

# Travel Characteristics of Two San Diego Subdivision Developments

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An origin-destination study of two San Diego subdivision developments was made in an effort 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 the survey, and the larger contained 7,158 occupied dwelling units, of which 4,296 were single family, 1,838 were duplexes, and 1,024 were apartments. Both subdivisions had planned shopping areas which were partially developed at the time of the survey.

In addition to a home interview survey, a cordon line was established around each study area and 100 percent of the outbound non-residents were interviewed as were all of the outbound transit riders. A screen line check of 95.8 percent was obtained in the smaller subdivision, while an accuracy of 98.8 percent was obtained in the larger.

Vehicle ownership in both study areas was found to be 1.22 vehicles per dwelling unit. Trip generation data was developed per dwelling unit for 5-day, 7-day and weekend trip types by type dwelling unit. Intrazonal trips were related to area.

Weekday and weekend auto-truck trip purposes were studied and trip purpose time profiles developed.

The possibility of forecasting future trips using the a. m. peak period work trip and projecting by the relation of the work trip to all trips was investigated. The a. m. peak period work trips and the total of the work and related business trips of the two study subdivisions appeared to be stable, although the problem of sample size was noted.

Freeway usage was studied, as a further experiment in the accuracy of projecting the a. m. peak period volumes. It appears that the a. m. peak hour volume could be used to expand freeway type trips in areas similar in size to those studied when the trip length is under five or six miles.

The orientation of the generated trips, both auto-truck and transit, is shown by desire line charts and trip length distribution curves. The work trip was also studied in terms of its trip length distribution. Close relationships were observed between the two study subdivisions in the trip purpose analyses of trip length.

These studies developed useful trip generation data by type dwelling unit. The relation of trip generation and orientation to land use appeared in several of the analyses, thus suggesting that consistent relationships between land use and travel characteristics do exist.

● THE City of San Diego has experienced a population growth of from approximately 203,000 in 1940 to over half a million today. This has created a need to plan for sustained rapid growth. One of the essential elements of good street and highway transportation planning is the ability to make reasonable forecasts of future travel. It is believed that there is a need to relate the traffic generating characteristics and travel

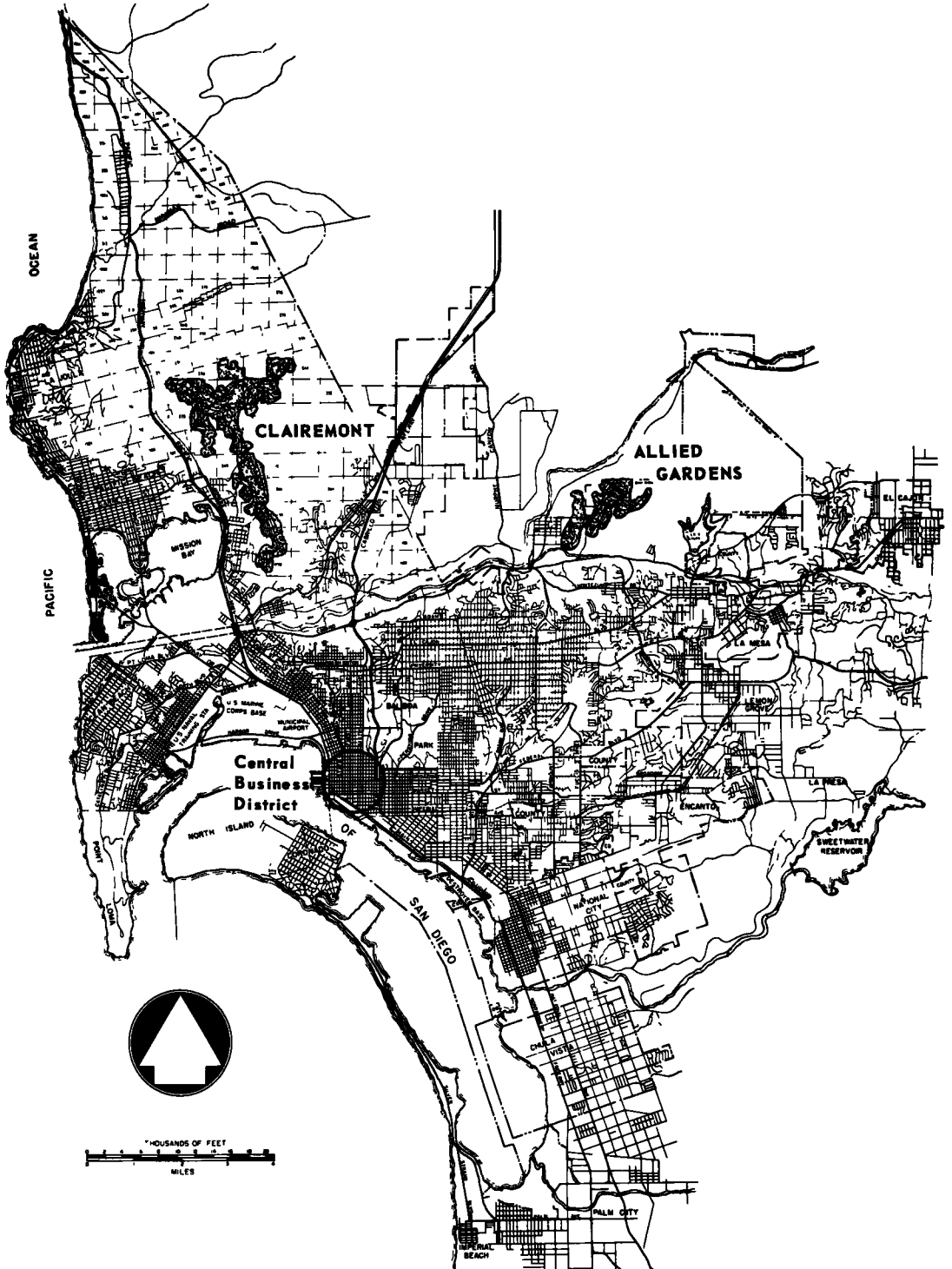


Figure 1. San Diego and vicinity, showing location of study areas.

patterns of various land uses to develop these forecasts of travel.

San Diego, covering 153.3 sq mi, is the central city of the metropolitan area of approximately 500 sq mi. Since January 1, 1957, there have been 295 new subdivisions filed with the City of San Diego. There has been a growing tendency in Southern California to build in large mass-production housing developments. These developments are generally well-planned and provide essential services for the residents of these planned communities. Thus, with large-scale housing development suddenly coming into being on formerly vacant land, it becomes increasingly important to be able to predict the impact of these developments on the traffic pattern of the metropolitan area. It is hoped that in San Diego in the near future it will be possible to estimate with reasonable accuracy the total origins to be expected, both auto-truck and transit, and to forecast their distribution when given an estimate of anticipated use of the land.

In 1952-53 a standard origin-destination survey was conducted in the San Diego metropolitan area by the Bureau of the Census for the California Division of Highways in cooperation with the U. S. Bureau of Public Roads. The results of this origin-destination survey and several important analyses have been reported in "San Diego Traffic Survey 1952-53" published by the California Division of Highways. In addition to the survey report, several tabulations and various other data have been made available to the City of San Diego. A number of analyses have been made of these data, but the individual dwelling unit and trip cards for the 1952-53 O-D have not been analyzed for trip purpose by selected geographical areas.

San Diego is one of the eight pilot cities selected to test the program of the National Committee on Urban Transportation. A study of travel desires and their relation to land use was an important part of the fact-gathering phase of the National Committee's program.

In an effort to develop relationships between land use and traffic generation and orientation, to contribute to the pilot city program, and to accumulate facts in areas which had been developed since the 1952-53 origin-destination study, it was decided to conduct an origin-destination study in two selected modern subdivisions during June and July 1956.

### The Subdivisions

The two selected subdivision developments were Allied Gardens and Clairemont. These were selected for study because they were essentially homogeneous, were designed to modern standards, and have been developed since World War II. Both subdivisions represent typical middle income communities for the San Diego area and are approximately equidistant from the central business district. Allied Gardens was brushy hillside at the time of the 1952-53 O-D study, and only a small part of Clairemont was developed at that time. Both subdivisions could be considered to be planned developments, one completely developed by one concern, and the other developed by several large concerns. Planning for both of these subdivisions included the development of shopping areas designed to serve the planned population. Neither included any industrial uses nor had a high school at the time of the survey. Both included schools and provision for parks. Both areas were susceptible to a reasonably simple cordon line treatment, and both subdivisions were isolated to a considerable extent from the rest of the community. The two study areas represented the large-scale housing development anticipated in the future in the San Diego metropolitan area. The travel characteristics developed for these subdivisions can be assumed to apply to similar future developments.

