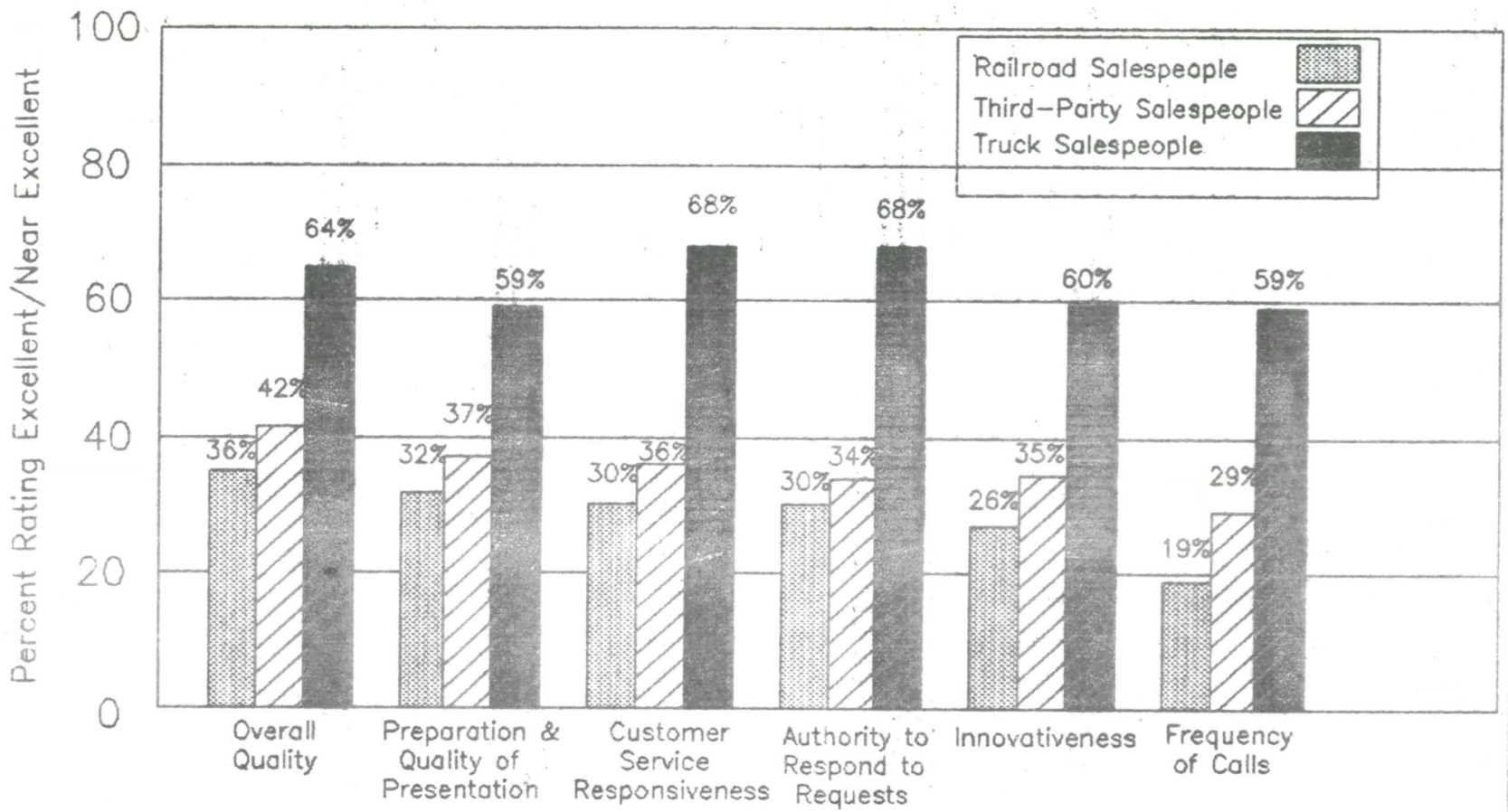


Figure III-7: Shipper Ratings of Intermodal and Truck Salespeople

Source: Temple, Barker & Sloane
Traffic Management, June 1989

to major national accounts such as UPS, domestic retail marketing is otherwise conducted almost exclusively through third parties.

3. The Role of Third Parties

Background. One critical issue is the effect of domestic containerization on the institutional relationship between railroads and third parties. Over the last decade, railroads have increasingly relied on third parties such as shippers' agents, brokers, and shipper associations as their primary intermodal customers. The railroads have effectively been selling services wholesale. Only the very largest intermodal shippers, such as UPS or major retail chains, deal directly with the railroads to any appreciable extent. Will large-scale domestic double-stack service lead to a general reversal of the trend toward third-party marketing? Probably not. The railroads no longer have large intermodal sales forces, and their geographical coverage is limited. The railroads have allowed, and even encouraged, the third parties to become dominant.

Third parties are, for the most part, freight forwarders, consolidators, shipper associations, shippers' agents, and licensed property brokers. The ocean carrier subsidiaries are a new generation of third parties. Each has a somewhat different role, but all serve as middlemen between the shipper and the railroad.

When the early trailers and containers appeared on the scene, freight forwarders and consolidators became the prime railroad customers for LTL (less than trailerload) or LCL (less than containerload) freight. They offered service only between their own facilities, which were usually located adjacent to rail yards or a spur line, and shipped almost exclusively on the railroads, with the origin pick-up and drayage to the forwarder's dock being performed by the shipper's truck or by a local trucking company paid by the shipper. The delivery at destination was reversed, using the consignee's truck or local trucking. One major function of freight forwarders was "marrying" two trailers for the same destination, or a light trailer with a heavy trailer, to take advantage

of carload rates. Today, freight forwarders and consolidators operate in all modes and offer extensive door-to-door service.

The growth of shipper associations was made possible by TOFC/COFC deregulation, permission for shipper associations to use contract carriers, and a 1981 ICC ruling that allowed shipper associations to use representatives to advertise and otherwise promote the advantages of membership. Shipper associations as we know them today are an expansion of the idea of shippers combining their shipments to obtain lower volume rates. Originally, an association's membership was comprised of shippers in the same industry, e.g. electronics, wearing apparel, or fresh produce. Later, other associations were formed on an industry basis without requiring members to ship the same products, e.g., manufacturers' associations, aerospace industries, and general merchandise shippers.

