

**THE TERMINAL GATE APPOINTMENT SYSTEM AT THE PORTS OF LOS
ANGELES AND LONG BEACH: AN ASSESSMENT**

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Abstract

Growth in international trade and changing patterns of production have resulted in greatly increased volumes of freight traffic in urban areas. Metropolitan areas that serve as major nodes within the international trade network are particularly affected. In California, state regulation was imposed on port operations in an effort to mitigate congestion and air pollution associated with increased port-related trade. This paper presents an evaluation of the terminal gate appointment system at the Los Angeles/Long Beach ports, implemented in 2003 in response to California Assembly Bill (AB) 2650. The legislation permitted terminals to adopt either gate appointments or off-peak operating hours as a means of avoiding fines for truck queues. Our results show that 1) implementation and use of the appointment system varied widely; 2) perceptions of the appointment system's effectiveness differed across user groups; 3) there is no evidence that the appointment system reduced queuing at marine terminal gates. Our results are largely explained by institutional and contractual relationships that drive port operating practices.

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INTRODUCTION

Economic restructuring and globalization have vastly increased the volume of international trade. The share of US GDP attributed to merchandise trade grew from 15 % in 1991 to 21 % in 2000 (Bureau of Transportation Statistics, 2003a). The U.S. is the world's largest maritime trading nation; the value of water-borne goods shipments exceeds that of all other modes of transport of international merchandise freight. It accounts for about 38% of all US international merchandise trade value (Bureau of Transportation Statistics, 2003b). Freight flows by all transportation modes have increased. Total US ton-miles of freight increased from 3.2 billion in 1990 to 3.8 billion in 2001 (Bureau of Transportation Statistics, 2006). Truck and air transport have increased faster than other modes, with trucks carrying about 80% of all domestic freight in terms of value.¹ Increased freight volumes have had significant impacts on metropolitan areas. Traffic at major freight generators (ports, airports, rail yards, warehouse/distribution nodes) has greatly increased, adding to congestion and impacting surrounding neighborhoods. Increased truck traffic contributes to congestion, more delay due to accidents, and more vehicle emissions.

Impacts of international trade, both positive and negative, have been particularly great in Southern California, home of the largest container ports in the US, as well as the fifth largest air cargo hub. On the positive side, it is estimated that the logistics sector accounts for about 585,000 jobs (1 in every 12 jobs in the region), and provides significant tax revenue to local governments (Chang, 2005). However, these economic benefits come with large external costs: congestion, air pollution, noise, and other impacts on local quality of life. Erie (2004) has observed that international trade creates policy dilemmas because the benefits are dispersed (in this case lower prices for goods and services throughout the US) and the costs are concentrated. The dilemma is particularly strong for local public officials, who are dependent upon trade for tax revenue and economic development, but at the same time must respond to legitimate and increasingly serious citizen concerns.

It is in this context that California Assembly Bill (AB) 2650 was passed. The regulation required marine port terminals to either extend hours of operation for truck pickups and deliveries, establish an appointment system for trucks, or otherwise reduce truck queuing at terminal gate entries. The stated purpose of the regulation was to reduce truck emissions. Port terminals had one year to institute changes in response to the regulation; enforcement began in July 2003. AB 2650 is unique; it was the first (and remains the only) state regulation on operating practices at port terminals aimed at mitigating air emissions.² It represents an ambitious attempt by the public sector to manage a growing urban problem: port-related truck traffic and vehicle emissions.

This paper summarizes results from a comprehensive evaluation of the regulation. We examine the factors that led up to the regulation, responses by port terminals, impacts on

¹ http://www.bts.gov/publications/national_transportation_statistics/2005/html/table_03_07.html.

² Port terminals are subject to many regulations, including some aimed at reducing vehicle emissions. Emissions regulations are typically imposed on vehicles, for example mobile cargo handling equipment. These regulate vehicle technologies, but not how such vehicles are used.

operating practices, and perceptions of key stakeholder groups. Our evaluation shows that impacts of the regulation were mixed at best; responses to AB 2650 had no measurable impact on truck queuing at the terminals. Far more significant is its impact on the key decision-makers in the international trade supply chain. We suggest that the PierPass program, which was implemented in 2005 through a collaborative effort of ports, terminal operators, and shippers, and extends operating hours at marine terminals during the evenings and on weekends, was facilitated by AB 2650.

The remainder of our paper is organized as follows. First, we provide a brief review of the relevant literature. Second, we provide some background on the growth of international trade and its impacts in California, with emphasis on Southern California. We identify factors that motivated a change in public policy and passage of AB 2650. Third, we describe the implementation of the regulation and discuss its outcomes. We conclude with some explanations for observed outcomes.

INTERNATIONAL TRADE AS URBAN PROBLEM

The vast freight literature is mainly in logistics, operations research, or transportation economics (e.g., Button and Pearman, 1981; Geunes and Pardalos, 2005; Gunther and Kim, 2005; Chadwin et al, 1990). The combination of dramatic increases in freight traffic and transportation systems operating at or near capacity has only recently resulted in growing visibility of freight and its role in urban congestion and environmental problems. Much of the research focus has been on road congestion as a symptom of greater supply chain congestion (Regan and Golob, 1999), or its impacts on local communities (Lena et al, 2002). Growing freight volumes have motivated several regional studies of freight traffic, e.g. for the upper Midwest (Adams et al, 2005) and Atlanta (Meyer, 2006), as well as proposals for major infrastructure investments to manage freight traffic.

It is perhaps not surprising that the emerging literature is coming from metropolitan areas where freight is a growing problem, for example Los Angeles, New York and Chicago in the US; and from cities in Europe like Amsterdam, Paris, and London. Environmental impacts of port-related goods movement and their environmental justice implications have been addressed for both New York and Los Angeles. Lena et al (2002) document high volumes of truck traffic in low income neighborhoods near the Ports of New York and New Jersey. They calculate estimates of emissions, and conclude that low income residents experience higher exposure levels. Southern California studies have shown that the air pollution from diesel exhaust increases cancer risk, and that the entire Los Angeles-Long Beach port complex is the single largest source of diesel pollution in the region (SCAQMD, 2000). A long-term child health survey has demonstrated a significant relationship between school absences and exposure to particulate concentrations (Coussens, 2004). Another Southern California study found seasonal variations in particle numbers (PN) and significant increases in PN concentrations as a result of ship idling occurring during the 2002 labor lockout at the ports of LA and Long Beach (Singh et al, 2005). Schweitzer (2006) found that exposure to risk from hazardous materials transport is greater among low income households.

