Less-Than-Truckload Trucking in Los Angeles: Congestion Relief Through Terminal Siting

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Traffic congestion in the Los Angeles, San Francisco, and San Diego regions may cost individuals and industry as much as $2 billion a year in lost time and lost productivity. Much of this cost is borne by the trucking industry and its customers. A major study was conducted at the University of California to develop and evaluate strategies for reducing congestion delays incurred by less-than-truckload motor carriers in Los Angeles. It was found that surplus capacity exists in the Los Angeles freeway system throughout much of the day and that trucks naturally avoid congested highways. Though existing terminals tend to be well located, some areas—notably, west Los Angeles and the Los Angeles Airport–El Segundo area—are not well served. Further, a shortage of vacant land in the south-central industrial core may force carriers to build terminals in remote locations. It is proposed that motor carriers be encouraged to establish terminals in these areas and to consolidate and merge their pickup and delivery operations, which would facilitate service from more sites.

The state of California recently commissioned the Urban Freeway Gridlock Study (*1*) "to investigate the impact of large trucks on peak-period freeway congestion." Among the study findings was that "congestion in Los Angeles, San Francisco, and San Diego may cost as much as $2 billion per year."

Although the motivation for this and other studies (*2,3*) was to measure and reduce congestion caused by trucks, it is clear that a large portion of the congestion costs is borne by trucks. According to the Urban Freeway Gridlock Study, each hour that a truck spends on the road costs $44 in wages, maintenance, fuel, and overhead—a number considerably larger than the value of an automobile's time. Delays impose additional costs on shippers and receivers, which depend on carriers for timely service.

LESS-THAN-TRUCKLOAD (LTL) TERMINAL OPERATIONS

LTL motor carriers transport medium-size shipments—shipments that are too large for parcel post or UPS, but too small for truckload service. According to the Urban Freeway Gridlock Study (*1*), approximately 45 percent of the truck miles in the Los Angeles region are by LTL carrier, of which approximately half are by LTL common carrier (e.g., Consolidated Freightways or Yellow Freight System) and half are by LTL private carrier.

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A typical LTL carrier transports shipments in three phases: local pickup, line haul, and local delivery. The pickup phase ordinarily occurs in the afternoon, after most of the days' orders have been received. After visiting multiple stops, the pickup and delivery truck deposits its load at an end-of-line terminal (usually the carrier's closest terminal to the shipment origins). From there, shipments are transported in larger line-haul vehicles, either to another end-of-line terminal or, in some cases, to a breakbulk terminal for further sorting. After the line-haul phase, shipments are delivered in the morning from an end-of-line terminal (usually the closest to the shipment destinations) in pickup and delivery vehicles. In terms of congestion relief, the important characteristics of the system are that (a) deliveries occur in the morning, (b) line haul occurs overnight, and (c) pickups occur in the afternoon.

Because line haul occurs overnight, it is not greatly affected by road congestion (nor does it contribute greatly to congestion). Pickups and deliveries, on the other hand, must occur during the day when businesses are open, often during the morning and afternoon travel peaks. These trucking routes are affected by congestion, especially if pickup and delivery vehicles travel in the same direction as commuters. That is, congestion has the biggest impact on delivery routes heading toward work centers in the morning and pickup routes heading away from work centers in the evening.

One way to provide congestion relief would be to schedule trucks so that they travel in off-peak periods. However, for LTL common carriers, such a schedule would require major changes in carrier, shipper, and receiver operations. Pickups and deliveries would either have to occur at midday, after deliveries are needed and before pickups are available, or they would have to occur overnight. However, overnight pickups and deliveries would disrupt line-haul operations and could be costly to shippers and receivers that do not currently have nighttime staffing.

Alternatively, trucking delay could be reduced by selecting better locations for LTL terminals. The strategic location of more satellite terminals would have the following beneficial effects:

- The lengths of pickup and delivery routes would be reduced, and
- Travel across congested road segments would be reduced.

In order to achieve the second objective, pickup and delivery trucks can be routed in the same manner as reverse commuters. For instance, if an LTL terminal were located

near a work center, trucks would travel in the opposite direction of commuters in the morning, as they leave to make deliveries, and in the opposite direction of commuters in the evening, as they return with their pickups.

OBJECTIVE

The objective of the following paragraphs is to summarize the findings of a research study conducted at the University of California that assessed the potential for reducing trucking delays caused by urban road congestion in the Los Angeles region. The emphasis is on improved selection of terminal sites for LTL common carriers, especially on the feasibility of placing terminals at locations that exploit surplus freeway capacity (e.g., reverse commuting).

The next four sections address the following issues in order: (a) Where and when is there excess capacity on the Los Angeles freeway system? (b) To what extent are carriers currently exposed to congestion? (c) Where are trucking terminals currently located? and (d) Where are the opportunities for improved terminal sites?

Although the focus is on reducing delays incurred by trucks, any strategy that reduces trucking delay would benefit motorists through reduced traffic volume on congested roadways.

SURPLUS CAPACITY IN THE LOS ANGELES FREEWAY SYSTEM

It has been said that Los Angeles is a city without a center, where work and residences are spread amorphously throughout a massive region. Indeed, compared with other major cities, Los Angeles is decentralized. But it is not true that it has no center. In recent years, the downtown of Los Angeles has experienced tremendous job growth, including the construction of highrise buildings that top the 1,000-ft mark. This large concentration of employment has come to have a significant impact on traffic patterns throughout the region. Like all major cities, roadways leading toward the downtown are congested in the morning and those leading away are congested in the evening. The reverse commute directions tend not to be as congested, and roadways located far from the center tend to be less congested.

The dominance of the traditional downtown is evident in the city's ring-radial freeway network, shown in Figure 1, especially in the vicinity of the downtown. In the newer parts of the region—San Fernando Valley and Orange, Riverside, and San Bernadino counties—downtown Los Angeles is less dominant, and freeways follow more of a grid structure.

An attempt was made to determine when and where surplus capacity exists on the Los Angeles freeway system through the analysis of traffic flow data. Through examination of highway congestion maps generated by the California Department of Transportation (Caltrans), it was initially observed that few freeway segments are congested in both directions at the same time [major exceptions include Ventura Freeway (101); San Diego Freeway (I-405), from I-10 to I-110; Santa Monica Freeway (I-10); and several road segments downtown and in the vicinity of Anaheim]. These observations were supported by an analysis of average daily traffic (ADT) and peak-hour counts (*4–6*). Nevertheless, neither of these data sources provides a detailed picture of how traffic levels vary by time and direction.

