

CHAPTER IV

ORIGIN AND DESTINATION SURVEYS ON THE HUA HIN-NONG PLUB FEEDER ROAD

Surveying Procedure for the Origin and Destination Survey

Origin-destination surveys along Hua Hin-Nong Plub road were performed on behalf of a team¹ from the Transport and Road Research Laboratory, England. The survey began on Friday, 18th April 1975, and was concluded on Monday, 21st April 1975. Roadside interviews of vehicle drivers were conducted from 05.30 to 22.00 hrs on four consecutive days. The results of this driver-interview and passenger-interview survey provide a great deal of information to enable a better understanding of the present patterns of the movement of persons and goods along the Hua Hin-Nong Plub feeder road. The data have enabled evaluation of the important characteristics of movement which show the level of development of the area transversed by the feeder road.

The location of the census station for interviewing drivers is shown in Fig. 4. It was situated about 4 kilometers west of Hua Hin town. Six interviewers were engaged to ask the drivers the questions that appeared in the forms. Two local

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policemen were employed to control traffic at the census station. Three speed-limit signs, a stop sign, and a "thank you" sign were put on the road sides for both directions of traffic to alert drivers to the need to stop their vehicles. When vehicles stopped, an interviewer used his own discretion to indicate whether it was a passenger vehicle or non-passenger vehicle. Different questions were asked of the drivers of these two types of vehicles. For passenger vehicles, the type of vehicle was recorded. The drivers were interviewed to ascertain their origin, destination, main purpose for the journey, and kind and quantity of loads. For non-passenger vehicles, the preceding questions were asked as well as questions pertaining to charges for the transportation of goods and whether payment was demanded before or after the trip. Other questions were also asked in both forms, but these were not taken into consideration in this study. The interviewing period was from 05.30 to 22.00 hrs. Some 90 percent of the drivers were interviewed.

Another three interviewers were assigned to interrogate the passengers who were travelling by mini-bus. A special form of questionnaire was used for these passenger interviews. These three interviewers rode the mini-buses as fare-paying passengers and interviewed the passengers en route. As the mini-buses operate from 07.00 to 17.00 hrs, these interviewers were working only during this period. When not performing their work on the mini-buses, they helped the interviewers at the census point,

especially during the peaks in traffic flow in the early morning and late afternoon. On the mini-buses, passengers were asked their origins, destinations, main reason for the journey, frequency of trips made per month, primary occupation, and level of education achieved. The interviewers also recorded the primary kind and quantity of goods carried by each passenger who was interviewed. Other questions were also asked in the passenger interviews, but those data were not analysed in the present study.

All vehicles which passed the census station, except bicycles, were stopped for interviews; the location of the census station is shown in Fig. 4. Subsequently, all of the information was coded with numbers to represent the data. These numbers were transferred onto coding sheets for card punching and then analysis by computer. The origin-destination survey data were analysed in part by using the CDC computer at the Asian Institute of Technology (AIT), and in part at the NEAC computer at the Chulalongkorn Computer Center.

The survey data were separated into three categories:

- (1) interviews of drivers of passenger vehicles, meaning those vehicles that were used primarily for carrying passengers;
- (2) interviews of drivers of non-passenger vehicles, meaning all vehicles other than passenger vehicles; and
- (3) interviews of passengers travelling on mini-buses.

In order to analyse the characteristics of traffic and passenger movements from the origin-destination survey data, 27 places in the study area were identified as being origins or destinations of person or vehicle trips.¹ These places are listed in Table 9 and shown in Fig. 6. The Hua Hin-Nong Plub feeder road is the main road which serves to connect most of the villages in Nong Plub and Hinlekkhai Sub-districts with Hua Hin town. It passes directly through ten places identified in the interviews; the remainder of those identified by the survey respondents are connected to this main stem by intersecting feeder roads. In this study, these 27 places were separated into four zones: A, B, C, and D which are defined in Table 9 and shown in Fig 6. Zones A and C represent the ten places served directly by the study feeder road. Zone A is entirely within Nong Plub Sub-district; Zone C places are entirely in Hinlekkhai Sub-district. Zones B and D represent the areas indirectly served by the study feeder road. Zone B places are all in Nong Plub Sub-district, and Zone D places lie entirely in Hinlekkhai Sub-district.

The census station was located in the eastern segment of the feeder road at a point which acted as a bottleneck to the study area. The study area which is served by the study feeder road is separated from Hua Hin town by a range of low-lying hills. With

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Trip = one-way journey (this definition has been used throughout this research).

Table 9 - Listing of Places in the Study Area

District	Zone	Code	Place name	Kilometrage (from Hua Hin town)	Village	Popula- tion in 1973
Nong Plub	A	03	Ban Nong Plub ¹	27	Nong Plub	1,694
		09	Dole	25	Nong Plub	
		21	Nong Yai Whum	21	Huei Pak Ngam	
		07	Walai	33	Walai	
		30	Tung Fag	35	Walai	
	B	43	Nong Ka Tum	31	Nong Plub	1,360
		48	Huei Pak Ngam	29	Huei Pak Ngam	
		23	Huei Sai Yam	31	Huei Sai Yam	
		41	Kaw Chang	35	Huei Sai Yam	
	Hinlekfai	C	01	Nong Khon	8	Nong Khon
18			Nong Hieng ²	5	Nong Khon	
28			Nong Sam Ore ²	6	Nong Khon	
10			Nong Tapow	14	Nong Tapow	
16			Nong Saw	15	Nong Tapow	
D		05	Wang Bot	15	Wang Bot	6,193
		34	Hai Nern	15	Wang Bot	
		11	Huei Mongkhon	16	Huei Mongkhon	
		35	Tung Khet	26	Huei Mongkhon	
		36	Khao Nokachip	24	Huei Mongkhon	
		12	Tub Tai	15	Tub Tai	
		47	Tung Yao	19	Tub Tai	
		17	Nong Pan Phuk ³	9	Nong Pan Phuk	
		24	Wang Katat	10	Nong Pan Phuk	
		22	Nong Haime	14	Nong Khra	
		29	Nong Khra	13	Nong Khra	
		49	Nong Song Hong	11 ⁴	Nong Song Hong	
		57	Hua Na	8	Hua Na	

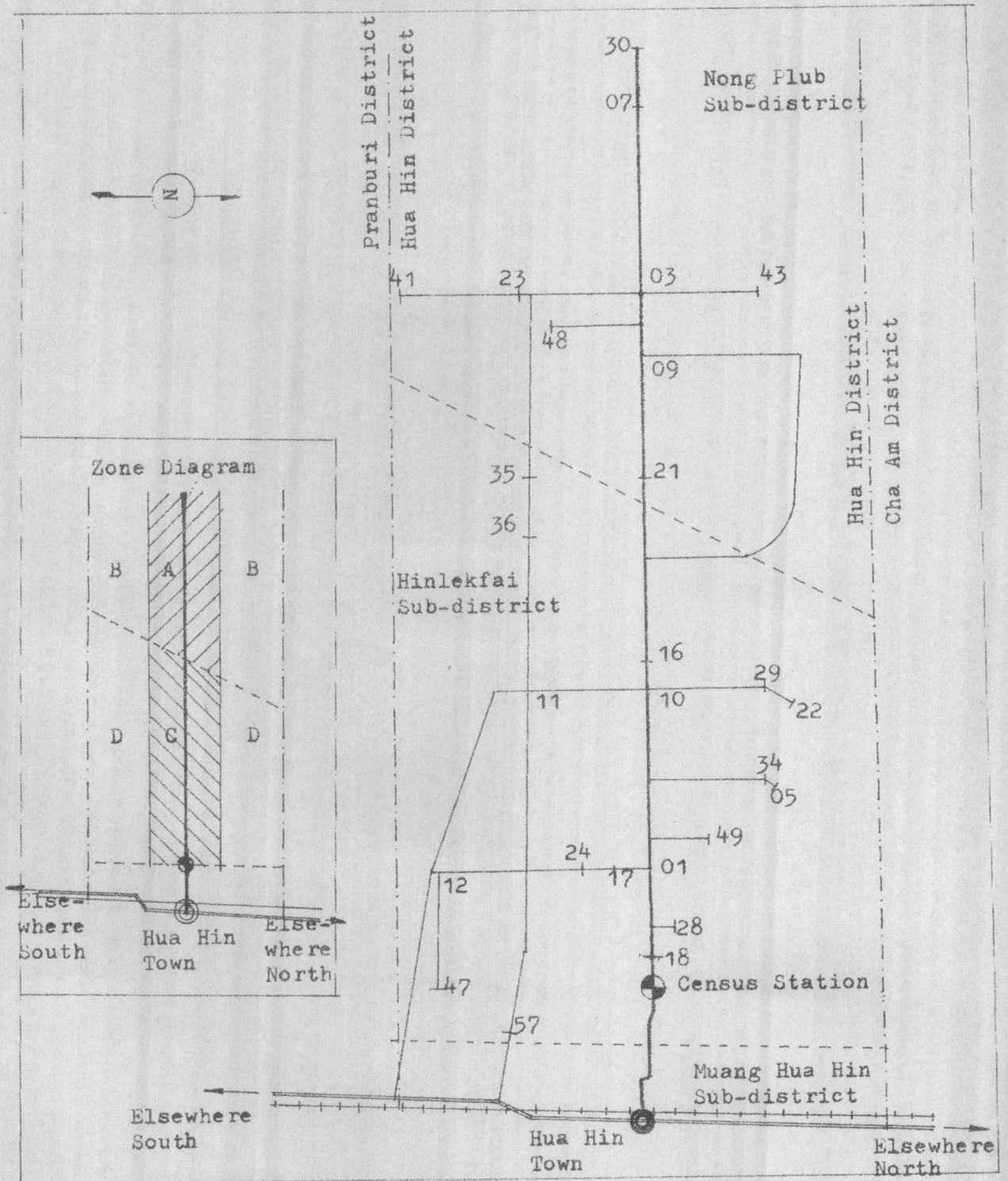
¹
Including Hua Hin Land Development Project.

