Intermodal Truck Traffic: Description and Results of a Survey in Chicago

THE PRIMARY OBJECTIVE
OF THE INTERMODAL
RAIL-YARD TRUCK SURVEY
WAS TO GAIN A BETTER
UNDERSTANDING OF THE
TYPE OF TRUCKS, THE
NUMBER OF TRIPS AND
THE CHARACTERISTICS
OF TRIPS MADE TO
INTERMODAL YARDS ON
AN AVERAGE WEEKDAY.

OVERVIEW

Over the last decade, the logistical nature of inter-city goods movement has changed significantly. Economic forces and technological advances have given rise to a system of goods movement based on major railroad consolidations, proliferation of short-line railroads, expansion of air-freight movements, emphasis on "just-in-time" movement and virtual warehouses. The carrying capacity of individual truck tractor units is also changing with an increased use of 53-foot trailers, doubles and even triples in the western United States. Engine characteristics and related alternate fuel efficiencies have also changed, partially in response to the deregulation and rises in the price of diesel fuel. The growth of e-commerce may increase and disperse goods movement as direct-to-home deliveries increase. Continued economic expansion and technological change will undoubtedly result in other, unforeseen changes in goods movement over the next decade.

As part of the growing global economy, an increasing portion of goods from domestic and foreign markets travel through intermodal sites. Intermodal travel includes more than one method of conveyance, such as rail-truck or truck-air combinations. Intermodal freight is packaged in containers that are lifted from one carrier to another or on trailers that piggyback onto flatbed rail cars.

Economic benefits to a region where intermodal centers are located include direct employment at intermodal sites, but more importantly the access to multimodal freight service offers an advantage to businesses that decide to locate in an area. Intermodal sites, however, also exact a cost: truck traffic on the roads leading to and from the sites has added to the congestion and pollution in the immediate area. The terminal operators face their own set of constraints. For instance, existing yards in built-out areas may be of insufficient size or configuration, with no contiguous land available for expansion, or may have outmoded technology. Some of these sites may be abandoned as new intermodal freight terminals are constructed in suburban areas. As a result, the flow of truck traffic in a region may shift, putting new burdens on local road networks.

For the transportation planner, the locational factors, market dynamics and technological changes that have shaped and are shaping the intermodal carrier industry are difficult to forecast. Due to increased efficiencies, the emergence of just-in-time shipping and the virtual warehouse, the intermodal industry is growing and changing at a rapid rate. In short, intermodal shipping has seen an increase in market share, and the type and amount of trips generated by the intermodal sites will increase as the use of containers for shipping everything from exotic produce to household goods increases.

A full-service intermodal yard serves as a collection/distribution center for goods, and future transformations in the practice of goods-delivery will have an impact on regional and local planning issues, such as congestion, air-quality, pavement-deterioration and safety issues. Given the changing face of the industry, it is important for regional planners to obtain a quantitative understanding of these operations. The results of the intermodal site survey in the Chicago, IL, USA, region provide that opportunity.

INTRODUCTION

The intermodal truck survey was conducted in the Chicago area in the fall of 1996. While the current information on the details of site operations are considered proprietary information, the data presented here are old enough not to provide any competitive detail, and yet allow planners and engineers much-needed quantitative information on an industry of growing importance.
Sampled Site Descriptions

The descriptions here are for the characteristics of each sampled site in 1995.