To follow up, an analysis of traffic data generated by the Caltrans automated freeway control system was conducted. This system is one of the most sophisticated in the world for monitoring real-time traffic flows. Flow detectors have been installed at over 900 sites, covering most of the major freeways in Los Angeles and Orange counties. Twenty-two sites were selected, spaced roughly at 5-mi intervals along the routes radiating from downtown Los Angeles. Figure 2 shows the total traffic count among all 22 sites by direction and time of day, and Table 1 presents traffic counts for individual sites.

The following observations were made:

- From 6:00 to 9:00 a.m., traffic leading toward the downtown exceeds traffic heading away by 28 percent.

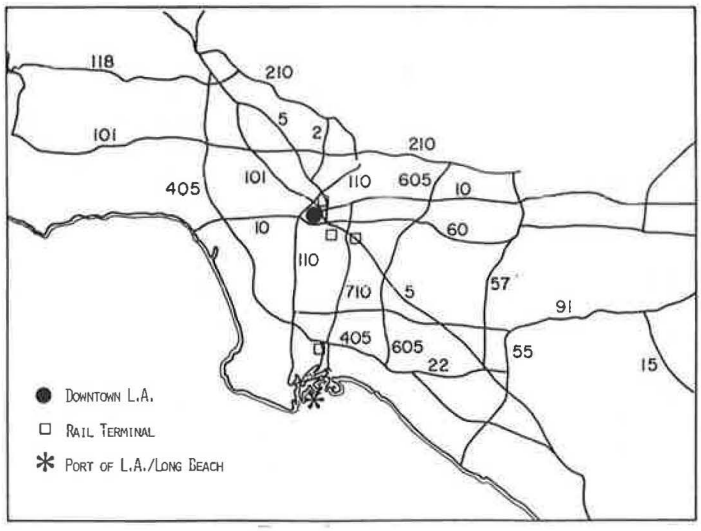

FIGURE 1 Major transportation facilities in Los Angeles region.

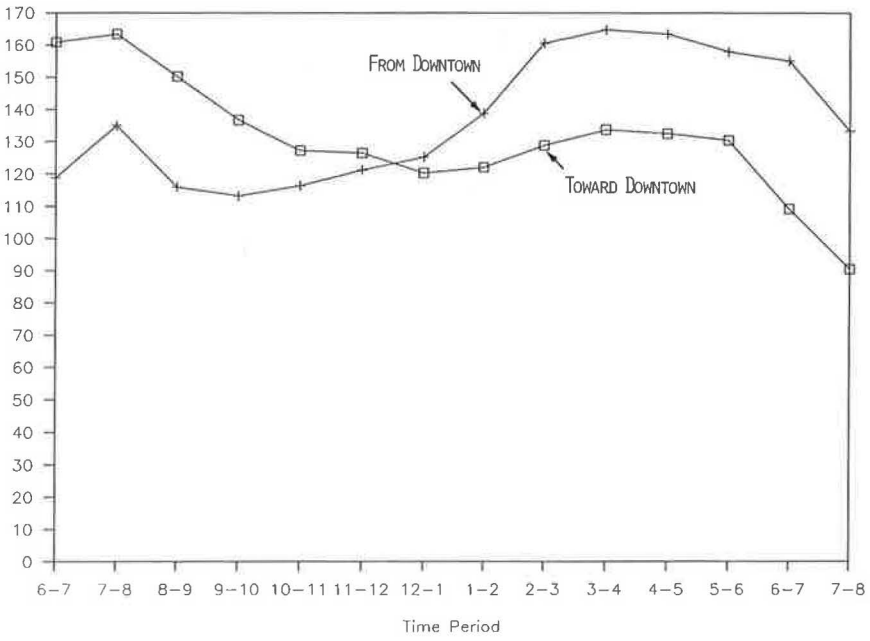

FIGURE 2 Traffic flow on radial routes by time and direction.

TABLE 1 TRAFFIC COUNTS BY TIME AND DIRECTION

Freeway	Location	Direction	Average Hourly Traffic 6-9	9-2	2-6
5	Burbank	To	7700	4800	5800
5	Burbank	From	5300	4200	6600
5	Tuxford	To	7100	3900	4000
5	Tuxford	From	3600	3700	6100
5	S. of 710	To	7900	6000	6000
5	S. of 710	From	5700	5500	6100
5	Los Feliz	To	7400	5400	6900
5	Los Feliz	From	6100	5100	7200
5	Rosencrans	To	5300	4500	4900
5	Rosencrans	From	4500	4400	4900
5	Orangethorpe	To	5800	5100	5700
5	Orangethorpe	From	10500	9100	11500
10	Crenshaw	To	6800	7300	7900
10	Crenshaw	From	5200	7500	7900
10	Westwood	To	7900	8000	8200
10	Westwood	From	8400	8000	8500
10	E. of 710	To	6000	5000	4000
10	E. of 710	From	3300	4400	5600
10	Atlantic	To	6700	5800	5400
10	Atlantic	From	4100	5100	6800
10	Rosemead	To	7100	6100	5900
10	Rosemead	From	4100	5300	7400
10	Citrus	To	7500	4800	5100
10	Citrus	From	4200	4300	7300
60	Atlantic	To	9700	6300	5400
60	Atlantic	From	4500	4900	7700
60	Rosemead	To	9000	6000	5800
60	Rosemead	From	4400	4600	7200
60	Turnbull	To	7400	5700	6500
60	Turnbull	From	5200	5700	8700
101	Western	To	6800	5700	5100
101	Western	From	5300	5400	7000
101	Vineland	To	8500	6800	5900
101	Vineland	From	5600	5600	8400
101	Van Nuys	To	6800	7200	7400
101	Van Nuys	From	9000	9900	9400
110	Slauson	To	6600	6500	5000
110	Slauson	From	6500	5900	7600
710	Imperial	To	6700	4800	6200
710	Imperial	From	5900	4200	6500
710	Del Amol	To	6000	4600	6400
710	Del Amol	From	6200	4300	5600
TOTAL		TO	158000	127000	131000
TOTAL		FROM	123000	123000	162000

- From 2:00 to 6:00 p.m., traffic leading away from the downtown exceeds traffic heading toward the downtown by 23 percent.
- Between 9:00 a.m. and 2:00 p.m., traffic levels leading toward the downtown average 80 percent of the peak-period count, and those heading away from the downtown average 76 percent of the peak-period count.
- Heading toward the downtown, the p.m. count is nearly the same as the midday count. Heading away from the downtown, the a.m. count is nearly the same as the midday count.