²
Including Queen's Project.

³
Including Thai Pineapple Company.

⁴
Distance from Hua Hin town via Southern highway and ARD
road to Huei Mongkhon (code 11).

Fig. 6 - Origin and Destination Places, and Zone Diagram
of the Study Area and Outside the Study Area



the exception of Hua Na (code 57)-- which is more conveniently served by the Southern highway and an ARD road running from the highway to Huei Mongkhon --all of the vehicles entering or leaving the study area had to use the study feeder road, and thus to pass through the census station. The 27 places were stated by respondents to be origins or destinations of trips, thus these places enabled study of the traffic and passenger movements in the study area. Trip termini outside the study area were grouped into three zones: Muang Hua Hin Sub-district (meaning Hua Hin town and its environs), elsewhere North, and elsewhere South. Movements originating in the study area were defined as "outward". Movements terminating in the study area were called "inward". All of the survey data was combined to study the characteristics of movements which are described in the following sections.

Passenger Vehicles

Any type of vehicle, excluding bicycles and farm tractors, could be classified as a "passenger vehicle" if the objective of its journey were to carry people from one place to another. Because of the importance of motorcycles as transporters of persons in the study area, the subsequent analysis dealt separately with motorcycles. All other motorized passenger vehicles were grouped for the study.

The incidence of origins or destinations at identified places were computed separately, and expressed as percentages of


the whole incidence, by the defined zones within and outside the study area. The data for motorcycle trips, collected by zone, are shown in Table 10. These results show that about 90 percent of the motorcycles passing through the census station were making trips between places in the rural area west of the check point and Hua Hin town, and vice versa. Motorcycle trips from origins situated to the north of Hua Hin Sub-district amounted to 5.4 percent of motorcycle trips through the check point; those with origins to the south of Hua Hin were 4.2 percent of the sample. A similar distribution occurred for motorcycle trips passing eastward through the census station: 4.6 percent were destined for places north of Hua Hin, and 4.2 percent were destined for south of Hua Hin. Motorcycle trips were thus found to be predominantly short (less than 30 km) with the main generator/ attractor of these journeys being Hua Hin town. From Table 10 it can be seen that 77 percent of the whole sample of motorcycles originated from Hinlekkhai sub-district, which is the portion of the study area nearer to Hua Hin town; some 74 percent of the motorcycle trips bound for the rural area west of the census station were destined for places in Hinlekkhai Sub-district.

Studying Zones A and C, which are located on the study road, it can be seen that 63 percent of the motorcycle trips originated (and 65 percent terminated) at places along the feeder road. Only 2.4 percent of the motorcycle trips either originated or terminated in Zone B which is the furthest and most remote of

Table 10 - Incidence of Origins and Destinations of Motorcycle
Trips to and from the Study Area

Zone	Incidence of Origins by zone		Incidence of destina- tion by zone	
	n	%	n	%
A	53	20.8	58	23.6
B	6	2.4	6	2.4
C	106	41.8	102	41.5
D	89	35.0	80	32.5
Total	254	100.0	246	100.0
Hua Hin	234	90.4	237	91.2
Elsewhere North	14	5.4	12	4.6
Elsewhere South	11	4.2	11	4.2
Total	259	100.0	260	100.0

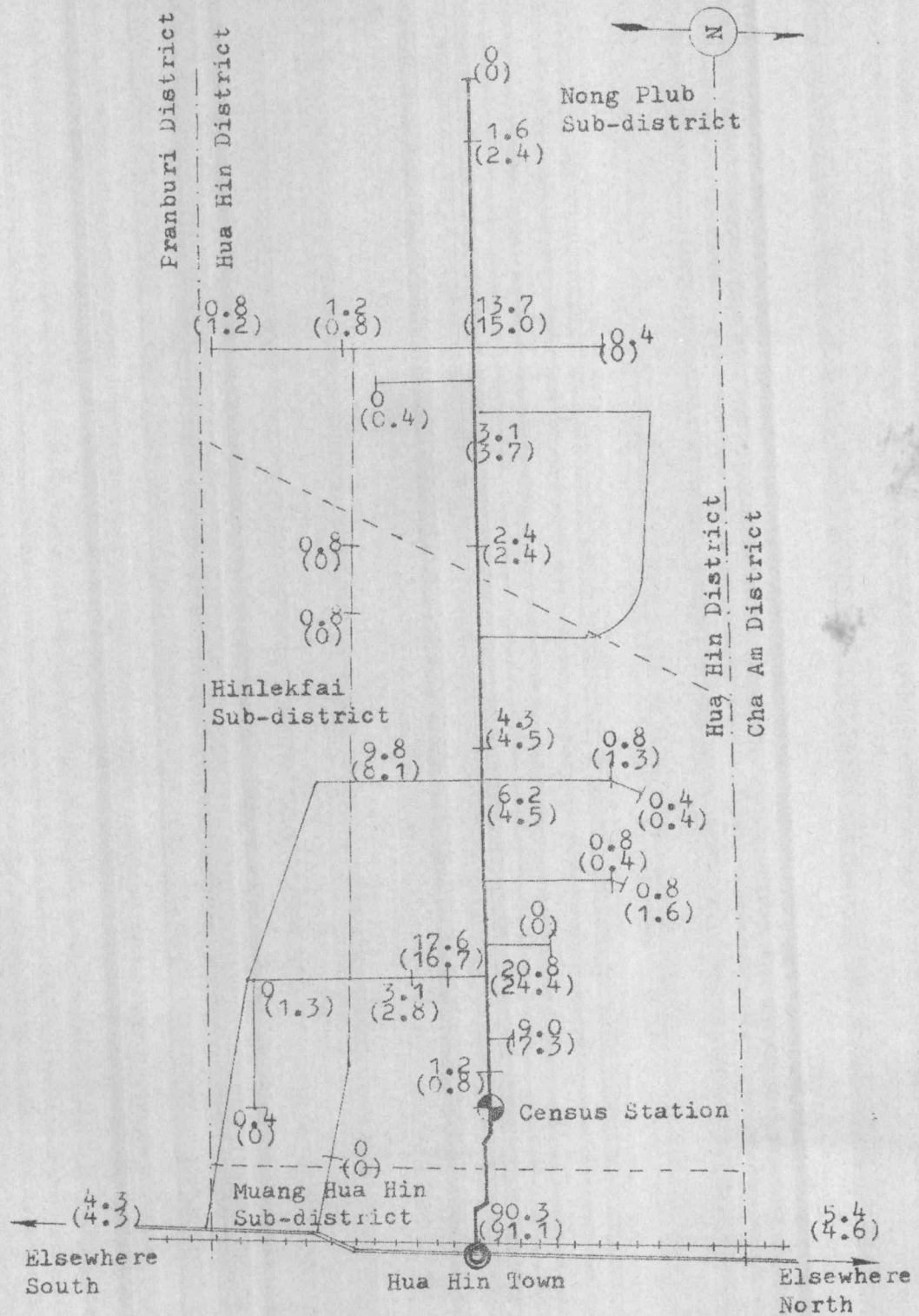
Source: Field survey.



the four zones. The comparable numbers of origins and destinations were nearly equal in number. This would indicate that the motorcycles using the study feeder road are generally engaged in round-trip journeys which returned to the first place of origin. The distribution of motorcycle origins and destinations by place are shown in Fig. 7.

