CHAPTER 4

ANALYSIS OF DATA

The observed data dealing with the classified directional truck traffic turning movement at intersections, the cane truck speed measurements and the travel times and the waiting times of the truck carrier boats are analyzed. The separate figures and tables showing the classified directional truck turning movement at each specify intersections, the spot speed determinations of the cane truck including the travel times and waiting times of the truck carrier boats are presented. Finally, the interpretation of such results are accordingly discussed.

4.1 Classified Directional Truck Traffic Turning Movement at Intersection

The manual counting was used to carry out definitively the truck turning movements at those three intersections, in which the criteria for a cane truck entering the intersection was that the front wheels of that truck should pass the given line on the approach.

The classification of movements by direction and by type of loading were; cane trucks (CT), empty trucks (ET), and other loaded trucks (OT). The turning movement at these intersections were; straight to, left turning and right turning. Consequently, the analysis of truck traffic volumes were carried out by mean of summing those truck turning movements in the direction of north bound (NB), south bound (SB), east bound (EB) and west bount (WB). Furthermore, all heavy trucks which passed through

the intersections during each successive observation time were counted, and the observations were recorded over 30 minutes intervals.

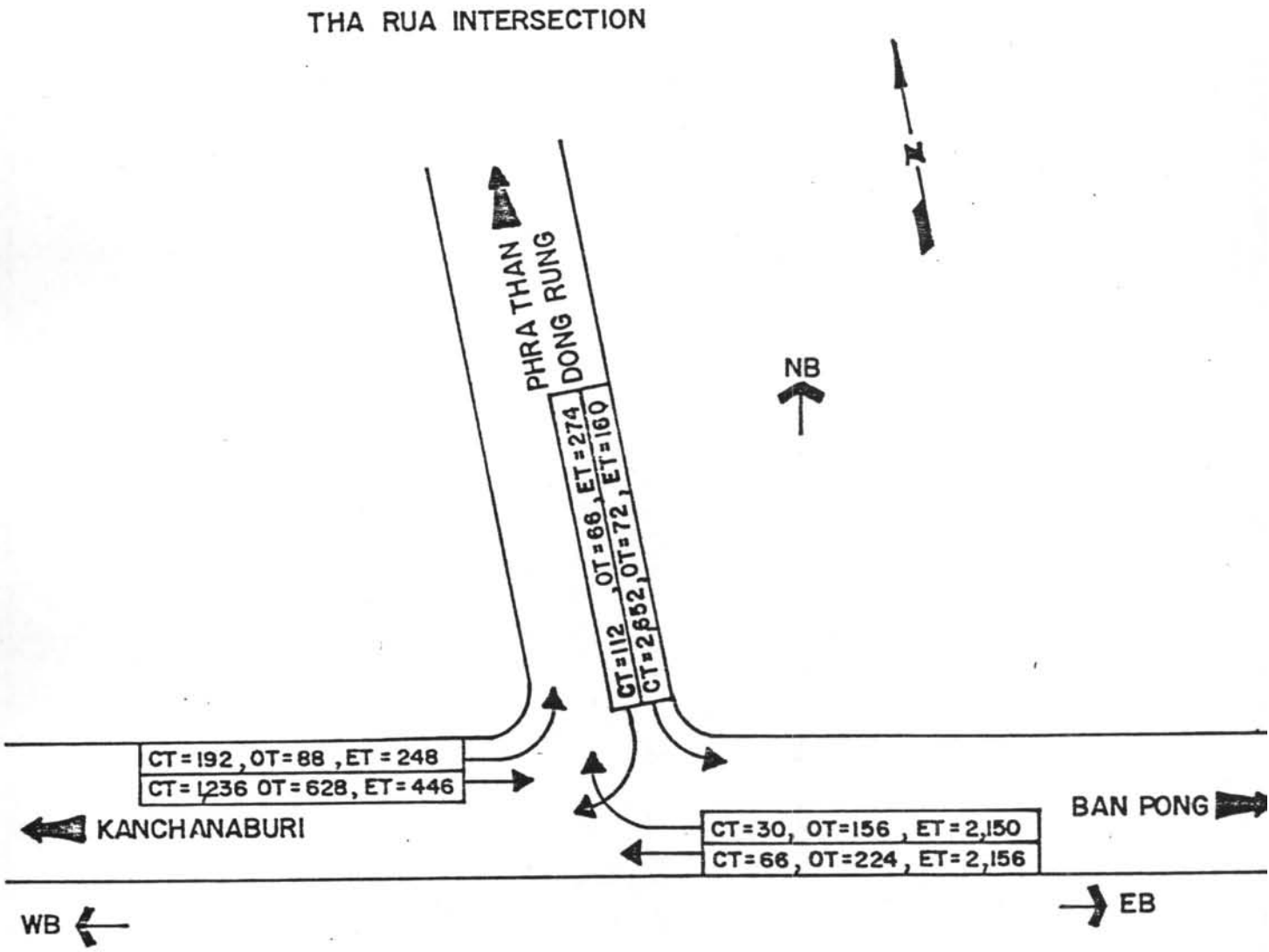
4.1.1 The Expansion Factors

In order to obtained the daily truck volumes at each selected intersection from successive time of observations which could not conduct the 24 - hr volume count. Therefore, the expansion factors technique was employed. The values of these factors could be obtained by expanding the numbers of observation hours to twenty-four hours. Adoption of this technique was based on the following criterias.

4.1.1 a) During the crushing period, the sugar mills were fulfilly operated all days and nights conforming to their capacities. No special stopping periods except for temporary engine maintenances of the mills, about 2-3 days at the middle time of the crushing season.

4.1.1 b) To employ adequate quantities of canes for crushing, the sugar mills predominate the cane trucks to travel all days and nights, special stopping of the cane trucks within this period occured only for unforseen events such as breakdowns, accidents, some short time repairing and etc.