It appears that most radial freeways operate below capacity for most of the day. Most radial roads leading toward the downtown only operate at peak capacity from about 6:00 to 9:00 a.m. Most roads heading away from the downtown only operate at peak capacity from about 2:00 to 6:00 p.m.

EXPOSURE OF TRUCKS TO CONGESTION

Ordinary two-axle automobiles and light trucks compose the vast majority of vehicles on the Los Angeles freeway system, and general traffic patterns are dominated by personal trips. During peak hours, traffic is further dominated by commute trips, which are reflective of where people live and work.

On most Los Angeles freeways, less than 5 percent of the vehicles are large trucks (three axles or more), whose traffic patterns differ substantially from personal vehicles. Most of their trips begin and end at manufacturers, transportation terminals, or warehouses. Consequently, truck travel patterns reflect the locations of industrial facilities.

In the Los Angeles region, the largest concentration of manufacturers and warehouses is in south central Los Angeles

along the Santa Ana Freeway (I-5) corridor. The largest transportation terminals are the ports of Los Angeles and Long Beach; Southern Pacific's Long Beach intermodal terminal, 20 mi south of downtown; and the Santa Fe, Southern Pacific, and Union Pacific intermodal terminals in the vicinity of the downtown (see Figure 1). In addition, unlike automobile traffic, which is dominated by commuting, truck trips are spread throughout their workday. These factors combine to cause truck travel patterns to differ substantially from general traffic patterns, in terms of both where they are on the road and when they are on the road.

The Urban Freeway Gridlock Study (*1*) found that "a substantial number of freeway sites had a smaller percentage of large trucks than is suggested by the statistical average." This issue was examined in depth through statistical analysis of truck and automobile traffic in the Los Angeles region. The data were collected by Cambridge Systematics Inc. as part of the Gridlock study using a video camera at 40 sites. For each site, truck (three or more axle) and automobile counts were obtained for six 15-min periods, two in the a.m. peak, two at midday, and two in the p.m. peak. In all, recordings were made for 221 15-min periods (19 data points were missing).

Figures 3a, 4a, and 5a show the percentage of trucks on the road by time of day. Similar graphs, for off-peak and p.m. peak, were presented elsewhere by Hall and Lin (*4*). The relationship between truck traffic and total traffic was ap-

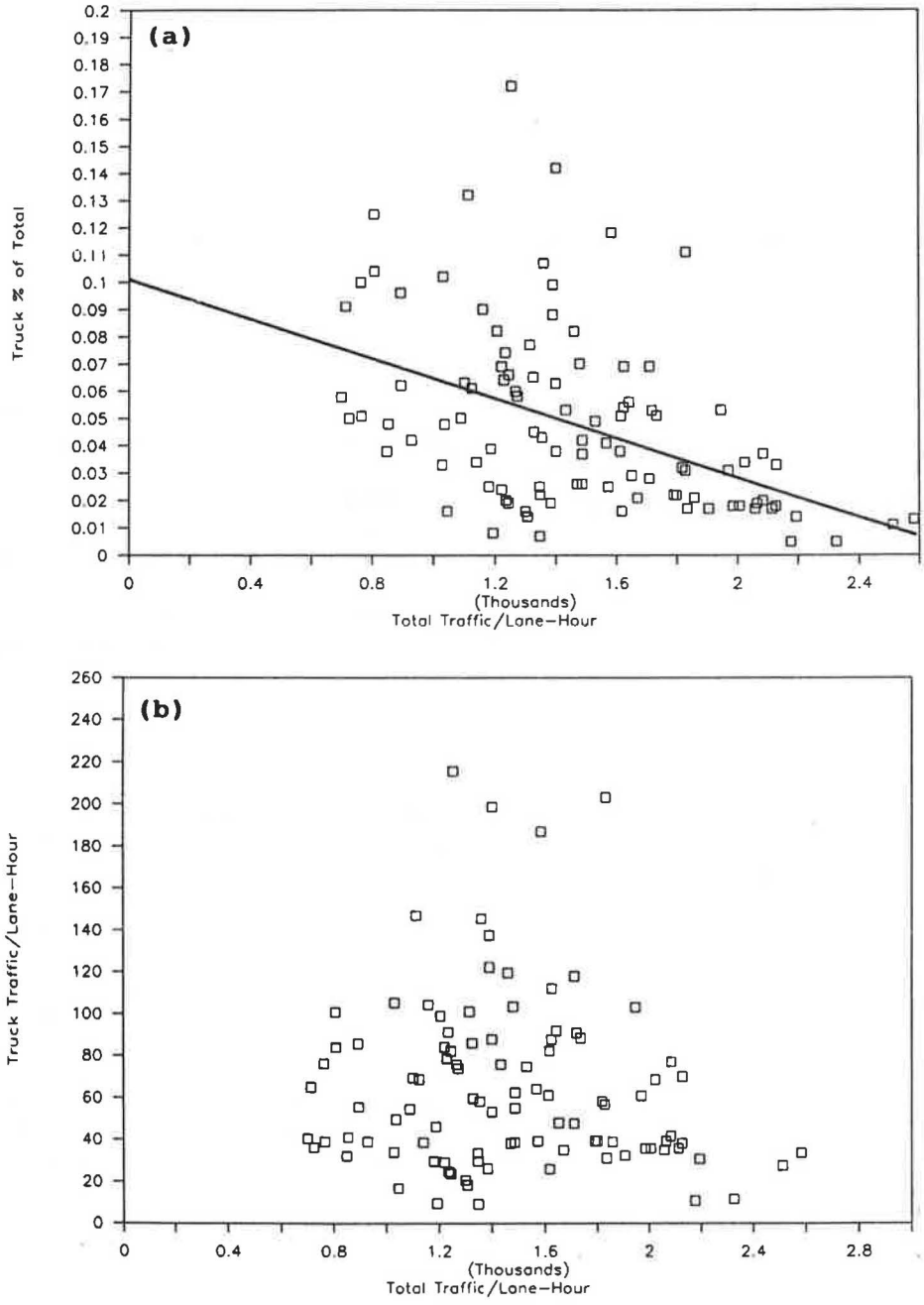

FIGURE 3 Truck traffic versus total traffic per lane-hour: Los Angeles a.m. traffic.

