# Implementing A Statewide Goods Movement Strategy and Performance Measurement of Goods Movement in California

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# Abstract

The project objective was to create structural and non-structural solutions to improve capacity utilization of Intermodal Corridors of Economic Significance in the combined Ports Los Angeles-Long Beach. In addition, this effort tested and validated Transportation System Performance Measurement for Commercial Goods Movement and International Trade as a means of monitoring and determining the cost-effectiveness of productivity improvement measures.

The Center for International Trade and Transportation has sponsored a survey of physical, operational, and institutional constraints affecting utilization of capacity in the Ports of Los Angeles and Long Beach and related intermodal facilities. It has also established a permanent Policy and Planning Committee. This project developed common goals and objectives for a California Goods Movement Strategy by translating the results of both CITT industry surveys and Caltrans' industry data and observations into a specific set of actions.

CITT port and intermodal productivity survey results and Caltrans data were translated into a hierarchical and sequential candidate list of action items for industry review by CITT Policy and Planning Group, as well as a broader industry review. We offer a review and analysis of suitability of the traditional and emerging performance indicators for application to measurement of goods movement.

An aspect of the goods movement supply chain involves the truck-terminal interface. Data was collected from three trucking companies that do business at the Port of Long Beach and Los Angeles, resulting in a sample of almost 20,000 individual moves in 1999. For the key performance indicator of truck wait times, we estimate that last year transactions which required more than two hour led to truck waits in and around the ports totaling 3.3 million hours for import transactions, and total truck wait hours at 3.76 million in 1999. The indicator of the temporal distribution of truck trips indicates the distribution is highly concentrated. More than 25% of all arrivals at the port complex occur between 7:45 a.m. and 8:45 a.m., and almost 20% of trips leaving the port occur from 9:00 to 10:00 a.m.

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# Disclosure

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# Acknowledgements

The project team wishes to acknowledge the financial and intellectual support of METRANS colleagues at both California State University Long Beach and the University of Southern California. Metrans is a U.S. Department of Transportation (DOT) designated University Transportation Center devoted to solving the transportation problems confronting major metropolitan areas using an integrated approach that blends the disciplines of engineering, policy, planning, public administration, and business administration. With its multi-modal orientation, with emphasis on goods movement, transit and highway infrastructure renewal Metrans was a perfect fit for the research direction of this project.

The principal investigators would also like to acknowledge the following individuals whose efforts were invaluable in meeting our project goals. The two senior consultants were Lawrence Mallon and Richard Hollingsworth, both of whom drew upon their wide professional backgrounds and associations. Mr. Mallon served as the benchmarking and strategic planning consultant, and Mr. Hollingsworth was our liaison with the Gateway Cities Partnership and industry participation. These individuals also worked on a regular basis with the CSULB Center for International Trade and Transportation (CITT), whose membership of leaders from labor and all facets of the transportation industry were consistently available and gracious in their participation. Finally, we wish to thank the staff in both the Port of Long Beach and the Port of Los Angeles for their timely assistance.

True to the spirit of funding to University Transportation Centers, the principal investigators are pleased to note the work of our students on the project staff. We especially acknowledge Jennifer Bailly, a graduate student in economics at CSULB and the winner of Metrans Outstanding Student Award in 1999. She, along with Wei Li, Laura Muñoz, and David Lovegren, contributed valuable services to the completion and publication of this report and, along with our faculty colleagues at California State University Long Beach, share our heartfelt appreciation.

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# Introduction

## Background of the Project

The 1998 California Transportation Plan (CTP) implements the policies established in its 1993 predecessor in two key respects: Transportation System Performance and Goods Movement. Caltrans is accomplishing this mission objective by:

(1) Developing a Transportation System performance module as a common basis for monitoring, evaluating and managing system performance emphasizing stakeholder accountability to users, the customers of the system;
(2) Developing a Statewide Goods Movement Strategy focusing on improving system efficiency maximizing capacity and minimizing long-term system costs. To this end Caltrans through its CTP Policy Advisory Committee and other means has sought to develop both agency policy and stakeholder consensus on current system performance, constraints and future demands, cost-effective means to improve system performance over the long term. In addition to Caltrans traditional role in facilitating movement of goods by truck, the strategy encompasses goods movement by air, rail, and vessel, intermodal facilities, border crossings, equipment, operational practices, and labor.

The elements of the Goods Movement Strategy module of the CTP include *inter alia*:

1. Current system demands and constraints;
2. Projected system demands and constraints;
3. Regulatory and institutional roles streamlining and integration;
4. Capital improvement needs;
5. Operational routing, and maintenance policies; and
6. Performance measurement, monitoring, and benefit/cost analysis.

The elements of the Transportation System Performance Module include:

1. Examination of current performance indicators and databases used to assess system performance;
2. Identification of gaps in monitoring, institutional barriers, and areas not currently measured;
3. Evaluation of parallel efforts conducted at the regional, state, and national level;
4. Development of stakeholder consensus and recommendation of best performance measures to monitor total system operation, and evaluate goal achievement across modes, facilities and services.

The State's efforts are largely focused on Intermodal Corridors of Economic Significance ("ICES"), including the combined ports of Los Angeles-Long Beach. The implementation goals of both modules include *inter alia*:

1. Goods movement being given full and appropriate consideration in the planning, design, development, operation, maintenance, and funding of the State's transportation system at the state, regional and local level;
2. Improving intermodal access and connections between airports, seaports, border crossings, and rail, truck and intermodal terminals;
3. Reducing physical, operating and regulatory constraints to full capacity utilization;
4. Inclusion of Goods Movement in Programming Guidelines as part of the SB 45 and State Transportation Improvement Plan ("STIP") for implementation by the California Transportation Commission and Metropolitan Planning Organizations.

The permanent and adjunct faculty, staff, students, associates, and supporting individuals and member organizations comprising the Center for International Trade and Transportation at CSULB ("CITT") under the University College and Extension Services made it uniquely suited to assist Caltrans. CITT shares the same goals of the Goods Movement Strategy by applying and obtaining stakeholder validation of its Transportation System Performance Module and Goods Movement Strategy module. The objectives were to: (1) Establish itself as Southern California's preeminent forum for improvements in international trade and transportation and (2) to define productivity constraints, develop industry consensus on the need for cooperative solutions and establish a sufficient structure to meaningfully address solutions are in complete congruity with those of Caltrans Good Movement Strategy. Similarly, CITT was founded with industry support to identify port and intermodal productivity and capacity constraints, and to develop and implement consensus solutions to those problems.

To this end CITT has established a permanent thirty odd member Policy and Steering Committee composed of representatives from every transportation mode and shippers organizations. The efforts of CITT center on fostering an environment of continuous productivity improvement as well as to assist in structuring, supervising and validating its research. Activities of CITT also include disseminating and implementing the results of its research in the trade and transportation community along the global supply chain.

As part of this effort, the Center has sponsored a survey of physical, operational, and institutional constraints affecting utilization of capacity in the Ports of Los Angeles and Long Beach and related intermodal facilities. The Center organized an industry-wide consensus building conference "Building Partnerships in International Trade and Transportation" in order to validate the survey results and establish an action plan for their implementation. This was followed up by a similar effort focusing on the critical role of the International Longshoremen and Warehouse Union ("ILWU") in determining the productivity and competitiveness of the combined ports and intermodal facilities. The Center is currently in the process of surveying shippers using the combined ports with the intention of utilizing the results to further refine and validate its long term efforts in removing productivity constraints and maximizing use of existing and planned capacity, including the dedicated Alameda rail Corridor, to meet future throughput requirements.

## Project Objective

The research project was designed to address the combined primary economic and public policy goals of both the Caltrans Goods Movement Strategy and CITT. The researchers examined user/customer validated specific structural and non-structural solutions to reducing or removing constraints to full capacity utilization of Intermodal Corridors of Economic Significance in the combined Ports Los Angeles-Long Beach. It is hoped that this report will assist in the process to achieve stakeholder consensus on these important issues.

## Methodology

The methodology was designed to combine the common goals and the objectives of the Caltrans Goods Movement Strategy. It was intended to remove or reduce capacity and productivity constraints at the thirteen intermodal marine terminals operating in the combined ports of Los Angeles-Long Beach. The results of both CITT industry surveys and Caltrans' industry data and observations were organized into a hierarchical, sequential set of specific initially non-structural action items. These action items will require economic cost-benefit analysis and justification prior to industry adoption on a trial basis. Specific action items may require:

- removal of legal or institutional barriers such as amendment to an interchange agreement between marine carriers over the movement of empty containers over the highway within the Los Angles basin
- adjustment of union work rules between the Pacific Maritime Association and the ILWU
- amendment to existing terminal leases between terminal operators and the ports agreements between shippers and carriers as to demurrage
- between terminal operators and trucking companies or warehouse and distribution centers concerning hours of operation.

Traditional measures of system performance such as the ratio of Volume to Capacity (V/C) well known to traffic engineers were compared to emerging measures developed by the Volpe National Transportation Center, such as System Network Connectivity. Operational Indicators Standards, and Facility Level Indicators Standards were subjected to industry review and evaluation, and utilized to measure the performance results and outcomes from the implementation of various productivity improvement and constraint reduction strategies and measures.

As a result, the final product of the research will include conclusions, observations, and recommendations supported by stakeholder consensus as to both comparison of tested methods of productivity improvement and constraint reduction strategies and measures, as well as the demonstrated relative suitability and effectiveness of various benchmarking standards of performance. Due to proprietary issues, some "key informants" requested that they not be cited by name as a source and are so listed in the notes to various tables and charts.

