TRIP-FREQUENCY STUDIES FOR NEW YORK STATE THRUWAY

Elmer B. Isaak, Engineer-in-Charge
New York State Thruway Traffic Survey

PROPOSALS for an annual permit valid for unlimited use on the New York State Thruway were the stimulus for investigating certain aspects of traffic which have not been generally explored in previous surveys. Since revenues under the permit plan would depend not only on the number of trips made, but more particularly on the number of different vehicles using the project, it was necessary to obtain information on the frequency of travel by individual vehicles making specific trips.

In conjunction with the origin-and-destination survey conducted throughout New York, therefore, drivers were asked the question "How many times a year do you make this trip?"

Some 376,000 replies were obtained to the questionnaire, representing a 25-percent sample of the 1,520,000 vehicles actually counted as passing the survey stations during the periods of the check. The replies were obtained principally by interviewing drivers in their vehicles, and the survey sample covered week-day and Sunday traffic under different seasonal conditions.

The stations selected for the survey were all outside of cities on main state highways, the principal routes covered being US 20, NY 5 and NY 17 across New York, US 9W between Albany and the City of New York area, and all the Hudson River crossings between New York city and Albany. In all, 49 locations were covered simultaneously, including 41 highway stations, five bridges and three ferries.

The results may therefore be considered indicative of typical conditions on main rural highways connecting large cities, but they do not reflect urban characteristics.

All trips considered as potential throughway users were analyzed in detail. These include most of the trips traveling along the main highways for at least a few miles, but very short trips and trips whose principal direction was across the main highway were eliminated. As a result of the trip frequency analysis of potential throughway traffic, two striking conclusions stand out: (1) a very small number of regular drivers on a particular highway account for a very substantial portion of the total traffic volume and (2) the overwhelming majority of individual vehicles on a particular highway during the course of a year are making occasional trips.

Passenger-car trips traveling along the main highways covered and considered potential to the throughway, were at the estimated annual rate of 59,700,000. Of these about 15,100,000 trips were found to be made by cars traveling with commuting frequencies of five times a week or more. The number of individual vehicles in this group was only 28,000, which was less than 1 percent of all the individual automobiles represented but they accounted for about 29 percent of all the passenger-car trips covered by the study.

The great majority of individual vehicles using the main highways in New York were found to be occasional travelers making trips occurring only one to four times a year. In order to give quantitative expression to this fact, it is necessary to use a term designating all trips made by an individual vehicle between two particular points during the course of a year. The term "vehicle run" has been adopted to apply to this value. A vehicle run may represent 1 trip or 500 trips between any two points by one vehicle. Obviously a single vehicle may make several vehicle runs on a given highway in a year, but it is unlikely that more than one of these will be of very high frequency.

Of a total of approximately 5,130,000 different vehicle runs per year estimated to be made by potential passenger car users of the New York Thruway, nearly 3,665,000 runs consisted of one round trip each. These unrepeated trips encompassed about 71 percent of all passenger-car runs, but they accounted for only 12 percent of the total traffic volume covered. Another 16 percent of all passenger-car runs represented only two to four round trips per year each, accounting for about 8 percent of the total trip volume.

Once a vehicle starts to travel a given route with a frequency of one or more trips a month, it begins to play a greater-than-average role in the traffic picture on that highway. Weekly trips, for example, accounted for over 15 percent of the passenger-car volume recorded in the survey, although less than 2 percent of the vehicle runs were in this category.

All trips made more often than once a week, including commuters, accounted for 45 percent of the traffic volume but only 1.3 percent of the passenger-car runs. Trips with commuting frequencies of five times a week or more, producing 29 percent of the traffic volume,involved only 0.5 percent of the total vehicle runs. This rather startling result illustrates the tremendous ability of a few vehicles, traveling regularly, to pile up large traffic volumes. Stated in the simplest terms, one car traveling daily makes 365 trips a year, but it requires 365 different cars making one trip a year to reach an equivalent total.

A more detailed breakdown of the trip-frequency groupings is shown in Table 1.

It is seen from the Table that the 59,706,000 trips are fairly well distributed among the 12 trip-frequency groupings. For the average day, taking into account both week days and Sundays, this distribution of trip frequencies would be fairly typical.