Improving productivity and efficiency of urban goods movement has been explored with respect to more efficient movement of cargo containers and the use of “virtual” container yards (Chang et al, 2006; Davies, 2006) or diversion of truck freight to rail or short sea shipping (Le-Griffin and Moore, 2006; Banister and Berechman, 1999) or changing operating practices (Yahalom, 2001). In Europe the emphasis has been on regulating truck traffic in urban areas by

prohibitions on location, route, weight, or time of day, or imposing mitigation fees on truck traffic.

Truck delays associated with operations at the Southern California ports were examined by Barber and Grobar (2001). Based on data provided by trucking companies, they estimated that about 40% of all transactions (pick up or drop off of container) had wait times of over two hours. Most relevant to this research is a survey of drayage firms and drivers that examined driver characteristics and use of appointments (Monaco and Grobar, 2004). Survey results showed that drivers spend a significant portion of their workday waiting at the ports, but there is some evidence that time spent inside terminal facilities decreased on average between the summer of 2002 and the fall/winter of 2003. Though firms indicated that they utilize the appointment systems at available terminals, most do not use the system consistently.

Also related to our work is the literature on the impacts of regulations similar to AB 2650. The California experience with Regulation XV (Giuliano et al, 1993; Giuliano and Wachs, 1997; Multisystems, Inc., 1997) provides a useful comparison. Regulation XV was adopted by the South Coast Air Quality Management District (AQMD) in 1987 (AQMD is also the enforcement agency for AB 2650). Like AB 2650, it was an attempt to achieve air quality objectives by changing operating practices of large firms, in this case setting specific targets for reducing employee vehicle commuting trips. Although there was a reduction in commute trips among firms subject to the regulation, the targets were achieved at only a few firms. Employers became resistant as the costs of compliance increased, while public support declined as it became apparent that the goals of the regulation would not be achieved. Ultimately in 1995 the state legislature passed a law prohibiting mandatory employee commuter programs, causing the suspension of the regulation (Giuliano and Wachs, 1997).

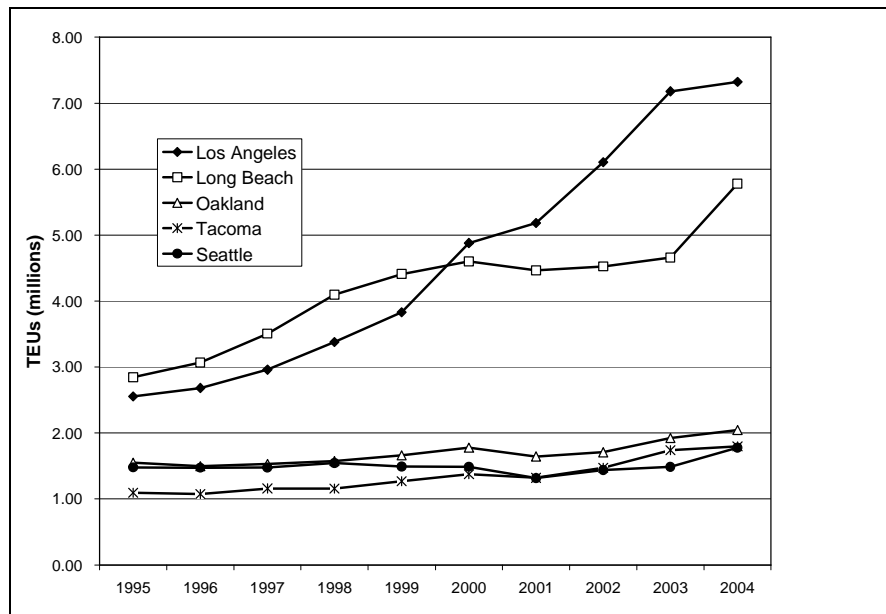
WHY AB 2650? INTERNATIONAL TRADE AND ITS IMPACTS ON SOUTHERN CALIFORNIA

The passage of AB 2650 took place in the context of rapidly increasing port-related trade in Southern California. The Ports of Los Angeles and Long Beach combine to form the largest container shipping facility in the U.S. in terms of both value of cargo and container traffic. Los Angeles/Long Beach is also the fifth busiest container facility in the world, handling 13.1 million TEU (Twenty-foot Equivalent Units, the standard measure of cargo volume) in 2004 and dwarfing other west coast ports. The next largest are Oakland (2.04 million TEU in 2004) and Seattle (1.77 million TEU in 2004). The ports serve the entire US: about 60% of all cargo originates or arrives outside the Los Angeles region.

While all of the major West Coast ports have experienced growth in the recent past, the rate of growth in Southern California has been more dramatic (Figure 1). Increased market share of the west coast port business is explained by several factors: 1) the large consumer market of Southern California (about 20 million population), 2) increasing returns to scale in ocean shipping, 3) capacity of the LA/LB ports for large ships, 4) a large trade-related industry base, and 5) good surface rail and ground transport connections with the national trade corridors.

Figure 1: West Coast Container Traffic 1995-2004

Source: American Association of Port Authorities



Rapid growth of port volume has resulted in rapid growth of external costs. Heavy-duty truck miles in the Los Angeles region (i.e. those trucks with five or more axles) have increased faster than total vehicle miles traveled. The major routes serving port-related trade carry very large HDT truck shares: 12 to 14% of total daily traffic, compared to 2 – 3% for other highways in the region.³ High volumes of trucks add to congestion problems and contribute disproportionately to incident related delays (Haveman and Hummels, 2004; California Highway Patrol, 2003).

Perhaps the most serious impact of increased trade is air pollution. As noted above, several recent studies have documented increased incidence and risk of cancer, asthma and other respiratory diseases. The ports are the largest single source of emissions, largely because the local air district, AQMD, does not have jurisdiction over ships or trains. Ships use high sulfur content “bunker fuel”, the cheapest form of diesel. Adding to the problem are the unique characteristics of the port drayage segment of the trucking industry which result in an older (and dirtier) HDT vehicle fleet.

Some key events raised public awareness of local congestion and air pollution problems and generated political pressure for government agencies to take action. The first was the release of the AQMD Multiple Air Toxics Exposure (MATES) II Study in 2000. MATES II was an ambient air monitoring and risk modeling exercise using 10 fixed regional sites and 14 mobile platforms in communities throughout Southern California. It assessed potential disproportionate cancer burdens and found that 71% of all cancer risk from air pollution comes solely from diesel exhaust (SCAQMD, 2000). A widely circulated map from the report showing concentrated diesel emissions was used to demonstrate that a “diesel death zone” existed in and around the ports. While ships are the largest polluters in and around the ports, trucks are the most visible, and the

³ Calculated by the authors from 2002 California State Department of Transportation, District 7 traffic volume data.

report contributed to public perceptions that trucks were major polluters and needed to be regulated.

