

Postcard Method of Obtaining Origin and Destination of Traffic and Comparison with Roadside-Interview Method

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● THROUGH cooperative financing, money became available to conduct origin-and-destination traffic surveys in the urban area of Ames, Iowa, during the fall of 1949. Contributors to the project were the Engineering Experiment Station of Iowa State College, the Iowa Highway Commission, and the City Plan Commission of Ames. The project was administered by the Engineering Experiment Station.¹

The objectives of the project were three-fold: (1) To assemble origin-and-destination information useful to the highway commission, the college, and the City of Ames in connection with their ordinary traffic handling and transportation planning, (2) to collect field data by which research could be conducted on the improvement of methods of making origin-and-destination studies of traffic, and (3) to compare the field postcard method of getting origins and destinations with the roadside-interview method.

Field stations were established on the basis that no attempt would be made to cover the interior traffic in Ames, other than that between the Fourth Ward area to the west and the Wards 1, 2, and 3 to the east (see Fig. 1 for the location of the following 13 stations):

- Station 1, US 69 at the north city limits
- Station 2, US 30 at the east city limits
- Station 3, US 69 at the south city limits
- Station 4, US 30 at the west city limits
- Station 11, Lincoln Way (US 30) east of Beech Avenue
- Station 12, Sixth Street east of Squaw Creek Bridge

- Station 13, Thirteenth Street, east of Stange Road
- Station 21, Wallace Road entrance to I. S. C. campus
- Station 22, Knoll Road entrance to I. S. C. campus
- Station 23, Morrill Road entrance to I. S. C. campus
- Station 24, Welch Road entrance to I. S. C. campus
- Station 25, Union Drive entrance to I. S. C. campus
- Station 26, Pammel Drive (Cemetery) entrance to I. S. C. campus

Postcard studies for the full 24-hr. day were planned for only the primary road stations at the city limits, stations 1 to 4, and the three east-west connections within Ames, Stations 11, 12, and 13. However, because of the unfinished paving on Thirteenth Street, the postcards were not passed out at Station 13. About 2 weeks following the handing out of postcards, roadside interviews were conducted at all stations for a 16-hr. period from 7 a. m. to 11 p. m.

FIELD PROCEDURES

Traffic-volume counts were taken with traffic recorders by the highway commission daily by hours from September 27 through November 13. These counts provided the basis for determining the traffic pattern for each day of the week and trend of the volume of traffic for the fall period. Further, these counts afforded a basis for assignment of personnel to the field stations so that the traffic could be handled with the minimum of delay.

Because of the paving of the Sixth Street extension from Riverside Drive west to the I. S. C. campus at Osborn Drive, the paving of Thirteenth Street from east of Squaw Creek west to Stange Road,

¹The over-all planning of the field work was handled by Mark Morris and Carl Schach of the Iowa Highway Commission, with the latter in active charge of the field work. Robley Winfrey handled the recruitment of personnel and the office details in the preliminary work and all of the analysis of the results. All of the IBM punching, sorting, and tabulating was handled by the Iowa Highway Commission through Schach.

TABLE 1
SUMMARY DATA ON POSTCARDS PASSED OUT

Sta- tion	Time Started	Time Ended	Number Cards Handed Out			Remarks
			In- bound	Out- bound	Total	
1	3 p. m. Thurs 20th	11 p. m. Thurs 20th	370	331	701	Rained out, rerun
1	7 a. m. Mon. 24th	7 a. m. Tues. 25th	1,459	1,617	3,076	
2	7 a. m. Mon. 17th	7 a. m. Tues 18th	2,007	1,882	3,889	
3	7 a. m. Tues. 18th	7 a. m. Wed. 19th	2,185	2,092	4,277	
4	3 p. m. Thurs 20th	11 p. m. Thurs 20th	487	533	1,020	Rained out, rerun
4	7 a. m. Mon. 24th	7 a. m. Tues 25th	1,787	1,841	3,608	
11	3 p. m. Wed. 19th	3 p. m. Thurs 20th	5,485	5,610	11,095	
12	3 p. m. Wed. 19th	3 p. m. Thurs 20th	2,802	2,633	5,435	
TOTAL			16,562	16,539	33,101	
Less reruns			857	864	1,721	
NET TOTAL			15,705	15,675	31,380	

work was somewhat delayed over what would have been desired from the standpoint of weather and the normal October traffic.

Publicity for the field work was given by a lead story in the Ames Daily Tribune just prior to the starting of each phase. Spot announcements were made over the local Radio Stations WOI and KASL. The staff of Iowa State College was sent a special letter through the college campus mail stating the objectives of the survey and asking for cooperation in returning the postcard, either through campus mail or through the postoffice mail.

The ordinary field party of six persons for passing out the postcards consisted of a party chief, a postcard passer for each direction, a traffic recorder, a timer, and a traffic director. The number of personnel was varied according to the traffic volume; the night shift was reduced to about three to five men.

The roadside-interview phase was conducted by the same field parties, plus many additional wives and students. For the one day, Wednesday, November 2, when interviews were taken at Stations 11 and 12, the field parties were supplemented

and the paving of Stange Road, Thirteenth Street, south to Pammel Drive, the starting of the field work and the timing of the

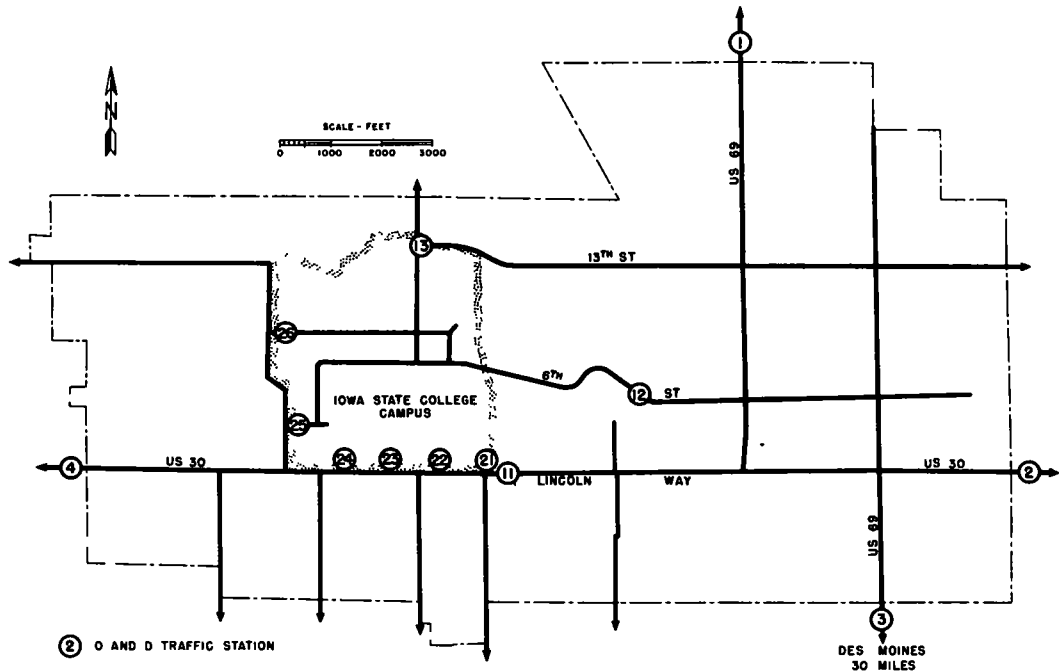


Figure 1. Outline of the corporate limits of Ames, Iowa, showing the location of Iowa State College campus and the traffic stations. Postcards were handed out at only Stations 1, 2, 3, 4, 11, and 12.

by senior girls from the Ames High School. All interviewers, male and female, were given about 1 hr. of assembled instruction on how to interview and a field practice consisting of the taking of 10 to 30 interviews.


interviewers handled traffic in both directions. Station 11 was operated as two separate stations, one for each direction. A timer called out the time each 2 min. over a public-address system. The interviewers recorded the time called on the

FIRST CLASS
PERMIT NO 156
(Sec 349 P.L.&R.)
AMES, IOWA

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in the United States

2c—POSTAGE WILL BE PAID BY—

Engineering Experiment Station
Marston Hall, Campus
Iowa State College
Ames, Iowa



PLEASE FILL OUT AND MAIL EACH CARD GIVEN YOU DURING THIS TRAFFIC SURVEY OF AMES, IOWA

Your filling out and mailing this card is appreciated. The information will be used in improving traffic in the Ames urban area.

In questions 1, 2, and 3, indicate the place by street address, building name, or firm name if the place is within Ames or the ISC campus, for other places give only the city and state.

1 From what place did you last leave just before receiving this card?

2 To what place did you first go just after receiving this card?

3 Where was your ultimate destination if it was not the place given in question 2?

4 How many people were there in the vehicle, including the driver?

5 In what state is the vehicle registered?, if Iowa, what is the county number?

6 In what city and state is the vehicle kept overnight when it is not on a trip?

7 Type of vehicle (check one)

<input type="checkbox"/> Car	<input type="checkbox"/> Panel or pickup truck
<input type="checkbox"/> Sta Wagon	<input type="checkbox"/> Medium weight truck
<input type="checkbox"/> Taxicab	<input type="checkbox"/> Heavy weight truck
<input type="checkbox"/> Bus	<input type="checkbox"/> Tractor-semi-trailer
	<input type="checkbox"/> Motor car transport

8 For trucks and trailer combinations, give total number of axles

9 Purpose of the trip (check one)

<input type="checkbox"/> Going to work	<input type="checkbox"/> Student going to or from school
<input type="checkbox"/> Coming from work	<input type="checkbox"/> Delivery of persons
<input type="checkbox"/> To or from shopping	<input type="checkbox"/> Delivery of things
<input type="checkbox"/> Business trip	<input type="checkbox"/> Social & recreational
<input type="checkbox"/> Social & recreational	<input type="checkbox"/> Attending meetings

Thank you—
Iowa State Highway Commission
Iowa State College, Engr. Exp. Sta.
City of Ames, City Plan Commission

Lincoln Way and
Beech Avenue
Eastbound

N^o 5926

Figure 2. Specimen postcard passed out to drivers. Each card is identified as to station, direction, and time of day through its serial number.

In operation at the station, the traffic was controlled by the traffic directors, who endeavored to stop the vehicle at the position of the interviewer who was to make the interview. On the interview line 2 to 14 interviewers worked at a time, the number present being adjusted by the party chief to fit the traffic volume. With the exception of Station 11, individual

lines of their data sheet as it was called. New data sheets were started at the beginning of each clock hour.

The questions asked were: Origin of trip? Destination of trip? Purpose of trip? Commodity carried (for trucks)? Place where vehicle was owned?

Information recorded by observation was: type of vehicle, number of axles

(trucks only), state of registration, county of registration (Iowa only), and number of persons in passenger cars.

The personnel consisted of the regular staff of the Traffic and Planning Section of the Iowa Highway Commission, which furnished party chiefs and traffic directors, wives of students at Iowa State College, and some male students.

