

# Dallas Traffic-Survey Methods and Cost Analysis

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The rapid growth in population of the metropolitan area of Dallas, with the corresponding growth in the traffic of the area, has resulted in the need for information to guide planning for immediate relief and future development. In 1950 and 1951 a comprehensive traffic survey embracing both external and internal traffic surveys of the 215-sq. -mi. metropolitan area supplemented by external origin-and-destination surveys at six outlying incorporated cities, and a parking survey of the central business district of Dallas was undertaken by the city and the state in cooperation with the Bureau of Public Roads. Current land-use data were obtained while selecting the internal sample.

Provision was made for recording detailed costs expressed in work units applicable to future projects of this nature. A brief description of the methods used in the survey with recorded unit and total cost data are expressed.

Application of the findings in the solution of the traffic problem are outlined. Land-use data found a place in planning for future traffic development.

● DURING the latter part of 1950 and early 1951, comprehensive traffic and parking surveys were made in the Dallas metropolitan area. In January 1951 a progress report on these surveys was presented to the Highway Research Board by D. K. Shepard. This paper is a final report, treating of the methods employed in the surveys and devoting major attention to the cost analysis of the project with the thought of furnishing data which may be used for planning and estimating similar undertakings.

Dallas, like many other cities, emerged from the wartime suspension of major street and highway improvements with the realization that drastic and immediate action was advisable to provide for the formation of a new and modern master plan.

By 1950, Dallas had exceeded both the population and vehicle registrations predicted for 1970. The population had increased from 295,000 persons in 1940 to over 430,000 persons in 1950. The area of the city proper had been extended from 50 sq. mi. in 1944 to 122 sq.mi. in 1950, with other annexations planned to bring the area to more than 150 sq. mi. in 1951.

To be able to formulate a new and modern master plan providing for the existing traffic volumes and to be able to plan wisely for future growth, it was evident that current and comprehensive traffic data were

needed. The selection of an east-west expressway route was being studied, and this fact added further impetus to the demand for the data. With these demands in mind, the City of Dallas requested and received the cooperation of Dallas County, the Texas Highway Department, and the Bureau of Public Roads in a traffic survey of the entire metropolitan area.

In preliminary conferences, representatives of the Bureau of Public Roads, Texas Highway Department, and the County and City of Dallas outlined the scope of the survey. The extent of the survey was limited to the estimated cost of \$100,000, and all available cost data were brought into use to outline a project which would provide the greatest value within this limit. The need of more extensive cost data was apparent, and it is the intent of this paper to place the information gained in form for such use.

The metropolitan area selected included an area of 215 sq. mi. with a population of 517,035. The area included nine incorporated cities which are completely surrounded by the Dallas incorporation.

In addition to this coverage of the metropolitan area, external origin-destination surveys were conducted at six outlying incorporated cities to obtain data for a county-wide, major thoroughfare plan to supplement the Dallas thoroughfare plan.

The population covered in the survey was 517,035 persons in the internal survey and 20,066 persons in the outlying communities, or a total of 537,101 persons - 88 percent of the total population of Dallas County.

The administration of the survey was assigned to the Traffic Section of the Highway Planning Survey, which organization furnished personnel to serve as project manager; supervisors of internal, external, and parking surveys; and chief accountant.

All other personnel were employed locally or borrowed from various city departments. For various phases of the operations, the city traffic engineer and city plan engineer assigned personnel to the survey; however, the unit cost records given in this report reflect this expense based on regular rates of pay for each item of work accomplished. Such personnel as the city furnished free of cost to the project are also reflected in the unit costs at the rates of pay charged for similar work.

The rates of pay for personnel were as follows: \$1 per hour for interviewers, samplers, office clerks and coders; \$1.25 to \$1.50 per hour for crew leaders; supervisors for each phase of the survey were paid on a monthly rate at \$225 to \$250 per month. In general all personnel, other than supervisory, were obtained from the Texas Employment Commission. One exception to this was the manner of obtaining home interviewers. Contact was made with district census director, who furnished a list of names of the census enumerators in the census which had just been completed. Excellent personnel were obtained by this method.

