Journal of Transportation Management

Volume 9 | Issue 1 Article 7

4-1-1997

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This paper examines the basic relationships which shippers, carriers, and facility operators have developed in the design and operation of bulk intermodal facilities, or transload terminals. The analysis is based on 349 truck-served transload facilities throughout the United States. The facilities are examined for commodity types being handled and the types of handling equipment being used. The results demonstrate a strong relationship between certain handling procedures and commodity types. Additionally, the size and volume of the facilities are related by commodity types and the number of rail spots. Finally, the specialization or dedication of a large number of facilities to individual commodities is addressed, as well as the basic thoughts on their investment needs to attract suitable customers. The information provided demonstrates that the market is very segmented on the basis of materials being handled, and that many facilities are commodity, and initially customer driven. These findings are important to transload providers in increasing their asset utilization, and also to users that seek efficient and effective transportation alternatives to meet their logistical needs.

IMPORTANCE OF THE ISSUE

Intermodal and multimodal have long involved the combining of ideas already in existence. For example, the container concept dates back to early Roman days. Jack White of the Smithsonian has thoroughly researched the roots of containerization, probing back as far as Circus Maximus in Roman times. His conclusion is that the barrel is the oldest form of containerization, a type of container which is still in use today (White 1988). Early interest in the use of containers - as documented by the Liverpool & Manchester Railroad in 1830 - came about because of the large amount of labor involved with moving bulk materials such as coal and grains. Containerization of commodities enabled the effective movement of freight, and quickly led to further innovations in combining modes to move products. The need for effective transportation still exists today as the marketplace becomes increasingly global. Furthermore, many shippers and carriers are finding that responsive, cost efficient, door-to-door service often involves multimodalism.

The ability to provide different means of transporting a product from origin to destination

has never been more important to industry. The role and nature of transportation is changing as shippers become more sophisticated and involved in the modal choice process. Trends in supply chain management are forcing warehouse managers to rethink their operations in order to find ways to "flow" inventory more efficiently and effectively. Transportation options, such as intermodalism, are an increasingly important component of supply chain strategy (Osswald 1985). While piggyback, trailer-on-flatcar (TOFC), and container-on-flatcar (COFC) have become the predominant way in which intermodalism is operationalized, logistically-linked transportation can involve multiple-modal partners in a movement without a container or other device to define the practice. Transloading involves both the modal change as well as the container change.

As a growing portion of intermodalism, transloading is playing a vital role due to its inherent advantages and characteristics. Previous research examined the operations of a number of southeast transload centers and included interviews with a number of the customers (Jennings 1994). The research findings indicated that transload:

- Provides more economical transportation under certain conditions,
- Allows access to different modes of transportation,
- Creates the ability to attract new or increased volumes of business or new suppliers,
- Provides service flexibility,
- Acts as a temporary warehouse for the product,
- Increases the feasibility and viability for various distribution activities to be contracted out,
- Enables the consolidation of shipments for at least part of the delivery movement, and
- Promotes larger volume movement in some lanes as needed.

TRANSLOAD MARKETING CONCEPTS

Much like the first 50 years of consumer goods manufacturing, the basic strategy of selling transportation in the past involved market aggregation. Using this principle, carriers attempted to appeal to as many potential customers as possible and relied upon high levels of traffic to maintain relatively low prices. Market aggregation is a suitable and appropriate practice only where the total market has few differences in customer needs or desires. The technique is also appropriate where it is operationally difficult to develop distinct products or marketing actions to reach different customer segments. However, few markets, and customers, are actually suitable for such treatment. In theory and concept, the practice of transload is no different.

Many of the companies which provide transload services readily admit that they entered the market almost by accident. A number started as a contractor for a single company and then expanded their services along similar product lines to attract and serve additional customers. As noted by Chris Lofgren, Chief Technology Officer for Schneider National Inc.: "We're more customer-oriented than market oriented, so we tend to get pulled into new markets by our customers. They'll take us to new places and then we build new customers once we're there (Saccomano 1996, p. 40)."