The relation of Allied Gardens and Clairemont to the San Diego metropolitan area is shown by Figure 1. Allied Gardens is the smaller of the two subdivisions. Figure 2 is a land use map of Allied Gardens. Allied Gardens contained 1,822 single family dwelling units at the time of the survey and an estimated population of 6,930.

Figure 3 shows the land use in Clairemont. Clairemont contained a total of 7,158 occupied dwelling units at the time of the survey, of which 4,296 were single family, 1,838 were duplexes and 1,024 were apartments, and an estimated population of 27,775.

Both subdivisions had planned shopping areas. At the time of the study, 2.7 com-

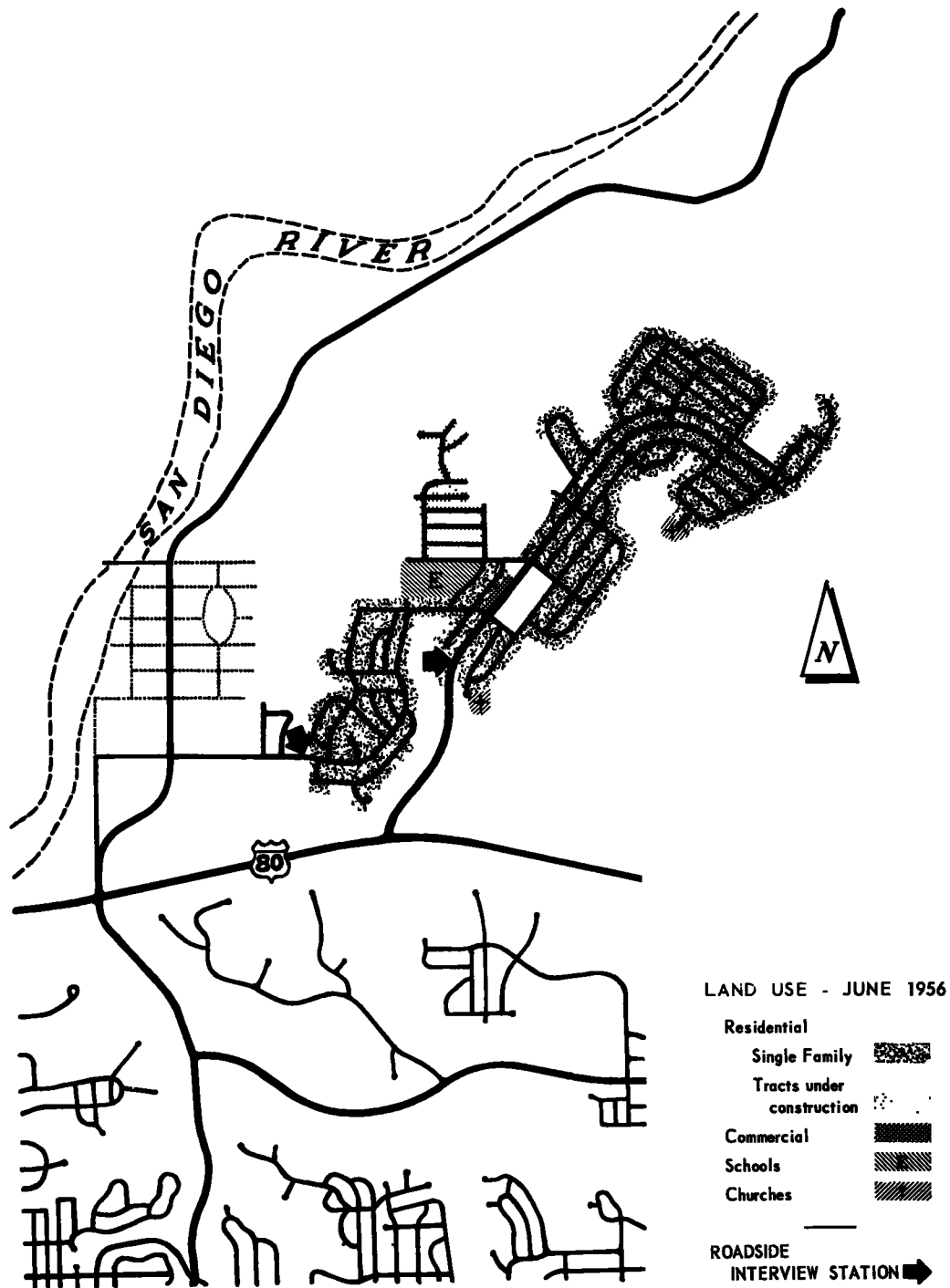


Figure 2. Allied Gardens, Origin-Destination Survey.

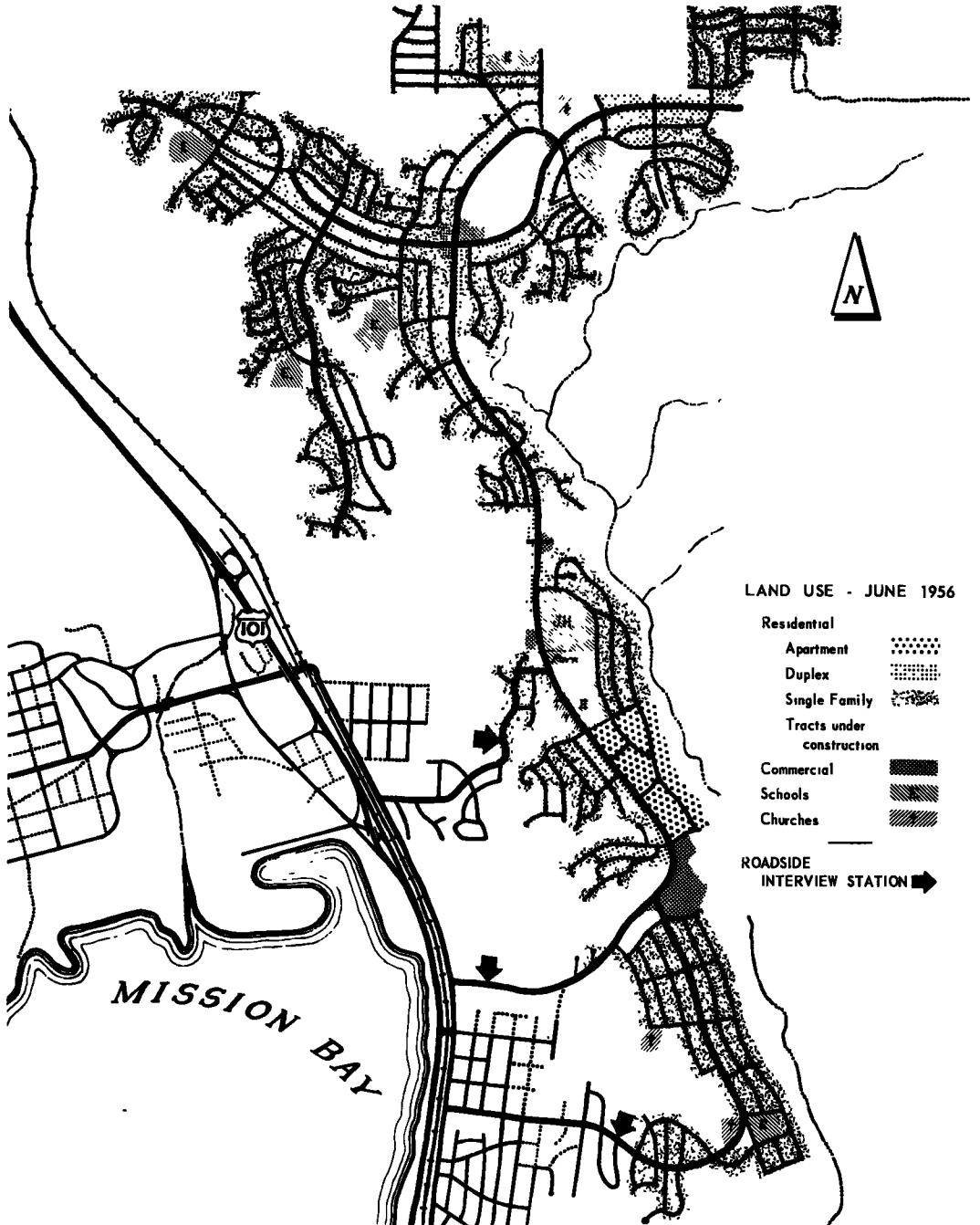


Figure 3. Clairemont, Origin-Destination Survey.

mercial acres were developed in Allied Gardens and 30.8 acres were developed in Clairemont. The shopping habits at Allied Gardens were studied in greater detail than Clairemont, as they were felt to be more isolable than the shopping areas of Clairemont.

Although neither of these modern, residential communities might be called completely balanced or completely developed communities, both of them represent a mature status of development in that all the essential functions of a neighborhood development were available. Selective shopping and many heavy goods were available in Clairemont, but such things as automobiles were not available. Both areas contributed to the land use balance then in existence in the metropolitan area.