A detailed accounting system was established to be able to determine actual costs and man-hour requirements for each unit of all phases of the survey. Time slips showing actual man-hours used on each phase of the work were submitted daily by each supervisor. These costs, along with material and supply costs, were posted to each operation daily using a control ledger system and accounts journal. This not only kept an accurate record of costs and man-hours for final reports, but made possible periodic summaries of accumulated costs for each unit of operation. The costs reflected include administration and administrative overhead of the field office and field operation. They do not include administrative costs of the higher echelon and should be so interpreted. Excellent

weather conditions throughout the period of the field survey served to hold costs to a minimum.

Office space was available for 60 people, and this space was used to the maximum during the peak period of operations.

## THE SURVEY

The study was divided into three phases: (1) the internal survey, consisting of (a) sampling, with related land use, (b) home interviews, (c) truck interviews, and (d) taxi interviews; (2) the external survey; and (3) the parking survey.

TABLE I  
DALLAS METROPOLITAN AREA TRAFFIC SURVEY  
COST REPORT SUMMARY - MAY 1, 1952

	Total Man Hours	Total Project Costs
ADMINISTRATION	7192	\$ 11574 22
EXTERNAL SURVEY	14323	17183 82
INTERNAL SURVEY	24089	27714 17
O & D REPORT	3419	6920 62
DALLAS COUNTY O & D	3392	4347 89
PARKING SURVEY	23189	29585 45
GRAND TOTAL	75605	\$ 97326 17

## INTERNAL SURVEY

### Sampling

A 5-percent sample of dwelling units was used for the entire metropolitan area. In selecting the sample, it was found that the Sanborn maps, in addition to being obsolete, covered a very small portion of the area to be surveyed. The City Plan Department had available land-use maps drawn to scale 1 in. to 400 ft. which had been maintained approximately up to date. It was determined that the most-accurate way of obtaining a sample was to use these land-use maps as a guide and actually travel in the field, checking the land-use maps against actual land use, and at the same time, bringing the maps up to date by notations relative to new occupancy or abandonment of dwelling units or other structures in the area. The samples were selected by two-man teams in automobiles. The driver called the type of occupancy of each dwelling to his recorder, who made the proper notations on the map. The driver kept count of the total dwelling units and called the house number of the sample to his

recorder, who recorded the addresses of the samples on a form provided for this purpose. In this manner, the sample was selected in every instance from a field inspection, and the City Plan Department, at the same time, obtained data for an up-to-date land-use map not only of Dallas but of the entire metropolitan area.

sample selection required 3,786 man-hours at a total cost of \$4,509.80. The unit cost of sample selection was 52 cents per sample for field work and 17 cents for mapping and supplies, or a total of 69 cents per sample.

It is believed that the value of the current land-use information for both present

TABLE 2

## DALLAS METROPOLITAN AREA TRAFFIC SURVEY

## ADMINISTRATIVE COST DATA

ADMINISTRATION	Date Started	Date <sup>2/</sup> Completed	Total Man Hours	Total Costs
<b>OFFICE OPERATIONS</b>				
Supervision	10-2-50	3-7-51	1617	\$ 4564.88
Accounting	10-2-50	12-1-51	1100	1343.45
Clerical	10-2-50	3-7-51	1118	1246.78
Typing	10-22-50	3-1-51	500	500.00
Drafting	11-12-50	3-3-51	237	265.41
Office Supplies			-	603.15
Postage & Freight			-	108.92
Office Equipment Rental			-	420.00
Total Office Operations			4572	9052.59
<b>OFFICE BUILDING MAINTENANCE</b>				
Labor <sup>1/</sup>	10-3-50	3-7-51	2620	1904.30
Supplies			-	113.77
Utilities			-	503.56
Total Office Bldg. Maintenance			2620	2521.63
<b>TOTAL ADMINISTRATION</b>			7192	11574.22

1/ Night Watchmen and Janitor Service.

2/ Dallas Field Office only.

For this phase of the work the City Plan Department and Traffic Control Department furnished the original personnel to train new men as they were employed. At the peak of this activity seven crews were in the field. It was found that careful selection of personnel for this work was vitally important and required men with good educational background and a thorough knowledge of the city.