# Goods Movement Performance Measures

The indicators incorporate a variety of statistics and are designed to quantify performance of the goods movement system and measure improvements in the goods movement system based on the benchmarks developed. The measurements developed in this study will give policy-makers objective criteria to base decisions on to improve productivity of goods movement in the region, compare the productivity of goods movement in California ports versus other regions, and to track improvements in productivity over time. The indicators were developed with according to a broad set of criteria based on the desired outcomes for the goods movement system in California:

- Mobility and Accessibility
- Reliability
- Sustainability
- Environmental Quality

To quantify the desired outcomes for the goods movement system a set of indicators to measure and benchmark productivity were developed for each category.

**Mobility/Accessibility**

- Average wait times for trucks inside the port complex: Truck waits are a current source of bottlenecks in the goods movement system. Long truck queues to enter the terminal and long transaction times slow the productivity of the system. With the projected increase in freight volume for the future, reducing these wait times can be a method to increase productivity of the system.
- Throughput per acre: Throughput per acre is a measure of performance, as it indicates the productivity of the harbor space.
- Dwell time: The dwell time indicator measures the average amount of time a container spends in the port.
- Ratio of Wheeled to Grounded Operations: This indicator also deals with the use of space at the port, and each form has its benefits. Wheeled operations consist of containers that are placed on chassis in the terminals. The benefit to this type of accessibility is that the container is ready to be hauled by truck drivers. The chassis needs to be connected and the driver can pull it out. This access has the constraint of requiring more space than the grounded operations. In grounded operations, containers are stacked on the ground. This type of operation allows for the storage of a much larger number of containers in a given area. The constraint of grounded containers is they must be flipped onto a chassis before the driver can haul the container out. In three cases of documented wait times, there was a long flip line that contributed to a terminal wait time in excess of two hours.
- Lifts per Hour: Indicates the number of containers being moved by harbor cranes per hour.

- Average number of times a container is handled while in the port complex.

**Reliability**

- Indicator of customs availability:
  A measure of the average length of time cargo containers clear customs.
- Average wait times for longshore crews:
  Indicates in what percentage of cases does an appropriately staffed crew arrive on time to service a vessel arriving in port.
- Equipment constraints:
  A measure of how often equipment (chassis) is rejected by truckers, delaying departure of containers from the port.

**Sustainability**

- Projection of Future Freeway Capacity Constraints:
  Compares the projection of future truck trips related to port activity to freeway trucking capacity constraints.
- Projection of Future Port Capacity Constraints:
  Compares the projected trade volumes with projected port capacity, measured by using current throughput per acre combined with projected future port acreage.

**Environmental Quality**

- Pollution caused by trucks queuing in the port complex:
  Measured by multiplying the environmental impacts of one hour of idling truck time with the average wait times for trucks found as an indicator of Mobility and Accessibility.
- Temporal Distribution of Truck Trips in port complex:
  Indicator is the ratio of truck trips beginning and ending at the port at peak hours, between the hours of 7 a.m. to 10 a.m. and 3 p.m. to 7 p.m., to total truck trips beginning and ending at the port.

# Mobility/Accessibility Indicators: Data

**Wait Times For Trucks**

In order to assess the wait times truckers typically face in doing business at the port, we obtained access to the databases of three of the trucking companies that do significant business at the ports of LA/Long Beach. We present below statistics on the merged dataset, including observations from each company surveyed. In the appendix, we provide details on our methods and sources of data, as well as graphs representing the data of each individual company. Individual company names are withheld to maintain confidentiality of the data source.

The number of observations (each observation reflects a movement of a container into or out of the port complex) obtained from each source is listed in Table 1.

Table 1. Number of Observations in the Sample

| Trucking Company | Number of Observations in the Sample |
|---|---|
| Company 1 | 2,392 |
| Company 2 | 14,220 |
| Company 3 | 2,885 |
| Total Observations | 19,497 |

As Table 1 indicates, our total sample includes data on almost 20,000 individual moves. The largest sample was obtained from company 2, which kept computerized records of individual moves that were easily downloaded into a format that we could use. Smaller sample sizes from the other companies were required since the method of data collection was much more labor-intensive. Our results were generally robust over the three companies surveyed. Data from the individual company samples is presented in Appendices II and IV.

Table 2 shows the distribution of truck waits in the combined sample. As Table 2 indicates, less than two-thirds of transactions involved wait times of less than two hours, with almost a quarter of transactions involving a wait in the range of 2 to 3 hours. These wait times reflect waits outside the terminal gate, as well as waits incurred within the terminal complex.

Table 2. Wait in Hours, Percentage of Occurrences

| Wait in Hours | Percentage of Occurrences |
|---|---|
| 10 hours + | 0.03% |
| 7 to 9:59 hours | 0.37% |
| 5 to 6:59 hours | 2.33% |
| 4 to 4:59 hours | 3.26% |
| 3 to 3:59 hours | 9.14% |
| 2 to 2:59 hours | 24.14% |
| Less than 2 hours | 60.73% |

Table 3 contains the wait times for trucks by transaction for the trucking companies surveyed. The waits are described by type of transaction: import, export, or empty container. The largest category in our sample was import-based observations, making up 88.4% of the total sample obtained from the three companies.

Table 3. Truck Waits by Transaction

| Truck Waits By Transaction | | | |
|---|---|---|---|
| Wait | Percentage of Occurrences | | |
| | Import | Export | Empty |
| 10 hours + | 0.03% | 0.00% | 0.00% |
| 7 to 9:59 hours | 0.41% | 0.00% | 0.00% |
| 5 to 6:59 hours | 2.56% | 0.20% | 0.48% |
| 4 to 4:59 hours | 3.59% | 0.61% | 0.48% |
| 3 to 3:59 hours | 10.06% | 1.64% | 1.72% |
| 2 to 2:59 hours | 26.59% | 5.74% | 4.32% |
| Less than 2 hours | 56.76% | 91.81% | 93.00% |

## Estimating Total Annual Truck Wait Hours at the Ports of LA/Long Beach

We can use the data presented in Table 3 to construct estimates of the total number of truck wait hours per year that are related to the operation of the ports of LA/Long Beach. We obtain these estimates by multiplying the number of container transactions at the ports by the percentage of waits associated with each type of transaction in our data.[1] For example, if the ports processed roughly 2.4 million import containers in 1999, and 3.6

[1] To obtain these estimates, container histories for 1999, in TEU's, separated into outbound loaded, inbound loaded, and empty, were obtained from the Port of Long Beach Container Statistics at www.polb.com and from the Port of Los Angeles Public Affairs. The values in TEU's are divided by 1.8 to give the number of containers, and summed for the two ports.

percent of these transactions were subject to waits between 4 and 5 hours, then there were about 86,000 incidences of 4-5 hour waits for import containers last year. The results of these estimates are presented in Table 4.

Table 4. Incidence by Transaction Type

| | **Incidence by Transaction Type** | | |
|---|---|---|---|
| | **Imports** | **Exports** | **Empty** |
| 10 hours + | 690 | 0 | 0 |
| 7 to 9:59 hours | 9799 | 0 | 0 |
| 5 to 6:59 hours | 61003 | 2057 | 5732 |
| 4 to 4:59 hours | 85432 | 6171 | 5732 |
| 3 to 3:59 hours | 239319 | 16455 | 20472 |
| 2 to 2:59 hours | 632664 | 57594 | 51590 |
| Less than 2 hours | 1350484 | 921502 | 1109599 |

We can then estimate total truck hours by multiplying the number of incidences in each category by the average wait time. Using the example above, if there were 86,000 incidences of import transaction waits in the range of 4-5 hours, we can multiply the number of incidences by the average wait (4.5 hours) to give us an estimate of roughly 387,000 hours of truck wait time in this category alone. We can then sum across transaction type and wait categories to get an estimate of total truck wait hours at the ports of LA/Long Beach for 1999.

Estimated Hours Per Transaction By Category

Table 5. Hours per Transaction Type

| | **Hours per Transaction Type** | | | |
|---|---|---|---|---|
| | Imports | Exports | Empty | Total |
| 10 hours + | 6,901 | 0 | 0 | |
| 7 to 9:59 hours | 83,292 | 0 | 0 | |
| 5 to 6:59 hours | 366,017 | 12,341 | 34,393 | |
| 4 to 4:59 hours | 384,441 | 27,769 | 25,795 | |
| 3 to 3:59 hours | 837,617 | 57,594 | 71,653 | |
| 2 to 2:59 hours | 1,581,660 | 143,985 | 128,976 | |
| Less than 2 hours | 1,350,484 | 921,502 | 1,109,599 | |
| | | | | |
| Totals | 4,610,412 | 1,163,191 | 1,370,416 | 7,144,019 |
| Total Over 2 hours | 3,259,928 | 241,689 | 260,817 | 3,762,434 |

The results are presented in Table 5. In order to be conservative, we include in our calculations truck wait hours for wait incidences above 2 hours. As the table indicates, we estimate that last year transactions involving import containers led to truck waits in and around the port complexes totaling 3.3 million hours. Including waits associated with other types of transactions, we estimate total truck wait hours at 3.76 million for 1999. Later in this study, we explore the environmental consequences of these truck wait hours.

Variations in Truck Wait Times by Terminal

While it was not the purpose of this study to highlight individual terminals, we did produce one statistic in order to gauge the degree of variation in truck wait times by terminal. We calculated average truck wait time by terminal, and found that there were significant differences in the average wait time, depending on the terminal where the transaction was taking place. In our data, we found that for 1999, the terminal with the highest reported wait times had an average truck wait time 2 hours higher than the terminal with the lowest reported wait times.

How can truck wait times be reduced?

Interviews with key informants from the trucking companies yielded some insights as to the ways the truck wait times could potentially be reduced, and the obstacles to achieving that objective. In addition, we also present data from the Los Angeles/Long Beach 2000 Trucker Survey by the Terminal Operators Committee from the Steamship Association of Southern California that highlights some issues relevant to improving the efficiency of trucking operations in the ports.

