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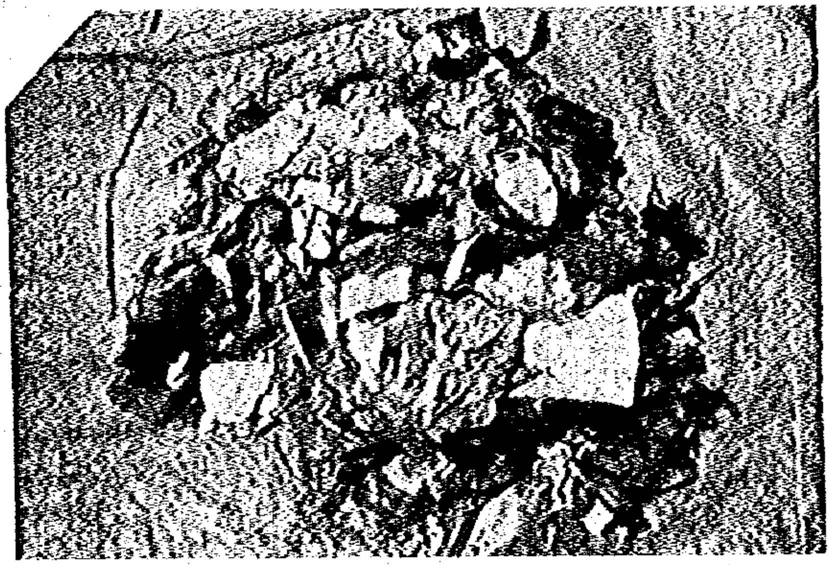

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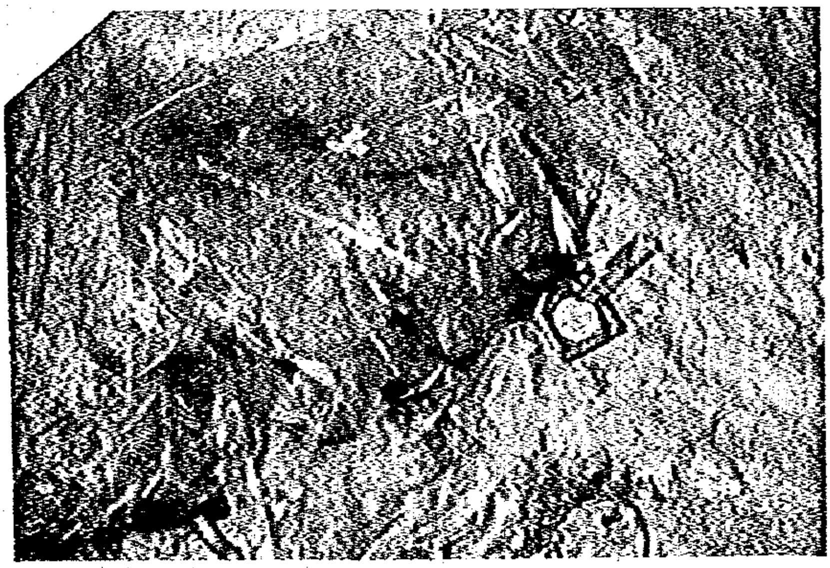

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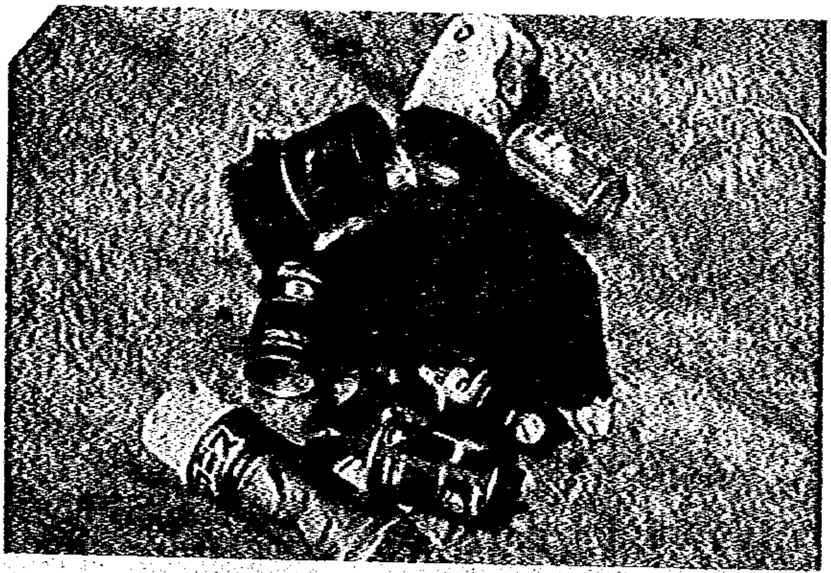

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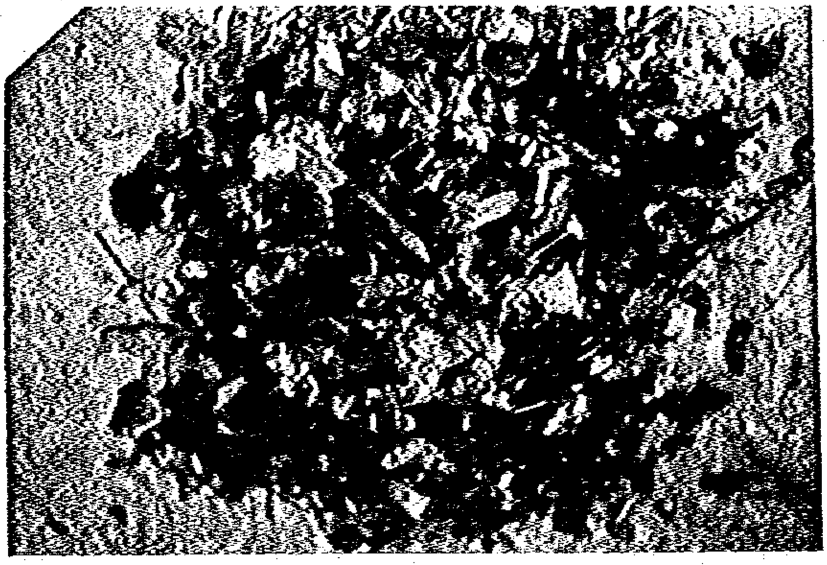

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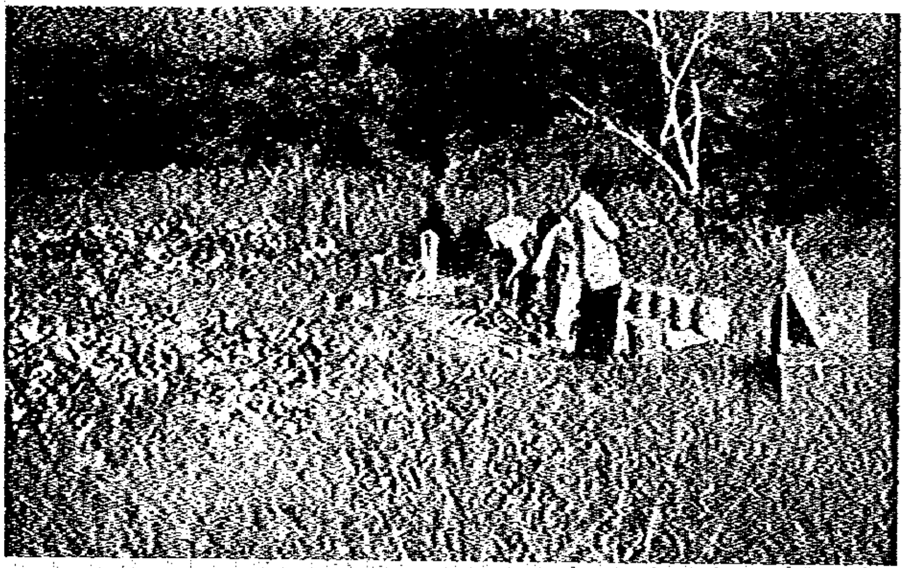

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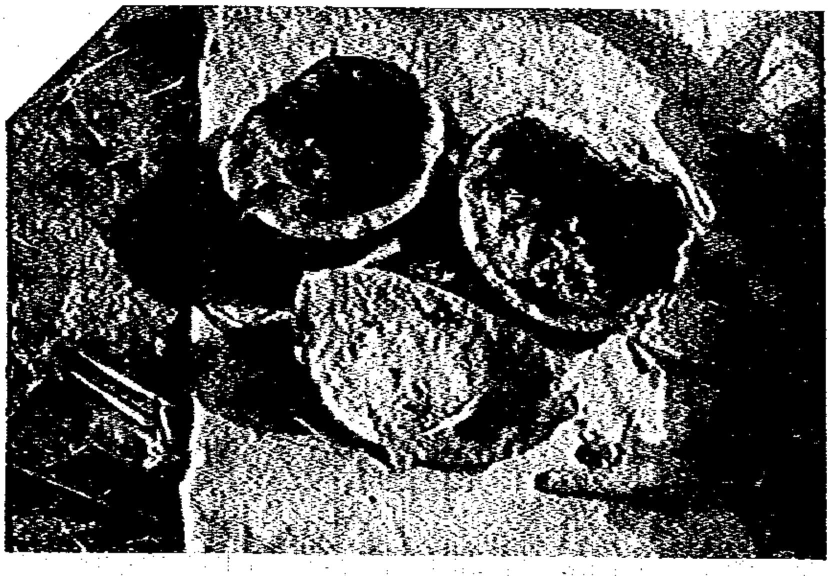

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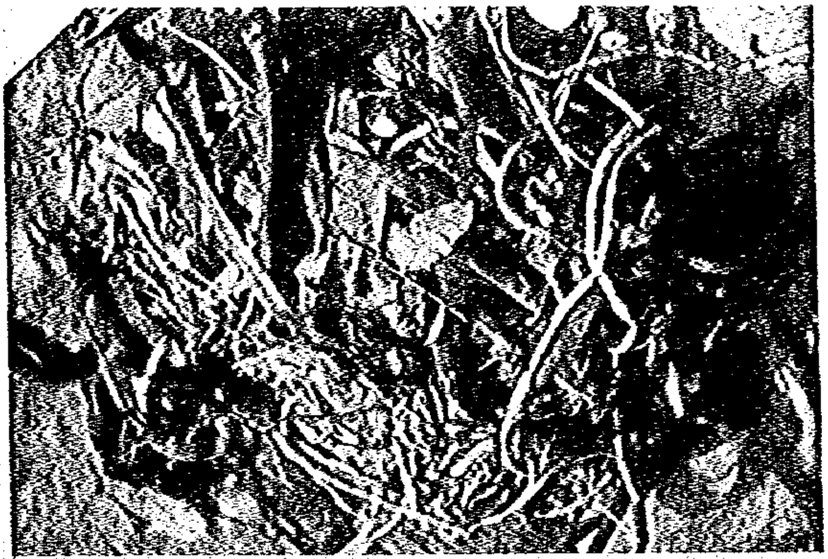

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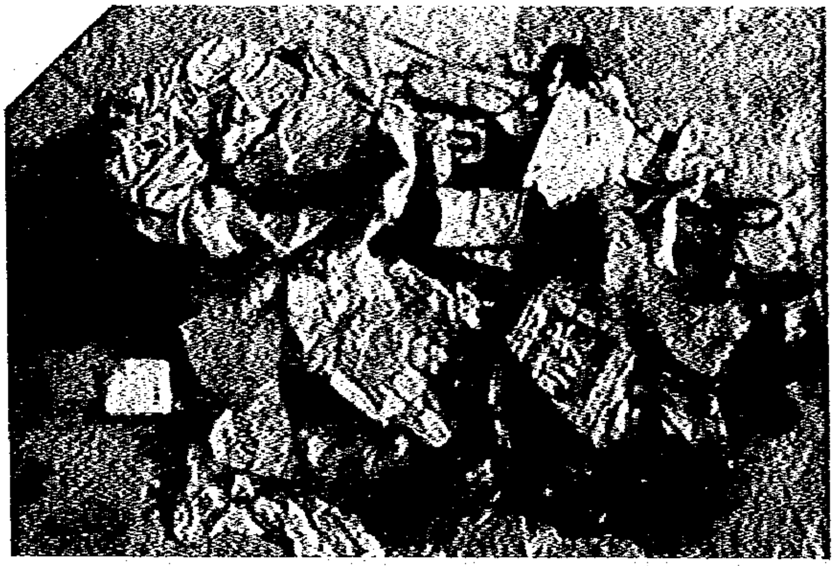