Regardless of the commonality of what is being shipped through a shipper association, the important factor is that the members ship from the same origins and to the same destinations. The association selects the routing, carriers, and shipping points. As nonprofit organizations, shipper associations own no transportation equipment and maintain small operating staffs. All these factors make it possible for the associations to offer their members rate discounts of up to 20 percent from what the member would pay if he shipped independently.

Shippers' agents increased in numbers in the early 1980's as a direct result of deregulation. Intermodal traffic is the main focus of most shippers' agents activity. As deregulation of railroad piggyback rates became effective, the shippers' agent was in a position to take advantage of multi-container and minimum quantity rail rates -- buying wholesale and selling retail to the shippers. The agent arranges a variety of services for its customers, including pickup, delivery, linehaul, and notification of goods arrival. An agent also may provide the customer with a single monthly billing for all transportation services, sometimes at better credit terms than the customer could receive from the carriers.

In the earlier years of marine containerization, the agents' ability to use empty marine containers to move domestic freight helped solve a major repositioning problem for the ocean carriers. But as the railroads responded more to deregulation, they set a new, lower level of rates for this service. They also lowered the minimum volume for multi-container moves, and were thus able to offer direct service to the smaller volume customer, particularly the smaller volume ocean carrier. As a result, the railroads cut into the shippers' agent market.

The licensed property brokers, commonly known as transportation brokers, have been one of the fastest growing segments on the intermodal scene. There were only a few licensed brokers before the Motor Carrier Act of 1980. By 1983 there were approximately 4,000, and today there are over 8,000. Licensed by the ICC, the brokers perform a variety of services that overlap those of the freight forwarder and the shippers' agent. A distinct difference is that the forwarder assumes liability and responsibility for the intermodal move, while the shippers' agent or broker lets the shippers and carriers work out liability among themselves. The rapid increase in the number of transportation brokers has increased the likelihood that some may be unqualified. Poor services from unqualified brokers would hurt the reputation of intermodal transportation in general, especially when the unqualified brokers blame other parties.

It has become apparent to carriers, shippers, warehousemen and others that brokers were beginning to control a great deal of freight. Many have established their own broker subsidiaries, and some have bought large brokers. Xerox and West Point Pepperell are among the large shippers who are also licensed brokers. Ryder System purchased one of the largest transportation brokers, Robert Walters.

Role of Third Parties in Domestic Containerization. The various types of third parties have had a dramatic effect on domestic containerization in the U.S. Much of their success has been due to their ability to make the intermodal concept work more effectively than the rail carriers could. In 1988, Inbound Logistics magazine published a reader survey and concluded that "third party service providers heavily influence at least

half of transportation buying decisions for almost one-fifth of the freight buyers." For domestic shipments, the survey found that "14.5% use third parties for 76% or more of domestic moves." Third party participation, however, is by no means universal: by 1990 "48.4% will still resist using third parties for even 10% of their shipments."

In the early days of containerization, the railroads would reposition the containers for the ocean carriers at little or no charge. But as the numbers of containers increased and the railroads assessed higher charges after deregulation, the ocean carriers' repositioning costs escalated. This escalation created an opportunity for the third party: the ocean carrier could reduce repositioning costs drastically if the container could be used to move domestic freight on the backhaul. The third party would generate the business, rent the container from the ocean carrier at an inland point, and deliver the container back to the ocean carrier at the port. In some cases, third parties have also moved smaller ocean carriers' loaded inbound containers by rail based on volume car rates, and completed the cycle with the repositioning.

Third parties taking advantage of deregulation entered into agreements with the rail carriers and the ocean carriers to use the ocean containers to move domestic cargoes back to port cities. This intermediation between rail and ocean carriers by third parties led to further expansion of the railroads' TOFC and COFC business. Third parties were later able to contract directly with the railroads for volume container moves of marine containers from ports of entry to inland destinations.

The successful third party operators learned a long time ago that it was necessary to provide a product that was acceptable to their customers as well as to the rail and ocean carriers. That end product was a loaded container delivered to and retrieved from the carrier. The organization and infrastructure necessary to produce this simple product, however, continued to expand to the point where third party companies made tremendous inroads with the carriers' own customers. The infrastructure of third parties now successfully covers the broad range of activity normally associated with major transportation companies.

Supplying containers, drayage, and terminal facilities were about all that was necessary not too many years ago. But with the growing importance of the need for management information and rapid communications, third parties expanded their service into those areas as well. A major user of a third party's service can connect with the third party's computer system to obtain up-to-date information regarding freight movements, including estimated arrival times, delivery times, delay information, equipment availability, and billing. It is even possible for the user to obtain from the third party a complete recap of all shipments for a specified period of time. Providing this type of an information interface places the third parties in a strong position with the shipping community, since railroads have only recently begun offering comparable services.

The third parties have taken on the full management obligations for door-to-door service. Starting with the pickup at the shipper's door, the third party provides the container (or a truck to handle the less-than-container shipments), and monitors the service. The shipment may be moved to a terminal for transloading from a truck or trailer into an ocean container, or moved directly to the rail yard. To this point, all the labor involved has been for the account of the shipper (loading the container or pickup vehicle) and the third party (terminal handling, drayage, etc.). On the other end of the rail movement, the third party retrieves the container at the rail terminal and delivers the loaded container either to the consignee, or to the third party's destination terminal where it is broken down and the individual consignments delivered to the consignees. Every segment other than the rail line-haul, but including obtaining the empty container to be loaded and the return of the empty container to the ocean carrier, has been managed by the third party. Third parties have even "guaranteed" services that underlying carriers have not.

Third parties, like other intermodal players, have room for improvement in their own operations. There is a wide range of third parties, from industry leaders such as Hub City, GST Corp, and American President Distribution Services, to much smaller firms with specialized, local

traffic bases. The degree of sophistication and commitment to intermodal service quality varies. Third parties that have not computerized, cannot use EDI, and do not have contractual arrangements with the underlying carriers may account for a significant part of the service quality problems the intermodal industry faces. Uneven performance by both third parties and railroads too often results in finger pointing rather than constructive efforts at resolution.

Truckload and containerload transportation is a buyer's market. Third parties that want to grow faster than intermodal transportation itself has grown have been adding truck brokerage and cargo insurance to their activities to offer their customers a full range of competitive options. Management of third party companies has been strengthened to the point where major third parties are now effective marketing and operational organizations. Computerization, improved handling methods and better terminal facilities are now the norm rather than the exception.

