Trends and Forecasts of Auto Trips Across The Hudson River Screenline in New York-New Jersey Metropolitan Area

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•IN AN EFFORT to visualize the time when a new interstate (New York-New Jersey) vehicular crossing may be needed, it was deemed advisable to make an intensive study in depth of the past trends of trans-Hudson auto trips, and to foresee as clearly as possible the probable overall expansion of interstate auto trip demand in the next 20 yr.

Currently, trans-Hudson auto trips represent about 84 percent of total trans-Hudson vehicular traffic; truck and bus trips account for the remainder. To a large extent, therefore, autos determine present usage of existing trans-Hudson vehicular capacity. Also, because of the strength of rates of auto trip expansion in the past and the likelihood of the continuance of a high rate of expansion in the future, auto usage is likely to continue to determine, to a large extent, the future need for interstate vehicular crossings.

TECHNIQUES OF PROJECTIONS

A generally common method of gaging trends of vehicular traffic has been first to ascertain past annual rates of growth over as long a series of years as the available data permitted. Such a time series is then projected on the basis of some adopted mathematical model with respect to time. It is usually assumed that one or more of th parameters will remain the same in the future. An annual time series for trans-Hudson auto trips is available from 1925 to 1962 (see Fig. 2).

Expressing anticipated expansion in a time series like trans-Hudson auto trips at approximately the same percentage rate of growth as that established in some selected period in the past, for example, predicates the future on the mere passage of time. To be sure, in the cases of many socio-economic time series, the researcher is often faced with no alternative except to apply some type of intuitive judgment, in projecting the series into the future, adopting the same rates as in the past, or revising them upward or downward according to someone's judgment.

However, the technique of projecting a time series could, in many instances, be improved by first considering the series at hand as being dependent on another correlativ time series. Such a correlative series must, of course, be more basic, to some extent at least, causative. Data for such a series must also be available for approximate the same period in the past as the dependent series. It is also desirable that projectio of the more basic time series be made in the past and later in the future by various other researchers for a number of different purposes.

AUTO OWNERSHIPS DETERMINE TRANS-HUDSON AUTO TRIPS

Past analyses have repeatedly confirmed the fact that trans-Hudson auto trips were closely correlated with auto ownership in the "traffic shed," consisting of the 18-county New York-New Jersey metropolitan area—nine in New York and nine in New Jersey (Fig. 1). To the extent that auto ownership in this traffic shed could be considered at least partially a causative factor, it may be regarded as an effective determinant of past trans-Hudson auto trip demand. An annual series of autos registered

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WESTCHESTER
N.Y.
CONN.
ROCKLAND
RIVER
TAPPAN ZEE
BRIDGE
N.Y.
N.J.
PASSAIC
HUDSON
BERGEN
LONG
ISLAND
SOUND
MORRIS
GEORGE
WASHINGTON
BRIDGE
BRONX
ESSEX
LINCOLN
TUNNEL
HUDSON
NEW YORK
HOLLAND
TUNNEL
QUEENS
NASSAU
SUFFOLK
UNION
UPPER
BAY
KINGS
SOMERSET
VERRAZANO
NARROWS
BRIDGE
RICHMOND
LOWER
BAY
SCREEN
LINE
OCEAN
ATLANTIC
MIDDLESEX
MONMOUTH
EIGHTEEN COUNTY NEW YORK-NEW JERSEY
METROPOLITAN DISTRICT
AND
HUDSON RIVER-UPPER BAY SCREEN LINE

Figure 1.

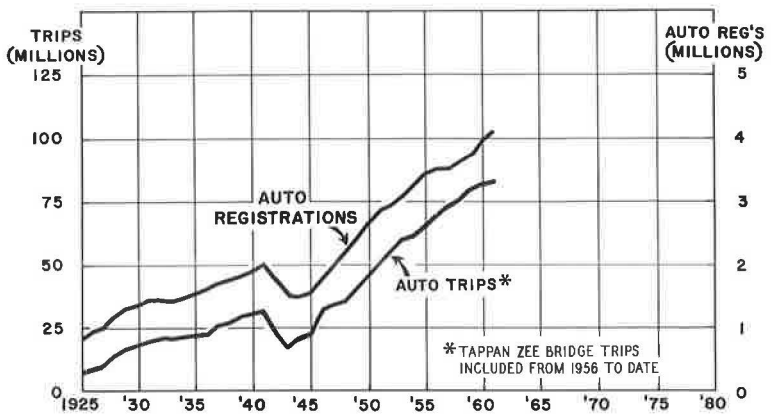

Figure 2. Annual trans-Hudson auto trips and annual auto registrations.

in the 18-county traffic shed is available from 1925 to 1962. Figure 2 shows that trans Hudson auto trips are fairly well correlated with auto ownership in the traffic shed tributary to the lower Hudson River screenline.

However, by plotting trans-Hudson auto trips against auto ownership in the traffic sh (Fig. 3 and Table 1), a quantification of the correlation was determined graphically as a "regression line." This regression line indicated on the average that for every addit al auto owned in the traffic shed, a total of about 22.7 incremental auto trips were generated across the Hudson River screenline during one year. In any given year, tran Hudson auto trips could also be computed from this regression line by deducting from the given year's auto registration in the traffic shed 550,000, and multiplying the adjusted registrations by 22.7 trips. In 1961 auto registrations amounted to 4,103,000. Deducting 550,000 leaves 3,553,000 as the adjusted registrations which, when multipli

