PierPASS, Inc

Ability/TriModal Transportation Services, Inc

Taking the Pulse of the Ports

DURATION OF TRUCK VISITS TO MARINE TERMINALS

DIGITAL GEOGRAPHIC
RESEARCH CORPORATION

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Final Report

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Glossary

BCO	Beneficial Cargo Owner
DGRC	Digital Geographic Research Corporation
GIS	Geographic Information Systems
GPS	Global Positioning System
LMC	Licensed Motor Carrier
MTO	Marine Terminal Operator
RCF	Reverse Cumulative Frequency
TMF	Traffic Mitigation Fee
TTSG	Truck Turntime Stakeholders Group
USDOT	U.S. Department of Transportation

Acknowledgements

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Executive Summary

A Truck Turn Time Stakeholders Group (TTSG) was constituted in the San Pedro Bay Ports in summer 2010, consisting of partners in the port freight business: the ports, marine terminal operators (MTOs), licensed motor carriers (LMCs), and beneficial cargo owners (BCOs), to address long-standing points of contention. PierPASS Inc., on behalf of TTSG, engaged Digital Geographic Research Corporation (DGRC) to evaluate port performance in respect of truck-terminal interaction. DGRC relied on its archive of METRIS^{SM} data—GPS tracks gathered from about 250 drayage trucks that frequent the ports, moving containers to destinations in the Los Angeles basin and beyond. The period of study is May through October 2010.

We define three durations as the basis of performance metrics: queue time (Q), terminal time (T), and visit time (V). Q begins when a truck arrives in the queue outside a terminal, and ends when it passes the entry pedestal. T is the duration of truck dwell inside the terminal, including one or more transactions conducted at wheeled storage, grounded storage, chassis yard, help desk and other service areas inside the terminal. V is the sum of queue time and terminal time.

Three classes of analyses are performed on these durations. The first is a visual assessment of scattergrams that plot Q, T or V against the time of entry into the queue, the time of entry into the terminal, and the time of departure from the terminal. Second, we examine terminal velocity in the context of reliability, using reverse cumulative frequency (RCF) curves. Third, synthesizing multiple RCFs at hourly intervals, we construct profiles over the course of a day, to identify periods of under-utilized capacity. A short final analysis traces the trend in queue time over the study period.

For the record, median queue time in October 2010 is 20 minutes, and terminal time is 31 minutes, for a total visit time of 51 minutes. We strongly caution against quoting these figures in isolation, as the distributions are highly skewed, and no single statistic can do justice to the patterns of variation in the 10,000+ monthly visits from which it is derived. Instead the analysis employs graphic representations that present the entire set of data, and that reveal operational regularities.

A vast majority of visits take less than two hours: 27% are under 30 min, 58% under an hour, 75% under 1 ½ hours, and 86% under 2 hours. A further 12% take 2-4 hours—while this is not a large proportion, it represents roughly 1,000 trips each work day among the population of all trucks visiting the ports. About 1-2% of visits are in the 4-8 hour range.

Trucks begin to queue as early as 03:30, though very few vehicles are involved in this “early bird” wait. Arrivals start in earnest at 07:00 when some gates open, and build up to 08:00 when all gates are open. Arrivals peak after lunch, and fall leading up to 17:00 when the dinner break hour begins. Visit times are surprisingly long in the late evening prior to the 22:00 break, although truck volume is significantly lower than during the day. As much as queues form outside the terminal for gate entry, the data indicate queue formation within the terminal for service in the periods leading up to breaks.

A Traffic Mitigation Fee (TMF) of $100 per container is levied on cargo involved in transactions between 07:00 and 17:00. The TMF funds night operations, which relieves congestion at terminals and on area highways. It is suspected that the TMF schedule leads trucks (a) to linger in the queue prior to the 18:00 gate, to avoid the TMF, and (b) to linger inside the terminal, because the TMF is not assessed on exits after 18:00. There is ample evidence of the former behavior. There are more waits leading up to the 18:00 gate opening than for 13:00 and 23:00 openings, and trucks wait further from the gate. However, the latter practice, lingering inside the terminal, is not evident in the data.

