CHAPTER 2

ORIGIN AND DESTINATION STUDIES

In any phase of engineering, the planning and design of a system require a knowledge of the loads or demands which will be placed on that system during its economic life. An urban transportation system is no exception. Recognition of the need for better understanding of urban travel patterns has led to the extensive, almost exclusive, use of origin and destination studies. These studies have provided data which are intended to serve as the basis for more rational forecasts of future traffic demands.

The origin and destination study establishes a measure of the patterns of movement of persons and goods within a particular area of interest. This kind of study estimates the travel characteristics observed for a typical day. The origin and destination study yields information regarding origins and destinations of trips, time of day in which the trips are made, and mode of travel. In more comprehensive studies, additional data are obtained. These include trip purposes, land use at the beginning or end of the trip, and background social and economic data about the person making the trips.

Methods of Conducting O & D studies.

Origin and destination studies are used by engineers and planners to obtain information regarding the volume, distribution, and operating characteristics of urban traffic. Their predecessors included volume counts, cordon counts and motor vehicle use studies, all of which were undertaken with similar motives. In this research home interview surveys were conducted to obtain the needed data; the accuracy of the home-interview data was evaluated by cordon counts.

Sampling and Site Selection

The most important component of the O-D study for the analysis of trip generation is the home interview. The first step in conducting such a survey entails selection of a systematic sample of dwelling units in the study area. The size of the sample typically ranges from 3 to 5 percent of all dwelling units depending upon the total number of dwelling units within the study area.

In this research, five estates of the National Housing Authority in the vicinity of Bangkok were selected for study. These are : Tungmahamek, Prachanivet 2, Huay Kwang Flats, Dindaeng Flats, and Klongchan. The sizes of the samples range from 5 to 10 percent of all dwelling units of each estate, depending upon the total number of dwelling unit within each estate. Table 5 shows the percentage of surveyed dwelling units and the percentage of sample to total dwelling units at each estate. The samples were selected at random from lists of household addresses. In addition, about 2 to 4 percent of the household addresses were randomly selected for reserve.

Questionnaire

The interview form had two parts : (1) household characteristic, and (2) travel characteristics.

The household characteristic section contained general questions about each household. In formation included : location of the household, type of dwelling unit, number of family members, number of children who are net yet going to school, number of vehicles owned by persons living at this address, and a count of the number of members of the household.

STUDY OF TRIP GENERATION FROM HOUSING ESTATES

INTERVIEW FORM

Sample No .....

Date of survey .....

1. Location of the household .....

   .....

2. Type of dwelling unit

☐ Detached house ☐ Duplex

☐ Row house ☐ Flat

3. Number of family members .....

4. Number of children who are not yet going to school .....

5. Number of vehicles owned by persons living at this address .....

   Private car .....

   Motorcycle .....

   Others (Specify) .....

Name	Sex	Age	Occupation							
			Government employee	Private employee	Private business	Student	Family work without pay	Not working	Others (specify)	Trip?

Figure 2a

Sample No....

Name	Trip No.	Origin	Destination	Mode of trip							Time		Purpose of trip						
				Auto-driver	Auto-passenger	Taxi	Motorcycle	Minibus	Bus	Others (specify)	Start	Arrive	Work	School	Business	Serve passenger	Shopping	Recreation	Home

Figure 2b

Table 5: Completeness of Survey

	Tungmahamek	Prachanivet 2	Huaykwang	Dindaeng	Klongchan		
					Row house	Duplex	Detached house
Total dwelling units (DU)	480	600	1,600	4,144	190	524	621
Surveyed dwelling units	40	78	99	228	27	52	62
Percentage of Surveyed DU to Total-DU	8.3	13.0	6.2	5.5	14.2	9.9	10.0
Refusals or no contact	11	10	15	14	4	13	15
Percentage of Refusals and no contact to surveyed DU	27.5	12.8	15.2	6.2	14.8	25.0	24.2
Vacant dwelling units	5	8	4	6	3	8	10
Percentage of Vacant DU to-Surveyed DU	12.5	10.3	4.0	2.6	11.1	15.4	16.1
Completed dwelling-unit samples	24	60	80	208	20	31	37
Percentage of Completed DU to-Surveyed DU	60.0	76.9	80.8	91.2	74.1	59.6	59.7
Percentage of Complete DU to-Total DU (Sample)	5.0	10.0	5.0	5.0	10.5	5.9	6.0

