INFLUENCE OF EXPRESSWAYS IN DIVERTING TRAFFIC FROM ALTERNATE ROUTES AND IN GENERATING NEW TRAFFIC

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SYNOPSIS

In recent years there has been a great deal of origin and destination data collected to provide a basis for highway route planning. Numerous techniques for collecting the data have been developed but little study has as yet been given to the manner in which the O and D data can be applied to provide reasonable estimates of traffic on proposed highway facilities. Furthermore, when the traffic estimates have been worked up on the basis of the origins and destinations of existing traffic, there is a question as to how much should be added to account for the generation of new traffic resulting from the provision of a superior facility.

This paper reports the results of an O and D study covering an expressway in Hartford, Connecticut, and the alternative street routes. The data are not sufficient to give definite results. They do indicate, however, that a time savings will not result in 100 percent diversion to the expressway from competing city streets. Diversions of from 40 to 60 percent were obtained with small time savings.

An attempt is made in the paper to measure the amount of traffic generated by the Merritt and Wilbur Cross Parkways, which parallel U. S. 1 across the southwest corner of the State of Connecticut. The state-wide trend of gasoline consumption, beginning in 1934, is fitted to the traffic trend for two locations on U. S. 1. The combined parkway and U. S. 1 traffic, for the periods following the completion of the parkways, rises above the gasoline consumption trend and this rise is credited to the generation of new traffic.

Origin and Destination study techniques, quite properly, have been given a great deal of attention in recent years. Origin and destination for traffic in rural areas can be established with a high degree of accuracy on the basis of roadside interviews. For most urban places, O and D data can be obtained quite simply by the direct interview of motorists at the roadside to produce results entirely satisfactory in coverage and accuracy for the highway planning purpose for which it is intended. The Public Roads Administration—in cooperation with the Census Bureau, States and Cities—has developed a system of O and D determination for cities and metropolitan areas that gives a very close evaluation of the trips that make up the total travel that occurs in and adjacent to these places.

Regardless of how it is obtained, states and cities now engaged in route planning should be able to organize O and D studies which will give the basic information essential to that planning. However, the basic data does not provide all the answers—not even all the traffic answers.

With O and D data available there must be established some basis of estimating the diversion of existing traffic from the streets and highways now serving it. There has been a lot of estimating done on the assumption that every motorist who would realize a time saving on the superior facility would use it. In many cases these "time savings" have been based on assumed operating speeds for existing facilities. In others, the values have been developed from trial runs by the so-called "floating with traffic" method. How good are these data as basic factors in predicting potential diversion?

In addition to diversion of existing traffic as a source of expressway traffic, there is the possibility that the superior highway will generate "new" traffic. There is a theory that the kind of roads now being planned—expressways with limited access, separation of cross traffic, etc—will induce a considerable increase over that which might otherwise be expected under our normal traffic growth trend. Do they? If so, how much?

The Connecticut Highway Department has attempted to find at least partial answers to the questions raised in the two preceding

paragraphs, to the end that O and D data may be used to give reliable estimates of traffic on proposed expressways. Connecticut is fortunate in having (1) a completed expressway connecting the center of Hartford with routes to the south, and (2) an extensive mileage of parkway, the operating characteristics of which are identical with expressways except for the exclusion of commercial traffic. These completed facilities have been used to furnish data bearing, in the first case, on "time savings" as a basis of estimating traffic diversion, and, in the second case, on the generation of "new" traffic through the creation of a superior facility.