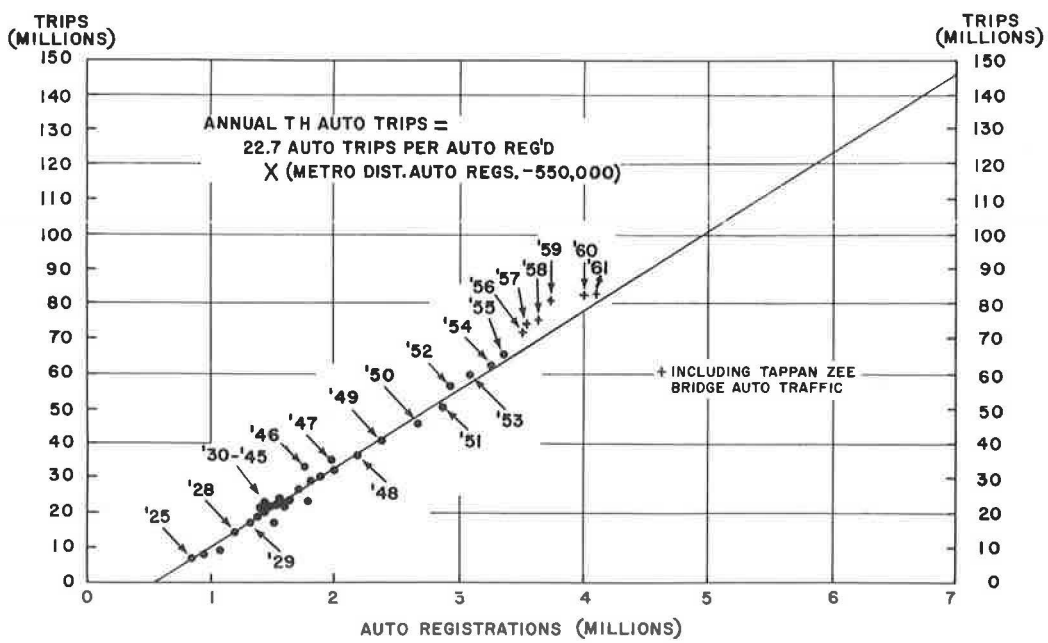

Figure 3. Annual trans-Hudson auto trips vs annual auto registrations.

TABLE 1

RECORDED, COMPUTED AND PROJECTED ANNUAL TRANS-HUDSON AUTO TRIPS ON ALL DAYS AND AUTOS REGISTERED IN 18 COUNTY TRAFFIC SHED, 1930-1980

Year	Recorded Auto Trips (1,000's)	Recorded Auto Regist. (1,000's)	Recorded Trips per Recorded Regist. (No.)	Adjusted[1] Auto Regist. (1,000's)	Recorded Trips per Adjusted Regist. (No.)	Computed Trips per Recorded Regist. (No.)	Computed[2] Auto Trips (1,000's)	Deviations[3] Recorded Minus Computed Auto Trips (1,000's)	(%)
1930	18,811	1,387	13.6	837	22.5	13.7	19,000	- 189	- 1.0
31	20,643	1,442	14.3	892	23.1	14.0	20,250	+ 393	+ 1.9
32	21,972	1,447	15.2	897	24.5	14.1	20,360	+1,612	+ 7.9
33	21,509	1,434	15.0	884	24.3	14.0	20,070	+1,439	+ 7.2
34	22,000	1,484	14.8	934	23.6	14.3	21,200	+ 800	+ 3.8
35	22,944	1,531	15.0	981	23.4	14.5	22,270	+ 674	+ 3.0
36	23,793	1,629	14.6	1,079	22.1	15.0	24,490	- 697	- 2.8
37	26,320	1,724	15.3	1,174	22.4	15.5	26.650	- 330	- 1.2
38	27,218	1,770	15.4	1,220	22.3	15.6	27,690	- 472	- 1.7
39	29,377	1,822	16.1	1,272	23.1	15.8	28,870	+ 507	+ 1.8
1940	30,231	1,903	15.9	1,353	22.3	16.1	30,710	- 479	- 1.6
41	32,318	2,014	16.0	1,464	22.1	16.5	33,230	- 912	- 2.7
42	23,399	1,796	13.0	1,246	18.8	15.7	28,280	-4,881	-17.3
43	17,309	1,522	11.4	972	17.8	14.5	22,060	-4,751	-21.5
44	21,224	1,507	14.1	957	22.2	14.4	21,720	- 496	- 2.3
45	23,481	1,567	15.0	1,017	23.1	14.7	23,090	+ 391	+ 1.7
46	32,875	1,763	18.6	1,213	27.1	15.6	27,540	+5,335	+19.4
47	34,852	1,982	17.6	1,432	24.3	16.4	32,510	+2,342	+ 7.2
48	36,314	2,192	16.6	1,642	22.1	17.0	37,270	- 956	- 2.6
49	41,197	2,399	17.2	1,849	22.3	17.5	41,970	- 773	- 1.8
1950	45,773	2,680	17.1	2,130	21.5	18.0	48,350	-2,577	- 5.3
51	51,074	2,865	17.8	2,315	22.1	18.3	52,550	-1,476	- 2.8
52	56,345	2,927	19.3	2,377	23.7	18.4	53,960	+2,385	+ 4.4
53	60,067	3,071	19.6	2,521	23.8	18.6	57,230	+2,837	+ 5.0
54	62,617	3,253	19.2	2,703	23.2	18.9	61,360	+1,257	+ 2.0
55	65,326	3,459	18.9	2,909	22.5	19.1	66,030	- 704	- 1.1
56	71,526	3,520	20.3	2,970	24.1	19.2	67,420	+4,106	+ 6.1
57	74,705	3,539	21.1	2,989	25.0	19.2	67,850	+6,855	+10.1
58	76,101	3,650	20.8	3,100	24.5	19.3	70,370	+5,731	+ 8.1
59	80,898	3,724	21.7	3,174	25.5	19.3	72,050	+8,848	+12.3
1960	82,641	3,983	20.7	3,433	24.1	19.6	77,930	+4,711	+ 6.0
61	83,310	4,103	20.3	3,553	23.4	19.7	80,650	+2,660	+ 3.3
62	89,284	-	-	-	-	-	-	-	-
				Projected					
1965	92,300	4,615	20.0	4,065	22.7	20.0	92,300		
1970	108,700	5,340	20.4	4,790	22.7	20.4	108,700		
1975	126,100	6,105	20.7	5,555	22.7	20.7	126,100		
1980	143,800	6,885	20.9	6,335	22.7	20.9	143,800		