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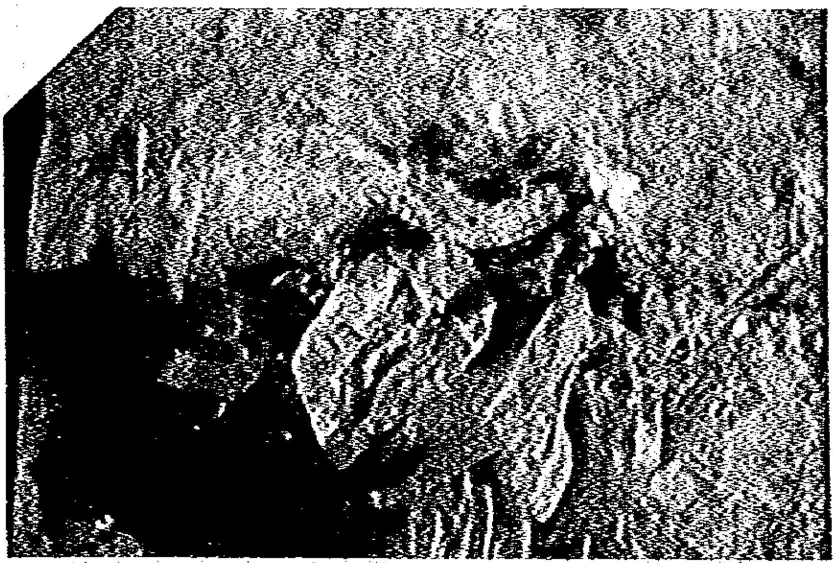

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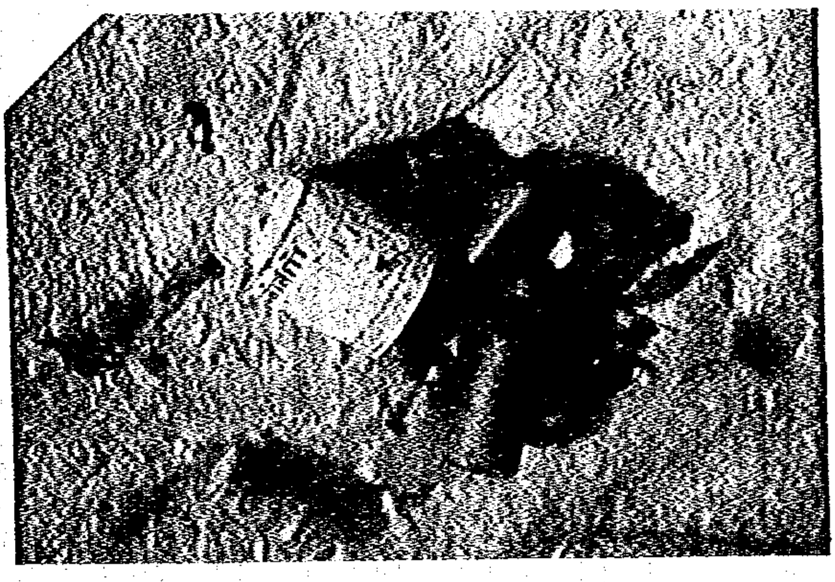

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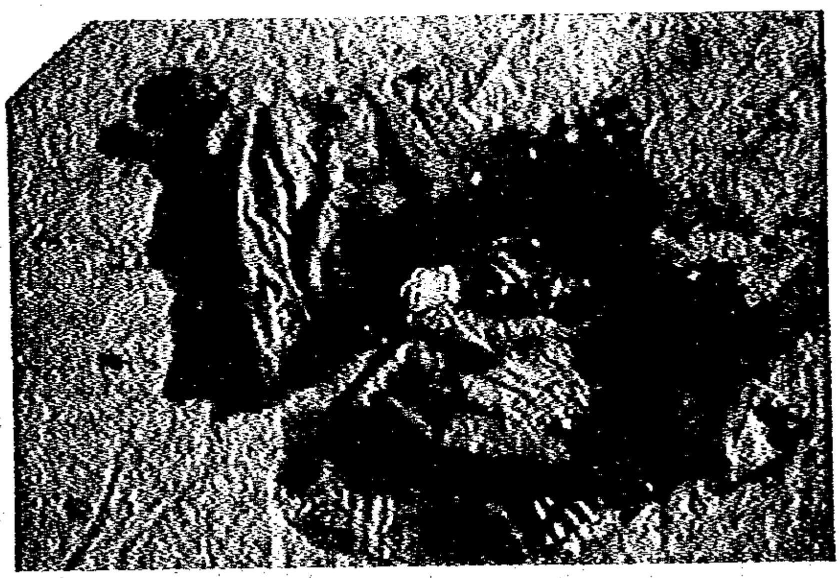

Cat 8

Appendix 3.4 Noise Measurements in Pattaya

REPORT

ON

NOISE MEASUREMENTS IN PATTAYA

Submitted to

PACIFIC CONSULTANTS INTERNATIONAL (JAPAN)

by

Project Consultants:

1. Dr. N.C. Thanh
2. Dr. B.N. Lohani
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February, 1978

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I INTRODUCTION

Noise is unwanted sound and thus subjective opinion of the people is very important in deciding a certain noise level for a situation or a location. As an example, expected noise levels in different places are given in Table 1.1. The audible sound pressures range between 0.00002 N/m^2 and 20 N/m^2 (Table 1.1) which corresponds to the threshold of hearing and threshold of feeling respectively. An average human ear can hear sound in the frequency range from about 20 to 20,000 cycles per second.

Table 1.1 - Examples of Noise Levels in Different Locations

Sound Pressure Level (Decibels)	Sound Pressure (N/m^2)	Typical Sound Source	Sensation
120	20	Thunder, gunfire	Extremely loud
110	6.3	Pneumatic drill	Very loud
100	2.0	Heavy machine shop	Very loud
90	0.63	Noisy Factory	Loud
80	0.20	Average Factory	Loud
70	0.063	Noisy office	Loud
60	0.020	Average office	Moderate
50	0.006	Quiet urban area	Quiet
40	0.002	Average Dwelling House	Quiet
30	0.0006	Country Lane	Very Quiet
20	0.0002	Quiet Church	Faint
10	0.00006	Sound Proff room	Very Faint
0	0.00002	Reference Level	Inaudible

This report presents the measured noise levels at different locations in Pattaya and discusses the results based on which recommendations are made where appropriate.

II SCOPE OF THE WORK

2.1 Noise Measuring Stations

Noise levels were measured at 19 stations which are shown in Fig. 2.1 as stations 1 to 14 and A-1 to A-5. Three noise levels were measured at each of the stations A-1 to A-5 along its cross section to get the variation of noise levels from sea to the traffic road. Thus altogether 29 locations were selected for noise measurements. The photographs and site diagrams of all the twenty nine locations are given in Appendix A. All the locations for noise measurements were fixed by the personnel of Pacific Consultants International (Japan).

2.2 Duration of Measurement

At station 13, noise levels were measured over twenty four hours at different time intervals to assess the variation, at different hours of the day. Each time noise level was measured for one minute, at all the frequencies ranging from 31.5 to 31,500 Hz (i.e. 31.5, 63, 125, 250, 500, 1000, 2000, 4000, 8000, 16,000 and 31,500 Hz) and at dB(A) at A weighting for 2 minutes.

One measurement at stations 1 to 5, and two measurements (one before noon and one in the afternoon) at stations 6 to 14 (except station 13) were conducted for 2 minutes for each location. Measurements at stations A-1 to A-5 (at the three locations along the cross section) also lasted for 2 minutes each.

For all noise level measurements weighting A was used. The International Standards for noise measurements and evaluation in general recommend the use of A weighting. Further, all measurements at stations at all the frequencies were carried out in terms of one-third octave.

2.3 Noise Measurement and Determination

A Bruel & Kjaer precision sound level meter, (Type 2203) conforming to the International Electrotechnical Commission's recommendation IEC-179, was used with a microphone (Type 4166, ½" windscreen model 0237) mounted on a portable floor stand (Type UA 0049) for noise level measurements. The noise levels measured were recorded in a recorder (Type 2306).

For frequency analysis, the octave band distribution was measured according to the International Organization for Standardization recommendation, ISO-R-266, except that the 16 Hertz level was omitted. A Bruel and Kjaer octave filter set (Type 1613) was used in combination with other octave frequencies centered at 31.5, 63, 125, 250, 500, 1000, 2000, 4000, 8000, 16,000 and 31,500 Hertz. Noise levels were continuously recorded by a Bruel and Kjaer recorder (Type 2305) with lined paper (Type QP 0102). Fig. 2.2 shows the measuring and recording arrangements.