Modern high standard major streets had been provided in both subdivisions. The city standard in both cases is four 12-ft travel lanes, two 8-ft parking lanes and a median. As is true with all new subdivisions in the City of San Diego, the subdivider provided high standard local residential streets with curbs and sidewalks.

### Study Methods

The home interview origin-destination surveys used the standard California procedure which had been used during the 1952-53 origin-destination survey. The interview form was the identical form used for the 1952-53 origin-destination survey, with the exception that shopping was divided between shopping and convenience goods and the number of vehicles regularly garaged or parked at each dwelling unit was obtained. A 10 percent dwelling unit sample was taken at Allied Gardens and a 5 percent sample was obtained in Clairemont. The purpose of selecting a 10 percent sample of dwelling units in Allied Gardens was twofold; first, because of the relatively smaller size of the subdivision, and second, to compare the results of the 10 vs 5 percent sample sizes. The 1952-53 O-D was conducted on the basis of a 5 percent sample of dwelling units.

This origin-destination study was directed, designed, organized, conducted, and

TABLE 1  
SUMMARY OF HOME INTERVIEW TRAVEL DAYS

Dwelling Unit Group	Completed Interviews by Travel Day							Total Travel Days for Which Information Was Obtained	Total Households Interviewed	Total Households in Dwelling Unit Group	Households Interviewed percent of total households
	1 Sunday	2 Monday	3 Tuesday	4 Wednesday	5 Thursday	6 Friday	7 Saturday				
1 Allied Gardens Single Family	24	26	33	35	31	30	29	208	184	1,822	10 10
2 Clairemont Apartments	5	14	13	6	6	7	5	56	51	1,024	4 98
3 Clairemont Duplexes	12	16	12	12	19	21	12	104	92	1,838	5 01
4 Clairemont Single Family (lower valuation)	23	33	17	16	25	16	24	154	131	2,623	4 99
5 Clairemont Single Family (higher valuation)	9	12	16	21	10	17	9	94	85	1,673	5 08
Total—All Clairemont Single Family	32	45	33	37	35	33	33	248	216	4,296	5 03
Total—All Clairemont Dwellings	49	75	58	55	60	61	50	408	359	7,158	5 02
Total—Allied Gardens and Clairemont	73	101	91	90	91	91	79	616	543	8,980	-

analyzed entirely by the City of San Diego. In an effort to maintain the best possible public relations, the owner's name and address of each selected sample dwelling unit was obtained from Water Department records. A letter signed by the City Manager was then sent to the owner of the dwelling unit explaining the purpose of the study and requesting his cooperation with the interviewer. The six interviewers were carefully trained and supervised, and thus, maximum accuracy was assured. The home interviewers coded each others interviews, thereby providing an important built in check. Table 1 shows the

TABLE 2  
CUSTOMERS BY TYPE ACTIVITY  
ALLIED GARDENS BUSINESS DISTRICT

Type Activity	Number of Customers	
	Thursday 7-12-56	Saturday 7-14-56
Service Station	189	209
Radio-TV Shop	14	21
Laundromat	48	81
Medical/Dental Office	15	Not Open
Barber Shop	38	54
Beauty Shop	39	42
Market	1,200	2,000
Shoe Sales-Repair	24	37
Variety Store	265	328
Drug Store	401	436
<b>Total Customers</b>	<b>2,233</b>	<b>3,208</b>

TABLE 3  
NUMBER OF CUSTOMERS BY HOUR  
ALLIED GARDENS BUSINESS DISTRICT

Time	Drug Store		Variety Store	
	Thursday 7-12-56	Saturday 7-14-56	Thursday 7-12-56	Saturday 7-14-56
10-11 a. m.	37	40	25	36
11-12 a. m.	35	32	34	39
12- 1 p. m.	35	39	17	28
1- 2 p. m.	35	40	38	34
2- 3 p. m.	46	34	29	31
3- 4 p. m.	39	39	30	33
4- 5 p. m.	40	46	25	42
5- 6 p. m.	43	64	33	43
6- 7 p. m.	46	49	4 <sup>a</sup>	2 <sup>a</sup>
Total	356	383	235	288

<sup>a</sup> Variety store closes at 6:00 p. m.; drug store closes at 7:00 p. m.

Note: This count represents the number of persons who were considered by an observer outside the entrances to have transacted some sort of business in these stores. Compared to the number of customers reported by the manager of the variety store, this count represents 89 percent of the total number of customers reported by the manager on Thursday, and 88 percent of those reported by the manager on Saturday.

study. Machine counts were conducted for 24 hours at all cordon stations during the study.

Careful field studies of the two study areas were made prior to the interviewing. During this field inventory the land use was recorded. In an effort to study the effect of economics on trip generation, the single family dwelling units in Clairemont were classified by dwelling unit valuation.

One of the underlying purposes of these origin-destination studies was to relate land use to trip generation and attraction. The attraction (drawing power) of a small residential neighborhood shopping center was studied by a customer count made at the Allied Gardens business district. Table 2 shows the customers by type activity for a typical weekday and a Saturday. Table 3 shows the attractiveness in terms of customers by time of day for two of the establishments.

The key-punching and machine analysis of the 543 home interviews and 3,682 roadside interviews was designed, supervised and carried out by the City of San Diego, using its own tabulating equipment.

The scope and accuracy of the studies are shown in Table 4. The very high accuracy indicated by the screen line checks is thought to be reasonable in view of the limited number of interviewers, their high caliber and the excellence of the supervision given in the field as well as the homogeneity of the two subdivisions.

Table 5 is a comparison of the results of the 5 and 10 percent sampling of dwelling units in Allied Gardens. The sample size of these studies is based on interviews for 7 days. This table compares various totals obtained by the two sample sizes as well as certain selected trip purposes and the screen line check. From this comparison it is concluded that a 5 percent sample size would have been adequate for over-all totals and the trip purpose analysis, but inadequate to determine travel patterns for Allied Gardens due to the serious variation in the number of interzonal transfers. Figure 4 demonstrates the significant difference in the number of interzonal transfers obtained by the two sample sizes. The importance of this is further emphasized by the relatively large size of Allied Gardens community. The

summary of travel days for which interviews were obtained by dwelling unit classification and study area.

Cordons were established around both areas and roadside interview stations were located on the entering roads—two for Allied Gardens and three stations at Clairemont. The roadside O-D interview study was designed to obtain data from a 100 percent of the outbound non-residents during a 16-hr period. A 100 percent sample of the outbound non-residents was obtained at all stations except one, Clairemont Drive, where 141 vehicles were passed during the peak hour. Clairemont Drive at that time carried an ADT of 18,340. Those vehicles that were not interviewed were classified and counted. A 100 percent classification count was made at the interview station during the 16 hours of

TABLE 4  
SCOPE AND ACCURACY

Scope of Home Interview Survey	Allied Gardens	Clairemont
Total Dwelling Units	1,822	7,158
Seven-Day Sample Size	10%	5%
Dwelling Units Interviewed	184	359
Expanded Population	6,931	27,775
Expanded Weekday Auto-Truck Driver Trips	13,442	41,647
Expanded Total, 7-day trips, all modes	21,871	86,036
<u>Accuracy—24-Hr Screen Line Check</u>		
Expanded Weekday Auto-Truck Driver Trips Crossing Cordon	6,370	20,020
Non-Resident Auto-Truck Driver Trips Crossing Cordon	3,448	7,958
Total	9,818	27,978
Counted Cordon Volume	10,245	28,329
Percent Accounted for by Interviews	95.8%	98.8%

TABLE 5  
COMPARISON OF 5 AND 10 PERCENT SAMPLES—ALLIED GARDENS

Item	5 Percent	10 Percent	Percent Difference
<b>Totals</b>			
Population	7,106	6,931	+ 2.5
Total 7-Day Trips, all modes	23,382	21,871	+ 6.9
Total 5-Day Auto-Truck Trips	13,261	13,442	- 1.4
<b>Vehicle Inventory</b>			
Cars	2,227	2,277	- 2.2
Trucks	101	109	- 7.3
Other	0	20	-100.0
Total	2,328	2,406	- 3.2
Screen Line Check	85.2%	95.8%	
<b>Trip Purpose</b>			
Percent of Work Trips	15.2	15.6	
Percent of Shopping Trips	11.0	11.8	
Subtotal Percent			
Work and Related Business Trips	36.5	35.4	
Subtotal Percent			
Vacation, Pleasure, Others	5.0	4.8	
Subtotal Percent			
Shopping, Medical, Dental Serve Passenger, etc.	58.4	59.7	
<b>Travel Pattern</b>			
Number of Interzonal Transfers			
5-Day Auto-Truck Trips	266	451	- 41.0

analyses in the balance of this paper use the 10 percent sample data of Allied Gardens.