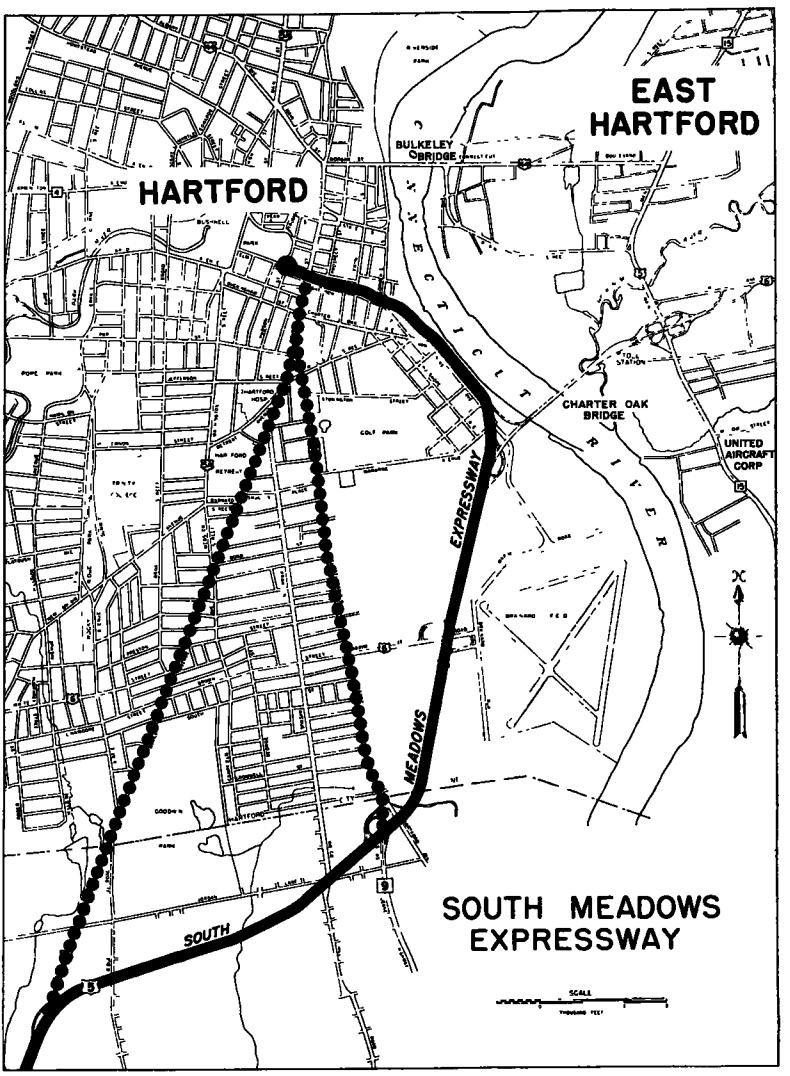

Figure 1. South Meadows Expressway

RELATIONSHIP OF TIME SAVING TO TRAFFIC DIVERSION

The South Meadows Expressway in Hartford (see Fig. 1) provides an expressway entrance to Hartford from the state highway routes to the south, US 5 and Conn. 9. It

was planned some years ago without the benefit of O and D studies and without making estimates of the traffic that would be diverted to the new route. The expressway is a four-lane, limited access highway providing a connection between the state routes south of Hartford and the street system in the center of the city. Its total length is about 4½ miles.

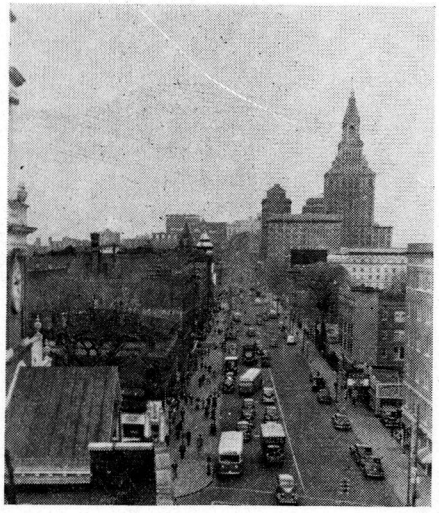

Figure 2. Main Street—Hartford

Figure 3. Maple Avenue—Hartford

Construction of the expressway was halted during the war. During this period the Highway Department completed an over-all plan for a system of expressways to serve the metropolitan area of Hartford, including the full utilization of the South Meadows Expressway. At that time—that is, when construction was suspended on the South Meadows Expressway—estimates of traffic that would be served by the South Meadows Expressway, as well as other portions of the over-all system, were developed based on some "indirect" O and D estimating. This indirect estimating was predicated on the assumption that various zones in the City of Hartford, which had been shown by an O and D study in East Hartford to have developed certain percentages of the total movement of traffic from Hartford to and from the east, would develop corresponding percentages of traffic from Hartford to and from points to the south. The estimates of traffic on the expressways, including the South Meadows Expressway, were based on: (1) those O and D estimates; (2) some meager data on comparative running times; and (3) the assumption that all traffic,

Figure 4. South Meadows Expressway

which would realize a savings in time by using a superior expressway facility, would be diverted to that facility.