The preparation of numerous base maps necessary for this work required 1,081 man-hours at a cost of \$1,425.01. This cost included map reproduction and supplies. In addition, the actual field work of

and future planning will be well worth the additional cost, for with these data it will be possible to expand trip information by areas as these areas develop.

In the Truck Study a 10-percent sample of all trucks registered and operated within the metropolitan area was selected from the state's motor-vehicle-registration records. A total of 2,519 truck samples required 286 man-hours at a unit cost of 12 cents per sample.

A 20-percent sample of all taxis operating in the area was selected from taxi-company records. This required only 10 man-hours and cost 13 cents per sample.

## Interviewing

Trip information involving all modes of transportation for each member of the household over 5 yr. of age was obtained at each dwelling unit selected for the sample. Supervisors with crews of 10 interviewers were assigned to census tracts and each tract was completed, except for call backs, before moving into a new area. Call backs were assigned to one interviewer with a car.

The use of census tracts as subareas for

dwelling-unit interviews proved well worthwhile for checking purposes. As soon as a tract was completed, summary data were expanded and compared with pertinent census data.

Interviewers were schooled for 2 days before starting actual field work. Excellent publicity was obtained through newspapers and radio and television stations. Letters explaining the purpose of the study were sent to occupants of all dwelling units selected as samples, as well as to truck owners and taxicab operators.

TABLE 3

## DALLAS METROPOLITAN AREA TRAFFIC SURVEY

INTERNAL STUDY  
UNIT COST DATA

INTERNAL SURVEY	Date Started	Date Completed	Units of Work Accomplished	Total Man Hours	Total Cost	UNIT COST	
						Field	Total
MAP PREPARATION	10-9-50	2-3-51	-	1081	\$ 1425 01 <sup>2/</sup>	\$ -	\$ -
SAMPLING							
Dwelling Units <sup>1/</sup>	10-9-50	1-12-51	8621	3786	4509 80	-	523
Trucks	12-7-50	1-9-51	2519	286	309 45	-	123
Taxis	2-3-51	2-10-51	82	10	11 00	-	.134
Total Sampling			11222	4081	4830 25	-	430
INTERVIEWING							
Dwelling Units - Office	11-6-50	2-3-51	-	1406	2440 37	-	-
Dwelling Units - Field	11-6-50	1-15-51	8086	7949	8782 95	1 081	1 383
Trucks - Office	1-7-51	3-1-51	-	198	401 43	-	-
Trucks - Field	1-7-51	2-24-51	1945	2075	2569 10	1 321	1 527
Taxis - Office	2-3-51	2-10-51	-	4	5 12	-	-
Taxis - Field	2-3-51	2-10-51	82	247	312 39	3 810	3 872
Total Interviewing			10113	11879	14471 36	1 149	1 431
CODING (Interviews)							
Coding Index <sup>3/</sup>	11-16-50	1-3-51	-	376	430 84	-	-
Coding - Dwelling Unit	11-15-50	1-20-51	8086	3476	3476 00	-	430
Coding - Truck	1-10-51	3-1-51	1945	1114	1165 86	-	599
Coding - Taxi	2-24-51	2-26-51	82	83	83.50	-	1 018
Total Coding			10113	5049	5156 20	-	51
SCREEN LINE							
Office	1-22-51	3-3-51	-	169	209 08	-	-
Manual Counts	1-22-51	2-8-51	8	281	280 63	35 079	-
Machine Counts	1-22-51	2-17-51	8	113	113 00	14 125	-
Total Screen Line			8	563	602 71	-	75.338
PUNCHING & VERIFYING (Cards)							
Dwelling Unit Interviews	1-17-51	2-20-51	60992	706	929 82	-	015
Truck Interviews	4-1-51	4-25-51	13115	139	178 60	-	014
Taxi Interviews	4-1-51	4-25-51	4009	27	36 45	-	009
Machine Rental			-	-	83 77	-	-
Total Punching & Verifying			78116	872	1228.64	-	016
TOTAL INTERNAL SURVEY FIELD OPERATIONS			10113	23525	\$27714 17	-	2 740

1/ Field inventory method Includes procurement of Land Use information

2/ Supervision included in Total Costs

3/ Coding Index Costs prorated to each phase of survey.