Results of the study strengthened the position of environmental advocates opposed to further port expansion. A second key event was the Natural Resources Defense Council's lawsuit against the Port of Los Angeles over the construction of the China Shipping Terminal in 2000. The settlement included \$10 million to clean up diesel trucks. It also required the terminal to use yard equipment powered by cleaner burning fuels and to test a new alternate marine power (amp) technology, cold ironing, so that ship engines could be turned off while in port.

Other events raised the public profile of port-related trade in 2000 – 2002, including the 9/11 terrorist attack, the opening of the Alameda Corridor in April 2002 after several years of contentious construction, and a major study of the I-710, the major highway connecting the ports with intermodal facilities just east of downtown Los Angeles, intended to determine what improvements would be necessary to accommodate the expected tripling of port trade by 2020. Forecasts of double or triple cargo volumes were seen by growing numbers of local residents as unacceptable and avoidable. It became increasingly clear to elected officials that without significant mitigation, infrastructure improvements such as the I-710 would not be politically acceptable.

State Assemblyman Alan Lowenthal introduced AB 2650 in January 2002; it took effect in July of 2002. Lowenthal was a strong advocate of environmental mitigation at the ports and saw more efficient port operations as a critical part of managing increased international trade. Truck vehicle emissions provided the legal basis for regulating port operations.

IMPLEMENTATION OF AB 2650 AND ITS OUTCOMES

We now turn to the passage of AB 2650 and its outcomes. Our assessment is based on monitoring of the appointment system over a 16 month period from January 2004 through June 2005.⁴ We collected data from a variety of sources: 1) extended structured interviews with managers at both ports, 8 terminal operators, trucking industry representatives, longshore labor, public agency representatives and elected officials; 2) field observation of truck flows at two terminals; 3) a trucking company survey, 4) SCAQMD compliance reports; 5) publicly available data on port operations; 6) newspapers and newsletters, and 7) data provided by selected terminals.

The legislation went into effect in July 2003. It imposed a penalty of \$250 on marine terminal operators for each truck idling more than 30 minutes while waiting to enter the terminal gate. Because the bill targeted ports of a certain size, only three were subject to the regulation: Los Angeles, Long Beach and Oakland. Terminals could avoid fines by extending full service gate hours to 70 per week (65 hours at the Port of Oakland), i.e. adding evening or weekend gates designed to spread out truck traffic, or by offering a gate appointment system to trucks to drop off or pick-up cargo containers. The bill had some important caveats: the penalty applied only to 1) trucks idling (not waiting with engine off), 2) trucks with an appointment, 3) wait time to the official entry of the terminal property (not the pedestal within the entry where trucks receive permission to enter the docks). A clean-up bill, AB 1971, was passed in summer 2004 to

⁴ This was the effective end date of the appointment system. In July 2005, PierPass, a new off-peak extended gate system was implemented at both the Ports of Los Angeles and Long Beach which made all terminals exempt from the requirements of AB 2650.

make the law applicable to both engine idling and truck queuing. AB 2650 had no jurisdiction over queuing within the terminal.

Implementation of AB 2650 at Terminals

The legislation included some guidelines: appointments must be for a window of at least 60 minutes and be available throughout the day. The number of appointments made available, types of transactions permitted, rules regarding making appointments, and operating procedures were flexible. Table 1 summarizes the implementation of AB2650 by the 13 terminal operators. Seven terminals adopted an appointment system, two added appointments to pre-existing but limited extended gate hours, three had pre-existing fully compliant extended gate hours, and one elected to do neither (hence making all trucks subject to the 30 minute queuing limit). That is, no terminal chose to comply with AB 2650 by instituting extended gate hours, or even modifying existing extended hours.

Table 1 also shows that appointments were implemented with different appointment providers, policies for making appointments, and gate procedures. Appointments are made via a proprietary web-based information system. The terminal operator determines which service is to be used, and the trucking companies and others pay to access the service based on volume of transactions. The information system is used by trucking companies to determine cargo availability. Based on the information offered by these various systems, a customer orders delivery, and the truck company makes the appointment and dispatches the truck. Trucking companies typically service all terminals, so using the appointment systems requires subscribing to each of the information systems used by the terminals they service. Trucking companies also had to comply with the different rules on how and when appointments could be made. Two terminals reserved lanes for appointments, and two terminals directed appointments to a separate gate. No terminal made special arrangements for trucks with appointments once they were inside the terminal.

Table 1: Terminal Response to AB 2650

Terminal	Compliance method	Extended hours	Appt system provider	Same day appts?	Phone appts?	Gate procedures
WBCT	Appointments	Saturday, Sunday – limited hrs	MTC Voyager	Yes	Yes	No priority
Yusen	Appointments	Day shift 7 days/week	Navis (no fee)	Yes, to 3:30 PM	Yes	3 appt lanes; all 9 at AM opening
APL	70 hr gate operation	Yes, for specific moves, shipping lines	N/A	N/A	N/A	N/A
APM Maersk	70 hr gate operation	Yes, 7 AM – 2:30 AM 7 days/week	N/A	N/A	N/A	N/A
Evergreen	Appointments	T-W-Th early AM gates as needed	MTC Voyager	Yes	Yes	1 of 4 lanes for appts
Trapac	70 hr gate + appointments	Night gate by appt, wheeled loads only	e-Modal	No	No	No priority
CUT	Direct	No	N/A	N/A	N/A	N/A
ITS	Appointments	Sunday gate for special cargo	e-Modal	Yes	No	Trucks with appts pulled from queue if wait time near 30 min.
LBCTI	Appointments	Sat, Sun 7 AM – 6 PM	e-Modal	No	No	Trucks with appts pulled if wait time over 20 min.
PCT	Appointments	No	e-Modal	Yes	Unknown	Appt trucks to main gate
SSA – A	Appointments	No	e-Modal	Unknown	Unknown	Appt trucks to main gate
SSA – C	70 hr gate operation	Full night gate 4 days/week	N/A	N/A	N/A	N/A
TTI	70 hr gate + appts	M-F early AM, limited; full Sat; limited Sun	MTC Voyager	Yes	Yes	No priority

Perceptions of the Appointment System

When asked of their assessment of the appointment system, terminal operators' responses ranged from negative to positive. Those who did not see appointments as a useful strategy made the following observations. First, terminals must be flexible and organize their operations based on the nature of their business. There is great variety in type of product, number of ships served, customer requirements, and dock space. Second, the web-based container information systems were already providing data on container availability; hence it was unclear what additional benefit appointments would add. Third, the most promising option for improving productivity is technology, such as efficient use of optical character recognition (OCR), using GPS to track container movers, and streamlined cargo tracking. Fourth, an appointment system adds to the data burden of terminal operators. Finally, there is an incentive to discourage appointments, since the greater the proportion of appointments, the more likely it will be that a truck with an appointment will be present in a long queue, and hence the greater risk of being fined.