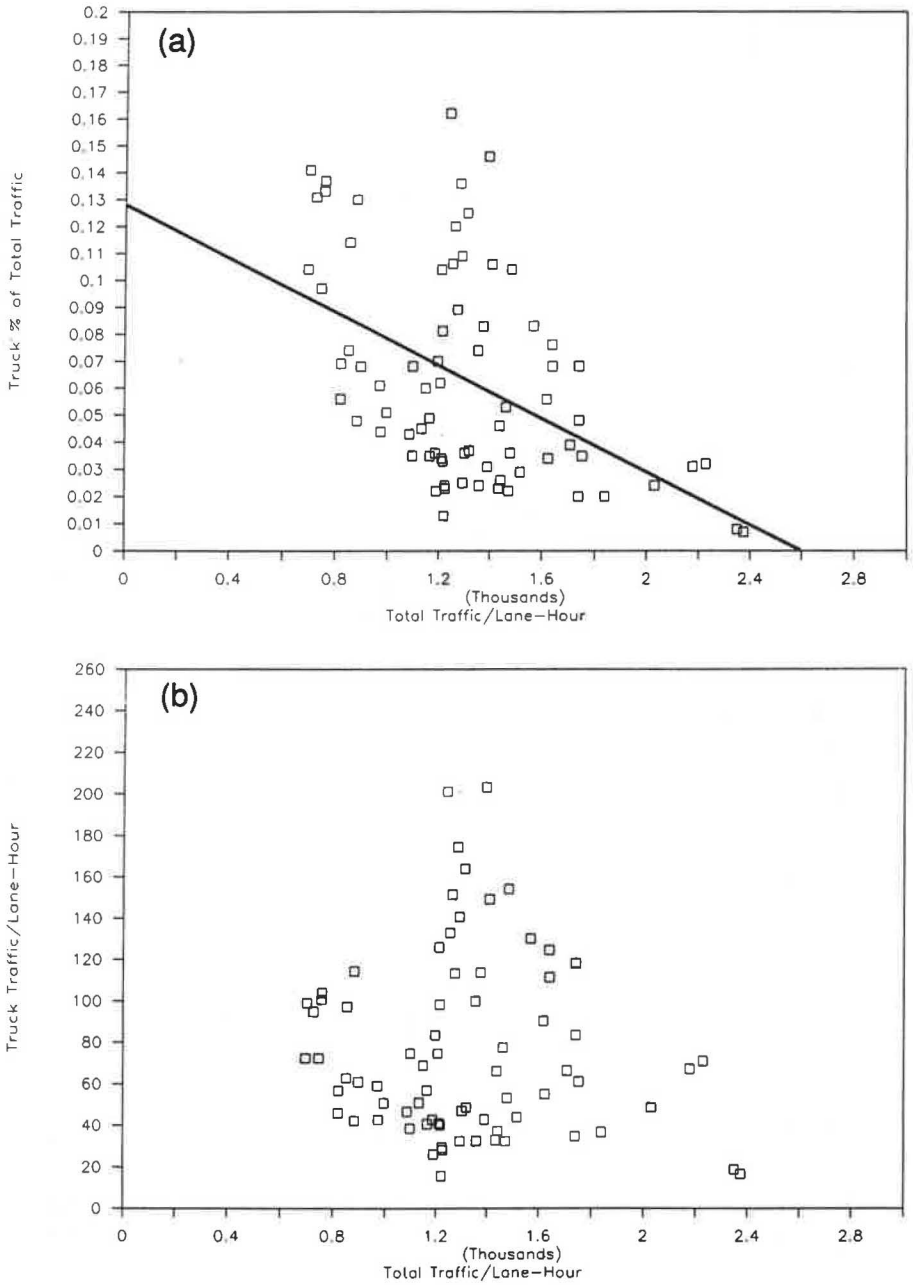

FIGURE 4 Truck traffic versus total traffic per lane-hour: Los Angeles off-peak traffic.

proximated by ordinary least-squares linear regression [negative correlation is weak (R_2 = 0.23) but significant, with t = 5.1].

It was observed that there is a natural tendency for trucks to avoid the most congested roadways:

- As a percentage of total traffic, truck traffic declines as traffic volume increases in the a.m., midday, and p.m. periods.
- As a percentage of total traffic, truck traffic is largest at midday, when roadways are the least congested, and smallest in the p.m. peak, when roadways are the most congested.

Figures 3b, 4b, and 5b convert the percentages into trucks per lane-hour. The figures demonstrate the following additional points:

- Truck traffic is nearly the same during the a.m. peak and midday but considerably smaller during the p.m. peak.
- Total traffic is largest during the p.m. peak, slightly smaller during the a.m. peak, and considerably smaller during the off-peak period.
- The largest truck volumes occur on freeways with medium traffic volumes (approximately 1,400 veh/lane-hr). Truck traffic is smaller on roads that have either a very large or a very small traffic level.

Roughly the same number of trucks is on the road during the a.m. peak and midday, probably because driver workshifts run from early morning through the afternoon. The higher percentage of trucks at midday is due to fewer automobiles

