

Trucks at Rest

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•THE purpose of this paper is to report a variety of preliminary findings about trucks at rest, that is, when they are not in movement on the streets. Such findings are limited to the data collected in a typical truck-taxi survey conducted by a typical areawide transportation study. Thus, they are not as exhaustive as might be developed from more intensive, in-depth interviews or observations. They are, however, useful in suggesting that, although highway improvements will materially aid the trucking industry, careful attention must be given also to developing modern and efficient facilities for loading and unloading, parking and maintenance, and other at-rest activities.

The Pittsburgh Area Transportation Study (PATs) made its truck-taxi survey during the fall and early winter of 1958. The survey, scheduled concurrently with the home interview survey, recorded trips by trucks and taxis registered at addresses in the study area. These were sampled at the rate of one in ten from official registration lists in Harrisburg (1). The interview was made with the driver of each vehicle or with his dispatcher. The data recorded included the type of vehicle, the garaging address, the business of the owner, and trip information similar to that obtained in the home interview survey.

During the survey 45 percent of the sample vehicles did not report any trips on the designated travel date. At first, this would appear to reflect only the relatively depressed economic condition of the Pittsburgh area during the survey period. Subsequent appraisals by various interviewers would indicate, however, that very few fleet operators or reputable businessmen reported no trips. Most non-tripmaking trucks appeared to be owned by individuals who did not want to be bothered; these persons seemed to find it simpler to say the truck was not used than to describe the trips that may have been made. The various accuracy checks indicated that many trips were, in fact, unreported. A correction factor of 20 percent was applied for planning purposes (2).

However, the proportion of sampled vehicles that did report tripmaking was fairly consistent by truck type and by day of week (Table 1). (For purposes of this paper, a "light truck" is defined as having 4 wheels; a "medium truck" is defined as six wheels or more and a straight body; and a "heavy truck" is defined as any combination vehicle, that is, truck-trailer, truck-semitrailer, etc.) Moreover, the average number of trips per vehicle per day was entirely consistent (Table 2). These findings are shown to demonstrate that the data for tripmaking trucks only seem relatively unbiased (although also subject to some underreporting). Thus, within limits, the conclusions drawn regarding the at-rest characteristics of the 23,000 tripmaking trucks should be generally representative of the 19,000 non-tripmaking trucks as well.

PROPORTION OF TIME AT REST

Various analyses have demonstrated that not all motor vehicles registered in the study area are likely to be used during a typical weekday. This includes both cars and trucks. On the average, only 81 percent of the 393,000 registered cars will leave the garage, and only 55 percent of the 42,000 trucks garaged and operating in the study area (3). Even the motor vehicles that are used are not used very continuously — at least, not in continuous motion on the streets. On the average, both tripmaking cars and trucks are being driven less than an hour a day; they are at rest 95 percent of the time!

TABLE 1
PERCENTAGE OF TRIPMAKING VEHICLES
IN THE TRUCK-TAXI SURVEY

Day	Vehicle Type				Avg. All Vehicles
	Taxis	Light Trucks	Medium Trucks	Heavy Trucks	
Monday	90	56	52	65	55
Tuesday	96	57	46	85	57
Wednesday	100	55	53	71	55
Thursday	82	58	53	83	57
Friday	—	53	54	43	53
Avg. weekday	91	56	52	67	55

TABLE 2
TRIPS PER DAY PER TRIPMAKING VEHICLE

Day	Trips (no.)				Avg. All Vehicles
	Taxis	Light Trucks	Medium Trucks	Heavy Trucks	
Monday	46	11.2	8.4	3.8	10.7
Tuesday	46	8.2	8.6	2.5	11.0
Wednesday	33	8.7	9.4	3.7	9.2
Thursday	40	10.8	8.9	3.5	11.1
Friday	—	15.1	8.7	2.9	11.2
Avg. weekday	42	10.5	8.8	3.4	10.6

The immobility of the automobile (an incongruous phrase) is easily understood. When a driver takes his automobile somewhere (to work, for example) there it will normally stay until he takes it elsewhere. It cannot readily be shared by another driver (even in the same family) because it cannot be returned automatically to some common base of operations, such as home. The immobility of the truck is more difficult to picture. The typical image is that of many trucks constantly in motion: picking up laundry and dry cleaning, delivering department store purchases, making calls to service television sets, and generally circulating among a diversity of urban activities. Stops are viewed as momentary and travel as continuing throughout the workday. Actually, this impression is misleading; many stops are much more than momentary.