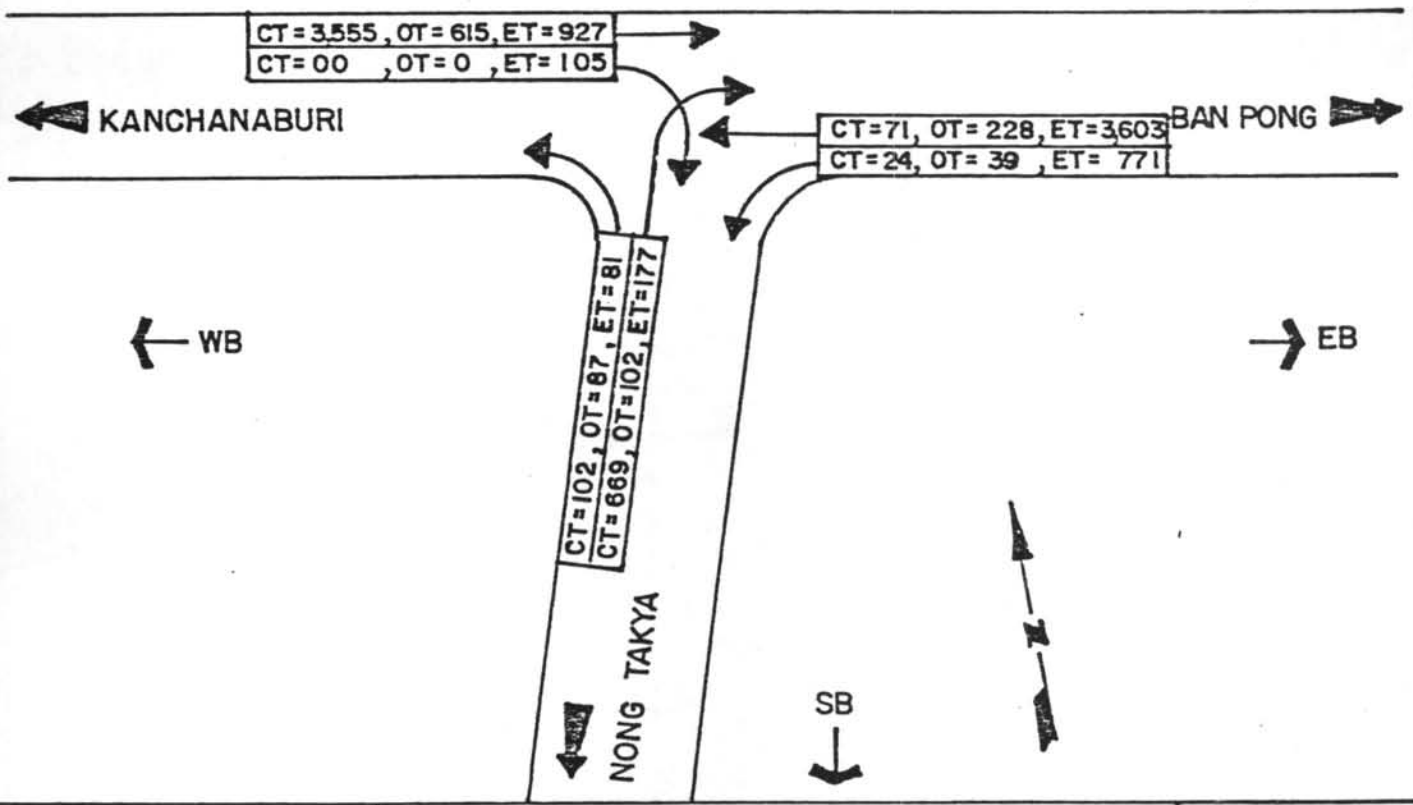
Therefore, the daily trucks volume could be estimated by multiplying the sample counted volumes to the expansion factors described above. Results of the analysis are illustrated in Fig. 14 to Fig. 17.



DIRECTION	TRUCK VOLUME (VEH / DAY)			TOTAL VEH / DAY
	CANE TRUCK (CT)	EMPTY TRUCK (ET)	OTHER LOADING TRUCK (OT)	
WEST BOUND , WB	178	2,430	290	2,898
EAST BOUND , EB	3,888	606	700	5,194
NORTH BOUND , NB	222	2,398	244	2, 864

FIG. 14 DIRECTIONAL TRUCK TRAFFIC MOVEMENT AT THA RUA INTERSECTION (Veh / day)

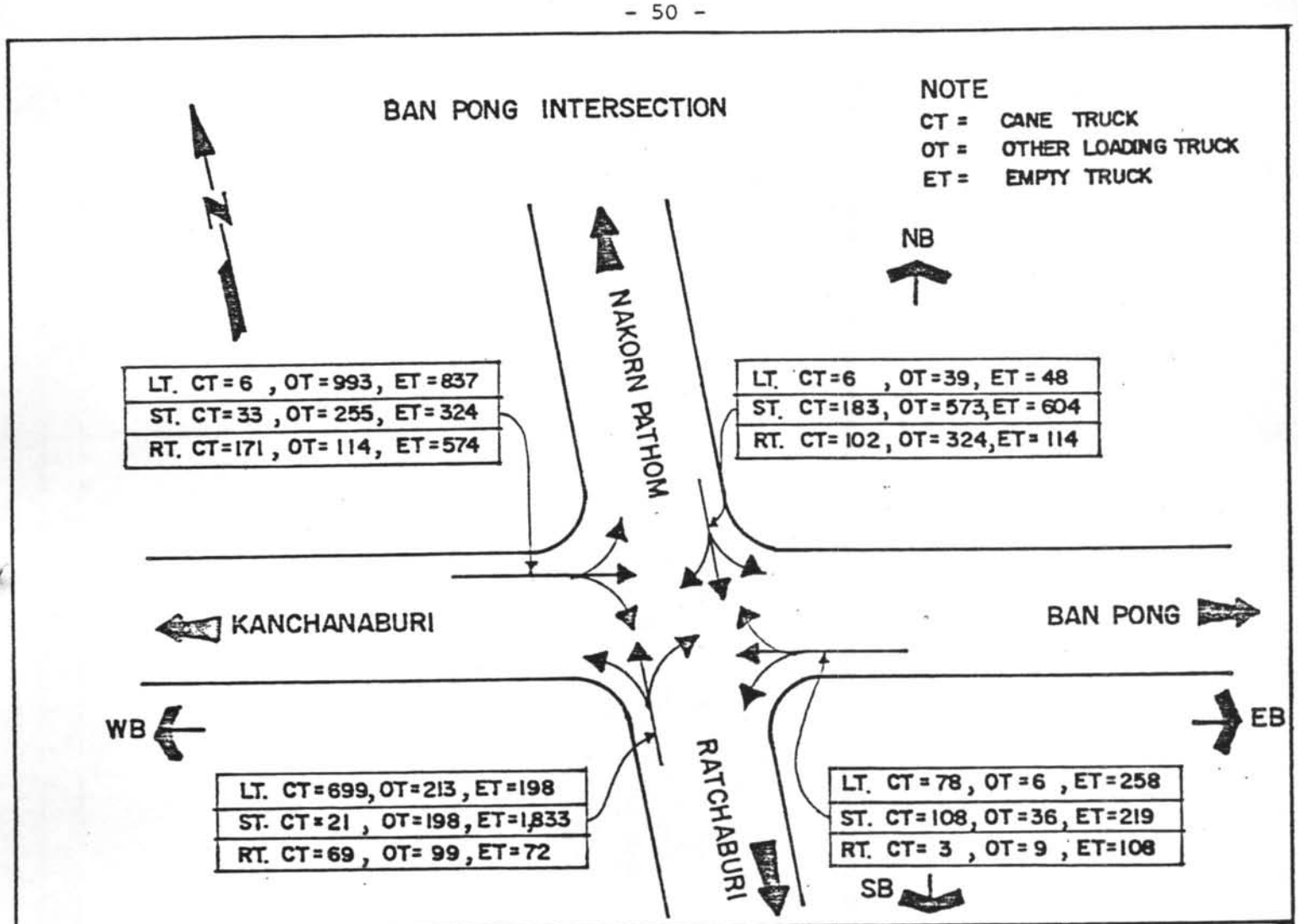
THA MAKA INTERSECTION.



DIRECTION	TRUCK VOLUME (VEH / DAY)			
	CANE TRUCK (CT)	EMPTY TRUCK (ET)	OTHER LOADING TRUCK (OT)	TOTAL VEH / DAY.
WEST BOUND , WB	173	3, 684	315	4,172
EAST BOUND , EB	4,224	1,104	717	6,045
SOUTH BOUND , SB	24	876	39	939

FIG. 15 DIRECTIONAL TRUCK TRAFFIC MOVEMENT AT THA MAKA INTERSECTION.