The three terminals that had already developed an appointment system saw it as an essential means for managing dock operations. Appointment slots can be determined for each yard area so that traffic on the docks is smoothed across the day, and so that high demand areas can be rationed. Why they do not also operate off-peak gates appears to be a function of terminal size (not enough land to run wheeled operations – see below), and nature of the client base in addition to cost. Space constraints would motivate efforts to increase efficiency.

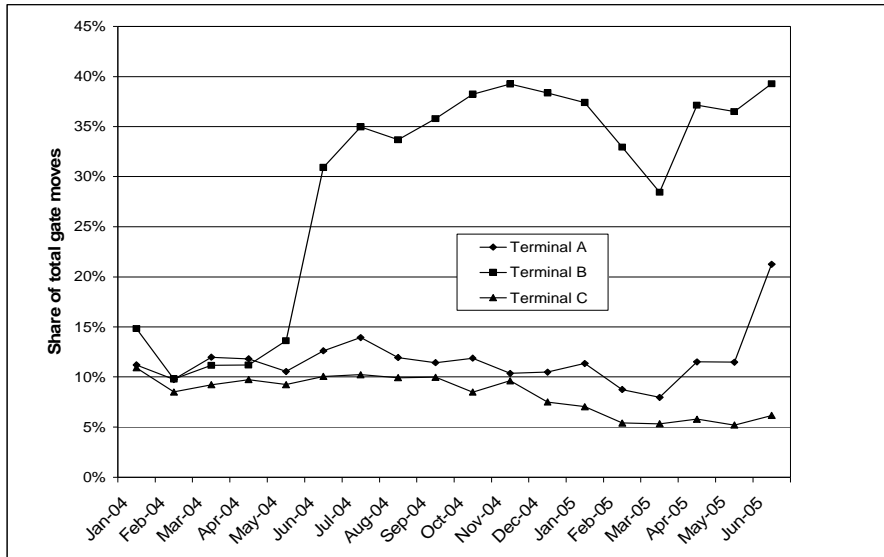
Terminal operators claim that the additional costs of providing extended gate hours is greater than the additional revenue that would be generated. Extended gate operation has high labor costs, as longshore labor contract rules provide large shift premiums and determine the number of longshore workers to be used for each work task (e.g. number of workers is not strictly based on volume of work). The terminals that have extended gate hours either have enough space so that all cargo is “on wheels” (attached to a chassis), or have special arrangements for specific customers that assure a high volume of containers processed during the off-peak hours. If cargo is on wheels, the truck driver attaches the chassis to the truck, and no longshore labor is involved. Thus appointments were viewed as a cheaper alternative that was also less disruptive to operations.

Use of the appointment system

Terminal operators were not required to report on use of the appointment system. Terminal data are proprietary, and only summary data are reported to the ports. Given the variation in how appointments were implemented and in how appointments were perceived by terminal operators, it is not surprising that their estimates of appointment use ranged from almost none to 30% or more. Most appointments are made for “import pickups” (picking up a loaded container), because these transactions are often time sensitive and subject to delays. We obtained data for three terminals over a long enough period of time to observe trends. Figure 2 shows appointments made by month as a share of total gate moves, from January 2004 through June 2005. Patterns for the three terminals are quite different, and reflect different practices with regard to appointments. Terminal B has pursued a strategy of increasing appointments as a way of managing truck moves on the dock. Once almost exclusively made for import pickups, appointments are being made for an increasing share of export drop-offs. Terminal A has recently decided to promote appointments; Terminal C has not aggressively promoted

appointments. We also obtained limited data from a fourth terminal; appointments were 1 – 3% of total moves. The variation across these terminals is consistent with our interview data.

Figure 2: Appointments as Share of Total Gate Moves



Enforcement

The provisions of the bill in Southern California were enforced by the South Coast Air Quality Management District. The AQMD was the obvious choice to oversee enforcement since it already regulates both stationary and mobile pollution sources in the Los Angeles air basin. AQMD assigned one full-time inspector to the entire port complex. The inspector roved the port conducting random inspections of queues. From October 2003 through June 2005, the SCAQMD inspector conducted over 4000 surveillances, or about 12 per day. Surveillances ranged from 5 minute checks to extended observations of queues. For the July 2004 through June 2005 period, average queue length at the terminals ranged from 5 to 26 minutes. Maximum observed queues ranged from 5 to 122 minutes.

In addition to daily random checks, the SCAQMD responded to complaints; 90 complaints were received. The number is surprisingly low, given the claims of truckers regarding wait times at the gates (see below). When there was “cause” to suspect a violation, a “targeted inspection” was conducted, and this inspection could result in a Notice of Violation. At Los Angeles and Long Beach, three Notices to Comply were issued, and no fines were imposed over the entire life of the regulation. Four Notices of Violation (fines) were imposed at Oakland (Table 2). The fact that no fines were imposed means only that no truck with an appointment was observed and documented to be waiting for more than 30 minutes. This could be due to 1) any observed queue was less than 30 minutes, 2) a longer queue resulting from “an unavoidable or unforeseeable event” which is not subject to fines, 3) trucks with appointments being pulled out of long queues, 4) no surveillance by SCAQMD at the time of the occurrence.

Table 2: AB2650 Violation Summary

Quarter	Southern California	Northern California
2003 Quarter 3	0	0
2003 Quarter 4	1 Notice to Comply	0
2004 Quarter 1	1 Notice to Comply	1 Notice of Violation
2004 Quarter 2	1 Notice to Comply	0
2004 Quarter 3	0	0
2004 Quarter 4	0	1 Notice of Violation
2005 Quarter 1	0	1 Notice of Violation
2005 Quarter 2	0	1 Notice of Violation

Although the AQMD claimed significant emissions reductions as a result of the regulation (SCAQMD, 2004), it is unlikely that appointments would have reduced wait time, given the way appointments were handled. There is anecdotal evidence that queues were reduced between July 2003 and June 2004, based on our interviews with terminal operators. We have no empirical evidence, as there is no source of systematic data on queue length at the ports for a period before and after the implementation of AB 2650. Computerization of some processing tasks and installation of OCR equipment at terminal gates was permitted under the 2002 ILWU contract, and conversions were largely complete by summer 2003. Terminal operators attributed shorter queues to the new technology which sped up the process of gate entry. In addition, in 2002 and 2003 the ports expanded by 700 acres and opened 120 new gates. The new and expanded terminals were able to incorporate new technology, and the additional space allowed a greater proportion of wheeled operations, all of which contributed to more efficient operations and shorter queues.