The interzonal movements (trips per day) of motorcycles passing the census station are shown in Table 11. Because the census station acted as a bottleneck to the study area, there are no data for trip movements between zones within the study area, nor between zones outside the study area. The generated trips per day divided by the population of each zone of origin—the trip rate per day of each zone—are shown by the bracketed numbers of Table 11. Even though the trips per day generated from Zone C were twice those from Zone A, the per capita trip rate per day from Zone C was only 43 percent higher than that of Zone A. The per capita trip rate per day of Zone D was about three times that of Zone B, even though the Zone D-generated trips per day were very much higher (15-fold) than those from Zone B. Whilst the generated trips per day from Zones C and D were nearly equal, their per capita daily trip rates were much different. The analysis of per capita trip generation clearly shows the influence of the feeder road on mobility insofar as motorcycle travel is concerned. Origins near the feeder road produced several times as many per capita motorcycle trips per

Fig. 7 - Percentage Incidence of Origins and Destinations of Motorcycle Trips Into and Out Of the Study Area



Plain numbers = percentage of origins for motorcycle trips
 Bracketed numbers = percentage of destinations for motorcycle trips

Table 11 - Generated Trips Per Day, and Generated Trips Per Day
Per 1000 Residents of Origin Zones, by Motorcycles to
and from the Study Area

Origin Destination	Origin				Hua Hin	Elsewhere		Total
	A	B	C	D		North	South	
A	-	-	-	-	12.5	1.0	1.0	14.5
B	-	-	-	-	1.5	0	0	1.5
C	-	-	-	-	21.7	1.5	1.2	24.4
D	-	-	-	-	19.2	0.5	0.2	19.9
Hua Hin	11.0 (6.5)	1.5 (1.1)	23.7 (10.2)	20.7 (3.3)	-	-	-	56.9
Elsewhere North	0.7 (0.4)	0 (0)	0.5 (0.2)	1.5 (0.2)	-	-	-	2.7
Elsewhere South	1.2 (0.7)	0 (0)	1.2 (0.5)	0.2 (0.0)	-	-	-	2.6
Total	12.9 (7.6)	1.5 (1.1)	25.4 (10.9)	22.4 (3.5)	54.9	3.0	2.4	122.5

Plain numbers = generated trips/day.

Bracketed number = generated trip/day per 1000 residents
of that origin zone.

day as those origins which were not directly served by the feeder road.

The incidence of origins and destinations of other passenger-vehicle trips, exclusive of farm tractors and bicycles, into and out of the study area are shown in Table 12. About 76 percent of these trips originated in Hua Hin, 16 percent from elsewhere north and 8 percent from elsewhere south. It is surmised that the percentage of trips originating from Hua Hin is less than those with Hua Hin as the destination because the questionnaires was not properly structured to distinguish between an ultimate destination and way stops along the journey. As the number of trip destinations in the study area is greater than the number of trip origins, it is likely that some trips outward bound from the study area were made by routes other than that used to enter the study area. From the percentages shown in Table 12, it can be seen that most of the trips (64 percent) terminated in Nong Plub Sub-district (Zones A and B). This finding may be somewhat biased because the sample of passenger vehicles contained many mini-buses which were operating between Hua Hin and Walai, the latter being situated at the remote western end of the study area. A subsequent analysis compares passenger trips with passenger-vehicle trips.

A comparison of Table 10 with Table 12 shows some striking differences between motorcycle trips and other passenger-vehicle trips, both into and out of the study area. Attention has already been called to the importance of Zone A for other

Table 12 - Incidence of Origins and Destinations of Trips Made By
Other Passenger-Vehicles¹ Into and Out of the Study
Area

Zone	Incidence of origin by zone		Incidence of destination by zone	
	n	%	n	%
A	461	60.2	524	62.2
B	23	3.0	19	2.2
C	125	16.3	134	15.9
D	158	20.5	166	19.7
Total	767	100.0	843	100.0
Hua Hin	655	75.8	632	81.1
Elsewhere North	135	15.6	83	10.7
Elsewhere South	74	8.6	64	8.2
Total	864	100.0	779	100.0

¹
Excluding motorcycles, bicycles and farm tractors.

Source: Field survey.

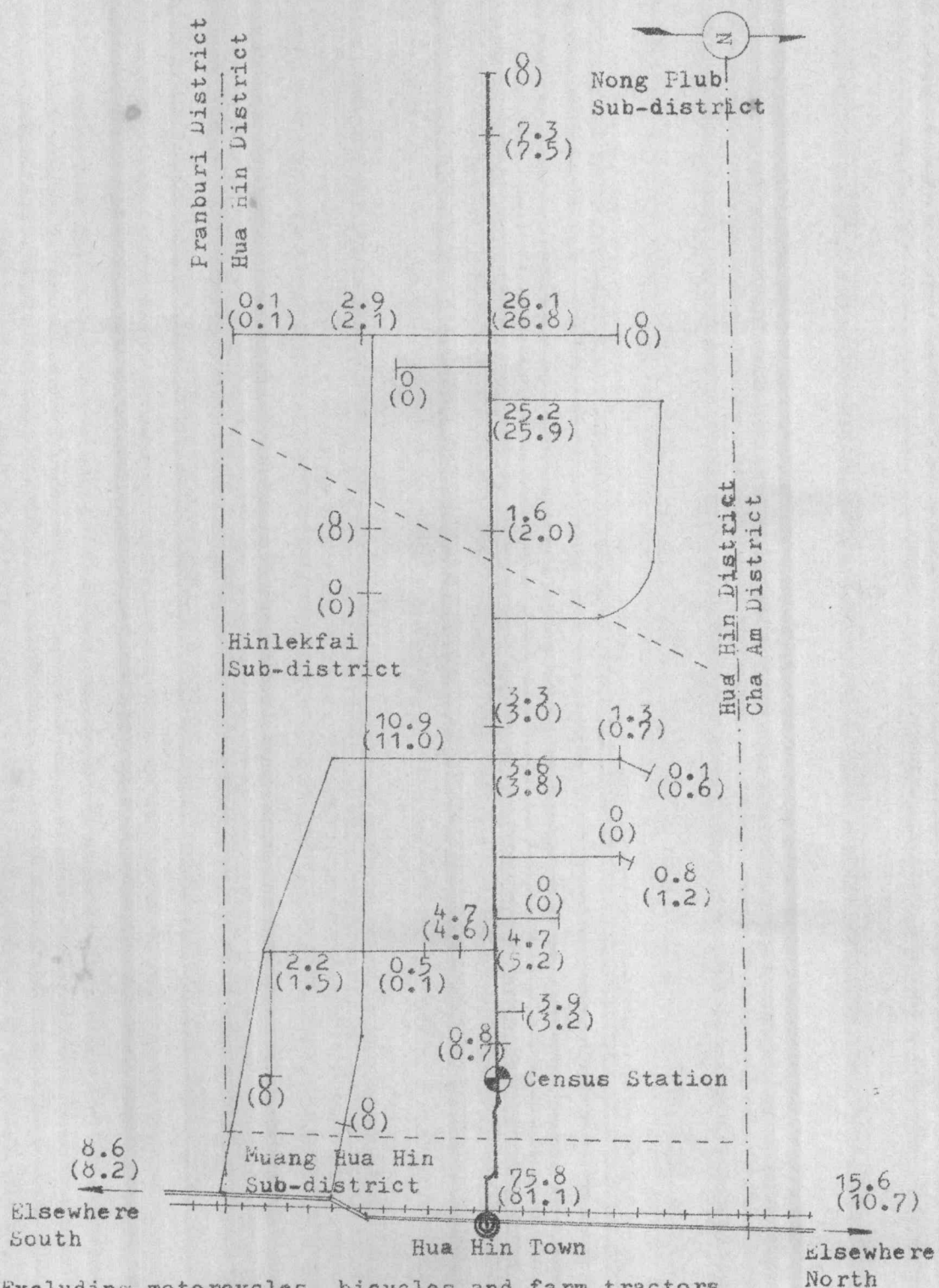
passenger-vehicle trips: 60 percent of the trips outward bound from the study area originated and 62 percent of the inward trips terminated in this zone which comprises only a few places along the feeder road. These figures are in sharp contrast to motorcycle trips originating (21 percent) or terminating (24 percent) in Zone A.

Continuing the comparison for passenger-vehicle trips for Zones C and D, the importance of Hinlekfai Sub-district for motorcycle trips (77 percent of origins, 74 percent of destinations) is in sharp contrast to the relatively lesser importance of this Sub-district for other passenger-vehicle trips (37 percent of origins, 36 percent of destinations).

In a similar vein, Hua Hin town is more important as an attractor/generator for motorcycle trips (90 percent of origins, 91 percent of destinations) than it is for other passenger-vehicle trips (76 percent of origins, 81 percent of destinations). The differences enunciated in these three paragraphs may well serve to mark the motorcycle as predominantly a short-distance vehicle, in contrast with those encompassed in the large category of "other passenger-vehicles".

The distribution of origins and destinations by percentages of incidents for passenger-vehicle trips (other than those made by motorcycles, bicycles, or farm tractors) are shown in Fig. 8.

Fig. 8- Incidence of Origins and Destinations of Trips Made by
Other Passenger-Vehicles¹ Into and Out Of the Study Area



¹ Excluding motorcycles, bicycles and farm tractors.

