CHAPTER 1

INTRODUCTION

Statement of Problem

The increasing importance of urban transportation stems basically from the rapid growth of urban poputations. It has been estimated that between A.D. 1950 and 2000 the urban population of all developed nations will rise from 500 million to 1,000 million. In the developing nations, however, it has been forecast that the population living in towns will increase from 500 million to an incredible 2,200 million, while the desperately poor rural villagers will double from 1,400 million to 2,800 million.

Table 1 gives some estimates that have been made of the way in which total urban and principal city populations grew between 1960 and 1970 in some developing countries. The extreme growth rates predicted for cities in the developing world are by no means solely due to natural increases in existing resident populations. Migration from rural areas is a key factor, as is illustrated by national urbanization figures for some developing countries shown in Table 1. These have led to an insufficient number of job opportunities and larger demands for housing and urban transportation.

In Bangkok, the urban population grew from 2.4 million to 4.3 million during the past ten years. This has caused an increase in number of housing projects, these extend chiefly into the eastern and northern suburbs of Bangkok. In the past ten years there has been an increase of not less than 150 housing

Table 1 : Growth in Total Urban and Principal City Populations 1960-1970 in Some Developing Countries.

Country	Total Population 1970 (thousands)	Annual Growth Rate 1960-70 (%)	Urban Population 1970 (thousands)	Annual Growth Rate 1960-70 (%)	% Urban		Principal City	Population (thousands)	Annual Growth Rate 1960-70 (%)	Principal City Population as % of Urban Population
					1960	1970				
Ethiopia	24,754	1.9	1,643	2.4	6	7	Addis Ababa	631	3.9	38
Zambia	4,326	3.1	1,137	6.4	19	26	Lusaka	225	-	20
Kenya	10,861	3.0	1,000	5.1	7	9	Nairobi	500	6.0	50
Taiwan	14,402	3.0	9,272	4.1	59	64	Taipei	2,150	4.7	23
Indonesia	118,184	2.3	21,136	4.2	15	18	Djakarta	4,500	4.7	21
Korea, South	32,168	2.6	12,547	4.1	28	39	Seoul	4,661	8.0	37
Malaysia	9,376	3.1	4,291	5.9	35	46	Kuala Lumpur	650	4.0	15
Philippines	38,290	3.5	8,867	4.3	22	23	Manila	4,100	4.3	46
Thailand*	31,239	3.0	4,659	4.5	11	13	Bangkok	2,100	6.0	45
Iran	28,805	3.0	11,306	4.8	33	39	Teheran	3,250	6.0	29
Greece	8,876	0.7	5,552	1.6	57	63	Athens	2,425	3.0	44
Portugal	9,723	0.9	3,549	1.7	34	37	Lisbon	1,500	1.2	42
Spain	32,958	0.8	19,369	1.7	44	59	Madrid	2,990	2.8	15
Mexico	50,624	3.8	29,468	5.2	51	58	Mexico City	3,541	5.0	12
Venezuela	10,390	3.5	7,934	5.6	62	76	Caracas	2,147	5.5	27
Brazil	93,545	2.8	50,025	4.6	45	54	Sao Paulo	8,405	6.4	17

*World Bank Atlas, 1973, gives mid-1971 population of Thailand as 37,340,000., and 1960-1970 population growth rate as 3.1%.

project, both of Government and private developers. The rapid growth and the
extension of urbanization into the adjacent areas of Nonthaburi and Samut-
Prakarn has created heavy demands on the transportation facilities which serve
Bangkok. Increased travel demands, coupled with inadequate adjustments in
supplies, have led to serious congestion in the city's transportation system.
Trip generation from housing estates seem to have prompted the research in
urban travel patterns in Bangkok.

The spending habits of urban families also show the importance of travel
and transportation. These expenditure patterns can be found in the periodic
surveys conducted by the National Statistical Office, the lastest of which was
conducted during 1971-1973. The percentage distributions among expenditure items
during 1971-1973 by all families in Bangkok and the municipal areas of the four
regions of Thailand are presented in Table 2. In this table "Transportation expense"
consists mainly of fares and the cost of private vehicle purchase and running costs.
In Bangkok, the Northeast, and the South, only food and housing consume a larger
share of the budget than transportation. Except for the Northern and Central
Regions, more money is spent on transportation by the average urban family than
clothing or any other expense. Outlays for transportation ranged from 6.84 per-
cent (Central Region) to 9.56 percent (Northeastern Region) of all expenditures.
Table 3 shows the growth rates of private consumption expenditures as determined
by the Office of the National Economic and Social Development Board in 1975.
Food which showed the greatest increase in expenditure with a growth rate of 13.0%
over the 1971 level, 31.0% over 1972 and 32.5% over 1973. Expenditure for
transportation showed the highest rise of all classes of expenditure. The total
expenditure for transportation was 15,700.- million baht in 1974, an increase