[1]Adjusted registrations = recorded registrations - 550,000.
[2]Computed auto trips = 22.7 (recorded registrations - 550,000).
[3]Deviations shown or smaller, 24 out of 32 years, ± 2,837; ± 7.2.
Note: Auto trips include those via Tappan Zee Bridge.

by 22.7, yields 80,650,000 as the trans-Hudson auto trips for 1961 as computed from auto registrations. This compared with 83,310,000 trans-Hudson auto trips recorded for 1961 or 3.3 percent above that computed.

It may be interpreted that the regression line intercept on the X-axis indicates that there may be about 550,000 autos in the traffic shed which do not cross the Hudson River at all, and that the other autos average 22.7 trans-Hudson trips a year. This interpretation cannot be directly supported by available data. It does not seem unreasonable, however, when one considers the number of municipally- or county-owned cars like New York City's police cars, taxicabs, doctors' cars and others that seldom, if ever, have occasion to go beyond their circumscribed areas of operations.

Again, while the regression line expresses only an empirical relationship, a priori reasoning would seem to indicate that the more autos there are in the traffic shed, the more auto trips will be made in the course of the year within the traffic shed. Also, by the law of probabilities it may be reasoned that the greater the total number of auto trips within the traffic shed, the greater the number of trips that would cross the Hudson River screenline that divides the traffic shed.

Other students of traffic have demonstrated similar relationships, except that their relationships held at a given time over a number of small areas. Thus, in the Chicago

study area, the data indicated that the more cars owned per acre in the various residential zones, the more person trips per acre were generated to and from homes.[1]

Thus, whether dealing with differences, as among small zones in an urban area at a given time, or with changes over a long period of time in the same traffic shed area, the more cars owned, the more trips across a screenline. An additional car owned yields a fairly constant number of trips. In the New York-New Jersey area, over time, an additional car owned in the traffic shed means 22.7 additional auto trips in the cours of a year across the Hudson River screenline. In the Chicago area, a difference of one car, as between zones, means a difference of 4.2 person trips a day to and from home (Table 2).

To test the accuracy of the regression line in the New York area over the 32-yr period (1930-1961, inclusive), each year's trans-Hudson auto trips were computed from the known auto registrations for the same years and compared with the recorded trips for the corresponding years (see Fig. 8 and Table 1).

Out of the 32 annual trans-Hudson auto trips computed from known auto registrations for those years, 24 are within ± 7.2 percent of the recorded trips. Out of the 12 years when differences exceeded ± 7.2 percent, seven were abnormal years which could have been recognized contemporaneously. Thus, trans-Hudson auto travel was held down in two World War II years (1942 and 1943) under gasoline rationing. On the other hand, there was super-normal travel in 1946 and 1947 as a reaction to wartime gas rationing, and in 1957, 1958 and 1959 after the Tappan Zee Bridge was opened to traffic. In other words, the level of trans-Hudson auto travel computed from past known current auto registrations in the 18-county traffic shed came within ± 7.2 percent of recorded trans-Hudson auto trips in 24 out of 25 individual "normal" years.

Over the past 32 years, the aggregate of autos registered in the traffic shed has constituted the single most important determinant of the levels of annual trans-Hudson auto trip demand, irrespective of the declines in trans-Hudson railroad commuter passengers and the steady growth of trans-Hudson bus passengers in the same period.

Auto ownership will apparently continue to be the single determinant that will largely establish annual levels of auto trips across the lower Hudson River-Upper Bay screenline. But how does one project auto registrations into the future in 18 individual counti as well as in the 18-county traffic shed? This brought up a new difficulty. Extrapolati county auto registrations as a time series, would again employ a weak statistical meth because it would ignore the different demographic changes in population and the different changes in the social and economic environments that will influence auto ownership A more desirable method would be to predicate future auto registrations on the basis of carefully prepared demographic projections of populations; after all, people determine auto ownerships. Here another statistical difficulty arose. Although county auto registrations have been available annually, population census figures are available only decennially. Intercensal annual population figures were merely population estimates. This paucity of recorded annual population figures thus limited the data for establishing correlations between auto registrations and populations to decennial data.

SIZES OF HOUSEHOLDS DECLINING

A priori reasoning would seem to suggest that numbers of households would be bette indicators of car ownerships than would population figures proper. The auto is a house hold ownership rather than a personal ownership item. Also, in the past, numbers of households have expanded at a faster rate than populations proper, because the number of persons in household groups has been declining not only in the New York region, but in the country at large even though average family size has been increasing in recent years.

Declining household size has been brought about by the larger numbers of unmarried adults and elderly persons maintaining separate living accommodations. Best judgment of demographers in the New York region indicated that factors that brought about declin

[1] HRB Bull. 253, p. 179, Fig. 2 (1960).

in the average size of households in the past are likely to operate in the future. Consequently, "persons-per-household" factors were likely to continue to decline in the future. This means that there are likely to be more households per 1,000 additional persons in the future than in the past. In fact, in the past decade, population in some counties has actually declined and households expanded. Moreover, individual counties

TABLE 2

RECORDED VS COMPUTED RESIDENTIAL ZONAL PERSON TRIP DESTINATIONS ON BASIS OF ZONAL AUTO REGISTRATIONS IN THE CHICAGO TRANSPORTATION STUDY AREA IN 1956