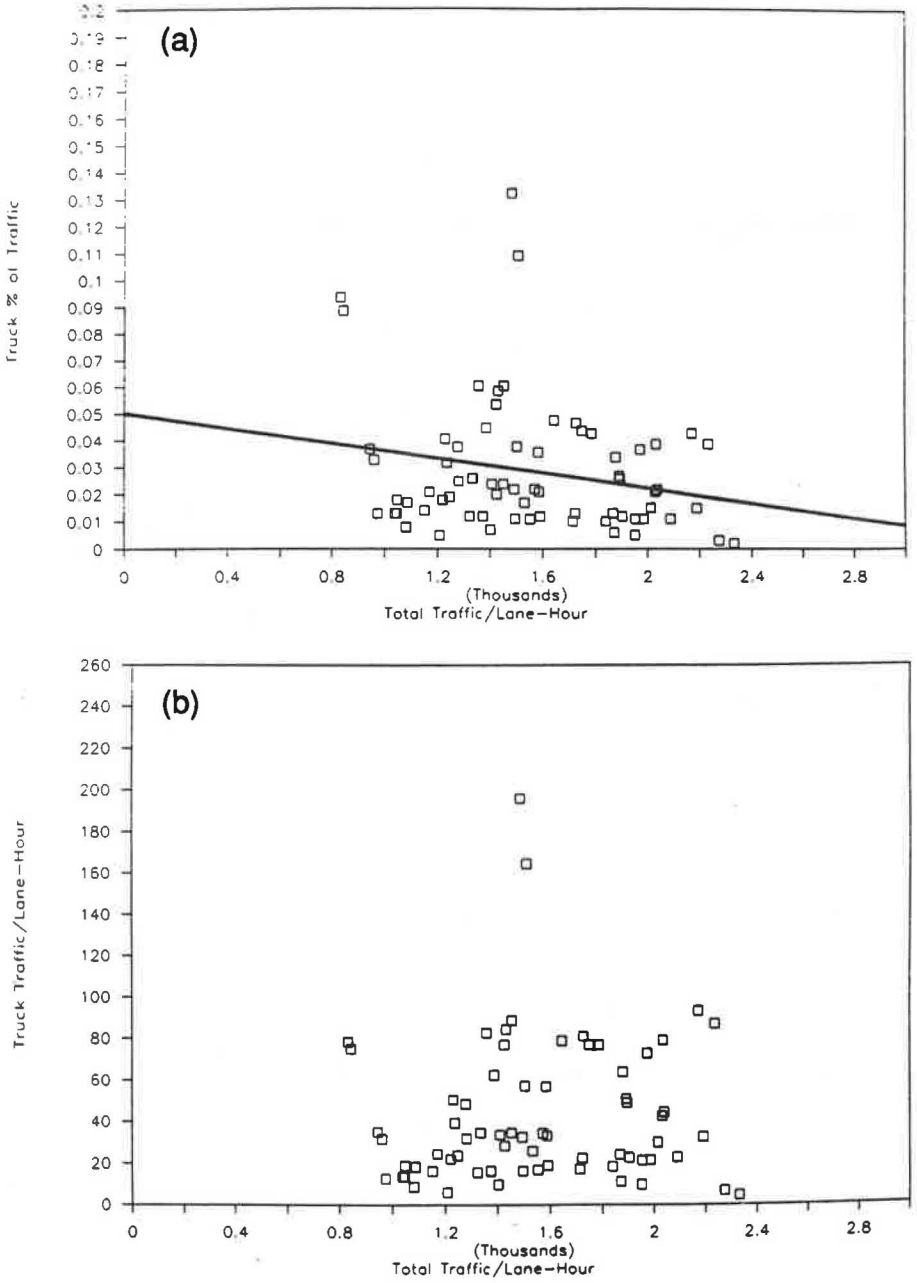

FIGURE 5 Truck traffic versus total traffic per lane-hour: Los Angeles p.m. traffic.

being on the road, not more trucks. During the p.m. peak, there are fewer trucks on the road because many carriers have terminated operations for the day. In all periods, there is a natural tendency for trucks to avoid congested routes.

The heaviest a.m. truck volumes occur on roadways that are relatively uncongested and are located near the ports of Los Angeles and Long Beach and near the south central industrial corridor. The smallest truck volumes occur heading toward the downtown or other employment centers, over congested roads. The absolutely lowest truck percentages occur on the Santa Monica Freeway, the most densely developed commercial corridor in the region.

In conclusion, trucks in the Los Angeles region seem to naturally avoid the most congested roadways. Nevertheless, it is impossible for trucks to avoid congested freeways completely (especially the Santa Ana and San Diego freeways).

LOCATIONS OF EXISTING TRUCKING TERMINALS

The travel pattern for trucks in the Los Angeles region depends on the locations of the major trip generators—manufacturers, warehouses, the ports, and rail yards—as well as on locations of trucking terminals. By locating terminals closer to trip generators, the total number of truck-miles can be reduced. By strategically locating terminals to exploit excess freeway capacity, the number of truck-miles over congested roadways can be reduced.

The existing locations of trucking terminals in the region are discussed in the following paragraphs. The analysis is based on two data sources: (a) the California Trucking Association (CTA) file of Los Angeles and Orange county terminals (San Bernadino and Riverside counties were excluded) and (b) service directories for seven major LTL carriers. Neither data source is comprehensive. Nevertheless, each gives a representative sample of existing terminal locations and provides insight into truck travel patterns in the Los Angeles region.

General Terminal Locations

The CTA data file contains the addresses of 600 terminals covering a wide variety of trucking types—LTL and truckload, private and common, and specialized carriers. The CTA data were coded by zip code, and the zip codes were ranked from largest to smallest according to number of terminals. From this ranking, it was found that the greatest concentrations of terminals are in south central Los Angeles—in the Santa Ana corridor stretching from downtown to Santa Fe Springs—and in the vicinity of the ports of Los Angeles and Long Beach, stretching up to Gardena. The first area is the manufacturing core of the region, and the second is the distribution core. Clearly, large numbers of motor carriers have selected sites to serve these customers.

Comparison with Manufacturing Employment

If terminals are to be located effectively, they should be placed close to the customers. Because manufacturers are the single largest source of customers, the terminal location pattern was compared with the pattern of manufacturing employment in the region (*7*). Through statistical regression, the relationship between number of terminals and manufacturing employment, by zip code, was approximated by a linear equation.

Figure 6 shows zip codes in which the number of terminals differs appreciably from that expected, given manufacturing employment. The Santa Ana Freeway corridor and the port area have especially large concentrations of terminals. On the other hand, several zip codes located in the suburbs, such as Chatsworth, El Segundo, and Redondo Beach, have far fewer terminals than expected.

Explanation of Terminal Clusters

Manufacturing employment is just one determinant of the number of terminals in a zip code. Other factors include manufacturing employment in nearby zip codes and location of major transportation facilities. The latter factor surely explains the large concentration of terminals in the port area. For carriers that serve the ports to locate elsewhere would be inefficient.