TABLE 2

SUMMARY OF NUMBER OF POSTCARDS RETURNED AMES URBAN AREA O AND D TRAFFIC SURVEY

October - November 1949

1949 Date	At Station	U S. Mail	Campus Mail	Daily Total	Cumulative Total
Oct. 17	34	12	0	46	46
18	29	563	11	603	649
19	112	900	31	1,043	1,692
20	234	2,629	255	3,118	4,810
21	4	3,278	478	3,760	8,570
22	16	1,500	6	1,522	10,092
23 - Sunday					
24	62	1,068	54	1,184	11,276
25	37	1,022	116	1,175	12,451
26	0	1,059	53	1,112	13,563
27	6	541	5	552	14,115
28	0	344	13	357	14,474
29	0	196	7	203	14,675
30 - Sunday					
31	0	225	0	225	14,902
Nov. 1	0	108	10	118	15,018
2	5	49	6	60	15,078
3	0	45	4	49	15,127
4	0	31	0	31	15,158
5	0	24	0	24	15,182
6 - Sunday					
7	3	28	0	31	15,213
8	0	43	0	43	15,256
9	0	27	0	27	15,283
10	0	20	0	20	15,303
11 - P. O. Closed					
12	0	15	0	15	15,318
13 - Sunday					
14	0	11	0	11	15,329
15	0	11	0	11	15,340
16	0	0	0	10	15,350
17	0	4	0	4	15,354
18	0	1	1	2	15,356
19	0	0	0	0	15,356
20 - Sunday					
21	0	0	5	5	15,361
22	0	0	9	9	15,370
23	0	0	9	9	15,379
24	0	0	0	0	15,379
25	0	0	0	0	15,379
26	0	0	1	1	15,380
27 - Sunday					
28	0	0	1	1	15,381

THE POSTCARD

Figure 2 is a specimen postcard given out to the drivers of the vehicles. The design and wording of the card was checked with a dozen or so individuals before it was printed. Even so, several items could have been made clearer to the drivers, judged on the basis of the returns. The cards were identified by station and direction, so that identification of those returned would be positive. Further, the cards were numbered serially from 1 up

TABLE 3 COMPARISON OF POSTCARDS HANDED OUT AND RETURNED BY HOURS

Clock Hour	STATIONS 1, 2, 3, AND 4 ALL CLASSES OF VEHICLES						
	Direction 1, Inbound			Direction 2, Outbound			Both Directions
	Cards Handed Out	Usable Cards Re-turned	Percentage Re-turned	Cards Handed Out	Usable Cards Re-turned	Percentage Re-turned	
7-8 A	640	262	40.9	361	172	47.6	43.4
8-9	460	208	45.2	419	195	46.5	45.8
9-10	470	211	44.9	464	201	43.3	44.1
10-11	473	208	44.1	439	189	43.1	43.6
11-12 N	478	220	46.0	427	185	43.3	44.8
12-1 P	420	188	44.3	424	192	45.3	44.8
1-2	500	195	39.0	486	187	38.5	38.7
2-3	488	178	36.5	521	208	39.9	38.3
3-4	485	188	38.8	532	234	44.0	41.5
4-5	600	238	39.7	705	266	37.7	38.6
5-6	535	229	42.8	719	285	39.6	41.0
6-7	370	154	41.6	392	134	34.2	37.8
7-8	363	147	40.5	316	119	37.7	39.2
8-9	192	67	34.9	219	82	37.6	36.3
9-10	199	64	32.2	209	74	35.4	33.8
10-11 P	192	61	31.8	226	78	34.5	33.3
16 hr Total	6,864	2,816	41.0	6,859	2,801	40.8	40.9
11-12 M	136	53	39.0	160	55	34.4	36.5
12-1	95	28	27.4	82	23	28.0	27.7
1-2	45	12	26.7	52	19	36.5	32.0
2-3	28	14	50.0	25	5	20.0	35.8
3-4	24	10	41.7	25	8	32.0	36.7
4-5	45	18	40.0	40	6	13.3	28.2
5-6	43	12	27.9	70	21	30.0	29.2
6-7 A	138	42	30.4	119	40	33.6	31.9
8 hr. Total	584	187	33.8	673	177	30.9	32.3
24 hr Total	7,418	3,003	40.5	7,432	2,976	40.1	40.3

TABLE 4

COMPARISON OF POSTCARDS HANDED OUT AND RETURNED BY HOURS

Clock Hour	STATION 11 ALL CLASSES OF VEHICLES						
	Direction 1, Westbound			Direction 2, Eastbound			Both Directions
	Cards Handed Out	Usable Cards Re-turned	Percentage Re-turned	Cards Handed Out	Usable Cards Re-turned	Percentage Re-turned	
7-8 A	430	214	49.8	279	132	47.3	48.8
8-9	269	123	45.7	297	149	50.2	48.1
9-10	263	118	44.9	266	120	45.1	45.0
10-11	274	129	47.1	286	128	44.8	45.9
11-12 N	356	159	44.7	364	173	47.5	46.1
12-1 P	366	173	47.3	382	151	39.5	43.3
1-2	342	138	40.4	348	145	41.7	41.0
2-3	285	109	38.2	281	107	38.1	38.2
3-4	295	159	53.9	342	190	55.6	54.8
4-5	383	201	52.5	469	235	50.1	51.2
5-6	498	287	57.6	508	284	55.9	54.8
6-7	401	186	46.9	312	137	43.9	46.7
7-8	318	154	48.4	368	193	52.4	50.6
8-9	241	110	45.6	251	118	47.0	46.3
9-10	224	112	50.0	289	130	45.0	47.2
10-11 P	225	105	46.7	235	106	45.1	45.9
16 hr Total	5,170	2,487	47.7	5,277	2,498	47.3	47.5
11-12 M	124	50	40.3	153	64	41.8	41.2
12-1	68	24	35.3	85	30	35.2	35.3
1-2	0 ^r	0	--	0 ^r	0	--	--
2-3	10 ^r	1	--	3 ^r	0	--	--
3-4	15	6	--	12	8	--	51.6
4-5	11	5	--	18 ^r	5	--	34.5
5-6	7 ^r	1	--	8 ^r	1	--	--
6-7 A	80	30	37.5	64	24	44.4	40.3
8 hr. Total	315	117	37.1	333	132	39.6	38.4
24 hr Total	5,485	2,584	47.1	5,610	2,630	46.9	47.0

r = rain, some vehicles not given cards.

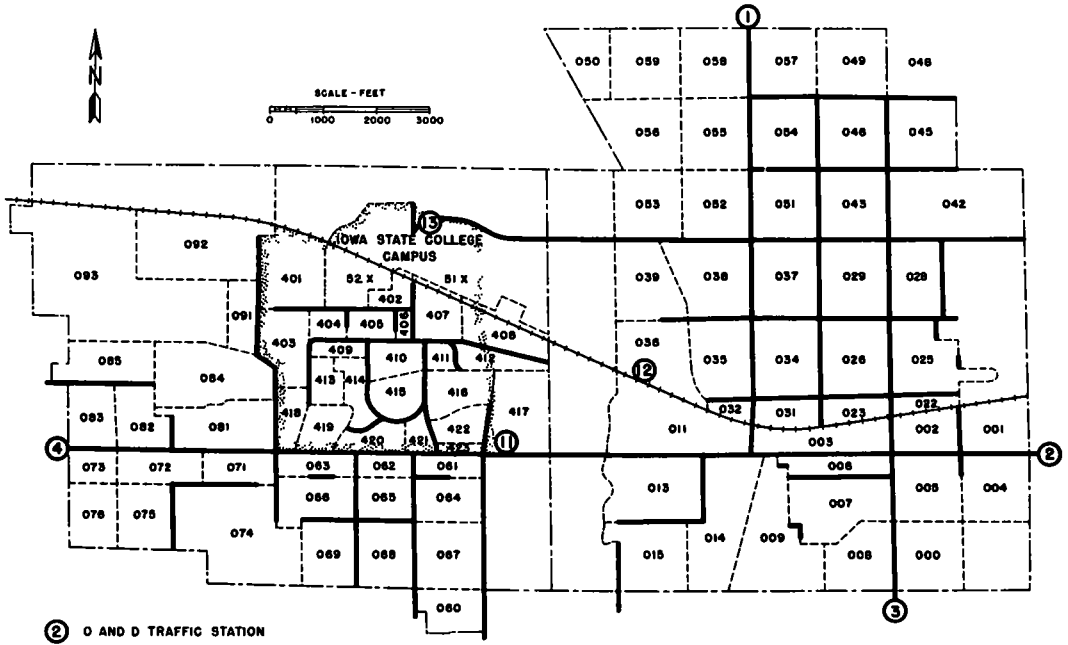


Figure 3. Zones and tracts for coding the origins and destinations within the City of Ames.

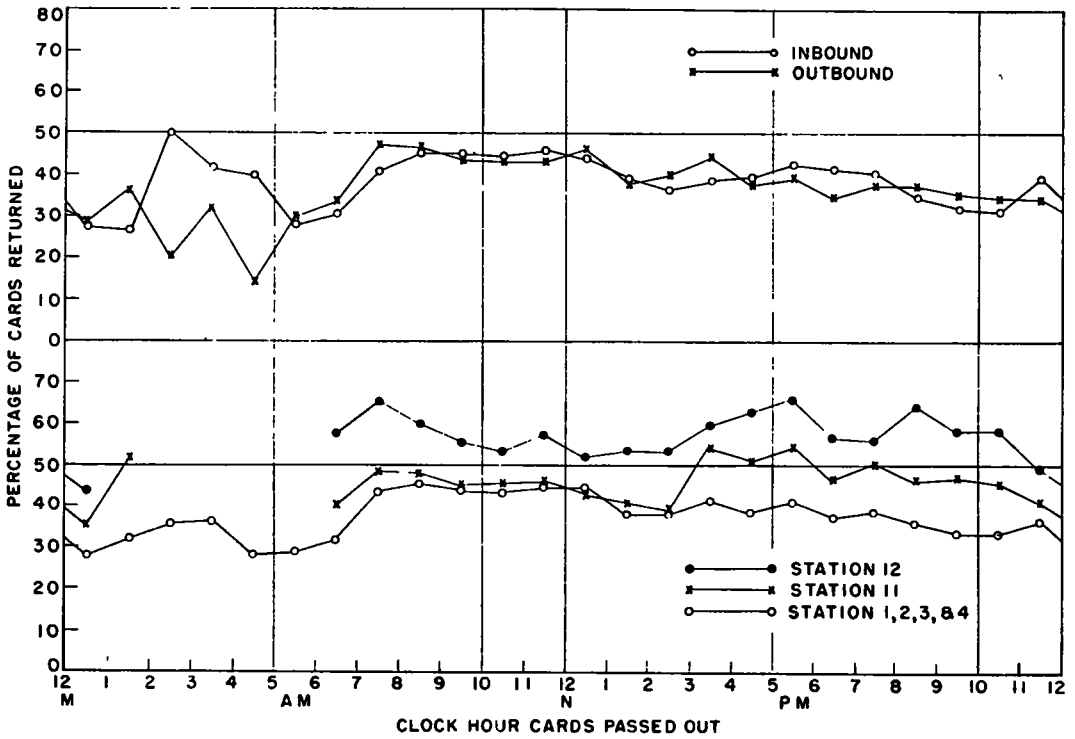


Figure 4. Percentage return of postcards by clock hours for combined Stations 1, 2, 3, and 4 and for Stations 11 and 12 for all classes of vehicles.