The duration of stop was not directly reported in the PATS truck-taxi survey. Rather, it was calculated from the start and arrival times reported for each trip. All trips by each truck were sorted into trip sequence. Then, the arrival time of the first trip was subtracted from the start time of the second trip; the arrival time of the second trip was subtracted from the start time of the third trip; and so on, to derive the duration of stop for the first, second, and following trips, respectively. The duration of stop for the last trip, of course, could not be calculated.

All told, the duration of stop remained unknown for 24,378 trips (Table 3), with the proportion highest for the truck types reporting the fewest total trips per truck (mediums and heavys). On average, as the last trip of the day, the vast majority are to base of operations (89 percent); the next most frequent purpose is personal business (9 percent). The remainder are varied throughout the four other trip purposes (to pick up goods, to deliver goods, to pick up and deliver goods, and to service). This breakdown holds generally for each vehicle type; to base of operations, for example, accounts for 84, 87, 92, and 78 percent of the last trips by taxis and by light, medium, and heavy trucks. Unfortunately, there is no way of knowing how many of these last trips also involve overnight loading, unloading, or other activities.

It is known, however, that the last trip usually occurs late in the afternoon, a common sense observation substantiated by Figure 1. For example, at midafternoon (3:00 PM) about 68 percent of the light trucks have yet to make their final trip of the day, about 59 percent of the medium trucks, and about 51 percent of the heavy trucks; after dinner (7:00 PM) only about 5 to 6 percent of the light and medium trucks are still on the road and about 20 percent of the heavy trucks. By comparison, it is evident that many taxis are on the streets until the last party breaks up.

Table 3 shows that 40,425 trips reported no duration of stop, with the proportion highest for taxis and light trucks. This is partly a function of the time coding technique;

TABLE 3
TRUCK-TAXI TRIPS INVOLVED IN THE
DURATION-OF-STOP ANALYSIS

Type of Trip	Trips (no.)				Total
	Taxis	Light Trucks	Medium Trucks	Heavy Trucks	
No stop	11,763	24,175	4,477	10	40,425
Stop calculated	16,740	112,733	54,435	2,192	186,100
Stop unknown	661	14,943	7,882	892	24,378
Total	29,164	151,851	66,794	3,094	250,903