Competitive or Cooperative? The issue of third party competition with carriers has been debated for as long as third parties have been working between shippers and carriers, and it will never be resolved to everyone's satisfaction. Third parties compete for domestic freight both among themselves and with railroads and ocean carriers who solicit freight directly from shippers. The cooperation between third parties and the railroads seems complete in those markets where the railroad has not marketed its intermodal service with much success and the third party business is both large and profitable.

The future of third parties in domestic containerization thus will be contingent upon the approach taken by the railroads to develop intermodal service. If the railroads elect to develop and maintain a strong intermodal marketing approach under their complete control, there could be difficult times ahead for the third parties. The larger question is whether the railroads can build and maintain such a service, and whether they can maintain an adequate return on the required investment.

In 1987, piggyback and container freight accounted for almost 20 percent of all rail carloads. Third parties played a major role in this market, but they played a larger role in moving freight via motor carriers. If the intermodal growth does have to come from the highways, third parties have to be a strong factor in the railroads' market planning. This may be difficult to promote if highway carriage offers higher returns to third parties.

To a degree, some large third parties who control truck traffic are beginning to take advantage of intermodalism by using motor carriers who are moving their trailers via rail between major cities. Carriers such as Consolidated Freightways and Roadway have found that railing trailers between some point pairs is economical and provides a satisfactory overall service. As this practice grows among the motor carriers, the third parties' position may be further enhanced: they are uniquely situated as competitors and cooperators of both the railroads and the motor carriers, and the movement of trailers by rail offers third parties an additional service to sell.

The third parties who structure their service to meet the demands of the shipper will be a major participant in domestic containerization. But the third parties will also have to have a strong marketing program to direct volume from the motor carrier industry to domestic containerization. Marketing of this type of service does not start and stop with the domestic shippers. Even before the service could be marketed to the shipper, the idea has to be accepted by the three entities necessary to make the service viable: the railroads, the truckers, and the steamship companies.

If a railroad is to be a wholesaler rather than a retailer, the role of the third party becomes central to the success of that railroad's intermodal program -- so much so, that the railroad may consider establishing or acquiring a third party, such as APC did a few years ago. UP has deliberately let API and its other multimodal customers do most of the intermodal marketing. While shifting marketing, administration and control of the freight away from the railroad, UP has been protected by a

long-term agreement which helps to assure loyalty and usage of their intermodal network. Santa Fe has elected to handle direct contact with United Parcel Service, the U.S. Postal Service, and the ocean carriers with their own sales effort, but Santa Fe relies heavily on third parties for the balance of their intermodal traffic.

Some railroads are formalizing their relationships with third parties. CSL has identified a core group of 22 third parties with which it expects to do most of its domestic business. BN America has similarly identified a group of 15 preferred third parties for its domestic container service, and provides them with management information, including dwell times at hubs, drayage pickup times, etc. Conrail found that 35 percent of its intermodal business is generated by a network of 80 third-party firms with whom it has contracted relationships; Conrail has issued a brochure describing the services offered by these firms.

For many years, the railroads' relationship with third parties was simple: the railroads issued price sheets and expected third parties to sell the service. Railroads have begun to talk of partnerships. The growing sophistication of third parties and the increasingly formal relationship with the railroads has led to a few pioneering three-party service agreements between a railroad, an agent, and a shipper. One example is a recent 5-year agreement involving Hub City and Nabisco, including guaranteed rate and service levels, and management reports for the shipper.

Third parties will remain a strong influence in domestic transportation, including domestic containerization. Many shippers are not convinced that dealing with a single railroad or ocean carrier produces the best price/service packages available. On the other hand, there are still a lot of shippers that prefer to deal directly with the railroad for service, price, performance, etc. Each railroad will create a marketing strategy for dealing with both shippers and third parties; few will go all one way or the other.

F. PROSPECTS FOR INDUSTRY-WIDE CONVERSION

Three closely related questions have to be addressed in any consideration of industry-wide conversion of rail intermodal traffic to containers:

- Is it probable that existing market forces will bring about a large-scale network of domestic double-stack operations?
- If so, would some facilitation effort smooth the way or create a better system?
- If not, is some coordinating or policy-making effort required to create a domestic double-stack system?

The progress of domestic containerization thus far and the history of maritime containerization, suggest that market forces will indeed achieve a substantial degree of domestic containerization.

The key factors are the incentives leading the various segments of the intermodal industry -- railroads, ocean carriers, motor carriers, draymen, third parties, and leasing companies -- to pursue individual domestic container strategies. If those incentives lead the various parties to pursue complementary and convergent strategies, there will be little or no need for coordinating mechanisms. Should those strategies diverge, or fail in the marketplace, the individual network segments will tend to suboptimize, and domestic container services will fall short of their potential without some effort to alter the incentives or override the divergent strategies. The form of the required coordinating mechanisms, if any, will depend on the nature and extent of the divergence.

1. The Trailer-to-Container Conversion

There has been considerable speculation regarding the extent to which intermodal trailer traffic will be converted to domestic containers, and the time required for such a conversion. There are several key factors in the trailer conversion issue:

- the extent to which some of the largest intermodal customers are willing to convert to containers;
- the relative ability of double-stacks and piggyback to compete in short-haul and niche markets;
- the prospects for replacement or retirement of the existing piggyback trailer fleet;
- the ability of refrigerated domestic containers to compete with refrigerated trailers for perishable commodities; and
- the lifetime of the current piggyback railcar fleet.

Current data suggest that the conversion of intermodal trailers to containers is proceeding slowly. Over the first 36 weeks of 1989, piggyback trailer ton-miles were down by 1.2 percent compared to 1988, and container ton-miles were up by 9.6 percent. Piggyback trailers, however, accounted for 60 percent of the total, and at the present rate of change trailers would still account for 48 percent after five years.

Less-than-truckload (LTL) motor carriers are emerging as a significant source of domestic intermodal traffic, and their operations rely on piggyback trailers. They will be hesitant to convert to containers unless the containers served a distinct market niche. The 28-foot trailers LTL carriers use do not readily convert to any existing container size, but they can be accommodated on "RTTX" TOFC flatcars (notably in SP's Triple Trax service).

Some major intermodal customers, notably, United Parcel Service (UPS) and the U.S. Postal Service, used intermodal trailers almost exclusively until very recently. APC's Chicago-Dallas domestic container route has attracted some UPS and Postal Service traffic. That traffic is still a tiny part of the amount that still moves by piggyback trailer, yet the provision of daily double-stack service on more and more routes will encourage UPS, the Postal Service, and other demanding customers to consider double-stack containers elsewhere.