The main complaint of the trucking companies is the limited hours of gate operations at the terminals. Limited hours lead to a high concentration of truck trips entering the ports between 7 and 10 a.m. (see "Temporal Distribution Indicator").

A result of this concentration is a tendency for long queues to develop, leading to these long observed wait times. In addition, the concentration of truck trips leads to greater congestion on area freeways and roads, further lengthening the time it takes a trucker to make a turn through the port complex.

It would seem that an obvious solution to this problem would be to simply extend the gate hours to the terminals. However, terminal operators complain that when they offer extended hours, which increase their costs substantially, the extra hours are not fully utilized by the trucking companies. The reason for this is that many shippers are unable to accept deliveries in off-hours, and truckers have no secure place to park full containers overnight in transit to the shipper's warehouses. Hence, the option of increasing gate hours would solve the problem of truck wait times only if a substantial degree of cooperation could be achieved between the terminals, truckers, and shippers. Below we present some data from the Los Angeles/Long Beach 2000 Trucker Survey by the Terminal Operators Committee from the Steamship Association of Southern California. All of the figures presented in this section illustrate data collected in the survey.

These data are consistent with the information provided in our key informant interviews. The first figure indicates that almost 40% of trucking companies operating in the ports do not have warehouse operations. For these companies, the lack of a secure overnight storage facility is an impediment to taking deliveries out of the port after regular hours.

Figure 1. Trucking Companies With a Warehouse Operation

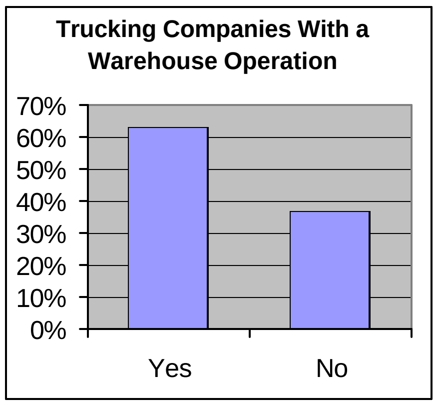
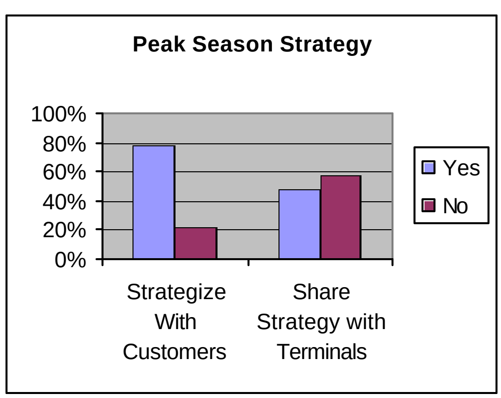



Figure 2 indicates that there are efforts underway to increase cooperation during peak season between the trucking companies, the terminals and the shippers. However, there are opportunities to increase this cooperation substantially—for example, Figure 2 indicates that only about half of the trucking companies share strategies with terminals for dealing with peak season loads.

Figures 2 through 4 also highlight some issues concerning truckers and their customers. While Figure 2 shows that the majority of trucking companies do strategize with customers during peak season, Figures 3 and 4 highlight the limited flexibility that customers provide to the trucking companies. Most truckers in the survey indicated that only a small percentage of their customers are willing to accept loads on the second shift, and even fewer are willing to accept loads on the third shift.

Figure 2. Peak Season Strategy



Thus, finding a solution to the problem of coordinating between terminals, trucking companies and shippers will not be easy. One possible solution would be to introduce a pricing mechanism whereby customers would be charged more to take deliveries during peak hours than off-peak hours. Such a pricing mechanism would encourage shippers to make their warehouses accessible to truckers during off-peak hours.

Figure 3. Second Shift Loads

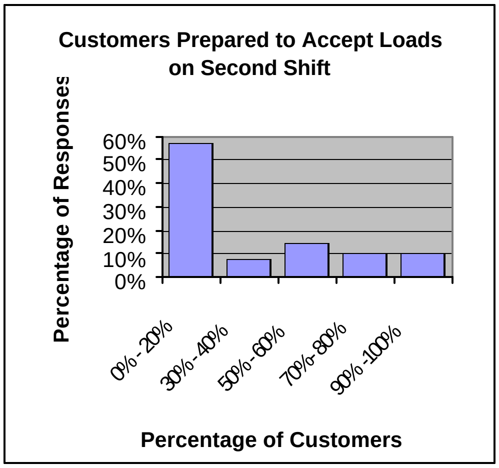
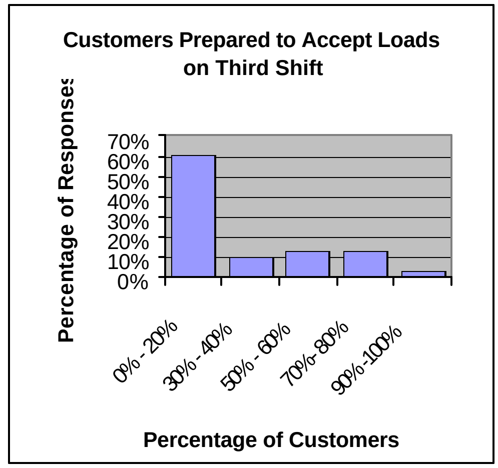
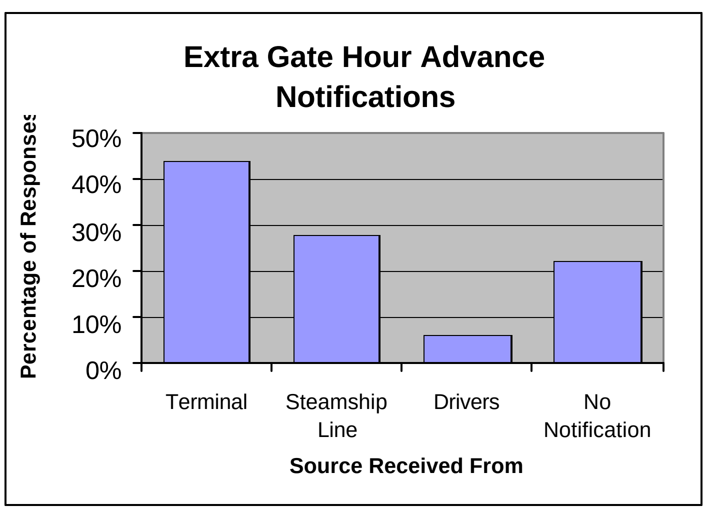



Figure 4. Third Shift Loads




New information technologies could be helpful, in that they could provide a tighter link of communications between the three parties. In our interviews, it was evident that the larger trucking companies were more able to take advantage of extra gate hours when offered, because they had established very close communications, with their own truckers, as well as with their customers and the terminals with which they did business. The smaller companies were more likely to complain that they did not get sufficient advance notice of extra gate hours, and that as a result they could not utilize these extra hours to move cargo to their customers. This is also consistent with the results of the trucker survey.

Figure 5. Extra Gate Hour Advance Notifications



As the Figure 5 indicates, over 20 percent of trucking companies responded that they were not notified of extra gate hours at the terminals. The figures below provide evidence of the proportion of trucking companies that are able to utilize extra gate hours, and the type of extra gate hours (day and time) most likely to be utilized by the trucking companies.

Figure 6. 0700 Gate Hour

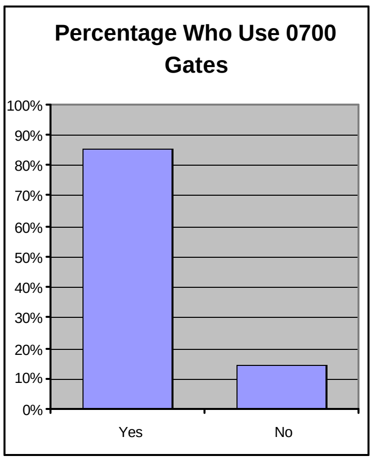



Figure 7. Extra Gate Hour

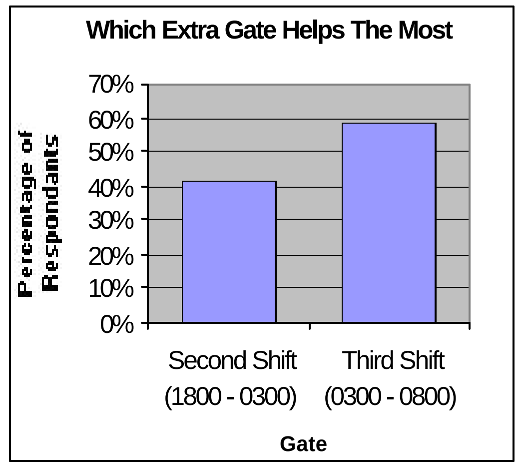
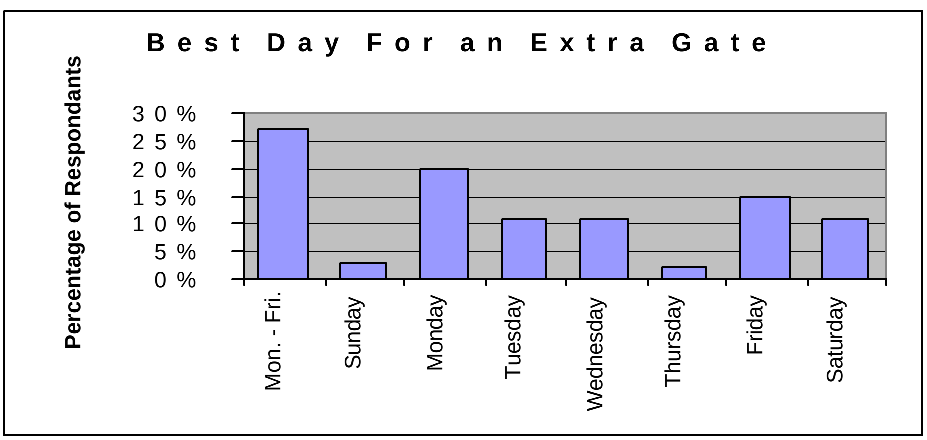



Figure 8. Best Day for an Extra Gate




Another complaint of trucking companies is the limited availability of customs operations. Customs offices are only open Monday-Friday, and staffing of the customs office is not volume driven. Thus, customs may also be a constraint in the effort to reduce truck wait times and increase port throughput by increasing gate hours.