Truck interviews were assigned by geographical areas for the convenience of personnel and resulted in considerable saving of time.

Taxi interviews were taken directly from manifest sheets turned in by the drivers. This made for both an easy and accurate method of obtaining the information.

6 a. m. to 10 p. m., with the exception of four of the higher-volume stations which were operated for a full 24-hr. period. A total of 70 stations were scheduled, 26 around the six suburban cities and 44 around the metropolitan area. Interviews were obtained from drivers of vehicles moving in both directions and were obtained from

TABLE 4

## DALLAS METROPOLITAN AREA TRAFFIC SURVEY

EXTERNAL STUDY  
UNIT COST DATA

EXTERNAL SURVEY	Date Started	Date Completed	Units of Work Accomplished	Total Man Hours	Total Cost	Unit Cost	
						Field	Total
OFFICE	10-25-50	3-1-51	-	898	\$ 1212 84 <sup>1/</sup>	\$ -	\$ -
INTERVIEWING	10-25-50	1-24-51	107128	5206	6735 01	-	063
MANUAL COUNTS	10-25-50	1-24-51	46	561	619.67	-	13 471
MACHINE COUNTS	10-25-50	1-24-51	46	381	439 66	-	9 558
CODING (Interviews)							
Coding Index <sup>2/</sup>							
Coding	10-31-50	3-1-51	107128	501 6521	574.45 6543 05	-	- .061
Total Coding			107128	7022	7117 50	-	066
PUNCHING & VERIFYING (Cards)							
Labor Costs	2-20-51	4-25-51	107128	756	992 60	-	.009
Machine Rental			-	-	66 54	-	-
Total Punching & Verifying			107128	756	1059 14	-	.010
TOTAL EXTERNAL SURVEY FIELD OPERATIONS			-	14824	\$ 17183 82		

1/ Supervision included in Total Costs

2/ Coding Index costs prorated to each phase of survey

Unit costs of interviews in the internal survey, including both office and field costs, were: dwelling unit interviews, \$1.38; truck interviews, \$1.53; and taxi interviews, \$3.87.

## EXTERNAL SURVEY

The external origin - and - destination survey consisted of two parts: (1) around the metropolitan area, and (2) around six isolated communities within the county. Interview stations were located on all highways and county roads carrying more than 200 vehicles per day. The lower volume stations were operated first with a small crew sufficient in number to man 3 stations per day. These men later formed the nucleus of larger crews to operate the higher-volume stations. On roads carrying less than 500 vehicles per day the survey was operated from 10 a. m. to 6 p. m. On the remaining stations the hours were from

95.5 percent of all vehicles which passed the stations. A total of 107,128 interviews were obtained in the external survey. This operation required 5,206 man-hours and cost 6 cents per interview.

Hourly automatic recorders were installed at all interview stations for a period of 24 to 48 hrs. at the time the interviews were being obtained. Five control stations were selected where automatic recorders were installed on the external cordon line for the entire period of the survey. These control counts were included with other machine counts on the external cordon line in the cost analysis and amounted to \$9.56 per station.

## ACCURACY CHECK

The reliability and completeness of the internal and external surveys were checked by a comparison of expanded trip data at crossings of a screen line previously es-

established for the purpose with the actual ground counts made during the survey. The viaducts across the Trinity River made an ideal screen line. Comparison of data indicated satisfactory survey coverage of approximately 90 percent of trips crossing the screen line. Screen-line costs were included in the cost data for the internal survey, since this phase was handled by internal personnel. Total screen line cost was \$602.71, which gives a unit cost of \$75.34 for each of the eight points checked.

### PARKING SURVEY

The area of the parking survey comprised 140 blocks, on which were located 110 public lots, 73 private lots, 30 garages and 3,003 legal curb spaces. Inventory of parking facilities was completed with a

18-in. reproductions were made to provide each interviewer with a map to insure his location at the proper facility.