The concentration of terminals along the Santa Ana corridor is probably due to its central location for those carriers that serve the entire Los Angeles region from a single terminal. To test this reasoning, alternative terminal sites were analyzed according to the average straight-line distance to manufacturing job sites in Los Angeles, Orange, Riverside, and San Bernadino counties. The most central location was found to be in Bell, west of I-710 and south of I-5, in the center of a terminal cluster. Locations were further analyzed to see which sites were nearly optimal for minimizing average straight-line distance. The middle and outer rings of Figure 7, representing average distance within 5 and 10 percent of optimal, almost exactly match the terminal pattern of Figure 6.

LTL Terminals

Terminals were evaluated for seven LTL common carriers: the three major carriers (Consolidated Freightways, Roadway, and Yellow), three smaller nationwide carriers (ABF, ANR, and P.I.E.), and a large regional carrier (Viking). Terminal locations and boundaries of terminal service regions were obtained from published service directories (*8–14*).

Topography and, to a lesser extent, governmental boundaries play a key role in dictating terminal locations and service

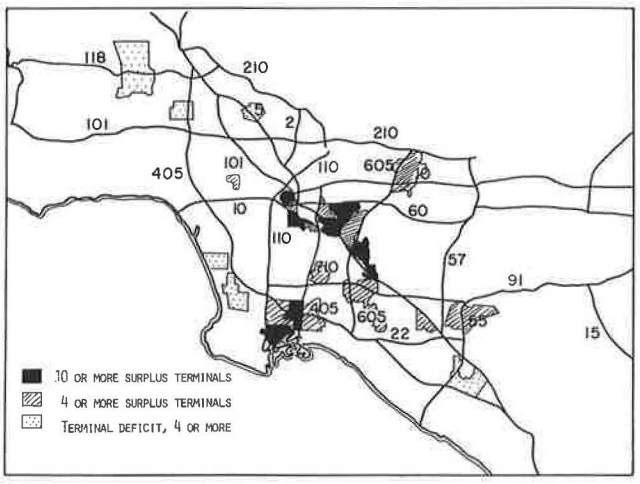

FIGURE 6 Zip codes containing many, or few, trucking terminals.

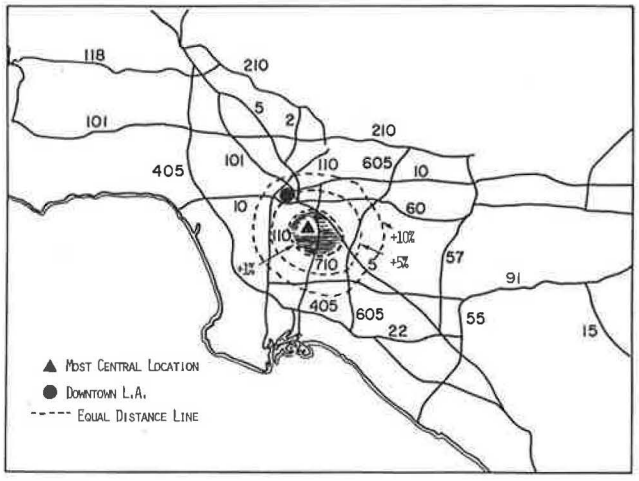

FIGURE 7 Most central location relative to manufacturing employment.

regions. All carriers appear to have divided Los Angeles into four distinct regions, as shown in the following table:

Region	*Boundaries*
San Fernando	Santa Monica and San Gabriel mountain ranges
Eastern	San Gabriel and Santa Ana ranges
Orange	Santa Ana range and Orange County line
Central	Santa Monica and Santa Ana ranges and Orange County line

To illustrate the region's topography, Figure 8 shows the positioning of 1,000-ft contour lines. Areas located above the 1,000-ft level tend to be sparsely populated and difficult to traverse. Consequently, service regions have been drawn to minimize pickup and delivery truck travel across the mountains.

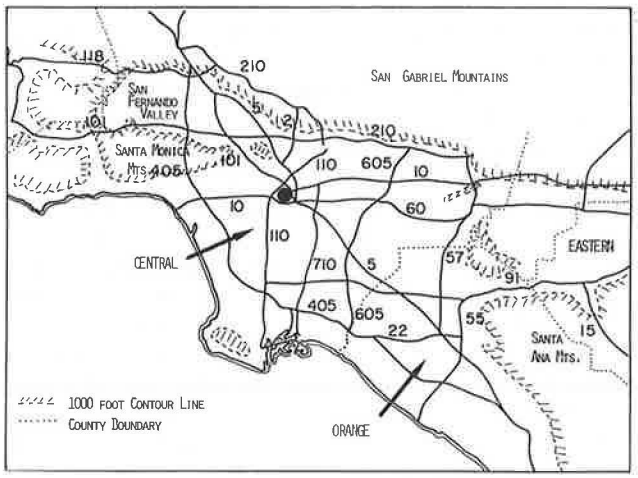

FIGURE 8 Los Angeles region topography.

TABLE 2 MAJOR MANUFACTURING CENTERS

Consolidated		Large LTL Carriers Roadway		Yellow	
San Fernando/Ventura					
Oxnard	92613	Ventura	93001	Ventura	93003
Pacoima	91331	Pacoima	91331	Sun Valley	91352
Simi	93065				
Central: Santa Ana					
L.A.	90021	L.A.	90058	L.A.	90021
Montebello	90640			Pico Rivera	90660
Santa Fe S.	90670	Santa Fe S.	90670	Santa Fe S.	90670
Central: San Diego					
Carson	90745	Wilmington	90744	Carson	90810
Compton	90220	Gardena	90248	Gardena	90247
Inglewood	90304				
Central: East County					
Industry	91789	Industry	91746		
Irwindale	91706				
Orange County					
Irvine	92718	Irvine	92718	Irvine	92718
Los Alamit.	90720				
Orange	92665	Orange	92667	Orange	92668
Eastern					
Fontana	92335	Ontario	91743	Fontana	92335
San Bern.	92324	San Bern.	92316	Riverside	92507

ABF		ANR		Medium LTL Carriers PIE		Viking	
San Fernando/Ventura							
Oxnard	93001	Oxnard+	93030	Ventura	93003	Oxnard	93030
Pacoima	91331	Pacoima	91331	Pacoima	91331	Sun Valley	91352
Central							
Carson	90810	Long Beach	90810	Carson	90746	Gardena	90248
Pico River	90660	L.A.	90023	L.A.	90058	Whittier	90601
				Montebello	90023		
				Industry	91769		
Orange							
Orange	92667	Orange	92665	Orange	92665	Anaheim	92806
Eastern							
Pomona	91767	San Bern.	92408	Fontana	92234	Pomona	91767
Colton	92324			San Bern.	92402	San Bern.	92408

• Recently closed

Table 2 presents the terminals by region, grouping terminals with similar locations. For instance, the first line gives the terminal serving locations to the west of San Fernando Valley. In all seven cases, that terminal is located in either Ventura or Oxnard. In Figure 9, locations of all seven carriers have been plotted, and Figure 10 shows terminal locations and service region boundaries for an example carrier, Roadway. Other maps are provided by Hall and Lin (*4*).

