

## CHAPTER IV



### STUDY PROCEDURE

The study involved field measurements of speeds and the corresponding vehicular flows at various levels of density. Density is difficult to obtain from an actual count of vehicles along a section of roadway when both density and flow are to be observed simultaneously. Density is a measurement at a given instant whilst flow is a measurement over a period of time, during which density may be changing. However, if cine photographs or Esterline-Angus twenty-pen recorder were to be taken at a known filming or chart paper speed, respectively, of vehicles traveling along a roadway, it would be possible to obtain measurements of space-mean speeds, flows, and densities. But, in this experiment, the density was calculated by dividing the flow by the speed.

#### Selection of site

The data to be measured was speed and the corresponding vehicular flow for various types of urban streets. Each street was allocated one of the categories described in Table 1.

The study was conducted on 17 streets with different characteristics at mid-block (between intersection) in Bangkok. These are shown in Table 2 and Figure 4 to 20.

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Table 1. Urban street classification.

Category Number	Type	Disturbance	Development	Pedestrian conflict	Number of major intersection/mile*
1	-Primary road	No.	Slight	None	0-1
2	-Main road	minor	Built-up	Some	2-7
3	-Distribution road	major	Built-up	Some	2-15
4	-Shopping street	heavy	Built-up	Excessive	2-7
5	-Residential streets and streets used for parking	heavy	Built-up	Some	10-25

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\*An intersection at which the traffic may have to stop or give way, e.g., traffic signals, roundabouts, police control, "Halt" signs, "Slow" signs.

Table 2 Classification, geometric, and other data of the streets studied.

Streets	Category No.	No. of Running lane per study dir.	No. of Parking lane per study dir.	Width of			Type of		Pavement surface condition	Type of development along roadway	Climate condition during collecting data	N.B.
				half roadway (m)	median (m)	footpath (m)	pavement	median				
1. Rama I Road	4	3	-	9.55	1.00	3.60	flexible	curbed and crowned + fence	good	busy shopping	sunny	one-way
2. Rama IV Road	2	3	1	14.10	1.50	4.10	rigid	curbed and crowned	good	shop house & office	cloudy	
3. Yaowaraj Road	4	3	2	16.00	-	2.50	flexible	-	fair	busy shopping	cloudy	
4. Ratchadamnoen Khang Road	3	4	1	17.60	4.50	4.00	rigid	curbed and crowned	good	shop house & office	sunny	
5. Phaholyothin Road	2	2	1	10.20	3.00	3.50	rigid	curbed and crowned	good	shop house	sunny	
6. Sukhumvit Road	2	2	1	10.45	1.20	3.00	rigid	curbed and crowned	good	shop house	sunny	
7. New Petchburi Road	2	2	1	10.50	1.00	3.00	rigid	high curb+fence	good	shop house	sunny	
8. Raj Prarop Road	4	2	-	7.05	0.50	2.50	flexible	curbed and crowned + fence	fair	busy shopping	sunny	
9. Charoen Krung Road	3	2	1	11.00	-	2.30	rigid	-	fair	shop house	sunny	one-way
10. Raj Vithee Road	3	2	-	8.50	4.00	2.25	rigid	curbed and crowned	fair	office	sunny	
11. Lat Phrao Road	3	2	1	9.85	4.00	3.50	rigid	curbed and crowned	good	residential & shop house	sunny	
12. Phrachao Taksin Road	2	2	1	12.90	3.50	4.00	rigid	curbed and crowned	good	shop house	sunny	
13. Phran Nok Road	4	2	1	9.50	4.00	5.00	flexible	curbed and crowned	good	shop house	cloudy	
14. Ramkhamhaeng Road	3	2	-	7.50	-	3.80	rigid	curbed and crowned	good	residential & shop house	sunny	
15. Soi Sena Nikhom 1	3	1	1	5.50	-	1.45	rigid	-	good	residential	cloudy	
16. Soi Aree	5	1	1	3.00	-	2.40	flexible	-	poor	residential	cloudy	
17. Chula Soi 12	5	1	-	6.75	-	2.50	rigid	-	poor	office	sunny	



Fig. 4 Study site, Rama I Road.