The travel characteristics part contained questions to be answered by all persons of household who make one or more trips on a stated previous date. These questions are about origins and destinations of each trip, mode employed in making each trips, time of starting and arriving, and purpose of each trip. The home interview form used in this research is shown in Figs. 2a and 2b

Data Collection

The data were collected in the random by selected dwelling units in five estates of National Housing Authority. Interviewers were instructed to obtain travel information at each selected address for a specific day and date. At each interview address, two kinds of information were collected: one concerned the household as a unit, the other was a inventory of the travel of each person aged five or over for a specified weekday. At each sample household, the type of dwelling unit, number of persons, the age and occupation of each household member aged five or over and the number of cars owned were recorded. Then, for each person aged five or over. a complete record was made of their travels for a specific 24-hour peroid. The interviewers recorded, for each person trip, the time and place the trip began and the time and place it ended (origin and destination), the method of travel used, and the purpose for which the trip was made.

Letters were mailed to each sample address two days in advance of the home call. The date of the interviewer' s call, plus a general outline of the questions to be asked, were contained in the letter. This provided an introduction for the interviewer and also made it essential that he arrive on schedule.

The home interview survey was first performed at the Tungmahamek housing estate in December 1975; during 1976 the other four other estates were surveyed: Prachanivet 2 in June; Huaykwang in July; and Dindaeng and Klongchan in December. The surveys were conducted from 09.00-16.00 hours on Saturdays and finished in a single day at each estate. With experience, the questionnaire could be completed in about twenty minutes at each household. By this method, successful interviews were achieved from about 12 to 15 household samples perday by each interviewer, depending upon the number of refusals, no contacts or vacant dwelling units. The surveys yielded a total of 460 interviews of household units from the total of 8,159 dwelling units in the five estates. Thus, the average sample size was 5.6 percent. The samples of dwelling units were assumed to represent all person trips and vehicle trips generated from these housing estates. Because of the wide spectrum of income levels represented by the five estates, each housing estate was treated separately in the analysis.

Sources of Variation and Accuracy Check.

Two kinds of data were collected in the O-D surveys: household attributes and information on characteristics of trips. The travel data were primarily intended to describe travel activity within the study area on an average weekday To accomplish this end, the data for the interviewed dwelling units were expanded so as to apply to the so-called universe of all dwilling units in each estate. As a first approximation, expansion factors to be applied to the data, were the reciprocals of the proportion of dwelling units sampled. In some instances, expansion factors were later revised dut to biases revealed by subsequent accuracy checks. The descriptions of travel provided by the home-

interview surveys are subject to at least four sources of error.

Day to Day Variability-The interview date was only one sample from a population of all possible weekdays. Hence, the reported number of trips represents only one observation from some frequency distribution of daily trips for that dwelling unit.

Sampling Variability Among Dwelling Units-The set of dwelling units selected for interviews constitutes only one random sample from the population of all dwelling units in the study area.

Reporting Errors-Conscious or unconscious falsifications of reported travel activity are unavoidable human failings. There is no a priori reason to expect such errors to be compensating.

Recording Errors-These are errors made by interviewers in recording reported trips.

For the first two kinds of errors, reliance is placed on the law of large numbers which states that with sufficiently large sample sizes, the data will converge to the population parameters. Reporting and recording errors are apt to be few if the surveys were performed carefully by experience interviewers.

Of the various kinds of accuracy checks, the most familiar are the screen line counts. In this research, cordon line counts were conducted to check the accuracy of the household interviews. This process provides an independent estimate, called the actual count or ground count, of daily number of vehicle trips and person trips crossing the cordon line.

Cordon line counts were performed at four estates (Prachanivet 2, Huaykwang, Dindaeng and Klongchan) for 14-hour periods (06.00 to 20.00 hrs) on Fridays, one day before the home-interviews, because the Saturday home interview surveys determined the characteristics of trips made on Fridays. At Prachanivet 2 and Huaykwang, ground counts of both vehicle trips and person trips crossing cordon lines which bounded the whole estates were determined. At Dindaeng, only person trips crossing the cordon line circumscribing ten flats (800 dwelling units) were determined. At Klongchan, both vehicle trips and person trips crossing a cordon line around the 190 dwelling units of row houses were determined. There were no cordon counts around the duplexes nor the detached houses because these units are situated along two public streets, so it would have been difficult to count the vehicle trips and person trips due to the many through trips being made by non-residents.