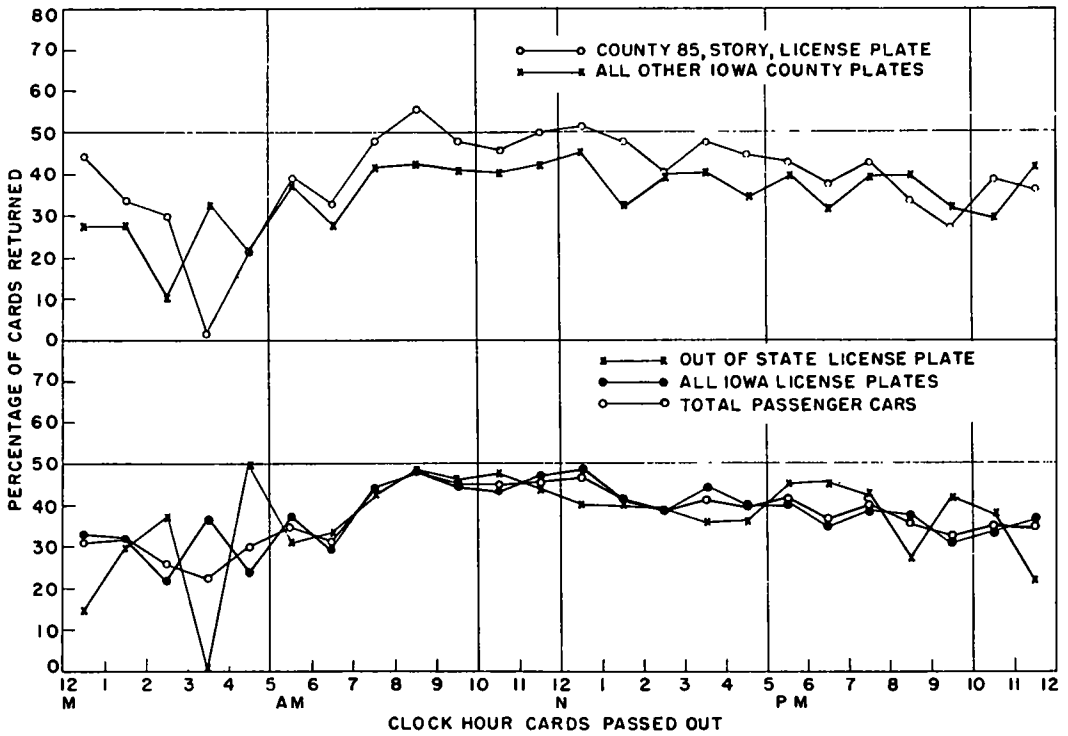


Figure 5. Percentage of postcards returned by passenger cars for Stations 1, 2, 3, and 4 combined for both directions by license plate.

TABLE 5

COMPARISON OF POSTCARDS HANDED OUT AND RETURNED BY HOURS

STATION 12 ALL CLASSES OF VEHICLES							
Clock Hour	Direction 1, Westbound			Direction 2, Eastbound			Both Directions
	Cards Handed Out	Usable Cards Returned	Percentage Returned	Cards Handed Out	Usable Cards Returned	Percentage Returned	Percentage Returned
7-8 A	352	230	65.3	99	64	64.6	65.2
8-9	173	104	60.1	98	59	60.2	60.1
9-10	126	73	57.9	107	57	53.3	55.8
10-11	112	59	52.7	129	69	53.5	53.1
11-12 N	153	81	52.4	296	178	60.1	57.7
12 - 1 P	277	139	50.2	198	110	55.6	52.4
1-2	207	119	57.5	163	79	48.5	53.5
2-3	111	66	59.5	113	54	47.8	53.6
3-4	127	66	52.0	169	111	65.7	59.8
4-5	207	135	65.2	300	185	61.7	63.1
5-6	240	149	62.1	324	223	68.8	66.0
6-7	157	85	54.1	138	83	60.1	56.9
7-8	157	85	54.1	118	70	59.3	56.4
8-9	102	65	63.7	99	64	64.6	64.2
9-10	99	59	59.6	87	49	56.3	58.1
10-11 P	81	48	59.3	102	69	57.8	58.5
16 hr Total	2,681	1,563	58.3	2,540	1,514	59.6	58.9
11-12 M	39	18	46.2	44	23	52.3	49.4
12-1	19	9	--	20	8	40.0	43.6
1-2	5	0	--	8	0	--	--
2-3	4	2	--	2	1	--	--
3-4	3	2	--	3	2	--	--
4-5	5	2	--	0	0	--	--
5-6	4	4	--	4	0	--	--
6-7 A	42	24	57.1	12	7	--	57.4
8 hr Total	121	61	60.4	93	41	44.1	47.7
24 hr Total	2,802	1,624	58.0	2,633	1,555	59.1	58.5

for each station and direction. These serial numbers were recorded by the timer at the end of each 2-min. interval throughout the 24-hr. day so that each card returned could be identified within intervals of 2 min. as to the time of day it was handed out.

Table 1 gives the schedule of passing out cards and the number given out at each station. Table 2 gives the number of cards returned by days.

There are minor discrepancies in the count of total vehicles by hours as tallied in the manual count and classification and the number of postcards passed out. The field parties were instructed to record the serial number of the top card in the deck each 2-min. interval through the day upon call from the timer, and the manual classifier and enumerator was instructed to start a new tally line with each 2-min. interval. Nevertheless there are variations of one to three vehicles between the two counts. Some of these variations result from mistakes in the numbering of the cards by the printer; some represent skipping and duplicating on the part of the field personnel. With the exception of

those differences in the two counts (which are attributed to the fact that during rain, cards were not passed out at certain time periods, although the manual count of traffic volume continued), the differences in counts is not of importance to the analyses reported.

Examples of typical codes for origins or destinations are:

043 813 On Kellogg Avenue in the 1300 block (Ames, zone 4, tract 3, Kellogg Street, 13 hundred block)

414009 Beardshear Hall, I. S. C. campus (I. S. C. campus, zone 1, tract 4, bldg. 009)

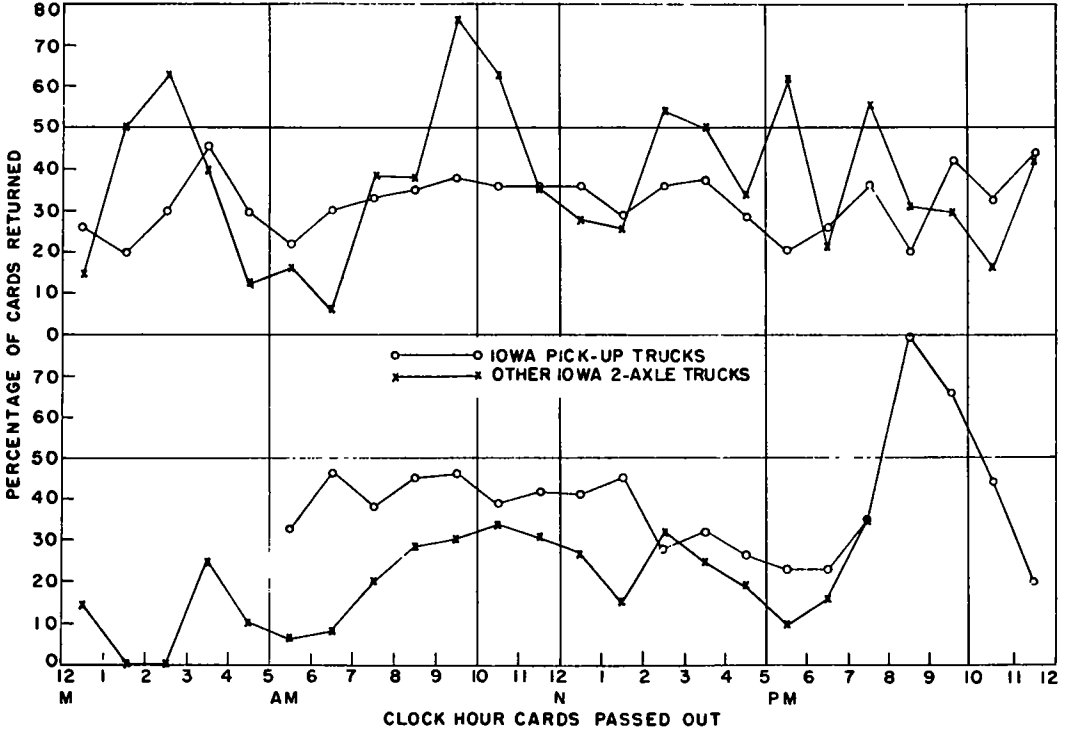


Figure 6. Percentage of postcards returned by trucks for out-of-state and Iowa registration plates for Stations 1, 2, 3, and 4 combined for both directions.

OFFICE WORK

A system of numerical codes was developed so that the analysis of the returns could be handled by IBM business machines. The city was divided into 10 geographical zones, with each zone divided into 10 or fewer tracts of about three blocks square. Within the tract the origins and destinations were coded to the street and block. Thus, the six-number code permits of determining the location in Ames of the origin and destination to the specific block length of street. The campus of Iowa State College was divided into 23 areas covered in the first three numbers of the code; the last three numbers designate the specific building. Figure 3 gives the zones and tracts for Ames.

514 762 Dwelling 762 in North Pammel Court (Pammel Court, north section, area 4, House No. 762)

185,056 Nevada, Iowa, (a town of more than 1,000 population; 85 is Story County, and 056 is Nevada)

177,027 Des Moines, Iowa

285,676 Ontario, Iowa, (a town of less than 1,000 population; 85 is Story County, and 676 is Ontario)

327,000 State of Minnesota (out of state, 27 is Minnesota, and 000 is any place in Minnesota)

The postcards returned were sorted by hand into stations and directions, and then arranged in serial number. Coding sheets were prepared by numbering vertically the 24 lines on the 11-in. dimension of a 17- by 11-in. ruled sheet. Consecutive serial

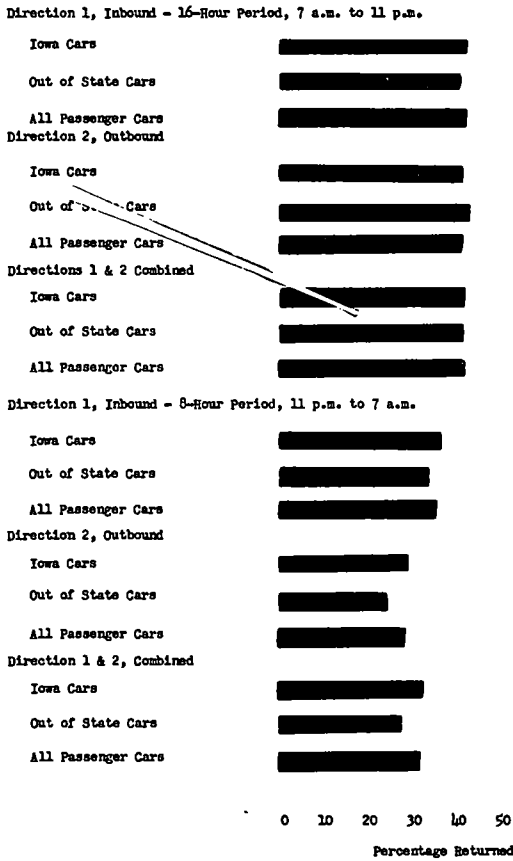


Figure 7. Percentage of postcards returned for passenger cars by registration plate, Stations 1, 2, 3, and 4, combined.

numbers were used from 1 up to cover the entire series of cards passed out at each station. Coding was then done directly on these sheets on lines corresponding to the serial number of the cards. Thus, the 24 lines on a coding sheet show the serial numbers of all cards passed out; the coded lines thereon represent the usable cards returned. The hour and 2-min. interval during which the cards were passed as recorded on the coding sheet were obtained by reference to the field record of the serial numbers and times.