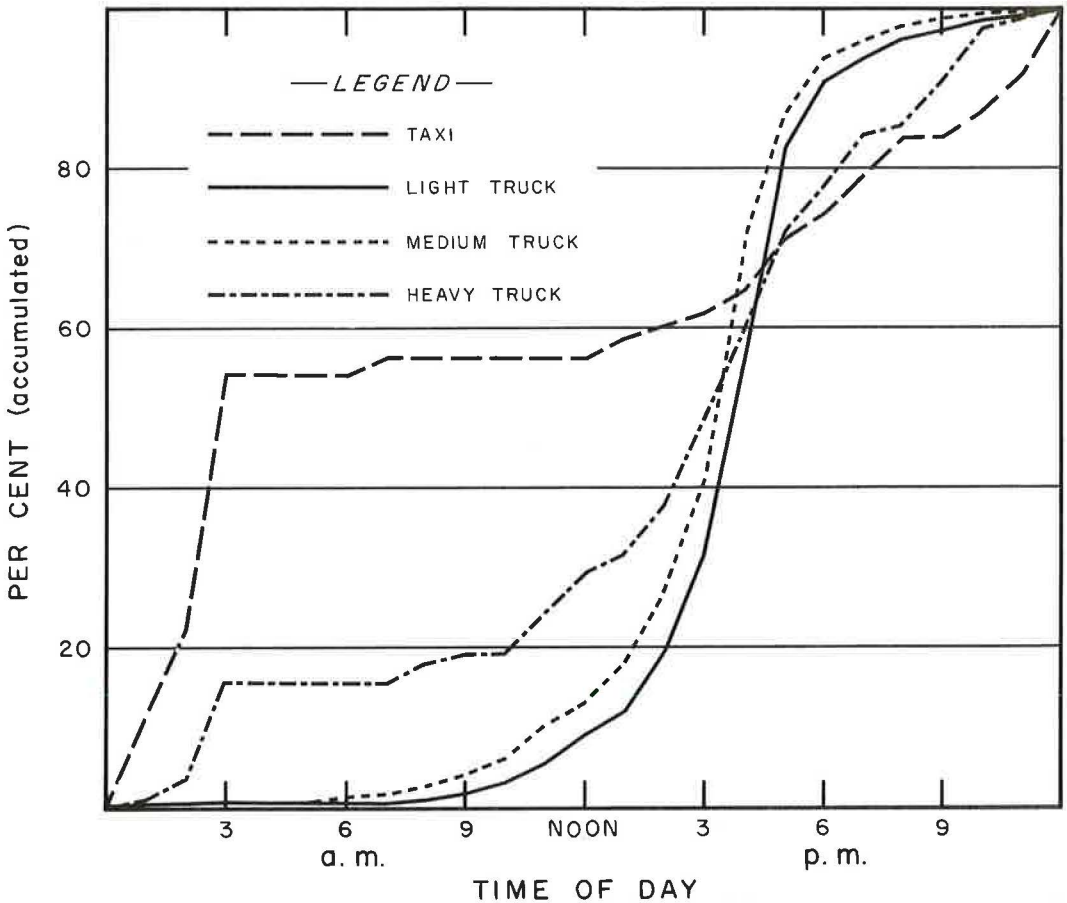


Figure 1. Percentage accumulation of last daily truck-taxi trips.

although start and arrival times were reported to the nearest minute, they were coded to the nearest tenth of an hour. Thus, a 5-min stop could be coded as no stop or a 2-min stop as a 6-min stop, depending on rounding. This is not a serious problem, however, and will not affect the analysis so much as erroneous time reporting itself. Despite the use of truck trip logs (4) distributed in advance of actual interviewing to truck fleet dispatchers and, subsequently, to their truck drivers to maintain a running record of the day's tripmaking, there are likely to be errors in the reported travel times. Except for a tendency to round off times to the nearest quarter hour, however, there should be no obvious bias; rounding errors should be largely self-canceling. Tripping, or making multiple stops within the same block, is not considered in the analysis; for certain kinds of delivery trucks, this omission would tend slightly to overstate the average duration of stop.

With these cautions asserted, the general analysis findings follow; they are organized largely to compare duration of trip stops by trip purpose, destination ring and destination land use, business-occupation, time of day, and truck type. The trips with unknown lengths of stops are specifically excluded; the findings are for the 226,525 trips whose duration of stops could be calculated.

Duration of Stop by Trip Purpose

Six trip purposes were used in the truck-taxi survey. A given trip could be to pick up goods, deliver goods, or for the combination purpose of picking up and delivering

goods. These three trip purposes accounted for 71 percent of all truck trips. Trips to the base of operations (for example, a dump truck garaged overnight at the driver's home and taken to a construction site in the morning) were 15 percent of all truck trips. Service calls were 11 percent. About 3 percent of all truck trips were for work-connected personal business. Where pickup or panel trucks were used as a family car, the trips were not recorded in the truck-taxi survey but in the home interview survey. Taxi trips consisted entirely of service (96 %) and to base of operations (4 %) purposes.

Table 4 gives the average duration of vehicle stop by trip purpose by vehicle type. The larger and heavier trucks made the longest stops, almost two hours on the average whether loading or unloading or simply waiting for an assignment. Obviously, they are seldom used for making service calls or for personal business. The smaller trucks

TABLE 4
AVERAGE DURATION OF VEHICLE STOP
BY TRIP PURPOSE

Purpose	Average Duration of Stop (min)				Avg.
	Taxi	Light	Medium	Heavy	
Pick up goods	—	29	51	110	36
Deliver goods	—	15	27	127	19
Pick up and deliver	—	14	25	50	17
Service	6	122	91	—	58
To base of operations	63	79	55	131	73
Personal business	—	90	47	—	82
Avg.	7	37	38	113	34