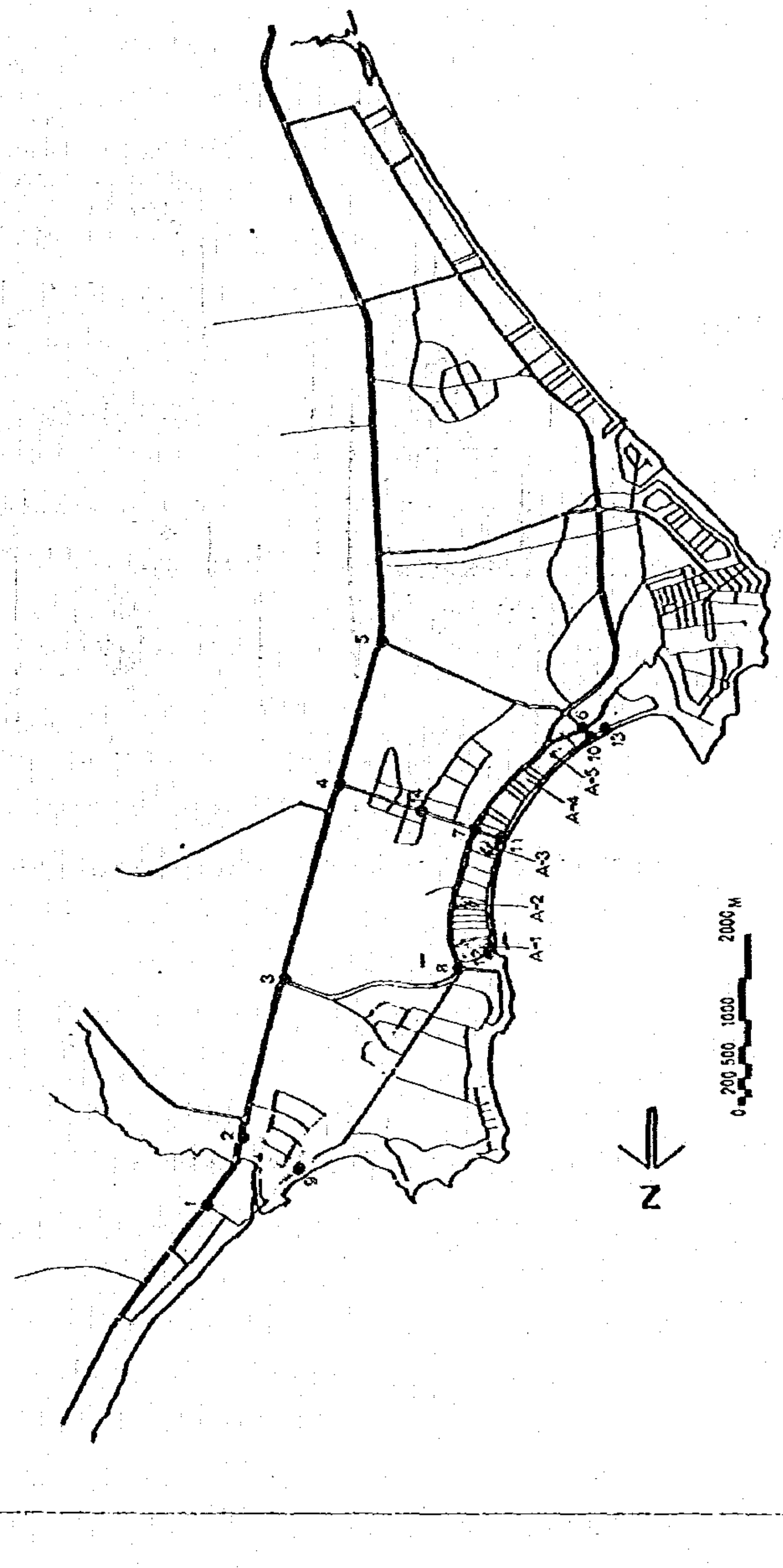


Fig.2.1 Location of Sampling Stations

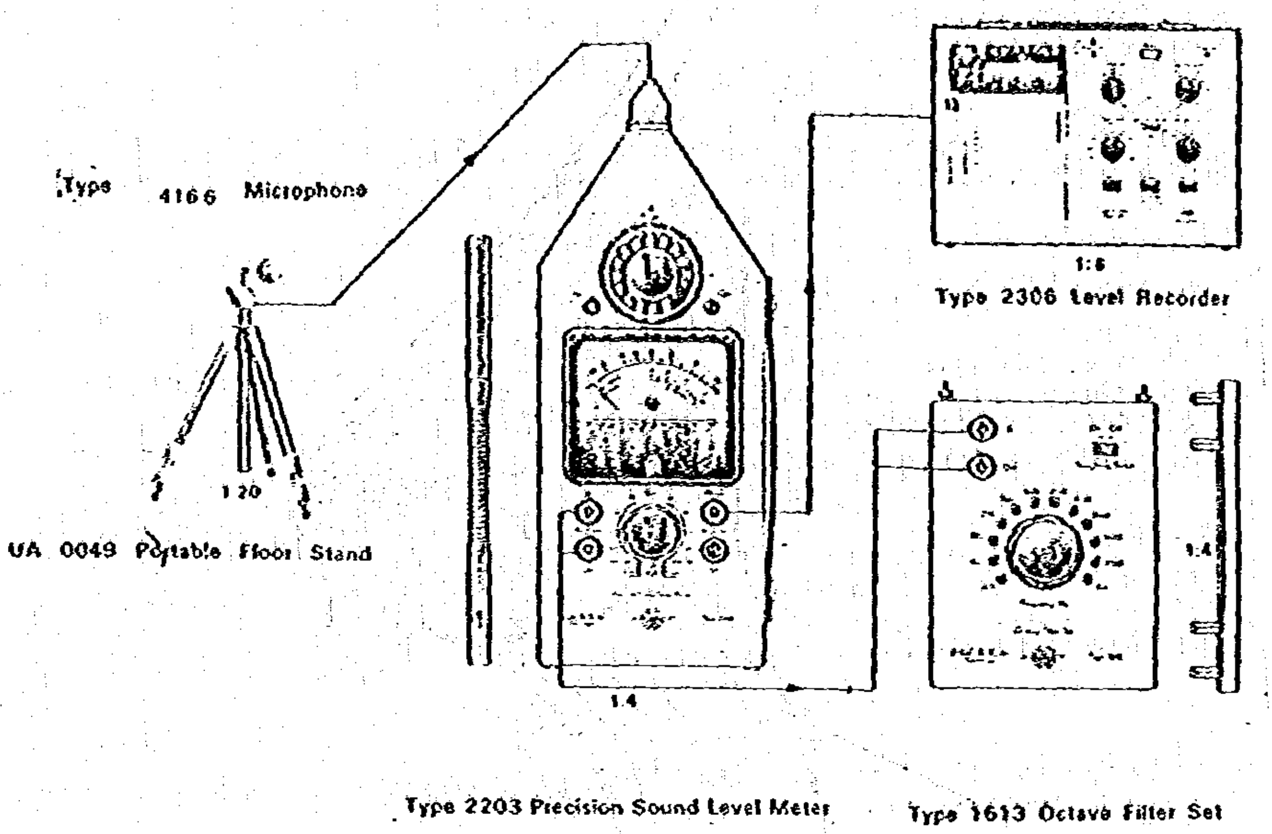


Fig. 2.2 Arrangement for Recording Noise Levels

The writing speed was an important factor in the determination of noise level, especially for random noise. Too fast or too slow a writing speed created problems in analyzing and recording. The writing speed range from 16 mm/sec to 100 mm/sec is recommended for the precision sound level meter used and, in the present study, the writing speed of 40 mm/sec was adopted. Next, the paper speed is noted. A formula may be used to determine a suitable paper speed for the analysis and is given by:

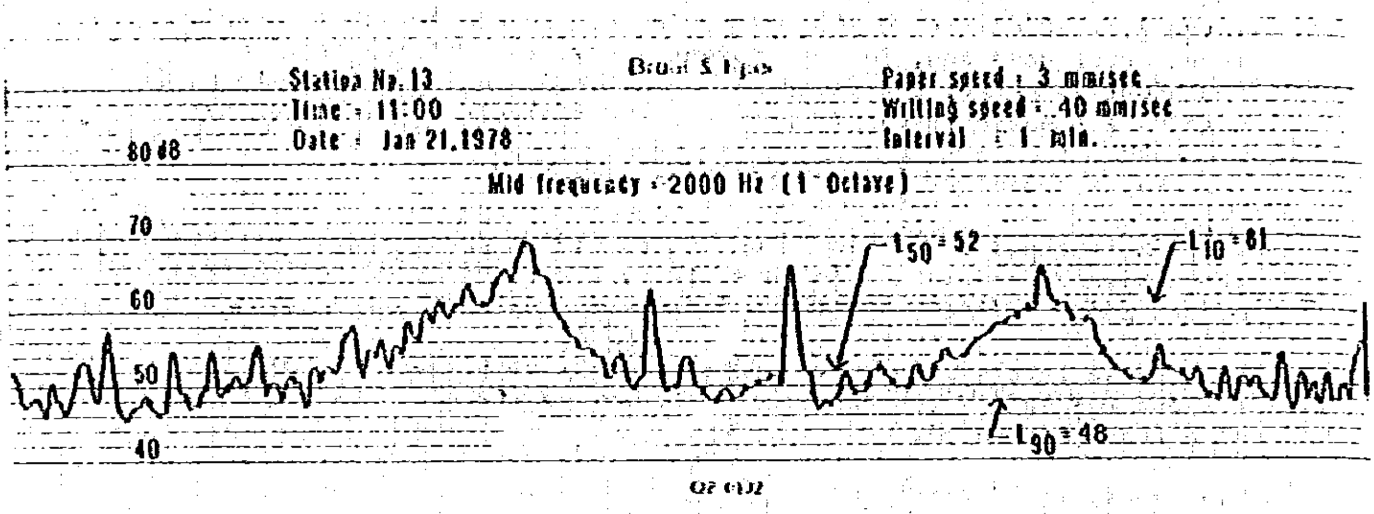
$$\text{Paper speed} \leq \frac{X}{75} \times \text{Writing speed}$$

where X is the distance in mm on the recording paper which corresponds to the analyzer bandwidth. In this study, the paper speed varied from 0.01 mm/sec to 30 mm/sec.

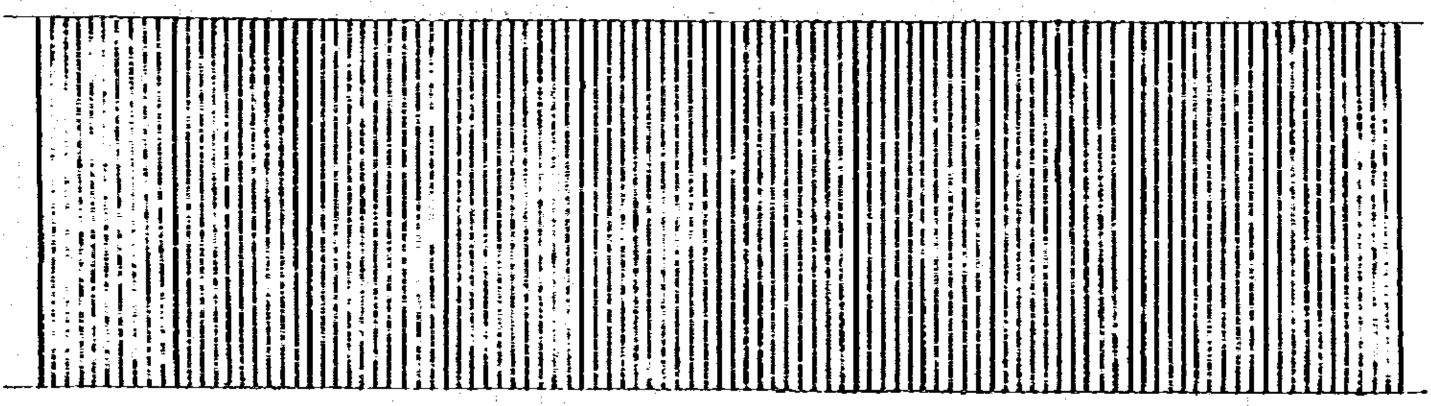
Noise levels were expressed as cumulative percentage values. L_{10}, L_{50} and L_{90} values representing noise levels for 10%, 50% and 90% of times were then calculated.

2.4 Analysis of Data

Fig. 2.3 shows a typical chart reading of noise level measurement at Pattaya. The time axis is divided into 100 equal intervals as shown by dots. This is considered equivalent to taking 100 random unbiased samples of the noise intensity, which is approximately representative of the total population of noise samples. The upper ten percent noise level is established by placing a straight edge over the graph to a position such that ten dots are over one edge and then reading the corresponding noise intensity level on the left of the chart. Similarly, the 50 percent and 90 percent noise levels are established by a similar procedure. The 10%, 50% and 90% noise levels are shown in Fig. 2.3 as L_{10}, L_{50} and L_{90} respectively.



(a) Typical Recording of Noise Levels



(b) Division into 100 equal parts

Fig. 2.3 Analysis of Recorded Noise Levels

III RESULTS AND DISCUSSIONS

3.1 Twenty Four-Hour Noise Measurementat Station 13

Noise levels were measured for 24 hours at different time intervals on January 21 and January 22, 1978 at station 13. Station 13 is the crowdest place in the downtown Pattaya. Right on the opposite side of the sampling station are night clubs which are crowded at night. Detailed data of noise level measurements (L_{10}, L_{50} and L_{90}) are presented in Table B1 to Table B6, in Appendix B and Fig. 3.1 shows the plot of the measured data between noise level (dB) and frequency (Hz). Fig. 3.2 shows the noise levels (L_{10}, L_{50} and L_{90}) at different hours of the day. Six measurements, two of which were effectuated before noon and four at night, were made at 11:00, 16:00, 20:00, 22:00, 24:00 hours on January 21, 1978 and 08:00 hours on January 22, 1978.

The peak noise levels at different hours of the day are shown in Table 3.1, from which it may be observed that noise levels at 16:00 and later hours in the evening are higher than that early in the morning and in the afternoon. This is to be expected due to the presence of bars and night-clubs with loud music around the area. When compared with the infrequent peak values recommended outdoor standards in Switzerland and United Kingdom, shown respectively in Table 3.2 and Table 3.3, the peak values are higher than the recommended infrequent values for commercial zone. The day time peak levels, 89 dB at 11:00 and 16:00 hrs, are within the recommended values for main roads in British and Swiss Standards. However, the night time noise levels, 93 dB at 20:00 hr., 91 dB at 22:00 hr., and 90 dB at 24:00 hr, are all higher than the recommended noise level of 80 dB at night time for infrequent peaks.

Table 3.4 presents ten, fifty and ninety percentile noise levels which are also considered as the maximum sound level, median and the background level in a given sampling station. Noise standards in the form of percentage values are adopted by the State of Minnesota in U.S.A. and is shown in Fig. 3.3. Comparing the noise levels stated by Minnesota Standards and the noise levels in Bangkok measured by Than-thong Tawi (1974)[1/] given in Table 3.5 the noise level (L_{10}) at station 13 during morning and day times i.e. 72 dB at 08:00 hr, 70 dB at 11:00 and 75 dB at 16:00 are sometimes slighty higher than the recommended value of 70 dB by Minnesota Standards but lower than the noise level in Bangkok at major road arteries. However, the noise levels at night i.e. 74 dB at 20:00, 75 dB at 22:00, and 73 dB at 24:00 is much higher than the noise level of 65 dB recommended by Minnesota Standards but is only little lower than the noise level at Bangkok (75.9 dB) at major road arteries.

Loudness and Noisiness

Although the measurable characteristics of sound (frequency and pressure), are important, they do not however indicate the subjective characteristics of

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1/ Thanthong Tawi, S. (1974), Bangkok, Noise Pollution Survey, Master's Thesis No. 639, Asian Institute of Technology, Bangkok.