It is possible, even likely, that there will remain some short-haul or niche markets where piggyback service will be more competitive than dou-

ble-stacks. The Florida East Coast route between Jacksonville and Miami is a prime example. Truckers turn over Miami-bound trailers to FEC at Jacksonville because there is little or no backhaul freight from Miami and the empty return is cheaper by rail. For all practical purposes, FEC's Jacksonville yard serves as the trucker's terminal, with FEC making the final delivery to Miami. That service would not be feasible with double-stacks because the rail movement is just one part of a longer highway movement.

The existing piggyback trailer fleet is many times larger than the existing domestic container fleet. Replacements have not kept pace with retirements in recent years, however, so the intermodal trailer fleet has been aging and shrinking. The result is that a substantial portion of the intermodal trailer fleet is at or near the end of its expected life. Absent more extensive replacement or refurbishment programs, the piggyback fleet will begin to decline rapidly within the next few years, speeding the conversion to containers. Some observers have expressed concern that the lack of replacements will keep older TOFC trailers active too long, exacerbating the intermodal image problem. Some major leasing companies have announced substantial purchasing or refurbishing programs for 1989, but the TOFC trailer fleet will probably continue to shrink overall.

Refrigerated piggyback trailers have a very small market share in perishable commodities. Their use has not significantly stemmed the tide of diversion from rail to truck, but refrigerated piggyback trailers have captured some of the perishables previously handled in refrigerated boxcars. Until refrigerated container service is well established and accepted by shippers of perishables, this traffic segment will stay in piggyback trailers.

Some in the intermodal field believe that massive piggyback trailer retirements and the superior performance of double-stacks will virtually eliminate intermodal trailers within 5-10 years. The mitigating factors discussed above, however, suggest that trailers will still be an important part of the intermodal business through most of the 1990's. If

intermodal trailers are not replaced and refrigerated domestic containers are successful, the conversion will be hastened and might be largely complete within the 10-year time frame.

The piggyback car fleet is also substantial, but diminishing. Many of Trailer Trains all-purpose TOFC/COFC flatcars have been refurbished and rebuilt within the last five years, and older equipment retired or converted to other uses. This fleet, as well as the piggyback cars owned by the railroads themselves, will be a source of readily available and depreciated equipment until the cars reach the end of their useful life, which will be another 10 years or more for newly reconditioned cars.

While the operating costs may be higher, handling containers and trailers on intermodal flatcars or spine cars may still be a viable option for some low-volume corridors. Each major railroad has intermodal service that includes both trailers and containers, and many railroads will maintain cars that can carry trailers as well as containers. Even American President Distribution Services reportedly still moves much of its traffic in intermodal trailers or containers on chassis. This equipment flexibility will allow the railroads to retain the residual TOFC business and continue to serve all their customers' needs.

Three of the four major western railroads are pursuing large-scale conversion of TOFC traffic to domestic containers. UP has announced that premium TOFC operations will be phased out in favor of double-stack service marketed by API or UP's other major customers; UP will keep TOFC only as a supplement to double-stacks, primarily for specific customers (such as UPS) with intermodal trailer requirements. BN has established BN America, with the long-term goal of replacing TOFC service with double-stacks on the BN system and beyond. SP is emphasizing domestic containers in its marketing strategy, in partnership with ocean carrier, multimodal, and third-party customers. SP may have started a small counter-trend by introducing "Triple Trax" service for triple 28-foot trailers between Portland and Los Angeles, a distance of some 1200 miles, but there are a limited number of such specialized niches. Santa Fe has a sustained commitment to piggyback trailer service, but is phasing out

conventional flatcars in favor of articulated trailer cars and has purchased both domestic containers and double-stack cars.

Among the major eastern railroads, Conrail and CSX foresee intermodal trailer traffic continuing to be a significant part of their business well into the future. Conrail generally has shorter on-line hauls than the western railroads, and it has a long-term working relationship with Santa Fe on transcontinental traffic. CSX (and CSL Intermodal) has publically proclaimed its support of TOFC traffic, and it is one of the few railroads to have invested in intermodal trailers recently. Norfolk Southern, on the other hand, appears to see its future in double-stack and RoadRailer service.

In summary, it appears that TOFC services will still be offered for some time. They are most likely to persist where major trailer shippers (such as UPS) require premium service, and in those shorter, less-dense corridors where RoadRailer services do not emerge.

2. RoadRailer Operations.

At present, predicting the future of RoadRailer or other carless operations is chancey, even impossible. Of several RoadRailer operations that were started, only one survives: Norfolk Southern's Triple Crown Service. That operation, however, is more extensive than all the previous efforts combined, and is still expanding. Moreover, Norfolk Southern reports Triple Crown's profitability has improved.

Whether or not RoadRailer or carless services endure, it is unlikely that they will ever serve as "feeders" to a double-stack network. One of the major advantages of carless technology is the low cost of terminals and terminal operations. This advantage would be offset, if not eliminated, were a container on RoadRailer chassis transferred to a double-stack car. Although RoadRailers may be more effective than double-stack trains at penetrating shorter hauls, once the RoadRailers are on the rails there is little or no point in incurring additional costs and delays by transferring their loads to double-stacks for a longer haul, especially since

transfer costs and delays are a major intermodal handicap in competition with trucks. Moreover, the use of RoadRailers as a feeder would be likely to introduce additional circuitry, already identified as a significant constraint on the ability of railroads to compete with trucks.

The Trailer Railer system in use by the Iowa Interstate Railroad is not technically a carless system like RoadRailers. Yet it has some of the same advantages, namely a reduced need for expensive terminals or terminal equipment. As a feeder system for double-stacks, however, it would face the same obstacles: the need for a third transfer, and the added circuitry and delay.

Any combined carless and double-stack operations are more likely to consist of adding carless equipment to stack trains, following BN's current experiments with compatible hitches. BN sees this as a possible means of serving shorter, less dense corridors.

3. Intermodal Functions.

The functions that must be performed in intermodal transportation have not changed with the introduction of double-stacks. In the long run, the potential customer will judge the attractiveness of intermodal transportation -- double-stack or other -- according to how well those functions are performed, regardless of who performs them.