Figures 2 and 3 illustrate the character of the arterial streets from which traffic is diverted by the expressway. Figure 4 shows a portion of the expressway at the offpeak period of the day. It illustrates the superior character of the facility resulting from limitation of access, separation of opposing traffic, adequate widths of pavement, wide stable shoulders and no pedestrians.

The South Meadows Expressway was completed to the center of Hartford and opened to traffic for its entire length late in 1945. The estimated traffic diversion from the existing routes did not materialize. Naturally we wondered why. We knew that our estimates

of O and D of the traffic using the existing routes might have considerable error because they were developed without the benefit of actual studies of the traffic using those routes.

was, therefore: Was the failure to get the amount of traffic diversion expected due to our rough approximating of origins and destinations, or to our "time savings" basis of predict-

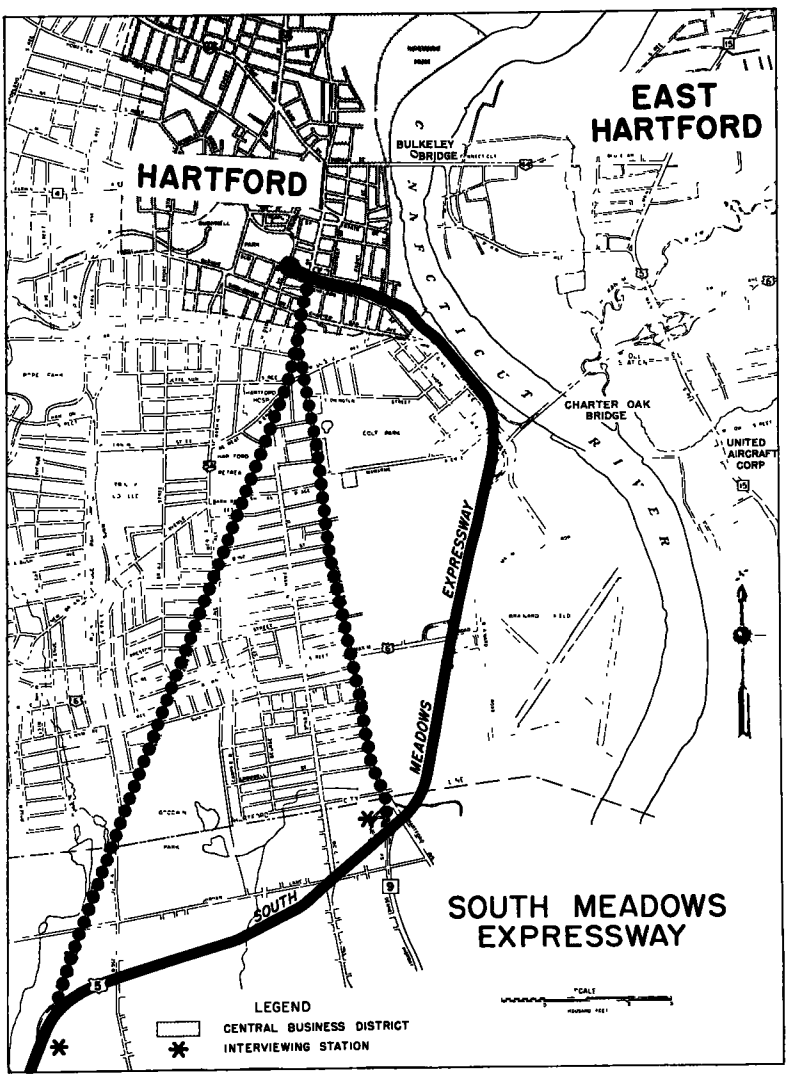

Figure 5. South Meadows Expressway

We knew too, of course, that the estimating of diversion, based solely on time savings and the assumption that you would get 100 percent diversion whenever there was a time savings, might provide results that varied considerably from actuality. The question in our minds

ing diversions, or to a combination of these factors?