Plain number = percentage of origins for other passenger-vehicle trips
Bracketed number = percentage of destinations for other passenger-vehicle trips

The interzonal movements (trips per day) of other passenger-vehicles—besides motorcycles, bicycles and farm tractors—passing the census station are shown in Table 13. The daily trip rates per 1000 persons are shown in brackets. The trips per day generated in Zone D were seven times those from Zone B, but the per capita trip rate per day was only 50 percent higher than **that from Zone B.**

With due consideration being given to the very large number of mini-bus trips travelling the full length of the feeder road from Hua Hin to Walai, the high degree of mobility to residents in Zones A and C (directly served by the feeder road), as contrasted to residents in Zones B and D, is brought out by the data shown in Table 13.

The distribution of number of passenger vehicles of each type, and the occupants carried by these vehicles, are shown in Table 14. The average number of occupants per vehicle is also presented. Perhaps the strongest point brought out by the data in Table 14 is the relatively high degree of utilization of passenger vehicles in the study area.

To study the reasons people had for making journeys in the passenger vehicles which passed through the census station, the reasons for the journey were obtained from passenger interviews and have been grouped into seven categories; the incidence of each category is shown in Table 15. It may be seen that work trips to and from the study area (westward: 36 percent)

Table 13 - Generated Trips Per Day, and Generated Trips Per Day
Per 1000 Residents of Origin Zones, by Other Passenger
Vehicles¹ to and from the Study Area

Origin Destination	Origin				Hua Hin	Elsewhere		Total
	A	B	C	D		North	South	
A	-	-	-	-	97.2	21.7	9.7	128.6
B	-	-	-	-	4.7	0	0	4.7
C	-	-	-	-	24.7	4.5	3.7	32.9
D	-	-	-	-	32.2	5.5	2.7	40.4
Hua Hin	89.2 (52.7)	5.0 (3.7)	25.5 (11.0)	34.2 (5.5)	-	-	-	153.9
Elsewhere North	12.7 (7.5)	0 (0)	3.2 (1.4)	2.7 (0.4)	-	-	-	18.6
Elsewhere South	10.7 (6.3)	0.5 (0.4)	2.0 (0.9)	1.7 (0.3)	-	-	-	14.9
Total	112.6 (66.5)	5.5 (4.0)	30.7 (13.2)	38.6 (6.2)	158.8	31.7	16.1	394.0

¹
Excluding motorcycles, bicycles, and farm tractors.

Plain numbers = generated trips/day

Bracketed numbers = generated trips/day per 1000 residents
of that origin zone.

Table 14 - Numbers of Occupants of Passenger Vehicles, and Average
Number of People Per Vehicle

Vehicle type	Number of people carried		Number of vehicles per 4 days	Average people per vehicle
	Per 4 days	Average per day		
Motorcycle	611	153	417	1.5
Land Rover	957	239	223	4.3
Small truck	3,414	853	353	9.7
Car	782	195	170	4.6
Mini-bus	5,000	1,250	320	15.6
Pick-up	807	202	166	4.9
6-wheel truck	2,642	660	99	26.7
Bus	1,500	375	38	39.5
10-wheel truck	508	127	14	36.3
Sub-total	16,221	4,054	1,800	9.0
Major load other than people (all vehicle types)	486 ¹	117 ¹	486	1.0
Total	16,707	4,171	2,268	7.3

¹
Drivers and other occupants of all types of vehicles carrying commodities as the major load.

Table 15 - Stated Reason for Trips Made by Passenger Vehicles Into
and Out of the Study Area

Journey reason	Outward (Eastward)		Inward (Westward)	
	n	%	n	%
Go home	346	32.0	182	15.6
Pickup passengers or deliver goods	320	29.7	335	28.6
Shopping	133	12.3	26	2.2
Personal business	119	11.0	156	13.3
To work	97	9.0	417	35.7
Don't know or undeclared	65	6.0	54	4.6
To school	0	0	0	0
Total	1,080	100.0	1,170	100.0

Source: Field survey.

and home trips (eastward: 32 percent) were the largest single trip purpose of vehicles transporting passengers. The second most important category of the journey reason for passenger vehicles was to pick up passengers or to deliver goods. This accounted for 29 percent of the inbound westward trips and 30 percent of the outbound eastward trips. However, the dominant flows of westbound trips to work, and eastbound trips to return home, underscore the magnitude of importance of job opportunities in this rural area. These work/home trip flows are in marked contrast to eastward (outbound) work trips, which amounted to 9 percent, and westward (inbound) trips to return home: 16 percent. Altogether, trips made by passenger vehicles passing through the census station which are associated with journeys to work or to return home accounted for nearly half of all passenger-vehicle trips (41 percent eastward, 51 percent westward). The absence of school trips resulted from the survey being conducted in April 1975 when schools were closed for the hot-season vacation.

In the field survey, the kinds of major loads that were carried on the passenger vehicles were determined. These are shown in Table 16. As expected, the predominant load that was carried was people: 79 percent of the outbound vehicles, and 84 percent of the inbound vehicles. Nearly one-sixth of the vehicles drove empty with neither goods nor passengers. Inwards to the study area, fuel or lubricants, and edibles or drinks, were the dominant goods that were being delivered by passenger

Table 16 - Incidence of Various Categories of Loads Carried by
Passenger Vehicles to or from the Study Area

Kind of load carried	Outward (Eastward)		Inward (Westward)	
	n	%	n	%
People	903	83.9	919	79.1
Spare parts or construction materials	8	0.7	7	0.6
Upland crops	5	0.5	2	0.2
Charcoal or fuel wood	4	0.4	1	0.1
Fruit or vegetables	2	0.2	1	0.1
Edibles or drinks	1	0.1	15	1.3
Domestic and retail goods	1	0.1	1	0.1
Fuel or lubricants	0	0	28	2.4
Fertilizer, seeds or insecticide	0	0	1	0.1
Empty vehicle	152	14.1	186	16.0
Total	1,076	100.0	1,161	100.0

Source: Field survey.

vehicles. A few passenger vehicles travelling eastward carried charcoal, upland crops, or spare parts or construction materials.

The number of passengers carried by each passenger vehicle are tabulated in Table 17, and shown in Fig. 9. These appear to be dispersed as a Poisson distribution. The arithmetic means of the two directions are nearly equal. The most frequently occurring occupancy (modal value) was two occupants per passenger vehicle.

Non-Passenger Vehicles: Light Trucks

Fortuitously, light trucks and heavy trucks are the only two types of vehicles that were found to be not used to carry passengers. The zonal origins and destinations of light truck trips to and from the study area are shown in Table 18. It appears that about two-thirds (65 percent) of light-truck trips passing through the census station originated in Hua Hin. The remainder came from elsewhere north (20 percent), and 15 percent from elsewhere south. About 75 percent of the observed light-truck trips originated in Zones A and C, which comprise places on the study feeder road; the remaining 25 percent originated in Zones B and D which are some distance away from the study feeder road. The again-repeated dominance of trip origins and destinations at places along the feeder road (as with motorcycle trips--two-thirds of all trips; and passenger-vehicle trips--more than three-fourths of all trips) lays stress on accessibility.

Table 17 - Tabulation of the Frequencies of the Number of People
Carried Per Passenger Vehicles to and from the Study Area

Number of people per passenger vehicle	Trip direction		Number of people per passenger vehicle	Trip direction		Number of people per passenger vehicle	Trip direction	
	Outward	Inward		Outward	Inward		Outward	Inward
0	152	186	21	1	1	41	0	0
1	183	195	22	1	7	42	0	1
2	202	198	23	0	4	43	1	0
3	73	104	24	2	2	44	0	0
4	65	53	25	23	29	45	6	5
5	40	35						
6	31	26	26	0	5	46	0	0
7	17	17	27	0	4	47	0	0
8	34	10	28	1	2	48	1	1
9	10	7	29	0	1	49	0	0
10	36	34	30	14	21	50	19	14
11	4	4	31	0	6	51	0	0
12	5	8	32	0	0	52	0	0
13	4	4	33	0	1	53	0	0
14	5	3	34	0	0	54	0	0
15	27	17	35	7	8	55	1	0
16	3	5	36	1	0	56	0	0
17	3	1	37	2	2	57	0	0
18	6	8	38	0	1	58	0	0
19	2	2	39	0	0	60	6	3
20	49	43	40	12	17	60(x)98	6	6

Source: Field survey. (4-day count)

Fig. 9 - Frequency Distribution of the Number of People Carried
Per Passenger Vehicle to and from the Study Area