(Veh / day)



DIRECTION	TRUCK VOLUME (VEH/DAY)			TOTAL VEH / DAY
	CANE TRUCK (CT)	EMPTY TRUCK (ET)	OTHER LOADING TRUCK (OT)	
NORTH BOUND, NB	30	2,778	1,200	4,008
WEST BOUND, WB	909	521	573	2,003
SOUTH BOUND, SB	432	1,431	693	2,538
EAST BOUND, EB	108	444	393	945

FIG. 16 DIRECTIONAL TRUCK TRAFFIC MOVEMENT AT HIGHWAY ROUTE NO. 323 AND BYPASS BAN PONG INTERSECTION (Veh / day)

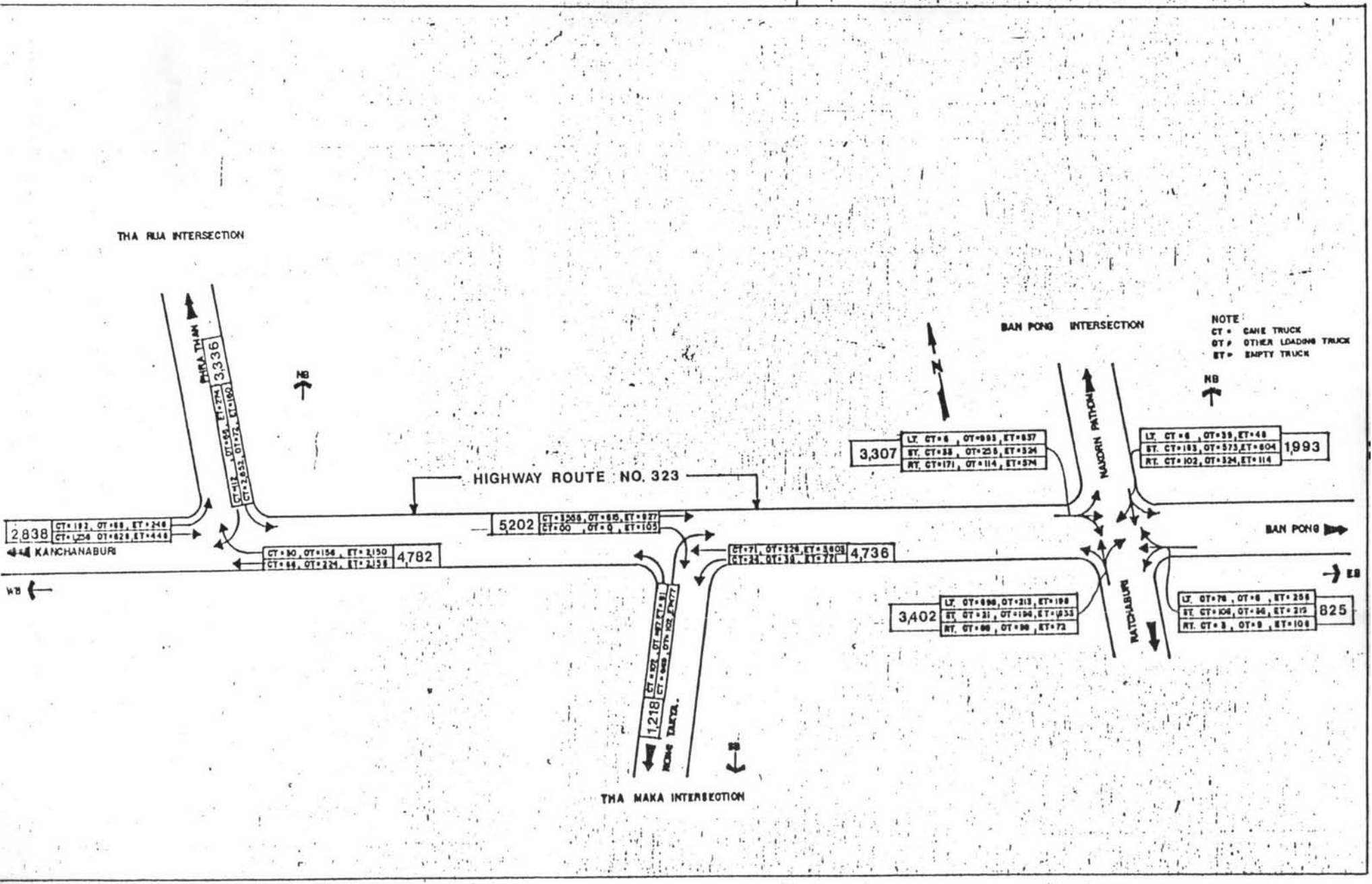


FIG. 17 Linkage of Truck Traffic Turning Movements at The Three Intersections on Highway Route No. 323; Veh./day

From Fig. 17, it could be noticed that total amount of cane trucks passing and entering successive intersection were not equal; this major discrepancy was due to the large number of sugar mills located along sides of highway route NO. 323 together with some minor collected roads between intersections which were neglected from traffic observations. The large discrepancy occured on the link joined between Tha Maka and Ban Pong intersection because ten sugar mills were located nearby this main haul route, on the contrary, only three sugar mills were situated between Tha Rua and Tha Maka intersections, thus, discrepancy occured on the later link were not significantly large as on the previous one.

4.2 The Cane Truck Speed Analysis

4.2.1 Speed Fundamental

Vehicular speed is the rate of movement of traffic or of specified components of traffic and is usually expressed in miles per hour or kilometres per hour. In engineering sense, the speed of a moving vehicle is defined as the ratio of the length of traveled path to the elapsed time.

From the above definition of speed, two distinct types of average speed measures can be derived to epress the rate of traffic movement. The first type of average speed is time mean speed or spotspeed, which is the mean valve of a set of instantancous vehicle is generally calculated as the average of several speeds at some given location on a roadway. Time mean speed spot-speed observations at the particular highway location and is symbolically represented by the following equation:

$$V_t = \frac{\sum_{i=1}^{n} V_i}{n} \qquad \text{.....(1)}$$

where; V_t = average time-mean speed,

V_i = spot speed of the i^{th} vehicle,

n = number of vehicles that comprise the sample of speed observations.

A second expression of mean speed is space-mean speed or travel speed, which is computed as the specified travel distance divided by the mean travel time of several trips over this highway section and is expressed by the following relationship:

$$V_s = \frac{dn}{\sum_{i=1}^{n} t_i} \qquad \text{.....(2)}$$

where; V_s = average space-mean speed,

d = travel distance,

n = number of trips that comprise the sample of time observations,

t_i = travel time of i^{th} trip.

Time-mean Speed is always greater than space-mean speed for a given sample of traffic flow except for the situation in which all vehicles are traveling at the same speed. The two speed measures are then equal in this special case.

An approximate relationship between time-mean and space-mean speeds has been developed in accordance with the following expression:

$$V_t = V_s + \frac{\sigma_s^2}{V_s} \qquad \text{.....(3)}$$

where; V_t = average time-mean speed,

V_s = average space-mean speed,

σ_s^2 = variance of the space-mean speeds.

Space-mean speeds are a function of the density of vehicles on the highway; time-mean speeds are related only to the number of vehicles passing a given point on the roadway.

In analyzing spot speed data, a number of significant values are obtained. Some of these values are computed

directly from the data while others are determined from a graphic representation. Average or mean speed is the most frequently used speed statistic. It is a measure of the central tendency of the data.