The distribution of vehicle runs, however, is extremely unbalanced, with the great concentration being in the low-frequency brackets. In the course of a year, each vehicle making only one trip annually must have 364 counterparts to account for one trip per day. Likewise, it requires about 120 vehicles making three trips a year to build up one trip a day. At the other end of the scale, each regular commuter very nearly accounts for a trip each day. As a result, the 14,000-most-frequent travelers made more trips in a year than were recorded by all the 3,665,000 vehicle runs which consisted of only one trip each.

TABLE 1

PASSENGER-CAR TRIPS IN EACH TRIP-FREQUENCY BRACKET COMPARED WITH NUMBER OF DIFFERENT PASSENGER-CAR RUNS

No. of Trips Per Year	Total One-Way Trips		Number of Different Vehicle Runs	
	Number	% of Total	Number	% of Total
1	7,329,000	12.3	3,665,000	71.4
2-4	4,958,000	8.3	826,000	16.1
5-8	2,073,000	3.5	173,000	3.4
9-17	5,534,000	9.2	231,000	4.5
18-34	3,806,000	6.4	76,000	1.5
35-70	9,086,000	15.2	95,000	1.8
71-135	5,063,000	8.5	25,000	0.5
136-225	4,772,000	8.0	14,000	0.3
226-280	4,971,000	11.7	14,000	0.3
281-325	4,854,000	8.1	8,000	0.1
326-375	2,225,000	3.7	3,000	0.05
Over 375	3,035,000	5.1	3,000	0.05
TOTALS	59,706,000	100.0	5,133,000	100.0

In Figure 1, the left-hand circle shows the distribution of annual trips, whereas the right-hand circle deals with the corresponding vehicle runs. The striking preponderance of low-frequency vehicle runs points up the importance of the occasional user on the highway. At the same time, the disproportionately large share of the total traffic volume built up by regular travelers and commuters is brought out.

The number of individual commuters and frequent travelers covered by the survey, estimated at about 28,000, may seem very small in proportion to the total volume of traffic involved. Since these vehicles made approximately 29 percent of the total trips moving along the highways surveyed, it would require only about 100,000 vehicles traveling with similar frequencies to account for all the traffic. This would obviously be an absurd assumption, since it is common knowledge that many occasional trips occur, and yet even 100,000 vehicles are a small percentage of the total number operating in the area covered by the survey. This area, incidentally, does not include the New York city commuting territory, as no survey stations were located there. It does cover the areas surrounding most of the other important cities of the state.

The over-all picture of passenger-car travel on main rural highways appears to be as follows. Something over one quarter of all paasenger-car trips are made by regular users constituting less than 1 percent of the individual vehicles traveling over a given stretch of highway. Roughly another quarter of the trips are made occasionally, from once to a few times a year, but these trips account for about seven eighths of all individual passenger-car runs. In between, nearly half of all trips are accumulated by noncommuting drivers traveling with some frequency, ranging from about once a month to three or four times a week. This group of trips represents about 12 percent of the different passenger-car runs.