Trucking Company Response

Truckers are paid by the load, not by the hour. Hence if appointments reduce trip times by reducing wait time or making sure cargo is released and ready for pickup, truckers have every incentive to make them. We conducted a survey of drayage trucking companies to elicit information on their responses to the appointment system. The trucking company decides whether to subscribe to the various appointment information services and makes the appointments on behalf of the contract driver. There is no readily available database of owner operators or drayage firms. We worked with the local regional unit of the California Trucking Association to contact drayage companies. Through meetings, follow-up calls and faxes over a period of 4 months, we obtained usable surveys from 27 companies. Although our sample is small, these companies together represent almost 2,000 drayage trucks, a significant portion of the estimated 10,000 – 14,000 trucks serving the port complex. Our results should be viewed with caution, however, since our sample is likely biased to larger companies.

Respondents represented a wide variety of firms with respect to longevity and size. The average firm has been in existence for 29 years, with a median of 22 years. Most firms utilize owner-drivers, rather than owning their own vehicles and hiring drivers. The firms are modest in size; the average truck fleet is 76 (median of 50), and average number of drivers is 70. The truck fleet ranges from 13 to 365 (including both company owned and driver owned vehicles).

Use of Appointment System

All but three firms reported that they used the appointment system, but the extent to which it was used varied greatly, which is consistent with the reports from terminal operators. Appointments were used primarily for pick-up of import containers; all of those who used the appointment system used it for import pick-ups. About 1/3 also used appointments for export drop off, and pick-up and drop off of empty containers. Appointments were generally made for a particular time of day and for certain terminals. Respondents were also asked about keeping appointments. The average percentage of appointments kept was 63, with a range of 6 to 100 percent. Since there was no penalty for missing or canceling appointments, the incentive was to keep them only when convenient to do so. The most common reason given for missing an appointment was delays at the marine terminal (Table 3).

Table 3: Reasons for Missing Appointments

	Yes	No
Freeway congestion	8	12
Delays on the customer end	6	14
Delays at marine terminal	18	2
Other	4	16

The extent to which appointments are used is significantly correlated with the percentage of customers that require appointments ($R = 0.60$), suggesting that appointment use is motivated by external factors. One might also expect that larger firms, or firms more inclined to use technology, are more likely to use appointments. There is no correlation between firm size and extent of appointment use. Those firms with vehicle tracking systems use appointments more extensively (52 vs. 34% of all transactions), but the difference between groups is not quite statistically significant (Sig. of $F = 0.128$).

Perceptions of Appointment System

There was an overall perception that the appointment system did not improve conditions for truckers. The majority stated that it did not improve their ability to meet customer demands, nor did it reduce turn times (the time required to complete a transaction at the docks, Table 4). No firm gave an unequivocally positive response. Respondents were also asked to rate the effectiveness of the appointment system at each terminal in reducing turn times on a scale of one to five, with 1 = not effective and 5 = exceptionally effective. We asked about turn times explicitly, because the intent of AB 2650 was to reduce queuing at the terminal gates, which should in turn lead to shorter turn times. However, it was also possible that the appointment system would simply shift the queue to inside the terminal if the rate of processing transactions did not change. Terminals are not given high marks: mean scores range from 1.4 to 2.3.

Table 4: Effectiveness of the Appointment System

Has the appointment system....	Yes	Somewhat	No
Improved your ability to meet customer demands?	0	10	15
Had any impact on reducing turn times?	0	8	17

One way of evaluating the effectiveness of the appointment system is to compare turn times with and without appointments. We asked respondents to give the average turn time for a dual transaction (empty in/load out). These are only rough estimates of turn times, and since dual transactions take longer than single transactions, these are upper end estimates. The mean is 2.8 hours. Since only one respondent does not use appointments at all, we cannot make any “with/without” comparisons. Instead we compare averages between those who used appointments for 35% or less of all transactions (the median value), and for more than 35%. Average turn time for the first group is 2.4 hours and for the second group is 3 hours. That is, firms using appointments for a greater share of total transactions have longer average turn times than those who use appointments less extensively. The difference between groups is not significant (Sig. of $F = .242$), but the differences are consistent with negative perceptions of appointment system effectiveness. It bears noting that it is also possible that appointments are used more when there is more congestion on the docks; hence, turn times alone are not an indicator of appointment system effectiveness.

Our ability to conduct any statistical analysis of our results is limited by small sample size. We wanted to examine whether perceptions of the appointment system are related to how it is used, or to firm characteristics. For example, we would expect that firms would use the appointment system more if they considered it effective, or that firms who used the system more actively (schedule at certain times or terminals) would consider it more effective. We found no correlation between extent of appointment system use and perceived effectiveness.

We conducted difference of means tests to determine whether those who schedule appointments at certain times of the day, or at certain terminals, have more positive assessments of the appointment system. Results are given in Table 5. The upper panel gives the group mean ratings for the effectiveness of the appointment system in meeting customer demand; the lower panel gives the group means for effect on turn times. There is a significant and positive difference between assessment on turn times and making appointments at particular times of the day, as expected. There is a negative and borderline significant difference between making appointments at certain terminals and meeting customer demand. This may indicate problems at particular terminals. No other group mean differences are significant.

Table 5: Use of Appointment System vs. Assessments

	Group mean – yes	Group mean – no	Sig. of F
Ability to meet customer demands			
Schedule appointments at certain time of day	.219	.143	.515
Schedule at certain terminals	.133	.313	.102
Impact reducing turn times			
Schedule appointments at certain time of day	.250	.000	.020**
Schedule at certain terminals	.167	.188	.850

We also compared perceptions of appointment system effectiveness with firm size and average reported turn times. As expected, more negative assessments of the appointment system's impacts on turn times are associated with longer average turn times (Sig. of F = .067), but assessment of the impacts on ability to serve customer demands do not. Finally, larger firms tend to have a more positive assessment of the appointment system, but the trend is not statistically significant.

Written comments, as well as the open-ended discussion conducted with respondents after completion of the survey, provide some explanations for their negative assessment. First, there was an expectation on the part of truckers that appointments would reduce transaction time by assuring that containers and/or chassis were ready and available for pick-up. However, this was not the case; practices "inside the gate" did not change as a result of the appointment system. Respondents commented that those with appointments still must wait in line for container moves, may find that the container is in fact not available, or that a chassis is not in working order. Second, some respondents noted that the real constraints are limited gate hours and limited dock labor. If container volumes are increasing and the container processing rate remains constant, transaction time will increase, with or without appointments. Third, several respondents noted the difficulty of using several different appointment systems, rather than having one system for all terminals and all appointments. Finally, respondents cited the difficulties of making and keeping sequential appointments, because any delay with an earlier transaction cascades to all other later transactions.