The fluctuations of person trips from the home interviews were expanded by appropriate factors, thereby yielding an estimate of the predicted number of person trips crossing cordon line. Comparisons of the actual and the predicted cordon line counts for four estates in Table 6, and Figs. 3, 4, 5, and 6. In all studies, the predicted counts generally fell somewhat below the actual cordon counts (a few were above) because of the sampling variations, the reported numbers of trips crossing the cordon line, and the expansion factors. Presuming that the surveys sampled 5 percent of all dwelling units, the expansion factor would be 20. If, however, only 4 percent of all dwelling units had been truly interviewed, then an expansion factor of 20 would clearly be too low. Such under sampling could have produced the kinds of discrepancies which were, in fact, observed. Another explanation could be offered about the discrepancies.

Table 6: Percent of Predicted Person Trips to Cordon Line Counts

Estate	Total dwelling units	Sample size %	% of Predicted to Cordon Counts
Prachanivet 2	600	10.0	76.9
Huaykwang	1,600	5.0	87.8
Dindaeng	4,144	5.0	77.3
Klongchan	1,335	6.6	77.1

There were many trips made by persons who did not live in the study area, but these non-resident trips crossed the cordon lines. These trips included those to serve passengers, social visit trips, and shopping trips. It is thought that many such trips were made because there are shops, markets and restaurants in the study area. Thus, the actual number of vehicle trips and person trips crossing cordon lines were greater than those predicted by expansion of the home-interviwe data.