Zone	Auto Regist.[a] (1,000's)	Residential		Deviations	
		Person Trip Computed (at 4.18[b] trips per auto regist.) (1,000's)	Destinations Recorded[c] (1,000's)	Recorded / Computed (Col. 4 ÷ Col. 3) (%)	Rec'd-Comptd[d] / Comptd (Col. 5 - 100) (%)
01	1.3	6	25	4.17	
11	48.9	204	240	1.18	+ 18
21	29.5	123	131	1.07	+ 7
22	23.2	97	88	0.91	- 9
23	30.0	126	122	0.97	- 3
24	17.7	74	67	0.91	- 9
25	11.9	50	42	0.84	- 16
26	8.7	36	34	0.94	- 6
27	15.1	63	83	1.32	+ 32
31	41.0	171	156	0.91	- 9
32	42.0	175	169	0.97	- 3
33	36.8	154	149	0.97	- 3
34	23.1	96	89	0.93	- 7
35	15.9	67	63	0.94	- 6
36	19.5	81	87	1.07	+ 7
37	37.3	156	174	1.12	+ 12
41	58.7	245	214	0.87	- 13
42	50.1	209	183	0.88	- 12
43	62.7	262	243	0.93	- 7
44	38.0	159	144	0.91	- 9
45	21.8	91	89	0.98	- 2
46	54.1	227	222	0.98	- 2
47	68.3	285	303	1.06	+ 6
51	33.5	140	146	1.04	+ 4
52	42.0	175	164	0.94	- 6
53	35.0	146	138	0.95	- 5
54	23.5	99	87	0.88	- 12
55	20.0	84	81	0.96	- 4
56	38.5	161	159	0.99	- 1
57	37.1	155	169	1.09	+ 9
61	25.1	105	117	1.11	+ 11
62	32.3	135	135	1.00	-
63	38.4	160	147	0.92	- 8
64	27.8	116	120	1.03	+ 3
65	16.3	68	63	0.93	- 7
66	43.4	182	196	1.08	+ 8
67	26.9	112	141	1.26	+ 26
71	20.6	86	85	0.99	- 1
72	26.4	110	106	0.96	- 4
73	20.0	84	84	1.00	-
74	20.0	84	79	0.94	- 6
75	4.2	18	17	0.94	- 6
76	38.1	159	182	1.14	+ 14
77	16.9	71	73	1.03	+ 3
Total	1,341.6	5,607	5,607	100	

[a] Table 19, Vol. 1, CATS.

[b] $\frac{5,607,000 \text{ residential person trip destinations}}{1,341,600 \text{ auto registrations}}$ = 4.18 person trips per auto registered.

[c] Table 23, Vol. 1, CATS.

[d] 33 out of 44 deviations ± 9% or less.

in the traffic shed differed widely in average size of households and in the rate at which household size was declining.

In the case of each county, two assumptions were consistently made: (a) the number of persons per household would continue to decline in the years, 1960-80, and (b) the rate of decline would be approximately the same as in the past 20 years (Table 3). In this way, future individual households were derived from the demographic projections of the populations for each county and for the aggregate of the 18 counties for the years 1965-80 in 5-yr intervals.

For the traffic shed as a whole, the effect of projecting declining household sizes in the individual counties indicated a decline in average size from about 3.16 persons per household in 1960, to about 2.79 persons by 1980. This represents a decline of about 11.7 percent in size of households for the next 20 years.

The demographic population projections for the traffic shed indicate that by 1980, population will expand by about 25 percent over 1960. The anticipated 11.7 percent decline in average size of households between 1960-80 would expand households per 1,000 persons by about 14 percent. Therefore, the number of households would expand by about 41 percent.

EXPANDING AUTO OWNERSHIP RATES

The geographical distribution of auto ownership in the traffic shed is dependent, to a large extent, on the spatial distribution of population and, more specifically, on the

TABLE 3

PERSONS PER HOUSEHOLD FOR 1940-1960-1980 AND PERCENTAGE CHANGES IN 20-YEAR PERIODS

Area	Persons per Household			Changes	
	1940 (No.)[a]	1960 (No.)[a]	1980 (No.)[b]	1960/1940 (%)	1980/1960 (%)
18 N.Y. - N.J. Counties	3.71	3.16	2.79	85.2	88.3
9 N.Y. counties	3.68	3.10	2.67	84.2	86.8
9 N.J. counties	3.79	3.33	3.01	87.9	90.4
New York City	3.64	2.93	2.38	80.5	81.2
N.Y. counties:					
New York	3.45	2.44	1.73	70.7	70.7
Bronx	3.69	3.07	2.55	83.2	83.2
Richmond	4.05	3.60	3.20	88.9	88.9
Kings	3.76	3.09	2.54	82.2	82.2
Queens	3.59	3.10	2.68	86.4	86.4
Nassau	3.76	3.73	3.70	99.2	99.2
Suffolk	4.14	3.85	3.58	93.0	93.0
Westchester	3.88	3.35	2.89	86.3	86.3
Rockland	4.57	3.94	3.40	86.2	86.2
N.J. counties:					
Bergen	3.71	3.38	3.08	91.1	91.1
Passaic	3.69	3.23	2.83	87.5	87.5
Hudson	3.76	3.08	2.52	81.9	81.9
Essex	3.78	3.20	2.71	84.7	84.7
Union	3.87	3.36	2.92	86.8	86.8
Morris	3.96	3.64	3.35	91.9	91.9
Middlesex	4.02	3.60	3.23	89.6	89.6
Monmouth	3.69	3.48	3.28	94.3	94.3
Somerset	4.04	3.59	3.19	88.9	88.9

[a] Computed from population and household data from U.S. Bureau of the Census.
[b] Computed by applying to 1960 county persons per household, the corresponding 1960/1940 county percentage changes.