Table 2 : Percentage Distribution of Expenditures for Current Consumption for

Bangkok and Municipal Area in Four Regions, 1971-1973

	Bangkok	North-Eastern Region	Northern Region	Central Region	Southern Region
All food and beverages (non-alcoholic)	44.35	38.36	44.10	43.58	42.13
Housing, furnishings, household-operations	14.76	17.60	15.72	14.38	18.01
Clothing and materials	7.70	7.90	8.76	8.21	6.94
Transportation expenses	8.10	9.56	7.22	6.84	7.96
Recreation expenses	2.77	3.01	3.57	3.05	2.56
Education expenses	4.54	3.25	3.10	4.05	3.56
Reading expenses	0.72	0.70	0.90	0.59	0.71
Medical and personal care	5.44	5.86	5.93	5.83	5.89
Tobacco and alcoholic beverages	5.16	4.93	4.65	4.84	4.07
Taxes, gifts, contributions and miscellaneous expenses	6.46	8.82	6.05	8.63	8.17

Source : Report Socio-Economic Survey 1971-1973, National Statistical Office, Bangkok, 1974

Table 3: Growth Rates of Private Consumption Expenditure at Current Market Prices,

Percentage Change From Previous Year

	1972	1973	1974
Food	13.0	31.0	32.5
Non-food	9.6	22.3	24.4
Clothing	9.9	24.9	21.5
Rent, water charges, fuel and light	7.9	18.1	20.6
Transportation	9.0	34.7	31.3
Recreation	11.6	21.6	26.4
Beverages and tobacco	5.3	6.7	23.5
Furniture	11.1	28.9	28.6
Health expenses and other	11.2	15.0	20.8
Total	11.1	26.1	28.1

Source : National Income of Thailand 1974-1975 Edition, Office of the National Economic and Social Development Board, Bangkok, 1975.

of 3,700.- million baht or 31.3 % over 1973. Fares for all modes of transport rose 27.2 % and the cost of private vehicle purchase rose 23.5 %. Thus, from the viewpoint of outlays, travel is a significant economic factor, consuming nearly one - tenth of the typical urban family's income.

Purpose and Scope

The principal thrust of the present research is the determination of trip generation from housing estates. Inherent in this research is determination of trip purpose, and mode of travel used by respondents; these are influenced by the income level of the family unit, car ownership, family size, residential density, and location of the housing estate. Thus, the road system, the required level of service of public transport (buses, minibuses, taxis), and forecasts of the model split can be derived from the results of research on trip generation as related to these independent parameters.

The Study Area

This research deals solely with National Housing Authority estates in the vicinity of Bangkok. The five estates which were studied are: Tung- mahamek, Prachanivet 2, Huaykwang Flats, Dindaeng Flats, and Klong chan.

Tungmahamek is 1 km from Sathorn Road in the Yannawa District. It can be approached by Soi Suanplu or Soi St. Louis. There are 480 households, with about 2,800 persons living there. It was built in 1960 for families having a monthly household income of 1,500 - 3,000 baht. Subsequently, it seems to

Table 4 : Information About the Housing Estates Studied

Location	General Type of Project	Date of Construction	Number of Units	Tenure	Monthly Charge (Baht)	Income Level (Baht/month)
1. Dindaeng	5 story walk-up flats	1963-present	4,144	Rental	100-120	Less than 1,500
2. Huaykwang	5 story walk-up flats	1971-present	1,600	Rental	100-120	Less than 1,500
3. Tungmahamek	Detached housing	About 1960	480	Hire-purchase	500	1,500-3,000
4. Prachanivet 2	Detached housing	1973	600	Hire-purchase	1,200	More than 3,000
5. Klongchan	2 story wooden row housing	1966	190	Rental	150	Less than 1,500
	2 story duplex units	1960-present	524	Hire-purchase	500	1,500-3,000
	Small detached houses	1971-1974	204	Hire-purchase	850	More than 3,000
	Medium-sized detached houses	1971-1974	417	Hire-purchase	1,200	More than 3,000

Source : Housing Bureau, Department of Public Welfare, and National Housing Authority.

have become a high-income level estate.