### Travel Characteristics

Various travel characteristics of the two study subdivision developments have been summarized in the tables and figures of this report. Fortunately the automobile ownership of medium valuation single family dwelling units of both of the study areas was found to be similar, as was the combined ownership per dwelling unit of the two areas. Thus the elimination of this as a variable in the comparison between these two study areas is believed justified. The vehicle ownership of each area by type dwelling unit is given in Table 6. An interesting and expected rela-

TABLE 6  
VEHICLES PER DWELLING UNIT BY TYPE OF DWELLING  
UNIT VEHICLES GARAGED AT DWELLING UNIT

Type Dwelling Unit	Automobiles	All Vehicles
Apartments—Clairemont	1.09	1.08
Duplexes—Clairemont	1.16	1.20
Single Family, medium valuation		
Clairemont	1.15	1.21
Allied Gardens	1.22	1.27
Single Family, high valuation		
Clairemont	1.39	1.42
All Types—Clairemont	1.20	1.24
Combined Allied Gardens and Clairemont	1.21	1.25

TABLE 7  
RESIDENT TRIP GENERATION PER DWELLING UNIT IMPACT ON METROPOLITAN AREA

Trip Description	Area and Type Dwelling Unit						Average	Combined Average
	Allied Gardens		Clairemont					
	Single Family Medium Value	Single Family Medium Value	Single Family High Medium Value	Duplex	Apartment	Average		
<b>5-Day</b>								
All	10.63	10.89	11.53	8.33	8.32	10.00	10.21	
Auto Driver	6.96	5.83	6.74	4.45	4.82	5.54	6.01	
Auto-Truck Driver	7.39	6.47	6.79	4.62	4.82	5.83	6.33	
Auto-Truck Passenger	3.02	4.15	4.39	3.26	3.17	3.83	3.56	
Mass Transit Passenger	0.20	0.28	0.33	0.41	0.30	0.33	0.29	
<b>7-Day</b>								
All	10.61	11.90	12.21	8.42	8.34	10.59	10.58	
Auto Driver	6.56	6.05	7.12	4.69	4.82	5.78	6.04	
Auto-Truck Driver	7.14	6.70	7.21	4.85	4.82	6.08	6.44	
Auto-Truck Passenger	3.29	4.99	4.69	3.24	3.27	4.23	3.92	
Mass Transit Passenger	0.17	0.21	0.32	0.32	0.25	0.27	0.24	
<b>Saturday</b>								
Auto-Truck Driver	7.93	6.29	8.00	6.83	4.40	6.54	7.05	
<b>Sunday</b>								
Auto-Truck Driver	4.42	8.18	9.78	4.17	5.20	7.19	6.28	



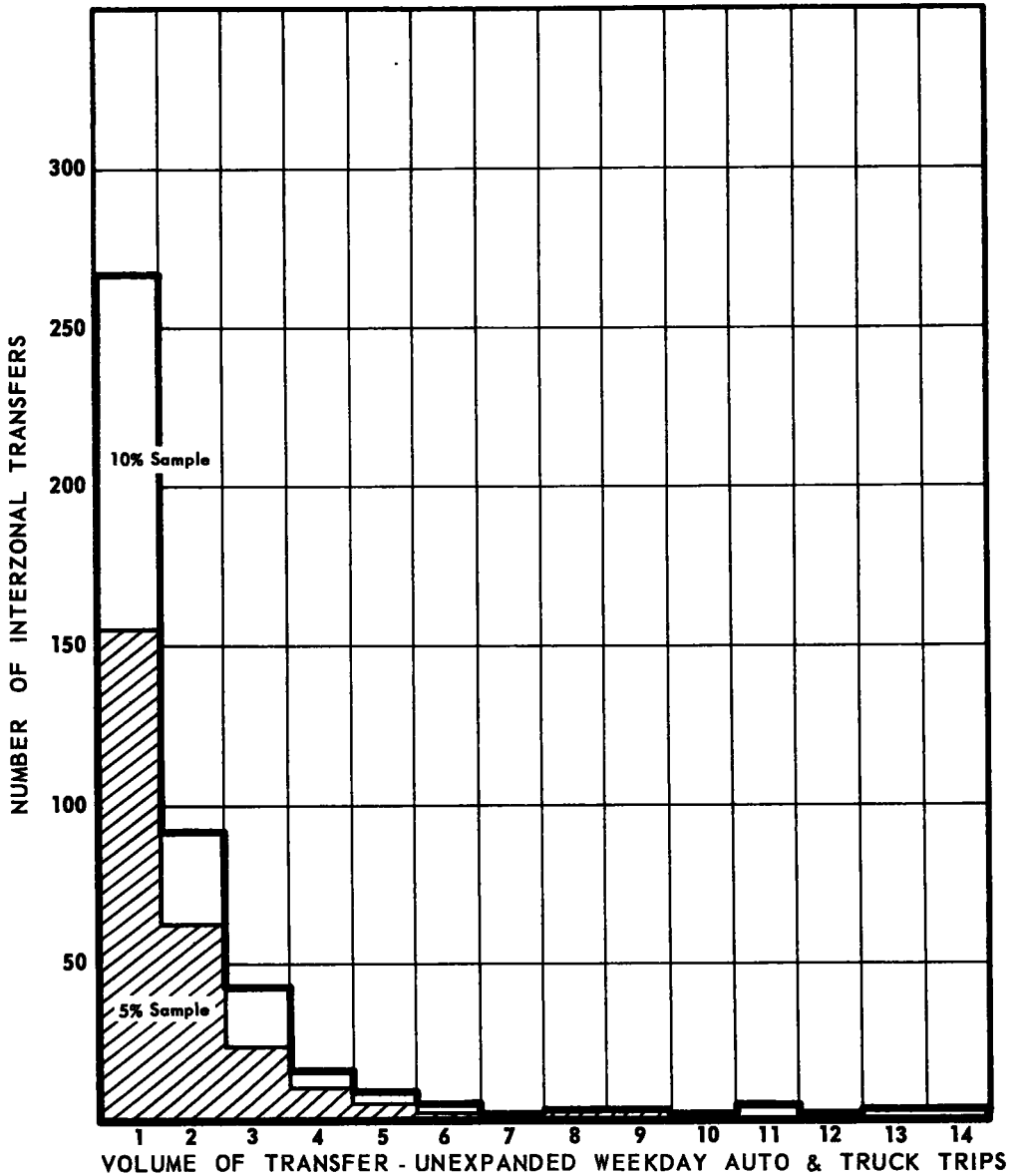


Figure 4. Comparison of 5 and 10 percent samples.

TABLE 8  
RESIDENT TRIP GENERATION OF DRIVER TRIPS PER DWELLING UNIT

Trip Description	Allied Gardens			Clairemont		Average	Combined Average
	Single Family Medium Value	Single Family Medium Value	Single Family High Medium Value	Duplex	Apartment		
5-Day Auto							
All	6.96	5.83	6.74	4.45	4.82	5.54	6.01
One or both ends in area	4.33	4.46	4.78	3.70	3.66	4.25	4.24
One end at home	3.88	3.79	4.34	3.19	3.13	3.67	3.73
5-Day Auto-Truck							
All	7.39	6.47	6.79	4.62	4.82	5.83	6.33
One or both ends in area	4.39	4.77	4.78	3.76	3.66	4.37	4.37
One end at home	3.92	3.96	4.34	3.24	3.13	3.74	3.80

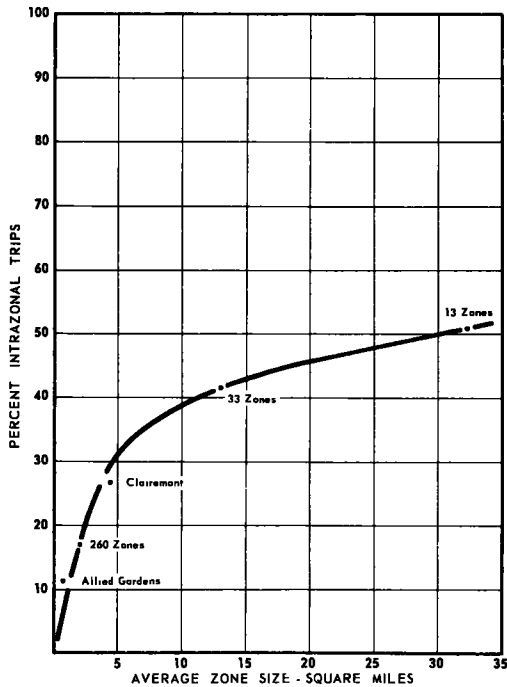


Figure 5. Auto and truck trips from 1952-53 San Diego Metropolitan Area O-D Study.

ends. Table 8 reports the generation of the 5-day auto and 5-day auto-truck driver trips for the several types of dwelling unit classifications. Again, this represents the resident impact on the total metropolitan area. Tables 7 and 8 develop the relation-

TABLE 9  
WEEKDAY RESIDENTIAL AUTO-TRUCK ORIGIN  
GENERATION CALCULATION

Elements	Allied Gardens	Clairemont
Expanded Resident Trips One or Both Ends in Area	8,000	31,200
Expanded Resident Trips One End in Area (intra-area trips removed)	5,930	20,040
Percent Intra-Area Trips	11.9	26.7
Resident Origins	5,035	21,180
Resident Origins at Residences (Commercial origins removed)	4,378	18,700
Resident Origins at Residents (Screen line factor applied)	4,570	18,950
Non-Resident Origins at Residences (Commercial origins removed)	1,544	3,375
Residential Area Origins Total	6,114	22,325
Per Dwelling Unit	3.35	3.12
Per Person	0.87	0.80
Residential and Commercial Area Origins Total	6,951	25,409
Per Dwelling Unit	3.82	3.55
Per Person	0.99	0.91

tion between dwelling unit type and automobile ownership was found to exist.