TABLE 4

AUTOS PER 100 HOUSEHOLDS VS HOUSEHOLDS PER ACRE, 1960

County	State	Households per Acre of Committed Land[1]	Autos Per 100 Households
Rockland	N.Y.	0.6	137
Somerset	N.J.	0.7	105
Morris	N.J.	0.8	146
Suffolk	N.Y.	1.0	146
Monmouth	N.J.	1.0	128
Middlesex	N.J.	1.6	127
Westchester	N.Y.	2.0	128
Passaic	N.J.	2.4	111
Nassau	N.Y.	2.5	142
Richmond	N.Y.	2.5	100
Bergen	N.J.	2.7	129
Union	N.J.	3.0	135
Essex	N.J.	4.9	103
Queens	N.Y.	9.2	81
Hudson	N.J.	11.1	77
Bronx	N.Y.	19.2	47
Kings	N.Y.	20.8	51
New York	N.Y.	51.0	25

[1] Land committed to residential, industrial, commercial, institutional and transportation uses and publicly owned open spaces.

spatial distribution of households. However, it is also dependent on the varying degrees of conduciveness to auto ownership in the different counties. Availability of mass transit in four of the five boroughs of New York City and in Hudson and Essex Counties in New Jersey, for example, has made car ownership less necessary than in the more outlying counties. There is also a consistent tendency for counties developed at low residential densities to display high auto ownership rates (expressed as autos per 100 households) and for high density counties to have low ownership rates (Table 4).

In the past two decades, auto ownership rates have risen in most of the counties. In the whole 18-county traffic shed, auto ownership rates rose from 59.7 autos per 100 households in 1940, to 69.8 in 1950, to 83.4 by 1960. It is apparent from these rising auto ownership rates that auto ownership in most counties has expanded even faster than households.

When individual county auto registrations were plotted against county households in censal years 1940, 1950 and 1960, the reason was clear. In Figures 4, 5 and 6,

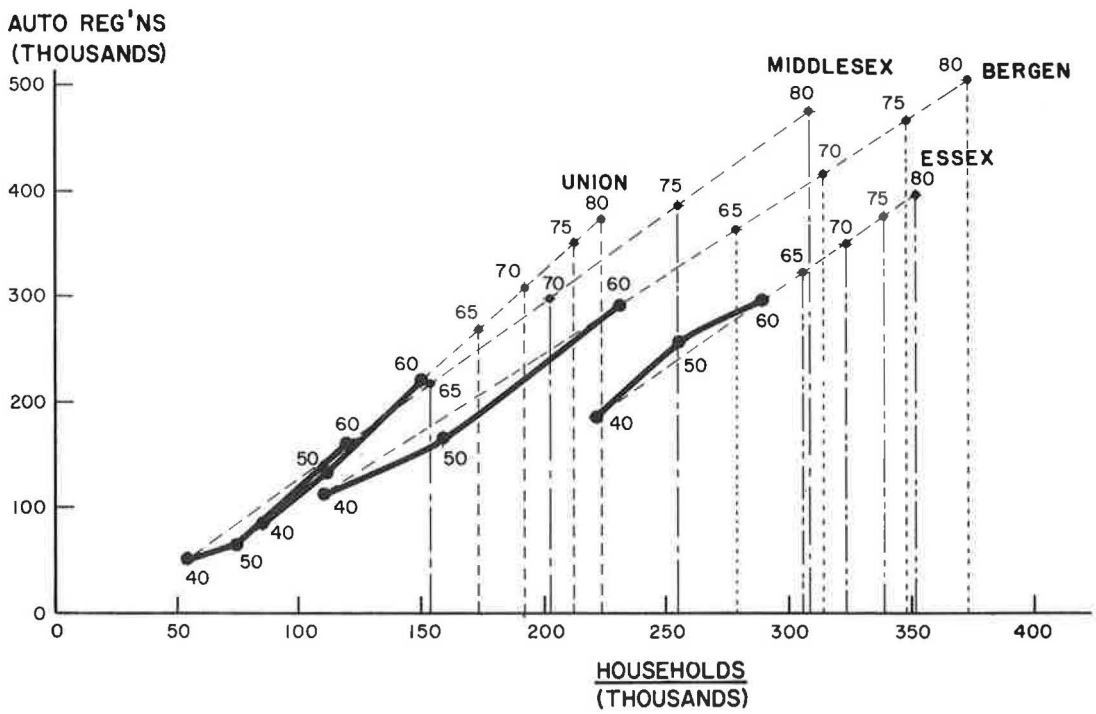

Figure 4. Auto registrations vs households, 4 N. J. counties.