Prachanivet 2 is near Klong Prapa in Nonthaburi; it is about 3 km from the Don Muang Superhighway along Ngamwongwan Road. There are 600 households with about 3,500 persons living there. It was built for households having a monthly income of 3,000-5,000 baht. Like Tungmahamek, Prachanivet 2 seems to have become an estate for high income level families.

Klongchan is in the Banggapi District. There are three type of house: row houses for low income household, duplexes for medium income households, and detached houses for high income households. There are 1,335 households and 7,000 persons living there.

Dindaeng Flats is in the Phrayathai District; this estate comprises flats for low income households. There are 62 buildings containing 4,144 units in which 25,000 persons presently live.

Huaykwang Flats is 3 km from the Don Muang Superhighway along Suthisarn Road. There are 20 buildings which total 1,600 units in which 10,000 persons reside. As with the Dindaeng Flats, Huaykwang was built for low income households. The other information about the housing estates selected for study are shown in Table 4.

Sources of Data

Investigation showed that no information on trip generation from housing estates in Bangkok was available. Thus, it was necessary that data pertaining to trip generation and the related variables be collected from home interview surveys, and checks of the accuracy made by screen-line counts. The statis-
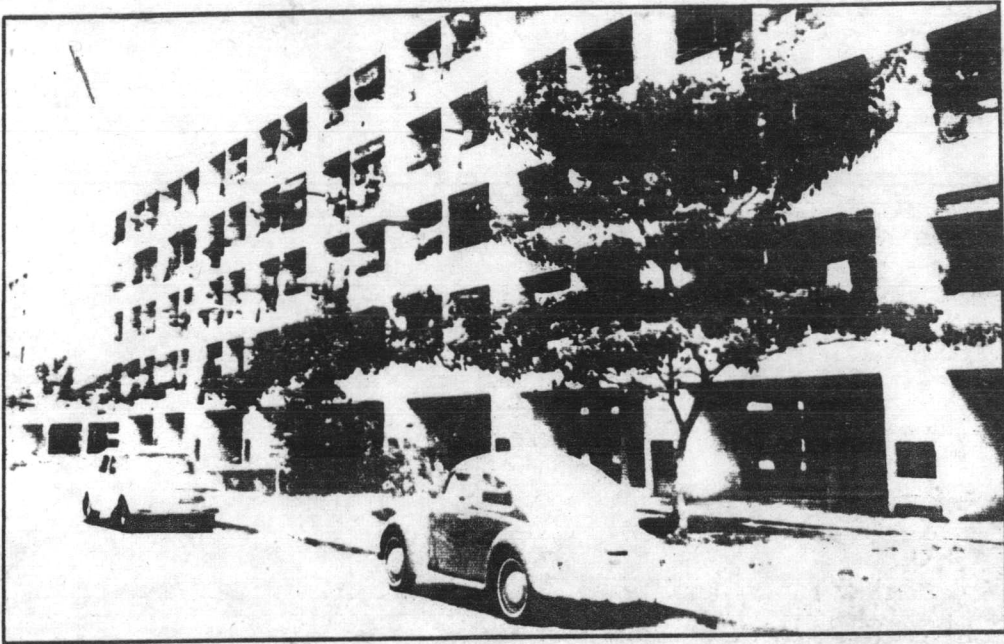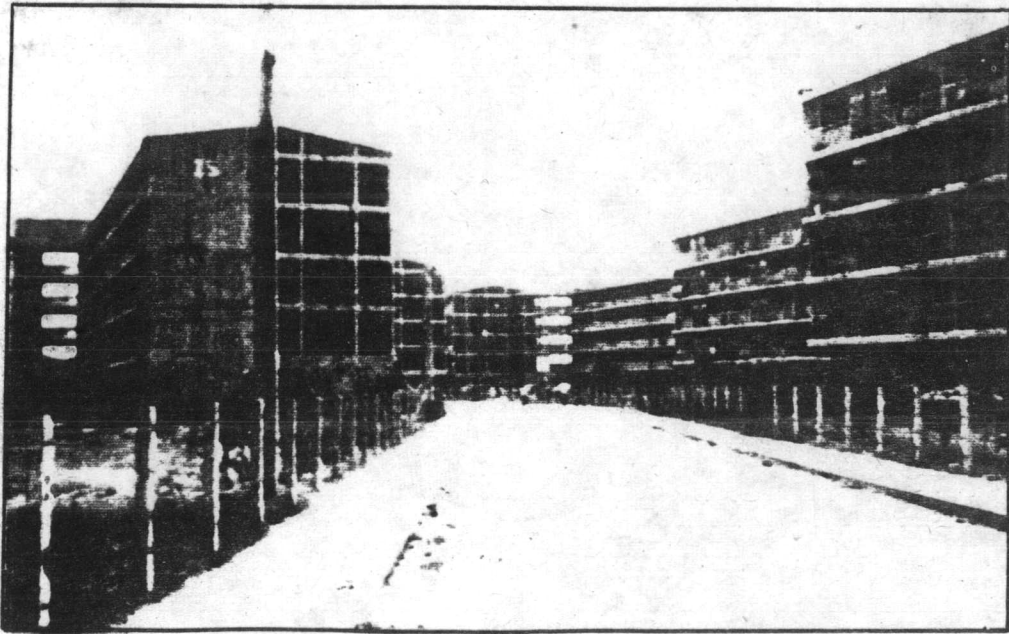
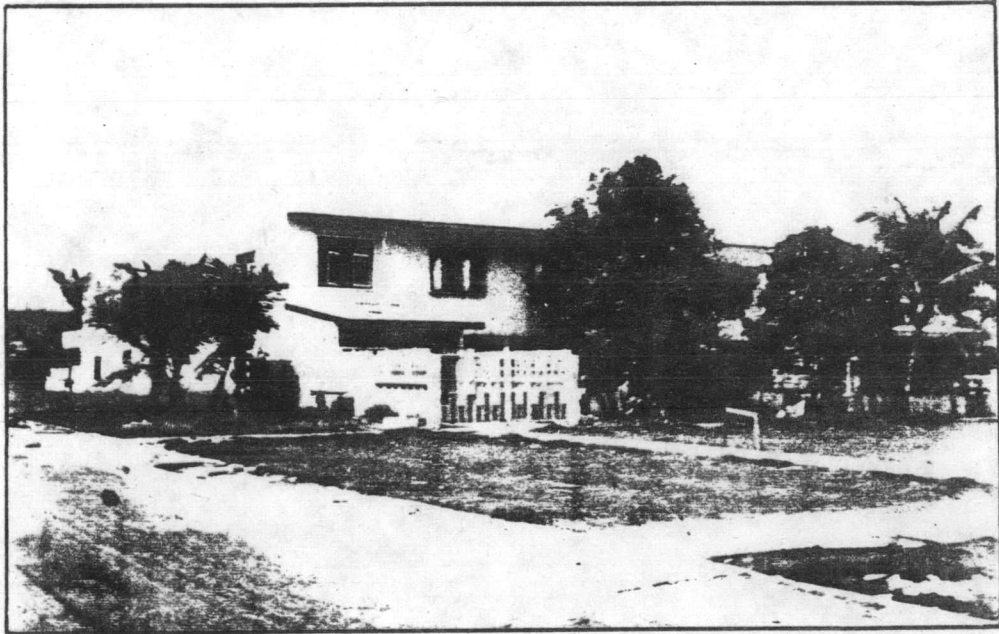Fig. 1a. Dindaeng Flats