The drayage firm survey shows that while the vast majority of firms used the appointment system, they saw little benefit in doing so. Respondents revealed a consistently negative assessment of the appointment system, both on its operation at the terminals, and on its overall impacts on serving customer demand and on transaction turn times. From the perspective of drayage firms, there is no evidence that drayage became more efficient as a result of the appointment system. Clearly the assessment of the appointment system differed greatly across stakeholder groups.

Estimating Impact of Appointment System on Wait and Turn Times

It is well known in travel survey research that self-reported, ex-post travel times tend to be approximate. Hence asking drivers about turn times before and after the legislation would not provide a reliable estimate of the appointment system's impacts. Because this research began after the implementation of AB 2650, a before/after data collection was not possible. A with/without study would compare wait and turn times of trucks with appointments to those without appointments. This would require matching trucks and drivers in queue with terminal data. Terminal data identifies drivers, containers, and chassis, but not trucks. It was therefore not possible to match field observation data with terminal data.

We use two methods to estimate the impact of appointments. First, we obtained turn times for appointment and non-appointment transactions from one terminal operator which we call Terminal B.⁵ Terminal operators measure turn time from the time the truck is cleared for entry at the pedestal to the time it is cleared for exit from the terminal. This allows us to compare turn time on the dock, but we have no information on gate wait times. Second, we conducted field observations at one terminal to measure wait times at the gate, as well as turn times (from entry to exit). We use the data to estimate potential time savings of appointments under plausible assumptions.

Terminal Operator Data and Results

Table 6 shows the number and duration of terminal transactions by type for four sample days. The majority of transactions are "import out," the release of import containers to a truck leaving the port. The next most common type of transaction involves "empties in" or the delivery by truck of an empty container. The third most common transaction involves the receipt of a full container for export (export in), and least common is the release of an empty container to be loaded on to a truck (empty out). Average transaction times were calculated from the data. It can be seen that picking up an import takes the longest time (over one hour on each of the sample days), and picking up containers takes longer than delivering them.

Table 6: Terminal B Transactions by Type

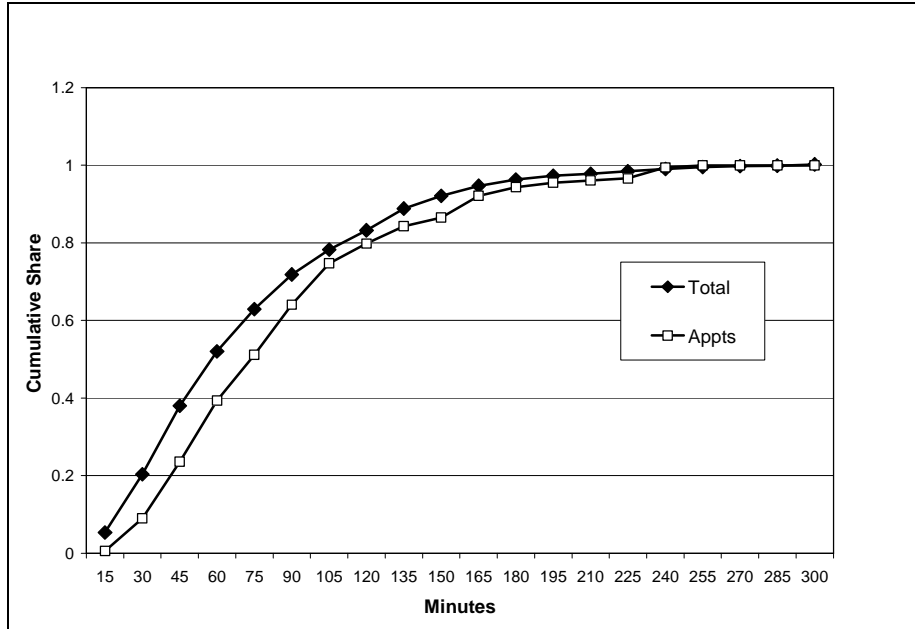
Transaction Type	7/27/04		7/28/04		7/29/04		8/5/04	
	N	Ave. Trans. Time (Min)	N	Ave. Trans. Time (Min)	N	Ave. Trans. Time (Min)	N	Ave. Trans. Time (Min)
Import Out	997	67.4	1004	75.4	893	73.0	924	71.4
Export In	207	11.6	201	15.9	188	17.2	194	17.6
Empty Out	86	44.1	100	33.9	59	57.9	61	50.0
Empty In	523	15.5	15	30.8	640	16.6	771	23.3

⁵ Identifiers are consistent with Giuliano et al, 2005.

The data provided by Terminal B allow us to make some rudimentary comparisons of transactions with and without appointments. The figures are for imports out only, since the greatest share of appointment use at any terminal is for this type of transaction. Table 7 shows that appointments represent a relatively small percentage of import pick-ups and therefore an even smaller share of total gate moves at this terminal. Figure 3 gives the cumulative distribution of transaction times for all import pickup transactions, and for import pickup with appointment transactions. It can be seen that transactions with appointments are longer than transactions without appointments. The group means are 52.6 minutes for all transactions and 84.60 minutes for transactions with appointments, and the difference is statistically significant. These findings are consistent with results from the trucker survey data. Our conservative conclusion is that we have no evidence from our small sample that appointments are associated with time savings. As we noted above, longer transaction times could simply mean that appointments are more likely to be used for the most complex transactions.

Table 7: Terminal B “Import Out” Transactions Involving Appointments

	7/27	7/28	7/29	8/04
Total Appointments	66	41	94	63
Total imports Out	1080	2292	1074	1180
Total Transactions	2680	5613	2549	2953
Appt. share imports	6.1%	1.8%	8.8%	5.3%
Appt. share transactions	2.5%	0.7%	3.7%	2.1%

Figure 3: Cumulative Distribution, Transaction Time for Import Pickups

Field Data Estimates of Time Savings

To determine total turn time, defined as wait time + transaction time, we conducted a field survey at one of the terminals (Terminal A). Student observers worked in three hour shifts at five different points between the entry gate and exit gate, recording times, load type, and vehicle identification data for vehicles as they passed. We tracked whether the truck had a container, a chassis without container, or no container or chassis (we had no way to know whether containers were full or empty). Because the data were collected in 3 hour shifts, matching entries with exits resulted in the loss of the longest trips. We therefore used our matches from the first hours of entries to determine transaction time, but all of the entry data to determine average wait time. For this exercise we use only the 3 most common transactions: bobtail in/container out, container in/bobtail out, and container in/container out, which together account for about 85% of all transactions. Results are shown in Table 8. The distributions of both queue time and transaction time have a long tail. Converting to natural log gives a normal distribution, so the figures in Table 8 are based on the natural log. Average turn time ranges from about 38 minutes to one hour. At this terminal there is a separate bobtail gate entry, so wait time for bobtails is shorter than wait time for trucks with containers. The transaction times are much shorter than those of Terminal B; our interviews with trucking companies confirm that transaction times vary across terminals.