Finally, the Table 6 shows the results of a question from section three of the trucker's survey that asked trucking companies to rank the five problems below, excluding terminal congestion, that the company drivers experience at the terminals based on the frequency of occurrence. This table highlights other issues that contribute to truck wait times at the port. Issues with equipment can be an important source of delays. This is also consistent with information we obtained from the trucking companies in our study.

Priority Ranking For "Causes Of Delay"

Table 6[1]. Ranking for Causes of Delay

| RANKING | PROBLEM |
|---|---|
| 1 | Quality of Customer Service |
| 2 | Booking/Bill of Lading Information |
| 3 | Equipment Shortage |
| 4 | Mis-matched Chassis |
| 5 | Bad Order – Equipment |

[1] Source: Los Angeles/Long Beach 2000 Trucker Survey, Terminal Operators Committee, Steamship Association of Southern California

### Throughput per Acre

Table 7 compares container throughput, and throughput per acre, for ports in the US and around the world. As the table indicates, the ports of LA/Long Beach have some of the highest throughput ratios found throughout the world. Although the Port of Hong Kong has extremely high throughput per acre, this is largely attributable to the large amount of transshipment activities taking place in that location. In order for the twin ports to be able to expand throughput either productivity must increase or land area must change. There are some limited opportunities for land areas of the ports to increase and be better utilized. Also, there is discussion of increasing gate times as an opportunity to raise throughput.

Container Throughput Per Acre For Selected World Ports

Table 7. Container Throughput Per Acre For Selected World Ports

| Port | Container Throughput 1999 | Acres | Throughput Per Acre |
|---|---|---|---|
| Hong Kong[2, 3] | 16,200,000 | 540 | 29,991 |
| Rotterdam[2, 3, 4] | 6,345,000 | 886* | 7,162 |
| Kaohsiung[2, 3, 5] | 6,985,361 | 1,160 | 6,021 |
| *Long Beach*[1] | *4,408,480* | *839* | *5,255* |
| Hamburg[2, 3] | 3,738,307 | 775 | 4,826 |
| *Los Angeles*[1] | *3,828,851* | *848* | *4,515* |
| Seattle[1] | 1,490,048 | 426 | 3,498 |
| Charleston[1] | 1,482,995 | 426 | 3,481 |
| Antwerp[2, 3] | 3,614,246 | 1,218 | 2,966 |
| Le Havre[2, 3] | 1,378,379 | 469 | 2,936 |
| Oakland[1] | 1,663,756 | 688 | 2,418 |
| New York-New Jersey[1] | 2,828,878 | 1,186 | 2,386 |
| Hampton Roads[1] | 1,306,537 | 1,171 | 1,116 |
| Savannah[1] | 793,165 | 1,046 | 758 |
| Kobe[2, 3, 6] | 1,991,680 | 2,867 | 695 |

[1] Source: American Association of Port Authorities.
[2] Source: Port of Hamburg
[3] Source: Terminal Operator Acreage: extracted from Containerization International Yearbook 2000, publisher: Informa Group; provided by the International Association of Ports and Harbors.
[4] Source: Hanno Terminal, Rotterdam
[5] Source: Port of Kaohsiung
[6] Source: Port of Kobe
* Excludes the Delta East Terminal.

## Dwell Time

Table 8 provides data on container dwell time in the Ports of LA/Long Beach. According to this source, dwell times in a major terminal in the port vary by season. All else being equal higher dwell time reflects lower throughput.

Table 8[1]. Average Dwell Time by Months/Days

| **Average Dwell Time by Month** | **Days** |
|---|---|
| January | 3.4 |
| February | 3.8 (Chinese New Year) |
| March | 3.3 |
| April | 3.1 |
| May | 3.4 |
| June | 3.3 |
| July | 3.6 |
| August | 4.1 |
| September | 4.3 |
| October | 4.5 |
| November | 3.9 |
| December | 3.5 |

Ratio of Wheeled to Grounded Operations

The ratio of wheeled to grounded operations in several US ports is shown in Table 9. Ports often times can be configured as wheeled or grounded operations. Wheeled operations have the advantage of significantly reducing the number of times a container is handled. Typically in wheeled operations, containers are offloaded and put on chassis; truckers pick up the chassis and container and move it off the port facility. The disadvantage of wheeled operations is it utilizes more land than a grounded operation. Where land is scarce or highly valued, containers are stacked vartically one on top of another. While this stacking uses the land more intensely it does involve additional handling of containers. As the ports get congestion it becomes clear that more of the operations will become grounded.

[1] Data set is a source that wishes to remain unknown, but is a “well-known authority” on the ports.

Table 9[1]. Ratio of Wheeled to Grounded Operations

| Ratio of Wheeled to Grounded Operations | | |
|---|---|---|
| Port | Grounded | Wheeled[2] |
| Charleston (space perspective) 100% of common areas are grounded | 50% | 50% |
| NY-NJ (refers to containers not space) | 50% | 50% |
| Seattle | 75% | 25% |
| LA/Long Beach | 67-75% | 25-33% |

Lifts per Hour[3]

LA/Long Beach – 29 per hour, average

## Reliability Indicators: Data

Indicator of Reliability of Longshore Crews

Our key informant interviews on the Ports of LA/Long Beach indicated that appropriately staffed gangs arrive on time to service vessels arriving in port in 5-10% of cases. Thus, this would constitute a major obstacle to increased efficiency in the ports. According to this source, this problem is worst on the First Shift (0800), better on the 2nd (1900), and mixed on the Third Shift (0300). This source attributes the problem mainly to the lack of "steadies," an antiquated dispatch system, a poor work ethic, and "people taking advantage of the situation."

Indicator of Equipment Constraints

Equipment constraints are a source of bottlenecks at the ports; they contribute to delays in departure from the terminals. The indicator of equipment constraints has been difficult to measure. There is some evidence of equipment delays from our trucking data collection. This evidence is presented in Appendix III. However, in our data, sources for wait times records on equipment delays are incomplete. Truckers did not always state or explain the

[1] Source: Port of Charleston, Port of Seattle, Port Authority NY-NJ, "well known authority," Ports of LA/Long Beach.

[2] No Wheeled terminals outside the US and Canada (Source: Jordan, Woodman, and Dobson).

[3] Source: Key Informant Interview, August 24, 2000.

source of their wait. Therefore, we do not have solid evidence on the proportion of truck waits caused by equipment constraints.

In the sample several cases were documented, reasons were due to chassis unavailability and container damage. The documented equipment delays are:

- The need to change a chassis to 40 foot, no good chassis was available.
- Time to get the container a chassis.
- The need to get container door patched at maintenance shop.

These equipment delays contributed to other factors that caused the drivers to have waits in excess of two hours.

## Sustainability: Data

Projection of Future Freeway Capacity Constraints

The growth of freight will bring additional challenges to the goods movement system in California. According to the forecast prepared for the Ports of LA/Long Beach by Mercer Management/DRI, container traffic is predicted to grow to 24,277 TEU by 2020. The study predicts container traffic growth of 4.8% annually from 1996-2000, and 6.2% between 1996-2020.

However, traffic volumes during the past few years have already put the combined ports on a path to exceed the forecasted cargo values. In 1999, the combined ports handled 8.2 million TEU. This value exceeded the Mercer Management/DRI (MMDRI) forecast for 1999 by 12 percent. Therefore, even taking the MMDRI forecast of 6.2% annual growth from 2000-2020, and applying it to the higher historical numbers, we get a forecast of 28 million TEU moving through the combined ports by 2020.

Typically trucks carry a 40-foot container, which is equivalent to two TEU. In order to estimate the number of containers that will move through the combined ports the number of TEU is divided by two. Using this method, 14 million containers are forecasted to pass through the ports in 2020. If 50% of this cargo were moved by rail, then 7 million would travel by truck or 14 million total container movements including the transportation of empty containers to and from the ports. This translates into a daily average (dividing by 292 working days per year) of 50,000 container trips per day.

This estimate is consistent to that provided by a 1999 report of the US Maritime Administration, which states, "The Ports of Long Beach and Los Angeles handle 20,000 truck movements and 30 train movements per day, these movements are expected to reach 50,000 truck and 100 train movements per day by 2020." [1]

However, the underlying growth forecast for these analyses is probably too low. During

[1] Note: U.S. Maritime Administration, An Assessment of the U.S. Marine Transportation System: A Report to Congress September 1999.

the past 5 years, for example, the Port of Long Beach has seen average annual growth rates of container traffic of over 11 percent. This growth rate is not likely to be sustainable over a 20-year period, in that it reflects a period of time when the US economy was unusually strong. However, if we were to take the 1999 cargo level, and apply an average annual growth rate of just 8 percent, we would have a cargo forecast for the combined ports of 40 million TEU by 2020. Dividing the number of TEU by two yields a forecast of 20 million containers. Using the same ratio of 50% of the containers moving by rail, an estimated 10 million containers will be moved by truck. This would translate into a forecast for 68,000 truck trips daily by 2020, including empty container trips.

What will this mean for the status of Los Angeles freeways, in particular, those adjacent to the ports of Los Angeles/Long Beach?