Since in fact all cane trucks do travel at the same speed, there is a spread or dispersion of speeds about the mean. The standard deviation (s) is statistical measure of this spread. The standard deviation of the sample is computed by first calculating the variance of the sample and then taking the square root as follows:

$$S^2 = \frac{f_i(x_i)^2 - \frac{1}{n}(\sum f_i x_i)^2}{n-1} \quad \text{.....(4)}$$

and; $$S = \sqrt{S^2}$$

where; S = standard deviation of the distribution

S^2 = sample variance

$\sum f_i(x_i)^2$ = sum of the mean square frequencies

$(\sum f_i x_i)^2$ = square of the sum of the mean frequencies

To measure the statistic that indicates the confidence with which the sample mean may be assumed to be the actual mean speed of all cane trucks by means of "Standard error of the mean" is as follows;

$$S_{\bar{x}}^2 = \frac{S^2}{n} \quad \text{.....(5)}$$

and $$S_{\bar{x}} = \sqrt{S_{\bar{x}}^2}$$

where; $S_{\bar{x}}$ = standard error of the mean

$S^2_{\bar{x}}$ = mean variance

S^2 = sample variance

This research attempted to compute all parameters directly from the data obtained by using hand calculations for the time mean speed and the space mean speed of the cane trucks while travelling along the line haul routes. Furthermore, the data analysis for the speed study of mean speed or average speed ($\bar{x}$), standard deviation (s), sample variance (s^2) and the standard error of the mean were calculated from those two observations. Details computation and summary of the time-mean speed and space-mean speed of cane trucks at each station by direction are presented in Table 15 to Table 23. Also, speed distribution curves are graphically illustrated in Fig 18 to Fig 21. The variation of cane trucks volumes during the observation period are graphically shown in Appendix Fig. B-1 to B-10.

Table 15 Determination of Time Mean Speed and Space Mean Speed for Cane Trucks

Station I WB Direction

Time (sec.)	Frequency (f)	Space Mean Speed (time ⁄ f)	Speed KPH (180/t)	Time Mean Speed (speed ⁄ f)
2.5	1	2.5	72.00	72.00
2.6	1	2.6	69.23	69.23
2.7	0	0	66.67	0
2.8	1	2.8	64.29	64.29
2.9	3	8.7	62.07	186.21
3.0	6	18.0	60.00	360.00
3.1	4	12.4	58.06	323.24
3.2	8	25.6	56.25	450.00
3.3	8	26.4	54.54	436.32
3.4	7	23.8	52.94	370.58
3.5	13	45.5	51.54	670.02
3.6	10	36.0	50.00	500.00
3.7	14	51.8	48.65	681.10
3.8	12	45.6	47.37	568.44
3.9	5	19.5	46.15	230.75
4.0	8	37.0	45.00	360.00
4.1	8	32.8	43.90	351.20
4.2	5	21.0	42.86	214.30
4.3	2	8.6	41.86	83.72
4.4	4	17.6	40.91	163.64
4.5	3	13.5	40.00	120.00
4.6	1	4.6	39.13	39.13
4.7	2	9.4	38.30	76.6
4.8	3	14.4	37.50	112.5
4.9	0	0	36.73	0
5.0	2	10.0	36.00	72.00
5.1	0	0	35.29	0
5.2	1	5.2	34.62	34.62
5.3	0	0	33.96	0
5.4	0	0	33.33	0
5.5	1	5.5	32.73	32.73
	$\Sigma f = 133$	$\Sigma t = 495.8$		$\Sigma V = 6,551.62$

$$\frac{\Sigma t}{N} = 3.728 \qquad V = \frac{\Sigma V}{N} = 49.26 \text{ KPH}$$

$$V = \frac{\text{Dist.}}{t/N} = \frac{50}{3.728} \times 3.6 = 48.28 \text{ KPH}$$

Table 16 Determination of Time Mean Speed and Space Mean Speed for Cane Trucks

Station I EB Direction

Time (sec.)	Frequency (f)	Space Mean Speed (time) ≠ f)	Speed KPH (180/t)	Time mean Speed (Speed ≠ f)
3.3	–	0	54.54	0
3.4	1	3.4	52.94	52.94
3.5	4	14.0	51.43	205.72
3.6	1	3.6	50.00	50.00
3.7	1	3.7	48.65	48.65
3.8	3	11.4	47.37	142.11
3.9	5	19.5	46.15	230.75
4.0	10	40.0	45.00	450.00
4.1	11	45.1	43.90	482.90
4.2	13	54.6	42.86	557.18
4.3	8	34.4	41.86	334.88
4.4	4	17.6	40.91	163.64
4.5	11	49.5	40.00	440.00
4.6	6	27.6	39.13	234.78
4.7	3	14.1	38.30	114.90
4.8	4	19.2	37.50	150.00
4.9	3	14.7	36.73	110.19
5.0	12	60.0	36.00	432.00
5.1	7	35.7	35.29	247.03
5.2	4	20.8	34.62	138.48
5.3	3	15.9	33.96	110.88
5.4	2	10.8	33.33	66.66
5.5	3	16.5	32.73	98.19
5.6	1	5.6	32.14	32.14
5.7	–	0	31.58	0
5.8	–	0	31.03	0
5.9	–	0	30.51	0
6.0	–	6.0	30.0	30.00

$\Sigma N = 121$ $\Sigma t = 543.7$ $\Sigma V = 4{,}924.02$

$\frac{\Sigma t}{N} = 4.493$

$V = \frac{Dist}{\Sigma t / N} = \frac{50}{4.493} = 11.13$ m/sec $V = \frac{\Sigma V_e}{N} = 40.69$ KPH

$V = 40.07$ KPH

Table 17 Determination of Time Mean Speed and Space Mean Speed for Cane Trucks

Station II Route 3199 WB Direction

Time (sec.)	Frequency (f)	Space mean speed (time x f)	Speed KPH (180/t)	Time mean speed (speed x f)
1.7	0	0	0	0
1.8	1	1.8	100.00	100.00
1.9	1	1.9	94.74	94.74
2.0	0	0	90.00	0
2.1	2	4.2	85.71	171.42
2.2	2	4.4	81.82	163.64
2.3	3	6.9	78.26	234.78
2.4	4	9.6	75.00	300.00
2.5	9	22.5	72.00	648.00
2.6	5	13.0	69.23	346.15
2.7	8	21.60	66.67	533.36
2.8	6	16.8	64.29	385.74
2.9	4	11.6	62.07	248.28
3.0	1	3.0	60.00	60.00
3.1	1	3.1	58.06	58.06
3.2	0	0	56.26	0
	$\Sigma N = 47$	$\Sigma t = 120.4$		$\Sigma V = 3,344.17$

$$\frac{\Sigma t}{N} = 2.562 \qquad V = \frac{\Sigma V}{n} = 71.15 \text{ KPH}$$

$$V = \frac{\text{Dist}}{\Sigma t/N} = \frac{50}{2.562} \times 3.6 = 70.25 \text{ KPH}$$

Table 18 Determination of Time Mean Speed and Space Mean Speed for Cane Trucks

Station II Route 3199 EB Direction

Time (sec.)	Frequency (f)	Space Mean Speed (time x f)	Speed KPH (180/t)	Time Mean Speed (speed x f)
2.1	0	0	85.71	0
2.2	1	2.2	81.82	81.82
2.3	0	0	78.26	0
2.4	3	7.2	75.00	225.00
2.5	1	2.5	72.00	72.00
2.6	1	2.6	69.23	69.23
2.7	2	5.4	66.67	133.34
2.8	2	5.6	64.29	128.58
2.9	4	11.6	62.07	248.28
3.0	5	15.0	60.00	300.00
3.1	4	12.4	58.06	232.24
3.2	3	9.6	56.26	168.78
3.3	4	13.2	54.54	218.16
3.4	6	20.4	52.94	317.64
3.5	1	3.5	51.54	51.54
3.6	3	10.8	50.00	150.00
3.7	2	17.4	48.65	97.3
3.8	4	15.2	47.37	189.48
3.9	2	7.8	46.15	92.3
4.0	4	16.0	45.00	180.0
4.1	0	0	43.90	0
4.2	1	4.2	42.86	42.86
4.3	0	0	41.86	0
4.4	0	0	40.91	0
4.5	1	4.5	40.00	4 40.00
4.6	0	0	39.13	0