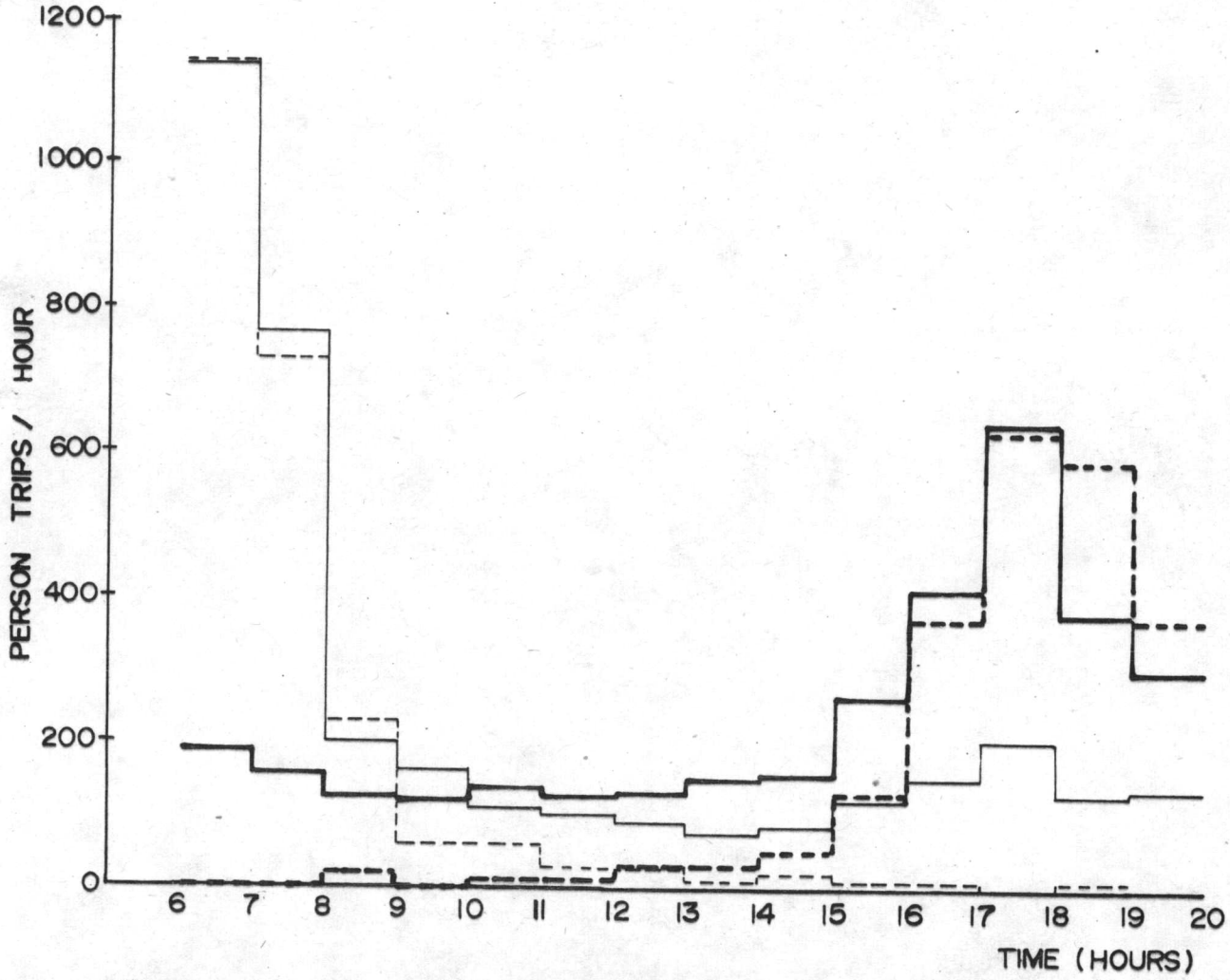

FIGURE 3: PERSON TRIPS ACROSS CORDON LINE COMPARISON
(PRACHANIVET 2)

----- OUTBOUND PREDICTED

- - - - INBOUND PREDICTED

——— OUTBOUND CORDON COUNT

——— INBOUND CORDON COUNT

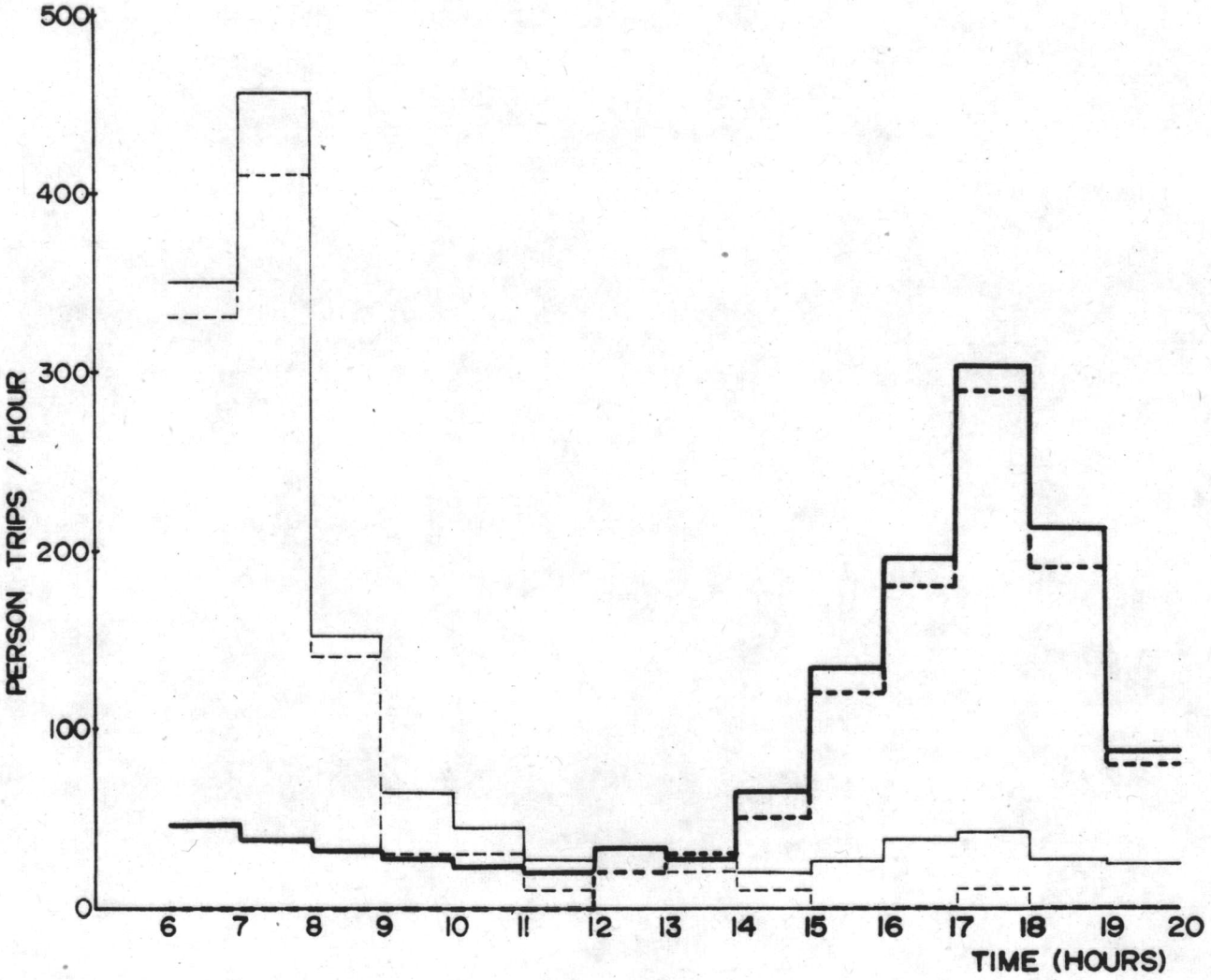

FIGURE 4: PERSON TRIPS ACROSS CORDON LINE COMPARISON
(KLONG CHAN)