A minimum of six terminals is needed to serve the region competitively, one each for Oxnard, San Fernando Valley, Long Beach, central Los Angeles, Orange County, and San Bernadino-Riverside. The larger carriers have divided Los Angeles into smaller service regions and established more terminals. Roadway, for instance, serves central Los Angeles from five terminals: Gardena, Industry, Long Beach, south central Los Angeles, and Santa Fe Springs. Roadway has also established two terminals in Orange County (Irvine and Orange) and two terminals in the eastern region (Ontario and San Bernadino). Nevertheless, there is no precise relationship between carrier size and number of terminals. Yellow has 75

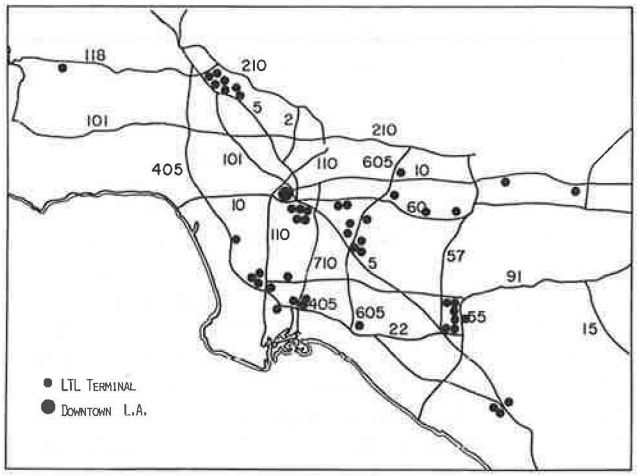

FIGURE 9 Locations of LTL terminals.

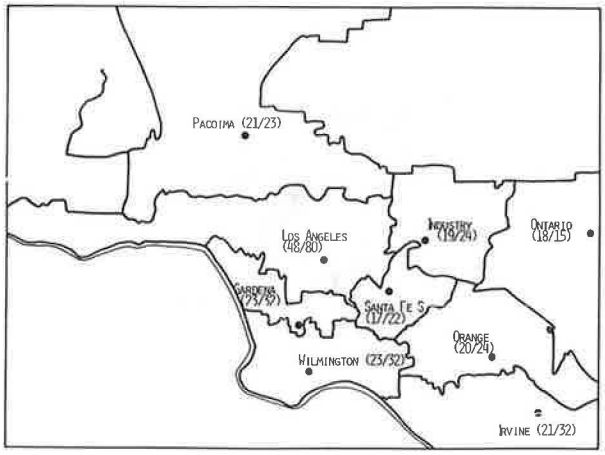

FIGURE 10 Roadway terminals and service regions (parentheses indicate tractors/doors).

more tractors and 73 more docks than Consolidated, but five fewer terminals. Viking, with six terminals, has a comparable number of docks as Roadway, which has 11.

The large carriers hold a natural advantage over the small in minimizing their pickup and delivery costs. With more terminals, large carriers can generally serve their customers from closer terminals. Consequently, they are not as exposed to road congestion delays. Consolidated, for instance, can serve the manufacturing center in El Segundo from nearby Inglewood. All other carriers would have to dispatch a truck from the Long Beach–Gardena area or from south central Los Angeles.

The distance and route from terminal to customer dictate the extent to which trucks are exposed to highway congestion. Some manufacturing centers enjoy much closer service than others, as indicated in Table 3. Accounting for existing terminal locations, freeway capacities, and prevailing traffic patterns, several industrial areas are especially difficult to serve:

- Carriers serving the entire region from south central Los Angeles:
  - —San Fernando Valley,
  - —West Los Angeles–Santa Monica, and
  - —Los Angeles Airport–El Segundo; and
- LTL carriers serving the region from multiple terminals (other than Consolidated):
  - —Glendale-Pasadena,
  - —Huntington Beach,
  - —Irwindale-Azusa,
  - —Los Angeles/Culver City, and
  - —Los Angeles Airport–El Segundo.

The San Diego corridor, from west Los Angeles to Redondo Beach, presents the biggest challenge. The San Diego Freeway is highly congested, often in both directions, and there is a general shortage of trucking terminals.

TABLE 3 LTL TERMINALS FOR SEVEN CARRIERS

Center/zip		Ave Dist to Terminal+	CF Dist to Terminal@	Access Route*
San Fernando				
Burbank	91504	5	6	5 south
Chatsworth	91311	11	10	5 north/118 west
San Fernan.	91342	5	5	5 north
Sepulveda	91406	5	5	surface,5 north/ 405 south
Central: I-5				
Commerce	90040	3	2	5 south
Santa Fe Sp	90670	4	0	surface
Vernon	90058	3	2	surface
Central: I-405				
Compton	90221	4	2	91 east,710 north
Culver Cty	90230	10	5	10 west
El Segundo	90245	8	2	405 north(CF:405 south)
Gardena	90248	2	3	surface
Redondo Bch	90278	6	3	405 north/surface
San Pedro	90731	6	5	110 south,surface
Santa Mon.	90404	13	8	10 west
Central: East County				
Azusa	91702	10	3	605 north
El Monte	91733	5	4	605 north
La Puente	91746	6	4	605 north/60 east
Orange				
Fullerton	92631	4	4	55 north
Hunt. Bch	92649	11	5	22 west
Irvine	92714	8	6	405 north
East				
Pomona	91766	8	6	10 west
Rancho Cuc.	91730	8	7	10 west,surface
Riverside	92507	7	6	215 south

+ Average straight-line distance from zip code to zip code.
@ Straight-line distance for Consolidated Freightways, zip to zip. Zero value indicates that terminal is located in manufacturing zip code.
* Most common access route among seven LTL carriers

LOCATIONS FOR NEW TERMINALS

Strategic terminal siting provides an opportunity for LTL carriers to reduce their congestion delays. In this section, positions for new terminals are examined in relationship to the existing manufacturing base and in relationship to freeway congestion. Because all carriers have made substantial investments in their existing facilities, and because additional terminals would require bigger investments, neither change could come quickly. Nevertheless, the cost of constructing a terminal is far less than the cost of constructing other industrial buildings, such as factories or even warehouses. So, establishing new terminals would not be impossible.