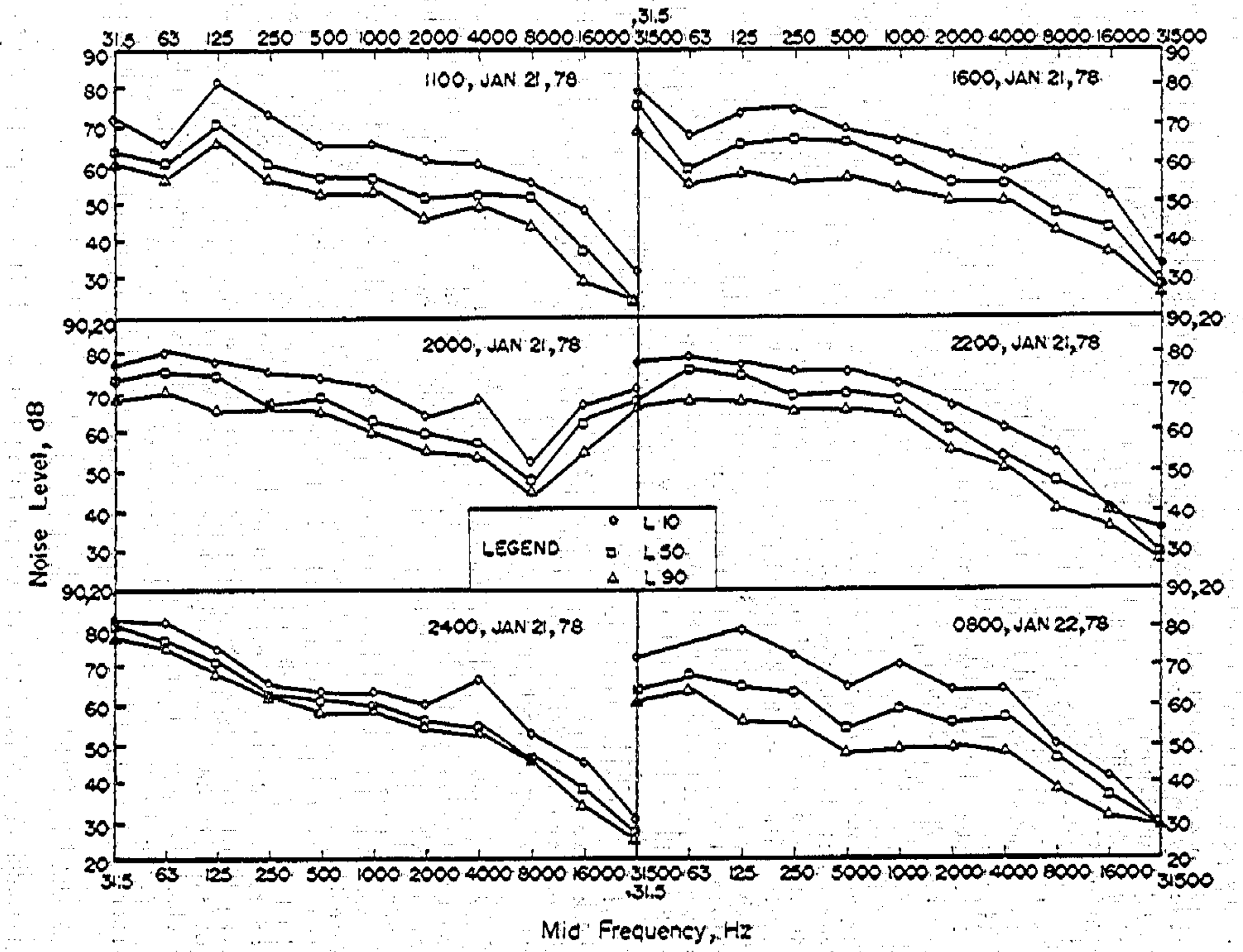


FIG. 3.1 Noise Level at Different Mid Frequency at Station 13

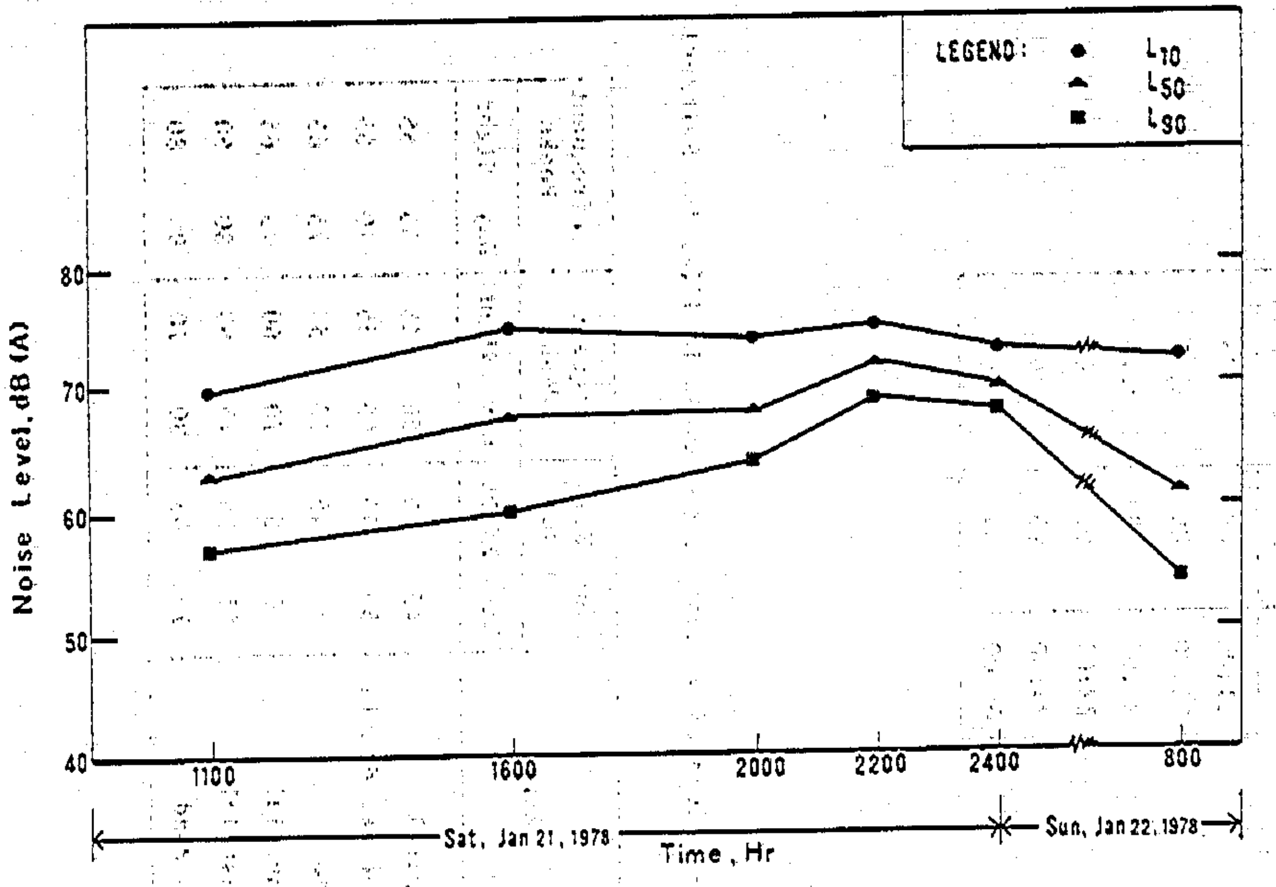


Fig. 3.2 Noise level variation at different time at station 13

Table 3.1 - Peak Noise Levels

Time	Peak Noise Level	
	dB	Frequency
11:00	89	125
16:00	89	31.5
20:00	93	31.5
22:00	91	63
24:00	90	63
08:00	85	63

Table 3.2 - Tolerated Outdoor Noise Levels in dB(A) for Switzerland

Zone	Basic Noise Level		Frequent Peaks		Infrequent Peaks	
	Day	Night	Day	Night	Day	Night
Hospital	45	35	50	45	55	55
Quiet Residential	55	45	65	55	70	65
Mixed	60	45	70	55	75	65
Commercial	60	50	70	60	75	65
Industrial	65	55	75	60	80	60
Main Road	70	65	80	70	90	80

Table 3.3 - Tolerated Outdoor Noise Levels in dB(A) for United Kingdom

Zone	Basic Noise Level		Frequent Peaks		Infrequent Peaks	
	Day	Night	Day	Night	Day	Night
Hospital	45	35	50	45	55	55
Quiet Residential	55	45	65	55	70	65
Mixed	60	45	70	55	75	65
Commercial	60	50	70	60	75	65
Industrial	65	55	75	60	80	70
Main Road	70	65	80	70	90	80

Table 3.4 - Percentile Noise Level, dB(A) at Different Hours of Day.

Time	Noise Level, dB(A)		
	L_{10}	L_{50}	L_{90}
11:00	70	63	57
16:00	75	68	60
20:00	74	68	64
22:00	75	72	69
24:00	73	70	68
08:00	72	61	54

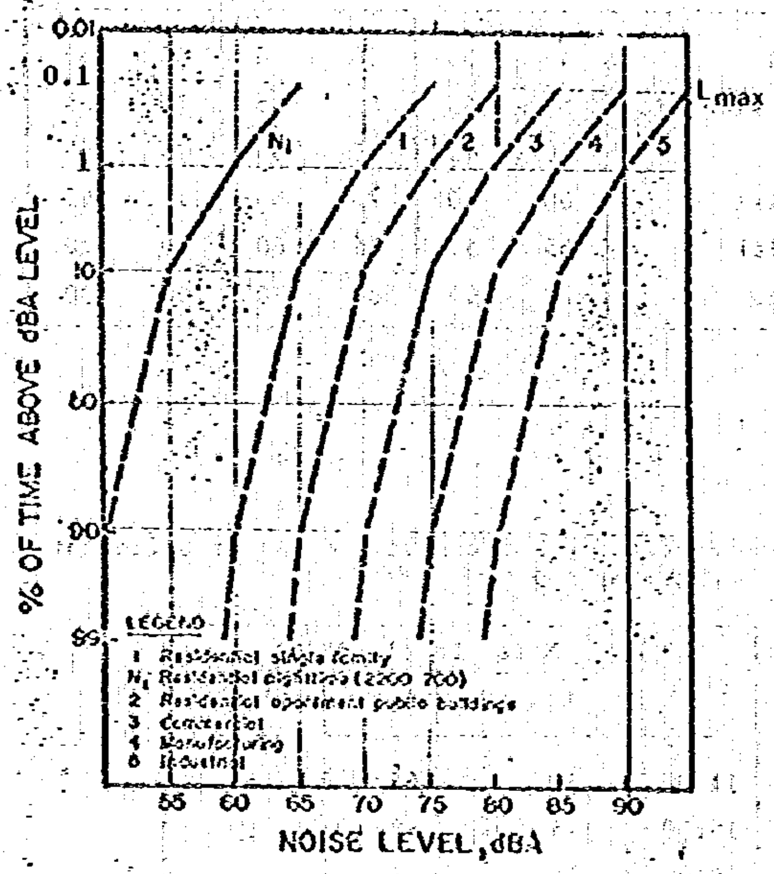


Fig. 3.3 Noise Standards Adopted by The State of Minnesota

sound namely "Loudness". This is the general complaint in respect to noise nuisance. Loudness in sones and loudness levels in phons have been calculated using the following Steven's formula:

$$\text{Loudness} = Sm + f(\Sigma S - Sm)$$

Sm = Maximum number of sones in any one band (Greatest of the Loudness Indices)

ΣS = Sones in all band (Sum of all the Indices of all the bands)

f = Fractional portion dependent on bandwidth where $f = 0.3$, 0.2 or 0.15 when the spectra of sound is measured at full, ½ or 1/3 octave.

Table 3.5 - Comparison of Bangkok Noise Levels with the Minnesota Standards, dB(A).

Predominant Activities in Area	Bangkok		Minnesota Standards
Private Detached Houses	day	54.5	55
	night	51.3	45
Shops/Markets	day	77.8	60
	night	72.3	50
Open Fields or Parks	day	58.9	-
	night	50.4	-
Major Road Arteries	day	79.2	70
	night	75.9	65

The loudness in sones value can be converted to loudness level in phons by the relation.

$$\text{Sones} = 2^{(\text{phons} - 40)/10}$$

Loudness indices corresponding to each of the noise level in dB at a particular frequency are obtained from standard tables and are shown in Table B1 to Table B6 in Appendix B. From the loudness indices, loudness and loudness level in sones and phons respectively were calculated and presented in Table 3.6.

Loudness is however not an indicator of annoyance or noisiness which depends upon many factors. Thus, perceived noisiness or annoyance is equally important in noise studies. The perceived noisiness scale is available and the scale gives more weight to the high frequencies and is called 'Perceived Noise'. Level which is measured in Perceived Noise decibel (PNdB). Since the object of the perceived loudness scale was to quantity noisiness or annoyance of a sound, a scale of noisiness or annoyance in a manner similar to the sone scale of loudness has been constructed and that unit of noisiness is called which is defined as the noisiness of a band of noise from 910 Hz to 1090 Hz of SPL 40 dB. The noisiness and noisiness level is computed by the method analogous to that for loudness level and is given as:

$$N = N_{max} + f(\Sigma n - N_{max})$$

where

N = Total Perceived Noisiness
N_{max} = highest of Noy values
Σn = the sum of the Noy values in all the octave band
f = 0.3, 0.2 or 0.15 for respectively full, ½ and 1/3 octave.