$\Sigma N = 54$ $\Sigma t = 177.1$ $\Sigma V = 3,038.55$

$\frac{\Sigma t}{N} = 3.28$ $V = \frac{\Sigma V}{N} = \frac{3,038.55}{54} = 56.27$ KPH

$V = \frac{Dist}{\Sigma t/N} = \frac{50 \times 3.6}{3.28} = 54.89$ KPH

Table 19 Data Analysis for Spot Speed Study

WB Direction Station I

Mean Speed KPH (X)	Speed Class KPH	Truck Frequency (f)	Cumulative Frequency	% Cumulative	fX	$f(x^2)$
30 (900)	27.50-32.49	(0)	0	0	0	0
35 (1225)	32.50-37.49	(4)	4	3.00	140	4,900
40 (1600)	37.50-42.49	(15)	19	14.0	600	24,000
45 (2025)	42.50-47.49	(38)	57	42.86	1,710	76,950
50 (2500)	47.50-52.49	(37)	94	70.68	1,850	92,500
55 (3025)	52.50-57.49	(23)	117	87.97	1,265	69,575
60 (3600)	57.50-62.49	(13)	130	97.74	780	46,800
65 (4225)	62.50-67.49	(1)	131	98.50	65	4,225
70 (4900)	67.50-72.49	(2)	133	100.00	140	9,800
		N = 133			6,550	328,750

$\bar{X}$ = 49.25 KPH

S^2 = 46.78

S = 6.84 KPH

$S^2_{\bar{X}}$ = 0.3517

$S_{\bar{X}}$ = 0.59 KPH

Table 20 Data Analysis for Spot Speed Study.

EB Direction Station I

Mean Speed KPH (X)	Speed Class KPH	Truck Frequency (f)	Cumulative Frequency	% Cumulative	fX	f(X)
25	22.50-27.49	0	0	0	0	0
30 (900)	27.50-32.49	2	2	1.65	60	1,800
35 (1225)	32.50-37.49	34	36	29.75	1,190	41,650
40 (1600)	37.50-42.49	39	72	59.50	1,440	57,600
45 (2025)	42.50-47.49	42	114	94.21	1,890	85,050
50 (2500)	47.50-52.49	6	120	99.17	300	15,000
55 (3025)	52.50-57.49	1	121	100.00	55	3,052
		121			4,935	204,125

$\bar{X} = 40.78$ KPH

$S^2 = 23.75$

$S = 4.87$ KPH

$S_{\bar{X}}^2 = \frac{S^2}{n} = 0.1963$

$S_{\bar{X}} = 0.44$ KPH

Table 21 Data Analysis for Spot Speed Study.

WB Direction Station II

Mean Speed KPH (X)	Speed Class KPH	Truck Frequency (f)	Cumulative Frequency	% Cumulative	fX	$f(X)^2$
50 (2500)	47.50-52.49	0	0	0	0	0
55 (3025)	52.50-57.49	0	0	0	0	0
60 (3600)	57.50-62.49	6	6	12.77	360	21,600
65 (4225)	62.50-67.49	14	20	42.55	910	59.150
70 (4900)	67.50-72.49	14	34	72.34	980	68.600
75 (5625)	72.50-77.49	4	38	80.08	300	22,500
80 (6400)	77.50-82.49	5	43	91.49	400	32,000
85 (7225)	82.50-87.49	2	45	95.74	170	14,450
90 (8100)	87.50-92.49	0	45	95.74	0	0
95 (9025)	92.50-97.49	1	46	97.87	95	9,025
100 (10,000)	97.50-102.49	1	47	100.00	100	10,000
		n =	47.00		3,315	237,325

$\bar{X}$ = 70.53 KPH

s^2 = 76.34

s = 8.73 KPH

$s_{\bar{X}}^2$ = 1.624

$s_{\bar{X}}$ = 1.274 KPH

Table 22 Data Analysis for Spot Speed Study.

EB Direction Station II

Mean Speed KPH (X)	Speed Class KPH	Truck Frequency	Cumulative Frequency	Cumulative Percent	fX	$f(X)^2$
35 (1225)	32.50-37.49	0	0	0	0	0
40 (1600)	37.50-42.49	1	1	1.85	40	1,600
45 (2025)	42.50-47.49	11	12	22.22	495	22,275
50 (2500)	47.50-52.49	6	18	33.33	300	15,000
55 (2500)	52.50-57.49	13	31	57.41	715	39,325
60 (3600)	57.50-63.49	13	44	81.48	780	46.800
65 (4225)	62.50-67.49	4	48	88.89	260	16.900
70 (4900)	67.49-72.49	2	50	92.50	140	9.800
75 (5625)	72.50-77.49	3	53	98.15	225	16,875
80 (6400)	77.50-62.49	1	54	100.00	80	6,400
		n =	54		3,035	174,975

$\bar{X}$ = 56.20 KPH

s^2 = 82.96

s = 9.10 KPH

$s_{\bar{X}}^2$ = 1.5363

$s_{\bar{X}}$ = 1.239 KPH

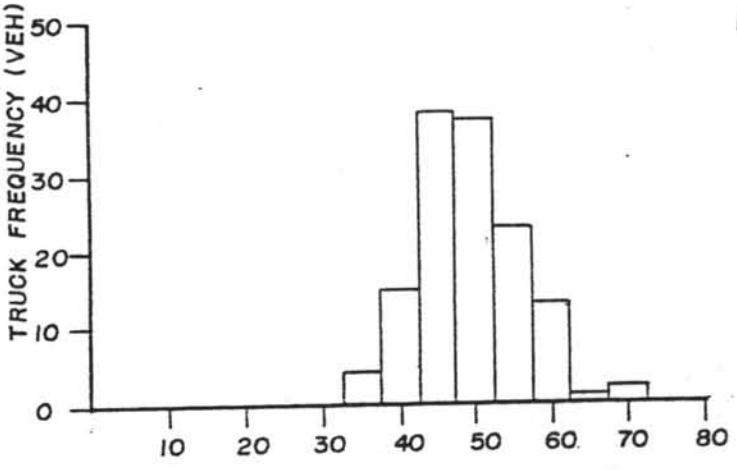
Table 23 Summary for the Cane Truck Speeds.