Information as to origin, destination, purpose of trip, and place and time of parking was obtained from 59,210 drivers of vehicles parking in the central business sector between 10 a. m. and 6 p. m. Manual classification counts were made of all vehicles crossing the internal cordon line which delimited the central business sector from 7 a. m. to 6 p. m. Four automatic traffic recorders on major streets crossing the internal cordon line furnished control information for the period of the survey. The final unit cost of the parking survey averaged 56 cents per interview. This cost included all phases of the parking survey. Inventory costs were \$1.40 per block of curb face and \$3.10 for each off-street facility. Curb interviews cost 22

TABLE 5

DALLAS METROPOLITAN AREA TRAFFIC SURVEY  
INTERNAL & EXTERNAL STUDY  
ANALYSIS & REPORT  
UNIT COST DATA

ORIGIN & DESTINATION REPORT INTERNAL & EXTERNAL SURVEYS	Date Started	Date Completed	Units of Work Accomplished	Total Man Hours	Total Cost	Unit Cost	
						Field	Total
<b>SORTING &amp; TABULATING (Cards)</b>							
Labor Costs	3-10-51	9-30-51	201399	452	\$ 684 80	\$ -	\$ .0034
Machine Rental	3-10-51	9-30-51	-	-	498 97	-	-
<b>Total Sorting &amp; Tabulating</b>			201399	452	1183 77	-	006
<b>ANALYSIS</b>	3-10-51	11-1-51	-	1885	2518 75	-	-
<b>PREPARATION OF REPORT</b>							
Typing			-	104	127.03	-	-
Drafting			-	978	1270 11	-	-
Reproduction (Books)			800	-	1820 96	-	2 28
<b>Total Preparation</b>			-	1082	3218 10	-	-
<b>TOTAL - METROPOLITAN AREA REPORT</b>			-	3419	6920 62	-	-
<b>TOTAL - INTERNAL &amp; EXTERNAL FIELD OPERATIONS</b>			-	38349	44897 99	-	-
<b>TOTAL - METROPOLITAN AREA TRAFFIC SURVEY</b>			-	41768	51818 61	-	-
<b>ADMINISTRATION <sup>1/</sup></b>					\$ 7523.24		
<b>GRAND TOTAL</b>					\$59341 85		

<sup>1/</sup> 65% Total Administrative Costs

crew of four men, plus the active participation of the parking supervisor.

Two maps were prepared, one showing the location of all curb faces and their code numbers and the other showing the location and code number of all off-street facilities. A sufficient number of 18-by

cents each while off-street interviews cost 20 cents each. Forty-four 16-to-24 hr. cordon-line manual counts were made at a cost of \$16.66 each and four control stations were operated with automatic traffic recorders for the entire period of the survey at a cost of \$120.75 each.

## ZONING

For the purpose of analysis and conformance with tabulating machine usage,

intermediate area was coded as Sector 8, with further divisions into districts, zones and subzones. The second digit indicated the sector of the city to which this county