In 1946 we decided to do some checking of the traffic using the alternative routes from the center of Hartford to US 5 and Conn. 9, south of the city, to see whether we could

determine what was actually happening. We obtained O and D interviews on Routes 5 and 9 for one weekday afternoon in June 1946, covering outgoing traffic between the hours of 12 Noon and 7 p.m. The locations of the stations, at which interviews were obtained directly from the motorists, are indicated on Figure 5. The stations covered both expressway and alternate street route traffic. We obtained 2226 interviews representing 38 percent of the total southbound traffic passing during the period in which interviews were obtained. The interviews cover a representative period of the day, including that portion of the day during which the peak of outgoing traffic movement occurs.

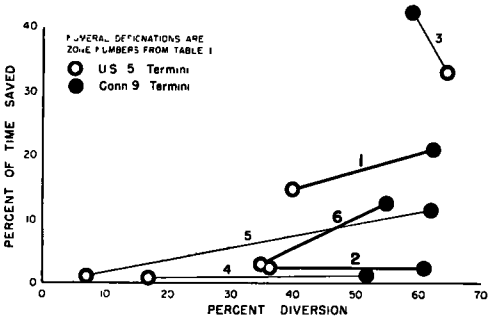

Figure 6. Diversion to Expressway of Zone-to-Route Travel

"Time runs" over all routes between zones of origin in the city and the routes to the south were made to establish the average running time for traffic at all periods for which interviews were obtained. A minimum of eight runs were made for peak and off-peak periods on each route of travel in the street system.

I should like very much to be able to report that we obtained some conclusive results from our studies. I should even be satisfied if I could report that the results obtained had some consistency in their indication of the influence of time saving on the diversion of traffic from the existing streets to the new expressway.

I can report that our indirect estimating of traffic origins and destinations in Hartford was not so rough as to have any great influence on the traffic volume estimates for the expressway. I can report, too, with finality, that our basis of estimating traffic diversion, based on diverting 100 percent of the traffic where any time saving is realized, is so unsound that it led to a large error in our traffic estimates.

In Figure 5 there are shown the zones in the central business area of Hartford from which the major movement of traffic to and from Hartford and the routes south of the city develops. Fifty-nine percent of the traffic from the city originates in these zones, as shown by the 1946 interviews for a June weekday. This percentage compares with 53 percent which was the amount obtained under our indirect estimating of origins and destinations. The small difference in these percentage values is not important.

We have analyzed data covering trips from zones in the central area by peak and off-peak periods, in relation to time savings and to distance losses. (There is a loss of distance in all cases except one small zone.) In order to hold the length of this report within reasonable limits I shall present the results only in the broadest terms.

Figure 6 presents the percentage of traffic diversion to the expressway for each of the zones in the central area, shown separately for each of the routes, US 5 and Conn. 9. The number of interviews on which the individual values are based range from a minimum of 20 to a maximum of 173.

It will be seen from Figure 6 that in no case did we obtain a diversion exceeding 65 percent. Zones 1, 2, and 6 are the most important of the zones (minimum sample 65 interviews) and is interesting to note that these zones had diverted to the expressway roughly 40 percent of the traffic bound from the zones to US 5, and 60 percent of that to Conn. 9. However, with these fairly comparable diversions, the time savings varied from almost none to 20 percent. There is no apparent consistency between the percentage of traffic diverted and the time saved.

The connecting lines on the chart are drawn between the points representing the same zone, the circled point representing traffic bound to US 5 and the solid one traffic to Conn. 9. Convenience of access to the expressway would be identical for the connected points, so it would seem that the connected points might be expected to have a more consistent relationship—time savings to percent of diversion—than would unlinked points.

But there is still no consistency on this score. It seems obvious that there must be one or more important factors other than time which influence the use of the expressway. In all cases, the expressway develops diversions for Route 9 traffic of over 50 percent. This occurs even where the time savings is negligible. On the other hand, diversions to the expressway of US 5 traffic varies from less than 10 percent to 40 percent, excluding zone 3 which appears out of line and for which, incidentally, we had the smallest interview sample.

Referring again to the difference generally found between the Route 9 and US 5 traffic, it might be that the comparative distance losses have a bearing. Route 9 and US 5 traffic suffers distance losses, by using the expressway, of the magnitudes shown in Table 1 from the three most important zones.