The second class of analyses addresses reliability, specifically the percentage of visits that take more or less time than a given threshold. We construct Reverse Cumulative Frequency (RCF) curves, which are informative and useful decision tools that facilitate establishment and monitoring of a

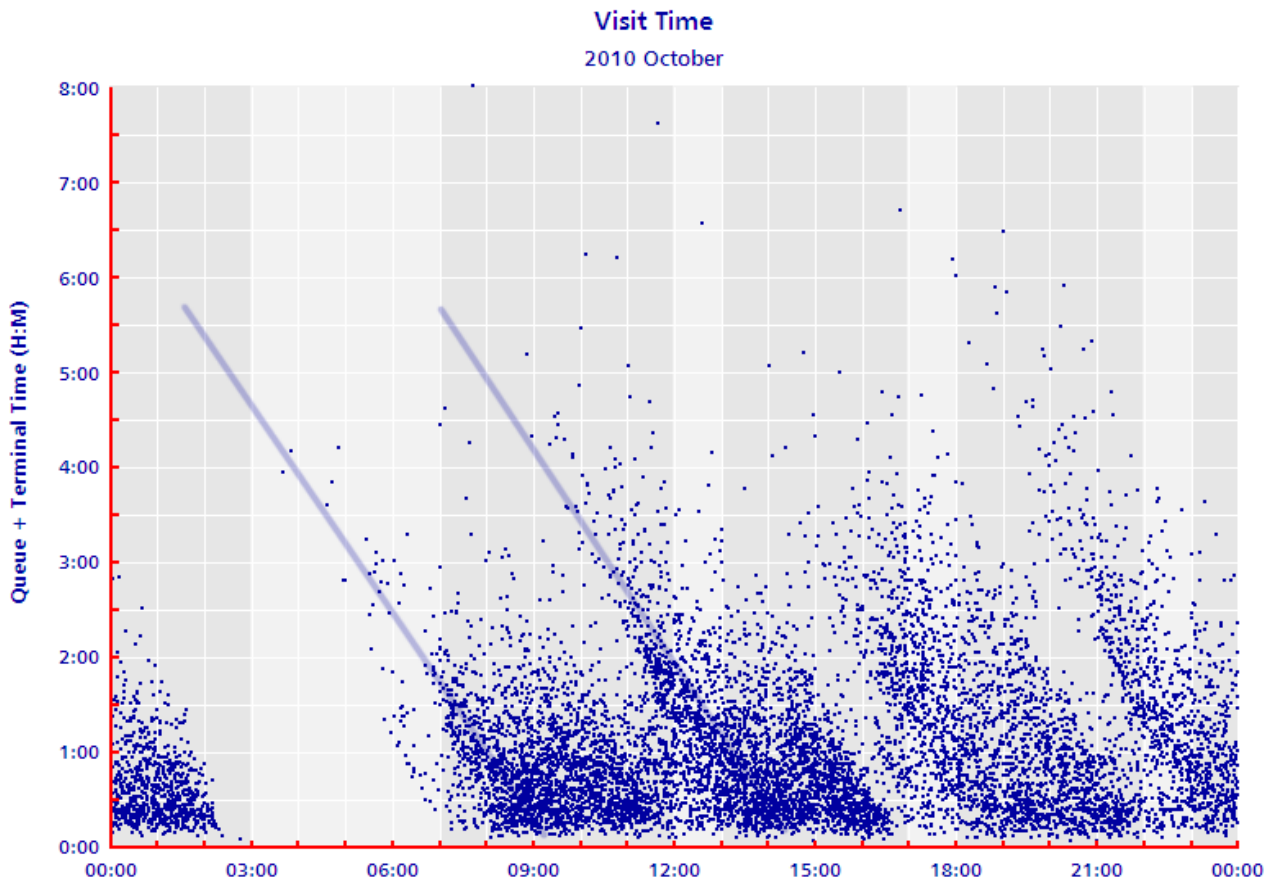

Figure 1. Visit Time, October 2010. Trend bars leaning to left show formation of queues for entry and in-terminal service.

performance standard or reference. A standard may specify, for example, that no more than 25% of visits take longer than an hour, and no more than 10% take longer than 1 ½ hours—the numbers are purely illustrative. MTOs differ in assets, business models and productivity, and a single standard across all terminals may be impractical; a set of terminal-specific benchmarks may be more appropriate. Reviewing the performance of individual terminals, two stand out with exceedingly short queues and terminal time. The curves indicated a wide variety of performance levels, with visit time at the slowest terminals twice as long as at the fastest.