TABLE 6

## DALLAS METROPOLITAN AREA TRAFFIC SURVEY

COUNTY TRAFFIC SURVEY  
UNIT COST DATA

COUNTY TRAFFIC SURVEY	Date Started	Date Completed	Units of Work Accomplished	Total Man Hours	Total Cost	Unit Cost	
						Field	Total
OFFICE	10-25-50	2-1-51	-	149	\$ 192 35	\$ -	\$ -
INTERVIEWING	10-25-50	11-13-50	16155	1265	1376 03	085	-
MANUAL COUNTS	10-25-50	11-13-50	26	214	218 63	-	8.41
MACHINE COUNTS	10-25-50	11-13-50	26	156	160 63	-	6 18
CODING INDEX <sup>1/</sup> CODING (Interviews)	10-31-50	12-15-50	- 16155	62 976	71 80 979 93	-	- 061
Total Coding			16155	1038	1051 73	-	065
PUNCHING & VERIFYING							
Labor Costs	2-20-51	4-25-51*	16155	111	145 40	-	009
Machine Rental			-	-	10 03	-	-
Total Punching & Verifying			16155	111	155 43	-	010
TOTAL FIELD OPERATIONS			-	2933	3154.80	-	-
REPORT							
SORTING & TABULATING (Cards)							
Labor Costs	12-1-51	2-1-52	16155	23	44 95	-	003
Machine Rental			-	-	16 30	-	-
Total Sorting & Tabulating			16155	23	61 25	-	004
ANALYSIS	12-3-51	4-1-52	-	110	161 49	-	-
PREPARATION							
Typing	1-5-52	3-31-52	-	34	43 38	-	-
Drafting	12-1-51	4-1-52	-	354	495 59	-	-
Reproduction (Books)	2-29-52	4-15-52	250	-	431 38	-	1 73
Total Preparation			-	388	970 35	-	-
TOTAL COUNTY REPORT			-	521	1193 09	-	-
TOTAL COUNTY TRAFFIC SURVEY			-	3454	\$ 4347.89	-	-
ADMINISTRATION <sup>2/</sup>					\$ 578 71		
GRAND TOTAL COUNTY TRAFFIC SURVEY					\$ 4926 60		

<sup>1/</sup> Coding Index costs prorated to each phase of survey

<sup>2/</sup> 5% Total Administration Cost

the area was divided into sectors, districts, zones, and subzones, designated numerically with a four-digit code. The metropolitan area was divided into sectors radiating from the business district of the city and designated by Numerals 0 through 7. Each sector was divided into districts, zones, and subzones. In the county area between the metropolitan area and the county limits, the sector lines were extended as district boundaries and this

district was adjacent. Adjoining counties and major cities in Texas were coded 9000 to 9600 and the United States was coded by states from 9700 to 9900. This system of zoning greatly simplified both coding, sorting and tabulating.

## CODING, PUNCHING AND VERIFYING

A coding index was prepared in which all streets were listed alphabetically.

TABLE 7  
DALLAS METROPOLITAN AREA TRAFFIC SURVEY  
PARKING STUDY  
UNIT COST DATA

PARKING SURVEY	Date Started	Date Completed	Units of Work Accomplished	Total Man Hours	Total Cost	
					Cost	Unit Cost
INVENTORY						
Curb - Office	10-10-50	10-21-50	140	23	\$ 53.61	\$ 1.015
Curb - Field	10-10-50	10-21-50	139	179	142.07	1.015
Off Street - Field	10-21-50	11-18-50	213	479	115.26	2.563
Off Street - Office	10-21-50	11-18-50	-	-	-	-
Off Street - Field	10-21-50	11-18-50	213	479	115.26	2.563
Off Street - Office	11-16-50	1-23-51	32736	6465	6621.86	202
Curb - Office	11-16-50	1-27-51	-	369	717.94	-
Curb - Field	11-16-50	1-23-51	32736	6465	6621.86	202
Off Street - Office	1-7-51	3-1-51	-	1108	1536.73	138
Off Street - Field	12-16-50	1-25-51	26474	3557	3657.90	138
Total Interviewing			59210	11493	12534.03	.174
CODING (Interviews)						
Coding Index <sup>1/</sup>	12-21-50	2-13-51	32736	313	359.03	-
Coding - Curb	12-21-50	2-13-51	26474	1766	2695.25	.082
Coding - Off Street	12-21-50	3-1-51	32736	1766	1766.00	.067
Total Coding			59210	4773	4820.28	.081
CORDON COUNTS						
Manual Counts	11-23-50	1-24-51	44	733	733.00	16.66
Machine Counts	11-17-50	1-20-51	4	467	483.00	120.75
Total Cordon Counts			48	1200	1216.00	25.33
PURCHING & VERIFYING (Cards)						
Curb Interviews	2-16-51	3-24-51	32736	300	385.84	0.12
Off Street Interviews	3-4-51	3-24-51	26474	184	241.74	0.09
Machine Rental			-	-	45.09	-
Total Purching & Verifying			59210	484	672.67	0.11
SORTING & TABULATING (Cards)						
Machine Operators	3-24-51	9-1-51	59210	337	503.72	0.08
Machine Rental			-	-	285.58	-
Total Sorting & Tabulating			59210	337	789.30	0.13
PARKING REPORT						
Preparation	3-24-51	11-30-51	729	1020.28	1965.50	2.46
Analysis	3-24-51	10-1-51	1282	2261.82	1965.50	-
Reproduction	12-1-51	1-15-52	800	-	-	-
Total Parking Report			-	2011	5247.60	-
CHIEF SUPERVISOR	10-10-50	2-1-51	-	758	1835.43	-
OTHER SUPERVISOR	10-10-50	2-1-51	-	1427	1613.36	-
Total			59210	23212	299585.45	499
ADMINISTRATION <sup>2/</sup>						
GRAND TOTAL					33057.72	\$ 558