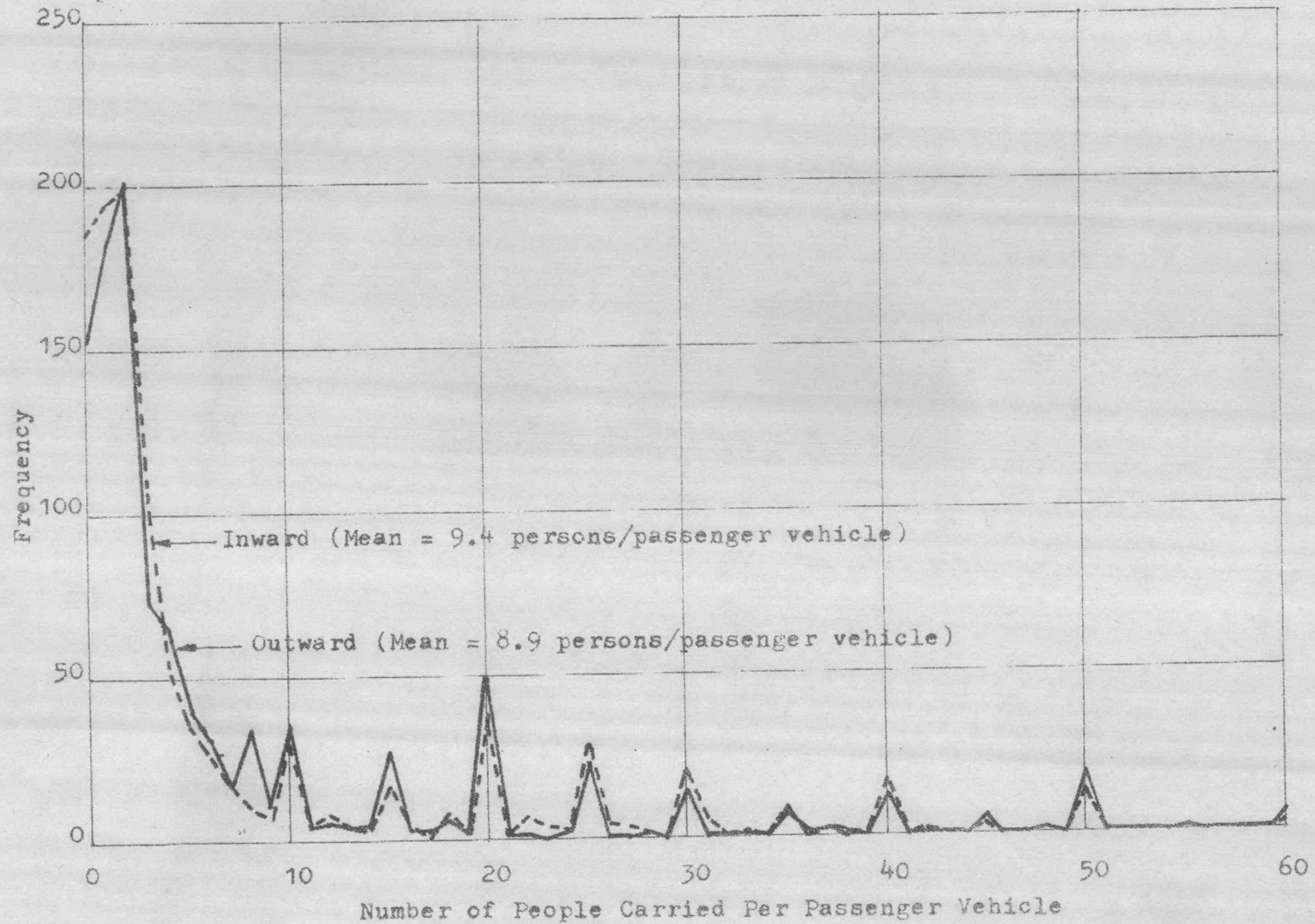


Table 18 - Incidence of Origins and Destinations of Trips made by
Light Trucks Into and Out of the Study Area

Zone	Incidence of origins by zone		Incidence of destina- tions by zone	
	n	%	n	%
A	67	48.5	28	45.2
B	3	2.2	4	6.4
C	37	26.8	15	24.2
D	31	22.5	15	24.2
Total	138	100.0	62	100.0
Hua Hin	43	65.2	93	66.0
Elsewhere North	13	19.7	31	22.0
Elsewhere South	10	15.1	17	12.0
Total	66	100.0	141	100.0

Source: Field survey.

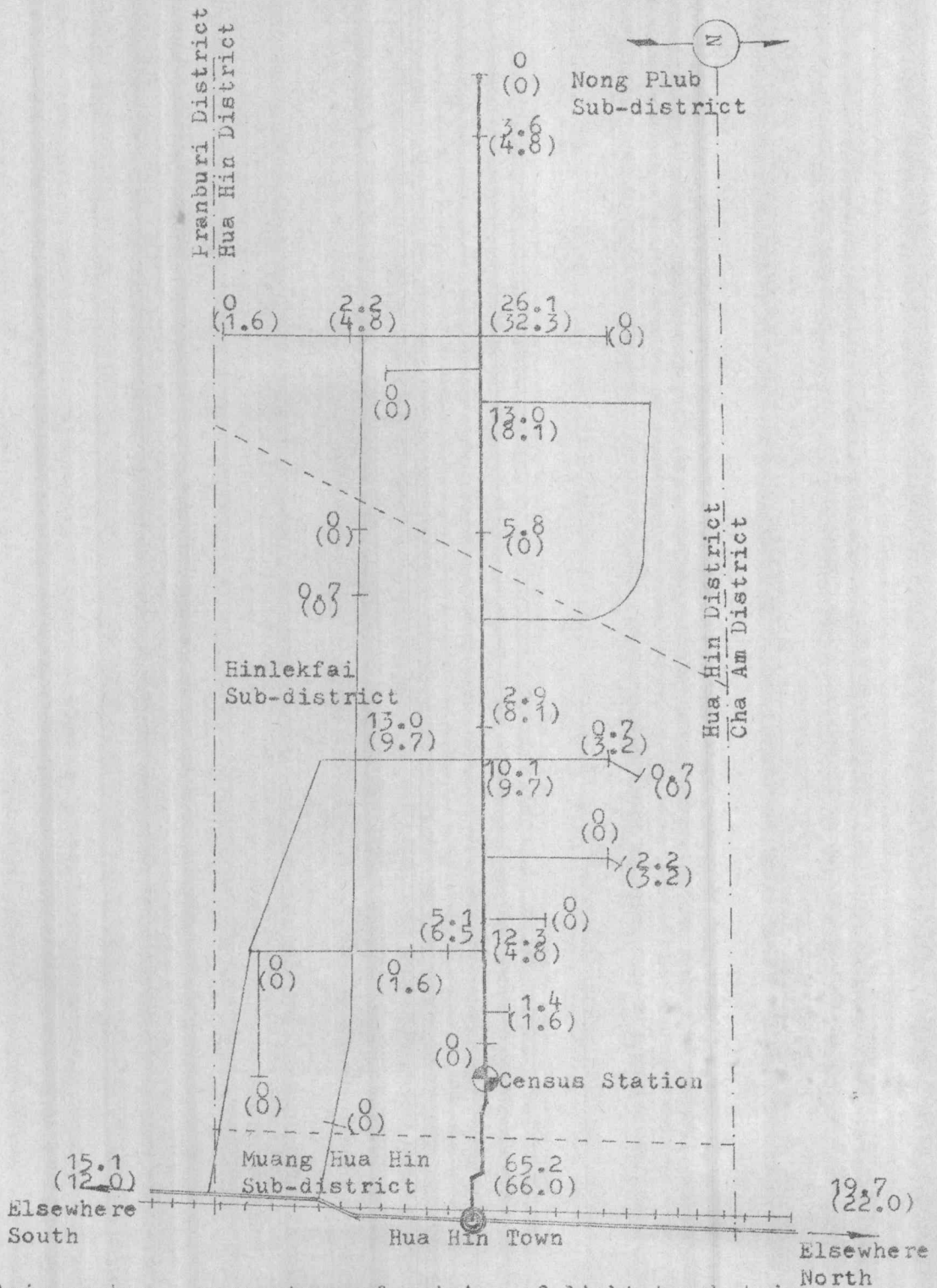
Nearly half of the light-truck trips, both those outward bound and inward bound, originated or terminated in Nong Plub Sub-district. The other half originated and terminated in Hinlekhai Sub-district. The incidence of origins and destinations at individual places are shown in Fig. 10.

Interzonal light-truck movements (trips per day) into and out of the study area are shown in Table 19. The daily per capita trip rates from each zone of origin in the study area are presented in the bracketed numbers. As with previously developed analyses, there is a strong contrast in available transport between the two zones served directly by the study feeder road and the two zones situated off the road. Each group of a thousand residents in Zone A had access to 10 light-truck trips per day (Zone C: 4 trips per day), whereas each 1000 residents in Zone B have access to only 0.5 light-truck trips per day (Zone D: 1.2 trips per day). This finding conforms to the earlier findings for trips by motorcycle and other passenger vehicles.