The Total Perceived Noisiness in Noys is converted to Perceived Noisiness Level in PNdB by:

$$\text{Noys} = 2^{(\text{PNdB} - 40)/10}$$

The Noys values for the noise levels in dB for each frequency in Hz is shown in Table B1 to B6 in Appendix B for all the measured values. The total perceived noisiness in Noys and the perceived noisiness levels in PNdB were calculated and are presented in Table 3.6

Table 3.6 - Loudness and Noisiness Levels at Station 13

Time Mea- surement	Percentile	Loudness Sones	Loudness Level Phons	Total Noisiness NOYS	Noisiness Level PN dB
11:00 Jan:21	L_{10}	23.1	85	24.2	86
	L_{50}	13.4	77	12.3	76
	L_{90}	9.7	73	8.8	71
16:00 Jan:21	L_{10}	22.9	85	22.0	85
	L_{50}	14.4	78	13.5	78
	L_{90}	9.8	73	8.9	71
20:00 Jan:21	L_{10}	31.6	90	32.9	90
	L_{50}	19.1	83	19.0	82
	L_{90}	14.7	79	13.7	78
22:00 Jan:21	L_{10}	26.3	87	27.7	88
	L_{50}	20.1	83	19.7	83
	L_{90}	16.3	80	15.1	79
24:00 Jan:21	L_{10}	25.1	86	27.0	88
	L_{50}	16.6	81	15.3	79
	L_{90}	14.5	79	13.2	77
08:00 Jan:22	L_{10}	24.2	86	25.9	87
	L_{50}	13.3	77	13.0	77
	L_{90}	9.0	72	8.4	71

Summary - In general, the noise levels at station 13 at all the hours, and especially at night are higher than the acceptable values stated in the standards and is mainly due to the automobiles and the loud music in the night clubs. The peak values are due to the automobiles as the noise levels are in the range of the noise from different vehicles. The average noise of vehicles at a distance of 4.6 metres in the city of Bangkok has been measured to be as shown below and it is believed that similar observations will be true in Pattaya.

Vehicle		Average Noise Level (dB(A))
Ten-wheel Trucks	-	96.1
Motorised tricycles	-	91.8
Trucks	-	88.5
Motorcycles	-	87.8
Vans	-	87.2
Taxis	-	87.1
Buses	-	86.8
Cars	-	84.5

The peak values shown in Table 3.1, varied from 85-93 for various times of the day and shows that the noise levels fall in the range for different vehicles except big trucks. As observed during noise measurement, the sources were taxis, cars and motorcycles. It is expected, although not measured, that the emission noise from most of taxis are higher than what may be acceptable. It is recommended that such emission noise level limitations be adopted, if the background noise level is to be reduced. One such standard recommended by the British Motor Vehicles which outlines the maximum sound levels for all types of vehicles is presented in Table 3.7 and may be adopted.

3.2 Noise Measurements at Station 1 to 12 and 14

A summary of the noise levels (L_{10}, L_{50} and L_{90}) measured at stations 1 to 12 and 14 is presented in Table 3.8. The highest noise level of 99 dB occurred at station 6 at 11:30 hours on January 21, 1978. This must be due to the big trucks with the horn blowing at the same time. The minimum noise level of 42 dB was measured at station 14 at 15:35 hrs on the same day. At this time, no vehicles passed through the sampling location during the duration of noise measurement. The L_{10} value at station 8 at 10:34 hr and 15:00 hr was 70 dB each is within the allowable limit of 90 dB for infrequent daytime peaks for main road in Swiss and British Standards, presented in Table 3.2 and Table 3.3 respectively. The L_{10} noise level at all other stations varied from 72 dB at station 12 to 82 dB at stations 4 and 6 and should be considered acceptable. The L_{90} values varied from 46 dB to 65 dB which, when compared with the daytime basic noise level for main road, recommended in British and Swiss Standards, should be considered to be within the limit.

In general, the background noise levels measured at stations 1 to 14 (except 13) should be considered acceptable. However, the peak or maximum values measured as high as 99 dB is certainly not desirable. Too often use of horn should be restricted and speed limit restriction should be observed.

Table 3.7 - Maximum Sound Levels, dB(A) (British Motor Vehicles, 1969)

	Class or Description of Vehicles	Maximum Range dB(A)
1.	Motor cycle of which the cylinder capacity of the engine does not exceed 50 cubic centimetres	77-80
2.	Motor cycle of which the said cylinder capacity exceeds 125 cubic centimetres	86-89
3.	Any other motor cycle	82-90
4.	Goods vehicle to which Regulation 30 applies and which is equipped with a plate complying with the requirements of paragraph (2) of that Regulation and showing particulars of a maximum gross weight of more than 3½ tons	89-92
5.	Goods vehicle first used before 1st January 1968 which complies with the requirements of Regulation 71 (3)(c) and is equipped with such a plate as aforesaid notwithstanding that Regulation 30 does not apply to that vehicle by reason only that it was so registered	
6.	Motor tractor	89-92
7.	Locomotive	89-92
8.	Land tractor	89-92
9.	Works truck	89-92
10.	Engineering plant	89-92
11.	Passenger vehicle constructed for the carriage of more than 12 passengers exclusive of the driver	89-92
12.	Any other passenger vehicle	84-87
13.	Motor car within the meaning of section 253 (2)(b) of the 1960 Act not being a goods vehicle of either of the kinds described in paragraphs 4 and 5 of this Column	85-88
14.	Any other vehicle not elsewhere classified or described in this Column	85-88

Table 3.8 - Noise Level Measurements at Station 1 to 12 and 14 (Date: January 21, 1978)

Station	Time	Noise, Level, dB(A)				
		L_{10}	L_{50}	L_{90}	Max	Min
1	13:50	79	72	63	92	56
2	13:42	78	69	63	86	58
3	14:28	74	64	56	80	52
4	14:06	82	69	58	89	53
5	14:33	76	67	62	89	59
6	11:30	82	72	62	99	53
	15:50	79	71	65	89	61
7	11:50	76	65	56	90	52
	15:28	76	68	60	83	57
8	10:34	70	65	57	79	51
	15:00	70	65	59	76	58
9	13:33	73	68	64	81	58
	16:35	78	71	65	87	62
10	11:40	73	69	65	92	63
	15:45	77	73	65	85	62
11	10:54	81	72	64	89	59
	15:20	73	68	64	88	61
12	10:44	72	65	57	78	53
	15:08	74	64	58	77	53
14	11:55	76	64	55	88	44
	15:35	74	61	46	85	42

3.3 Noise Measurements at Stations A-1 to A-5

The noise levels measured at stations A-1 to A-5, three in each location along its cross section from the main road to the sea beach. Table 3.9 presents the results of the noise level measurement at all the fifteen locations and Fig. 3.4 shows the plot of the noise levels along the cross section. Traffic noise creates an unpleasant environment for the beach lovers. Assuming that the desired noise level limit at sea beach is just like for quiet residential area mentioned in Swiss and British Standards, it may be observed that the noise levels at all the stations are much higher than the acceptable daytime level of 55 dB for basic noise level. The L_{10}, L_{50} and L_{90} values ranged from 62-78 dB, 62-74 dB and 56-69 dB respectively. The noise levels are reduced at half distance between the pavement and the sea beach. Noise at the sea beach due to wave sound and the activities of the people, is not uncomfortable whereas the noise created by trucks and other vehicles near the pavement are certainly objectionable. This was observed in a study

Table 3.9 - Noise Level Measurements at Stations A1-A5
Date: January 22, 1978

Station	Measuring Point	Time	Noise Level, dB(A)				
			L_{10}	L_{50}	L_{90}	Max	Min
A-1	A-1-1	10:33	77	68	57	82	53
	A-1-2	10:37	68	64	58	74	53
	A-1-3	10:41	72	68	63	76	59
	A-1-1	15:30	77	65	61	95	58
	A-1-2	15:33	70	67	65	79	62
	A-1-3	15:36	75	70	67	79	62
A-2	A-2-1	10:50	73	64	56	81	53
	A-2-2	10:54	62	67	56	76	53
	A-2-3	10:57	72	68	64	78	60
	A-2-1	15:02	76	69	61	84	58
	A-2-2	15:45	70	65	62	75	59
	A-2-3	15:48	78	74	69	83	67
A-3	A-3-1	11:05	74	65	64	92	59
	A-3-2	11:09	66	62	59	74	57
	A-3-3	11:12	73	69	68	75	63
	A-3-1	15:55	72	66	62	86	58
	A-3-2	15:58	70	68	63	79	61
	A-3-3	16:00	77	72	70	85	65
A-4	A-4-1	11:26	71	65	62	82	59
	A-4-2	11:29	72	68	65	80	61
	A-4-3	11:33	76	72	68	82	63
	A-4-1	16:15	78	70	64	89	62
	A-4-2	16:18	74	67	65	79	64
	A-4-3	16:22	75	73	69	87	66
A-5	A-5-1	11:43	74	69	64	79	61
	A-5-2	11:47	72	68	64	81	61
	A-5-3	11:50	74	71	66	82	62
	A-5-1	16:30	74	68	64	87	62
	A-5-2	16:34	74	71	68	76	66
	A-5-3	16:38	75	72	68	78	66

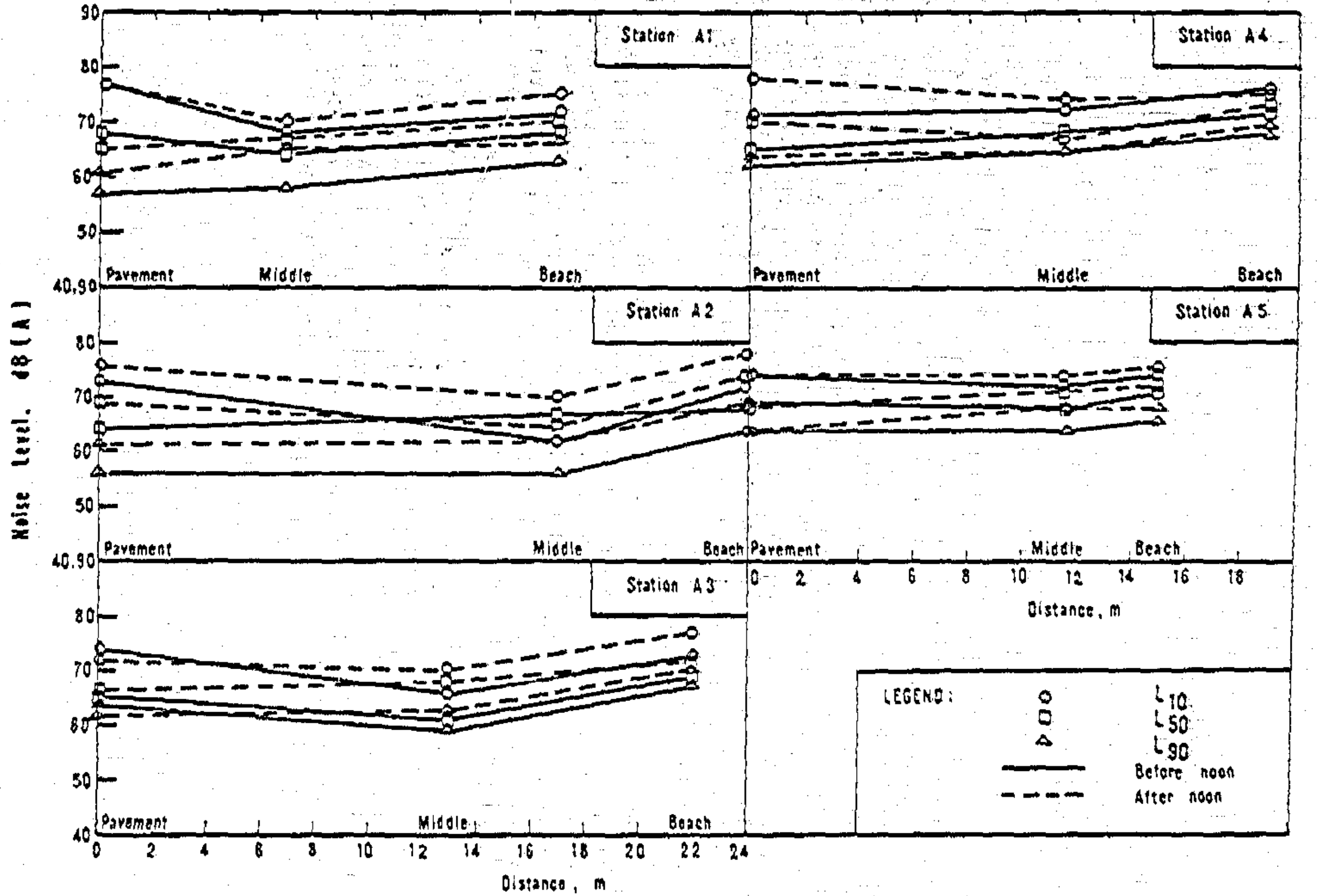


Fig. 3.4 Cross-Section of Noise Level at Stations A1 to A5

Table 3.10 - Noise Level Reduction by Coconut Tree Barrier

Land Side	11:54	72	69	66	77	64
Sea Side	11:56	64	58	55	67	53
Reduction		8	11	11	10	10

carried out by McKennel (1963)[1/] who made a major analysis of the reaction of people to noise in the community. Table 3.11 shows some of the results of a general questionnaire survey made at 450 points spaced over 36 square miles of Central London. It is interesting and not surprising to note that noise from road traffic is the major source that disturbs people most whether they are at home, outdoors or at work. Although the results pertain to Central London, they would undoubtedly apply to any major city in Asia as well. In Asian cities not only are the roads all planned and badly constructed, but the vehicles are not properly maintained, not correctly drived, and driven using horn frequently. Hence, the noise from road traffic is probably much annoying and severe than shown for central London.