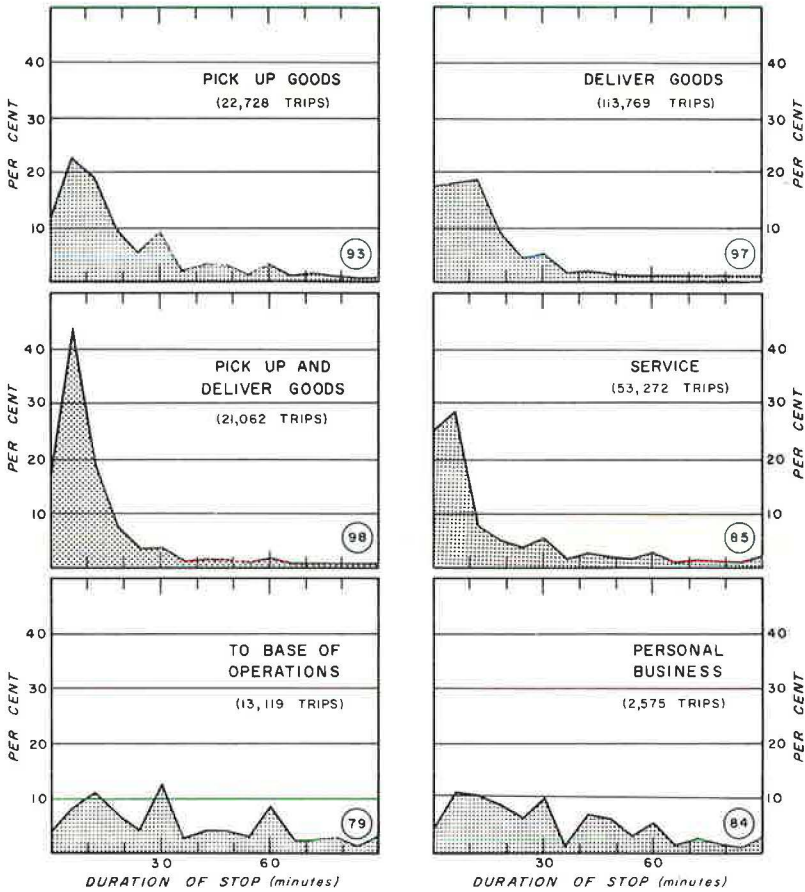


Figure 2. Percent of truck-taxi trips by duration of stop by trip purpose.

(lights and mediums) averaged just over one-half hour per stop. Service stops ranged from $1\frac{1}{2}$ to 2 hours. Goods-handling stops ranged from 14 to 51 minutes. Taxis made the shortest service stops (6 min) but stopped as long as trucks at their base of operations.

Without respect to vehicle type, the personal business trip required the longest period of vehicle inactivity (82 min), somewhat longer than the 73-min wait at the base of operations. Service calls averaged 58 minutes. Picking up goods required 36 minutes, or nearly twice as long as delivering goods. Where goods were both picked up and delivered, only 17 minutes were required; apparently such trips can involve only small parcels easily handled by the driver alone.

Figure 2 shows the percentage of truck trips by duration of stop by trip purpose. The circled numbers at the lower, right-hand corner of each graph show the proportion of trips with stops less than 90 minutes; the total number of trips in each trip purpose category is shown in parentheses. For example, there were 2,575 personal business trips, of which 16 percent require a stop exceeding 90 minutes. Except for personal business and to base-of-operations trip purposes, the distributions are marked by the high proportion of trips that make short stops and by the rapidly decreasing proportion that make longer stops. The bumps at $\frac{1}{2}$ - and 1-hr intervals reveal the slight biases in time reporting.

The foregoing evidence suggests that the goods-handling stops (except for the largest trucks) may account less for the average truck's daily at-rest time than do the stops at its base of operations and at the driver's personal business destinations. Actually, it would seem that stops for all purposes might be shortened in the future. Better vehicle design and improved loading-unloading facilities should reduce the average time at rest for goods-handling purposes; better management should reduce the waiting for assignment at a base of operation; substitution of an alternate travel mode, or a management ruling, might eliminate the inactivity during some of the personal business calls (most of these trips, however, are to eat lunch and so could not be eliminated). Similarly, the service call may never be shortened.

Duration of Stop by Truck Owner's Business

The truck-taxi survey recorded the truck owner's or operator's business as one of 10 categories. Three (primary metal manufacturing, outdoor public services, and mining-agriculture) reported only 1,535 trips combined, or 0.7 percent of all reported truck trips, and hardly warrant discussion. (It is significant to note, however, that the dominant employer in the Pittsburgh area, primary metals, accounted for only 7 percent of the total trucks garaged in the area and for an even smaller proportion of the total tripmaking.) Manufacturing other than primary metals, however, was the most active trip-producing business, reporting 27 percent of all trips. Transportation, utilities, and communications, as a group, reported 24 percent; wholesaling, 21 percent; services, 13 percent; retailing, 12 percent; governmental, institutional, and religious, as a group, 8 percent.