----- OUT BOUND PREDICTED

- - - - - IN BOUND PREDICTED

——— OUT BOUND CONDON COUNT

——— IN BOUND CONDON COUNT

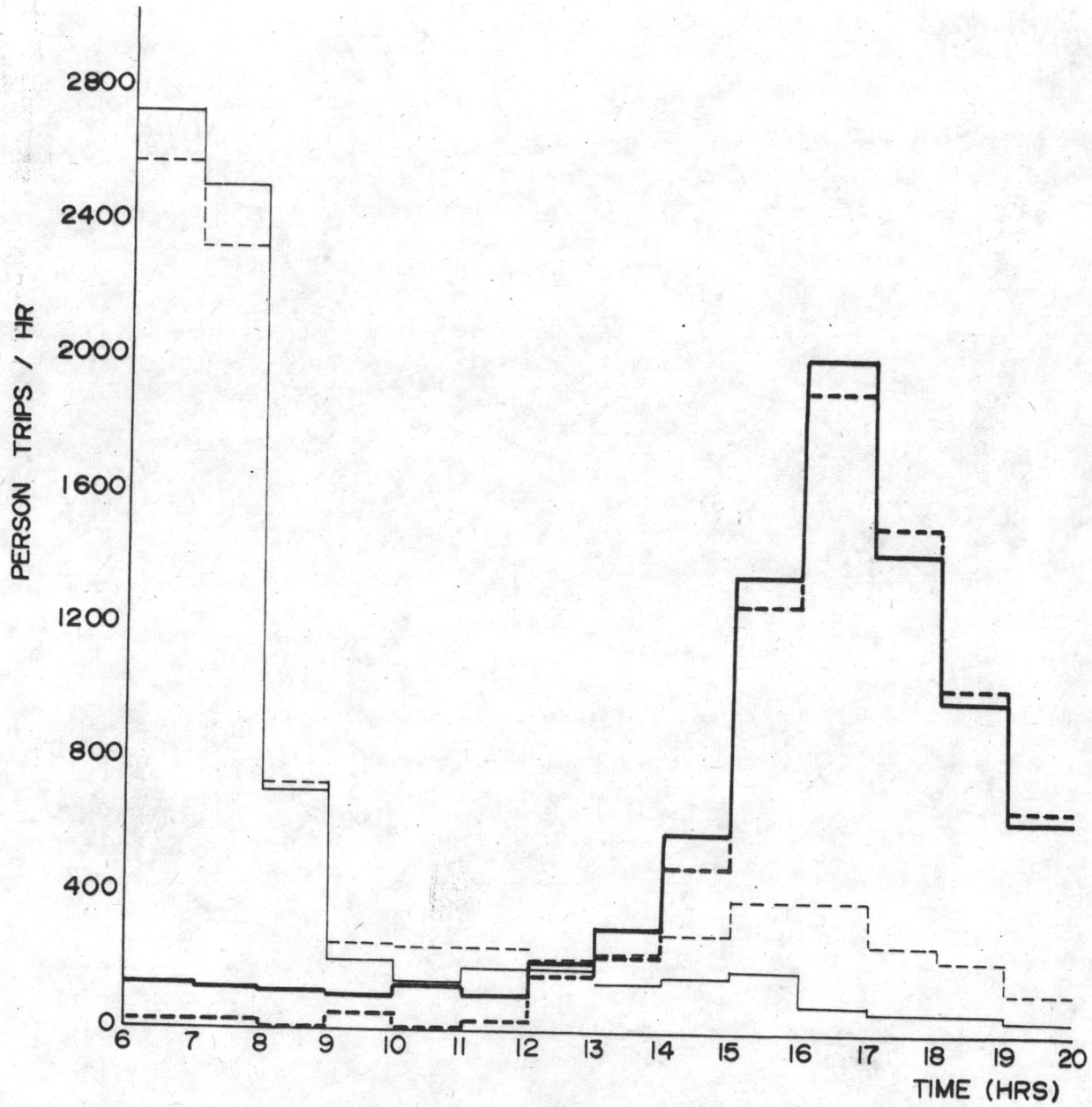

FIGURE 5: PERSON TRIPS ACROSS CORDON LINE COMPARISON
(HUAY KWANG)