Quite a few coconut trees are seen in the beach area and thus the decibel reduction by coconut tree as a barrier was studied. Table 3.10 shows the noise level measured at both the sides of a coconut tree having a circumference of 94 cm. As much as 11 dB in noise level was observed reduced. In view of this, coconut trees at close spacing, but avoiding to create shade, could help reduce the noise levels.

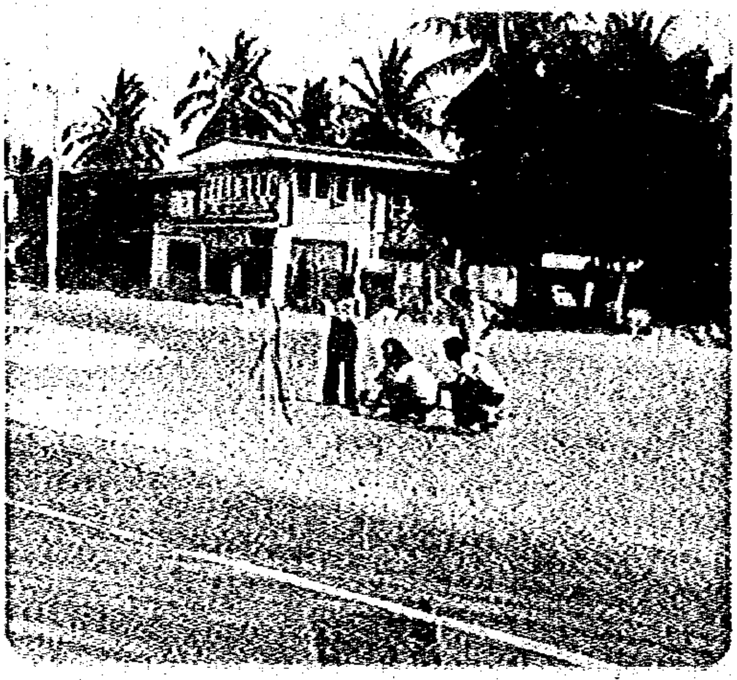
In general, noise levels along the cross section at stations A-1 to A-5 is unacceptable for the recreation in the beach. Especially the traffic noise should be controlled. This may be done by putting emission limits to the vehicles, prohibiting horns, diverting traffic etc. As an alternative measure, some kind of barrier may be built along the beach area joining the road pavement without destroying the aesthetics of the beach area.

[1/] McKennel, A.C. (1963), Aircraft Annoyance around London Heathrow Airport U.K. Govt. Social Survey for Wilson Committee on Problem of Noise, 1963.

Table 3.11 - Noises which Disturb People at Home, Outdoors and at Work.

Description of Noise	Number of People Disturbed, Per 100 questioned		
	When at home	When Outdoors	When at Work
Road Traffic	36	20	7
Air Craft	9	4	1
Trains	5	1	-
Industry / Construction Works	7	3	10
Domestic / Light Appliances	4	-	4
Neighbours Impact Noise (Knocking etc)	6	-	-
Children	9	3	2
Adult Voices	10	2	2
Wireless / T.V.	7	1	1
Bells / Alarms	3	1	1
Pets	3	-	-
Other Noise	-	-	-

APPENDIX A



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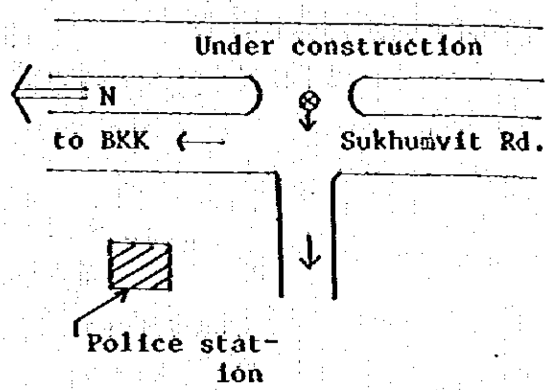

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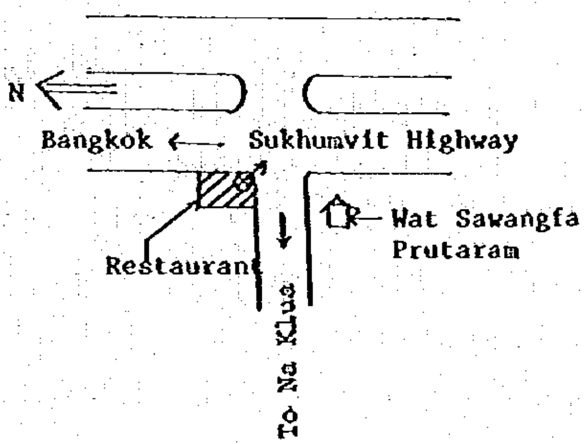

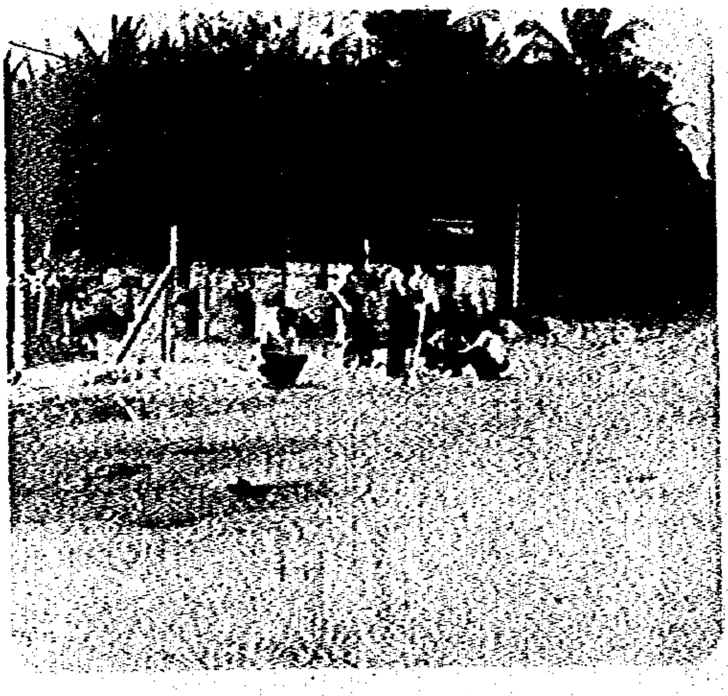

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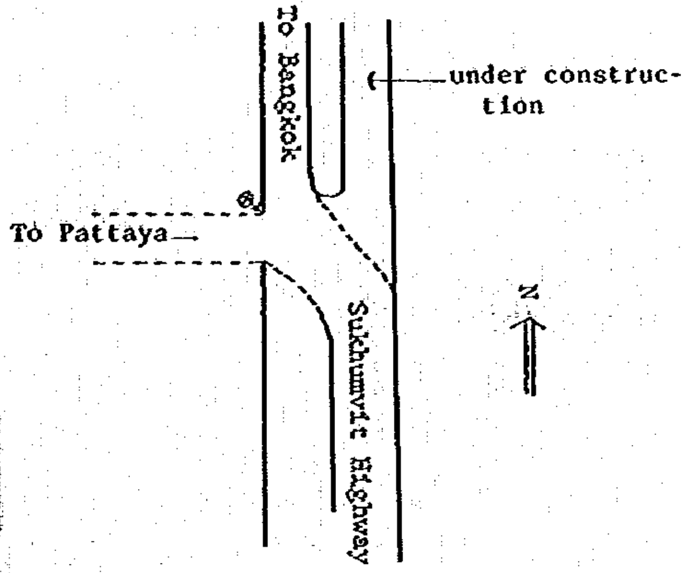

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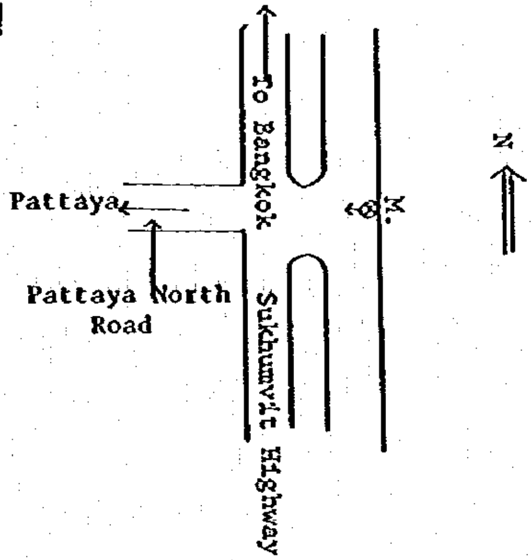

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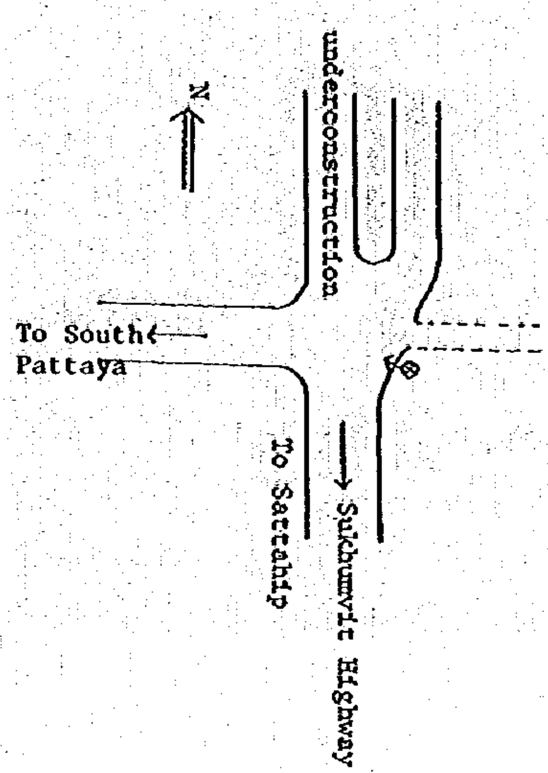
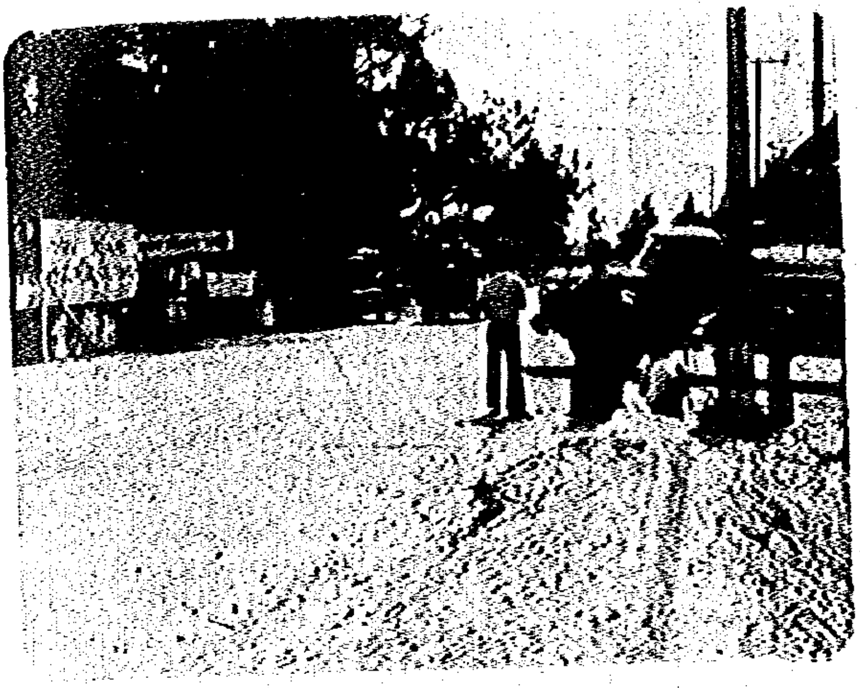

N
underconstruction
To South Pattaya
To Sattahip
Sukhumvit Highway



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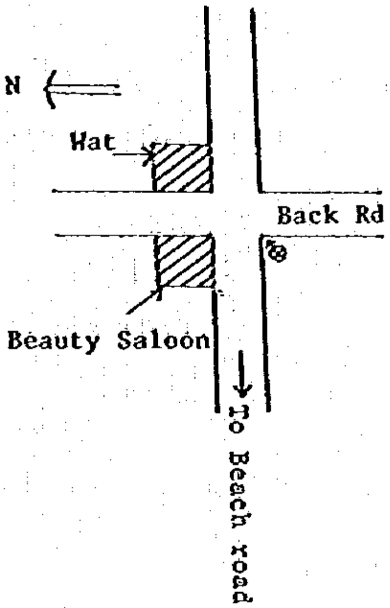