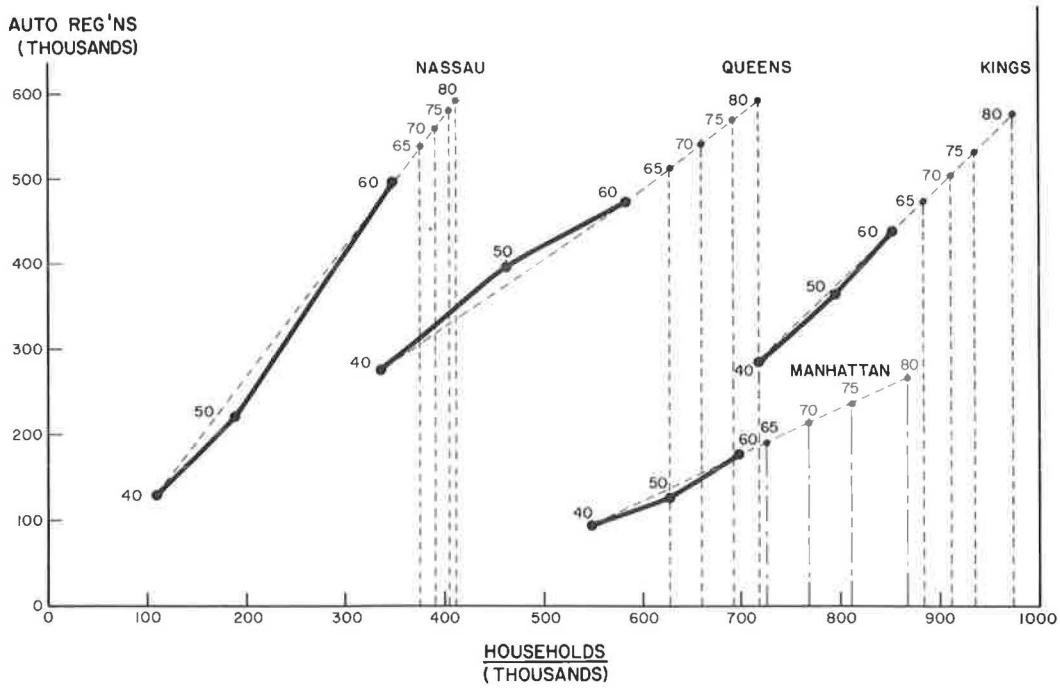

Figure 5. Auto registrations vs households, 4 N. Y. counties.

straight lines are fair representations of the correlations between each county's auto ownership and its households. These straight-line relationships indicate that over the past two decades the average incremental individual county auto ownership rates have been uniform but consistently higher than such rates in any of the three censal years. Thus for the 18-county traffic shed, in the 20-yr interval, an approximate average of 131 autos were added for every 100 additional households. This incremental auto owne ship rate is considerably higher than the auto ownership rate that prevailed even in the last year, 1960, when the rate stood at 83.4 autos per 100 households. Consequently, it would appear that county auto ownership rates in the traffic shed will probably continue to rise in the future.

However, it should be pointed out that the 131 autos added per 100 households added in the traffic shed during 1940-60, are not to be equated to the average auto ownership of new households added in the 20-yr period. Older households also increased their auto ownership rates in that period. There were no statistical data to determine how much of the auto ownership increment was absorbed by new and how much by old households.

Even though these high levels of overall incremental car ownership rates are subjec to statistical data "blind spots," nevertheless they do reflect two important factors that have been responsible for the continuing rise in car ownership rates. One has been the postwar suburban residential developments that have been largely low density where cars have been essential for suburban living. As a consequence, the cars added per 100 households were usually much higher than car ownership rates in older more dense populated areas. The other factor contributing to rising car ownership rates has been the rising trend in the standard of living which has increased ownership rates even in fully developed urban counties.

Thus, Hudson County, N.J. and Kings County, N.Y. are examples of two counties where land uses have been largely developed. Their populations actually declined between 1950 and 1960, but their number of households has increased. Their auto registrations and auto ownership rates per household have also increased. In Hudson County the auto ownership rate rose from 72 autos per 100 households to 77. In Kings County the ownership rate rose from 45 autos per 100 households to 51.

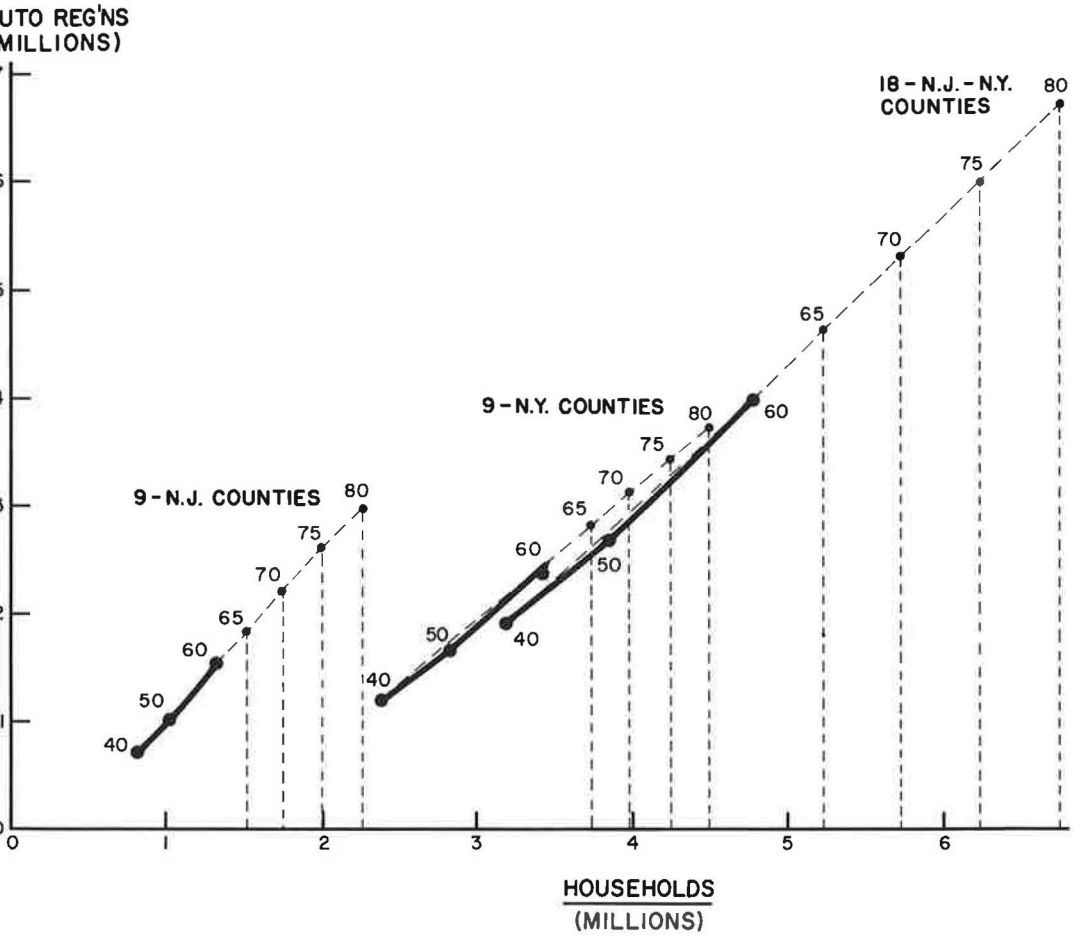

Figure 6. Auto registrations vs households.