Table 8: Average Queue, Transaction and Turn Times by Transaction Type (Minutes)

Transaction Type	Queue Time	Transaction Time	Turn Time
Bobtail in/container out	4.6	35.6	40.2
Container in/bobtail out	10.2	27.7	37.9
Container in/container out	10.2	50.3	60.5

If trucks with appointments do not have priority access (and hence must wait in the entry queue with all others), and if no special arrangements are made to have cargo ready for those with appointments, there is no reason to expect that transactions with appointments would take less time. Our interviews revealed that most terminals do not have special arrangements for appointments. What if terminal operators did offer priority access to trucks with appointments? What if cargo was confirmed available and ready for pickup during the appointment time window? We use our field data to estimate potential time savings. Using data from Terminal A appointment records, we find that in summer 2004 nearly all appointments were for import pickups. Kept appointments as a share of all import moves was 16% in July 2004 and 14% in August 2004. We use 15% import appointments as Scenario 1, 30% for Scenario 2, and 50% for Scenario 3. Within each scenario, we consider

- a) queue time reduced 5 minutes;
- b) queue time reduced plus transaction time reduced 5 minutes;
- c) queue time reduced plus transaction time reduced 10 minutes.

The reduced queue time assumes priority gate entry equivalent to the current bobtail gate. Reduced transaction time represents a lower and upper bound of savings due to cargo being ready for pickup. Using the three major transaction types and the mean queue time and transaction time values, we calculate total minutes of turn time for each of the transaction types. Results on a per turn basis are given in Table 9. We omit the container/bobtail transactions, as these are not affected by appointments (by assumption). If only queue time is reduced, there are no savings for bobtail entries, but a 9.3% savings for container entries. If we add average 5 minute reduction in transaction time, savings increase to 12.4 and 17.5% respectively. If we reduce transaction time even further, savings of about 25% are generated. Time savings in this range would likely motivate truckers to use appointments more frequently.

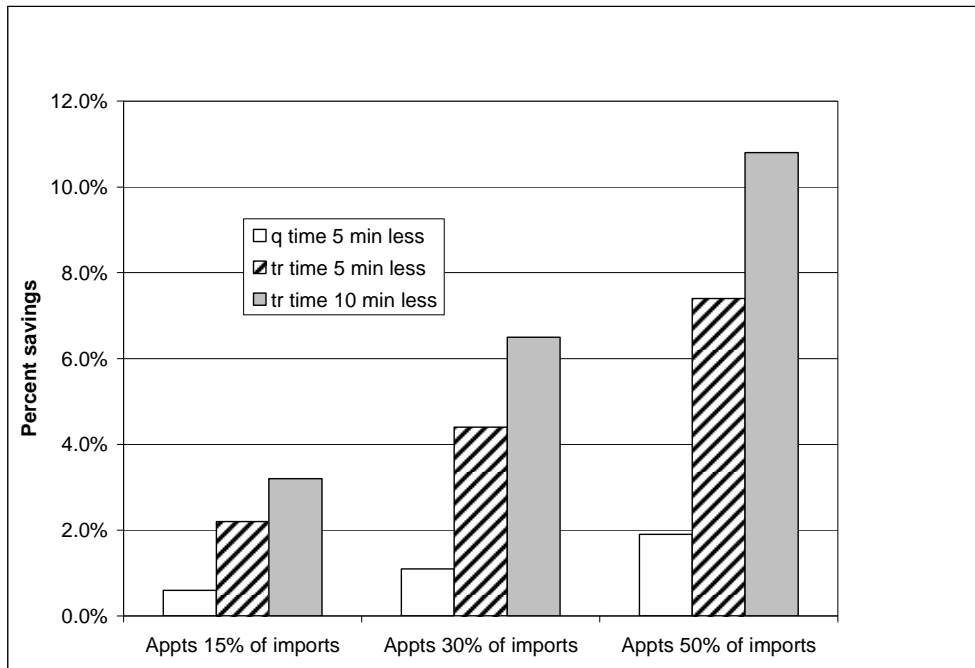
Table 9: Per turn savings from appointment scenarios (minutes)

	Base	Scenario “a”	% saved	Scenario “b”	% saved	Scenario “c”	% saved
Bobtail- container	40	40	0	35	12.4	30	24.9
Container- container	61	55	9.3	50	17.5	45	25.8

We estimated time savings as a share of all transactions by weighting transactions according to their shares in the data: 30/40/30 for bobtail/container, container/bobtail, container/container. Since all appointments are for import pickups, only bobtail/container and

container/container moves are affected. Also, the bobtail/container moves realize no savings from reduced queue times, as bobtails already have a priority entry. Results are summarized in Figure 4 and indicate the following. First, 15% of imports equals about 6% of all gate moves, so time savings are small relative to total turn time of all moves. Second, reduced queue time has less impact than reduced transaction time, because queue time savings accrue only to the 30% share of container/container transactions. Third, it would take a large increase in appointment use, as well as operating practices that save substantial time, for truckers to significantly reduce total turn time. It should be noted that our estimates are approximate and likely optimistic. We have not accounted for the other 15% of moves (moves involving chassis and bobtail in/out), and have effectively assumed that all container out moves are imports.

Figure 4: Time Savings from Import Appointments, as Percent of Total Turn Time



CONCLUSIONS

Our results may be summarized as follows. First, we have no evidence to suggest that the appointment system reduced queuing at terminal gates. In part this is due to data constraints; there is no empirical data on terminal gate queues prior to the implementation of AB 2650. Data from terminals and information from interviews supports a finding of no impact for two reasons: 1) the majority of terminals did not view appointments as an effective operational strategy, and few efforts were made to offer any priority to those with appointments; 2) trips with appointments made up a very small share of all trips at most terminals, and hence could not have had a significant impact on queuing even if such trips were granted priority. Our estimates of potential turn time savings from appointments suggests that a large proportion of trips would have to use appointments, and appointment trips would have to be given some priority in order to realize significant time savings. If there was no benefit to making appointments, it is to be expected that relatively few appointments would be made. Second, the major stakeholders had very different views regarding the appointment system. Terminal operators had varied

perceptions about the utility of appointments and negative perceptions of the legislation; trucker perceptions were consistently and strongly negative, and AQMD considered the program a success and claimed it had resulted in significant reductions in diesel emissions.