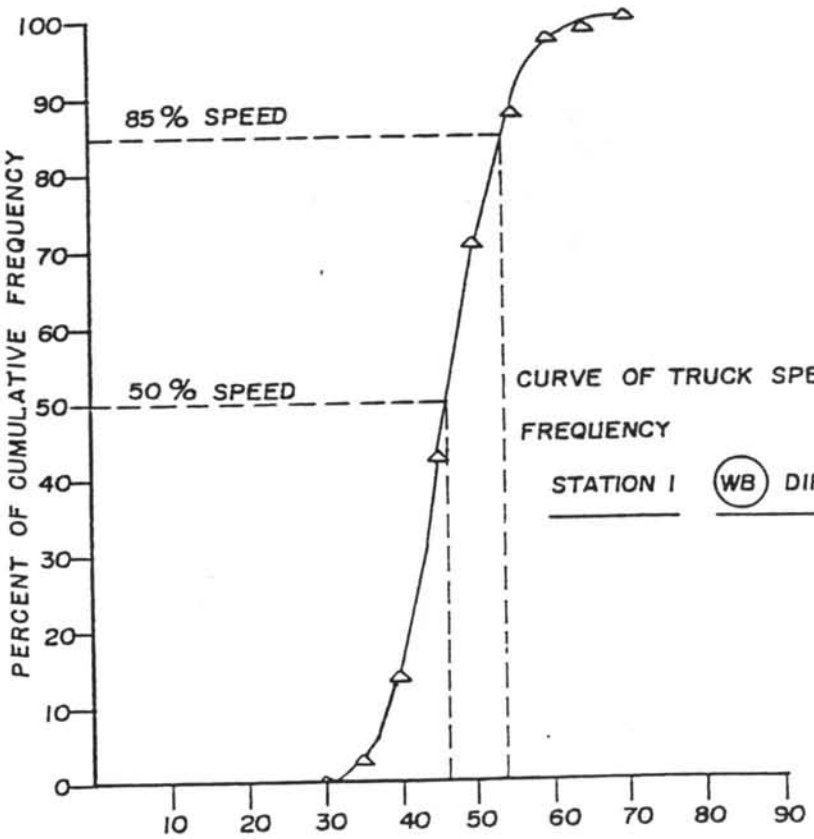
Station	Speed by Direction					
	EB.			WB.		
	Time mean speed (KPH)	Space mean speed (KPH)	Average speed (KPH)	Time mean speed (KPH)	space mean speed (KPH)	Average speed (KPH)
I	40.69	40.07	40.78	49.26	48.28	49.25
II	56.27	54.89	56.20	71.15	70.25	70.53

HISTOGRAM BETWEEN TRUCK FREQUENCY & SPEED (KPH)

STATION I. (WB) DIRECTION

SITE 1.50 KM FROM THA RUA MARKET TO EAST





CURVE OF TRUCK SPEED & PERCENT OF CUMULATIVE FREQUENCY

STATION I (WB) DIRECTION

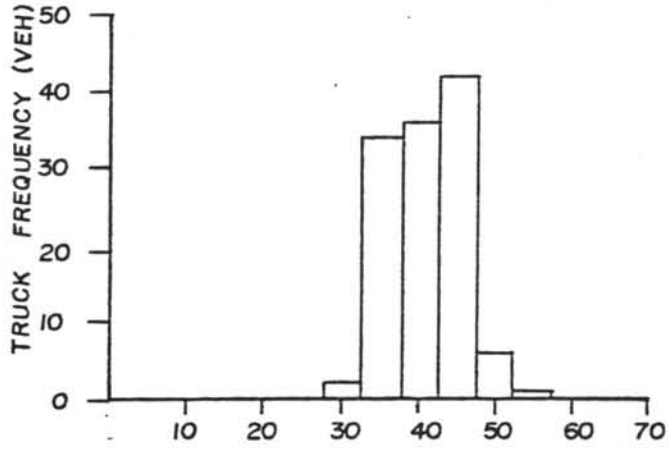
FIG. 18 CUMULATIVE SPEED DISTRIBUTION CURVE

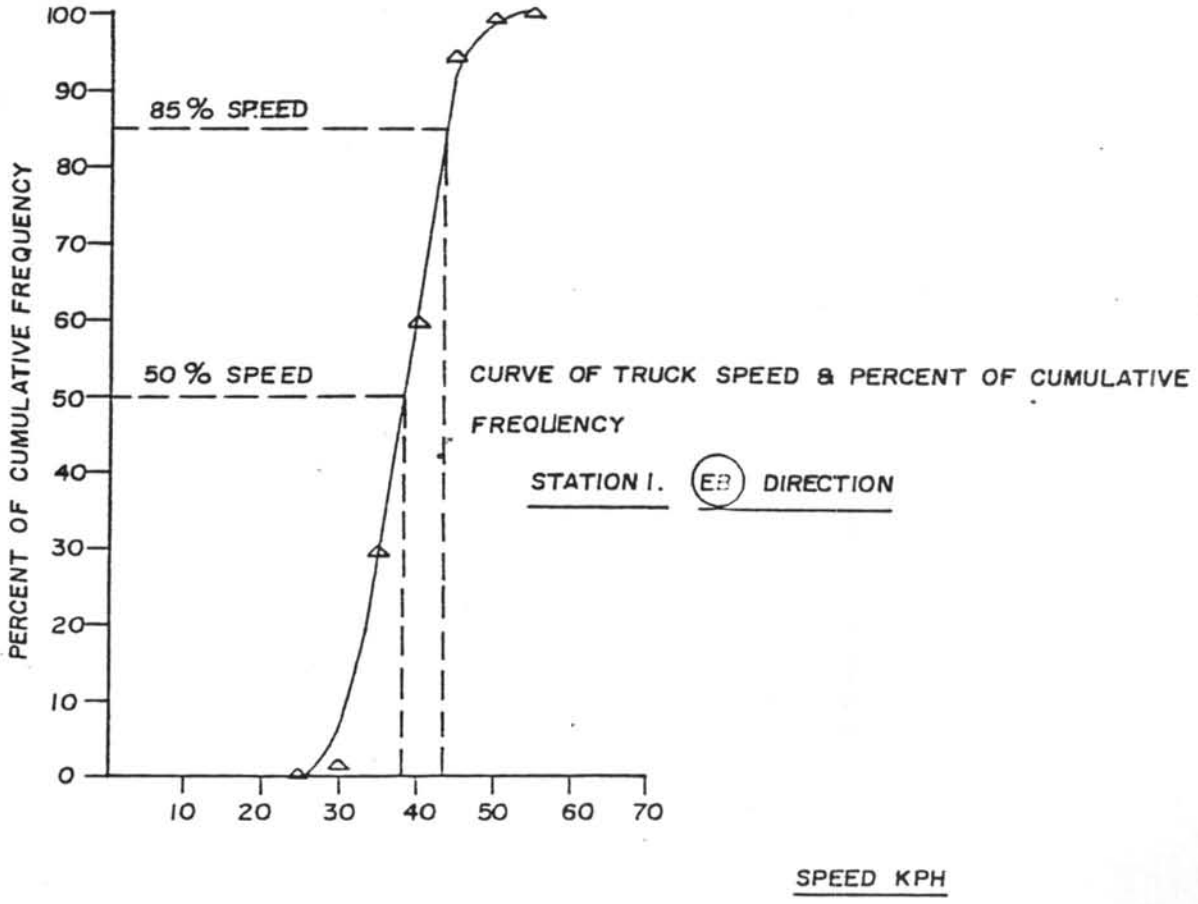
STATION I (WB) DIRECTION

1. HISTOGRAM BETWEEN TRUCKFREQUENCY & SPEED (KPH)

STATION I (EB) DIRECTION.