The intermodal market will not tolerate mediocrity. Each participant must determine which functions it can perform efficiently, competitively, and profitably. Functions that cannot be performed efficiently will be neither competitive nor profitable, and the provider is unlikely to endure in that function. The better alternative is cooperation with efficient providers of that function, even if with sometime competitors.

It is not necessary, and it may not always be desirable, for one firm to perform every function. The crucial point is that each firm must be a part of a chain of firms, or a succession of partnerships, that performs

all the functions efficiently, competitively, and profitably. Such arrangements have been termed "strategic partnerships" to denote the need for a long-term, structured relationship in pursuit of a common goal. The relationship between API and UP, in which API is assuming much of the responsibility for marketing the intermodal line-hauls performed by UP, is one example of a strategic partnership.

Some participants, especially the railroads and ocean carriers, may have to form multiple strategic partnerships to serve different markets. For example, Santa Fe has a long-standing working relationship with Conrail for piggyback service between Los Angeles and New York. But Conrail also handles API's double-stack business in the same corridor in conjunction with UP and CNW, and Santa Fe recently entered a voluntary coordination agreement with BN for service between Los Angeles and Memphis.

Some other participants may not choose to form partnerships because their role is best performed as a neutral provider of services to all. Equipment manufacturers and leasing companies, for example, are not likely to restrict their potential market by working more closely with some customers than with others. Terminal operating contractors may successfully serve carriers that compete with one another; some contractors already do so.

The success of these strategic partnerships will rest largely on the effectiveness of coordination and communication. The need for coordination in intermodal operations is obvious, as coordination is imperative for efficiency and reliability. The need for coordination in marketing, contract terms, and customer service is less obvious, but just as crucial if the resulting product is to appear "seamless" to the customers. Disputes among the partners on claims resolution, customer billing, rate making, or shipment tracing will quickly and permanently alienate customers who can obtain superior service from other intermodal operators -- or from truckers.

If coordination of the functions and high day-to-day service quality are to be sustained, as they must be, good communications are a must. With

the myriad of new technologies for voice contacts, written messages, and computerized data sharing, customers will not accept excuses for delayed, lost, or inadequate communications. Communications with and between intermodal partners are absolutely essential for responsiveness. Motor carriers, most of whose communications are internal and straightforward, set a high standard of responsiveness that must be met, or at least approached, by domestic double-stack operators.

4. Emergence of an Intermodal Industry.

From one perspective, organization of the intermodal marketplace has become confusing and complex. There is no longer a single, well-defined railroad role. Ocean carrier roles are just as diverse, and range far inland from the ship. Ports have undergone a radical change in their scope of action, and find themselves involved in everything from computers to railroad tunnels. The firms involved range from small shipper agents and local draymen to major ocean carriers, railroads, third parties, and multimodals. Even within categories, there are vast differences: no two major railroads are organized quite alike, and the same can be said of ocean carriers and their subsidiaries.

Roles overlap, and any given function might be performed by two or more different participants. Drayage, for example, might be performed by a contract drayman, a railroad subsidiary, or a multimodal subsidiary. Thus far, the only immutable functions have been the rail and ocean line-hauls, performed strictly by railroads and steamship lines. Even those functions may be subject to organizational change with the further growth of multi-modals.

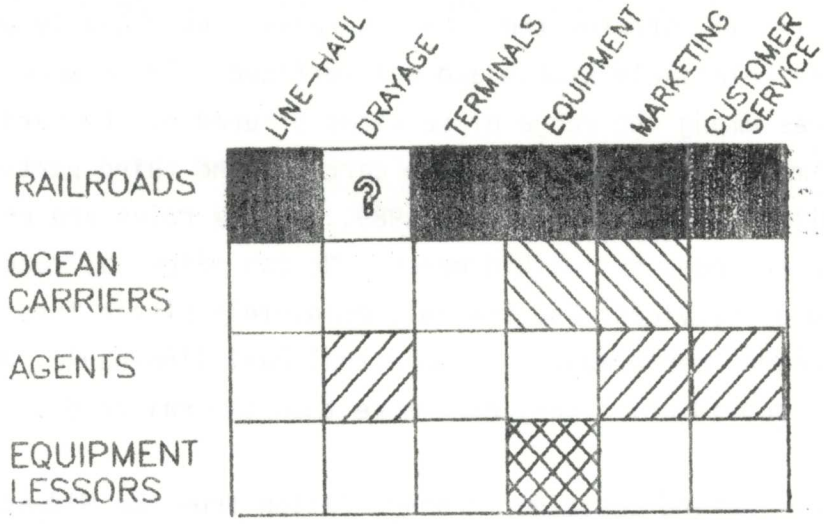
The sharp distinction between carriers and third parties is disappearing, as carriers take on functions previously reserved for shipper agents, consolidators, and others. Third parties, in turn, have assumed some functions previously reserved for carriers, such as terminal operations and equipment supply. Although confusing to the analyst, improved coordination within organizations and increased competition between organizations should ultimately benefit the customer.

Figure III-8 illustrates the changing roles. As recently as 1980, the roles were relatively stable and well-defined. There were only small differences among the range of services offered by the various railroads, and the "menus" of competing ocean carriers and third parties were likewise similar to one another. In 1989, all the roles are changing, not only between modes but within modes. No two major railroads offer the same menu of services, and the only completely stable function has been the railroads' performance of the actual rail line-haul. Ocean carriers and their subsidiaries vary even more than the railroads.

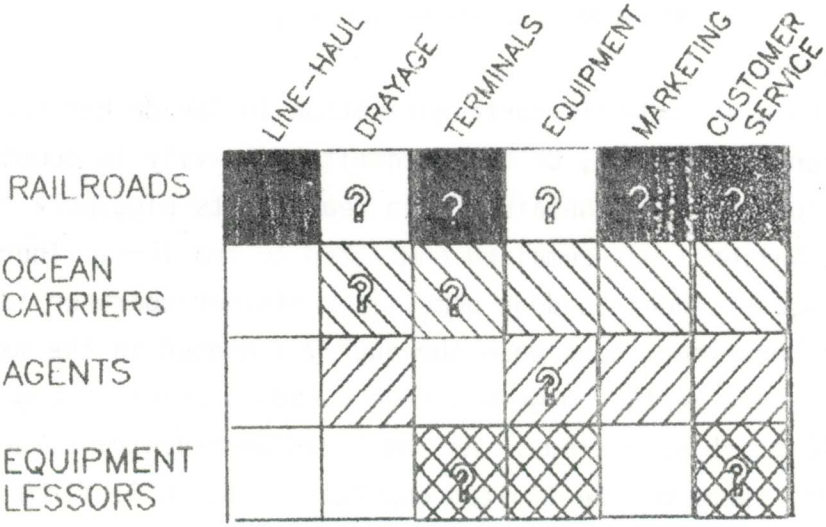
A customer seeking container transportation from the Midwest to Los Angeles, for example, already can choose between API, CSL, Centennial Express, Rail-Bridge, ESI, and any number of third parties. As a consequence, a potential domestic or international container shipper might receive sales calls from a variety of different parties, each selling some or all of the same underlying services.