In projecting individual county auto-ownership rates, it was assumed on the basis of such data as shown in Figures 3, 4 and 5 that the average incremental auto-ownership rates (auto ownerships added per 100 additional households) of each of the 18 counties experienced during the 1940-60 period would be the same in the next two decades. If this assumption were realized approximately, then the average number of autos per 100 households for the traffic shed, about 83 in 1960, would rise to about 100 autos per 100 households by 1980.

SUMMARY

Through the chain of relationships which were established between county populations and households, county households and auto registrations, and between registrations in the traffic shed and trans-Hudson auto trips, the carefully prepared demographic projections of county populations were translated into interstate auto trip demand across the lower Hudson River-Upper Bay screen line (Fig. 7).

Table 5 gives the translation from (a) demographic projections of population, to (b) the correlative households, (c) to the correlative auto registrations, and to (d) the interstate auto trip demand. It indicates, that in the 1960-80 period an anticipated 27 percent expansion in the population of the traffic shed would mean a 44 percent expansion in households, an overall expansion of 73 percent in auto ownership, and 85 percent expansion in interstate auto trip demand across the lower Hudson River-Upper Bay screenline.

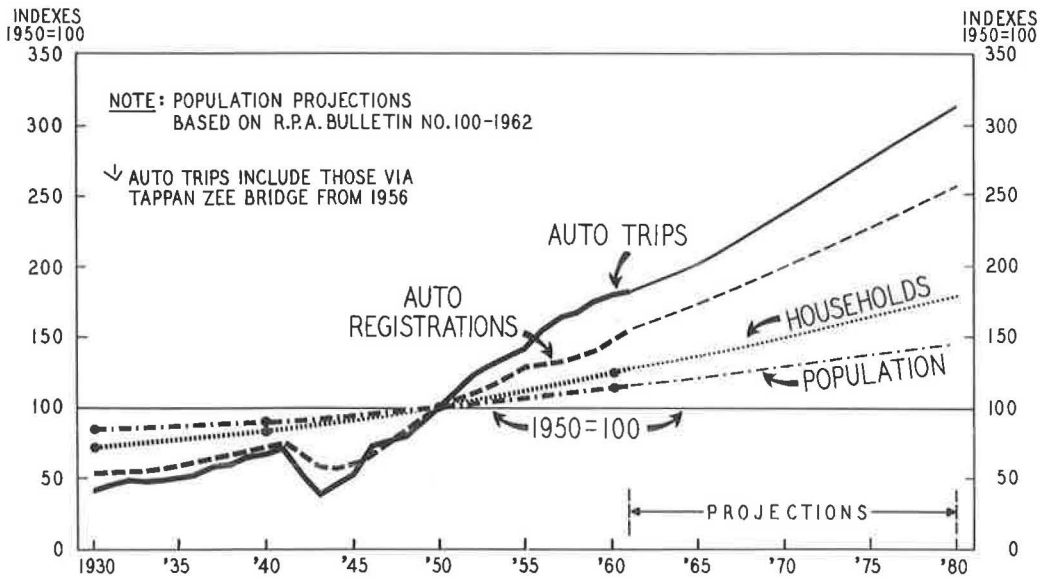

Figure 7. Recorded and projected population, households, auto registrations, and trans-Hudson auto trips in the traffic shed.

In absolute terms, an anticipated increase in population of 4,075,000 persons would produce an increase of about 2,090,000 households which, in turn, would produce an increase in car ownership of about 2,902,000. These cars would yield an increase in interstate auto trips of about 65,870,000. This is equivalent to a rate of growth of about 3 percent a year, compounded.

This compares with an overall average rate of growth of trans-Hudson auto trips between 1930 and 1960 of about 5.1 percent a year, compounded (Fig. 8). If the future annual rate of growth of trans-Hudson auto trips were to continue at the same average rate established in the 30-yr period, their annual volume would double in about 14 yr. If continued at that same rate during the 1960-80 period, the 1960 annual volume of trans-Hudson auto trips of approximately 82.6 million would reach a total of about 222 million trips. This would represent a 20-yr increase of about 139 million trans-Hudso auto trips.

This 139 million increase compares with the increase of about 65.9 million interstate auto trips predicated on demographic projections of county populations and the chain of relationships with households, auto ownerships, and auto trips herein described.

On the basis of the experience of about 5.0 million annual auto trips per bridge lane, the 65.9 million additional interstate auto trip demand which would be developed between 1960 and 1980, could be accommodated with about 13 additional lanes. This incremental annual volume in the next two decades could thus be accommodated by the margins of annual capacity available in 1960 plus the six lanes of the lower deck of the George Washington Bridge opened on August 29, 1962, plus six of the 12 lanes of the Narrows Verrazano Bridge which would be devoted to interstate vehicular traffic. Three of these will be available in 1965 and three more after 1975.

There would, of course, be additional need to accommodate the 20-yr expansion of interstate truck and bus traffic. Consequently the need for a new interstate vehicular crossing would become felt before 1980. Planning for such a crossing would undoubted begin long before 1980.