The coding was not checked other than by inspection of the completed sheets to see if the origin and destination looked reasonable for the station and direction.

Neither was the punching of the cards verified. Once the cards were punched they were sorted by origin and then listed. Again, by inspection of these listings for reasonableness the further main errors

were eliminated by re-examination of the coding sheets and original postcards.

DIFFICULTIES WITH THE RETURNED INFORMATION

The difficulties had with the information contained on the cards were mainly what would be expected. When dealing with run-of-the-mill vehicle drivers, it is expected that information gathered in a traffic survey by the use of postcard questionnaires would contain discrepancies, and that sometimes wanted information would be missing. On the whole, however, the information was satisfactorily submitted. The record (Table 2) of cards returned daily totals 15,381 cards. The 15,381 includes 619 cards from Stations 1 and 4 which were not used, since the passing out was repeated later when it became necessary to suspend operations on account of rain. Available net cards totaled 14,762, of which 14,374 were coded. Not every one

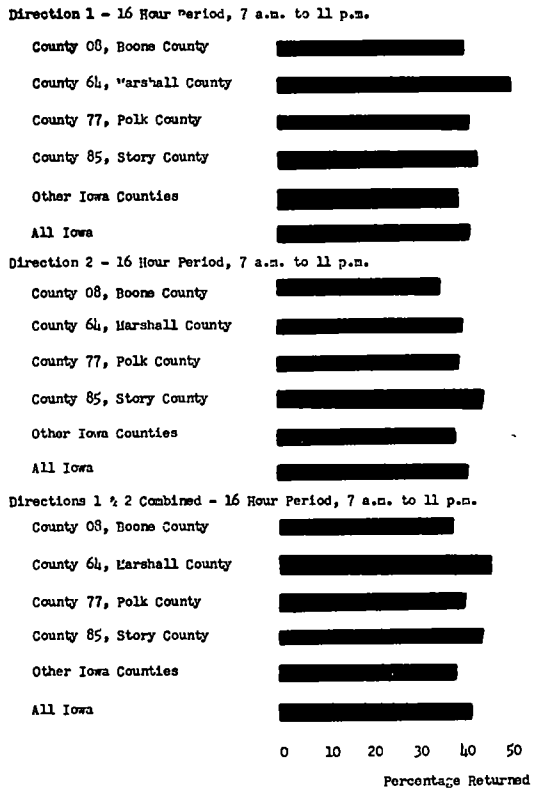


Figure 8. Percentage of postcards returned for passenger cars by Iowa registration plate, Stations 1, 2, 3, and 4, combined.

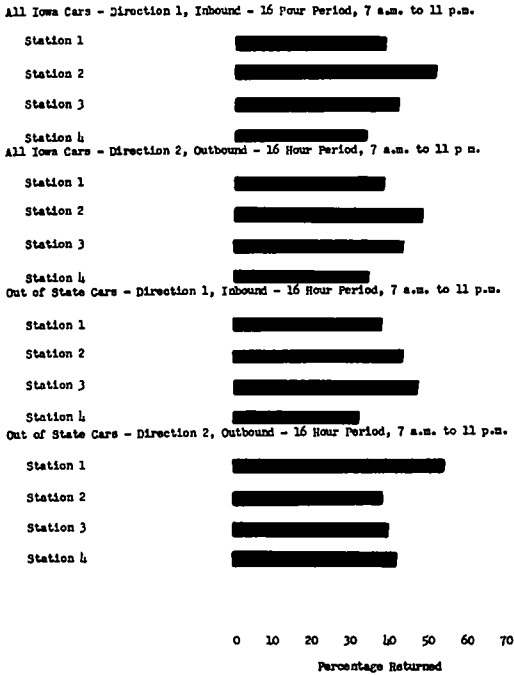


Figure 9. Percentage of postcards returned for passenger cars by registration plate, for each exterior station.

of the cards punched was 100 percent usable, though at least either the origin or destination was determined. These figures indicate that 97.37 percent of the cards returned were coded and punched.

From the standpoint of an origin-and-destination traffic survey, the main item that gave trouble was the description of the origin and the destination. Many cards had these items either incomplete, stated in general terms, confused, or a definitely wrong geographical location. The following answers are types of answers frequently encountered: a street number without giving the city; Ames, Iowa, without giving the street number; home to work; to Bill Smith's place; to a location north of Ames for a vehicle given the card when headed south at the south entrance to Ames (Station 3).

Considerable of the difficulty with the origin and destination is attributed to the fact that many drivers received more than two cards during a given day and possibly at more than one station. When filling out these cards, the driver did not realize that each card was for a particular station, direction of travel, and minute of the day. As a result, the correct trip was recorded on the wrong card. The coders

salvaged many of these cards by a process of matching; that is, all questionable cards were compared in terms of the indicated trip, type of vehicle, time of day, and handwriting.

RESULTS OF THE ANALYSIS

Inasmuch as this study of the postcard method was directed toward those aspects of the method which would help to evaluate its reliability, there is no attempt to analyze the results strictly to determine the origin and destination of the traffic passing the six stations. Rather, the results are analyzed to determine any bias in the return of the cards and a comparison of the origin and destinations with those obtained by the roadside-interview method.

RETURN OF CARDS BY HOURS OF THE DAY

Tables 3, 4, and 5 give by hours the

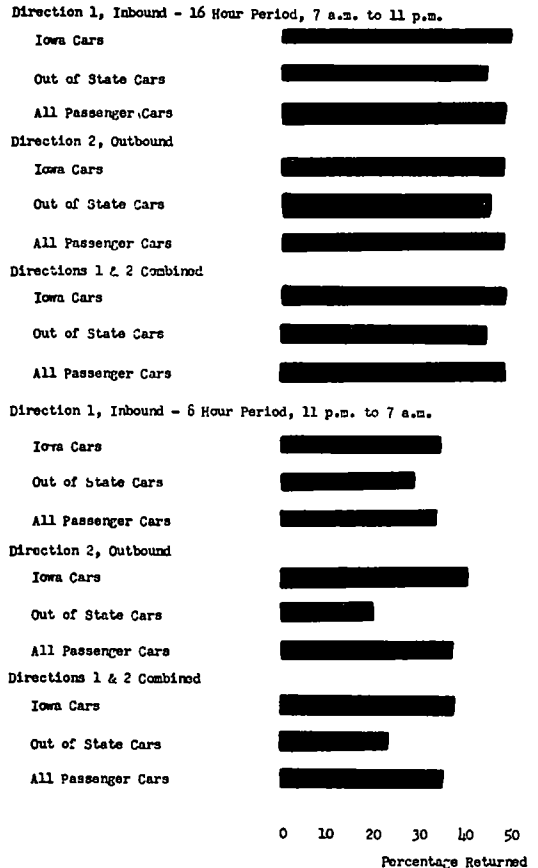


Figure 10. Percentage of postcards returned for passenger cars by registration plate, Station 11.

cards handed out and the usable cards returned by all classes of vehicles for each hour of the 24-hr. day. Summary curves of the percentage of cards returned each hour is given in Figure 4.

There appears to be no significant difference in the four exterior stations in the percentage of the cards returned by outgoing vehicles and incoming vehicles. There is, however, some trend downward in the percentage returned from the hour

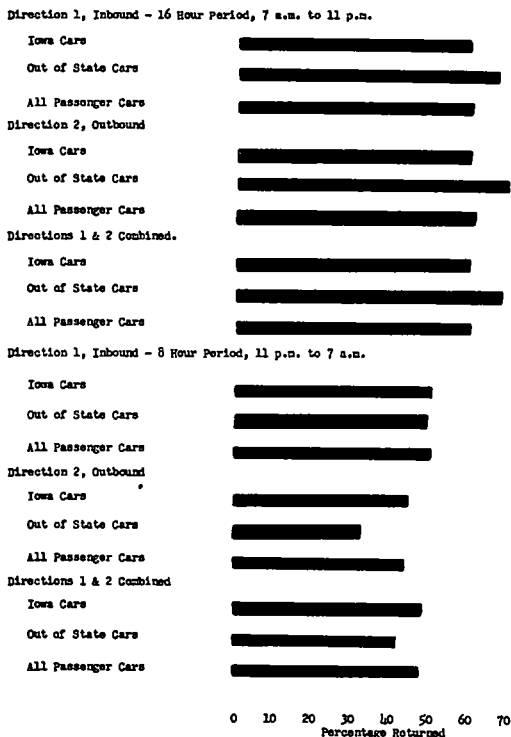


Figure 11. Percentage of postcards returned for passenger cars by registration plate, Station 12.

from 7 to 8 a.m. to the same hour the next day. For the four stations, the 8-hr. period from 11 p.m. to 7 a.m. averaged 32.3 percent returned for both directions and all vehicles as compared to 40.9 percent for the 16-hr. period from 7 a.m. to 11 p.m. The number of cards returned in the individual hours of the 8-hr. period was so small as to render unreliable the percentage returned for any given hour.

Figure 4 gives the highest percentage return from Station 12, next from Station 11, and the lowest from Stations 1, 2, 3, and 4 combined. Station 12, the Sixth Street connection between the eastern area

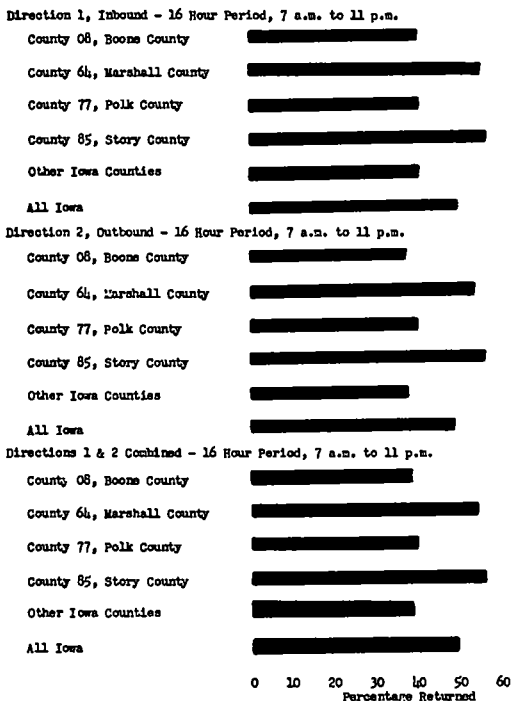


Figure 12. Percentage of postcards returned for passenger cars by Iowa registration plate, Station 11.

of Ames and the college campus, is used largely by college employees. These employees received a letter stating the purposes of the survey and asking for their cooperation. Further, perhaps the college

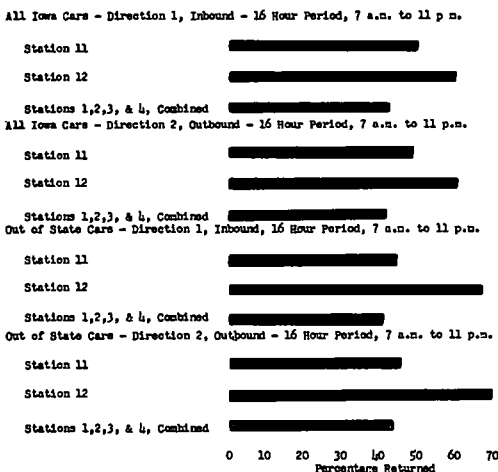


Figure 13. Percentage of postcards returned for passenger cars by registration plate, for interior Stations 11 and 12 and for exterior Stations 1, 2, 3, and 4, combined.