Table 5 shows the duration of vehicle stop according to the owner's business by vehicle type. Again, heavy trucks, regardless of the business in which they are used, made the longest stops; light and medium trucks, the shortest stops. As among the different businesses, there was remarkably little variation as to duration of stop. All except wholesaling averaged around one-half hour; wholesaling, however, averaged twice that. No clear reason can be determined for this variation. Possibly, it is because wholesaling activities tend to cluster in particular areas and create their own crowding and congestion. Certainly, this is true around the produce markets lining Penn Avenue in Pittsburgh's Strip district.

Figure 3 shows that 17 percent of the stops by trucks in the wholesale businesses were longer than $1\frac{1}{2}$ hours, a noticeably higher proportion than for trucks in the other businesses. Generally, however, the distributions are more uniform than those by trip purpose shown in Figure 2. This is not very surprising — the nature of the goods to be moved, which can be inferred from the truck owner's business, is perhaps less important than their quantity and gross weight. It would normally take longer to load a large truck than a small truck, no matter what the cargo.

Duration of Stop by Destination Land Use

Clearly, there should be some relationship between the trucker's business-occupation and the type of land use to which most of his truck trips are destined. But a truck owned by a wholesale firm would obviously make trips to other kinds of activity sites, for example, to retail establishments. This is why there cannot be an exact correspondence between the duration of truck stop by business-occupation (Table 5) and by destination land use (Table 6).

Although heavy trucks average a 5-hr stop at residential land, this seems appropriate for loading or unloading a moving van — about the only kind of heavy truck likely to make residential stops (Table 6). The 14-min taxi stops at "transportation" represent reporting-in at the taxi company headquarters; the 8-min stops at "streets" represent waiting at taxi stands.

TABLE 5
AVERAGE DURATION OF VEHICLE STOP
ACCORDING TO OWNER'S BUSINESS

Business	Average Duration of Stop (min)				Avg.
	Taxi	Light	Medium	Heavy	
Retail	—	33	39	115	35
Services	—	25	29	171	26
Wholesale	—	81	48	80	70
Manufacturing (other than primary metals)	—	16	24	146	18
Transportation, utilities, and communications	7	52	42	142	26
Governmental, institutional, and religious	—	18	35	28	25
Avg.	7	37	38	113	34