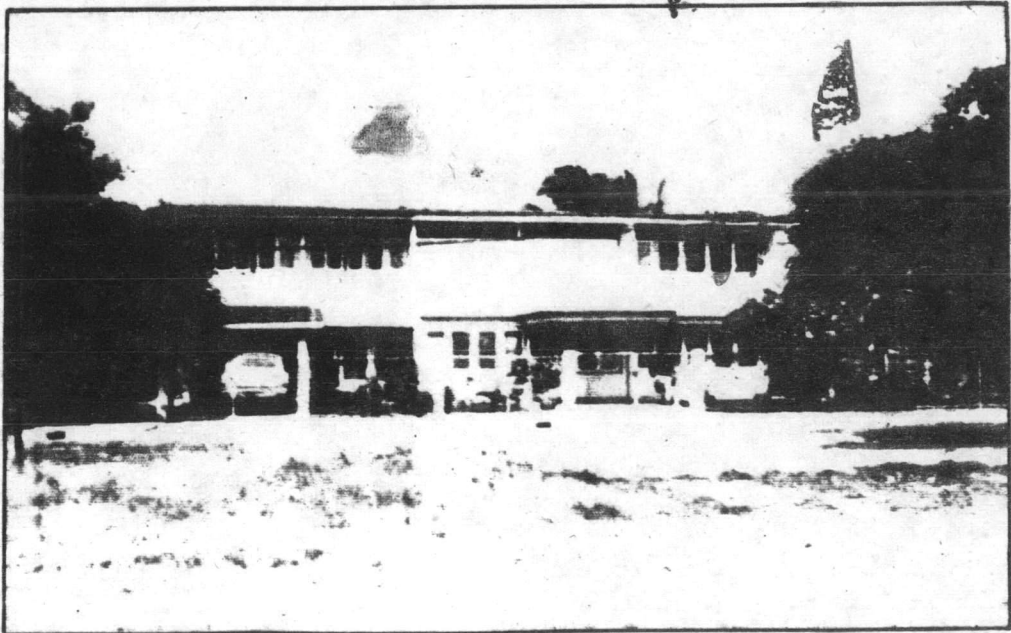Fig. 1b. Huaykwang Flats

Fig. 1c. Row house, Klongchan
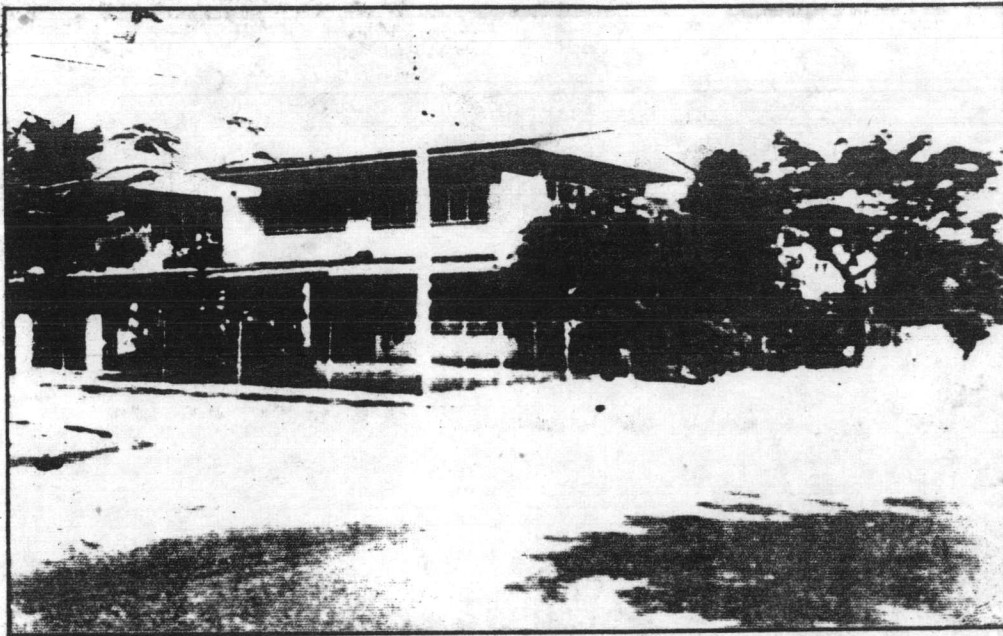

Fig. 1d. Duplex, Klongchan
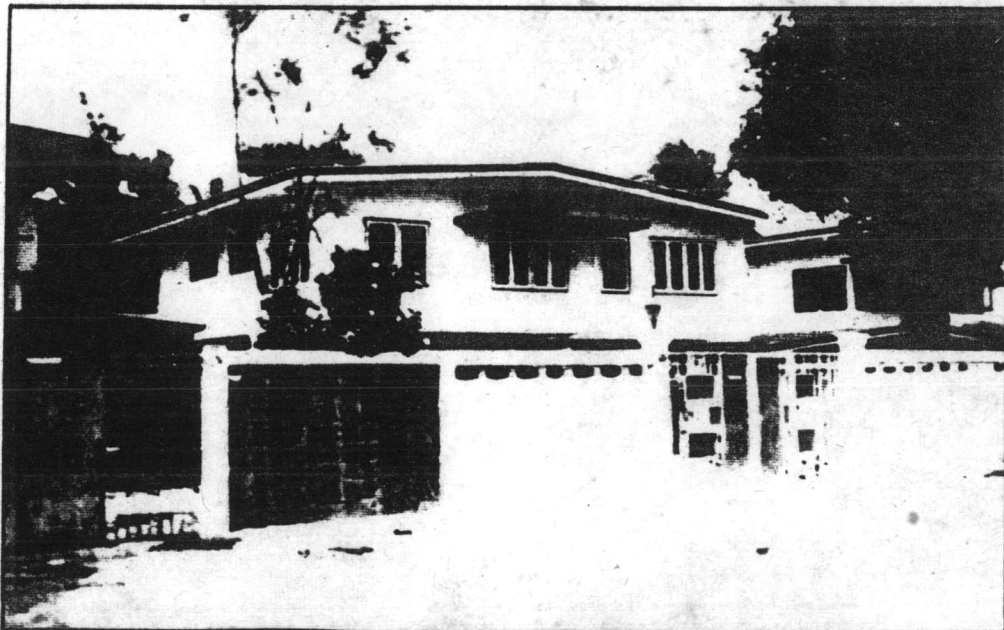
Fig. 1e. Detached, Klongchan