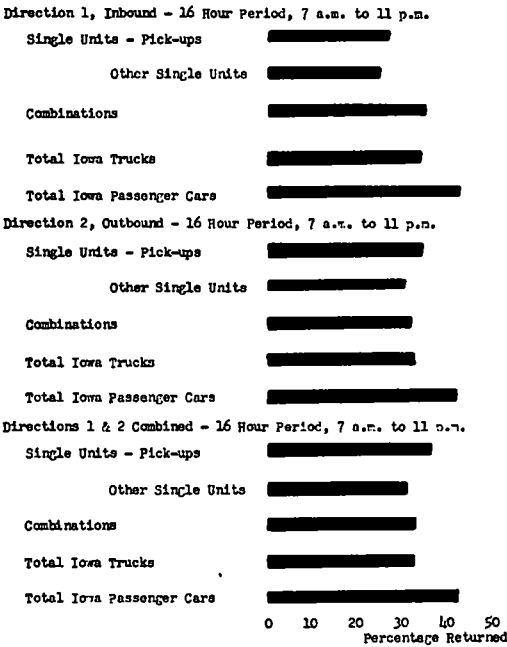


Figure 14. Percentage of postcards returned for Iowa trucks, and Iowa passenger cars by registration plates, Stations 1, 2, 3, and 4, combined.

people were somewhat more inclined to cooperate in a study of this type than was the average run of drivers, since the project was in charge of one well known to them. The returns from Station 11 also included many cards from college employ-

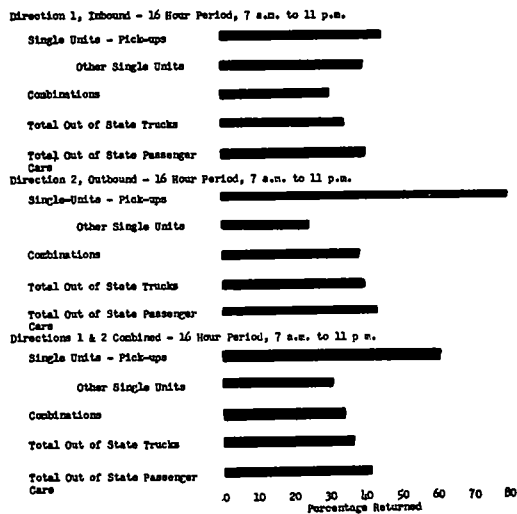


Figure 15. Percentage of postcards returned for out of state trucks and out of state passenger cars by registration plates, Stations 1, 2, 3, and 4, combined.

ees. Stations 1, 2, 3, and 4 passed ordinary traffic, such as moves into and out of typical Midwestern cities of 15,000 to 25,000 population.

Attention is directed to the rather high position of the curve for Station 11 at 3 to 4 p. m. as compared to the other hours. From Table 1 it is seen that this station

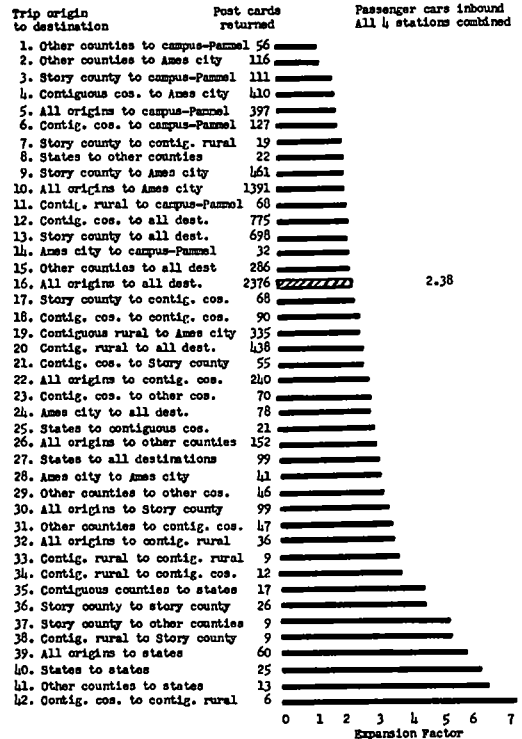


Figure 16. Postcard expansion factors for trips between origin-and-destination groups. The roadside-interview trips between the same origin-and-destination groups are used as the base (100 percent trips) to which the postcard trips were expanded. Expansion factors are omitted for trip groups of less than 25 roadside interviews and less than 6 postcards returned.

was started at 3 p. m. There may be some indication that the percentage of cards returned is somewhat higher the first hour or hours of operation of the station than throughout the remainder of the day. This high point is also found for the exterior stations at 7 to 8 a. m., the beginning hour. Station 12, on the other hand, shows its high hours at 7 to 8 a. m., and 5 to 6 p. m., though the passing out of cards was started at 3 p. m. Station 12 is greatly different in

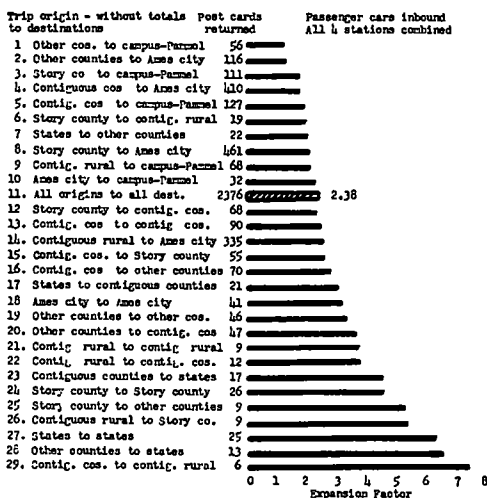


Figure 17.

character of traffic than Station 11, for the reason that it carries only local passenger cars and light commercial trucks between the college campus and the eastern area of Ames, including the main business district.

Figure 5 shows that the returns from the passenger cars bearing an 85 (the local Story County) license plate returned a higher percentage of cards than did the passenger cars bearing license plates from all other Iowa counties combined. The percentages for the hours of 11 p. m. to 7 a. m. are erratic because of low number of cards returned. The downward trend of the curve from 7 a. m. to midnight is evident on both the Story County and other county returns.

The lower graphs of Figure 5 indicate that there is little difference in the percentage returns hour for hour between the returns from out-of-state registered passenger cars and those registered in Iowa. An important fact to keep in mind, however, is that in Ames, Iowa, because of the Iowa State College, there are many out-of-state

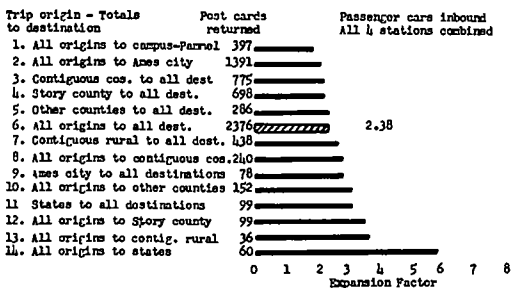


Figure 18.

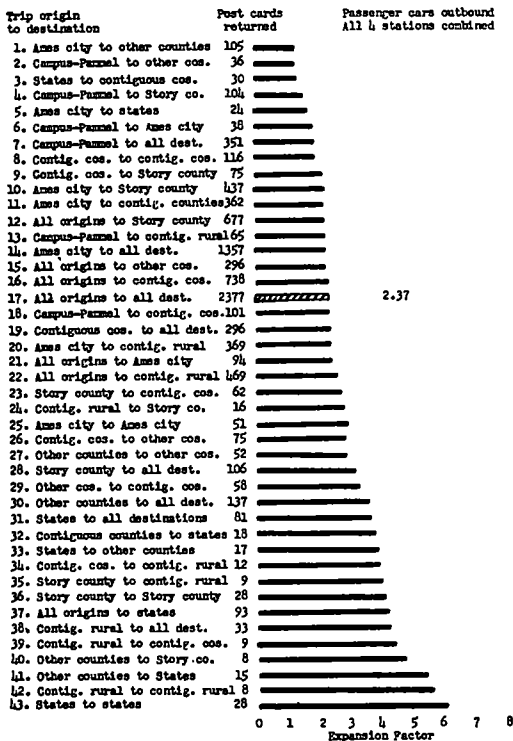


Figure 19.

licensed passenger cars in operation daily which are permanently kept in Ames, at least from September to June. In the fall of 1951 there were 510 out-of-state cars registered with the college. About 1,650 Iowa cars from other than Story County were registered and 2,955 Story County cars. These cars, however, would not

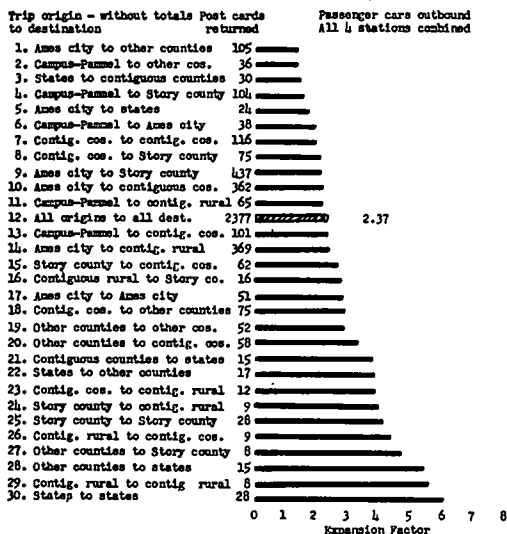


Figure 20.

pass Stations 1, 2, 3, or 4 frequently during week days.

The curves of Figure 6 for trucks disclose but little significant difference in

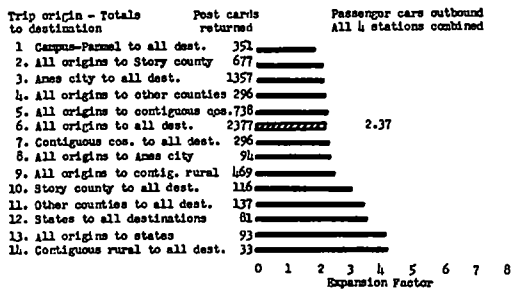


Figure 21.

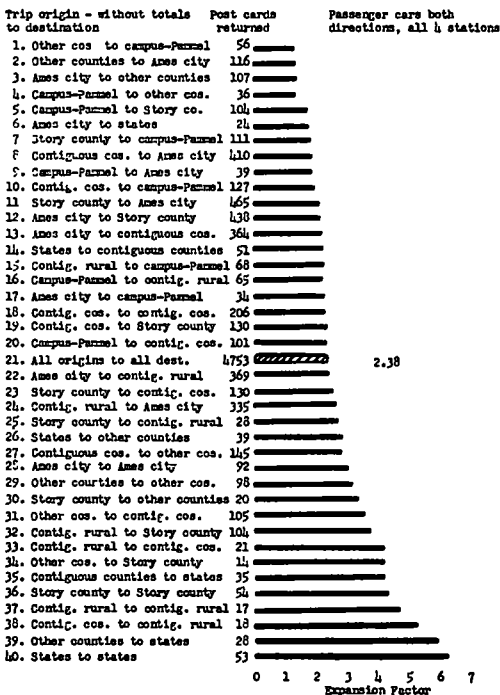


Figure 22.