<u>Projection of Future Port Capacity Constraints</u>

If container cargo values rise to 28 million TEU by 2020, this would imply a four-fold increase in the throughput of the combined ports. Some of this can be handled by expansion of port facilities. However, significant increases in port acreage will require expensive land acquisition and landfill costs. In addition, it is unlikely that sufficient land or landfill opportunities will be available to increase the capacity of the ports by a factor of four. Therefore, a key element in determining whether the ports will be able to manage the forecasted levels of cargo values will be whether throughput per acre can be raised significantly to increase the productivity of the scarce acreage available in the ports.

A clear option available to increase the productivity of existing acreage is to increase the hours of port operation, moving toward 24-hour operations. As discussed above, an obstacle to extended hours is the lack of cooperation between all of the parties involved (truckers, shippers, terminal operators). From the terminal operators point of view there has to be a sufficient number of moves in order to ensure the economic viability of the extended gate operations. While truckers have an incentive to use gate hours if it will significantly lower the time it takes to pick up a container in the terminal, they require a secure place to drop the container. This need may be fulfilled by warehouses, but is contingent on customs being open, or in the case of a non-custom item for the warehouse to be available. Shippers must be prepared to accept delivery in off hours.

## Environmental Quality: Data

<u>Indicator of Pollution caused by Trucks Queuing up in the Port Complex</u>

A consequence of trucks lining up and having excess waits at the harbor is the environmental degradation from hours of truck idle time. Table 10 shows the emission rates for various pollutants per hour of truck idle time.

HC, CO, NOx and CO2 Idle Emission Rates in EMFAC2000[1]

Table 10. Idle Emissions Rates

| Idle Emissions Rates (grams per hour) | | | |
|---|---|---|---|
| **HC** | **CO** | **Nox** | **CO2** |
| 44 | 247 | 396 | 29687 |

If we multiply these rates by our estimate of total truck waits, we obtain an estimate of the impact of these truck waits on the region's air quality in 1999.

Table 11. Idle Emissions Resulting from Truck Waits at Port Complex, 1999

| Idle Emissions Resulting from Truck Waits at Port Complex, 1999 (millions of grams) | | | |
|---|---|---|---|
| **HC** | **CO** | **NOx** | **CO2** |
| 165.5 | 929.3 | 1,489.9 | 111,695.4 |

A second environmental indicator is the generation of particulate matter by trucks standing idle in and around the port complex. Table 12 shows the rate of emission of particulate matter, by age of vehicle.

Table 12[2]. Idle Emissions Rates by Class

| Class | Idle Emission Rates (grams per hour) |
|---|---|
| | **Particulate Matter** |
| **Pre-1988** | 5.370 |
| **1988-1990** | 3.174 |
| **1991-1993** | 1.860 |
| **1994** | 1.004 |

Although we do not have an exact breakdown on the age of all trucks doing business at the ports, we can obtain a range of environmental impacts by multiplying these numbers by our total annual wait time estimate of 3.7 million hours, for wait times above two

[1] Source: PM Idle Emissions Rate from USEPA's PART 5 on page 64. Data provided to us by California EPA Air Resources Board.

[2] Source: PM Idle Emissions Rate from USEPA's PART5 on page 64. Data provided to us by California EPA Air Resources Board.

hours. Truck waits at the port, therefore, will generate in the range of 3.7 million to 19.9 million grams of particulate matter annually. Anecdotal evidence suggests that the high end of this range may be most relevant, since many truckers doing business at the ports are operating older vehicles.

Indicator of Temporal Distribution of Truck Trips

The distribution of truck trips is based on the number of trips originating and ending in the port complex. It is the ratio of truck trips to the port at peak hours to the total number of truck trips. Peak hours are between 7 and 10 a.m. and 3 to 7 p.m. These are the times in which the freeways are busy with commuter traffic. These times are also times in which there are a large number of truck trips to and from the harbor areas adding to the congestion.

As with truck wait times, our indicators of temporal distribution are based on almost 20,000 observations of container movements entering and leaving the ports in 1999. We present data aggregated from the three trucking companies surveyed. Individual company data are found in Appendix IV to this document.

As Figure 9 and Figure 10 indicate, the distribution of truck trips arriving and leaving the port is highly concentrated. This is particularly the case with arrivals to the port. More than 25% of all arrivals to the port complex occur within a single hour period 7:45 – 8:45 a.m.

Figure 9. Distribution of Truck Trips Arriving at the Ports by Time of Day

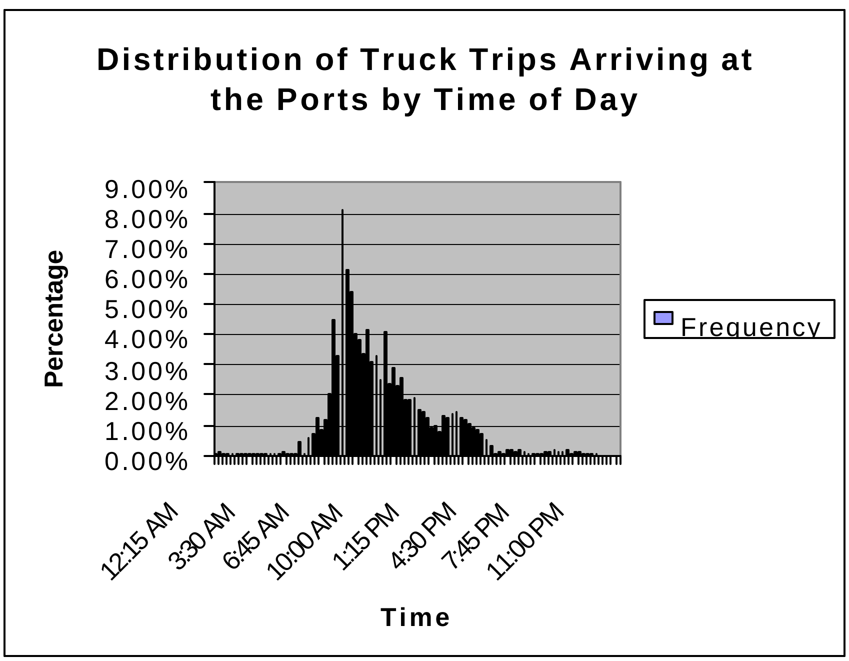
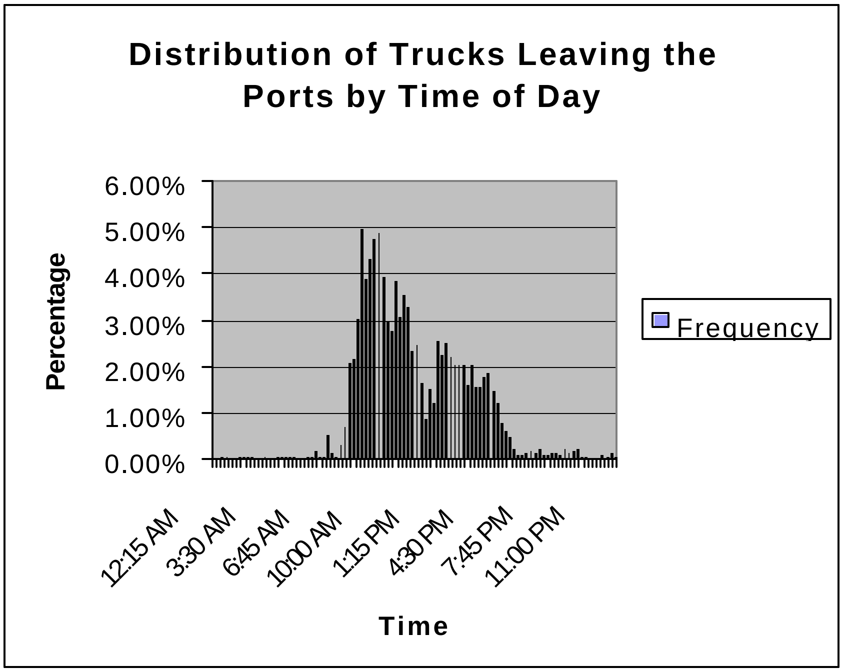


Figure 10. Distribution of Truck Trips Leaving the Ports by Time of Day




Although trips leaving the ports are more temporally dispersed than arrivals, still almost 20% of trips leaving the port occur within an hour's timeframe, from 9 to 10 a.m. These figures suggest that the temporal distribution of truck trips to the ports of LA and Long Beach is heavily concentrated. This is particularly the case for truck trips arriving at the ports during the morning hours. As our discussion with key informants in the trucking industry suggested, a key to reducing overall truck waits at the ports is to spread out this distribution more evenly over time. This would require not only longer gate hours, but also coordination between truckers, terminals and shippers so that cargo can move through the ports more efficiently.

The Port has developed a temporal distribution of truck trips. The data is based on gate transactions at the Port of Long Beach and the Port of Los Angeles.

| | 7-8 am | 8-9 | 9-10 | 10-11 | 11-12 | 12-1 pm | 1-2 | 2-3 | 3-4 | 4-5 |
|---|---|---|---|---|---|---|---|---|---|---|
| In | 9.5% | 12.2% | 13.3% | 12.2% | 7.4% | 9.1% | 13.2% | 11.6% | 8.2% | 3.3% |
| Out | 0.1% | 12.7% | 13.7% | 11.2% | 12.0% | 7.7% | 10.3% | 14.2% | 10.1% | 7.8% |

Data on the temporal distribution of truck trips provided by the ports differs from the data in this study. The 20,000 transactions used as data points in this study point to a concentration of truck arrivals where the data from the ports shows a smoother pattern of flows across time. The difference in distribution is attributable to the differences in the data sources. The port data measures gate movements, it does not reflect time spent by trucks waiting outside the terminal gates. However, much of the congestion at the ports appears in the form of long waits outside terminal gates. Since, the data used in this study includes truck waits outside terminal gates it reflects a greater degree of congestion. For example, consider a situation where a large number of trucks arrive in the morning between the hour of 8 and 8:30. Our temporal distribution indicates when they arrive outside the terminal gates, and is highly concentrated. The Ports data are reflecting the point of time when each truck enters the gate.

| Time of Arrival Outside Gate (our data) | Wait Outside Gate | Time Entering Gate (Ports' data) |
|---|---|---|
| 8:00 | 0 | 8:00 |
| 8:15 | 20 | 8:35 |
| 8:30 | 40 | 9:10 |

Because of the growing wait times, a truck arriving at the complex only 30 minutes later than the 8:00 truck actually is recorded at the gate 70 minutes later. Thus, the gate transactions will reflect a more continuous pattern of arrivals over time than our data source.