Experience with domestic containerization in Canada has been different. One nationwide carrier, CP Rail, committed heavily to domestic container service (using 44'3" containers) to replace its piggyback system, while Canadian National has remained committed to trailers. There is thus one coast-to-coast, door-to-door domestic container operator in Canada, and domestic containers have been thoroughly accepted in the marketplace. Only in recent months, however, have Canadian carriers begun to commit to double-stack operations. As the Canadian industry structure is so different, there may be limited opportunity for U.S. firms to learn from the Canadian experience.

Despite the progress made thus far, both international and domestic double-stack services remain limited by fragmentation. The TBS survey found that 40 percent of intermodal users, and 43 percent of non-users, cited fragmentation as a major reason for not using intermodal transportation more, or not using it at all.



1980 - Static Roles



1989 - Changing Roles

Figure III-8
Changing Intermodal Roles

Fragmentation handicaps:

- o the intermodal service manager seeking to provide the best possible service at the lowest possible cost;
- o the operating or marketing officer seeking to optimize his own efforts and maximize his contribution to the whole;
- o and, most importantly, the international or domestic customer seeking efficient, high-quality door-to-door service.

With fragmented responsibility, any one participant in a movement can disrupt it, and no single participant can insure door-to-door performance.

Double-stack transportation has developed, and continues to develop, despite its fragmentation. But double-stack transportation cannot attain its ultimate potential unless the necessary functions are successfully integrated in the eyes of the customer. "Brand name" double-stack transportation has yet to emerge. "One-stop shipping" is still more a concept than a practice, although some multi-modal companies come close.

From a purely intermodal perspective, however, these developments make sense, and they are part of a single trend: the emergence of an intermodal industry. Intermodal transportation, with double-stack service as its most prominent manifestation, is becoming an industry within an industry. In railroads, ocean carriers, and ports, intermodal transportation is being recognized as a separate, specialized line of business. Double-stack container transportation is the most vivid illustration, since in involves different equipment, functions, and participants than piggyback or carless technologies.

Figure III-9 illustrates this point. Each of the participating groups, by one strategy or another, is distinguishing a subset of its activities involved in intermodal transportation. These subsets may just be departments or individual employees, or they may be organized as business groups or subsidiaries.

Multimodal companies are emerging as major players -- not only as operators of "one-stop" services, but as multi-function service providers to