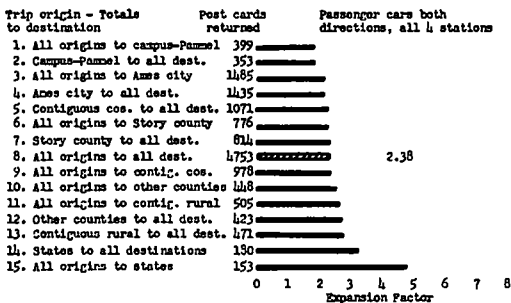


Figure 23.

postcards returned by hours because of the small number of cards passed out and returned. Perhaps the curve for the pick-up trucks in the lower section is higher than the curve for other two-axle trucks because the pick-up vehicles are mostly of local ownership and use.

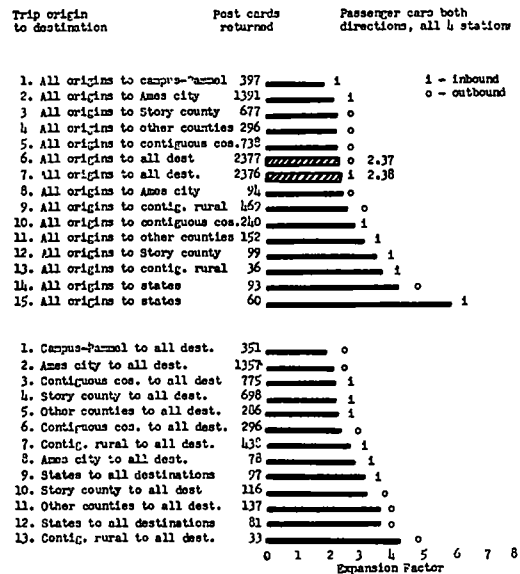


Figure 24.

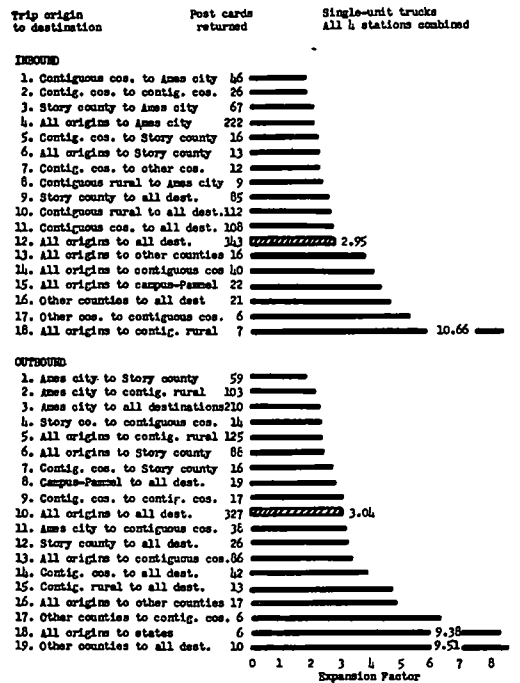


Figure 25.

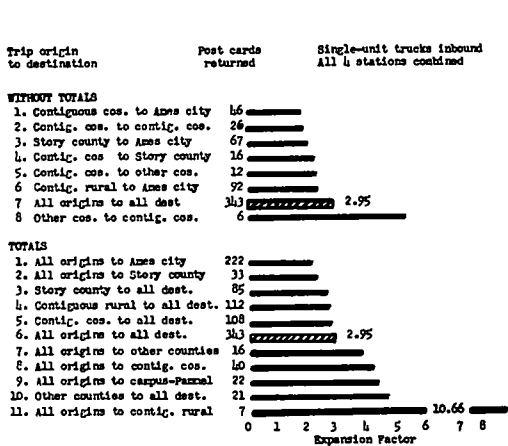


Figure 26.

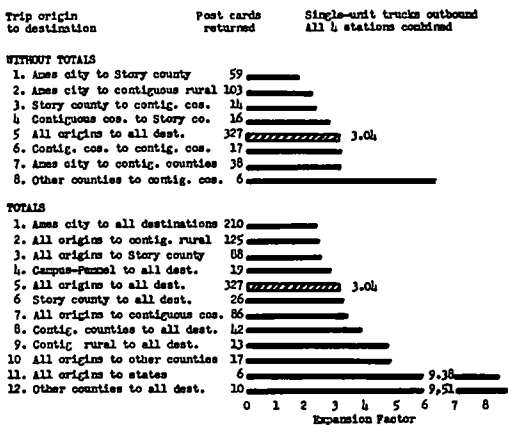


Figure 27.

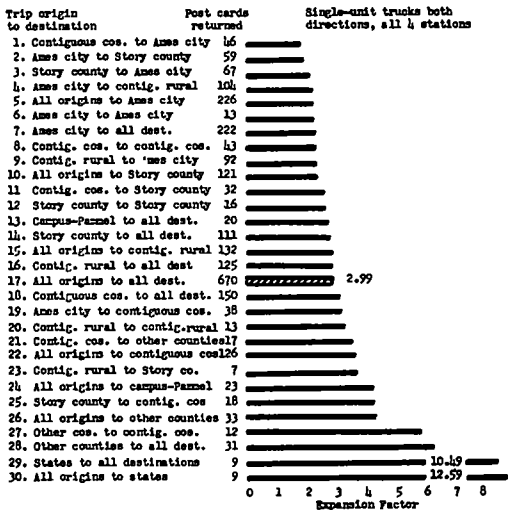


Figure 28.

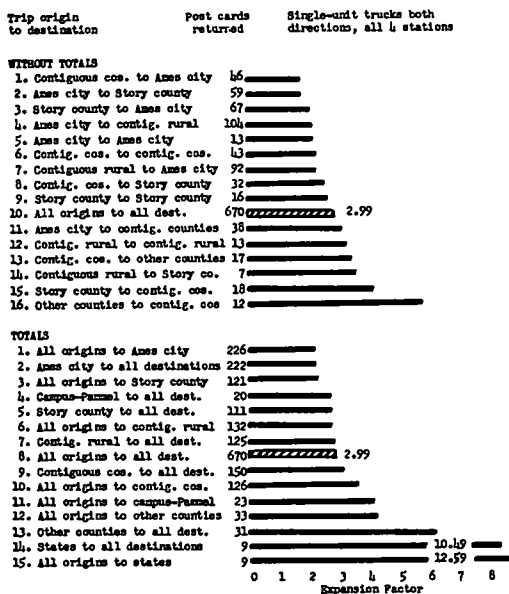


Figure 29.

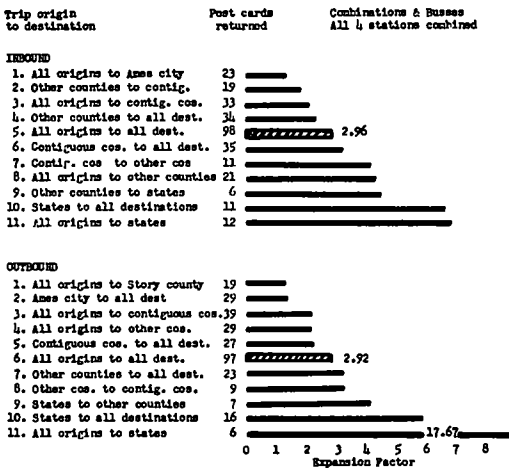


Figure 30.

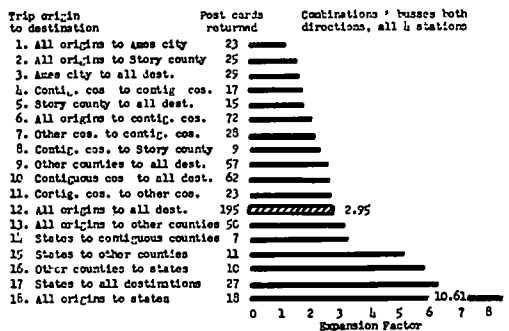


Figure 31.

Return By Station, Class of Vehicle and Registration Plate

Figures 7 through 15 set forth the percentage of cards returned by classes of vehicles by registration plate, direction, and station for the 16-hr. and the 8-hr. periods for all six stations.

Figure 7 indicates that the percentage of passenger cars returning cards was about 42 percent for the 16-hr. period and only 32 percent for the 8-hr. period, all four exterior stations combined and directions combined.

The comparison in Figure 8 is by counties, three counties contiguous to Story,

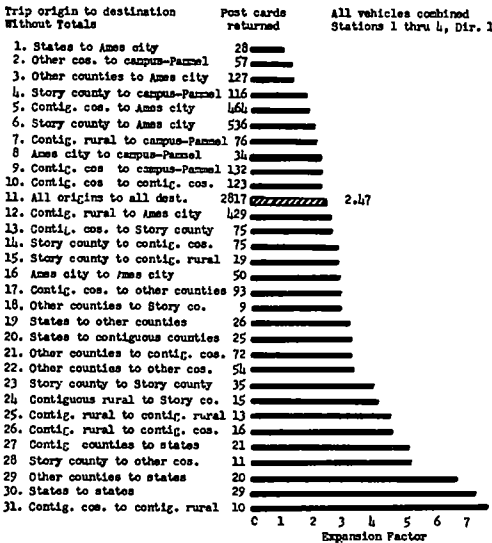


Figure 32.

the local Story (County 85), and other Iowa counties. The variations in the percentage returned from passenger cars is lowest for Polk County (to the south from Station 3) and other counties, with Marshall County, which is east of Story County, having a percentage about equal to that of Story County.

Figure 9 shows considerable variation in the percentage of cards returned by exterior stations, though no particular difference in the return by direction, nor between Iowa registered cars and out-of-state registered cars. There is no apparent reason seen for the variation in percentage by stations.

For interior Station 11, the US 30 east-west highway through Ames, Figure 10 shows about a 49-percent return from Iowa

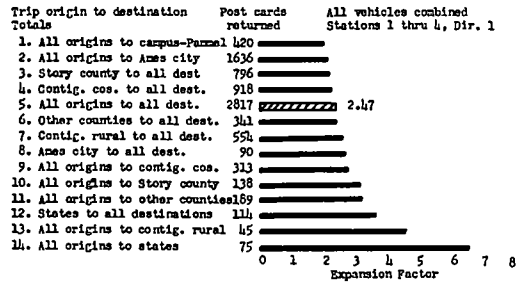


Figure 33.

registered passenger cars for both directions for the 16-hr. period as compared to 45 percent for the out-of-state cars. Similar percentages for the 8-hr. period are 38 and 24 percent, respectively.

The college-Ames east-west connection, Station 12, indicates the reverse percentages between Iowa and out-of-state registered cars as shown for Station 11, with only 61 percent returns from the Iowa cars and 69 percent from the out-of-state. Again, the 8-hr. period produced a small percentage return falling to 49 percent for the Iowa cars and 42 percent for the out-of-state. For Station 12, however, it should be kept in mind that the out-of-state registered cars as well as the out-of-county registrations are quite largely local cars that are based at Ames for the school year.

In Figure 12, Marshall County and Story County registered passenger cars again show up with high percentages as compared with other counties.