This example demonstrates one of several methods upon which segmentation is based. The categories include:

- Customer needs such as reliability, performance, convenience, and economy;
- Product- or service-related behavior such as amount of usage, purchase predisposition and experience, and purchase influence;

- Person- or firm-related behavior such as being an innovator, early adopter, early majority, late majority, or laggard in their practices; and

- Demographic descriptors such as location and access.

The marketing and investment activities of the transload industry seem to follow these same patterns which are used for "traditional" products and services. Many of the centers examined started as either a "one commodity" or a "one handling device" operation. However, as business matured, many have customized their operations for individual materials and customers, or have decided to only serve a small segment of the market via specialization.

From a shipper's viewpoint, transloading is often used to obtain lower transportation costs through consolidation practices, reaching new carriers or modes, or a combination of both. Additionally, many shippers report that they use transload to avoid asset investment. Therefore, the value in "marketing" transload would be the improvement in return on assets through: (1) increased sales, (2) reduced transportation expenses, and (3) reduction in the level of assets employed.

Many transload facility operators invest based upon a single customer's need, and then try to attract new customers with similar products and handling needs. This practice is an appropriate managerial technique in that investment has already been made in equipment. It is far less expensive to attract the portion of the market which can use the same facilities and equipment as opposed to marketing to customers with different needs, and which would entail additional investments to serve them. In today's business environment of increased competition and value-added service, this alternative for market segmentation appears to be the most logical for a facility operator. The extent to which the transload marketplace models this concept is examined in the following section.

STATISTICAL ANALYSIS OF FACILITIES

The facilities used in this analysis encompass 349 operations located throughout the United States during 1995/1996. These data represent a secondary data source in that the commercial listings for the facilities are published by *Modern Bulk Transporter.* The annual data collection relies on a self-reporting technique through direct advertising and phone solicitation as the primary means for motivating participation. The research staff of the journal uses an active search method to identify as comprehensively as possible the entities that comprise the facility population. The reported information includes items such as address and phone number, the number of rail spots at the facility, types of commodities handled, and the general types of handling equipment and services provided.

The general commodity types include acids, asphalts, dry and liquid chemicals, dry and liquid food products, petroleum products, and plastics. These general types cover a large share of the commodities previously found to be moving via transload, with only raw materials such as ores, stones, and coal; and finished industrial products such as steel shapes and brick not being represented. Of the commodities handled, plastics, dry and liquid chemicals, and dry foods were handled by more than half of the facilities. Asphalt was handled by less than ten percent of the facilities analyzed for this study. Table 1 presents an itemized product breakdown for the reporting facilities.

TABLE 1
Number of Listed Facilities Handling the Various Product Types

PRODUCT TYPE	NUMBER OF FACILITIES REPORTED AS HANDLING	PERCENTAGE OF FAILURES
Acids	121	34.7%
Asphalt	29	8.3
Chemicals (Dry)	236	67.6
Chemicals (Liquid)	200	57.3
Foods (Dry)	183	52.4
Foods (Liquid)	136	39.0
Petroleum Products	137	39.3
Plastics	242	69.3

Equipment and Services

The number of facilities reporting that they handle a product is considered to be representative of the ease of moving each commodity type, as well as the general volumes of each type moving in the industry. For example, the four types reported as handled by more than half of the facilities are heavily dependent upon nationwide consumer and industrial demand, and can be transloaded at many locations with minimal equipment. Several such sites examined in an earlier study indicated that not much more than modal access was necessary as the carrying highway and rail vehicles are often equipped with the needed handling equipment (Jennings 1994).