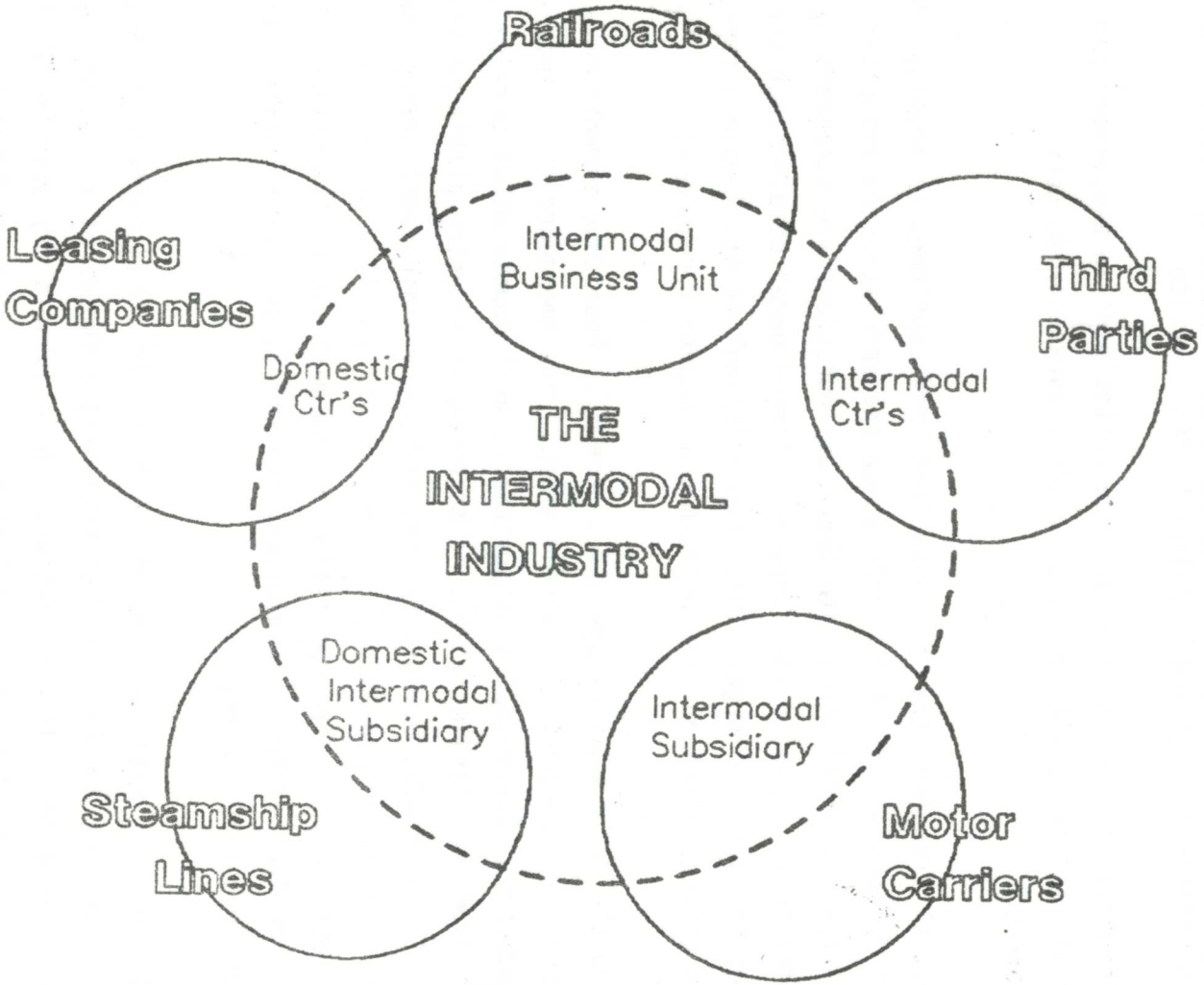


Figure III-9

The Emerging Intermodal Industry

other participants and to each other. APDS is already one of CSL's largest customers, and CSL is a major customer of SP's new combined intermodal department. Intermodal business groups may have more in common and more need to communicate with other intermodal business groups than with their parent organizations. Relationships between intermodal business groups and parent organizations are likely to involve capital allocation, financing, budgeting, and planning. Relationships among different intermodal business groups are more likely to involve day-to-day operations, changing market conditions, short-term leases, or contract negotiations. Increasingly, double-stack customers will be dealing with the "intermodal industry," not with the parent organization.

5. Competitive Pressure and Product Differentiation.

Every historical and current development points toward increased competitive pressures on intermodal transportation in general, and on double-stacks in specific. The pressure has made it increasingly difficult for carriers or third parties to prosper by merely providing generic double-stack transportation or double-stack equipment.

As in other fields ranging from automobiles to computers, today's innovation quickly becomes tomorrow's minimum standard. This is certainly true of rates, where ocean carrier marketing of westbound container backhauls has reportedly eroded TOFC and truckload rates from the Midwest to the West Coast. This is equally true of service, where the reduced transit times and gentler handling on double-stack trains have set new standards for both TOFC and truck movements.

The discretionary nature of international container flows, the ease with which intermodal traffic can be shifted between carriers, and the deregulated environment have all broadened competition for potential double-stack traffic. All four major western railroads can compete for the same international traffic, and much of the same domestic traffic. The three major eastern railroads are in similarly close competition. There is effective competition between third party shippers; between third parties and railroads; between third parties, railroads, and ocean carriers; and between multi-modals and everyone else -- and each intermodal operator

must still compete with truckers, some of which now have intermodal divisions.

In such an environment, unadorned linehaul double-stack transportation becomes a commodity, and it can achieve only the low unit revenues and profits typical of price-sensitive commodities. The same observation applies to the supply of double-stack cars, containers, and chassis, all of which have become undifferentiated commodities.

The physical elements of double-stack operations are relatively straightforward, and the intermodal industry has expertise in all categories: cars, containers, trailers, chassis, tractors, ramps, and lift equipment. The nexus of the problem is how to organize the operation to provide a flexible, differentiated, and profitable intermodal product. There may be more than one way to conceive a differentiated product, more than one approach to a profitable package, and more than one end result. It is not necessary to determine a single, optimal mix of services: the optimal mix will vary with different circumstances. It <u>is</u> necessary to focus on long-term profitability, and to adjust the mix of services to match.

If the customer is renting carrier capital and labor, but managing the operation himself, all the carrier can expect is a return on capital and labor. That return will be limited by the willingness of other parties to provide their identical capital and labor for a lower return. If railroads merely compete on rates for identical, bare-bones services, they are essentially renting facilities, equipment, and labor to third parties and intermodal operators, and they will earn only the minimal return on capital that such rentals can command.

Profitability is not just an issue for the railroads. Third parties, equipment suppliers, draymen, terminal operators, and other participants also have rate-of-return goals to be met if they are to remain in the intermodal business and expand. Returns for all these participants must come from one door-to-door revenue stream. Dividing the pie is an easier task if the pie is larger to begin with.

So long as each intermodal operator has to compete head-to-head with undifferentiated offerings from others, the only rates the industry will be able to sustain are those that provide the minimum return acceptable to the industry. If there is no reason to prefer one intermodal service over anyone else's service, carriers can only improve profitability by relentless cost cutting, which competitors will be free to match. In the absence of product differentiation, rates will fall to the minimum necessary to keep competing products in business.

6. Value-Added Double-Stack Strategies

The concept of a differentiated intermodal product and a flexible, adaptive system can be approached from the customer's perspective. What should the double-stack product and system look like to existing and potential customers? What network of intermodal services can the customer access? What kinds of customers does the industry want to serve: high-volume shippers, occasional shippers, forwarders, truckers, or ocean carriers? Can a single system present itself as the answer to each of them?

The concept of product differentiation has been applied in many contexts. In this context it should mean that a "commodity" (intermodal transportation) is packaged and delivered in a way that makes it appear different, and more valuable to the purchaser, than a competitor's commodity which is otherwise indistinguishable. "Product differentiation" thus leads to "brand name" transportation. The goal is to offer differentiated incremental services for which the customer is willing to pay an incremental price significantly above the producer's costs.

The obvious implication is a need for what has been called "value-added" transportation. Value-added transportation incorporates any or all of the functions required to complete the door-to-door intermodal package, including some functions that were traditionally performed by shippers. Customers are willing to pay higher rates to carriers who accept risks, or closely manage the movement on the customer's behalf. Customers are

not willing to pay higher rates if they must perform such functions themselves.

A cautionary note is in order: what the intermodal industry terms "value-added" transportation may still fall short of the overall service standard set by truckload motor carriers. From the shipper perspective, current intermodal service would be better termed a "no-frills" option, requiring shippers to supply part of the transportation package -- hence their expectations of a price discount.

Any railroad that wants to stay in the intermodal market should be prepared to offer, and integrate, a diverse mix of equipment, services, and rates to meet the needs of the marketplace. It is not necessary to debate the pros and cons of domestic containerization, or of other new services. Ocean carriers are already in domestic containerization and will be increasing their position, both as a by-product of expanding international operations and as an operation in its own right. TOFC services will remain for some years to come. RoadRailers have carved a niche in service to the automotive industry that may grow to encompass other niches. The future is likely to bring more variations in equipment, train operations, rate and service packages, and intermodal operations.

Having one intermodal system for ocean carriers, another for domestic containers, a third for trailers, and a fourth for RoadRailers, would make it hard for any railroad to manage intermodal operations, hard for clients with multiple needs to use that railroad, and hard for that railroad to make a profit. Rather, the industry should aim for one, flexible, robust system that can handle multiple customer needs. Ideally, the system would be able to take whatever the customer provides and add or contract for whatever is needed to make a complete package, for which the industry can command a profitable price.