Figure 13 affords opportunity to com-

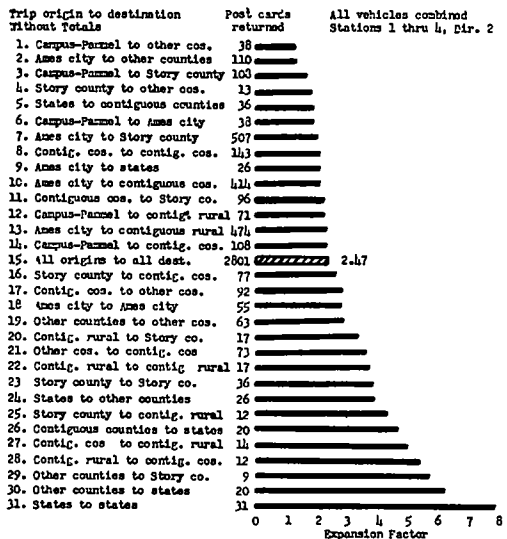


Figure 34.

pare the returns from passenger cars for the 16-hr. period by interior and exterior stations. For both the Iowa and out-of-state registrations, the highest returns were received from Station 12 with Station 11 being in the middle, and the combined exterior stations producing the lowest percentage returns.

Figure 14 shows that the percentage returns for Iowa registered vehicles from the exterior stations are about 10 percentage points greater from passenger cars than from commercial vehicles. The

TABLE 6

SUMMARY OF ADJUSTMENT OF ROADSIDE INTERVIEWS FOR STATIONS 11 AND 12 TO STANDARD VOLUME 16-HR. PERIOD

Vehicle Class	Actual Number of Interviews			Adjusted to Standard Volume		
	Interior-Interior Trips	Ext-Ext and Int-Ext Trips	Total Trips	Interior-Interior Trips	Ext-Ext and Int-Ext Trips	Total Trips
Station 11, Direction 1						
Pass Cars	2,491	1,432	3,923	3,153	1,428	4,581
Single Unit	287	221	508	327	213	540
Combinations	8	77	85	7	72	79
Total	2,786	1,730	4,516	3,487	1,713	5,200
Station 11, Direction 2						
Pass. Cars	2,522	1,305	3,827	3,298	1,283	4,581
Single Unit	298	239	537	327	213	540
Combinations	6	72	78	6	73	79
Total	2,826	1,616	4,442	3,631	1,569	5,200
Station 12, Direction 1						
Pass. Cars	1,728	249	1,977	1,918	242	2,160
Single Unit	99	19	118	108	22	130
Combinations	0	0	0	0	0	0
Total	1,827	268	2,095	2,026	264	2,290
Station 12, Direction 2						
Pass Cars	1,748	280	2,028	1,987	293	2,280
Single Unit	103	27	130	104	26	130
Combinations	0	0	0	0	0	0
Total	1,851	307	2,158	2,091	319	2,410

pick-up truck had a higher percentage than did the other classes of trucks.

Figure 15 illustrates about the same trend for out-of-state trucks as is shown in Figure 14 for Iowa registrations.

COMPARISON OF ORIGINS AND DESTINATIONS OBTAINED FROM THE 100-PERCENT ROADSIDE INTERVIEWS WITH THE POSTCARD RETURNS

As stated in the introduction, roadside interviews for the 16-hr. period of 7 a.m. to 11 p.m. were conducted at each of the stations at which postcards were distributed. The roadside interviews were conducted about 2 weeks after the postcard field work had been completed and most of the cards were received. As near as can be judged, the traffic conditions were comparable during the days of the two separate surveys, except that on Wednesday, November 2, 1949, the day that the

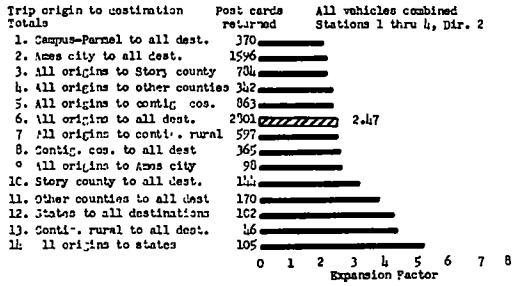


Figure 35.

two interior stations, 11 and 12, were operated for interviews, the day was unseasonably cold, windy, and generally disagreeable to the field parties as well as to the traffic. As a result of this bad weather, the traffic on Station 11 was 1,442 trips short of a normal week day, and Station 12 was 447 trips short. A detailed study of the traffic at these stations as observed in the manual count and classification the day postcards were handed out, the hourly volumes from the automatic recorders, and the roadside interviews indicates that there was no lessening of the through traffic, of the interior-exterior traffic, nor of the exterior-interior traffic on this Wednesday. Practically the entire shortage came from local passenger trips interchanging be-

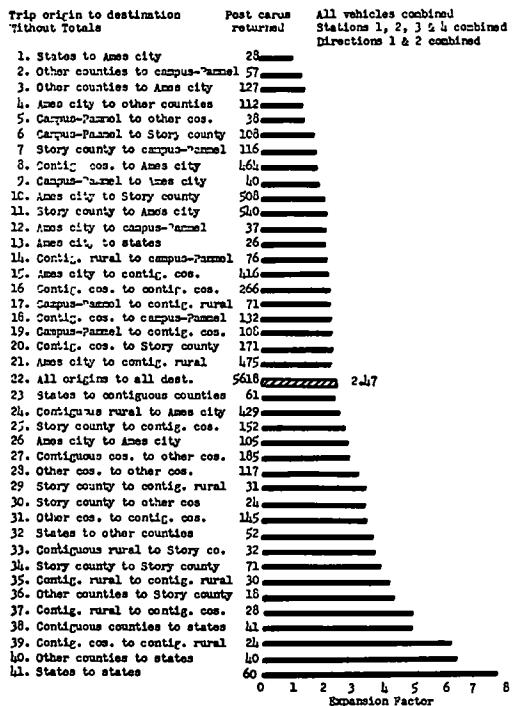


Figure 36.

tween the eastern and western areas of Ames. Consequently, the roadside interviews were adjusted accordingly (see Table 6 for a summary of these adjustments).

The origin-and-destination distributions for Stations 1, 2, 3, and 4 as determined from the roadside interviews were used without adjustment in comparing with the similar results obtained from the postcard returns.

expansion factor, by which the postcard returns could be expanded to equal the number of identical trips obtained in the 100-percent interviews for the 16-hr. period. See Table 7 for a specimen table of the data and calculations. This method of comparison assumes that the traffic and origin-and-destination distribution on the days of the two separate surveys was com-

TABLE 7
SPECIMEN TABLE SHOWING CALCULATION OF EXPANSION FACTORS FOR COMBINED STATIONS 1, 2, 3, AND 4, DIRECTION 1, INBOUND, PASSENGER CARS

Origins	Destinations						States	Total	Error
	Ames City	Campus Pammel	701-704	County X85	Contiguous Counties	Other Counties			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
0. Errors	19.4	4.4	1.0	2.4	1.9	1.2	1.9	34.2	2.0
1. Ames City 00X-099	131.5	74.5	11.2	5.0	0	1.0	0	223.2	
2. Campus Pammel 4XX-5XX	0	0	0	0	0	0	0	0	
3 701-702-703-704	865.2	144.9	33.9	49.1	45.8	14.1	8.8	1,163.0	1.2
4. County X85	959.7	201.0	38.3	118.1	163.6	48.4	21.3	1,555.1	4.7
5. Contiguous Co.	762.7	252.5	44.8	148.1	227.1	199.0	77.0	1,715.6	4.4
6. Other Counties	162.6	75.8	1.0	19.8	170.0	155.2	84.8	669.2	
7. States	24.0	7.2	0	4.1	63.9	45.6	159.7	304.5	
8 Total	2,925.1	780.3	130.2	346.6	672.3	464.5	353.5	5,864.8	12.3
1. Ames City 00X-099	41	32	0	1	2	2	0	78	
2. Campus Pammel 4XX-5XX	1	1	0	0	0	0	0	2	
3 701-702-703-704	335	68	9	9	12	3	2	438	
4. County X85	461	111	19	26	68	9	3	698	
5. Contiguous Co.	410	127	6	55	90	70	17	775	
6. Other Counties	116	56	2	6	47	46	13	286	
7. States	27	2	0	2	21	22	25	99	
8 Total	1,391	397	36	99	240	152	60	2,376	1
1. Ames City 00X-099	3.21	2.33	—	—	—	—	0	2.86	
2. Campus Pammel 4XX-5XX	—	—	0	0	0	0	0	—	
3. 701-702-703-704	2.58	2.13	3.77	5.46	3.82	—	—	2.66	
4. County X85	2.08	1.81	2.02	4.54	2.41	5.38	—	2.23	
5. Contiguous Co.	1.86	1.99	7.47	2.69	2.52	2.84	4.53	2.21	
6. Other Counties	1.40	1.35	—	—	3.62	3.37	6.52	2.34	
7. States	—	—	0	—	3.04	2.07	6.39	3.08	
8 Total	2.10	1.92	3.62	3.50	2.80	3.06	5.89	2.38	

NOTE: Upper section of table gives the roadside interview trips between each origin and destination multiplied by the adjusting factor to raise the number of interview trips to the number of post cards handed out.

The middle section gives the number of cards returned for each origin and destination pair.

The lower section gives the expansion factor for each origin and destination pair, upper section divided by the middle section

The object of the comparison of the origins and destinations of the traffic as obtained by the two field methods was to determine whether there was any unequal returns of the postcards which could be attributed to the origin and destination of the trips. In order to accomplish this comparison, all postcard returns by origin and destination pairs were summarized for identical pairs of origins and destinations as obtained by the roadside interviews. The ratio of the postcard trips to the roadside-interview trips for each origin-destination group thus produced a conversion or

parable. So far as could be determined, such assumption is valid.

In making the comparison of results obtained by the two methods, attention was focused on larger classes of trips, that is, trips between larger areas or zones, rather than the smaller tracts or individual counties or cities. In general the classifications used as origins and as destinations are: (1) states other than Iowa, (2) counties of Iowa other than Story and other than those contiguous to Story, (3) counties contiguous to Story, (4) Story County, (5) rural area adjacent to Ames city, (6) Ames city area,

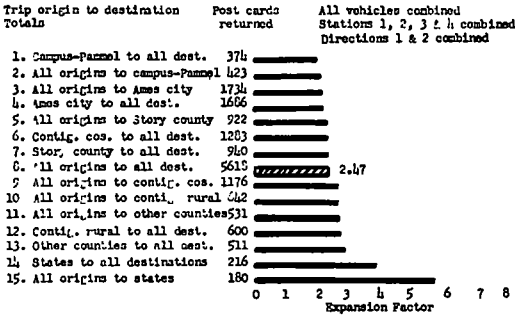


Figure 37.

and (7) campus and Pammel Court area of Iowa State College.

This combination of origins and of destinations massed the data sufficiently so that the number of trips in most trip groups was large enough to give a reliable indication of the expansion factor. Further, in order to eliminate trip groups in which the total number of trips was small, the charts presented in the series of figures do not include trips between origin-and-destination pairs which had less than 25 trips in the roadside interviews or less than 6 postcards returned.

Exterior Stations

Figures 16 to 24 present in detail the comparison of the number of passenger car trips as obtained in the roadside interviews and in the postcard survey.

Figure 17, passenger cars inbound from all four exterior stations, is a typical spread of the expansion factor, in this case, from about 1.38 to 7.46 for the 29 listings of origin-and-destination pairs, with 2.38 as the factor for all trips combined. For these four stations combined, an expansion on the basis of 2.38 for all trips would state the number of trips from other counties to the campus-Pammel area as 172.5 percent of the true number and state the number of trips from the contiguous counties to the contiguous rural area as only 31.9 percent of the correct total. The other listings of origins to destinations would lie in between these two extremes.