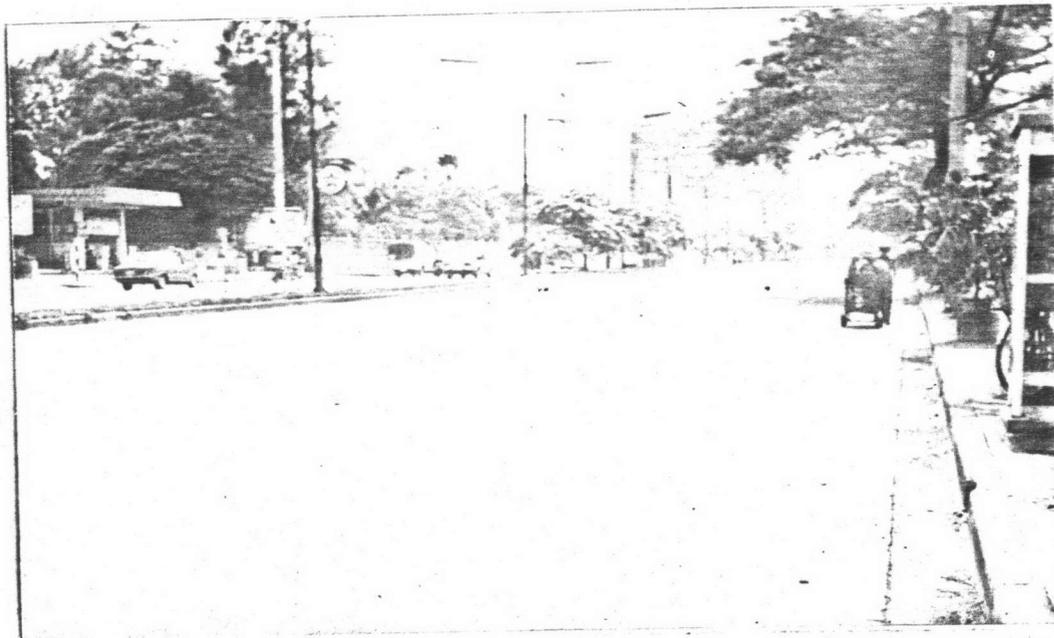


Fig. 5 Study site, Rama IV Road.



Fig. 6 Study site, Yaowaraj Road



Fig. 7 Study site, Ratchadamnoen Khang Road.

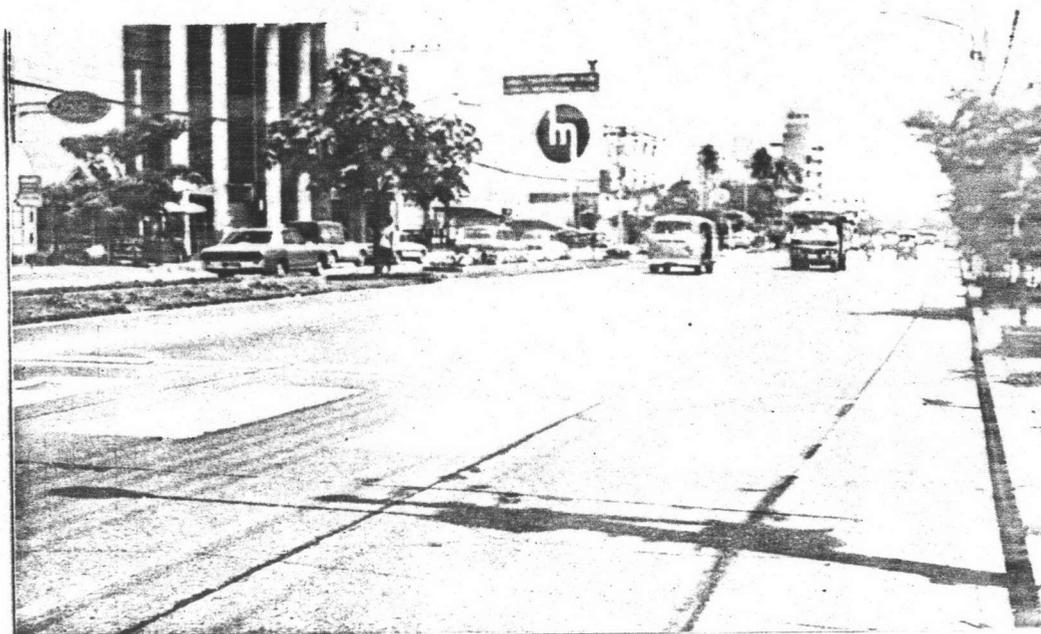


Fig. 8 Study site, Phaholyothin Road.