However, compared to the total length of travel between common points for Conn. 9 and US 5 travel, these distance losses are not of strikingly different magnitude. In fact, in one case—the Main Street zone—the percentage distance loss to US 5 is actually less than to Route 9 (See Table 2).

The foregoing discussion and the data presented are based on time savings developed from the average of trial runs. It will be recalled that the percent of time saved by using the expressway, based on the average of the time runs, ran from negligible savings up to 20 percent except for one zone. Table 3 shows time run variations as established for off-peak and peak traffic periods. It will be noted that there was no significant variation in time runs on the expressway, but that there are extremely large variations between the fast and slow runs for the street sections. This is

TABLE 1

Zones	Conn 9	U. S. 5
	miles	*miles*
1. Jewell Street	0.7	1.2
2. Main Street	1 0	1 4
3. Lafayette Square	0 9	1.7

TABLE 2

PERCENTAGE OF DIVERSION, TIME SAVED AND DISTANCE LOST BY USE OF EXPRESSWAY BETWEEN SOUTHERN ROUTES AND ZONES IN THE CENTER OF HARTFORD

Zones in City Center	Routes South of City					
	U S. 5			Conn 9		
	Diversion	Time Saved	Dist. Lost	Diversion	Time Saved	Dist. Lost
	%	%	%	%	%	%
1. Jewell	40	14.4	26.1	63	20 5	23.3
2. Main	36½	2.2	32.6	61½	2.7	37.0
3. Commerce	65	33.4	2.1	59	42.7	−7 0
4. Tunnel	17	.9	26.9	52	1.0	27.8
5. Asylum & Broad	7	1.1	37.8	62	11.6	27.3
6. Lafayette Sq.	35	3.0	41.4	55	12.2	31 0

TABLE 3
TIME RUN VARIATIONS
(In Minutes)

Expressway

	Peak and Off-Peak			
	Fastest	Slowest	Aver.	No. of Runs
Hudson St. Circle to Silas Deane (Rt. 9) . . .	4.75	4.88	4.80	5

Existing Streets

	Off-Peak				Peak			
	Fastest	Slowest	Aver.	No. of Runs	Fastest	Slowest	Aver.	No. of Runs
Corner Park & Main to Rt. 9.	4.15	5.12	4.57	8	4.53	5.00	4.72	8
Asylum & Main to Charter Oak & Main	1.83	2.85	2.25	13	2.10	4.63	2.88	9
Asylum & Main to Rt. 5 (via Maple Ave)	9.58	11.68	9.98	13	9.40	15.83	11.25	9
Tunnel to Church St. & Main St.	1.42	2.42	1.57	13	1.10	2.50	1.87	9
Main and Church St. to Asylum & Main St.	0.43	1.30	0.92	13	0 40	1.53	1.00	9
Trumbull & Jewell St. to Hudson St Circle.	0 53	1.63	0.90	13	0.57	1.27	0.85	9
Lafayette Sq. to Charter Oak & Main St.	0.20	0.77	0.50	13	0.25	0.77	0.50	9

Note: Combinations of the above short runs were made to determine average driving times between central points in Hartford and Routes 5 and 9.

pointed out to show the need for careful programming of time runs to obtain average figures and the possibilities of wide variance on the same route under changing conditions.

In summary:

1. Estimates of 100 percent diversion where expressways provide time savings are far too optimistic.

2. Origin and Destination determinations, even on "indirect" projection, are accurate in comparison with the rough handling the data get in projecting them onto planned facilities.

3. Extensive studies should be made, wherever superior facilities and ordinary streets are now competing, to get a basis for more thoroughgoing analysis than is possible with the data we now have.

We are preparing in Connecticut to make a further study of the traffic using the South Meadows Expressway.

Before leaving this phase of my discussion I should like to point out that our traffic density records, before and since the 1946 interviews, indicate that the expressways apparently do not divert the maximum percentage from competing routes immediately upon the opening of the new route. The comparative volumes on the expressway and the alternate routes have shown a consistent trend to the expressway from the streets, as shown in Table 4.

TABLE 4

	Percentage of All Hartford-Terminating Traffic Using Expressway
November 1945	23
March 1946	33
October 1946	37
March 1947	44
October 1947	50

When we again interview traffic, as we likely shall in 1948, we shall find out whether this trend is bringing the "time savings" factor into a more significant position.