Of the total of 2,376 cards returned (Fig. 17) only 593 (Items 9 to 14) would be expanded to within a 10-percent-plus-or-minus range from the roadside-interview total, should the expansion be based on the ratio of cards returned to total cards passed to 100 percent of the traffic.

A closer inspection of Figures 16 through 37 indicates that, in general, the pairs of origins and destinations having one terminal interior to the exterior stations have a lower expansion factor (a greater percentage return) than do these trips having both termini exterior to the stations; this result is particularly evident for those trips from one state through Iowa to another state.

Just how serious is this wide variation in expansion factors as related to particular classes of trips depends, of course, on each origin-and-destination survey and the specific applications of the results. That the number of cards returned by the passenger-car drivers was controlled to an appreciable extent by the particular trip, origin to destination, is evident from this analysis.

Figures 25 through 29 present the expansion factors for single-unit trucks. For these trucks, the expansion factor runs as high as 12.59, or 4.2 times the average factor. The general trends and sequence of items on the graphs is similar to that for the passenger cars.

Figures 30 and 31 give the expansion factors for the combination vehicles and busses. The number of busses is so small

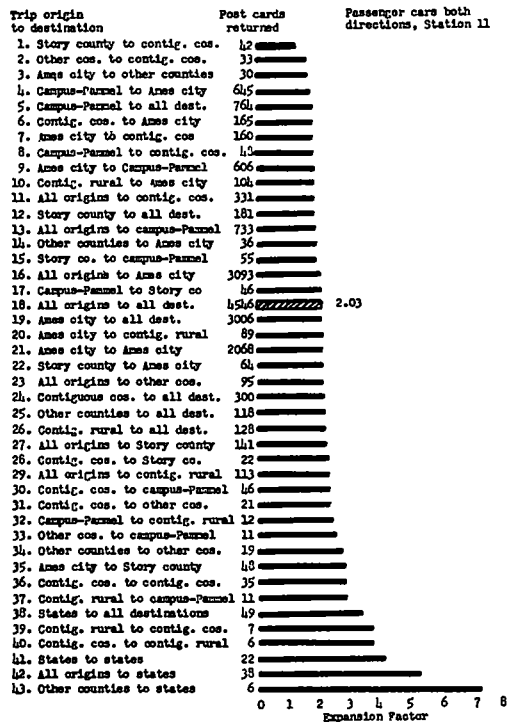


Figure 38.

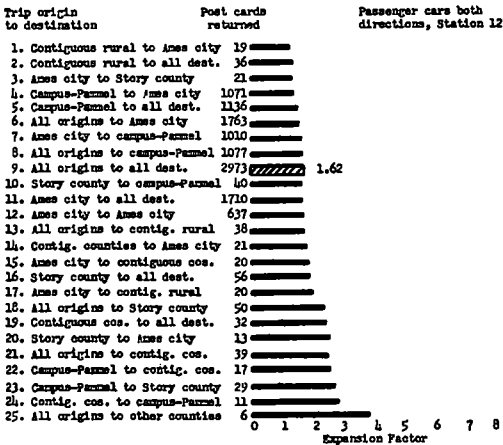


Figure 39.

(less than 5 percent) that these data represent the tractor-semitrailer class almost exclusively. The over-all expansion factor of 2.95 compares to 2.99 for the single-unit trucks, and 2.38 for passenger cars. The range of the expansion factor for inbound combinations varies from 1.35 to 6.85 and for outbound the range is 1.30 to 17.67. The generally small numbers of trips makes the expansion of the postcard returns for combination vehicles somewhat more uncertain than for the two other classes of vehicles.

The results for the combined four exterior stations, both directions, and all three classes of vehicles is given in Figures 36 and 37. With an over-all factor of 2.47, the range of 41 items of origin-and-destination pairs is from 1.12 to 7.65. A range from 10 percent below and above the average factor of 2.47 would include Items 15 through 24 (Fig. 36) totaling 2,129 trips or 37.9 percent of the total of 5,618.

Stations 11 and 12

Figures 38 through 42 show the expansion factors for Stations 11 and 12. There is a greater uniformity of rate of return from the several origin-and-destination pairs, as shown by Figure 38 for passenger cars, both directions, Station 11, than was achieved from the four exterior stations. The range of the expansion factor of the 43 items (including the lines of totals) is from 1.28 to 7.26. A range of 10 percent, plus and minus, from the average factor of 2.03 includes Items 6 through 26 for a total of 3,441 trips from a total of 4,546 postcards returned.

Station 12, on Sixth Street between the campus and eastern Ames, has an over-all expansion factor of 1.62 for both directions and a favorable range of from 1.30 to 3.82 (Fig. 39). A 10-percent variation covers Items 5 through 13 for a total of 1,687 trips from a total of 2,973 cards returned from passenger cars. The more-favorable range and distribution of the expansion factor for Station 12 no doubt is partially accounted for by the high percentage return of 58.5.

For single-unit trucks (Fig. 41) the range of the expansion factor is greater than for passenger cars and there is a less clustering of the items about the average expansion factor of 2.74 for Station 11.

Of the many charts presenting the expansion factors, Figure 42 for single-unit trucks on Station 12, presents the most-favorable distribution of factors. True, not many of the origin-and-destination pairs qualified (25 or more trips in the roadside interviews and at least 6 postcards returned), but such as are presented are within a range of 10 percent plus or minus of the average factor. The expansion factor for trips inbound to the campus is 2.80 and for the outbound trips the factor is 2.63. The reverse order of magnitude could be expected because of the convenience of returning the cards from the college offices through campus mail.

DISCUSSION OF RESULTS

The following items are presented as being significant results brought out in the

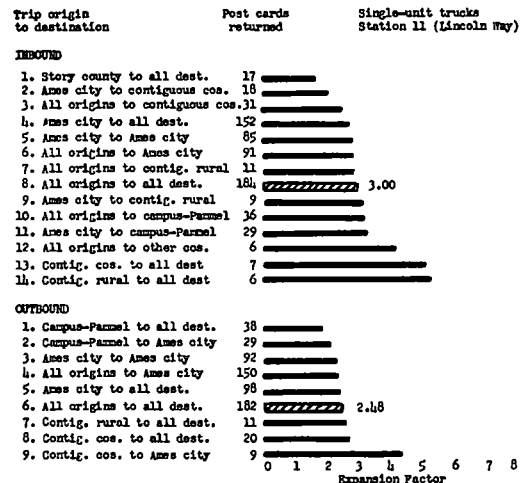


Figure 40.

preceding presentations of the information assembled from the postcard origin-and-destination study and a comparison of the results therefrom with similar results obtained by roadside interviews:

1. There is some tendency to a reducing percentage of postcards returned starting with the morning hour of 7 to 8, and continuing to midnight.

2. The 8-hr. period from 11 p. m. to 7 a. m. produced a significantly less percentage of returns than did the 16-hr. period from 7 a. m. to 11 p. m.

3. About equal percentages of returns were received from the inbound and out-bound traffic streams. At least between the various hours and various stations there was no consistent pattern of differences.

4. A smaller percentage return of cards was received from the drivers of trucks than from drivers of passenger cars.

5. For the two interior stations, the locally owned and operated vehicles produced a higher percentage return than did the vehicles bearing a non-Story County license plate.

6. There was considerable variation in percentage return of cards, station to station, county to county of registration, but no explanations are evident of the cause of the variations. The one exception is that the high percentage return of 58.5 percent from Station 12 is attributed to special letters sent to the college employees and that many drivers through Station 12 were most willing to cooperate in the project because of personal relations, friendly and professional, with those in charge of the survey.

7. For the traffic volumes encountered and for the wide dispersion of origins and destinations, many pairs of origins and destinations had so few cards returned that

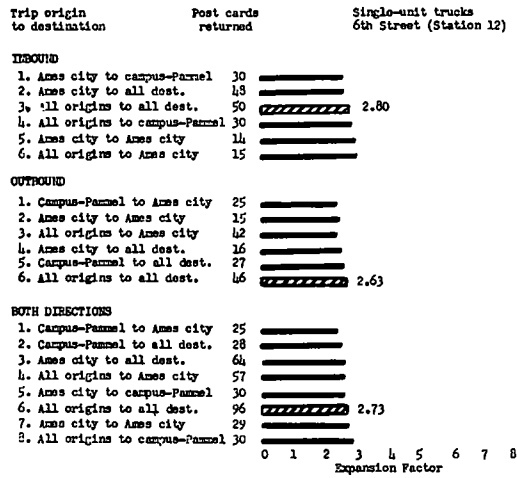


Figure 42.

any expansion of the small return would produce unreliable information. This situation was particularly true of the single unit trucks and of the combination vehicles.

8. There is a smooth range of expansion factors from roughly 1.3 to 8.0 for the postcards returned for particular pairs of origins and destinations to bring these returns up to the number of same trips found in the roadside interviews at the same stations for the 16-hr. period of 7 a. m. to 11 p. m.

9. There seems to be no specific rela-

Conclusions and Final Discussion

From the results of this study of the field postcard method of gaining origin-and-destination information of traffic, there is evidence that the expansion factors should be carefully determined, preferably by classes of vehicles, registration plate, and by hours of the day. Even so, there is no assurance that the expanded results would be in an acceptable agreement with the actual distribution of trips by origins and destinations. This study (Figs. 16 to 42) developed a wide variation of expansion factors for the various origin-and-destination-trip groups and without sufficient consistency that the relation between the expansion factor and the geographical location of the origin-and-destination pairs, other than, in general, the factor is lower when one terminus is interior to the station than when both termini are exterior. Generally, trips from one state across Iowa to another state resulted in higher expansion factors than did other types of trips.

correct factors could be anticipated and

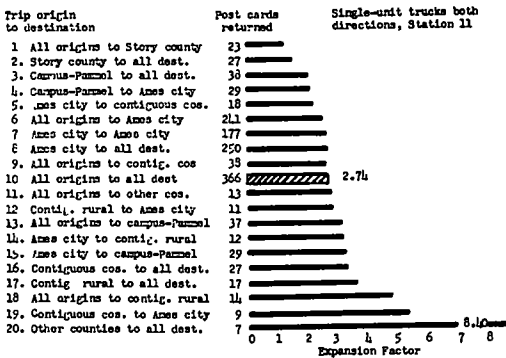


Figure 41.

assumed ahead of knowing the true distribution of the trips.

Unfortunately, with the postcard method there is no means available of checking the correctness of the expanded returns once they are expanded to trips between specific origins and destinations.

There may be applications of the postcard method for which the approximations of the traffic distribution by origins and destinations as gained by the field postcard method would be sufficient, or surveys in which such high return of cards is obtained as to render errors of expansion within acceptable tolerances. Even so, it would appear that some roadside interviews should be conducted in order to get a basis

of evaluation of the reliability of the postcard returns.

The returns for the 8-hr. night period were so small, that expansion of a station to a 24-hr. day on the basis of the 16-hr. survey would be as accurate as expanding the questionable small return for the light night and early morning hours.

Although the serial numbering of the cards and the manual enumeration of traffic in 2-min. periods was adopted for purposes of research and comparison with the roadside interviews, similar provisions would be advantageous for other surveys. Perhaps a 5- or 10-min. interval would be desirable rather than the 2-min. period used in this survey.