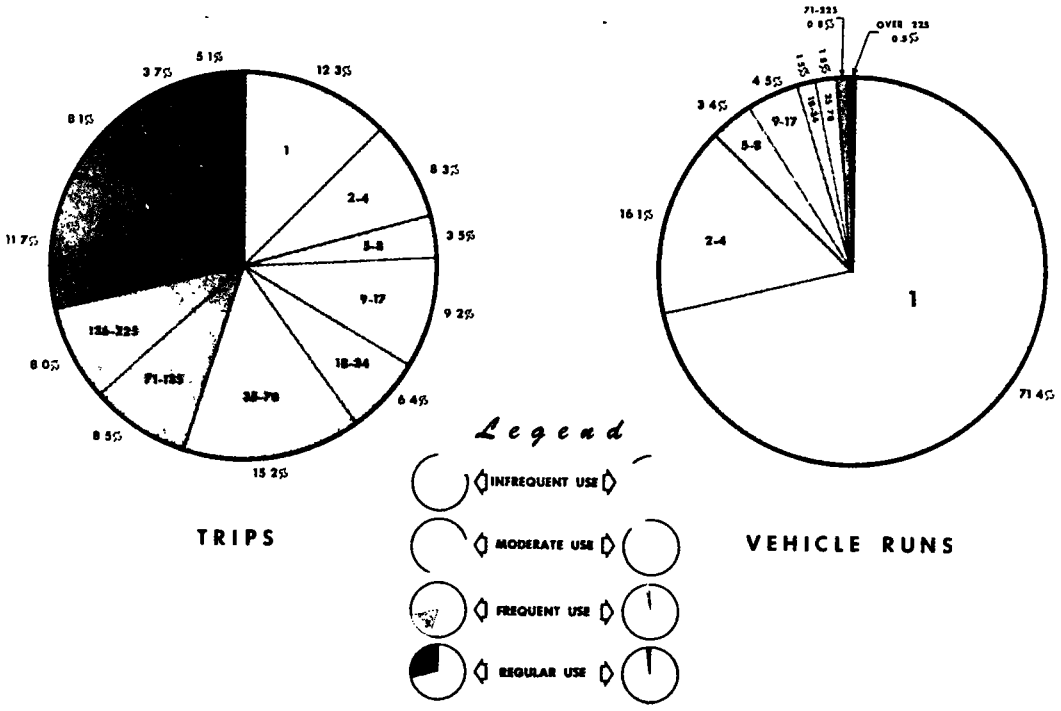

Figure 1. Trips and vehicle runs potential to throughway by trip-frequency groups (passenger cars, 1950).

TRIP FREQUENCIES OF COMMERCIAL VEHICLES

Similar studies for light and heavy trucks also reveal some interesting characteristics, which apply to main highway traffic potential to the throughway but not necessarily to local or strictly urban movements.

About 48 percent of all movements by heavy trucks were found to be repeated from once a week to four times a week. This reflects normal operating practices for over-the-road truckers. More frequent trips accounted for 33 percent of the total volume, whereas occasional trips made less than once a week tallied up to only 19 percent of the total.

Light commercial vehicles in the delivery-truck class show a greater tendency to highly repetitive trips. The survey showed that 42 percent of all trips were made five times a week or more, with some vehicles traveling the same route two or three times a day. Another 37 percent of the trips were repeated from one to four times a week, but the balance of occasional trips still accounted for 21 percent.

In spite of the tendency of commercial vehicles to travel on regular routes, they do make substantial numbers of occasional trips. During the course of a year, about five out of eight truck runs on the main highways are unrepeated, and another one out of eight runs is made only two to four times a year. Nevertheless, more than four fifths of all trucking trip

volumes are built up by the runs repeated once a week or more. These truck runs include only 9 percent of those made by all trucks.

A breakdown of the number of one-way trips and vehicle runs in each frequency bracket is shown in the following table:

TABLE 2

COMMERCIAL VEHICLE TRIPS AND VEHICLE RUNS
IN EACH TRIP FREQUENCY BRACKET

No. of Trips Per Year	LIGHT TRUCKS				HEAVY TRUCKS			
	Trips		Vehicle Runs		Trips		Vehicle Runs	
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total
1	153,000	4.3	76,500	61.4	235,000	4.1	117,500	61.7
2-4	111,000	3.1	18,500	14.8	172,000	3.0	28,700	15.1
5-8	82,000	2.3	6,800	5.5	94,000	1.7	7,800	4.1
9-17	201,000	5.6	8,400	6.8	283,000	5.0	11,800	6.2
18-34	193,000	5.4	3,900	3.1	287,000	5.1	5,700	3.0
35-70	475,000	13.3	4,900	3.9	831,000	14.7	8,700	4.5
71-135	380,000	10.6	1,900	1.5	889,000	15.7	4,400	2.3
136-225	476,000	13.3	1,400	1.1	1,021,000	18.0	3,100	1.6
226-280	336,000	9.4	700	0.6	514,000	9.1	1,000	0.5
281-325	531,000	14.9	900	0.7	558,000	9.8	900	0.5
326-375	274,000	7.7	400	0.3	300,000	5.3	400	0.2
Over 375	361,000	10.1	400	0.3	480,000	8.5	500	0.3
TOTAL	3,573,000	100.0	124,700	100.0	5,664,000	100.0	190,500	100.0

TRAVEL DISTANCES

Analysis of the origins and destinations of traffic traveling along main state highways and potential to the New York State Thruway afforded an opportunity to determine the distances traveled by various classes of vehicles, and also to correlate travel distances with trip frequencies.