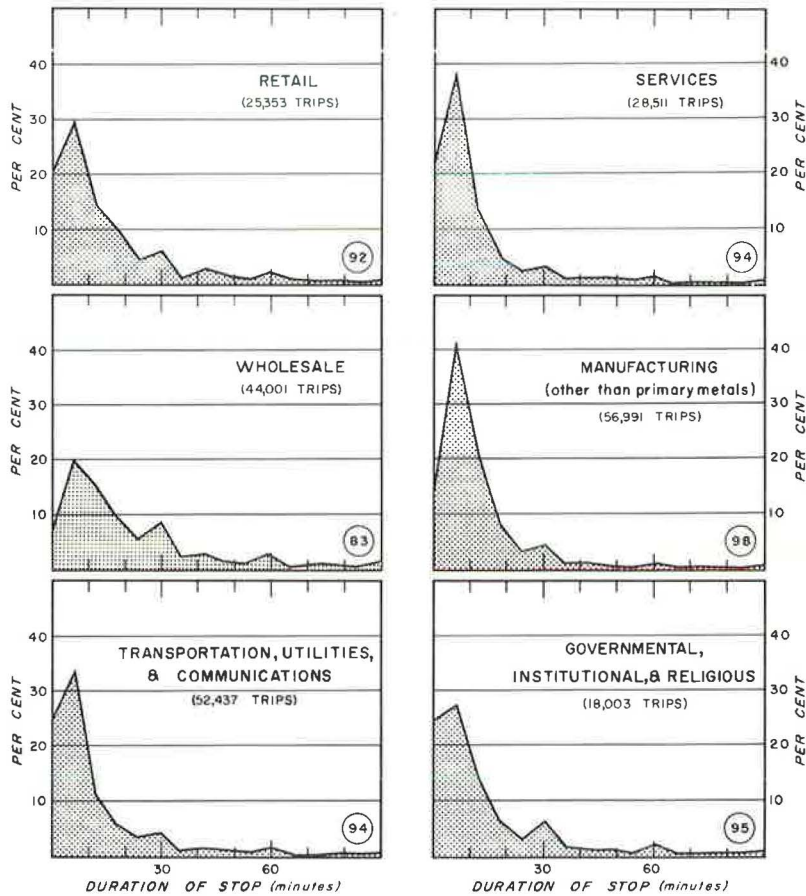


Figure 3. Percent of truck-taxi trips by duration of stop by owners business.

TABLE 6
AVERAGE DURATION OF VEHICLE STOP
BY DESTINATION LAND USE

Destination Land Use	Average Duration of Stop (min)				Avg.
	Taxi	Light Truck	Medium Truck	Heavy Truck	
Residential	6	30	33	306	27
Retail establishments	6	33	25	136	30
Services	6	46	35	33	37
Wholesale	5	59	48	69	53
Manufacturing	4	83	53	130	67
Transportation, utilities, and communications	14	76	56	104	58
Public buildings	4	63	30	30	39
Public open space	2	68	50	—	51
Airports, streets, and railroad land	8	27	51	24	26
Avg.	7	37	38	113	34

TABLE 7
AVERAGE DURATION OF VEHICLE STOP
BY DESTINATION RING

Destination Land Use	Average Duration of Stop (min)				Avg.
	Taxi	Light Truck	Medium Truck	Heavy Truck	
Ring 0	6	29	24	132	19
Ring 1	7	37	29	57	28
Ring 2	7	31	29	78	27
Ring 3	8	30	31	129	27
Ring 4	6	32	31	118	29
Ring 5	8	33	34	104	31
Ring 6	7	39	39	65	38
Ring 7	22	39	30	42	36
Avg. ^a	7	33	32	89	30

^aAverages do not correspond with other tables because trips to ring 8 (outside the cordon line) are excluded.

apparent reason for this; perhaps it is simply part of the transition between predominately urban and predominately rural activity.

Duration of Stop by Time of Day

As shown by Figure 4, the longest stops of the day for any truck tended to be during the morning hours (5:00 to 9:00 AM). From 8:00 to 4:00 PM, the average duration of stop decreased steadily. Possibly, this reflected a tendency for trucking activities to pick up momentum as the business progresses — starting slowly while there is still much time and accelerating as there is increasingly less time to get the job done. Such at-rest trucking activity as continues after normal closing hours (5:00 to 6:00 PM) again resumed a slower pace. There were, of course, slightly longer stops during the lunch and dinner hours.

It is not possible to demonstrate psychological motivation by transportation study data; however, it is possible to show that the average duration of stop for all trucks varies by time of day by trip purpose (Table 8). There is a discernible trend for nearly all kinds of trips to involve progressively shorter stops between 6:00 AM and 6:00 PM. This seems particularly so for trips to pick up goods — decreasing from 74 minutes to 20 minutes. Evidently, the heaviest and most complete load is taken on early in the

Duration of Stop by Destination Ring

It might be supposed because of congestion and crowding that truck stops would tend to be longest in the more highly built-up central portions of the study area (the inner rings). This does not seem to be true. The average duration of stop (Table 7) generally increases with increasing distance from the Golden Triangle (ring 0). In the Triangle itself, light and medium truck stops are shortest (29 and 24 min, respectively). Taxi stops are also shortest there (6 min) but heavy truck stops are longest; however, they are also the least frequent (only 1 percent of all Golden Triangle truck trips). The overall brevity of stops in the Triangle suggests several possibilities: greater mechanical efficiency of goods handling equipment; greater manual efficiency because working under time pressure; greater enforcement of loading zone time limits; greater frequency of illegal parking (and, hence, increased desire to limit the length of stop); or simply better overall business management by downtown firms. This, of course, is just guesswork; it is impossible to discover the reasons from transportation study data.