SITE 1.5 KM FROM THA RUA MARKET TO EAST



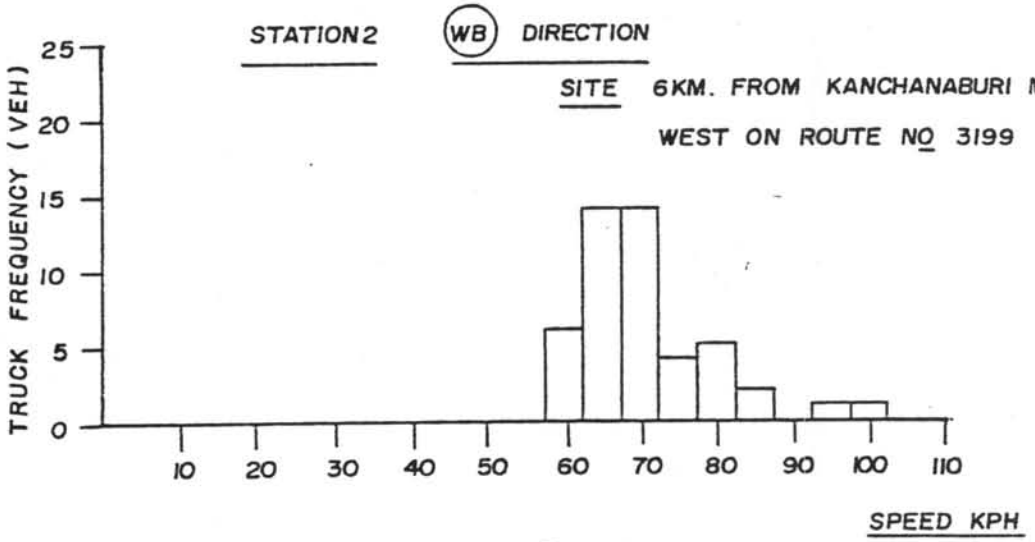


CURVE OF TRUCK SPEED & PERCENT OF CUMULATIVE FREQUENCY

STATION I. (EB) DIRECTION

FIG. 19 CUMULATIVE SPEED DISTRIBUTION CURVE STATION I. (EB) DIRECTION

HISTOGRAM BETWEEN TRUCK FREQUENCY VS. SPEED (KPH)



CURVE OF TRUCK SPEED VS. PERCENT OF CUMULATIVE FREQUENCY

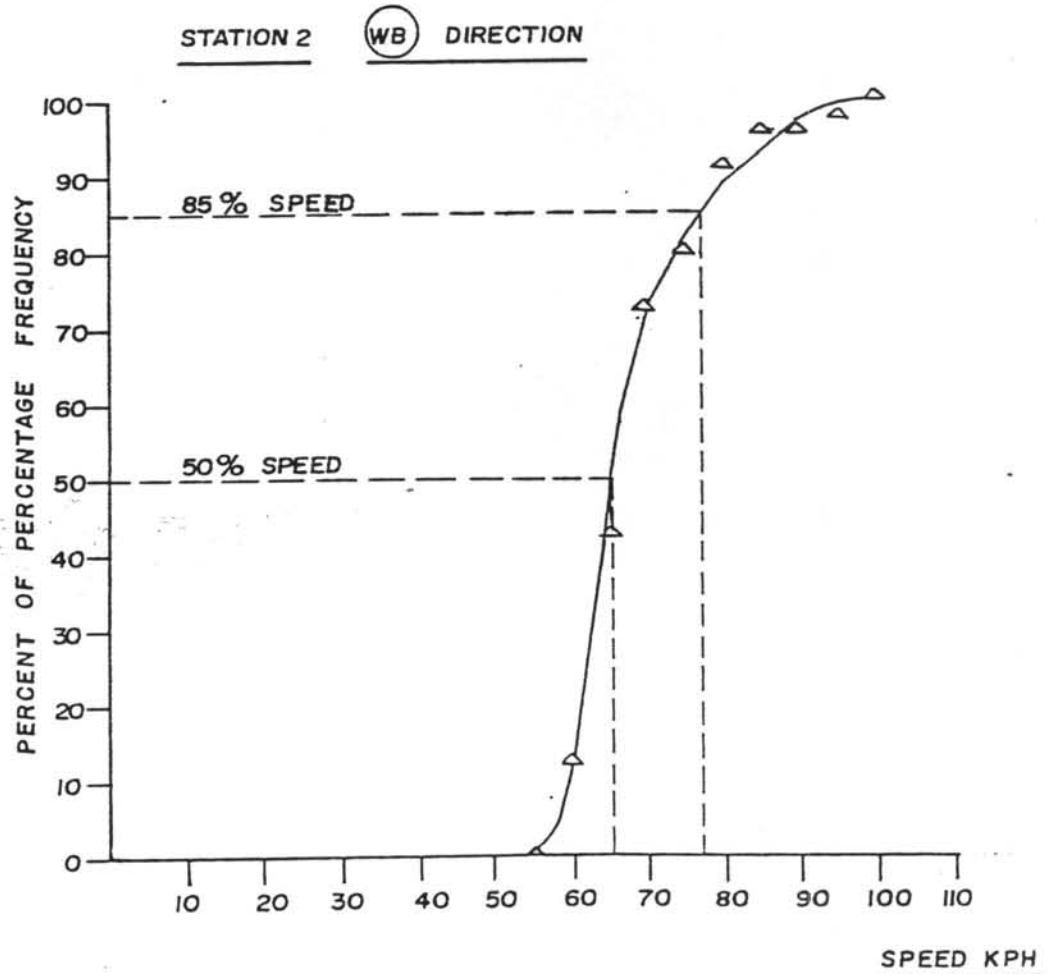
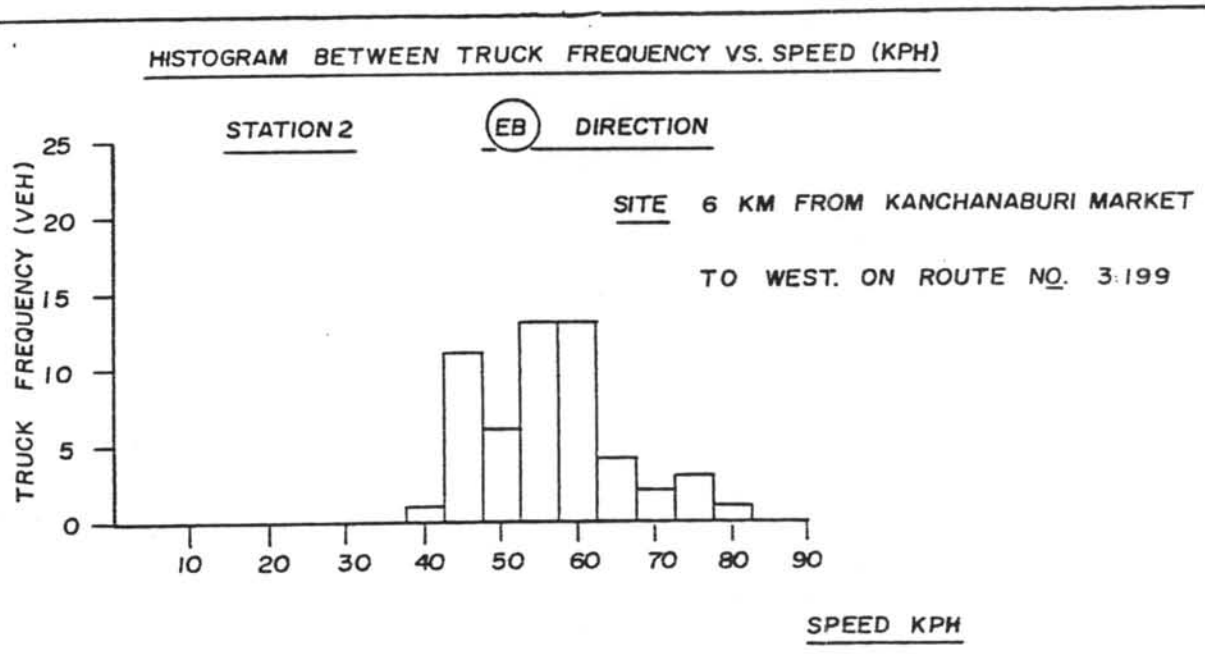