## Conclusions and Recommendations

The results of the Phase I study confirmed the adaptation and use of redefined performance indicators from passenger vehicle movement to evaluate the effectiveness of surface transportation related to goods movement. This conclusion was confirmed on the basis of (1) available data in the public domain, (2) anecdotal data from industry interviews and (3) in depth analysis of proprietary data supplied by several major trucking firms. The focus is on the key performance indicator of truck wait/turnaround. This is used as a measure of the performance of the truck-terminal gate interface in the goods movement supply chain. The results of the study were validated by members of the Policy and Steering Committee of CITT. Phase II data analysis involving marine terminal performance and other sources will continue to evaluate passenger movement derived performance indicators to goods movement applicability.

Adaptability of generic performance indicators aside, the principal findings of the Phase I study documented for the first time the temporal and spatial congestion of truck wait/turnaround times at the fourteen terminals at the combined ports of Los Angeles Long Beach. The aggregate impact of an estimated 3.8 million in annual wait delays at the marine terminals in the ports is magnified with ripple effects throughout the region beginning with the I-710 corridor.

The study data suggest the key indicator or truck wait/turnaround times is a capacity constraint and limits the goods movement supply chain during normal conditions and the vulnerability of the current system to stress during peak or surge conditions. Significantly as more and more warehouse and distribution facilities move to the Inland Empire and beyond, turnaround times will inevitably increase and regional congestion will likewise increase. This result will also be reflected in other performance indicators such as mobility/accessibility, sustainability, and environmental impacts.

The findings support the fundamental conclusion that, in the absence of major new infrastructure improvements anticipated before the end of the decade to relieve truck congestion and conflict with passenger vehicular movement, voluntary demand management measures must be implemented. Objectives for demand management should include:

- terminal throughput to meet the anticipated two to four fold increase in volume of cargo (including empty container return and interchange)
- spacing container pickup and return by extending gate hours
- implementing a queuing system to reduce delays
- substituting information technology based empty container checking and full container dispatch, and equipment interchange

This will necessitate a commitment of terminal operators, cooperation of organized labor, and corresponding changes in receiving patterns by consignees. Coordinated changes in the current Equipment Interchange Report (EIR), management-labor practices under the current Coastwide Agreement, contractual arrangements between trucking companies and shippers, and marine terminals are also needed. Absent voluntary compliance by all parties, tariff changes in drayage or demurrage charges to extend hours, prioritizing containerized cargo pickup, and empty container return at the ports will be required.

# Implementation

The nature of this first phase goods movement research does not lend itself to typical implementation statements. The conclusions and recommendations do suggest that the research data to follow will be valuable in re-convening a dialog between government, labor and industry toward the end of practical, efficient and effective solutions to the goods movement issues in the region. This additional work is now underway and will produce results that can be considered by the above parties for subsequent implementation.

# APPENDICES

I. Methodology For Trucking Company Data Collection

II. Presentation of Individual Company Data

III. Truck Driver Comments on Excess Wait Times

IV. Temporal Distribution of Truck Trips

# APPENDIX I

Methodology For Trucking Company Data Collection

TRUCKING COMPANY 1: Trucking Company 1 is a midsize trucking company servicing the Ports. A database of trucking information was compiled from trucking company files in order to construct the distribution of truck trips to and from the harbor, and provide data on the average wait times for truck transactions at the terminals. Sections of files were chosen at random and all relevant data was recorded. The sample was stratified based on the monthly container volume through the Port of Long Beach in 1999. Samples were taken from a cross section of each month, so that all weeks were included.

From each billing, three documents were used in constructing the information database: the freight bill, the driver handbills, and the terminal interchanges. All bills that were selected in the sampling process were recorded if they contained at least one transaction in or out of the harbor area.

From the freight bill, the type of transaction was recorded, either an import or an export transaction, the freight location, and the charge to the customer, if any, for truck driver wait times at the terminal in excess of two hours. Where possible the dual transaction for each container was recorded. In the case of an import transaction, the full load out, and the empty container return was tracked. For export transactions, the empty container out of the terminal, and the full load into the terminal were tracked. Cases in which there was a rail transfer, warehousing, or reuse of the container were excluded from the sample, and only the single transaction into or out of one of the harbor terminals was recorded. Some of these single transactions included either a pick up or drop off of a bare chassis.

From the driver handbill, the driver wait times were recorded and the date of the transaction. All transactions, load in, empty in, load out, empty out, chassis in, chassis out, had a separate handbill if one was filled out. Each handbill contains a section for the harbor in and out time. In the case of wait times under two hours it is not mandatory for the drivers to write in their times. In construction of the database when this area was left blank, the wait time was recorded as less than two hours. Any times written in by the driver were recorded as written, regardless of the length of time. In many cases, particularly trips involving the pick up or drop off of an empty container, a handbill was not filled out by the driver. For analysis, when a handbill was not available, the transaction time at the terminal is presumed to be less than two hours.

The third document from which data was taken was from the terminal interchange forms. The date of the transaction was recorded from these forms and verified with the driver dates. In the case of discrepancies the date from the terminal interchange was used. The terminal times were also recorded from the interchanges. When provided, both the terminal in and terminal out times were recorded. With the majority of terminals only one time is provided; this time reflects either an in or an out time depending on the type of transaction. For "in" transactions, load in, empty in, chassis in, the terminal time is the time of the driver into the terminal. For "out" transactions, load out, empty out, chassis out, the terminal time is the time of the driver out of the terminal. All single times were treated separately and entered as either in times or out times in the database based on the transaction. When driver times and terminal times were both recorded they were checked against one another for consistency. In six of the sample observations the trucker provided an "in" time, but no "out" time. Four of these observations were "out" transactions so the time provided on the terminal interchange was an "out" time, subsequently this time was used to complete the data for the observation. The remaining two of these observations were "in" transactions, so the trucker and terminal times were both "in" times, in these cases the transaction time is presumed to be less than two hours.

TRUCKING COMPANY 2: Trucking Company 2 is a large trucking company working the Ports. The company provided data to us on trips to the harbor. The system of tracking truck trips is computerized at this company. Trucks are timed when they leave the facility to when they return. This data was downloaded from the system and provided to us to construct wait times for trucks at the Ports and to construct the distribution of truck trips to and from the terminals. To construct the wait times the total time the truck was making the trip to the harbor was calculated, then the transit time each way was subtracted off the total trip time to obtain the length of time the trucker was at the terminal. We are using as the transit time the time it would take to drive at normal speeds from the trucking company facility to the Ports. Part of the wait time may reflect congestion on the 710 freeway or on streets down by the piers. The calculated wait times will also incorporate waits on the streets outside the gates of the terminals. The data provided is based on the activities of one of the company trucking divisions and is not a comprehensive list of activity. It is a list of moves which are quantifiable, based on their reporting system. The data includes non-bobtail trips made to a single berth in 1999. The data excludes any round trips involving more than one terminal, bobtail, and one-way trips.

TRUCKING COMPANY 3: Trucking Company 3 is another large trucking company sending trucks down to the Ports of Long Beach and Los Angeles. Trucking company harbor dispatch employees complied a list of moves from their records and provided them for the study. As with Trucking Company 2, Trucking Company 3 times the drivers from the time they are dispatched to the time they return to the facility. The wait times were calculated by figuring the Total Trip and subtracting the transit time each way to the Ports. Included in the data set were three months of peak transactions and three months of off- peak transactions. All of the transactions provided were import transactions. The times given for dispatch and arrival to the facility were rounded up to the nearest fifteen minutes.

# APPENDIX II

Presentation Of Individual Company Data

TRUCKING COMPANY 1: Trucking Company 1 is described in Appendix I above. One important characteristic of the data from Trucking Company 1 is that we have incomplete information on waits under two hours. This particular company bills its customers for waits over two hours. Thus, drivers have a strong incentive to record any waits above this threshold so that they can be compensated for their wait times. However, any wait under two hours is not billable and so the drivers do not record the exact length of these shorter waits. Thus, any handbill for which no wait is recorded is considered to represent a trip with a wait shorter than two hours.