Further analysis reveals that very long visits are more likely at particular terminals, and to a lesser degree, with particular LMCs. If a terminal or truck is involved in *x*% of visits, it should be a participant in *x*% of delays. Three terminals, which host 10% of visits, account for 28% of visits over 4 hours, while the fastest 2 terminals account for 25% of visits but only 2% of long visits. Four LMCs most associated with long visits moved 32% of containers and accounted for 48% of delays. In the case of terminals, these variations indicate significant differentiation of performance (3× and 12×), whereas in the case of LMCs the contrast is slight (1.5×).

Analysis of capacity produces surprising findings. (1) Daytime visits are shortest for trucks that arrive at 15:00. This would suggest that there are few arrivals at that time; in fact the arrival rate is high. (2) The 10th percentile of Visit time (longest visits) is highest at 22:00. Again, one assumes that this is a time of heavy demand; in fact the arrival rate is low. (3) The arrival rate of trucks in the queue is relatively steady in the course of the day: higher in the morning, lower in the evening. What varies is their admission rate into terminals, due to either (a) breaks, or (b) to a far lesser extent, trucks

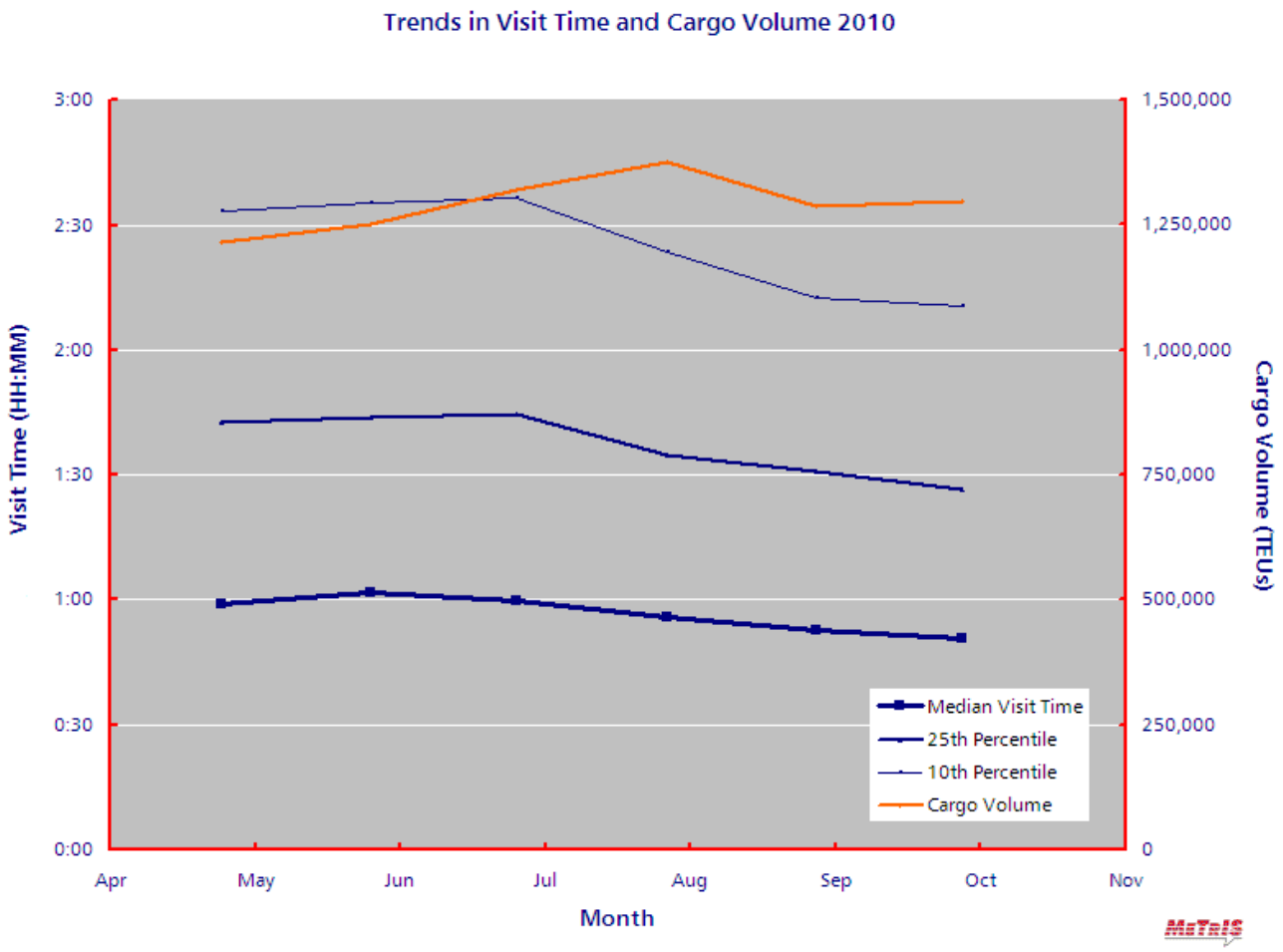

Figure 2. Trends in Visit Time and Cargo over study period

lingering in the queue to avoid the TMF. The uniform arrival rate suggests that institution of an appointment system may have limited impact. (4) There is a pronounced rise in admission rate immediately following breaks. This produces a *small* but consistent swell in terminal time an hour later. The small magnitude of impact suggests that there is surplus capacity in the system, in terms of physical infrastructure and labor, when that labor is fully operational. (5) Based on visual analysis, the predominant predictor of visit time is not truck arrival rate, but the timing of breaks. (In formal statistical terms, correlations do not establish cause-effect, hence it is difficult to argue with certainty that breaks are the singular *cause* of increased visit durations; however, there are multiple aspects of the observed correlations, and it is intuitively obvious that a terminal with inactive labor is unproductive).