Omitting trips beyond the cordon line, Table 7 shows, by inference, that such trips have longer stops on the average than trips with destinations inside the cordon line (the overall duration of stop time drops for each truck category). For example, heavy truck trips to ring 0 through 7 averaged an 89-minute stop; trips to ring 0 through 8 averaged 113 minutes. There were lesser differences for light and medium truck trip stops. There is no readily

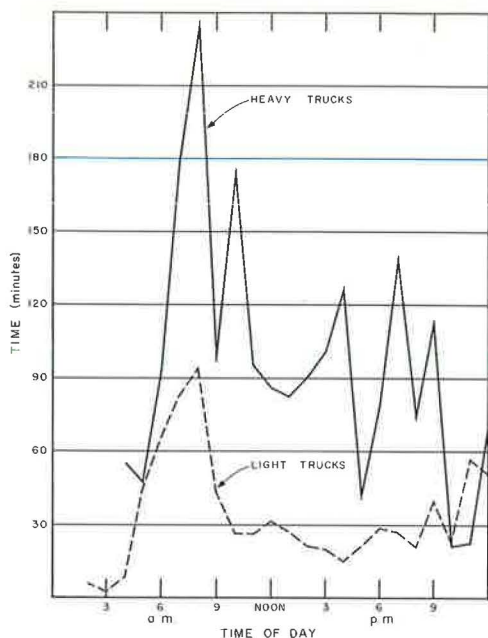


Figure 4. Average duration of truck stops by time of day.

TABLE 8
AVERAGE DURATION OF STOP FOR ALL TRUCK TRIPS
BY ARRIVAL HOUR BY TRIP PURPOSE

Arrival Hour (beginning)	Trip Purpose					Pers. Bus.
	Pick-up	Deliver	Pick-up and Deliver	Service Op.	Base	
6 AM	74	18	12	194	107	6
7	51	19	19	244	157	273
8	46	24	22	235	92	116
9	38	16	10	121	92	99
10	34	16	12	68	82	31
11	27	17	14	66	82	57
12 Noon	33	17	17	88	73	47
1 PM	25	14	15	81	56	39
2	23	14	12	45	56	61
3	26	12	13	40	49	117
4	14	11	7	30	39	31
5	20	12	8	67	51	60

TABLE 9
COMPARISON OF AVERAGE TRIP TIME
AND AVERAGE STOP TIME

Vehicle Type	Average Trip Time (min)	Average Stop Time (min)
Light truck	13	37
Medium truck	16	38
Heavy truck	34	113
Taxi	14	7
Avg.	14	34