GENERATION OF "NEW" TRAFFIC

The Merritt Parkway (see Fig. 7) was opened to carry traffic from the New York State Line to a connection with US 1 in Westport, Connecticut, in 1938. In 1939 the Merritt Parkway was opened to traffic as far east as Stratford, and in 1942 the connecting section of the Wilbur Cross Parkway was opened to provide a superior facility practically into New Haven. This represents about 50 miles in Connecticut, but connecting parkways in New York provided parkway facilities for passenger vehicles all the way into New York City—about 75 miles.

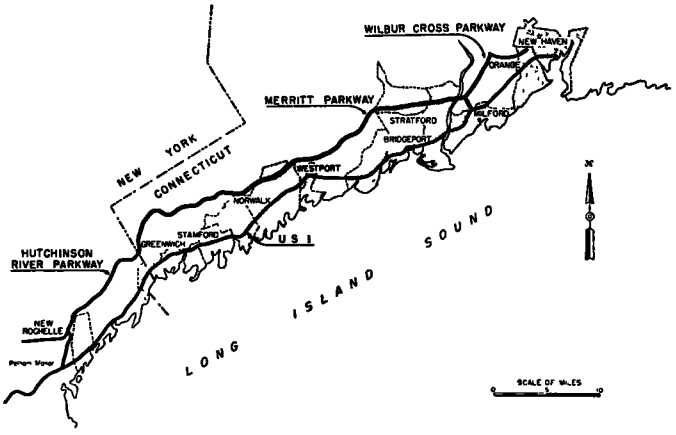

Figure 7. Connecticut Parkways

For traffic bound any distance across the southwest portion of the State the old Boston Post Road, US 1, provides the only important alternate to the Merritt Parkway. By comparing passenger vehicle traffic on US 1 before the parkway opening with the combined US 1 and parkway total of passenger vehicles afterward, we have some measure of the generation

of new traffic. We have done this for two locations, one in Greenwich and one in Orange (See Fig. 7). The traffic values for the parkway are based on continuous counts at the toll stations. The US 1 values are from manually operated stations—fourteen 8-hour daytime counts (6 AM to 2 PM and 2 PM to 10 PM) and several night counts each year.

The comparison for Greenwich is presented in Figure 8. The solid line represents US 1 passenger vehicle traffic before the opening of the parkway and the combined passenger vehicle traffic after the opening. The figure

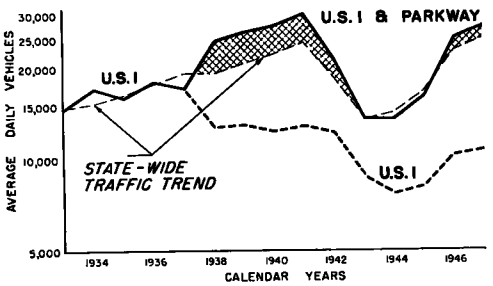

Figure 8. Traffic Generated by the Merritt Parkway in Greenwich

TABLE 5

Year	Vehicles per Day	Percentage over Trend
1938	5500	28
1939	5500	26
1940	5300	24
1941	6000	25
1946	2300	10
1947	2600	10

shows an average daily traffic volume on US 1, increasing from 16,000 in 1935 to 17,500 in 1937, and then dropping to 13,000 in 1938 with the opening of the parkway. The combined parkway and US 1 traffic runs from 25,000 in 1938 up to 30,000 in 1941, falling during the war years and recovering to 28,000 in 1947.

Superimposed on the traffic volumes in Figure 8 is the trend of gasoline consumption—presumably representative of statewide traffic volumes. With this trend set in the figure to approximate the US 1 traffic prior to the parkway opening, it is seen that the combined parkway and US 1 traffic is well above the trend in 1938, 1939, 1940 and 1941 and somewhat less above the trend since the war. The war period was, of course, an abnormal and not significant period.

If the surpassing of the trend represents generation of "new" traffic, quantitatively and in percentage it was about as shown in Table 5.