Table 7 gives the trip generation per dwelling unit for 5-day, 7-day, and weekend trip types. This table represents the total resident generating impact of the study subdivisions on the entire metropolitan area regardless of location of trip

TABLE 10  
WEEKDAY AUTO-TRUCK TRIP PURPOSE PERCENTAGE DISTRIBUTION

Destination Purpose	24-Hr 1952-53 O-D Summary	Trip Purpose as Percent of Total					
		24-Hr	Allied Gardens		24-Hr	Clairemont	
			A. M. Peak Period	P. M. Peak Period		A. M. Peak Period	P. M. Peak Period
Work	15.3	15.6	55.2	8.6	16.3	58.0	3.5
Related Business	21.5	19.8	4.7	18.9	7.1	4.4	2.7
Subtotal	36.8	35.4	59.9	27.5	23.4	62.4	6.2
Medical and Dental Shopping	0.7	0.8	1.0	-	0.7	-	-
Convenience Goods Shopping Goods	-	9.3	1.9	10.0	9.9	1.1	14.5
Total	7.9	11.8	1.9	11.3	12.4	1.1	15.5
Education, Civic and Religion	1.3	0.5	1.9	-	0.7	2.7	-
Eat Meal	1.7	2.0	1.0	1.8	2.7	2.2	1.6
Serve Passenger	10.4	11.6	24.8	12.2	13.6	24.6	19.3
Personal Business	5.1	6.4	1.0	5.4	6.6	1.1	6.5
Change Travel Mode	0.5	0.6	3.8	0.5	0.5	1.6	-
Home	28.6	26.0	3.8	37.8	31.7	3.3	45.6
Subtotal	56.2	59.7	39.2	69.0	68.9	36.6	88.5
Vacation	-	-	-	-	0.2	-	-
Pleasure	0.4	1.6	-	1.3	2.2	0.5	1.4
Others	6.4	3.2	1.0	2.3	5.2	0.5	3.8
Subtotal	6.8	4.8	1.0	3.6	7.6	1.0	5.2
Unknown	0.2	-	-	-	-	-	-
Total	100.0	99.9	100.1	100.1	99.9	100.0	99.9

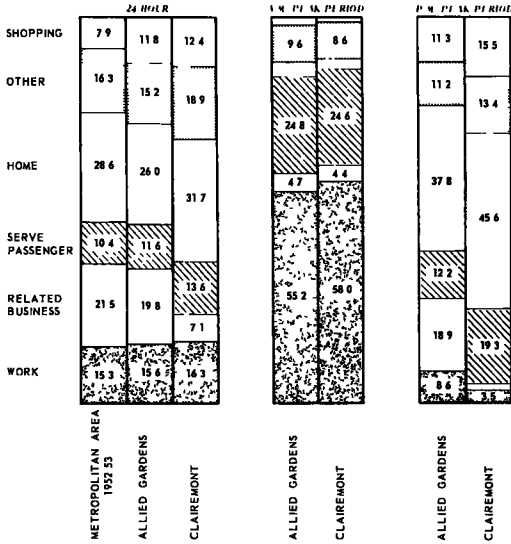


Figure 6. Weekday auto-truck trip purpose percentage distribution.

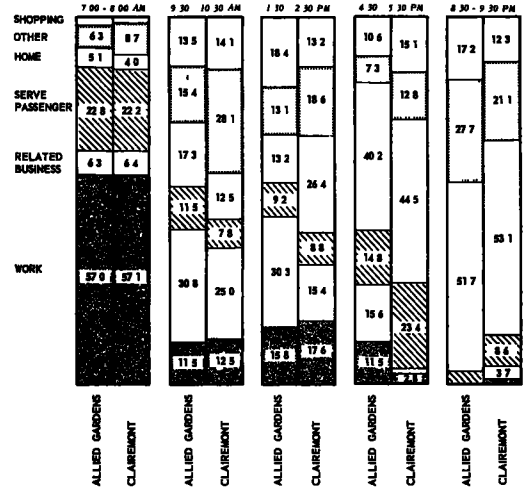


Figure 7. Weekday auto-truck trip purpose percentages by selected hours.

follow use the auto-truck driver trips to develop relationships as these are believed to be the desired end result.

It has been found in several studies that the effect of the intrazonal (intra-area) trip is significant and should be considered in the development of trip generation data. Figure 5 is a plot of the relationship between zone size and the percent of intrazonal trips. Allied Gardens and Clairemont are plotted as specific points to show their relationship to the metropolitan area curve. Table 9 indicates the calculations that are necessary to determine the weekday residential origins generated at a dwelling unit. Table 9 gives origins per dwelling unit for residential and for combined residential and commercial areas of the two subdivisions. Approximately 0.7 percent of the us-

ships between auto driver and auto-truck driver trips. The various analyses that

TABLE 11  
AVERAGE WEEKDAY AUTO-TRUCK TRIP PURPOSES BY SELECTED HOURS—ALLIED GARDENS

Destination Purpose	Interview Trips and Percent Distribution									
	7:00-8:00 a. m.		9:30-10:30 a. m.		1:30-2:30 p. m.		4:30-5:30 p. m.		8:30-9:30 p. m.	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Work	45	57.0	6	11.5	12	15.8	14	11.5	-	-
Related Business	5	6.3	16	30.8	23	30.3	19	15.6	-	-
Subtotal	50	63.3	22	42.3	35	46.1	33	27.0	-	-
Medical and Dental Shopping	1	1.3	2	3.8	1	1.3	-	-	-	-
Convenience Goods Shopping	2	2.5	5	9.6	10	13.2	11	9.0	5	17.2
Shopping Goods	-	-	2	3.8	4	5.3	2	1.6	-	-
Total	2	2.5	7	13.5	14	18.4	13	10.6	5	17.2
Education, Civic and Religion	1	1.3	-	-	-	-	-	-	-	-
Eat Meal	1	1.3	-	-	-	-	1	0.8	2	6.9
Serve Passenger	18	22.8	6	11.5	7	9.2	18	14.8	1	3.4
Personal Business	1	1.3	3	5.8	4	5.3	5	4.1	3	10.3
Change Travel Mode	1	1.3	-	-	-	-	-	-	-	-
Home	4	5.1	9	17.3	10	13.2	49	40.2	15	51.7
Subtotal	29	36.7	27	51.9	36	47.4	86	70.5	26	90.0
Vacation	-	-	-	-	-	-	-	-	-	-
Pleasure	-	-	-	-	1	1.3	1	0.8	1	3.4
Others (visit friends, etc.)	-	-	3	5.8	4	5.3	2	1.6	2	6.9
Subtotal	-	-	3	5.8	5	6.6	3	2.5	3	10.3
Total	79	100.0	52	100.0	76	100.1	122	100.0	29	100.3

able gross acres in Allied Gardens and 0.8 percent of the gross acres of Clairemont were in commercial uses at the time of the survey. It is interesting to note that 40.7 percent of the trips generated by Allied Gardens and 25.2 percent of the trips generated by Clairemont have both ends outside the respective areas. This is a function of zone size as is the intrazonal relationship.