Non-Passenger Vehicles: Heavy Trucks

Study of the incidence of origins and destinations of heavy trucks which passed through the census station, as shown in Table 20, shows that 42 percent of these heavy trucks originated from Hua Hin. As expected, this is a substantially

Fig. 10 - Incidence of Origins and Destinations of Trips Made by Light Trucks to and from the Study Area



Plain number = percentage of origins of light-truck trips

Bracketed number = percentage of destinations of light-truck trips

Table 19 - Generated Trips Per Day, and Generated Trips Per Day
Per 1000 Residents of Origin Zones, Made by Light Trucks
Into and Out of the Study Area

Origin Destination	A	B	C	D	Elsewhere			Total
					Hua Hin	North	Elsewhere South	
A	-	-	-	-	4.5	1.5	1.0	7.0
B	-	-	-	-	0.7	0.2	0	0.9
C	-	-	-	-	3.2	0.2	0.2	3.6
D	-	-	-	-	1.5	1.2	1.0	3.7
Hua Hin	12.0 (7.1)	0.7 (0.5)	6.0 (2.6)	4.0 (0.6)	-	-	-	22.7
Elsewhere North	3.0 (1.8)	0 (0)	1.5 (0.6)	3.0 (0.5)	-	-	-	7.5
Elsewhere South	1.7 (1.0)	0 (0)	1.7 (0.7)	0.7 (0.1)	-	-	-	4.1
Total	16.7 (9.9)	0.7 (0.5)	9.2 (3.9)	7.7 (1.2)	9.9	3.1	2.2	49.5

Plain numbers = Generated trips/day.

Bracketed numbers = Generated trips/day per 1000 residents
of that origin zone.

Table 20 - Incidence of Origins and Destinations of Trips Made by
Heavy Trucks Into and Out of the Study Area

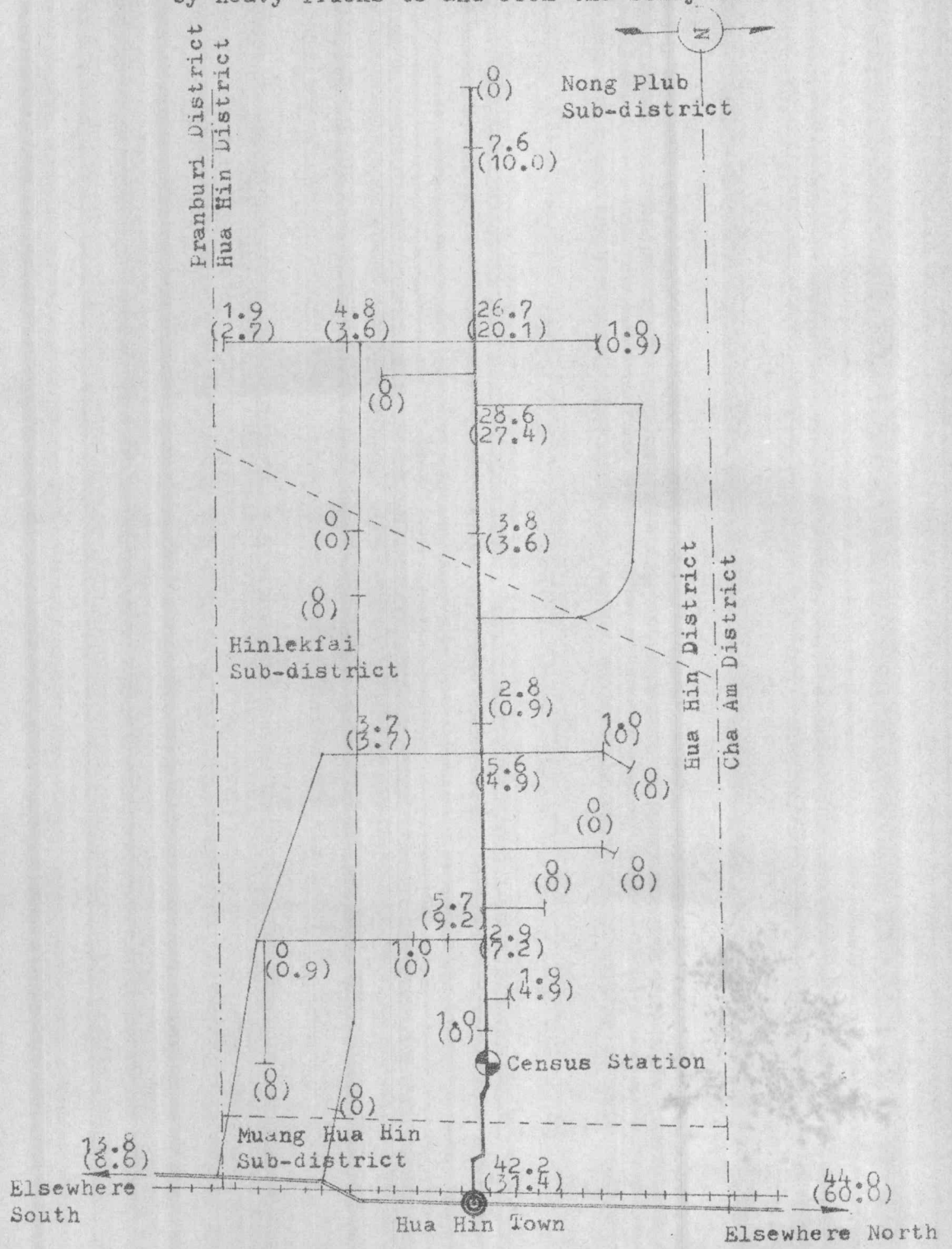
Zone	Incidence of origins by zone		Incidence of destinations by zone	
	n	%	n	%
	A	70	66.7	67
B	8	7.6	8	7.3
C	15	14.3	19	17.4
D	12	11.4	15	13.8
Total	105	100.0	109	100.0
Hua Hin	46	42.2	33	31.4
Elsewhere North	48	44.0	63	60.0
Elsewhere South	15	13.8	9	8.6
Total	109	100.0	105	100.0

Source: Field survey.

smaller fraction than that of light trucks originating in Hua Hin. Nonetheless, it is the second largest fraction of all origins of heavy trucks bound into the rural study area. This may reflect a fault in the form of the questionnaire: the driver interviews did not ascertain the purpose of the previous stop, which thus was evidently reported as an origin rather than an intermediate way-stop for servicing the vehicle or its driver. The data show that a large fraction (60 percent) of the heavy-truck trips had destinations in the elsewhere north zone. The importance of elsewhere north as a zone of destination, compared with its smaller magnitude as a zone of origins lends credence to the possible fault in the definition of origin of a trip in the driver interviews.

Table 20 shows that 81 percent of the outward-bound heavy trucks came from Zones A and C, and 67 percent of the total originated in Zone A. Only 19 percent came from Zones B and D, which constitute places removed from the study feeder road. Altogether, nearly 75 percent of the heavy trucks came from Nong Plub Sub-district, a very much higher fraction of origins than that of light trucks. Nearly 30 percent of all the heavy-truck trips terminated or originated at the Dole factory (place code 09). The incidence of origins and destinations of heavy-truck trips from or to each place is shown in Fig. 11.

Fig. 11 - Incidence of Origins and Destinations of Trips Made by Heavy-Trucks to and from the Study Area



Plain number = percentage of origins of heavy-truck trips
 Bracketed number = percentage of destinations of heavy-truck trips

The interzonal movements of heavy trucks (trips per day) passing the census station are shown in Table 21. The bracketed numbers show the trip rates per day of the zone of origin.

Non-Passenger Vehicles: Commodity Movements

Data showing the incidence of various types of commodities carried by non-passenger vehicles are presented in Table 22. The predominant types of goods that were carried outward from the study area are: upland crops (18 percent of the loads); charcoal, wood or bamboo (15 percent); and spare parts or construction materials (10 percent). Inward-bound loads were dominated by: spare parts or construction materials (8 percent of the loads); charcoal, wood, or bamboo (4 percent); fertilizer, seed, or insecticide (4 percent). Other important inward-bound loads on non-passenger vehicles were upland crops (3 percent), and fuel or lubricants (3 percent). Attention is called to the very high fraction of empty vehicles: 54 percent of those outward bound from the study area, and 75 percent of those inward bound.

The quantities of major commodities (tons/day) carried by the non-passenger vehicles are shown in Table 23. The predominant commodity carried outward was tinned pineapple. This was followed with lesser amounts of sugarcane, charcoal, and fresh pineapple. The dominant goods that were delivered on inward-bound trips were sand, natural fertilizer, fuel, and pineapple plants.

Table 21 - Generated Trips Per Day, and Generated Trips Per Day
Per 1000 Residents of Origin Zones, Made by Heavy
Trucks Into and Out of the Study Area

Origin Destination	A	B	C	D	Hua Hin	Elsewhere North	Elsewhere South	Total
A	-	-	-	-	5.7	8.5	2.5	16.7
B	-	-	-	-	1.2	0.7	0	1.9
C	-	-	-	-	2.5	1.5	0.5	4.5
D	-	-	-	-	2.0	1.2	0.5	3.7
Hua Hin	3.5 (2.1)	0.5 (0.4)	2.2 (0.9)	1.7 (0.3)	-	-	-	7.9
Elsewhere North	12.5 (7.4)	1.2 (0.9)	0.7 (0.3)	1.2 (0.2)	-	-	-	15.6
Elsewhere South	1.5 (0.9)	0.2 (0.1)	0.2 (0.1)	0 (0)	-	-	-	1.9
Total	17.5 (10.3)	1.9 (1.4)	3.1 (1.3)	2.9 (0.5)	11.4	11.9	3.5	52.2

Plain numbers = Generated trips/day

Bracketed numbers = Generated trips/day per 1000 residents
of that origin zone.