On the other hand, asphalt is a product seldom handled in such a manner. During a previous case study of transload facilities (Jennings 1994), two facilities were identified and studied which handled the commodity. In this case, one of the operators said that the only major benefit provided by the facility was transferring the operation and investment to another party as the same storage, handling, and other devices were needed as at a normal industrial location. This avoidance of cost or facility development by the shipper and receiver was reported by Beier (1977). However, because of the facilities required to handle asphalt, there is a great deal of expense to the terminal operator. This in turn necessitates a large volume to justify the installation of the equipment as well as the availability of financing. Since many of the operators of transload facilities are also attempting to minimize investment, this type of facility seems to be built less often.

The general services and handling equipment listed in the *Modern Bulk Transporter* include: air compressors, scales, blending meters, sampling services, hot water heater, steam heating, tank trailer cleaning, liquid storage tanks, and liquid pumps. Several of these are clearly related to certain types of products such as liquid storage tanks and liquid pumps. Others, such as scales and sampling services, are not so clearly associated. Additionally, five transfer devices described as being for dry bulk were included. These include vacuum trailers, augers, blowers, gravity systems, and portable vacuums/air conveyors.

One of the purposes of this study is to more clearly define the relationships between the services and devices required by the shippers and handlers of the various products. Previous articles which have examined facilities where bulk commodities are transloaded have indicated that the facilities are designed specifically for a limited number of products and that the handling devices will indicate this trend (Jennings and Holcomb 1996).

The analysis presented in this paper supports that theory and finds that the commodities handled will significantly determine what handling devices are required. Furthermore, it is suggested that the devices available can indicate to those marketing the facility what commodity types are most suitable for its use. The number of handling devices which are significantly different for those facilities handling various types of products are shown in the Appendix, Tables A1 through A4.

Acids are one commodity type which clearly demonstrates how the different handling devices relate to the presence, or lack thereof, at the transload facility. Air compressors, with 91.7% of those facilities handling the product reporting its presence, is an obvious piece of equipment needed. Many acids are carried in special tanks, both by rail and highway, which require tank pressurization to completely empty the contained chemical. Liquid pumps (85.1%) are another obvious requirement for most acids. Steam heating (52.1%), hot water (33.9%), and scales (85.1%) are other requirements of which facilities handling acids have significantly higher occurrences. Even blending meters (19.8%), an item which few facilities reported having for any reason, are found significantly more often at facilities handling acids than at those which do not.

The relationship between commodities and the facility's handling device requirements is important to each part of the process from marketing to operations. Knowledge of the commodity leads the investor in the equipment acquisition and provides information concerning investment costs for the facility. On the other hand, knowing what equipment is available, the relationship can help marketing to direct efforts to the most appropriate commodities for growth in transloading and the facility.

Rail Spots

The number of rail spots per facility as shown in Table 2 depicts the diversity that currently exists across transload facilities. Some commodities, such as petroleum products, asphalts, and acids, seem to require rail service more often than do the other products included in this study. Many of the petroleum products moving via transload in today's market appear to be used motor oils. This low value commodity is perfect for receiving the benefit of lower transportation costs from using rail for the line haul while using a motor carrier for the local pick up. In an earlier study of a bulk transload facility it was found that several companies were using this technique with one truck and using the tank car as temporary storage until the car was full and ready for shipment to the refinery (Jennings 1994).

TABLE 2
Reported Percentage of Railcar Spots by Commodity Handled and Facility
Number of Spots

COMMODITY	NONE	1-20	21-40	41-60	61-80	81-100	100+
Acids	19.8	19.8	18.2	10.7	10.7	9.9	10.7
Asphalt	17.2	17.2	10.3	20.7	10.3	13.8	10.3
Chemicals-Dry	25.0	21.2	16.9	10.6	9.7	7.6	8.9
Chemicals-Liquid	22.5	24.0	17.0	10.5	9.0	7.0	10.0
Foods-Dry	24.0	17.5	20.2	9.3	9.3	8.2	11.5
Foods-Liquid	24.3	19.1	16.2	7.4	11.8	8.8	12.5
Petroleum	14.6	24.1	16.8	10.9	12.4	10.9	10.2
Plastics	21.9	19.0	18.2	10.7	9.5	8.3	12.4

Likewise, asphalts very logically require rail service in most movements. This is due to the volume of materials needed to justify the expense of the specialized transload facility. Additionally, the movement of asphalt is performed in specially heated tank cars on the railroad, and is generally moved in solid blocks to avoid delay. This type of movement requires large car volumes to be practical and may further explain why asphalt transload facilities seem to have more rail car spots than facilities for other types of commodities.