Our conclusions lead to some questions: 1) why did most terminal operators set up appointment systems that were unlikely to reduce queuing or turn times? 2) why did truckers expect that the appointment system would lead to shorter turn times? 3) why was the appointment system viewed as a success by AQMD and other public agencies?

Explaining terminal operator response

The ports have a long history of independence (Erie, 2004). Because of the importance of international trade to the local economy, local leaders and agencies have until recently been cautious in imposing regulations that port interests viewed as costly or a threat to increased trade volume. Port interests are powerful: the ports are landlords, with long-term leases offered to terminal operators to provide dock services. The terminals are largely owned by steamship companies. Through a trade organization, the Pacific Maritime Association (PMA), ports, terminal operators and steamship lines cooperate in setting basic operating policies and in negotiating with the longshore union (ILWU). AB 2650 was imposed from the outside, without the endorsement of the PMA. Port interests had just completed negotiations on the new labor contract, and saw technology implementation permitted by the new contract as the most promising way to improve efficiency of port operations. Among some respondents, there was a perception that landside congestion and air pollution were not the responsibility of the ports or terminal operators. Most terminal operators saw appointments as an added responsibility that would not improve their operations. In addition, the terminals had been switching to cleaner dock vehicles in response to air quality regulations, and considered this a far more significant contribution to air quality than any effects of the appointment system.

Why terminal operators chose an appointment system rather than extended hours is clear; appointments were a much less costly way of complying with the regulation than implementing extended gate hours. In addition, the risks of non-compliance were low. The exemptions in AB 2650 made it difficult to enforce. In order to cite a terminal operator, the AQMD inspector had to document that the queue was longer than 30 minutes, and that a given truck both had an appointment and waited in line longer than 30 minutes. Given the small share of appointments, the likelihood that the inspector's random monitoring would result in documenting an excessive wait time was very small. And even if a violation occurred, a fine of \$250 was a small price to pay for avoiding the much greater costs and disruption of extended gate hours.

Explaining drayage industry response

In contrast to the ports, terminal operators, steamship lines, and ILWU, the drayage industry has little influence on port operations, or supply chain operations more generally. The drayage industry is characterized as a "price taker," having no market power with which to influence wages or work practices (Belman et al, Belzer). Drayage companies contract with owner-operator drivers, who by their status as independent companies are subject to anti-trust regulations and hence cannot cooperate to set prices. Typically delivery agreements are made between the buyer and seller of the freight, with the delivery bid out with a set price to drayage companies. Drayage companies in turn contract drivers, who are paid a flat fee per trip. Because drivers are paid by the trip, delays are costly.

Terminal operators have no incentive to employ practices that would reduce delays for truck drivers. Rather, their incentive is to serve their customers (the steamship lines and major import/export companies) and manage dock operations within the constraints of ILWU work rules and contract provisions. The terminal operators pay ILWU workers, but do not pay truck drivers. Drayage companies have long accused terminal operators of ignoring the concerns of truck drivers, and have sought relief through the California Trucking Association and the state legislature, but to no avail. Earlier versions of AB 2650 included a limit on turn times; this was opposed by the PMA and the Long Beach Board of Harbor Commissioners and removed from the bill as a condition of withdrawing their opposition.

Apparently drayage truckers expected that AB 2650 would result in less delay for truckers both inside and outside the terminals. They expected that appointments would give them some priority; that at a minimum cargo would be ready for pickup if an appointment was made. Once it became apparent that appointments had no advantage, there was no reason to make them. For truckers this was one more instance of port interests taking advantage of them.

Explaining public agency response

We have noted that expansion of the terminals and implementation of OCR are more likely explanations for shorter queues at terminal gates than the appointment system. Even if gate entry queues had been reduced as a result of AB 2650, reductions in queuing delay or emissions could not be claimed unless it could be demonstrated that total turn times had been reduced. It is quite possible that faster processing time at the gate entry would simply lead to more congestion on the docks, unless transaction time on the docks was fast enough to manage an increased throughput rate at the gates. Since the regulation had no jurisdiction on the docks, terminal operators had no incentive to speed up transactions, especially if it involved additional costs to them.

The fact that no citations were issued at Los Angeles or Long Beach implied success. Congestion and air pollution at the ports were major issues for local leaders, and AQMD reports suggested that the problem had been solved. It was clearly in the interest of local public officials to claim success in the form of air quality improvement, despite the lack of persuasive evidence.

POLICY IMPLICATIONS

The results of AB 2650 have some notable policy implications. AB 2650 demonstrates the pitfalls of imposing regulations on entities with significant economic power. Major industries have extensive political influence and can use it to deflect or neutralize efforts that are perceived as damaging (e.g. the history of US fuel economy standards). In this case port interests were able to avoid provisions that would have seriously affected port operations. AB 2650 also demonstrates the pitfalls of imposing regulations that seek indirectly to achieve policy objectives. If reduced emissions were the objective, then regulations on vehicle emissions would be a more effective strategy. Targeting queuing at terminals suggests that emissions reduction was not the primary objective.

We believe AB 2650 was a strategic move. It sent a clear signal to port interests that their operations were no longer beyond the bounds of public intervention. When Assemblyman Lowenthal⁶ introduced AB 2041 in February 2004, it was viewed as a credible threat. AB 2041

⁶ Assemblyman Lowenthal became Senator Lowenthal after being elected to the State Senate in November of 2004.

called for the establishment of a Port Congestion Management District that would mandate extended gate hours as a congestion mitigation strategy. By August, the Pacific Merchant Shipping Association (PMSA) announced an initiative to offer extended hours at all terminals, and AB 2041 was withdrawn shortly thereafter. Port interests were motivated to collaborate and find their own way of solving the problem, in this case by establishing the PierPass program, which imposed a fee of \$40 per TEU moved during peak hours, with the fee established to offset the additional costs of operating extended gate hours.

Finally, AB 2650 is reflective of the increased visibility of port-related trade and its local consequences. It was the first such regulatory legislation, but is unlikely to be the last. Appointment systems are under consideration in New York/New Jersey and Vancouver, BC. Truck idling bills have been introduced in Illinois, Rhode Island, Connecticut and New Jersey. The New Jersey legislation (AB 2646) bears more than a little resemblance to AB 2650. It would prohibit the idling or queuing of heavy duty diesel trucks at marine terminals for more than 30 minutes while waiting to enter a terminal. Fines are \$250.

In California, bills have been introduced to limit turn times to 60 minutes, to allow the local air district to regulate locomotive emissions, to define ports and distribution centers as stationary sources for emissions regulation, and to impose a cap on total port-related emissions. Some of these bills will eventually pass, or will motivate further collaboration among port interests in an effort to avoid regulation. We conclude that the impacts of AB 2650 go far beyond the queuing problem at terminal gates.

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