Table A2-1. Wait in Hours, Percentage of Occurrences, Trucking Company 1

| **Truck Wait Times** | |
|---|---|
| **Wait** | **Percentage Of Occurrences** |
| 10 hours + | 0.08% |
| 7 to 9:59 hours | 0.04% |
| 5 to 6:59 hours | 0.42% |
| 4 to 4:59 hours | 0.96% |
| 3 to 3:59 hours | 2.05% |
| 2 to 2:59 hours | 1.84% |
| less than 2 hours | 94.61% |

Table A2-2. Truck Waits by Transaction , Trucking Company 1

| Truck Wait Times By Transaction | | | |
|---|---|---|---|
| **Empty In** | | **Empty Out** | |
| Wait | Percentage | Wait | Percentage |
| 3 to 3:59 hours | 0.30% | | |
| 2 to 2:59 hours | 0.20% | 2 to 2:59 hours | 3.06% |
| Less than 2 hours | 99.50% | Less than 2 hours | 96.94% |
| | | | |
| **Load In** | | **Load Out** | |
| Wait | Percentage | Wait | Percentage |
| 4 to 4:59 hours | 1.74% | 10 hours + | 0.19% |
| 3 to 3:59 hours | 0.58% | 7 to 9 hours | 0.09% |
| 2 to 2:59 hours | 2.33% | 5 to 7 hours | 0.93% |
| Less than 2 hours | 95.35% | 4 to 4:59 hours | 1.86% |
| | | 3 to 3:59 hours | 4.19% |
| | | 2 to 2:59 hours | 3.26% |
| | | Less than 2 hours | 89.48% |

Table A2-3. Seasonal Variations, Trucking Company 1

**Seasonal Variations:**

| Month | Percentage of Trips | |
|---|---|---|
| | Over 2 hours | Over 3 hours |
| January | 3.64% | 1.82% |
| February | 13.21% | 8.49% |
| March | 2.11% | 0.00% |
| April | 6.61% | 3.31% |
| May | 0.83% | 0.00% |
| June | 2.94% | 1.76% |
| July | 10.63% | 7.25% |
| August | 4.65% | 2.71% |
| September | 3.79% | 1.75% |
| October | 4.02% | 2.87% |
| November | 7.49% | 5.29% |
| December | 6.86% | 1.47% |

Table A2-4. Average Wait Time, Trucking Company 1

| Month | Average Wait in Excess of Two Hours |
|---|---|
| January | 3:02 |
| February | 3:29 |
| March | 2:28 |
| April | 3:10 |
| May | 2:05 |
| June | 3:02 |
| July | 4:31 |
| August | 2:30 |
| September | 2:32 |
| October | 3:55 |
| November | 3:14 |
| December | 3:03 |

TRUCKING COMPANY 2: The following tables reflect data obtained from Trucking Company 2 (described in Appendix I above).

Table A2-5. Wait in Hours, Percentage of Occurrences, Trucking Company 2

| Truck Wait Times | |
|---|---|
| **Wait** | **Percentage of Occurrences** |
| 10 hours + | 0.02% |
| 7 to 9:59 hours | 0.50% |
| 5 to 6:59 hours | 2.68% |
| 4 to 4:59 hours | 3.92% |
| 3 to 3:59 hours | 9.89% |
| 2 to 2:59 hours | 24.35% |
| 1 to 1:59 hours | 35.41% |
| Less than 1 hour | 23.22% |

Table A2-6. Truck Waits by Transaction , Trucking Company 2

| **Truck Wait Times By Transaction** | | | |
|---|---|---|---|
| Empty In – Empty Out | | Empty In – Load Out | |
| Wait | Percentage | Wait | Percentage |
| 5 to 6:59 hours | 2.01% | 10 hours + | 0.02% |
| 4 to 4:59 hours | 2.01% | 7 to 9:59 hours | 0.53% |
| 3 to 3:59 hours | 6.30% | 5 to 6:59 hours | 2.77% |
| 2 to 2:59 hours | 16.62% | 4 to 4:59 hours | 4.10% |
| 1 to 1:59 hours | 43.84% | 3 to 3:59 hours | 10.26% |
| Less than 1 hour | 29.23% | 2 to 2:59 hours | 25.23% |
| | | 1 to 1:59 hours | 35.44% |
| | | Less than 1 hour | 21.66% |
| | | | |
| Load In – Load Out | | Load In – Empty Out | |
| Wait | Percentage | Wait | Percentage |
| 7 to 9:59 hours | 0.36% | 5 to 6:59 hours | 0.32% |
| 5 to 6:59 hours | 1.82% | 4 to 4:59 hours | 0.00% |
| 4 to 4:59 hours | 2.55% | 3 to 3:59 hours | 2.22% |
| 3 to 3:59 hours | 5.45% | 2 to 2:59 hours | 7.59% |
| 2 to 2:59 hours | 11.27% | 1 to 1:59 hours | 27.85% |
| 1 to 1:59 hours | 32.00% | Less than 1 hour | 62.03% |
| Less than 1 hour | 46.55% | | |

Table A2-7. Seasonal Variations, Trucking Company 2

**Seasonal Variations:**

| Month | Average Wait in Hours |
|---|---|
| January | 1:11 |
| February | 1:26 |
| March | 1:42 |
| April | 1:49 |
| May | 1:34 |
| June | 1:28 |
| July | 2:39 |
| August | 2:10 |
| September | 2:04 |
| October | 2:05 |
| November | 2:07 |
| December | 1:55 |

To make company 2 data comparable to that of company 1, we can also calculate average waits in excess of 2 hours for company 2. These data are quite comparable to the data obtained from company 1.

Table A2-8. Average Wait Time, Trucking Company 2

| Month | Average Wait Over 2 Hours |
|---|---|
| January | 3:06 |
| February | 3:12 |
| March | 3:06 |
| April | 3:06 |
| May | 2:57 |
| June | 2:48 |
| July | 3:36 |
| August | 3:07 |
| September | 3:05 |
| October | 3:06 |
| November | 3:08 |
| December | 2:55 |

TRUCKING COMPANY 3: The following tables reflect data obtained from Trucking Company 3 (described in Appendix I above). All the transactions that are provided by Trucking Company 3 are import transactions.

Table A2-9. Wait in Hours, Percentage of Occurrences, Trucking Company 3

| Truck Wait Times | |
|---|---|
| **Wait** | **Percentage of Occurrences** |
| 5 to 5:59 hours | 2.22% |
| 4 to 4:59 hours | 1.91% |
| 3 to 3:59 hours | 11.33% |
| 2 to 2:59 hours | 41.56% |
| 1 to 1:59 hours | 35.29% |
| Less than 1 hour | 7.69% |

Table A2-10. Seasonal Variations, Trucking Company 3

**Seasonal Variations:**

| Month | Average Wait in Hours |
|---|---|
| May | 3:06 |
| June | 2:03 |
| July | 2:14 |
| August | 1:56 |
| September | 2:02 |
| October | 1:42 |

Data from Trucking Company 3 were available for 6 months only. Within these months, the seasonal variation in wait times is reported above.

# APPENDIX III

Truck Driver Comments on Excess Wait Times

1. Three hours stand by at harbor.
2. Five hours stand by at terminal.
3. Five hours stand by.
4. Four hours stand by at terminal.
5. Line to enter port, lunch break, wait for crane, line to exit.
6. Long slow line to enter port, lunch break, container spot temporarily closed, flip empty, pick up load, line to exit. Arrive at harbor at 11 a.m., in berth at 1:51, out at 2:50.
7. Too busy inside, lots of trucks.
8. Container on demurrage.
9. Very slow to get in.
10. Long line, very slow.
11. Congested port, plus both breaks.
12. Line at front of berth, inside berth: need to change chassis to 40 foot, no chassis: good ones.
13. Long line, also stop at 4:30 to 6:30.
14. Lots of trucks to flip loads, container on the ground.
15. Very slow flip, very hard to get into berth.
16. Congested harbor, plus lunch break.
17. Overcrowded port, took care of demurrage, port took their morning break.
18. Entire harbor shut down due to congestion, overcrowded lanes and accidents.
19. Long slow line to enter harbor, port took their morning break, had to get container door patched at maintenance shop.
20. Problem picking up order.
21. Long line in front of me, port took their lunch break until 1:00 p.m., long flip line, port took their afternoon break.
22. One hour, 30 minutes only to pay demurrage, rest of the time to get it a chassis.
23. No freight release.
24. Line, demurrage only paid through 8-20-99.
25. Three hours and 15 minutes at terminal.
26. Three hours stand by.
27. Subject to inspection, bags wet, damaged material leaking out.
28. Waited three hours and 15 minutes on 4-26-99, could get nothing out: demurrage is owed. Spent three hours at terminal 8 a.m. to 11 a.m. on 4-27-99.
29. Drop inside wet.

# APPENDIX IV

Temporal Distribution of Truck Trips

METHODOLOGY: The data from the three companies in the study are combined to obtain the aggregate distributions of trucks arriving at and leaving the Ports. The systems used by trucking Company 2 and Trucking Company 3 of tracking trucks are similar. Both record the time the truck leaves the trucking company facility and the time the truck returns. The times used to construct the aggregate distribution are the same as the times used for the individual distribution of Company 2 and Company 3. The Distribution of Truck Trips Arriving at the Ports was constructed using the time the truck left the company facility plus the average transit time from the facility to the Ports. The Distribution of Truck Trips Leaving the Ports was constructed using the time the truck returned to the company facility minus the average transit time from the facility to the Ports. The individual distribution for Trucking Company 1 uses the time on the terminal interchange form. This time reflects the time the truck entered or left the terminal and excludes any wait time outside the terminal. Any wait outside the terminal is captured in the times used for Trucking Company 2 and Trucking Company 3. For comparability, in the aggregate distribution, the times recorded by the truck drivers on the driver handbill are used where available to capture any wait time outside the terminal. Observations in the database for Trucking Company 1 that do not have a time entered by the driver, the terminal time is used for the aggregate distribution. Cases in which the terminal time is used comprise of 3.4% of the total observations for the aggregate distribution of truck trips arriving at the Ports, and 5.2% of the total observations for the aggregate distribution of trucks leaving the Ports.

TRUCKING COMPANY 1: The database of trucking company records was also used to construct the distribution of trips to and from the ports. To construct the distributions, the time from the terminal interchange was used. As these charts indicate, the distribution of trips arriving and leaving the ports is highly concentrated.