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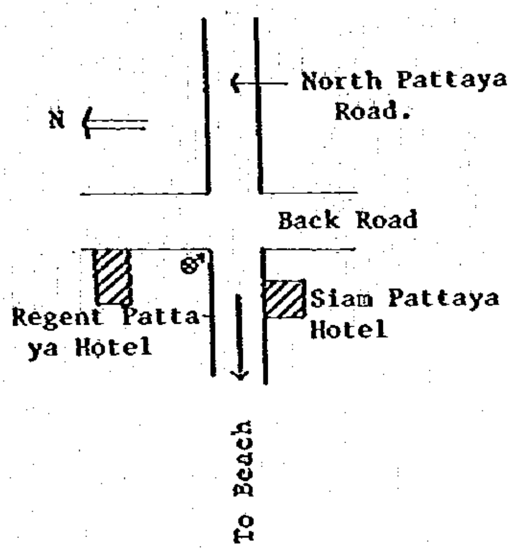

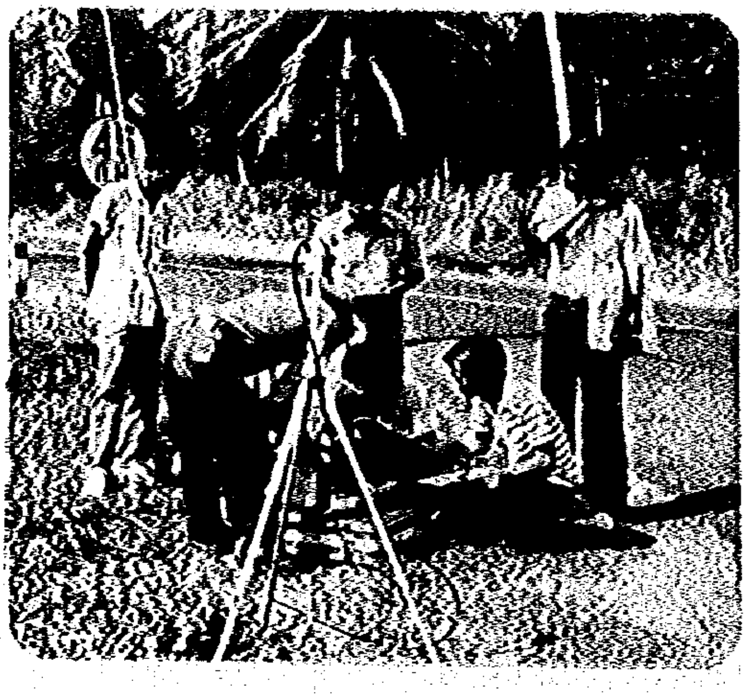

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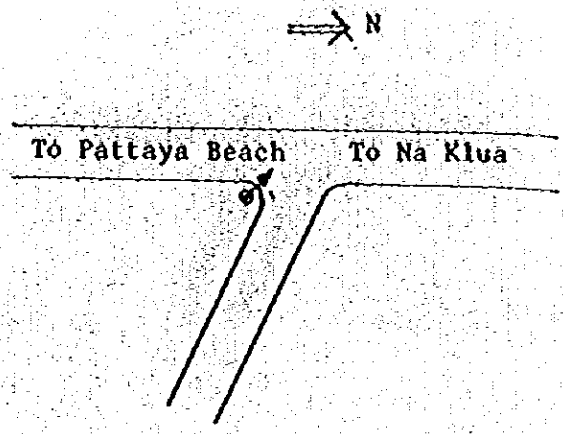

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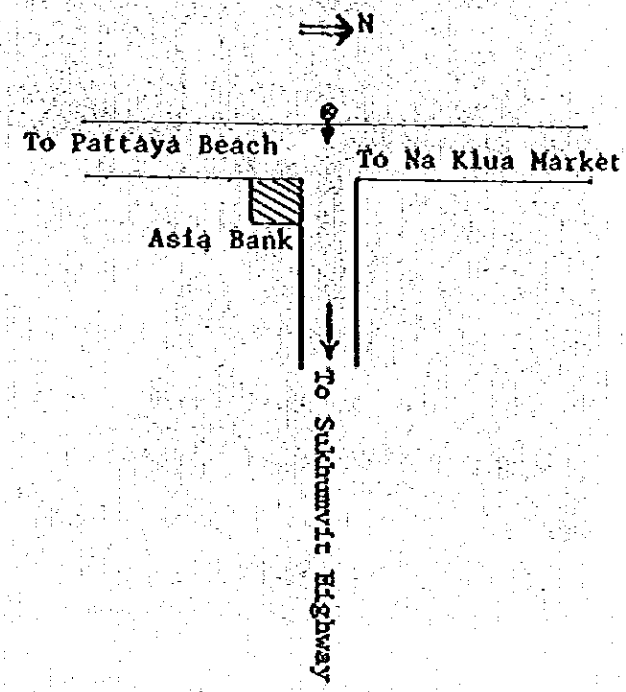

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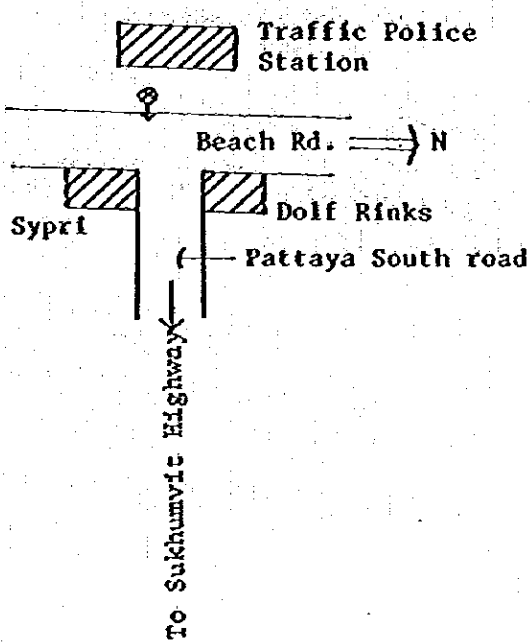

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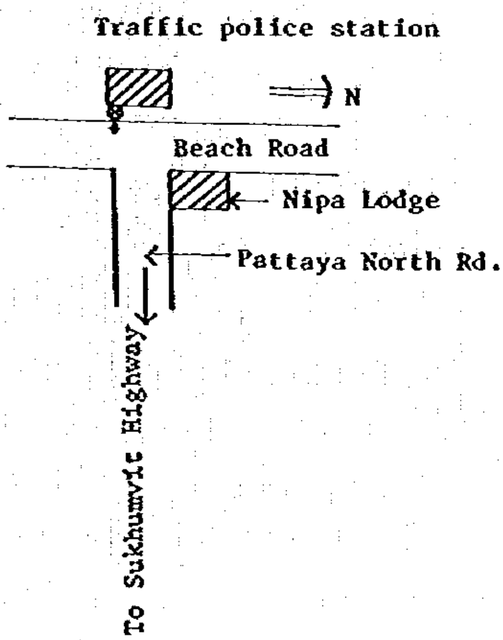

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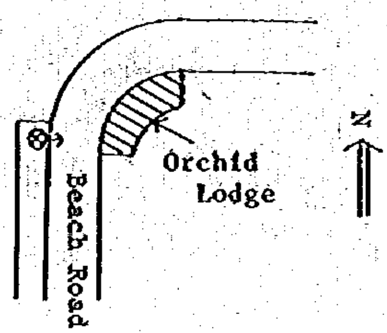

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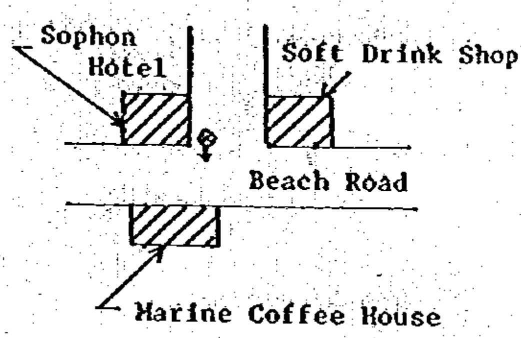

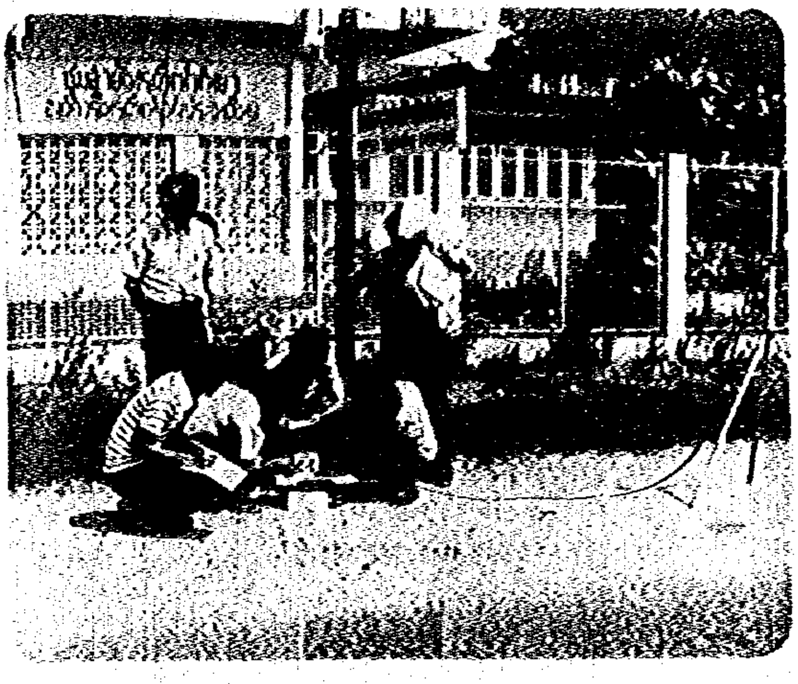

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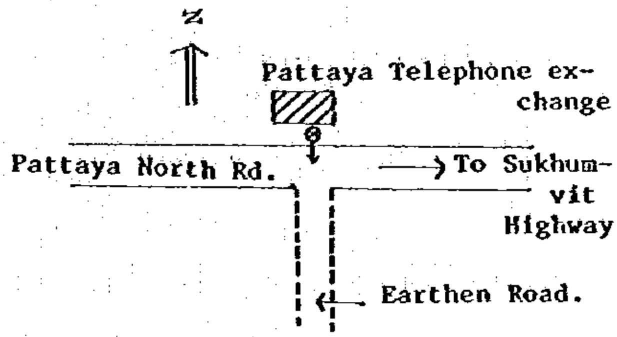
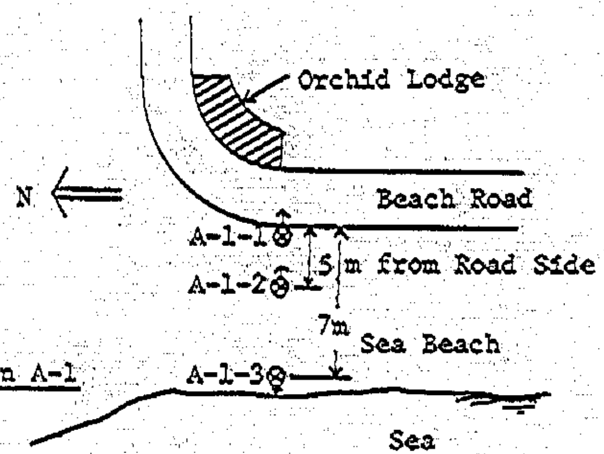

N
Pattaya Telephone ex-
change
Pattaya North Rd.
To Sukhum-
vit
Highway
Earthen Road.