The findings above are based on aggregate analysis, month by month. This may mask day-to-day and terminal-by-terminal variation. For example, in a given month, all weekday truck arrivals between noon and 13:00 at all 13 container terminals are aggregated into one count for that hour, and all weekday visit times between 13:00 and 14:00 are combined to examine the impact on visit time the following hour. One may rightly argue that the rate of truck arrival in any given queue varies from one hour to the next, that appointment systems do have a significant effect on productivity, or that a surge of trucks into a terminal does impact terminal velocity. These are valid observations at a micro scale, and the study does not challenge them. However, to the extent that our interest is in macro-level relationships, regularities that persist at the aggregate level are considerably more persuasive.

Finally, the analysis of trends over time produced encouraging findings. While cargo volumes increased 6% from May to October, visit time decreased 13%. For the longest 10% of visits, the improvement was better, at 15% (Figure 2).

Arising from the analysis, we offer the following recommendations:

1. Review the management of one-hour breaks (noon, 17:00, 22:00) to minimize productivity gaps and their impacts on terminal velocity and gate congestion.
2. Review the all-or-nothing aspect of the TMF structure, to minimize queue congestion in the hours immediately prior to 18:00.
3. Consider establishing terminal-specific performance standards, supported by a continuing process of monitoring visit time.
4. Consider measures such as land bridges (pre-removal of containers to off-dock yards) and information exchange between terminals and trucks to streamline operations.
5. Consider detailed study, assisted by METRIS, of where delays occur within terminals, and what measures can be taken to reduce or eliminate long delays.
6. TTSG should continue to provide a cooperative and constructive forum for identifying and resolving truck-terminal issues.