Products such as foods tend to have a higher percentage of facilities without rail spots. The rationale for this seems to be that many foods are time sensitive and motor carrier to air is an alternative for these higher value commodities. For example, the airport at Seattle, Washington, specializes in moving fresh fish via air to inland markets.

Facility Investment Decisions

Plastics represent a very diverse market thus explaining the large percentage of both small and large facilities serving the product. Plastics are a universally used material, going into everything from milk bottles to industrial piping. Previous case studies discovered that small companies go from using truckload sizes of plastics to railcar loads when a certain volume is met (Jennings 1994). However, since most companies did not base facility location solely on transportation costs, or simply did not anticipate the growth, the move to rail is often accomplished via transload using a nearby transload facility or any other available spur track. It is only at the point in time when commodity volume grows to a level where it is possible to achieve substantial transportation savings that a move to a site with direct rail access is considered.

Because of this pattern, many of the manufacturers of plastics have begun to open their own reload facilities for better control of service quality and to manage the handling of their materials. Examples of this include a bulk distribution facility where a major chemical manufacturer and processor has a dedicated operation for their own distribution needs, while immediately adjacent a separate bulk distribution facility is operated for several other plastics manufacturers.

Some companies have become very specialized in their decision as to what products to handle and what equipment and facilities are necessary. For example, Ee-Jay Motor Transports operates a plastics transload terminal in East St. Louis, Illinois. Ee-Jay has been involved with bulk intermodal work since the company's founding in 1949 when it was created to haul oil to Mississippi River barges. It became involved with the rail-to-truck transload movement of bulk commodities in 1957. By 1981, thirteen dry bulk vehicles were being used mainly to haul plastic pellets to dairy plants, soft drink bottlers, and other industrial customers. Growth of rail-to-truck transload has increased the operations to 30 dry bulk trailers and 31 tractors.

From 1981 to 1996, the volume of plastic pellets moving through the rail-to-truck transload facility in East St. Louis tripled. This has allowed Ee-Jay Motor Transports to expand and improve the transfer facility to create one of the largest rail hubs in the United States. Currently the 20-acre facility has 120 railcar spots with plans for 20 more. Ee-Jay feels that it has created a competitive advantage by offering one contact for both transfer and transportation in that it eliminates questions of process ownership and responsibility for the service.

Ee-Jay attributes their success to understanding the needs of their core customers. Jim Dougherty, president of Ee-Jay, stated in an article that: "Our objective is to listen very carefully to customer requirements so that we are a no-problem vendor. Shippers should hear from us only if there is a problem with the product, not with the delivery....This is an industry where your reputation means a lot, and we work hard to keep our good reputation ("Ee-Jay Profits from Plastic Pellets," 1996, p.52).

Listening to their customers has allowed Ee-Jay to acquire specialized equipment based upon the materials they handle. Although the company primarily owns pneumatic trailers, it is planning to add more vacuum/pneumatic trailers because of the equipment's ability to load anywhere. This is an example of value-added service to customers in situations where removing products from railcars that are derailed or damaged in accidents is required. Other examples of specialized investments based upon the commodity shipment requirements include:

- In-line air filters to prevent contamination from the incoming air,
- Gauges to monitor air temperature of blower air,
- Heat exchangers to provide temperature protection for handling low-density polyethylene which has a lower melting point than other plastics,
- Paved loading areas to prevent contamination from the soil,
- Wash facility for cleaning trailers and transfer machines,
- Trailer-mounted white neoprene domelid gaskets based upon shipper requests, and
- Stainless steel hosing to prevent contamination.