Servicing Entire Region from a Single Terminal

South central Los Angeles is the most central location from which to serve the entire Los Angeles region. It offers the minimum average travel distance to the region's manufacturing employment, and it offers good freeway accessibility to all but San Fernando Valley and west Los Angeles–El Segundo. It effectively exploits surplus freeway capacity heading south, to the ports and to the Santa Ana corridor.

An analysis of existing terminals indicates that a large number of motor carriers have wisely selected south central Los Angeles for their terminals. The only concern is that future carriers will avoid the area because of high land costs and the lack of vacant industrial land. In its 1989 analysis of the Los Angeles industrial real estate market, Grubb and Ellis Realty (*15*) stated the following:

> The scarcity of available land and the area's high prices have combined to keep construction activity low. The small amount of development activity that does occur consists primarily of teardowns of old structures, particularly multi-story industrial warehouse space, which is considered unsafe by earthquake or fire standards.

One alternative to south central Los Angeles is the Santa Fe Springs-La Mirada area, to the southeast, where there is some vacant industrial land. This area offers improved access to the fastest growing areas in the region: Orange, Riverside, and San Bernadino counties. San Fernando Valley, on the other hand, can only be reached by the circuitous I-605–I-210 route or through the congested downtown via the Santa Ana Freeway.

A second alternative is the Carson-Dominguez area to the south. It offers excellent access to the ports and the San Diego corridor, and good access to south central Los Angeles, via the Long Beach Freeway (I-710). Vacant industrial property is available, and prices are relatively low. The biggest drawbacks would be difficult access to San Fernando Valley and increased distance from the growing Riverside and San Bernadino counties.

In the future, lower land prices and vacant property may draw carriers even farther from the center, to East Los Angeles County or San Bernadino and Riverside counties. This

shift would certainly create congestion; average travel distances would increase and trucks would be forced to travel in the same direction as commuters.

With the lack of vacant land in south central Los Angeles and the absence of a direct route to San Fernando Valley, carriers may find it impossible to serve the entire region from a single location in the future. Independent of freeway congestion, the size of the Los Angeles region presents a challenge. The urbanized area encompasses a region larger than the state of Delaware and a population bigger than that of Pennsylvania.

Multiple Terminals

In this section, multiple terminals opportunities in the four Los Angeles regions—San Fernando, Eastern, Orange County, and Central—are examined.

San Fernando

All seven LTL carriers currently serve the valley from the Pacoima–Sun Valley location. This location places the carriers strategically at the intersection of the Golden State (I-5) and Hollywood (I-170) freeways and near the manufacturing center of the valley. It would be difficult to improve on the current location.

Orange County

If a carrier can only provide one terminal in Orange County, then Orange—used by all seven LTL carriers surveyed—is a reasonable choice. Orange provides immediate access to the I-5–91–57 triangle and close access to the manufacturing center in Irvine. However, given the size of the Orange County market and the congestion on roadways heading toward Irvine, two terminals are warranted, with the second in Irvine.

Eastern

The concern in Eastern is not so much with existing congestion but with future congestion. The Ontario-Fontana area, along the Devore Freeway (I-15), is prime for development, and the larger carriers have wisely established terminals there. Because the area is large, reasonable locations for a pair of terminals are San Bernadino and Fontana.

Central

The central region contains at least three distinct manufacturing centers—San Diego corridor, Santa Ana corridor, and East Los Angeles County—which suggests that a minimum of three terminals is needed to serve the region.

San Diego Service to the northern part of the corridor would improve if the smaller carriers moved farther north to the Gardena-Torrance area (as Viking has already done). Gardena provides good reverse commute access to the ports and improved access to El Segundo, Los Angeles Airport, and Santa Monica. Ideally, the corridor would be served by two terminals, one to the north in the Inglewood area and one to the south in the Carson–Long Beach area.

Santa Ana Vernon-Commerce in south central Los Angeles provides immediate access to the industrial core and the downtown and reverse commute access to Santa Fe Springs and South Gate. Unfortunately, the lack of vacant land is an obstacle to locating there, and some carriers have moved farther south. Ideally, two terminals would be used, with the second in the Santa Fe Springs area.

East County El Monte, near the intersection of the San Gabriel (I-605) and Pomona (60) freeways, provides excellent reverse commute access to the manufacturing centers of Azusa-Irwindale and Industry–La Puente.

Addition of Terminals

The ideal way to avoid road congestion would be for motor carriers to establish more terminals, closer to their customers. In this regard, Consolidated Freightways, with 16 terminals, serves as a model. Although other individual carriers may not have the volumes to justify 16 terminals, they could justify more terminals if they pooled their traffic. Following are some possibilities:

- Jointly operated terminals for several LTL carriers, to minimize the investment of each;
- A pooled fleet of pickup and delivery trucks to be shared by carriers; and
- Independently operated terminals to serve multiple LTL carriers, with terminals acting as agents for pickup and delivery (LTL carriers would be responsible for line haul between terminals).

In this era of deregulation, trucking is a highly competitive but fragmented industry, with many small operators. Although shippers have benefited from low prices, some efficiency has been lost. From the standpoint of highway congestion, a reduction in the number of competitors, or cooperative agreements among competitors, would allow carriers to strategically locate terminals in more locations and to reduce truck travel over congested roads. This direction should be encouraged.

CONCLUSIONS

Los Angeles has been called a city without a center. Yet it has a fast-growing downtown that influences traffic patterns throughout the city. Los Angeles has also been called a city with perpetual traffic congestion. Yet most freeway segments only operate at capacity for a few hours each day, in one direction at a time. Combined, these factors indicate that even automobile-dominated cities, such as Los Angeles, have sur-

plus road capacity ready to be exploited. By strategically locating terminals to make trucks act as reverse commuters, and by strategically locating terminals to reduce travel distance, congestion-related delays can be reduced for trucks and automobiles alike.

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