——— INBOUND CORDON COUNT
——— OUTBOUND CORDON COUNT
- - - - INBOUND PREDICTED
- - - - OUTBOUND PREDICTED

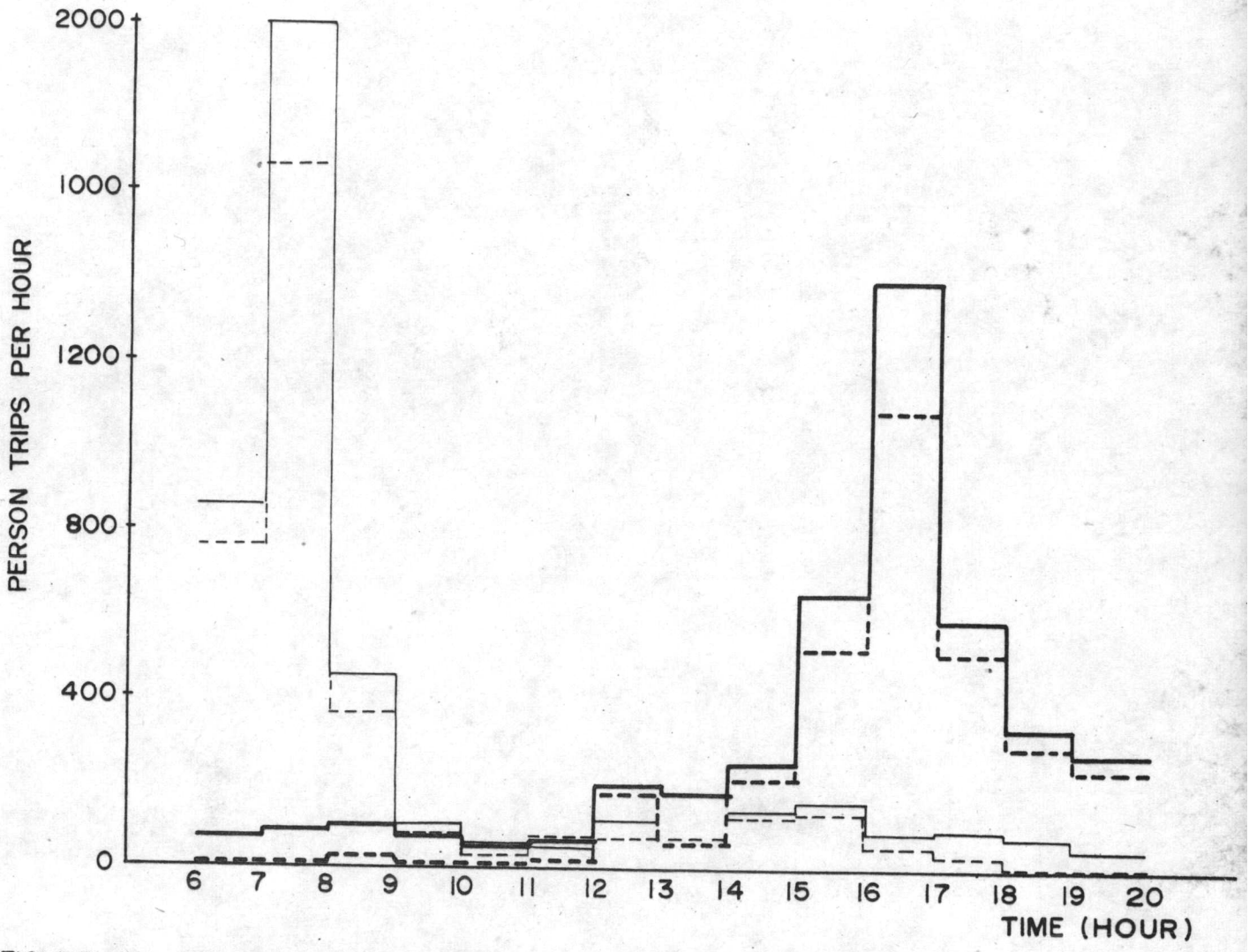

FIGURE 6 : PERSON TRIPS ACROSS CORDON LINE COMPARISON (DINDAENG)

INBOUND CORDON COUNT
OUTBOUND CORDON COUNT
INBOUND PREDICTED
OUTBOUND PREDICTED