TABLE 5

RECORDED AND PROJECTED POPULATION, HOUSEHOLDS, AND AUTO REGISTRATIONS IN THE NY-NJ TRAFFIC SHED AND INTERSTATE AUTO TRIP DEMAND AND TRANS-HUDSON TRIPS, SELECTED YEARS, 1930-1960

Year	Population (1,000's)	Households per 1,000 Persons	House-holds (1,000's)	Autos per 100 Households	Auto Regist. (1,000's)	Annual Auto Trip Demand per Auto Regist.	Annual Inter-state Auto Trip Demand (1,000's)	Annual Recorded Trans-Hudson Auto Trips
Recorded								
1930	11,011	246	2,708[a]	-	1,387	13.7	19,000[e]	18,811
1940	11,822	270	3,190	59.7	1,903	16.1	30,710	30,231
1950	13,137	292	3,841	69.8	2,680	18.0	48,350	45,773
1960	15,095	316	4,775	83.4	3,983	19.6	77,930	82,641
1961	-	-	-	-	4,103	19.7	80,650	83,310
1962	-	-	-	-	-	-	-	89,284
Projected								
1965	15,990[b]	327	5,230[c]	88.2	4,615[d]	20.0	92,300[e]	-
1970	17,040[b]	337	5,750[c]	92.9	5,340[d]	20.4	108,700[e]	-
1975	18,120[b]	347	6,295[c]	97.0	6,105[d]	20.7	126,100[e]	-
1980	19,170[b]	358	6,865[c]	100.3	6,885[d]	20.9	143,800[e]	-
				Changes (%)				
60/40	128	117	150	140	209	122	254	-
80/60	127	113	144	120	173	107	185	-
				Computed Changes per Year (%)				
60/40	1.2	0.8	2.1	1.7	3.8	1.0	4.8	-
80/60	1.2	0.6	1.8	0.9	2.8	0.3	3.1	-

[a] Families.
[b] RPA Bulletin 100 9/62, Table 5, p. 36, Appendix.
[c] Based on declining county projections of persons per household (1940-1960).
[d] Based on county incremental auto registrations per incremental households (1940-1960).
[e] Based on formula: annual auto trip demands = 22.7 × (auto regist. - 550,000).

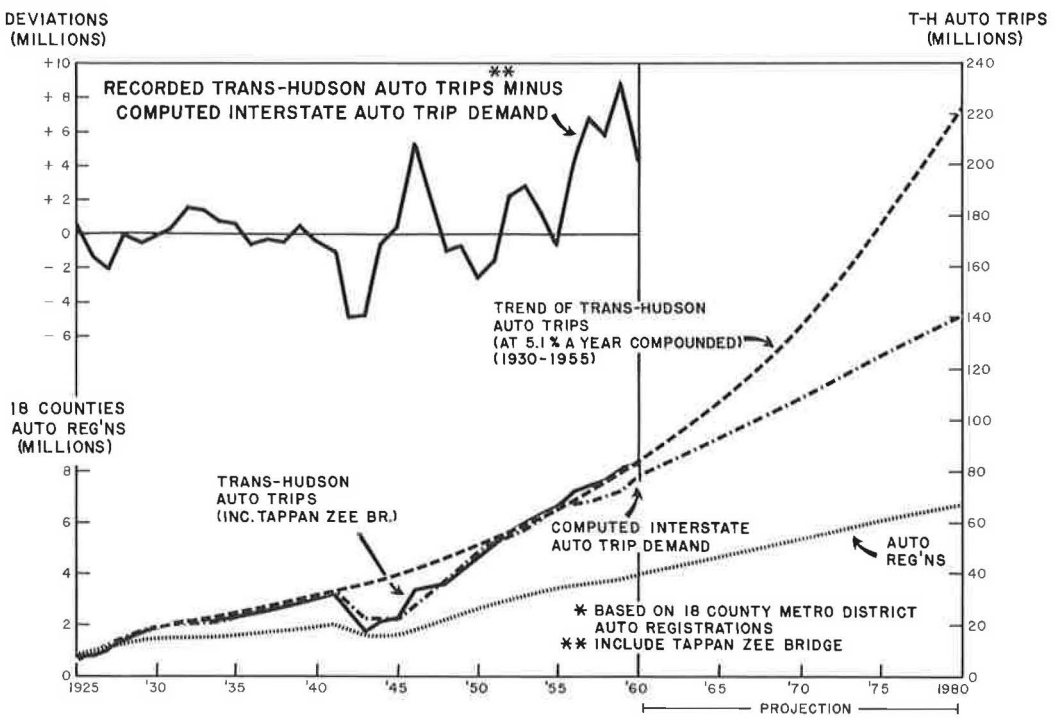

Figure 8. Annual trans-Hudson auto trips vs interstate auto trip demand.

FURTHER STUDY OF AUTO OWNERSHIPS

It has been shown that auto ownerships are the prime determinants of auto trips in a metropolitan area. Auto registrations become available annually. On the other han determinants of future auto ownerships, population and households, become available as recorded census data only decennially. In intercensal years, population and household data are only estimates, consequently there is a need to check auto ownership projections based on demographic population and household projections more often tha every 10 years. Auto ownership projections should be checked preferably with annual projections of their determinant series, recorded indicators which could be checked annually themselves.

Auto registrations are also closely related to licensed drivers as might be expecte Nationally, for example, in the past 15 years, an average of about 90 autos has been added for every 100 new licensed drivers. Annual projections of licensed drivers cou therefore be forged into powerful tools for forecasting annual auto ownerships and checking the goodness of these forecasts annually through recorded auto registrations.

The 1960 census data of population recorded the boys and girls who, each year, for the next 20 years will become potential licensed auto drivers. They also record the number of oldsters who are likely to give up driving, in the next 20 years. Thus by aging the 1960 population data year by year, the net potential drivers who will be adde each year could be determined. These data could then be converted into annual forecasts of probable licensed drivers from which future annual auto registrations could b estimated.

Thus the 1960 census of population by sex and age composition in single year steps could be used as excellent determinants of annual auto registrations whether in a metr politan area or in the entire nation. This is a worthwhile project.