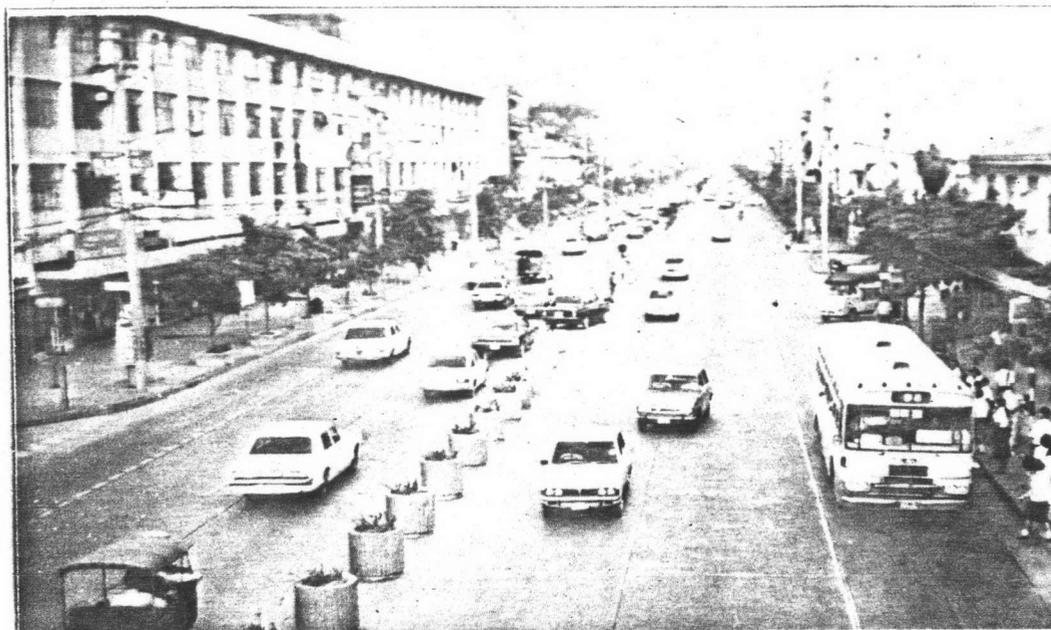


Fig. 9 Study site, Sukhumvit Road.



Fig. 10 Study site, New Petchbury Road.



Fig. 11 Study site, Raj Prarop Road.

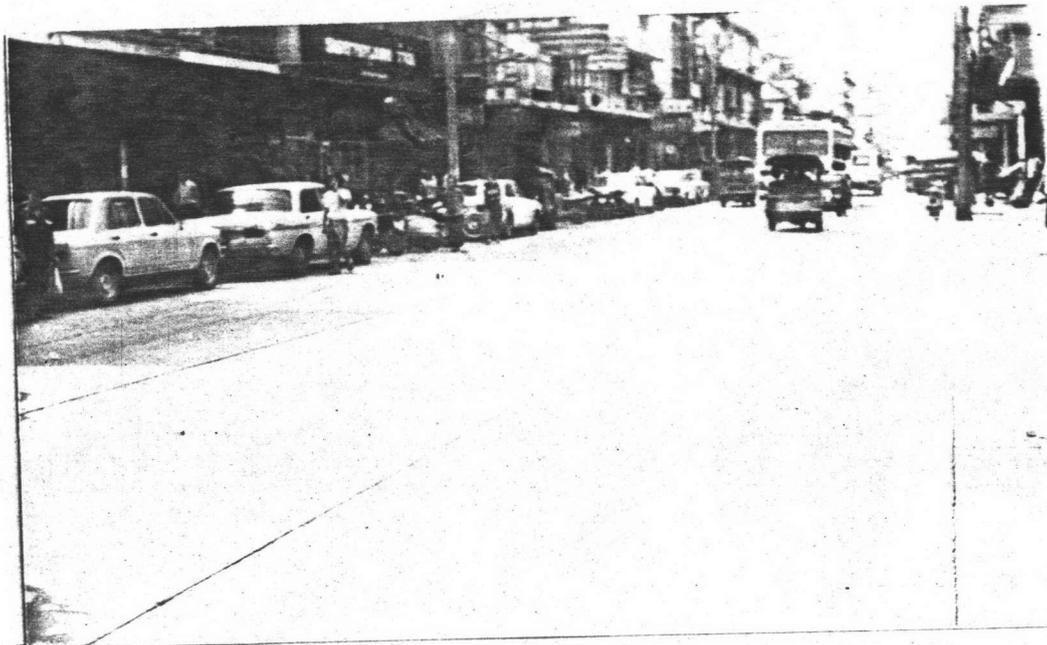


Fig. 12 Study site, Charoen Krung Road.



Fig. 13 Study site, Raj Vithee Road.



Fig. 14 Study site, Lat Phrao Road.