Many of these investments are made based upon the value and characteristics of the commodity handled (e.g. plastic pellets). "Contamination is the biggest fear in this business," says Thomas Imlay, Ee-Jay company controller ("Ee-Jay Profits from Plastic Pellets," 1996, p.54). Specially trained transfer operators handle all trailer loading at the transload terminal and perform the transfer work only during daylight hours for safety reasons and to reduce the contamination threat. All loaders and drivers receive training in the company's contamination control program. This includes keeping records of products last contained in the trailer or transferred through the transfer machines used to load the pneumatic trailers. In addition, plastic samples are taken from each railcar upon delivery to double check the billing information and from the loaded trailers to ensure that the load is correct. Samples are retained for 30-60 days for audit and control purposes. The level of

service detail extends to the cleaning and drying of trailers after product transfer, and no backhauls are made.

Due to the fact that many of the product types examined in this study are fairly general in nature and include many different types of final products, use is found for them by companies of all sizes. As noted in the plastics example, many of the commodities experience an increase in their demand which can result in a change in the transportation and handling techniques as time goes by. Therefore, many of the concepts described for the plastic transload facilities are applicable to the other products reported in this analysis.

CONCLUSIONS

Previous research in the area of transload cited the ability to lower the overall transportation and handling costs in the supply chain as an important reason for utilizing the practice (Jennings 1994; Jennings and Holcomb 1996). This analysis has expanded on those findings in that it has shown that transload (or bulk load) facilities acquire and operate handling equipment for the primary purpose of meeting specific customer needs.

The basis for this conclusion can be found in the number of handling devices which are statistically significant for certain commodity types. Initially this decision allows the facility to avoid unnecessary investment costs, and ensures high utilization of handling equipment. As acknowledged by previous case studies, this in turn is reflected in a lower cost transportation option for the shipper than other modal alternatives.

It appears that many of those marketing transload facilities have realized the value of market segmentation on the basis of customer need and respective handling equipment (i.e. service provided). However, the greater value may be that by knowing the equipment available at a site, the transload business can be increased by using the same market segmentation factors to identify prospective shippers and their commodities which can be handled with little or no additional investment expense at the existing facility. This ability to align the providers with the users can potentially increase return on investment through improved equipment productivity for the transload facility. As discussed above, this efficiency is often reflected in the cost of doing business, thereby resulting in a favorable outcome for the shipper as well.

It should be noted that while knowledge of the commodity and the initial customer needs direct the investor in the equipment acquisition phase, marketing does not begin the process of investment. That is, in the beginning the customer defines the scope of the business for the transload facility. Once the investment is made, however, the relationship changes in that economies of scale motivate those providing this transportation service to "market" their services to the most appropriate shippers/commodities for business growth. From this point forward marketing plays an important role in asset utilization through the expansion of business and value-added services.

Many of those outside of the bulk reload field consider the practice to be more primitive than containerization. However, the findings of this research have indicated that the practitioners of transload are clearly complying with the basic principles of sound business. They are providing a competitive system of product transportation which allows a company to avoid unnecessary costs and investments while providing added value to the product.

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APPENDIX

TABLE A1
Evaluation of the Use of Handling Devices for the Movement of Acids and Asphalts

HANDLING DEVICE	PERCENTAGE REPORTED HAVING DEVICE	
	Acids	Asphalts
Air Compressor	91.7*	86.2
Scale	85.1*	89.7
Blending Meters	19.8*	24.1
Sampling	71.1	86.2*
Hot Water Heater	33.9*	31.1
Steam Heating	52.1*	69.0*
Tank Cleaning	25.6	20.7
Liquid Tank Storage	19.8*	24.1
Liquid Pumps	85.1*	89.7*
Vacuum Trailer	47.1	48.3
Auger	37.2*	34.5
Blower	60.3	58.6
Gravity System	9.1	6.9
Portable Vacuum/Air	62.0	51.3

* Statistically significant device at 0.01.