Figure A4-1. Distribution of Truck Trips Arriving at the Ports, Trucking Company 1

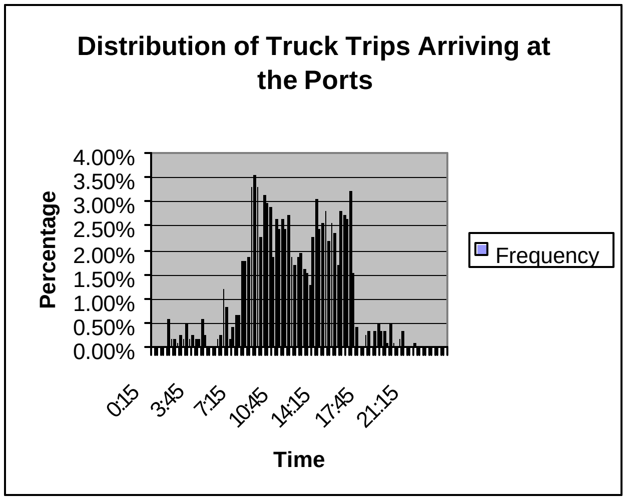
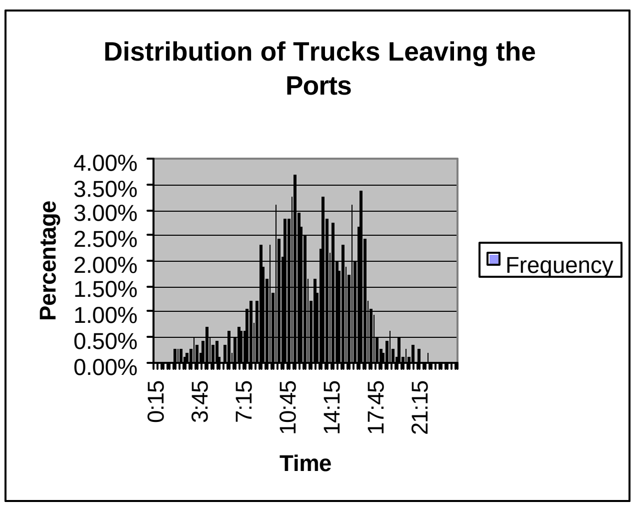



Figure A4-2. Distribution of Trucks Leaving the Ports, Trucking Company 1



TRUCKING COMPANY 2: Trucking Company 2 is a large trucking company working the Ports. The company provided data to us on trips to the harbor from their computerized system. Trucks are timed when they leave the facility and when they return. This data was downloaded from the system and provided to us to construct wait times for trucks at the Ports and to construct the distribution of truck trips to and from the terminals. The Distribution of Truck Trips Arriving at the Ports was constructed using the time the truck left the company facility plus the average transit time from the facility to the Ports. The Distribution of Truck Trips Leaving the Ports was constructed using the time the truck returned to the company facility minus the average transit time from the facility to the Ports.

Figure A4-3. Distribution of Truck Trips Arriving at the Ports, Trucking Company 2

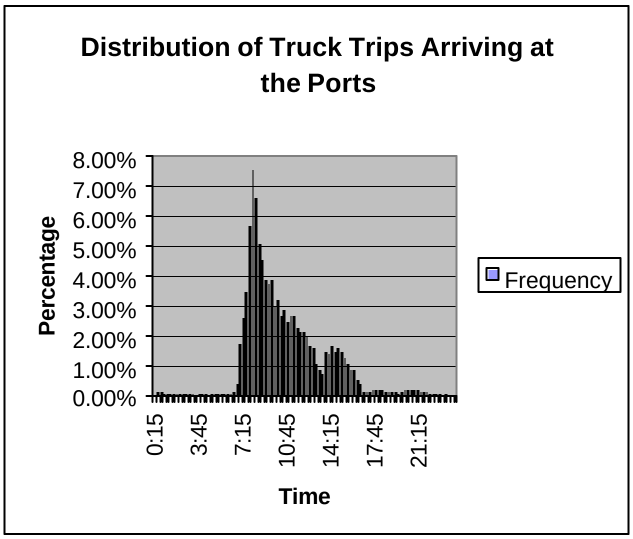
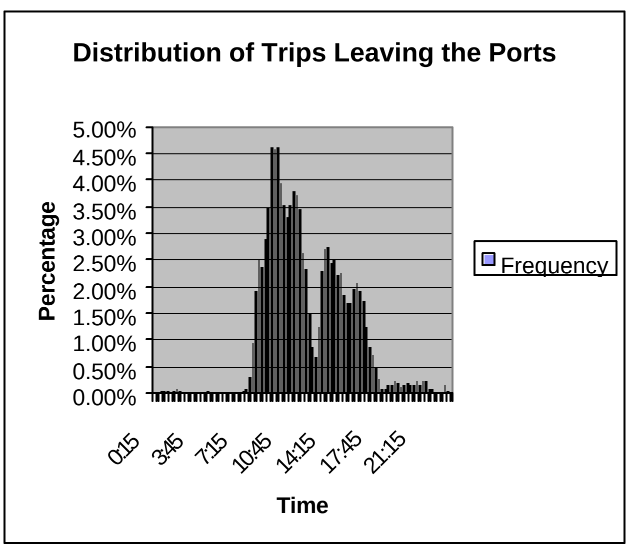



Figure A4-4. Distribution of Trucks Leaving the Ports, Trucking Company 2



TRUCKING COMPANY 3: Trucking Company 3 is another large trucking company sending trucks down to the Ports of Long Beach and Los Angeles. Trucking company harbor dispatch employees complied a list of moves from their records and provided them for the study. As with Trucking Company 2, Trucking Company 3 times the drivers from the time they are dispatched to the time they return to the facility. Included in the data set were three months of peak transactions and three months of off-peak transactions. All of the transactions provided were import transactions. The times given for dispatch and arrival to the facility were rounded up to the nearest fifteen minutes.

Figure A4-5. Distribution of Truck Trips Arriving at the Ports, Trucking Company 3

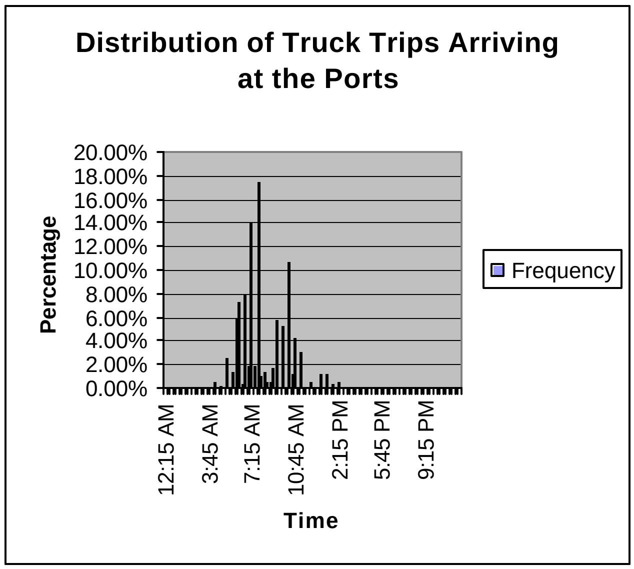
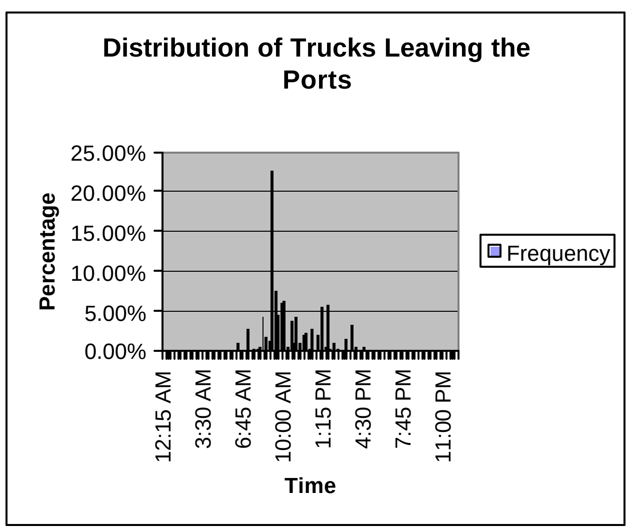



Figure A4-6. Distribution of Trucks Leaving the Ports, Trucking Company 3



# References


Anderson, Kevin M. and Walton, C. Michael. Evaluating Intermodal Freight Terminals: A Framework for Government Participation. Center for Transportation Research, University of Texas at Austin and Southwest Region University Transportation Center. August 1998.

American Association of Port Authorities. "North American Container Traffic in TEU's." Spreadsheet File. 2000.

American Association of Port Authorities. "United States Port Container Terminal Area." Spreadsheet File. 2000.

Easley, Richard Bernard. Gate Operations at Barbours Cut Container Terminal: A Case Analysis. Master's Thesis, The University of Texas at Austin. August 1994.

Cambridge Systematics, Inc. Intermodal Freight Transportation, Volume 1: Overview of Impediments, Data Sources for Intermodal Transportation Planning, and Annotated Bibliography. Federal Highway Administration and United States Department of Transportation. December 1995.

——. Intermodal Freight Transportation, Volume 2: Fact Sheet and Federal Aid Eligibility. Federal Highway Administration and United States Department of Transportation. December 1995.

Containerisation International Yearbook 2000. Informa Group. 2000. (Provided by: Nagai, Hiro, Assistant under Secretary. The International Association of Ports and Harbors. July 2000.)

Holguin-Veras, Jose and Walton, C. Michael. A categorized and Annotated Bibliography to the Performance Analysis of Port Operations. Center for Transportation Research, University of Texas at Austin and Southwest Region University Transportation Center. March 1995.

Johnson, Dan. "Jordan Woodman Dobson." Personal Interview. February 2000.

Port of Los Angeles. "Port of Los Angeles Container History." 2000.

Steamship Association of Southern California, Terminal Operators Committee. "Los Angeles-Long Beach Trucker Survey 2000." June 2000.

United States Environmental Protection Agency. Part 5: PM Idle Emissions Rate. Page 64. (Provided by: California Environmental Protection Agency, Air Resources Board.)

United States Department of Transportation. An Assessment of the U.S. Marine Transportation System: A Report to Congress. U. S. Department of Transportation. September 1999.