Fig. 1f. Detached, Tungmahamek

tical data were obtained from the National Housing Authority, the Housing Bureau of the Department of Public Welfare, and the National Statistical office of Thailand.

Expected Usefulness of the Research

At present there is virtually no information available on trip generation from housing estates (or other major generators) in Thailand. The information is needed for rational planning of transportation facilities to serve housing estates. This research is a major step forward in developing relationships that are essential to the rational planning of transport for housing estates in Bangkok. This work, deals solely with National Housing Authority estates, is perceived as the first of a series of related research projects for both Government and private-enterprise housing estates, and subsequently for other major generators of person trips, both in Bangkok and in other large cities of the Kingdom.

Literature Review

Since the first origin and destination study was conducted by the Hayden-Cartwright in 1934, the O-D studies have reflected the need for more information concerning travel activity within urban areas. By the post-World War II years, traffic engineers had also turned their energies toward analysis of travel demands and behavioral patterns. The application of more powerful and sophisticated mathematical and statistical tools of analysis also led to significant advances in our understanding of urban travel demands.

In the period from 1952 to 1960, O-D studies were conducted in many large city, such as Detroit (1955) and Chicago (1960). In these studies, substantially greater attention was first given to analysis of trip generation rates. In addition, other trip generation studies were being reported at around the sametime in various publications of the Bureau of Public Roads and of the Highway Research Board. These earlier studies fall into two major categories: (1) those which refer to land use; and (2) those which apply to home-based travel. Both types of study exhibit an over-riding concern with forecasting.

HALL (1958) studied travel characteristics of two San Diego subdivision developments to develop relationships between land use and traffic generation, and to study the orientation of the generated traffic. The smaller of these study subdivision developments contained 1,822 single-family dwelling units at the time of survey, and the larger contained 7,158 occupied dwelling units; of the latter, 4,296 were single-family, 1,838 were duplexes, and 1,024 were apartments. These studies developed useful trip generation data by type of dwelling unit. The relationships of trip generation and orientation to land use appeared in several of the analysis, thus suggesting that consistant relationships between land use and travel characteristics do exist.

WYNN (1959) studied trip generation in Washington, D.C. in 1956 to 1958. The National Capital Region includes: the District of Columbia; the counties of Montgomery and Prince Georges in Mary land; and the cities of Alexandria and Falls Church, and the counties of Arlington, Fairfax, Loudoun and Prince William in Virginia. The most important sources of detailed travel information for the National Capital Region were the Washington Metropolitan Area Transportation Studies of 1948 and 1955 which were prepared by the

Regional Highway Planning Committee for the Maryland State Roads Commission and the highway departments of Virginia and the District of Columbia, in cooperation with the Bureau of Public Roads.

The perspective which may be gained from a comparative analysis of the two studies is enhanced by the numerous changes which took place in the years between studies of 1948 and 1955. Urban population increased about 41 percent, car ownership doubled, and the average income level of residents increased substantially. Travel increased more rapidly than population in the years between the two surveys, from an average of 1.55 trips per person per day in 1948 to 1.62 trips per person per day in 1955. While population within the study area increased 41 percent in the seven years, 1948 to 1955, personal travel by residents increased 53 percent, from 1,723,870 trips in 1948 to 2,626,532 trips in 1955. Significant changes also occurred in modes of travel. The number of private cars owned by residents more than doubled and the use of public transit declined about 5.5 percent, from 677,860 reported trips per day in 1948 to 639,413 trips per day in 1955. Trips in the commercial category almost doubled, with most being made by car. Social trips and school travel increased by only 25 percent.