TABLE A2
Evaluation of the Use of Handling Devices for the Movement of Dry and Liquid Chemicals

HANDLING DEVICE	PERCENTAGE REPORTED HAVING DEVICE	
	Dry Chemicals	Liquid Chemicals
Air Compressor	79.2*	85.5*
Scale	80.1*	78.5
Blending Meters	11.9	16.5*
Sampling	67.4*	71.0*
Hot Water Heater	21.2	27.5*
Steam Heating	28.0	40.5*
Tank Cleaning	33.1*	28.0
Liquid Tank Storage	7.2#	17.0*
Liquid Pumps	62.7*	79.5*
Vacuum Trailer	65.7*	53.0
Auger	33.5*	30.0
Blower	69.1*	61.0
Gravity System	13.6	11.5
Portable Vacuum/Air	64.8*	59.5*

* Statistically significant device at 0.01.
# Denotes statistical significance but not the largest component of reporting dry chemical facilities.

Table A3
Evaluation of the Use of Handling Devices for the Movement of Dry and Liquid Foods

HANDLING DEVICE	PERCENTAGE REPORTED HAVING DEVICE	
	Dry Foods	Liquid Foods
Air Compressor	80.9*	88.2*
Scale	82.0*	81.6*
Blending Meters	12.6	17.6*
Sampling	73.8*	74.3*
Hot Water Heater	24.6*	36.0*
Steam Heating	32.8	50.0*
Tank Cleaning	36.1*	31.6
Liquid Tank Storage	6.0*	16.2
Liquid Pumps	65.0*	84.6*
Vacuum Trailer	69.9*	63.2
Auger	33.3*	33.1
Blower	70.5*	63.2
Gravity System	13.1	12.5
Portable Vacuum/Air	68.9*	64.7*

* Statistically significant device at 0.01.

TABLE A4
Evaluation of the Use of Handling Devices for the Movement of Petroleum Products and Plastics

HANDLING DEVICE	PERCENTAGE REPORTED HAVING DEVICE	
	Petroleum Products	Plastics
Air Compressor	87.6*	71.9*
Scale	86.9*	79.3*
Blending Meters	20.4*	9.5
Sampling	73.7*	68.6*
Hot Water Heater	32.1*	21.1
Steam Heating	47.4*	26.9
Tank Cleaning	25.5	34.3*
Liquid Tank Storage	17.5*	5.8*
Liquid Pumps	82.5*	59.1
Vacuum Trailer	53.3	74.4*
Auger	29.9	29.3
Blower	60.6	69.4*
Gravity System	13.1	10.7
Portable Vacuum/Air	62.8*	67.8*

* Statistically significant device at 0.01.

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Barton Jennings (Ph.D., University of Tennessee) is senior research associate at the University of Tennessee Transportation Center and adjunct professor of logistics and transportation. Dr. Jennings' research areas include carrier operations, intermodal transportation, and transportation regulation and policy. Dr. Jennings' career has included work in both the Class I and shortline railroad industry as well as work with state transportation departments. He has a particular interest in the use of railroads in developing countries and has traveled extensively to explore this subject. He regularly conducts workshops on regulatory compliance for the railroad industry and on many technical issues for several state highway departments. Dr. Jennings has been the author or co-author on a number of reports and journal articles in these and other fields.

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Mary Collins Holcomb (Ph.D., University of Tennessee) is associate professor of logistics and transportation at the University of Tennessee. Dr. Holcomb's research interests focus on two related areas of strategic logistics management: process design for quality and customer service measurement. Dr. Holcomb's professional career involved eighteen years at the Oak Ridge National laboratory in transportation research for the U.S. Department of Energy, U.S. Department of Transportation, and the U.S. Department of Defense. Her background also consists of varied industry experience including Burlington Northern Railroad, General Motors, and two years of collaborative research with Procter & Gamble. Dr. Holcomb is the former editor of the *Transportation Energy Data Book* and author and co-author of numerous reports in the area of transportation policy.