There are several things which should be noted before we turn to the next figure:

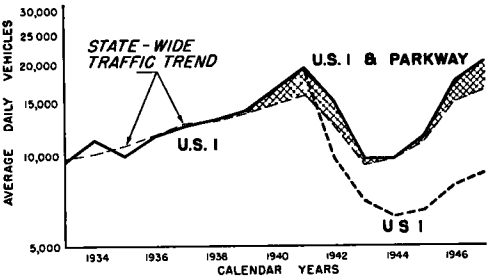

Figure 9. Traffic Generated by the Wilbur Cross Parkway in Orange

TABLE 6

Year	Vehicles per Day	Percentage over Trend
1941*	3600	23
1942	2500	20
1946	2500	17
1947	3800	23

* (before completion)

TABLE 7

Year	Average Daily Traffic		Percentage of Total on Parkway
	Parkway	US 1	
1942	5400	9700	36
1946	9700	7900	55
1947	11700	8700	57

First, as more extensive sections of the parkway became available for travel, there was no added generation. In fact, under the current condition, with parkway to New Haven and further improvements beyond, there is indication of less generation of new new traffic than when the superior facility was much shorter, 10 percent now as compared with about 25 percent before the war:

Second, the 1947 traffic is about 3000 below 1941 although the statewide trend of traffic is above 1941.

Figure 9 is the same sort of a chart as Figure 8, representing the situation in Orange on US 1

and the Wilbur Cross Parkway. While the parkway was not opened in Orange until 1942, there was a striking increase in US 1 traffic the preceding two years. This sharp increase, which put the route above the trend, was maintained after the completion of the parkway and is reflected in the 1946 and 1947 postwar traffic. It will be noted, in contrast to the previous figure, that the 1947 traffic exceeds the value for 1941.

If it is assumed that the amount of traffic above the trend line is "generated" by the superior facility, Table 6 gives the values and percentages.

It will be seen that at the Orange location there is a great deal of consistency between the values before and after the war.

It would appear from the data we have for the major routes in Greenwich and Orange that there can be a generation of "new" traffic because of the provision of superior facilities. There is a possibility that the generated traffic may be as great as 20 or 25 percent of the volume which might be estimated if the "new" traffic is ignored. There is a possibility, too, however, that this additional increment may not be continuous over the years. The Greenwich situation brings this out.

In concluding this discussion I should like to point out that it was shown by the percentages of diversion obtained on the South Meadows Expressway that there is a trend toward greater relative usage for at least two years after the completion of that facility. Furthermore, Figures 8 and 9 show a proportionately greater use of the parkway and a lesser use of US 1 since the parkway was completed all the way to New Haven in 1942. For example, in Orange—as illustrated by Figure 9—the comparative values (average daily traffic) on the parkway and US 1 were as shown in Table 7.

We shall follow with interest future trends on these routes. It will be necessary to correlate, with our studies of traffic volumes, detailed information on the trips making up the traffic. Change in the character of traffic —more or less long trips or important new traffic generators—are factors that might be affecting the distribution between the routes.

FRINGE PARKING IN RELATION TO TRAFFIC CONGESTION

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SYNOPSIS

Fringe parking facilities are shown to possess powerful potentialities for performing desirable functions in the preservation to cities of their original reasons for being, and that fundamentally, accessibility is what cities have chiefly lost through all forms of traffic congestion. The problem is thus identified as an accessibility problem, not a parking problem, and accessibility not just to the private passenger car, but to people by the most feasible and least traffic-congesting means of transportation.

Fringe parking, therefore, must be made to function successfully in solving the accessibility problem. The three essential means of controlling the functioning of fringe parking facilities are described, also both the temporary and permanent places these facilities can take in the retrieving and preservation to cities of their valuable and necessary functions. The fundamental requirement is high-lighted of developing a well-conceived and complete pattern of fringe parking facilities, preferably by a parking authority or other specifically designated municipal agency, and of exercising the right of eminent domain when need be, to obtain properly situated fringe facility sites.

Freeing of the downtown traffic flow in the big city is foreseen as off-street parking is provided and curb parking removed, and as a proper pattern of fringe parking facilities keeps the all-day worker parker and other long-time parkers out of the downtown area. An accompanying boon to transit is envisaged, because of more short-haul business within the fringe, and less non-profit or low-profit long haul business outside of it.