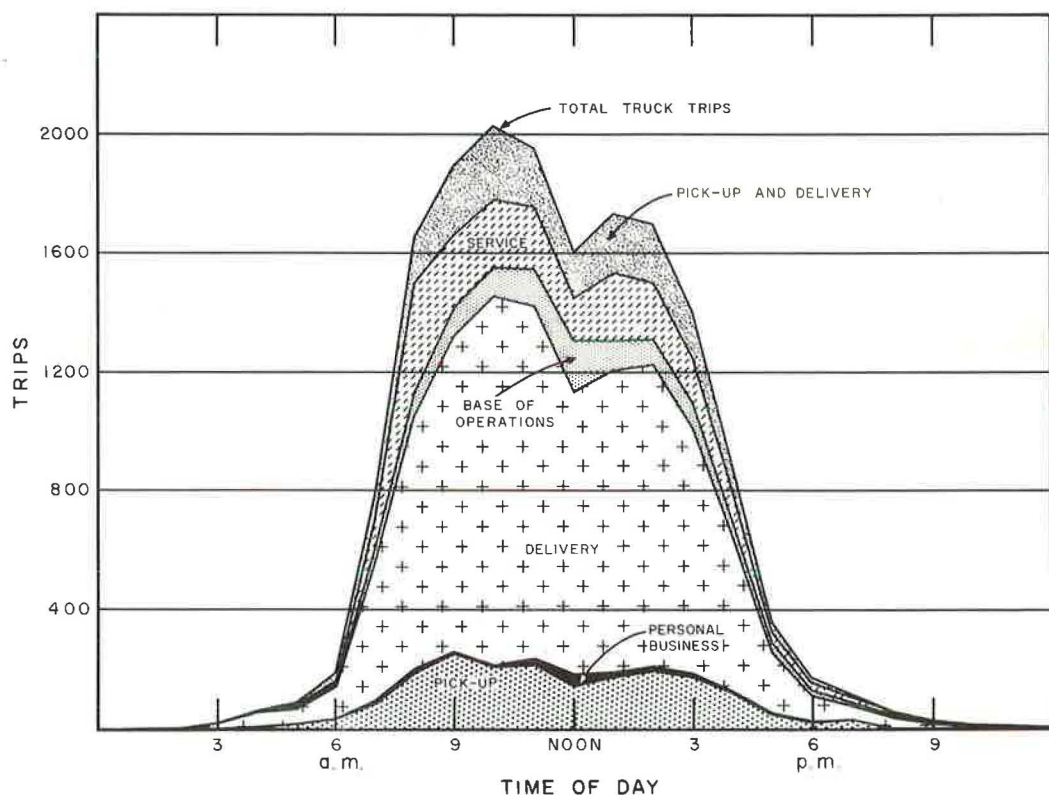


Figure 5. Truck trips by time of day by trip purpose.

morning; loads taken on later in the day must be lighter and less complete (unless it is assumed that the goods handlers work faster in the afternoon). Strangely enough, there was less variation in the average duration of stop to deliver goods or to pick up and deliver goods. Since the proportions of truck trips by trip purpose do not vary significantly by hour of day (Fig. 5), it is clearly the trend toward shorter stops that produce the pattern in Figure 4.

COMPARISON OF TRIP TIME AND STOP TIME

If the typical truck is at rest 95 percent of the day, the average stopped time must greatly exceed the average time in motion, or trip time. Strictly speaking, it is impossible to make a direct comparison because the duration of stop after the last trip of the day could not be calculated. This, of course, is the longest stop of all, representing, in most cases, overnight parking or storage. Although there is some truck activity after dark, the bulk of all truck trips occur during the day; in fact, nine out of ten truck trips are made between 7:00 AM and 6:00 PM (Fig. 5).

Excluding the time at rest after the close of the work-day, however, the average truck stop during the day took about twice as long as the average truck trip itself (Table 9). The average trip time for a light truck was 13 minutes, while its average stop time after the trip was 37 minutes; medium trucks averaged 16 minutes per trip, 38 minutes per stop; and heavy trucks, 34 minutes per trip, almost 2 hours per stop. Taxis, on the other hand, took longer to complete their journeys than to complete their stops, 14 minutes vs only 7 minutes.

Some concept of a typical truck's activity during the day can be reconstructed from what has been presented (except that a representative mixture of trip purposes will have to be assumed; there is a wide variation by individual vehicles). A typical trip-making medium truck, for example, makes nine trips a day. Without respect for the owner's business, assume that one trip is to the base of operations, one is to pick up goods, and seven are to deliver goods. The 9 trips themselves would total 144 minutes ($16 \text{ min} \times 9$); the trip stop at the base of operations, 55 minutes (Table 4); the trip stop to pick up goods, 51 minutes; and the 7 stops to deliver goods, 27 minutes each. This totals 439 minutes, or just over 7 hours. In this hypothetical example, the truck is in motion about $2\frac{1}{2}$ hours a day or roughly 10 percent of the time, somewhat more than the average total travel time.

Clearly, the shortening-up of truck stops could have important implications. The productivity per truck would be enhanced. Perhaps two trucks could do the work of three. This would not mean less truck travel; the same mileage would result. But it would mean that truck registration would be reduced as could be the consequent demand for terminal and parking facilities in particular areas of concentrated truck activity. No doubt truck owners and operators are well aware of this. Their efforts toward improved truck utilization, together with the trend toward higher-capacity trucks, may be the reason why truck registrations are increasing less rapidly than auto registrations in many urban areas.

The most obvious way to improve truck utilization, of course, is to operate around the clock with successive drivers. With the exception of long-haul carriers and certain special kinds of off-hour trucking (as by newspapers, dairies, shift-work plants, etc.), very little truck activity occurs after normal working hours. Despite the potential cost savings involved, business affairs evidently cannot easily be rearranged to take advantage of the less crowded driving and parking conditions after hours.

SUMMARY

Despite relative brevity of a majority of truck stops, they are, on the average, longer than casual observation would suggest. Counting overnight storage, the average truck is at rest 95 percent of the time; counting only the stops made during the day, the average truck is at rest more than twice as long as it is in motion. This suggests that, although highway improvements will materially aid the trucking industry, careful attention must be given also to developing modern and efficient facilities for loading and unloading, parking and maintenance, and other at-rest activities.

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