One of the purposes of the study of these two subdivisions was to test the possibility of forecasting future trips using the a. m. peak period work trip and then expanding the projection by the relation of the work trip to all trips on a 24-hr basis. Table 10 gives the weekday auto-truck trip purpose in Allied Gardens and Clairemont for the 24-hr

TABLE 12  
AVERAGE WEEKDAY AUTO-TRUCK TRIP PURPOSES BY SELECTED HOURS—CLAIREMONT

Destination Purpose	Interview Trips and Percent Distribution									
	7:00-8:00 a. m.		9:30-10:30 a. m.		1:30-2:30 p. m.		4:30-5:30 p. m.		8:30-9:30 p. m.	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Work	72	57.1	8	12.5	16	17.6	6	2.8	1	1.2
Related Business	8	6.4	16	25.0	14	15.4	3	1.4	3	3.7
Subtotal	80	63.5	24	37.5	30	33.0	9	4.1	4	4.9
Medical and Dental	-	-	5	7.8	2	2.2	-	-	-	-
Shopping										
Convenience Goods	2	1.6	6	9.4	9	9.9	31	14.2	8	9.9
Shopping Goods	-	-	3	4.7	3	3.3	2	0.9	2	2.5
Total	2	1.6	9	14.1	12	13.2	33	15.1	10	12.3
Education, Civic and Religion	4	3.2	-	-	-	-	-	-	-	-
Eat Meal	4	3.2	-	-	-	-	2	0.9	3	3.7
Serve Passenger	28	22.2	5	7.8	8	8.8	51	23.4	7	8.6
Personal Business	2	1.6	7	10.9	8	8.8	14	6.4	3	3.7
Change Travel Mode	-	-	-	-	-	-	-	-	1	1.2
Home	5	4.0	8	12.5	24	26.4	97	44.5	43	53.1
Subtotal	45	35.7	34	53.1	54	59.3	197	90.4	67	82.7
Vacation	-	-	1	1.6	-	-	-	-	-	-
Pleasure	1	0.8	2	3.1	3	3.3	4	1.8	3	3.7
Others (visit friends, etc.)	-	-	3	4.7	4	4.4	8	3.7	7	8.6
Subtotal	1	0.8	6	9.4	7	7.7	12	5.5	10	12.3
Total	126	100.0	64	100.0	91	100.0	218	100.0	81	99.9

TABLE 13  
WEEKDAY VS WEEKEND AUTO-TRUCK TRIP PURPOSE PERCENTAGE DISTRIBUTION

Destination Purpose	Trip Purpose by Percent of Total					
	Allied Gardens			Clairemont		
	Weekday	Saturday	Sunday	Weekday	Saturday	Sunday
Work	15.6	7.9	5.7	16.3	9.5	5.2
Related Business	19.8	16.7	3.8	7.1	6.8	14.6
Subtotal	35.4	24.6	9.5	23.4	16.3	19.8
Medical and Dental	0.8	1.3	-	0.7	0.3	0.3
Shopping						
Convenience Goods	9.3	9.6	18.9	9.9	13.2	8.8
Shopping Goods	2.5	6.6	4.7	2.5	4.6	2.1
Total	11.8	16.2	23.6	12.4	17.8	10.9
Education, Civic and Religion	0.5	0.9	2.8	0.7	-	4.0
Eat Meal	2.0	3.5	4.7	2.7	4.0	1.4
Serve Passenger	11.6	11.4	8.5	13.6	13.2	11.2
Personal Business	6.4	7.9	3.8	6.6	7.4	6.0
Change Travel Mode	0.6	1.3	-	0.5	-	0.3
Home	26.0	23.3	28.3	31.7	30.7	30.4
Subtotal	59.7	65.8	71.7	68.9	73.4	64.5
Vacation	-	0.9	-	0.2	-	-
Pleasure	1.6	2.2	3.8	2.2	4.9	6.3
Others	3.2	6.6	15.1	5.2	5.5	9.5
Subtotal	4.8	9.7	18.9	7.6	10.4	15.8
Total	99.9	100.1	100.1	99.9	100.1	100.1

period and compares this to the 1952-53 O-D survey. Table 10 also shows the a. m. and p. m. peak period trip purpose in the two subdivisions. The data in Table 10 indicates a stability of the a. m. peak period work trip and the total of work and related business trips of the two study subdivisions. Figure 6 graphically presents a comparison of selected purposes. However, it should be borne carefully in mind that an orientation of the generated trips using a. m. peak period work trips would be based on a very weak percent of total 24-hr trips; even for areas as large as Allied Gardens and Clairemont. Tables 11 and 12 emphasize the trip purpose sample size problem. These tables indicate the destination purposes of trips reported for a typical weekday by residents for selected hours for Allied Gardens and Clairemont. Figure 7 summarizes the data contained in Tables 11 and 12.

Table 13 and Figure 8 compare the weekday and the weekend auto-truck trip purpose. Generally the expected daily trends are borne out, with shopping trips being highest on Saturday and work trips reducing on Saturday and reaching the lowest percent on Sunday. It is interesting to note, however, that there seems to be a considerable amount of shopping at Allied Gardens on Sunday as compared to Clairemont. This could possibly be due to sampling error.

The distribution or orientation of the generated trips is really the significant problem of forecasting future travel. The ability to determine a close approximation of the resident generated origins is within reach. The pattern of the Allied Gardens resident auto-truck desire lines is shown in Figure 9. These desire lines were plotted per thousand dwelling units in order to make them comparable to the Clairemont auto-truck pattern as well as the transit patterns. Figure 10 shows the Clairemont pattern of resident auto-truck desire lines per thousand dwelling units.

The orientation pattern is simply demonstrated by studying the straight line trip length distribution. The trip length distribution for the metropolitan area in 1952-53 is given in Figure 11. Figure 11 also includes the trip length distribution of all auto-truck trips with one end in Allied Gardens or Clairemont and for work trips with one end in the respective area. The close relationship between work trips generated in one area or the other and between all trips generated in the two study areas is quite encouraging. A study of these curves clearly indicates that there are fewer short all-purpose trips from outlying subdivisions than there are for the whole metropolitan area. The trip length distribution of the auto-truck trips with one end in the area comparing the convenience shopping to the shopping goods trips of Allied Gardens and Clairemont is shown in Figure 12. Again the trip purpose relationships between the two areas appear to be good.

The trip length cumulative curves developed in Figures 11 and 12 were drawn by connecting actual point plots. Smooth curve relationships can be interpreted from these data and are believed to exist. Certain characteristics of the presented trip length distribution curves appear to be satisfactorily explained by existing conditions and therefore data from additional areas will be required in order to develop these smooth curves. Figures 13 and 14 present the trip destination purpose family of curves of the major purposes selected for Allied Gardens and Clairemont respectively. Related business trips have been plotted as two curves for each area. One plots related business trips with one end in the area and the other plots trips with neither end

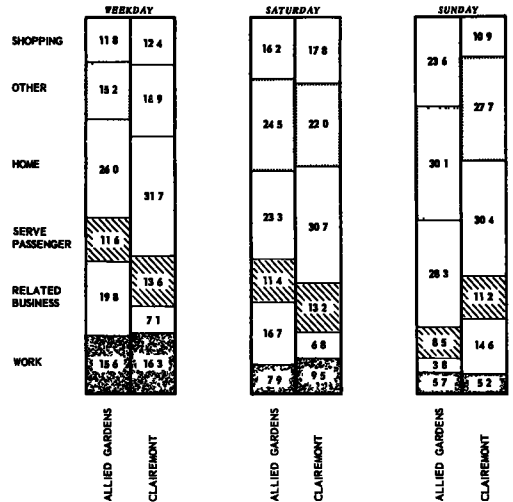


Figure 8. Weekday vs weekend auto-truck trip purpose percentage distribution.