Station A-1-1

Station A-1-2

Station A-1-3



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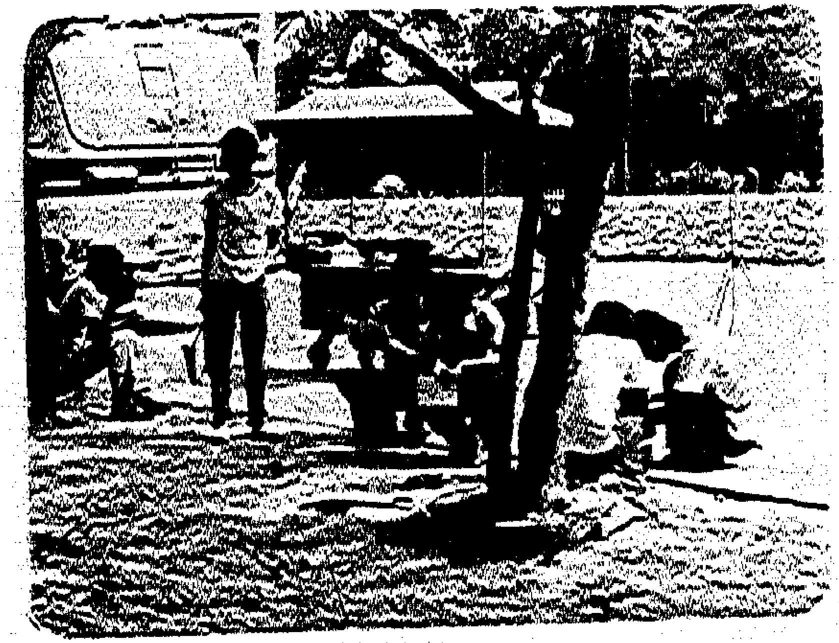

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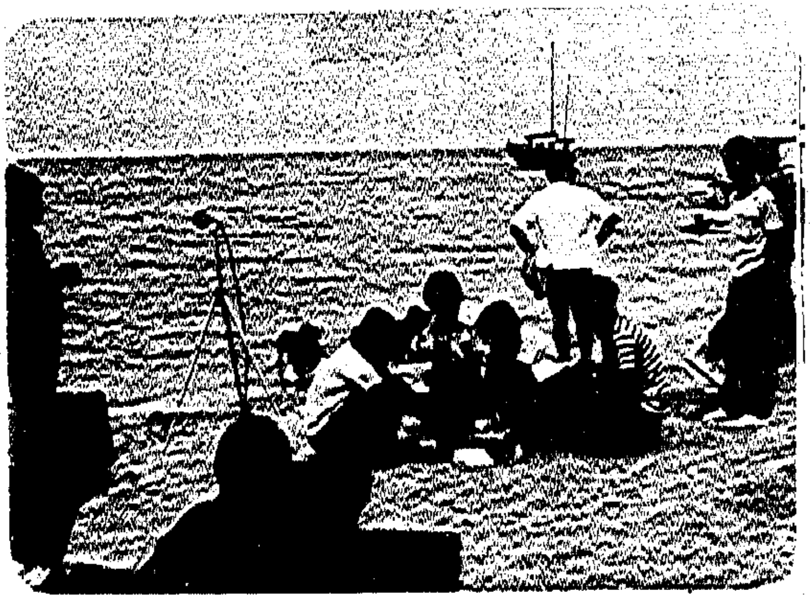
Station A-2-2



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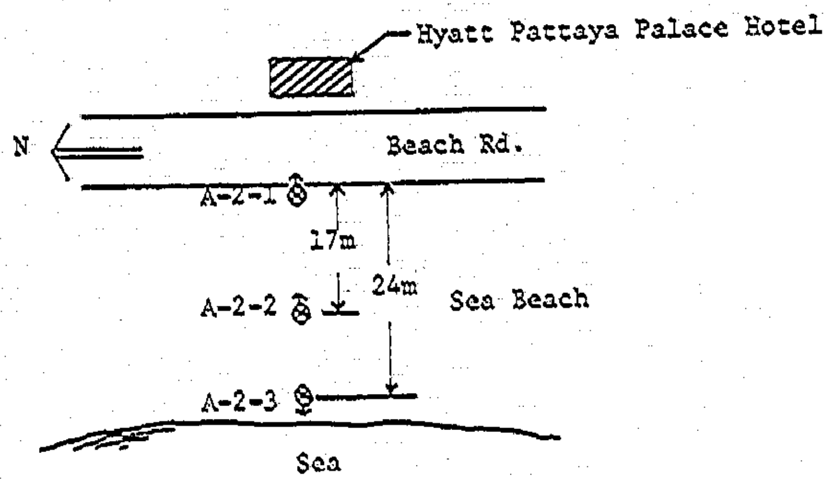

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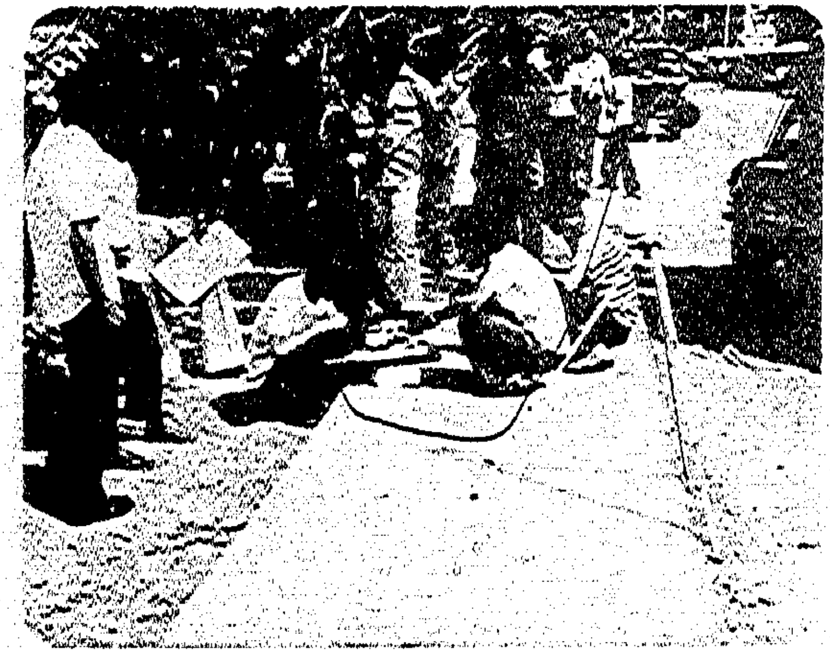

Station A-3-1

Station A-3-2

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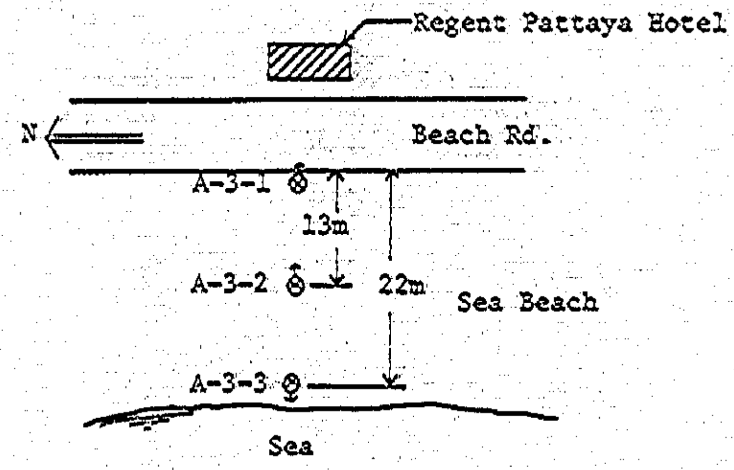


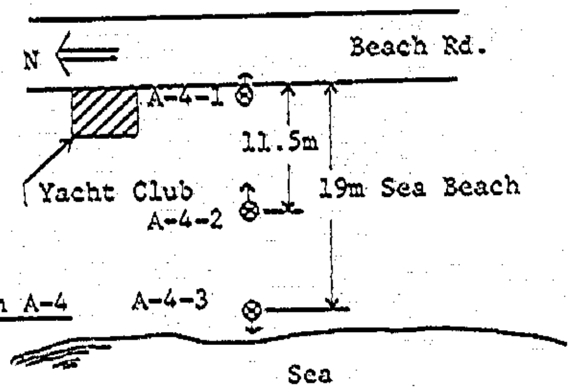
Station A-3

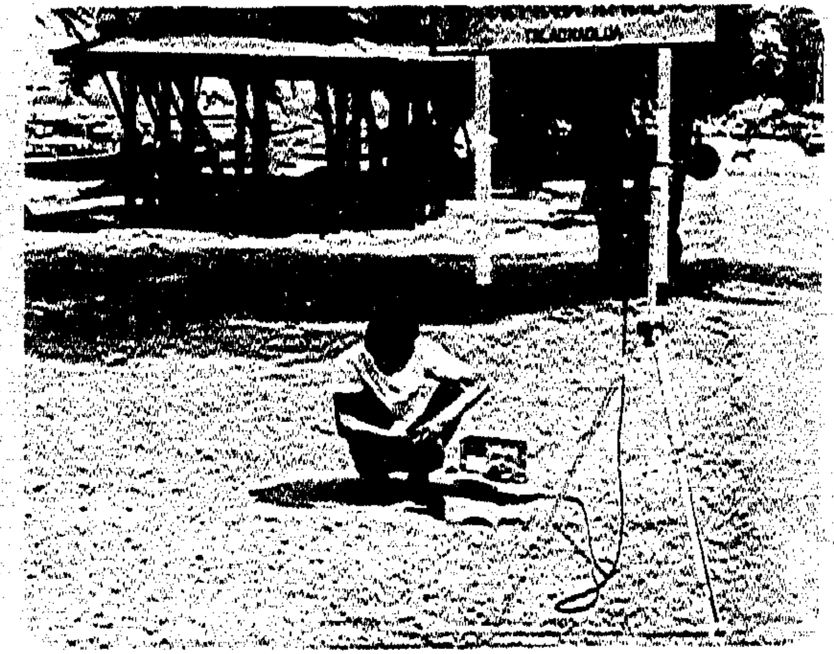
Station A-4-1

Station A-4-2

Station A-4-3

Station A-4





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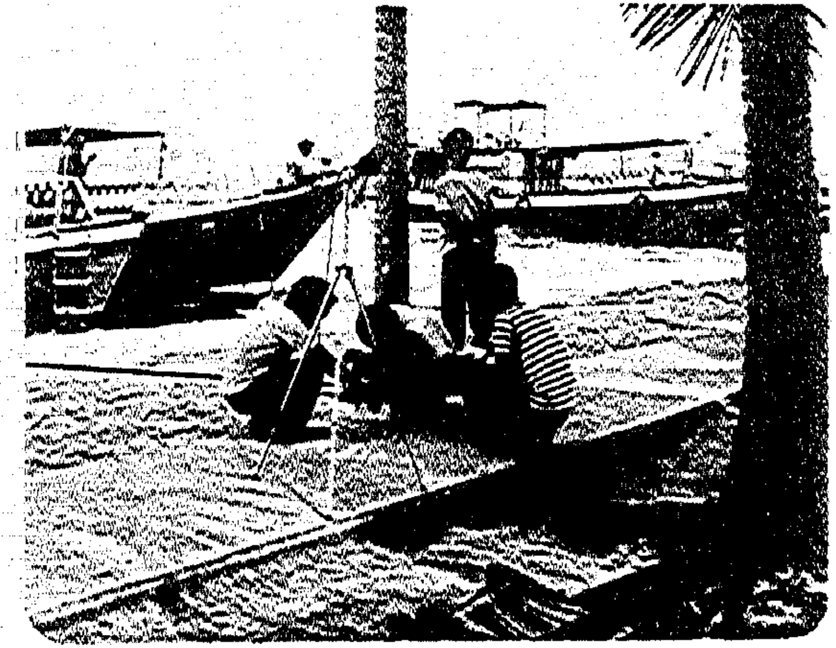

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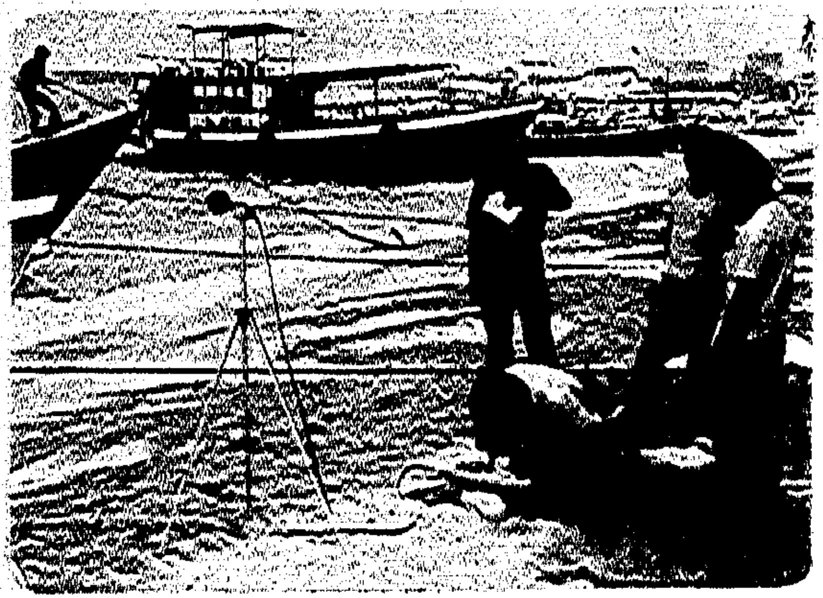

Station A-5-3

Station A-5