<sup>1/</sup> 1/4 of total cost of Coding Index.  
<sup>2/</sup> 30% of total Metropolitan Area Survey Administrative Costs

All principal cities and towns within the state, major buildings within the city, outlying shopping areas and neighborhoods, schools, theatres, industrial establishments, and housing projects were also included. When completed, the coding index comprised approximately 175 pages and was bound with a spiral binding and heavy cover to enable easy access to all pages.

The cost of the coding index was \$1,486.12, but it is believed that its preparation produced a saving in coding costs sufficient to justify the expenditure, as well as to promote a greater degree of accuracy. Coding index costs were prorated to each phase of the survey and included in unit coding costs.

Punching and verifying were started as soon as coding and checking were completed for a tract or station. A total of 260,609 cards were used to record data from all phases of the survey.

All work through coding was done in the Dallas field office. Some punching was done by the City of Dallas, but the majority was done in the Planning Survey Accounting Section in Austin. Unit cost of coding for the Internal Survey was 51 cents per interview; dwelling unit coding cost 43 cents per interview; truck interviews cost 60 cents each, and taxi interviews cost \$1.02.

The external survey coding cost 7 cents per interview, and coding for the parking survey cost 8 cents per interview.

Average cost of punching and verifying cards for all phases of the survey was 1.2 cents per card.

#### TABULATING, ANALYSIS AND PUBLICATION

Tabulating, analysis, drafting, and reproduction were done in Austin. Three reports were printed covering (1) Metropolitan Area Traffic Survey, (2) Dallas County Traffic Survey, and (3) Parking Survey.

#### COST ANALYSIS

Unit costs for some of the more-important phases of the survey have been mentioned previously. The final cost of the internal and external traffic study was \$59,341.85; the parking study,

\$33,057.72; and the county traffic study, \$4,926.60, or a total cost of \$97,326.17. A detailed man-hour requirement and cost analysis record of all phases of the project is outlined in Tables 1 to 7, inclusive.

Table 1 shows the distribution of the total cost to each phase of the survey; Table 2 the individual costs, time of beginning and ending and man-hours for each item of the administrative costs; and Tables 3 through 7 unit costs, man-hours, units of work accomplished and dates of starting and completion for all phases of the internal, external, county, and parking surveys.

#### APPLICATION OF DATA

The final report was not complete until 18 mo. after the initiation of the study, but tabular data were placed in use as it became available. Preliminary data were furnished the city and state within 2 mo. after completion of field work by reproduction of tracing paper work sheets for origin-destination data. Photostatic copies of the parking tables were also prepared for early use of these data. This preliminary information proved most timely and useful to both the city and state.

The City of Dallas, immediately upon completion of the study, set up an office to use these data as a basis for the (1) revision of its major thoroughfare plan, (2) development of a network of expressways for the metropolitan area, (3) determination of adequate standards of right of way and paving, and (4) development of data to guide future street programs. Population trends have been established and extended to a 20-to-30-yr. period. The increment of population increase from 1950 to 1970 or 1980 is being distributed to survey zones on the basis of type of zoning, plans for the extension of utilities, building trends and other similar factors. This expansion of the origin-destination data was made possible by the complete and current land-use information obtained in the sampling procedure.

The Texas Highway Department has used the survey data as a basis for the location of expressway routes, the design of intersections and the assignment of traffic to future routes in the area.