Table 22 - Types of Commodities Carried by Non-Passenger Vehicles
to and from the Study Area

Commodity	Outward		Inward	
	n	%	n	%
Upland crops	42	17.6	5	2.7
Charcoal, wood or bamboo	36	15.1	8	4.2
Spare parts or construction materials	23	9.6	15	8.0
Edibles or drinks	3	1.3	3	1.6
Domestic and retail goods	2	0.8	3	1.6
Fruit or vegetables	2	0.8	1	0.5
Fertilizer, seeds or insecticide	1	0.4	7	3.7
Fuel or lubricants	1	0.4	5	2.7
Animal foods	1	0.4	1	0.5
Empty vehicle	128	53.6	140	74.5
Total	239	100.0	188	100.0

Source: Field survey

Table 23 - Quantity of Load Per Day Being Carried By Non-Passenger
Vehicles to and from the Study Area

Commodity	Quantity of load per day being carried (tons/day)	
	Outward	Inward
Tinned pineapple	44.7	-
Sugarcane	26.7	-
Charcoal	20.0	-
Fresh pineapple	12.0	-
Fuel wood	3.2	-
Sand	-	15.0
Natural fertilizer	-	7.5
Fuel	-	6.4
Pineapple plants	-	3.5
Chemical fertilizer	-	0.5
Pig food	-	0.5

The transportation cost for selected commodities moving to or from the rural study area were obtained from the driver interviews. These data are summarized in Table 24. Also ascertained from the interviews with the drivers of non-passenger vehicles were indications of the method of payment of the transportation cost. These data are shown in Table 25. Clearly, most of the payments for transporting goods were made after the goods had been delivered to their destinations.

Mini-bus Passengers

The data which are concerned with mini-bus passengers were obtained from a field survey of randomly selected passengers. Interviewers boarded and rode mini-buses which were plying the route from Hua Hin to Walai. Each interviewer attempted to question as many passengers as possible during the journey. Upon completion of a trip in one direction, the interviewers boarded a mini-bus travelling in the opposite direction and continued the pattern of interviewing. The incidences of origins and destinations by zone of mini-bus passengers are shown in Table 26. Most of the westward-bound passengers originated in Hua Hin (93 percent), with only 5 percent coming from elsewhere north, and 2 percent coming from elsewhere south. Of the outbound (eastward) passengers, nearly two-thirds (66 percent), originated in Hinlekhai sub-district. The remainder of origins in the rural study area were from places in Nong Plub Sub-district (34 percent). This means that there was

Table 24 - Average Transportation Costs of Commodities Delivered
by Non-Passenger Vehicles Into and Out of the Study
Area

Commodity	Haulage direction	Transportation cost (Baht/ton-km)
Sand	Inward	2.68
Charcoal	Outward	1.00
Fuel wood	Outward	8.50
Sugarcane	Outward	0.54
Fresh pineapple	Outward	0.39
Tinned pineapple	Outward	0.45

Source: Field survey.

Table 25 - Methods of Payment of Transportation Cost for Goods
Delivered From or To the Study Area

Method of payment of transportation cost	Incidence	
	n	%
After delivery	72	82.8
Before delivery	5	5.7
None (goods belonged to the vehicle owner)	10	11.5
Total	87	100.0

Source: Field survey.

Table 26 - Incidence of Origins and Destinations of trips Made
by Mini-bus Passengers Into and Out of the Study Area

Zone	Incidence of origins by zone		Incidence of destinations by zone	
	n	%	n	%
A	81	33.1	149	40.7
B	3	1.2	3	0.8
C	96	39.2	154	42.1
D	65	26.5	60	16.4
Total	245	100.0	366	100.0
Hua Hin	338	93.4	219	91.7
Elsewhere North	19	5.2	13	5.4
Elsewhere South	5	1.4	7	2.9
Total	362	100.0	239	100.0

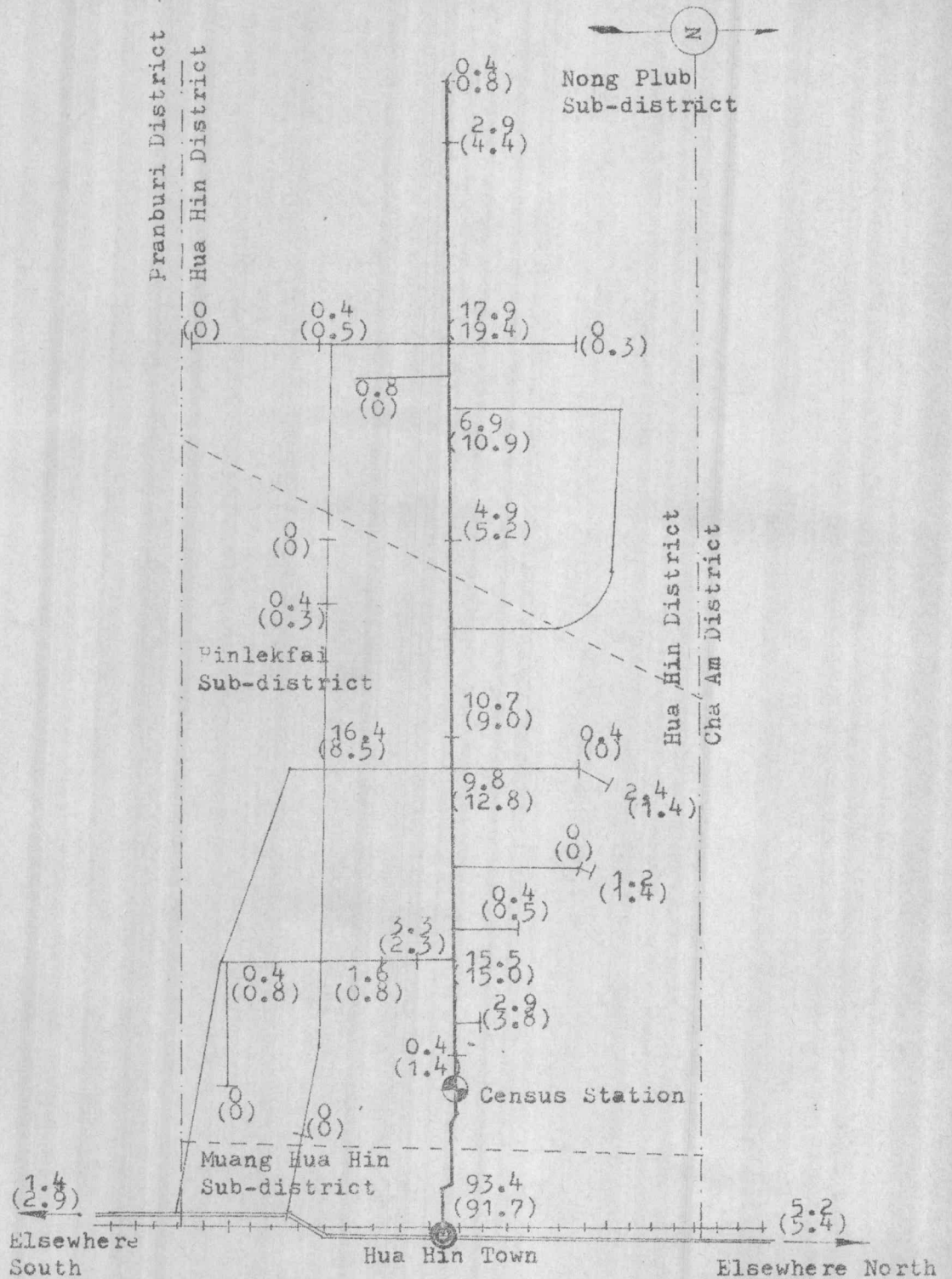
Source: Field survey.

less travel from the further group of villages than there was from those nearer Hua Hin. Mini-bus trips originating in Zones A and C (those places served directly by the Hua Hin-Nong Plub feeder road) amounted to nearly three-quarters (72 percent) of rural origin trips, thus again emphasizing the importance of accessibility in trip generation. The incidences of origins and destinations of mini-bus passengers for each place are shown in Fig. 12.

The interzonal movements of mini-bus passengers are shown in Table 27 in terms of passenger trips per day. The number of trips per day per 1000 residents of each zone of origin is also tabulated to illustrate the per capita frequency of trip-making from each zone. From Table 27, Zones B and D which are remote from the mini-bus routes, generated far less frequent trips than zones situated near road. The mini-bus fare was found to be about Baht 0.30 per kilometer per person.