UPS Air Cargo Service is a useful example. UPS takes only full air cargo containers on an airport-to-airport basis (as opposed to UPS Air Package Service). But, if the customer has less than a full container, UPS will

find a forwarder. If the customer's dock is too small for a container, UPS will find a container stuffer. If the customer needs pickup and delivery at either end, UPS will find a local drayman. So even though UPS does not itself provide "full service" air cargo, it can assemble the other pieces so the client can use UPS.

Just as an intermodal service strategy goes beyond running trains, an assessment of the intermodal industry's current capabilities goes beyond physical equipment, facilities, and other capital investments. Management structures, communications systems, and sales forces are obvious resources. The working relationships between participants -- connecting railroads, steamship lines, ports, long-haul motor carriers, third parties, equipment suppliers, and local truckers -- are less obvious but equally crucial.

The intermodal industry can expand vertically by providing additional services to its existing customers. It can also expand horizontally by serving new customers. Horizontal expansion involves identifying new markets, customer groups, or traffic types that double-stack systems could serve profitably. The demands of those new customers can then be compared to existing resources and capabilities. If some investment or commitment is required -- leasing equipment, adding to the sales force, buying a freight forwarder -- the incremental cost and risk can be weighed against the expected volume and profit.

Rail intermodal services have often been reactionary, responding to customer initiatives rather than pursuing new markets. The reactions have often been ad hoc, meeting the needs of a few new customers without building an integrated system. The ability to react is good, but ad hoc reactions are not likely to provide long-term, system-wide solutions.

Fortunately, intermodal systems are built from a small number of basic elements, many of which are multi-purpose. Whenever an investment or organizational development is contemplated, its flexibility and adaptability can be considered within the range of foreseeable futures. Suc-

cessful specialization would require either superhuman predictive powers, or a conscious decision to remain in a relatively small market niche.

Railroads have recently launched several attempts at creating brand-name intermodal services:

- o ATSF's Quality Service Network and Quality Stack Service;
- o BN's Expeditor and BN America;
- o CSL's Frequent Flyer and Select Service;
- o NS's Triple Crown;
- o SP's Trackstar and DRGW's Railblazer; and
- o UP's BulkTainer.

The actual services behind these names vary widely. Some are high-service, short-haul piggyback rains (Quality Service Network, Expeditors, Trackstars, and Railblazers). Others are double-stack services that have been singled out for special promotional attention (Quality Stack Service, Frequent Flyer). Three are door-to-door services (Select Service, Triple Crown, and BulkTainer), but only one includes door-to-door domestic double-stack service (Select Service, combining CSL Intermodal and CMX for drayage). American President has established its own "Red Eagle" door-to-door service using American President Trucking and American President Intermodal.

Railroads have begun to offer the beginnings of value-added services. Conrail's forthcoming Mercury System is expected to yield computer-aided traffic solicitation and dispatching. Conrail also has begun to provide truck-competitive cargo insurance. SP has introduced Container Bridge, a chassis pool and drayage system, in support of its Los Angeles ICTF. BN provides its customers with ShipSmart, a logistics software package. UP has two value-added subsidiaries: UP Logistics and UP Technologies.

CSX has an array of value-added activities that it is attempting to mold into a cohesive network. CSL Technologies offers computer support. CSL

Logistics, based on the activities of CTI Trucking, manages time-sensitive just-in-time auto parts shipments, is planning a hub distribution center for Ford Motor Company, and expects to participate in the management of goods flows including warehousing and distribution. CSX Corp. also has a majority interest in World Trade Services, the developer of a computerized custom broker's network.

Railroads start from a "no frills" or "value-subtracted" position relative to motor carriers, and many of the innovations now being tried simply move railroads closer to the motor carrier standard. Yet such efforts may perform the vital function of germinating genuine service competition among the railroads and their partners.

7. Market Forces and Incentives.

All of the findings indicate that market forces presently at work will lead to the development of an effective double-stack network for international and domestic containers. This network may not be optimal. There are a number of operational and marketing shortcomings and some institutional obstacles that may prevent the railroads from realizing the full potential of double-stack intermodal service. Moreover, until railroads, third parties and intermodal operators begin to offer a differentiated product -- brand-name transportation or value-added services -- they will continue to compete on price and remain highly vulnerable to improvements in truckload economics.

Profitability and traffic incentives exist for the railroads and other participants to form partnerships or strategic alliances in pursuit of higher service quality, improved customer service, and a premium transportation product. We believe the formation of partnerships and alliances will be facilitied by the emergence of the "intermodal industry".

There still exists some areas where the creation of industry standards would hasten progress. Although container sizes are not a major issue, the industry would benefit from early resolution of the ISO "wide body" container controversy (discussed further in Task IV). The industry would

certainly benefit from agreements on standards for Automatic Equipment Identification, Advanced Train Control Systems, and Electronic Data Interchange.

Some physical impediments still exist. The railroads have made substantial progress on removing clearance restrictions, with significant help from state and local government agencies in some areas. The industry itself appears able to maintain adequate terminal capacity and equipment fleets. Urban terminal and port access, rather than rail access, may be a growing problem that cannot be solved from within the intermodal industry.

Every major railroad has innovative programs underway, but no one railroad has yet emerged as an intermodal industry leader across the whole range of issues identified in this report. A recent survey of railroad intermodal executives by Manalytics did identify some intermodal market leaders from the railroad industry's own perspective: Conrail in the East, and Santa Fe and BN in the West. That same survey identified American President as the clear market leader among double-stack operators, and Hub City (followed by GST Corp. and American President Distribution Services) as the third-party market leader.

Customers have reponded well to the individual initiatives of railroads and other intermodal participants, but no one participant has yet combined the best features of each. This may be due in part to the "not invented here" syndrome. Whatever the reason, the intermodal industry as a whole does not yet have a leader to set standards for performance, profitability, and customer service.

The critical railroad issue, if it can be narrowed to one, is institutional: railroad management commitment to intermodal business, specifically double-stacks. The highly competitive market for intermodal transportation will not tolerate mediocrity, and, in the past, railroad operations, marketing, and customer service have been mediocre. Double-stack service started and grew because some ocean carriers were willing to make a commitment and assume some risks. In order for the railroads

to realize the full potential of domestic and international double-stack service, they will have to do the same.