FIG. 20 CUMULATIVE SPEED DISTRIBUTION CURVE STATION 2 (WB) DIRECTION



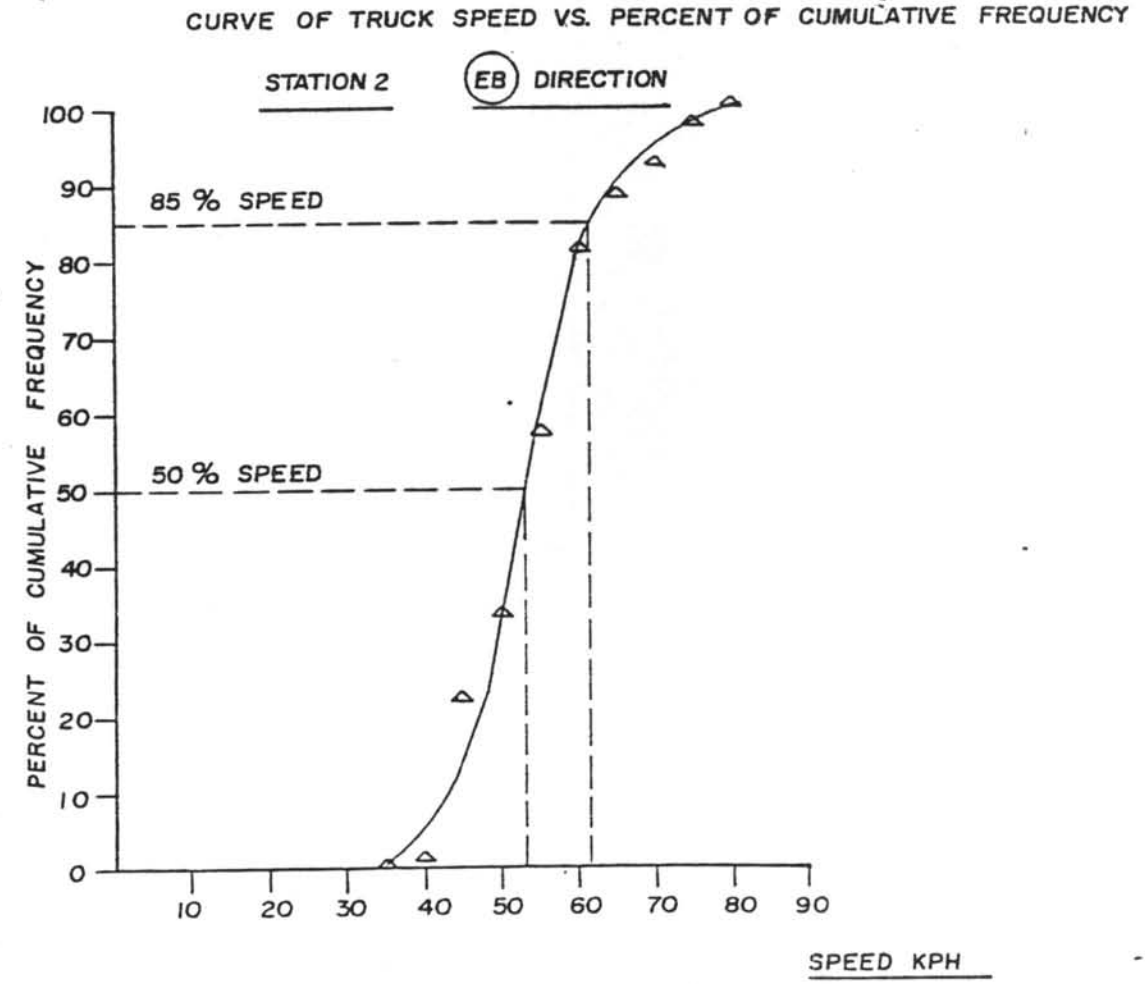


FIG. 21 CUMULATIVE SPEED DISTRIBUTION CURVE STATION 2 . (EB) DIRECTION.

4.3 Determination of Truck Carrier Boats Travel Time and Waiting Time

The determination of the travel time and waiting time of the truck carrier boats at each ferry were carried out by using stop watchs to measure the time spent for these two categories. The analysis of the gathering data by each ferry are shown in Table 24 to Table 26, the results are summarized in Table 27.

Table 24. The travel time and waiting time at Ferry No. 1

Running No.	Time (hr)	Travel Time (min)	Waiting Time (min)
1	19.02	2.50	1.50
2	19.06	2.35	3.65
3	19.12	3.02	0.98
4	19.16	3.55	4.45
5	19.24	2.91	3.09
6	19.30	2.52	2.48
7	19.35	2.78	2.22
8	19.40	3.00	1.00
9	19.44	3.42	2.58
10	19.50	3.03	3.97
11	19.57	3.32	1.68
12	20.02	2.95	2.05
13	20.07	2.48	1.52
14	20.11	2.30	2.70
15	20.16	3.14	3.86
16	20.23	3.65	

$\bar{X}$ = 2.93 min $\bar{X}$ = 2.51 min

S = 0.42 min S = 1.10 min

Table 25 The travel time and waiting time at Ferry No. 2

Running No.	Time (hr)	Travel Time (min)	Waiting Time (min)
1	20.00	2.60	2.40
2	20.05	2.68	2.32
3	20.10	3.42	6.58
4	20.20	2.35	2.65
5	20.25	2.32	3.68
6	20.31	2.45	0.54
7	20.34	2.54	0.46
8	20.37	2.97	4.03
9	20.44	2.80	1.20
10	20.48	2.90	2.10
11	20.53	2.81	2.19
12	20.58	2.00	3.00
13	21.03	2.72	0.28
14	21.06	2.80	0.20
15	21.09	3.07	0.93
16	21.13	2.38	0.62
17	21.16	4.01	0.99
18	21.21	2.00	1.00
19	21.24	2.03	0.97
20	21.27	2.00	1.00
21	21.30	2.25	0.75
22	21.34	1.83	1.17
23	21.37	3.05	0.95
24	21.41	2.27	0.73
25	21.44	2.37	7.63*
26	21.54	8.47	

$\bar{X}$ = 2.81 min $\bar{X}$ = 1.93 min

S = 1.25 min S = 1.87 min

*High travel time due to unturnable of boat at the bank as well as waiting for trucks

Table 26 The travel time and waiting time at Ferry No. 3

Running No.	Time (hr)	Travel Time (min)	Waiting Time (min)
1	20.09	3.18	1.82
2	20.14	2.20	0.80
3	20.17	5.75	1.25
4	20.24	3.25	2.75
5	20.30	3.05	0.95
6	20.34	3.30	1.70
7	20.39	2.98	1.02
8	20.42	2.62	1.38
9	20.46	3.30	1.70
10	20.51	3.33	3.67
11	20.58	3.00	2.00
12	21.03	3.33	20.67*
13	21.27	2.37	2.63
14	21.32	3.05	4.95
15	21.40	2.30	2.70
16	21.45	2.13	1.87
17	21.49	3.83	2.17
18	21.55	4.38	0.62
19	22.00	2.47	1.53
20	22.04	2.75	

$\bar{X}$ = 3.14 min $\bar{X}$ = 2.95 min

S = 0.83 min S = 4.41 min

*High travel time due to unturnable of boat at the bank as well as waiting for trucks

Table 27 The comparison of the mean and standard deviation of the results

Ferry No. \ Value		N (trip)	$\bar{X}$ (min)	S (min)	
1.	Travel Time	16	2.93	0.42	
	Waiting Time	15	2.51	1.10	
2.	Travel Time	26	2.81	1.25	
	Waiting Time	25	1.93	1.87	
3.	Travel Time	20	3.14	0.83	
	Waiting Time	19	2.95	4.41	