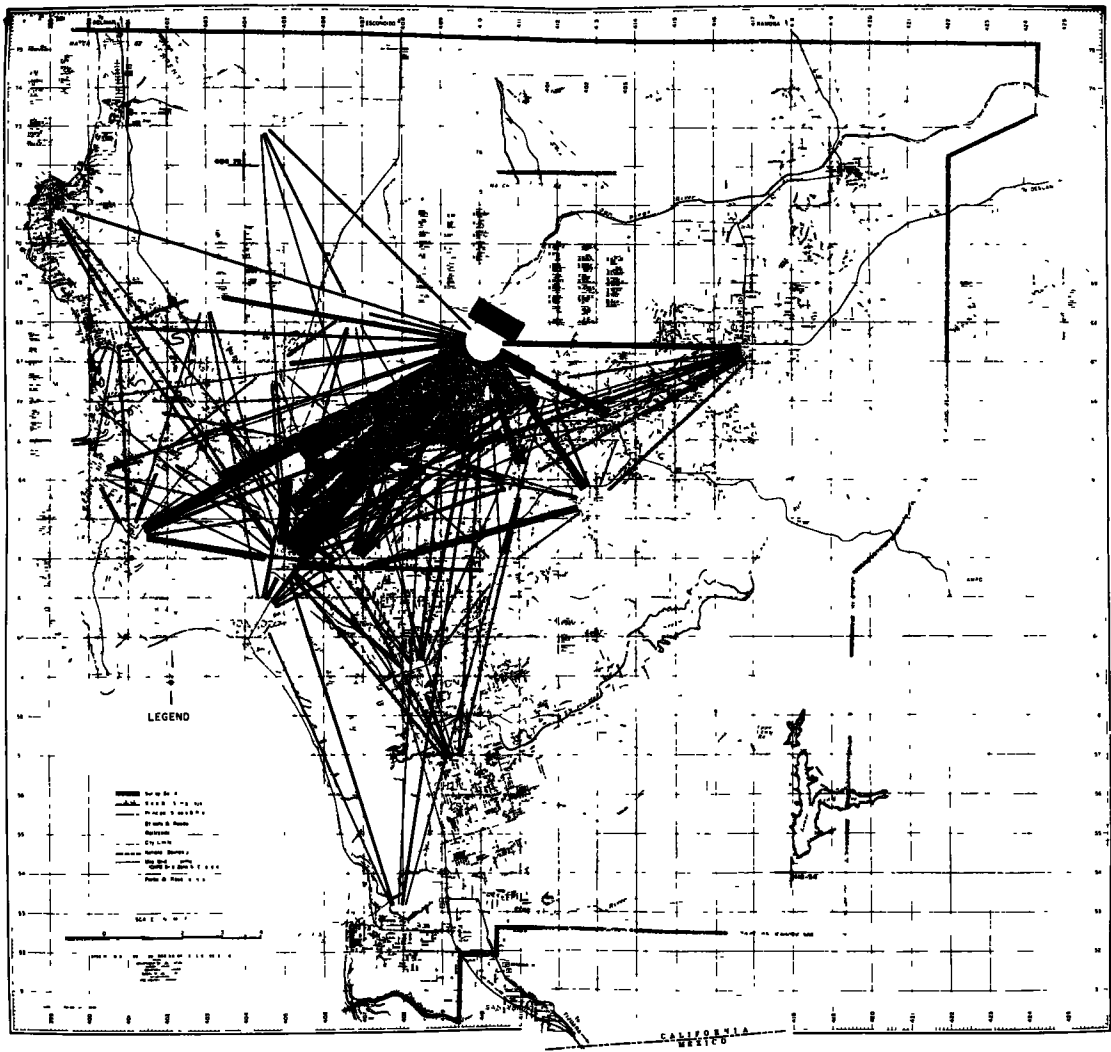


Figure 9. Allied Gardens auto and truck trip desire lines per 1,000 dwelling units, June-July 1956.

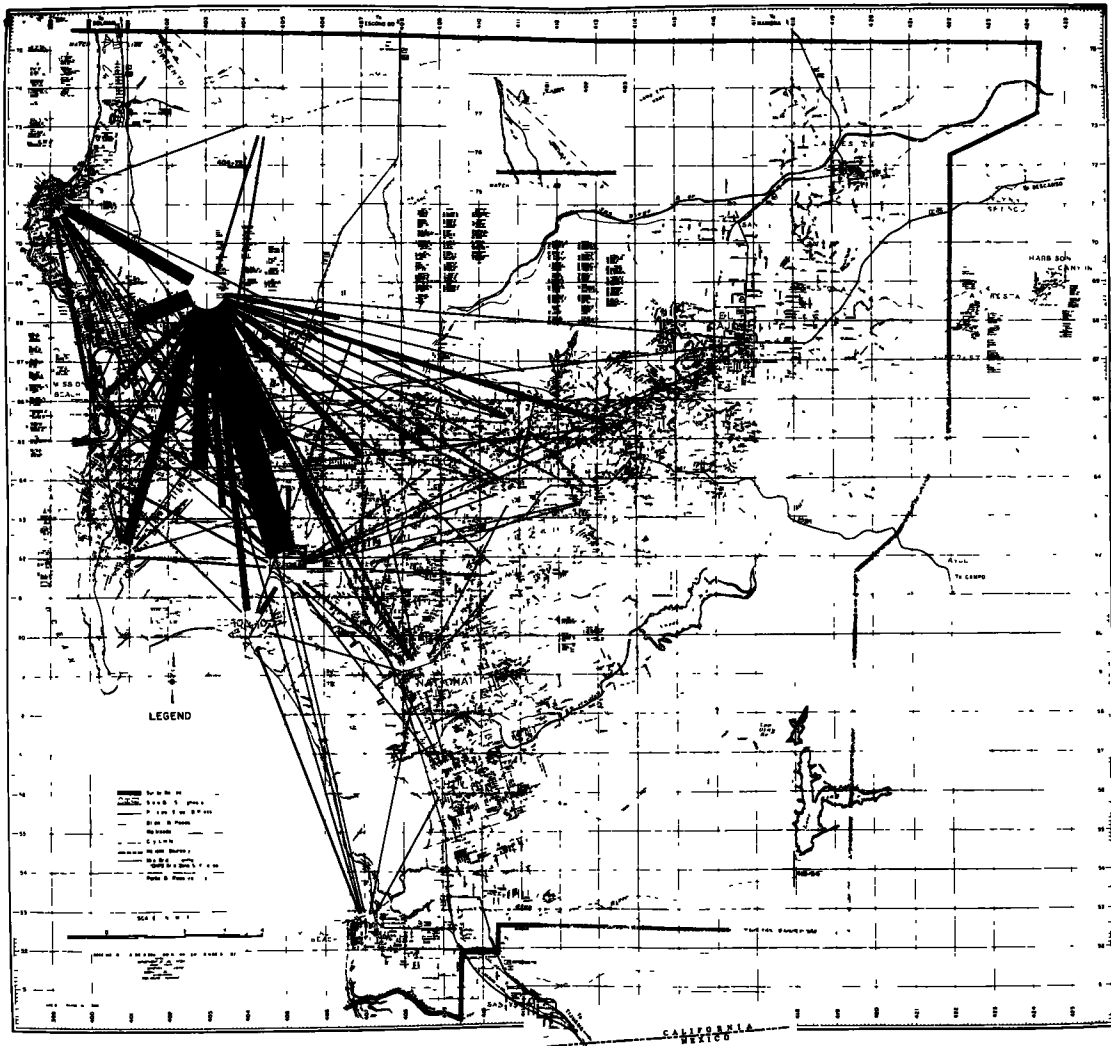


Figure 10. Claremont auto and truck trip desire lines per 1,000 dwelling units, June-July 1956.





in the study area. It is interesting to note that the related business trips form the only significant difference in the pattern of the two families of curves.

Southern California has developed in the age of the motor vehicle; consequently, primary attention is focused on the freeways and major streets and highways and their development. However, throughout the San Diego Metropolitan Area Transportation Study an effort has been made to keep the role of transit in proper perspective. Table 14 contains the weekday mode of travel distribution of the two study areas.

TABLE 14  
WEEKDAY TRIP 24-HOUR VOLUME BY MODE

Mode of Travel	Allied Gardens		Clairemont	
	Number	Percent	Number	Percent
Auto-Truck Driver Trips	10,245	98.2	28,329	95.9
Bus Passenger Trips	202	1.8	1,206	4.1
Total Trips <sup>a</sup>	10,447	100.0	29,535	100.0

<sup>a</sup> Excludes auto-truck passenger trips.

Figure 15 presents the transit desire lines per thousand dwelling units for Allied Gardens and Clairemont. The desire lines clearly indicate some relation between the level of service and the use of transit exists. Clairemont has direct service to the major employment areas as well as downtown while Allied Gardens requires at least one transfer to reach similar destinations. Efforts are continuing to more empirically define the complex but important relationships between level of service and transit use. Figure 16 contains the trip length distribution of the metropolitan area 1952-53 mass