- BNSF (Corwith Yard) in Chicago. This intermodal operation occupies 357 acres, with 10 inbound trains and 10 outbound trains every day. In 1995 more than 460,000 trailers/containers were handled (tapped or demurred from flatcars), or 1.1 trailers/containers every minute, 24 hours per day, 365 days per year.
- BNSF in Hodgkins/Willow Springs. This modern, showcase facility occupies 260 acres adjacent to Burlington Northern Santa Fe's main line on the Des Plaines River and the nearby UPS distribution facility. On average, nine inbound and eight outbound trains are loaded daily. Almost 325,000 trailers/containers were handled in 1995, or nearly 900 in each 24-hour day.
- BNSF Cicero Yard occupies 80 acres and loads/unloads 11 inbound trains and 11 outbound trains daily. This 24-hour operation handled nearly 437,000 trailers/containers in 1995, almost 1,200 per day.
- Union Pacific, Global I in Chicago. This site was constructed on 103 acres, and being in a built-out area has specific concerns with roadway congestion. The operations load/unload four inbound trains and four outbound trains on an average weekday. In 1995 over 360,000 total trailers/containers were handled.
- Union Pacific, Global II in Northlake. This site occupies 100 acres and loads/unloads four inbound and five outbound trains on an average weekday. In 1995 over 216,000 total lifts were conducted, or about 50 per day.
- Union Pacific, Yard Center in Dalton. This 75-acre site averaged 205,000 trailers/containers total in 1995. This site loads/unloads four inbound and five outbound trains on a weekday, and primarily serves the corridor to Texas and Mexico for the auto industry.
- Norfolk Southern, Landers Yard in Chicago. This site occupies 98 acres and loads/unloads five inbound and seven outbound trains daily. The site handled over 260,000 trailers/containers in 1995.
- CSX in Bedford Park. Located on 250 acres this site loads over 1,600 lifts each day, for a total of over 615,000 trailers/containers handled per year. The site averages 10 inbound and 10 outbound trains per day. The service corridors include New Jersey, Philadelphia, PA, Atlantic, GA, and Jacksonville, FL, USA. Daily stack service is provided to and from the Pacific Northwest.
- Markham Yard (the Meyers Facility) in Harvey. Located on 32 acres, this site loads/unloads four inbound and four outbound trains per day on average. The site logs an average of 390 lifts per day, for a total of about 144,000 trailers/containers handled per year.
- Conrail in Chicago. Situated on 85 acres, the number of trains to and from this site varies more than others, but an average 12 inbound or outbound trains are loaded/unloaded daily. The site handles about 750 trailers/containers per day, or about 286,000 in 1995.

The survey was designed to obtain characteristics of a sample of trucks and the trips made by those trucks, which travel to the surveyed intermodal facilities. Ten rail yards, representing older urban facilities and newer state-of-the-practice suburban facilities, were surveyed to determine the amount of truck trips attracted to each site in an average 24-hour weekday. Most of the sites were surveyed on a Tuesday, Wednesday, or Thursday. Information was obtained by intercepting drivers arriving at a sample of intermodal sites and conducting a short interview about the origin of the trip that brought him to the intermodal yard and the destination of the next trip. The survey collected four types of information to develop trip characteristics and trip rates for each individual site:

- Detailed information about the site, including size in acres, number of employees (regular and contract) and the number of lifts per day;
- Detailed information about a sample of trucks and the trips made by those trucks arriving at the intermodal sites, including the type of truck, weight and dimensions, cargo type, and origins and destinations;
- A manual classification count of all trucks entering the site during the 12-hour survey period using standard truck-type silhouettes; and
- An independent, 24-hour count of all vehicles entering the site on the survey day.

The 24-hour tube counts were conducted for estimates of total entrants, since bob-tails, for instance, and trucks that enter a site but are not picking-up or dropping-off a load, may enter without check-in at the gate. Therefore, gate counts underestimate the number of arriving vehicles.

All information was collected during the same 24-hour survey day. To calculate trip rates for the site, the 24-hour tube counts (axle counts) at each driveway were used in conjunction with the manual classification counts made by field staff stationed at each of the same driveways on the survey day. The manual counts were used to determine the vehicle mix and the average number of axles per vehicle, and to adjust the 24-hour axle counts. The resulting estimate of the total number of trucks attracted to the facility in a 24-hour period was doubled to estimate inbound and outbound traffic. Trip rates were then calculated by the number of employees, the site size in acres and the number of lifts or containers/trailers loaded per day.