Trip data from the origin-destination surveys have been related to population, land uses and trip lengths to derive trip-estimating procedures. The number of trip-ends generated in a district may be developed in two parts--the home-based ends and the purpose ends. About 90 percent of the trips made by area residents for work, commercial, or social purposes were found to begin or end at the place of residence and were classified as home-based. The remainder (miscellaneous trips) neither began nor ended at home.

SHULDINER (1966) evaluated generation models for non-residential trips. He separated trip attraction models into three broad categories: (1) Land-use based models, (2) activity-purpose models, and (3) an assortment of procedures gathered under the rubric of Other Methods. In the land-use based models, trip generation is assumed to be related to the kinds, amounts, intensities, and locations of a limited set of generalized land-use classes. In land-use activity and trip purpose models, trip purpose types are generally combined on the basis of the similarity of land use at the non-home end, and the trip length characteristic is evidenced by each trip type. The specific number of general purpose categories used in the analysis will depend on the size and type of community being studied, the size of the home interview sample, the budget, and other factors. Multiple regression analysis and competitive models are used for the analysis of a wide variety of factors potentially related to trip attraction, and for evaluating an equation relating trips to the selected independent variables.

SHULDINER (1962) studied the relationship of trip generation to home characteristics from O-D data conducted in 1956 by the California Division of Highways in Modesto. The relationship between a number of household and neighborhood characteristics, and the frequency of person-trips associated with individual dwelling units, was analyzed. Family size and vehicle ownership were found to have the greatest effect on trip production. Other dwelling unit variables affected trip generation only slightly, when the impact of associated variations in family size and vehicle ownership were accounted for. A fuller understanding of observed variations in trip generation was derived from consideration of certain social characteristics of the generating area. Two

indices obtained from census data-social rank and degree of urbanization were found to be particularly useful in this regard. Shuldiner included a brief discussion of the apparent gain in precision which can result from grouping data before conducting a regression analysis. Examples of the bias that such aggregation produces are considered.

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SHARPE, HANSEN, and HAMNER (1958) studied factors affecting trip generation of residential land-use areas from data of the two home-interview type origin and destination traffic surveys made in the Washington, D.C., metropolitan area in 1948 and 1955. It was reported that the major factors affecting trips by residents of an area are population and automobile ownership. With data normally developed from a home interview type origin and distination survey, it is possible either to up-date the resident trip information or, with slightly less reliability, to forecast the trips for some future date. It was found that the total number of trip ends in a residential area is appreximately equal to the number of trips made by residents of that area between all origin and destinations. Therefore, any method for estimating residents' trips is equally applicable to estimates of total trip ends occurring on residential land. As a corollary, the number of trips to non-residential land in an urban area could be estimated if the number of trips made by residents of the entire urban area were known.

Generally, about 80 percent of all trips made by the residents of a residential area begin or end at home. Also, approximately 80 percent of the total trip ends occurring on residential land, by residents and non-residents, are home oriented. These proportions are greater in areas where car ownership and economic status are lower, and where population density is higher. They do not vary appreciably with distance from the central business district.

WALKER (1966) studied the relationship between the social status of the head of household and trip generation from homes. This research was explored in detail, using the home-interview survey data gathered in 1961 by the Puget Sound Regional Transportation Study (PSRTS). The result was an understanding of the relationships between "social status" and trip production from the home. It is apparent from the analysis that households with like automobile ownership and family size have different trip production generation rates when examined by social status groups. For small areas within a community, this fact can be significant, as research in community patterns of living has shown that families of a particular occupation tend to be separated spatially from families of other occupations in direct proportion to the distance between the occupations on the Edwards' ranking by socioeconomic status.

Walker pointed out two ways in which the inclusion of the social status variable could aid researchers confronted with analysis and forecasting of trip generation from the home. From census data, automobiles per household, number of persons per household, and occupation of the head of the household are available by small statistical areas. By application of generation rates based on the composition of the statistical area with regard to these variables, an independent forecast of trip generation from the home can be developed. This can be compared with the reasonableness of the results of the particular procedure used for the actual forecast, (for example, regression analysis or land-use generation rates). In addition, by using census data to estimate trip production (lacking a full-scale origin and destination survey), small area comprehensive community planning could benefit, particularly in the development of more realistic circulation plans.