As has been noted by numerous previous surveys, most trips are short. Over 60 percent of all passenger-car trips were for less than 25 mi., and 74 percent were for under 50 mi. Less than 12 percent of passenger car trips along the main highways extended for more than 100 mi., and less than 6 percent were for over 200 mi.

Light trucks have even shorter trip characteristics than passenger cars, but heavy trucks make many more long trips. Approximately 21 percent of all heavy-truck trips were found to be for distances over 200 mi., and only 41 percent were for less than 50 mi.

Table 3 shows the distribution of travel distance for passenger cars, light and heavy trucks, as determined by the New York State Survey:

TABLE 3

TOTAL TRAVEL DISTANCES OF POTENTIAL THROUGHWAY TRIPS AS DETERMINED BY 1950 TRAFFIC SURVEY

Total Distance Traveled (Miles)	Passenger Car Trips		Light Truck Trips		Heavy Truck Trips	
	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total
0-50	43,971,000	73.6	3,011,000	84.3	2,335,000	41.2
50-100	9,136,000	15.3	373,000	10.4	1,341,000	23.7
100-150	2,127,000	3.6	54,000	1.5	395,000	7.0
150-200	1,365,000	2.3	43,000	1.2	402,000	7.1
200-300	1,299,000	2.2	33,000	0.9	478,000	8.4
300-400	1,046,000	1.7	28,000	0.8	406,000	7.2
over 400	762,000	1.3	31,000	0.9	307,000	5.4
TOTALS	59,706,000	100.0	3,573,000	100.0	5,664,000	100.0

RELATION OF TRAVEL DISTANCES TO TRIP FREQUENCIES

It is logical to expect that long trips will be made infrequently, and that frequently repeated trips will be short. A correlation between travel distances and trip frequencies has been developed for trips expected to be diverted to the New York State Thruway, and the results are depicted graphically in Figure 2. The traffic covered in this chart does not include all potential trips, but only those expected to be throughway users.

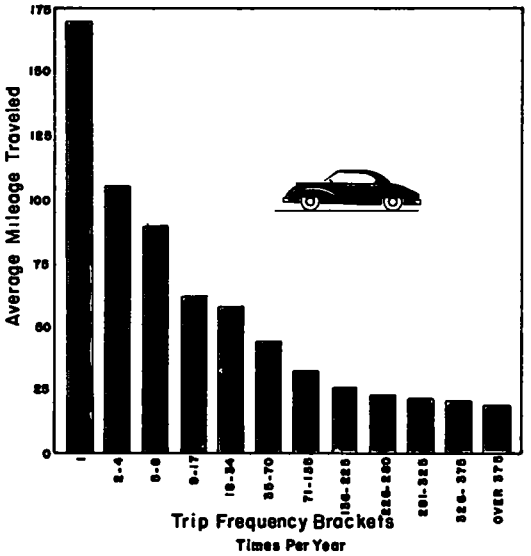

Figure 2. Average total travel distance of throughway passenger-car trips in frequency brackets.

In the lowest-frequency bracket of unrepeated trips, the average trip distance is 170 mi. Trips made from two to four times a year average 105 mi., and as the frequency increases the distance steadily decreases. In the high-frequency brackets of five trips a week or more, the average travel distance is about 20 mi. These mileage figures refer to the total travel distances of trips now being made, but expected to be diverted to the throughway when it is opened.

SUMMARY

As a result of the analysis of potential New York State Thruway trips, four principal characteristics of main-highway traffic stand out:

1. A very small percentage of the individual vehicles on the road accounts for a substantial portion of the total traffic.

2. Most of the individual vehicles traveling along a particular highway during the course of a year are engaged in occasional trips.

3. The great majority of trips on main highways are short, but a small percentage of passenger cars and a considerably larger percentage of trucks make longer trips.

4. Length of trip decreases as frequency increases.