The data collected at the intermodal stations was related specifically to the sampled sites. However, it can be used to draw a picture of characteristics, which might be expected at a future facility with similar size and characteristics. The rates calculated from the sample, given the quantity and type of truck trips generated by a specific facility by size or class, provide vital information in making decisions about local-area improvements near facilities where these rates would apply. An example would be determining the impact on local streets of new development, which would incorporate an intermodal station. The potential application of such data include the following:

- Provide base data to project changes in highway usage that would result from rail-line abandonment or closing of a comparable intermodal site;
- Provide base data to estimate the type and amount of traffic generated by a future intermodal site of similar design and characteristics; and
- Evaluate the effect on the current volume of traffic of greater use of rail/truck as a cargo mode.

The sites were selected to represent intermodal yards in the City of Chicago and in the suburban area. Ten railroad yards are used in the analysis described in this feature. Five intermodal sites were within the City of Chicago, and five intermodal yards were selected from the suburban areas. A brief description of each is given in the Sidebar above.

SURVEY METHODOLOGY

The owner/operators of the sampled sites were recruited and contacted for permission to conduct the survey. The purpose of the survey was explained, and the procedures of having surveyors on-site were reiterated. The intermodal operators were extremely cooperative, often providing additional data and safety equipment to the surveyors, where it was required. A site plan was completed for each sampled site, showing the driveway locations and preliminary placement of the tube-counters.

Each site was assigned a survey day during recruiting—most sites were surveyed on...
Table 1: Unloaded vehicle weight distribution.

<table>
<thead>
<tr>
<th>Vehicle weight range</th>
<th>Number</th>
<th>Percent of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 8,000 lbs.</td>
<td>135</td>
<td>6.1%</td>
</tr>
<tr>
<td>8,001 to 24,000 lbs.</td>
<td>1,246</td>
<td>56.3%</td>
</tr>
<tr>
<td>24,001 to 63,999 lbs.</td>
<td>641</td>
<td>29.0%</td>
</tr>
<tr>
<td>64,000 plus</td>
<td>63</td>
<td>2.8%</td>
</tr>
<tr>
<td>Don’t know</td>
<td>128</td>
<td>5.8%</td>
</tr>
<tr>
<td>Total</td>
<td>2,213</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Table 2: Origin/destination kind of place.

<table>
<thead>
<tr>
<th>Kind of place</th>
<th>Origin number</th>
<th>Origin percent</th>
<th>Destination number</th>
<th>Destination percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>A truck terminal</td>
<td>585</td>
<td>26.4%</td>
<td>511</td>
<td>23.1%</td>
</tr>
<tr>
<td>An intermodal facility</td>
<td>464</td>
<td>21.0%</td>
<td>357</td>
<td>16.1%</td>
</tr>
<tr>
<td>A business, warehouse, factory</td>
<td>1,103</td>
<td>49.8%</td>
<td>605</td>
<td>27.3%</td>
</tr>
<tr>
<td>Don’t know</td>
<td>61</td>
<td>2.8%</td>
<td>740</td>
<td>33.4%</td>
</tr>
<tr>
<td>Total</td>
<td>2,213</td>
<td>100.0%</td>
<td>2,213</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

a Tuesday, Wednesday, or Thursday. On the survey day, counts and interviews were conducted from 6 a.m. to 6 p.m. with drivers of trucks as they queued for entry into the site. The data items collected for each sampled truck included:

- Truck type (silhouette);
- Trucking company name and location;
- Unloaded vehicle weight;
- Trailer length/height;
- Whether the trailer is a container;
- Whether vehicle is carrying cargo or empty;
- Major commodity on-board (coded to Standard Transportation Commodity Codes);
- Weight of cargo;
- Origin of trip to the site (city, region, or outside of region);
- Origin kind of place (truck terminal, intermodal facility, or other business);
- Origin address;
- Destination of trip from the site (city, region, or outside of region);
- Destination kind of place (truck terminal, intermodal facility, or other business);
- Destination address;
- Route taken from origin to site (three roadways); and
- Frequency of this trip in last week (seven days).

The interview was about a minute and a half in duration.