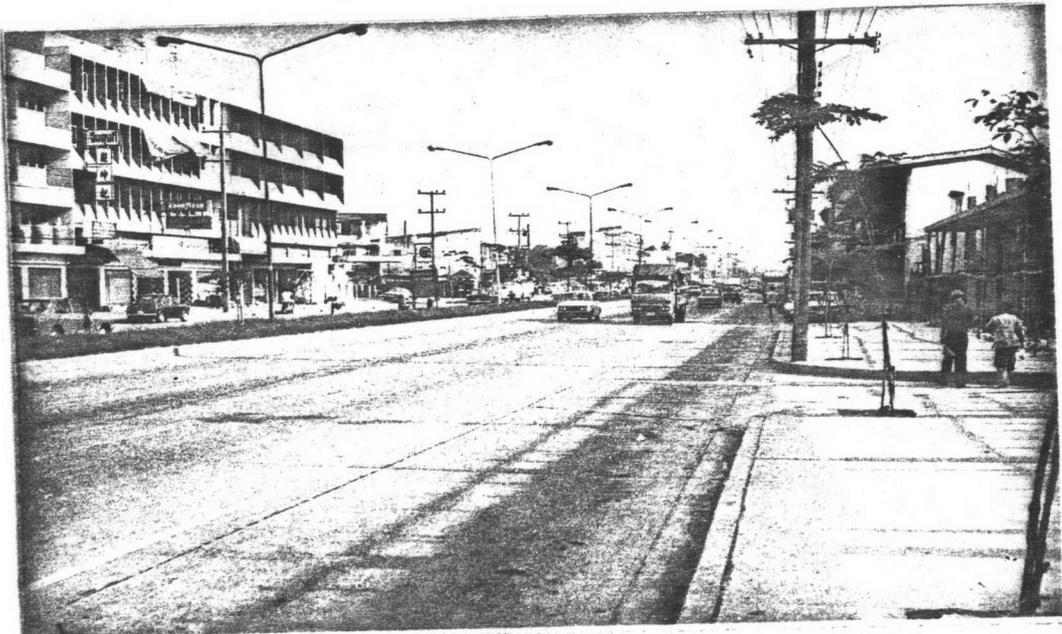


Fig. 15 Phrachao Taksin Road.



Fig. 16 Study site, Phran Nok Road.



Fig. 17 Study site, Ramkhamhaeng Road.



Fig. 18 Study site, Soi Sena Nikhom 1.



Fig. 19 Study site, Soi Aree.



Fig. 20 Study site, Chula Soi 12.

### Data Collection

To investigate the relation between flow, speed, and density properly, it is necessary to sample traffic flow characteristic over the range of all possible densities. Observations were acquired from 2:30 to 5:30 p.m. on weekdays, which including peak and off-peak period of traffic flow, and were made between March 26, 1979 and August 8, 1979. Data were collected in unidirectional half of streets by manual for each lane. The procedure is described below.

Two characteristics of traffic flow were collected, flows were obtained by counting number of vehicles passing a given point in one minute interval by using tally counter, and the corresponding speeds were obtained, by using method of spot speed study, by measured the time required for a vehicle to traverse a measured course or trap of 25.00 meters. According to the theory, speed should be collected for every vehicle in the traffic stream, but by this method of collecting data, we could not measure speed for every vehicle, so we measured as many as possible, which represented speed of all vehicles in that one minute interval. This method of collecting data for obtaining traffic stream models is not a precise theoretical consideration, but it is a practical method that is rapid, easy, reasonable precision and economy.

Observation were limited to vehicles which were not motor cycles so as to provide models having macroscopic characteristics. The field observations resulted in a set of about 180 one-minute samples of speed, density and flow for each street. Some streets took much time for obtaining data of traffic flow characteristic over the range of all possible density.

### Organizing the Data

Speeds, densities, flows were obtained in the manner described below.

Space-mean speeds were obtained from the formula\*

$$u = \frac{90}{\sum t_i} ; \text{ kph} \quad \text{--- (22)}$$

where  $t_i$  = measured time for a vehicle to traverse a course length of 25.00 meters, sec.

$n$  = number of observed speeds.

Flows were obtained from the formular

$$q = 60N ; \text{ vph} \quad \text{--- (23)}$$

where  $N$  = number of observed vehicles passing a given point in one-minute.

Densities were computed from Wardrop's formular\*

$$k = q/u ; \text{ vpk} \quad \text{--- (24)}$$

These computations were performed for each lane seperately. For obtaining models of all lanes of street, flows and densities for each lane were superimposed and speeds were computed again from Eq.24

In applying Eq.24, it should be noted that headway greater than 9 seconds should not be utilized due to the absence of continuity

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\* See Appendix A

of flow where such long gap are presented.

The flow-speed-density data were tabulated in Appendix B.