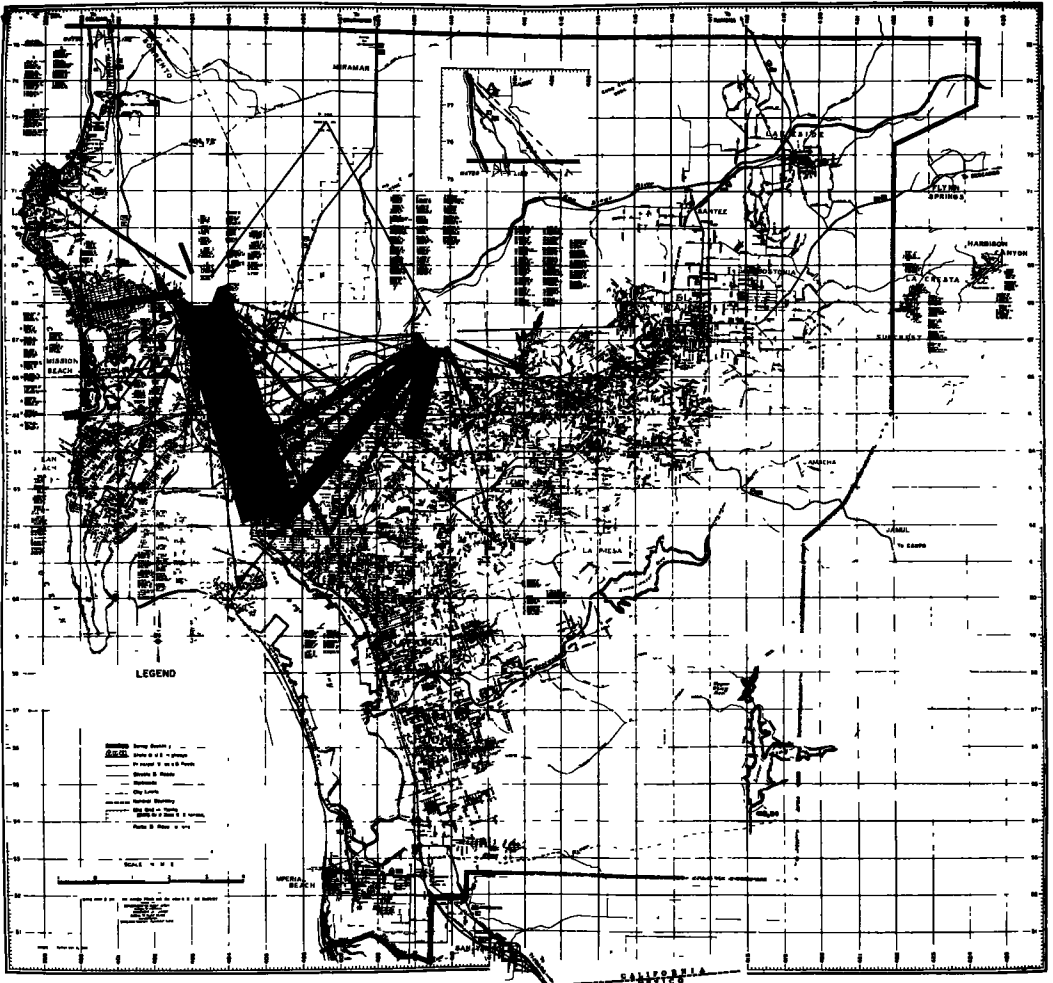


Figure 15. Outbound bus passenger desire lines per 1,000 dwelling units.

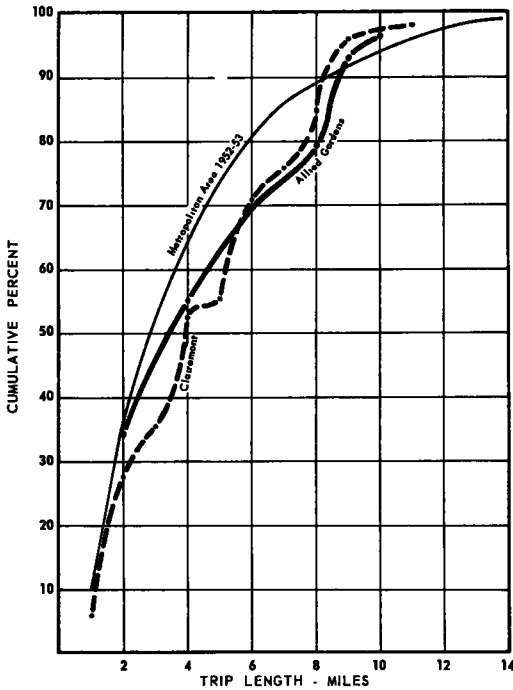


Figure 16. Cumulative percentage distribution of trip length, mass transit passengers.

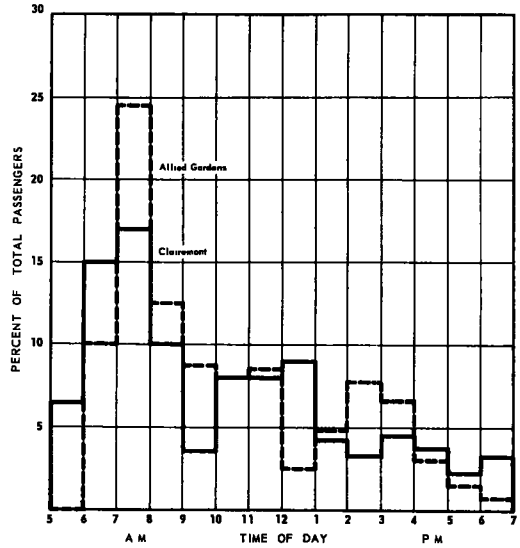


Figure 17. Percentage-time distribution of outbound bus passengers, two-day average, June-July 1956.

transit trips and the mass transit trips of Allied Gardens and Clairemont. The close relation of the trip length curves of the two study areas is the more interesting because of the wide variance in the transit level of service. The percentage time of day distribution of outbound bus passengers for the two study areas is compared in Figure 17.

Freeway usage by residents of the two subdivisions was coded during the interviews. Table 15 summarizes the actual freeway use and incorporates a further experiment in the accuracy of projecting from the a. m. peak hour volumes. The sample size, as well as the expansion factor, play an important part in the accuracy of the expansion.

TABLE 15  
ACTUAL FREEWAY USAGE VS EXPANDED PEAK HOUR USAGE  
ALLIED GARDENS-CLAIREMONT O-D SURVEY

Freeway-Expressway Section	A. M. Peak Hour Volume	Expanded 24-Hr Volume	Actual 24-Hr Volume	Percent Difference	Distance in Miles Centroid to Center	
					Allied Gardens	Clairemont
Pacific Highway (US 101) - US 80 to North City Limits	48	525	471	11.5	8	1
Mission Valley Road (US 80) - US 101 to US 395	27	295	279	5.7	6	4
Mission Valley Road (US 80) - US 395 to Fairmount	35	383	352	9.9	3	5
Alvarado Canyon Road (US 80) - Fairmount to Fletcher Parkway	32	350	359	- 2.5	1	8
El Cajon Boulevard (US 80) - Fletcher Parkway to Chase	3	33	34	3.1	4	12
Cabrillo Freeway (US 395) - Ash to US 80	21	230	229	0.4	6	5
Cabrillo Freeway (US 395) - US 80 to North City Limits	4	44	37	18.9	4	3
Wabash Avenue - Harbor to University	3	33	34	- 2.9	6	8
Montgomery Freeway (US 101) - 8th St., National City to Border	2	22	33	-33.3	10	12
Fletcher Parkway - US 80 to Lake Murray Blvd.	2	22	24	- 8.3	4	11
<b>Total</b>	<b>105</b>	<b>1,937</b>	<b>1,850</b>	<b>4.7</b>		

A third important variable, which relates to sample size, is the distance from the origin of the trip to the particular freeway or expressway section. Table 15 indicates that generally, freeway usage could be estimated with reasonable accuracy when expanding on the a. m. peak hour volume, particularly when the trip is under 5 or 6 miles in length.

### SUMMARY

These studies of the travel characteristics of two San Diego subdivision developments have furnished accurate data on trip generation and dwelling unit origin generation. The trip generation data by type of dwelling unit appears to be significantly different and is helpful in developing trip origins. The trip origin calculation furnishes a sound basis for differentiating between the resident generated origins and the total auto-truck origins from all parts of the metropolitan area to be expected in a typical subdivision.

The general close similarity of the 24-hr trip destination purpose of the auto-truck trips between the metropolitan O-D study and the two specific study areas is encouraging and again suggests that consistent relationships between land use and trip generation do exist. The trip destination purpose analysis has given a clear 24-hr picture and an indication of the time profile of trip purpose to be expected. Trip purpose projections would appear to be generally on a weak statistical base, except for a. m. peak hour or peak period work trips or combined work and related business trips. This is particularly significant in view of the relatively large size of the two study developments. The trip length relation by trip purpose between the two study areas is borne out in several of the figures presented and is useful for the orientation of generated trips. Thus, it is concluded that there is a relationship between trip generation and orientation, and land use.

Several of the relationships developed from this intensive study of two subdivision developments in San Diego have been used in conjunction with the traffic generator study to make a forecast of future year origins in each of 234 traffic assignment zones within the metropolitan transportation study area. The development of future (horizon) year origins was based on the land use and population estimates of the city and county planning departments. The origins were summated by residential, commercial, industrial, major institutional, parks and recreational, and military uses. Future year trips for a population of 2.3 million are now being distributed over a study system of freeways, expressways, and major streets and highways by the California Division of Highways.

There is a need for further study to develop additional traffic generator data, particularly in the commercial and industrial uses. Much still must be done to develop empirical distribution relationships between land use and travel patterns in order to orient the generated trips. As the federal aid highway program reaches high gear it is particularly important to be able to apply soundly developed relationships between travel and land use to urban freeway and major street planning.