RESULTS

A total of 2,213 interviews were obtained during the survey period. In the following analysis, the sites are most often combined to assess the characteristics of intermodal sites in the region. For trip rates, the sites are both analyzed separately and in the aggregate.

The vast majority of vehicles entering the sites were categorized as tractor-trailers. Table 1 shows the distribution of vehicle weights for the sampled trucks. The numerical average trailer length was 42 feet (ft.) 8 inches (in.), and the average height was 13 ft. 6 in. Well over half, 56.2 percent, of the sampled trucks were carrying containers.

Over 36 percent of the vehicles arrived at the site empty, the remaining three out of five trucks (64 percent) were carrying cargo. This means that the predominate flow during the 12-hour survey period was outbound—that is cargo was being loaded onto railcars more than it was being unloaded.

The averaged cargo weight for in-bound vehicles was more than 22,500 pounds (lbs.). Please note that although the trip rates were calculated by doubling the arrivals counts, it is not believed that other characteristics of the trucks, such as weight, would be equivalent inbound and outbound.

Table 2 shows how integral the intermodal facilities are to the local economy: nearly half of the origins were local businesses, such as warehouses and factories. Over one-quarter of the vehicles came from a truck terminal to the intermodal site, primarily empty trailers coming to pickup arriving goods. Most of the destinations were also local businesses, such as warehouses and factories, although over one-third of the drivers did not know the destination of their outbound trip. It was customary for many drivers to contact their dispatcher either by radio or telephone for the next trip after completing the dropoff or pickup at the current location.

Drayage

One of the main concerns for analysis was to determine the amount of drayage, or trips that move between intermodal facilities, such as carrying goods from the airport to a rail yard, or back and forth between rail yards. Part of this concern is the issue of queuing, and a belief that the trucks carrying drayage are larger and heavier than other freight carriers.

Out of the sample of 10 intermodal rail yards, less than 10 percent (8.2 percent) of all trucks were classified as operating drayage. Table 3 shows the descriptive data on drayage haulers and elaborates on those trucks that had both an origin and a destination of "an intermodal facility" as presented in Table 2. The drayage haulers were not found to be heavier or larger than other freight carriers. The greatest difference between drayage and other freight haulers was the lower percent of drayage vehicles carrying containers.

Trip Rates

Table 4 presents the calculated two-way truck trip estimates for heavy trucks for each of the 10 intermodal railroad sites. Truck arrivals to each sampled site (based on estimates of the 24-hour in-bound axle counts) were doubled to calculate these truck trip rates, making the assumption that within a 24-hour period the same number of trucks that entered the site would leave the site. The average for the sampled rail intermodal sites hover around 2.0 trips per daily lift at the site, which indicates one arrival and one departure. On average there are just over 12 truck trips per regular and contract employee, and overall about 15.3 truck trips per acre.

Time of Day

The percent of truck arrivals (averaging all facilities) in each hour begins the time period for the 12-hour survey period as shown in Figure 1. The histogram shows consistent activity during the business day, with an early afternoon peak, at about 1 p.m. Averaged for all sites, 18.5 percent of the trucks arrived during the morning peak period from 6 a.m. to 9 a.m., and 23.3 percent during the afternoon peak period from 11 a.m. to 2 p.m.
Table 3. Comparison of drayage description and all others.

<table>
<thead>
<tr>
<th>Data Item</th>
<th>Droy</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average cargo weight (lbs.)</td>
<td>22,003 lbs.</td>
<td>22,614 lbs.</td>
</tr>
<tr>
<td>Percent containers</td>
<td>47.3%</td>
<td>57.0%</td>
</tr>
<tr>
<td>Average length</td>
<td>42 ft.9 in.</td>
<td>42 ft.8 in.</td>
</tr>
<tr>
<td>Average height</td>
<td>12 ft.6 in.</td>
<td>13 ft./6 in.</td>
</tr>
</tbody>
</table>

A percent of the trucks arrived during the afternoon peak period from 3 p.m. to 6 p.m.