The reason for making the journey was ascertained from each passenger. These are summarized in Table 28. The predominant reason stated by the outward-bound passengers was shopping (39 percent of the passengers). Another 27 percent of the passengers travelled outward to deal with personal business. Nearly one-fifth (18 percent) of the outward-bound passengers were returning home, and only about 10 percent were travelling on mini-buses to work outside the study area.

Fig. 12 - Incidence of Origins and Destinations of Trips Made
by Mini-bus Passenger to or from the Study Area



Plain number = percentage of origins of mini-bus passengers

Bracketed number = percentage of destinations of mini-bus passengers

Table 27 - Generated Trips Per Day, and Generated Trips Per Day
Per 1000 Residents of Origin Zones, Made by Mini-bus
Passengers Into and Out of the Study Area

Origin Destination	A	B	C	D	Elsewhere			Total
					Hua Hin	North	South	
A	-	-	-	-	342.9	22.9	10.9	376.0
B	-	-	-	-	7.6	0	0	7.6
C	-	-	-	-	337.8	17.8	0	355.6
D	-	-	-	-	142.2	2.5	2.5	147.2
Hua Hin	190.5 (112.5)	7.6 (5.6)	210.8 (90.6)	132.1 (21.3)	-	-	-	541.0
Elsewhere North	2.5 (1.5)	0 (0)	15.2 (6.5)	15.2 (2.5)	-	-	-	32.9
Elsewhere South	7.6 (4.5)	0 (0)	2.5 (1.1)	2.5 (0.4)	-	-	-	12.6
Total	200.6 (118.5)	7.6 (5.6)	228.5 (98.2)	149.8 (24.2)	830.5	43.2	12.7	1,472.9

Plain numbers = generated trips/day

Bracketed numbers = generated trips/day per 1000 residents
of that origin zone.

Table 28 - Stated Reason for Trips Made by Passengers on Mini-buses
Into and Out of the Study Area

Journey Reason	Outward (Eastward)		Inward (Westward)	
	n	%	n	%
Shopping	96	39.0	18	5.0
Personal business	66	26.8	93	25.7
Go home	44	17.9	199	55.0
To work	25	10.2	44	12.1
Pickup or deliver goods	10	4.1	5	1.4
Don't know or undeclared	5	2.0	3	0.8
To school	0	0	0	0
Total	246	100.0	362	100.0

Source: Field survey.

The predominant reason for passengers travelling inward was to return home (55 percent of the passengers). About one-fourth (26 percent) travelled to the rural area on personal business. Only 12 percent of the mini-bus passengers were travelling to work in the study area. As previously noted, the survey was conducted during the school vacation period; thus, there were no school trips made.

The average number of trips per month made by passengers, and the total number of one-way passenger trips per month from each origin zone in the study area, are shown in Table 29. In Tables 29, 30, 31, and 32, values of the average number of passengers per day were derived from the multiplication of the number of interviewed passengers by the expansion factor shown in the footnote to each table. The total passenger-trips per month were obtained on the basis of 30 days per month. Analogous data for the destination zones are shown in Table 30. The average number of one-way passenger-trips per month of Zones A, C, and D (both as origin zones and as destination zones) are but slightly different. However, Zone B—which was found to be a low-incidence generator (Table 26)—is also characterized by a significantly lower average trip rate per month than the other three rural zones. As previously suggested, the poor accessibility of Zone B places may be the principal deterrent to higher levels of personal travel. Zone C exhibited the highest zonal incidence of mini-bus passenger origins and destinations as well as the highest zonal trip-making rate.

Table 29 - Average Trips Per Month of Mini-bus Passengers, and
Total Number of One-Way Passenger Trips Per Month,
from Each Zone of Origin in the Study Area

Origin zones	Number of interviewed passengers		Average trips per month from origin zone	Average number of passengers per day ¹	Total eastbound passenger trips per month
	n	%			
A	81	32.9	15.7	205.7	6,171
B	3	1.2	4.7	7.6	228
C	97	39.5	18.0	246.4	7,392
D	65	26.4	13.0	165.1	4,953
Total	246	100.0	15.76 ²	625.	18,750

Source: Field survey.

$$^1 \text{ Expansion factor} = \frac{5000}{(2)(246)(4)} = 2.54$$

Total of mini-bus passengers = 5,000

Number of days of interviewing = 4

Number of interviewed passengers = 246

Mini-bus directions of travel = 2

² Weighted average.

Table 30 - Average Trips Per Month of Passengers, and Total Number of One-Way Passenger Trips Per Month, to Each Zone of Destination in the Study Area

Destination zones	Number of interviewed passengers		Average trips per month to destination zone	Average number of passengers per day ¹	Total westbound passenger trips per month
	n	%			
A	149	40.7	15.5	254.8	7,644
B	3	0.8	11.0	5.1	153
C	154	42.1	17.7	263.3	7,899
D	60	16.4	16.9	102.6	3,078
Total	366	100.0	16.64 ²	625.	18,750

Source: Field survey

$$^1 \text{ Expansion factor} = \frac{5000}{(2)(366)(4)} = 1.71$$

Total mini-bus passengers in 4 days = 5,000

Number of days of interviewing = 4

Number of interviewed passenger = 366

Mini-bus directions of travel = 2

² Weighted average

The average number of trips per month of mini-bus passengers, and total passenger-trips per month, for each occupation category are shown in Table 31. Similar parameters are given for each education category in Table 32. From the occupation analysis, it can be seen that the differences in the monthly rates of trip making by each of the three occupation categories making trips most frequently (merchants, civil servants, and employees) were hardly significant; all were nearly 20 trips per month. The agriculturists' trip-making rate was only slightly smaller than the other three defined occupations. However, the fraction of agriculturists was nearly half (48 percent) of the sample so the total passenger trips per month for agriculturists is much higher than all other categories, as shown in Table 31. On the contrary, civil servants whose trip-making rate per month was high (20 trips per month) produced the smallest total passenger trips per month because of the small fraction of civil servants (4 percent) found in the interview sample. From Table 32 it appears that, for mini-bus passengers, the higher the level of education attained, the higher is the monthly rate of trip making. As passengers who had attained only a primary school education amounted to 85 percent of the interview sample, this category represented the highest total passenger trips per month on the study feeder road.

The kinds of goods that were carried by passengers on mini-buses were studied; the results are summarized in categories

Table 31 - Average Trips Per Month of Mini-bus Passengers, and
Total Passenger Trips Per Month, in Each Occupation
Category

Occupation	Number of interviewed passengers		Average trips per month of passengers	Average number of passengers per day ¹	Total passenger trips per month
	n	%			
Agriculturist	295	48.4	14.5	604.7	18,141
Merchant	146	24.0	20.6	299.3	8,979
Employee	96	15.8	18.5	196.8	5,904
Civil servant	24	3.9	19.6	40.2	1,476
Other	48	7.9	10.2	98.4	2,952
Total	609	100.0	16.45 ²	1,250.	37,500

Source: Field survey

$$^1 \text{ Expansion factor} = \frac{5000}{(609)(4)} = 2.05$$

Total passengers in 4 days = 5,000

Number of interviewed passengers = 609

Number of days of interviewing = 4

² Weighted average.

Table 32 - Average Trips Per Month of Mini-bus Passengers, and
Total Passenger Trips Per Month, in Each Education
Category

Level of Education Attained	Number of interviewed passengers		Average trips per month of passengers	Average number of passenger per day ¹	Total passenger trips per month
	n	%			
Non-educated	34	6.1	5.7	76.5	2,295
Primary school	472	85.1	16.5	1,062.0	31,860
Secondary school	49	8.8	19.2	110.2	3,306
Total	555	100.0	16.08 ²	1,250.	37,500

Source: Field survey.

$$^1 \text{ Expansion factor} = \frac{5000}{(555)(4)} = 2.25$$

Total passengers in 4 day = 5,000

Number of interviewed passengers = 555

Number of days of interviewing = 4

² Weighted average.

of commodities shown in Table 33. Most of the passengers (80 percent) travelling on mini-buses carried no goods. Of the goods carried, the most common commodities were: upland crops; edibles or drinks; and fruit or vegetables. The only discernible pattern was the dominance of upland crops being carried on the outward journeys, and edibles or drinks being carried on the inward journeys.

Table 33 - Numbers of Incidents of the Commodities Carried by passenger on Mini-bus to and from the Study Area

Commodity	Outward (Eastward)		Inward (Westward)	
	n	%	n	%
Upland crops	20	8.3	23	6.5
Fruit or vegetables	10	4.2	7	2.0
Charcoal	6	2.5	2	0.6
Edibles or drinks	4	1.7	29	8.2
Domestic and retail goods	3	1.2	11	3.1
Animal food	0	0	5	1.4
Fertilizer, seeds or insecticide	0	0	1	0.3
No goods carried	197	82.1	276	77.9
Total	240	100.0	354	100.0

Source: Field survey