CONCLUSION

The data collected in this study give an excellent overall picture of the trip characteristics of trucks serving intermodal yards in the City of Chicago and in the surrounding suburban areas. In addition to the localized nature of the data, it is believed that they do have transferability to similar sites in other cities and regions. Where additional local data can be collected, the information obtained in this study presents a good point of comparison. Overall, the results of this survey should help contribute to the body of knowledge on truck trip generation rates for intermodal yards. More research and publication of details of this overlooked industry are needed. The data presented here have simply scratched the surface of understanding the effects of the intermodal industry's growth on the area network.

ACKNOWLEDGMENTS

The authors wish to acknowledge Joseph Alonzo and the staff of the Chicago Department of Transportation for the effort and hard work they put into the intermodal site survey. CBA Market Research, of Winston-Salem, NC, USA, helped collect the data. The design, oversight and analysis of the data were conducted by Nancy McGuckin, while Senior Associate at Barton-Aschman Associates, Washington, DC, USA.

Table of Conversion Factors

<table>
<thead>
<tr>
<th>To convert from:</th>
<th>To:</th>
<th>Multiply by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear feet</td>
<td>Meters</td>
<td>0.3048</td>
</tr>
<tr>
<td>Linear inches</td>
<td>Centimeters</td>
<td>2.540</td>
</tr>
<tr>
<td>Pounds</td>
<td>Kilograms</td>
<td>0.4536</td>
</tr>
</tbody>
</table>

Table 4. Estimated 24-hour truck trip rates by site.

<table>
<thead>
<tr>
<th>Site name</th>
<th>Truck trips per daily lifts</th>
<th>Truck trips per employee*</th>
<th>Truck trips per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>BNSF Corwith</td>
<td>2.19</td>
<td>15.66</td>
<td>11.14</td>
</tr>
<tr>
<td>BNSF Hodgkins</td>
<td>3.77</td>
<td>22.67</td>
<td>12.91</td>
</tr>
<tr>
<td>BNSF Cicero Yard</td>
<td>1.17</td>
<td>4.36</td>
<td>17.45</td>
</tr>
<tr>
<td>Union Pacific Global I</td>
<td>2.20</td>
<td>14.88</td>
<td>21.24</td>
</tr>
<tr>
<td>Union Pacific Global II</td>
<td>2.95</td>
<td>17.45</td>
<td>17.45</td>
</tr>
<tr>
<td>Union Pacific Yard Center</td>
<td>2.41</td>
<td>†</td>
<td>18.05</td>
</tr>
<tr>
<td>Norfolk Southern Leaders Yard</td>
<td>2.29</td>
<td>10.21</td>
<td>16.87</td>
</tr>
<tr>
<td>CSX</td>
<td>2.11</td>
<td>8.39</td>
<td>14.26</td>
</tr>
<tr>
<td>Illinois Central Markham Yard</td>
<td>2.57</td>
<td>22.50</td>
<td>31.05</td>
</tr>
<tr>
<td>Conrail</td>
<td>2.27</td>
<td>8.46</td>
<td>20.90</td>
</tr>
<tr>
<td>Average</td>
<td>2.39</td>
<td>12.10</td>
<td>15.29</td>
</tr>
</tbody>
</table>

\*Employees include regular and contract employees.
†Data on total employment not available.

Figure 1. Percent of truck arrivals by time of day.

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NANCY McGUCKIN is an Independent Consultant who is developing expertise in primary data collection and meaningful research regarding travel behavior. She has broad experience in designing origin-destination and attitudinal surveys used for quantifying and analyzing travel behavior and to create inputs into the travel demand forecasting process. The range of survey designs includes household travel surveys, on-board transit surveys, workplace surveys, special generator surveys, and truck and commodity flow surveys. She has helped plan the Nationwide Personal Transportation Survey for the year 2000 for the Federal Highway Administration and is working on coordination with the American Travel Survey of long-distance trips. She is concentrating on trend analysis and collection techniques for the surveys and coordinating the design and testing of model improvements identified in the Travel Model Improvement Program.

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