

CHAPTER IIMETHODS OF STUDY

The technical field survey and investigation for the sedimentation in the pier area of Royal Operation Fleet, Sattahip Naval Base, Chonburi were carried out within the period from July 1975 up to July 1976. The surveys were designed to provide all necessary data of the site to allow proper conclusion drawn on the sedimentation of the area concerned.

In view of the time period for this complete study it was planned to obtain the field data over the one-year span for the model studies foreseen. The emphases of these model studies were laid upon the hydrographical, meteorological and geological aspects.

Apart from the technical field surveys and investigation, laboratory analyses on sedimentary properties had been extensively carried out.

Quantitative approach to the problems was made whenever and wherever possible for both technical field survey phase and laboratory study in order to allow numerical evaluation at the final stage.

2.1 BEACH TOPOGRAPHIC SURVEY.

In order to observe the topographic changes of the beach with regard to their depositional and erosional processes that took place

over the period of one year (July 1975 - July 1976) a series of beach profile survey was planned and executed.

Due to the relatively uniform nature of the beach and nearshore zone of the area employed in the present study, it was therefore decided to space the beach profile of 200 metres apart. This allowed part of the beach of 2 kilometres distance (on both sides of the pier) covered by 12 profiles. Each profile line was located at right angle to the coastline and covered the zone of upwash, zone of breaking waves down to the low-water line. The reference stations for every profile were established permanently on the backshore in order to allow the subsequent surveys to be carried out under the same control. In addition, the elevation of each reference station of the beach profiles had been worked out by referring to the standard benchmark in the neighbourhood.

Standard theodolite survey was employed in the topographic investigation of all the beach profiles earlier established. These profiles are referred to in the text as A, B, C, D, and L respectively, (Fig.1.1.3). Staff reading for elevation along each profile was taken every 8-metre interval. The approximate length of the profiles was 60 metres, which therefore providing about 100 data points for every survey programme.

The topographic beach surveys were carried out 5 times over the one-year period mentioned earlier. It was planned in such a way that all seasonal variation could be covered. These 5 surveys were

executed as follows.

- a) 12th July, 1975 : the first survey;
- b) 24th October, 1975 : the second survey;
- c) 11th February, 1976 : The third survey;
- d) 14th May, 1976 : the forth survey; and
- e) 2th July, 1976 : the fifth survey.

Apart from the seasonal factors which had been taken into consideration for the time of surveying programme, maximum tidal-range period had also been considered. Thus each surveying programme was able to carry out down from the reference stations to the lowest tideline.

2.2 SAMPLING PROCEDURES.

Representative surface sediments on the beach were collected at all elevation reading points for every profile extending from the reference stations down to the lowest tideline. Samples were taken within the area of $30 \times 30 \text{ cm}^2$. and approximately 4 cm. deep. This allowed approximately 100 samples from 12 profiles covering 2-kilometres distance on the beach to be taken in each surveying programme.

The sampling procedure was carried out simultaneously with the beach topographic survey during the ebb tide period.

In addition, an attempt had been made to study the suspended sediment in the nearshore and offshore zones of the area studied. Four sampling stations were set up for this purpose and these would be referred to as station nos. 1, 2, 3 and 4 respectively (Fig.1.1.3). Station nos. 1 and 2 were established in the nearshore zone within the intertidal area on both sides of the pier. From these two stations the suspended sediments transported by longshore current and tides were observed. The other two sampling stations, nos. 3 and 4 were established in the offshore zone to observe the suspended sediments transported landward from the Bay.

The equipment employed for this purpose were constructed according to the basic single-stage suspended sampler, model US U-59, used by the United States Geological Survey for Water-Resources Investigation (Guy & Norman, 1970), (Fig.2.2.1).

Suspended sediments were sampled from 3 different depths, namely, near-surface, mid-depth, and near-bottom levels (Fig.2.2.2). The water and suspended sediments samples were collected from the equipment by the controlling mechanism of displacing the air in the 1-litre polyethylene bottle through the nozzle. Salinity determinations were carried out simultaneously within the sampling area using the refractometry method.

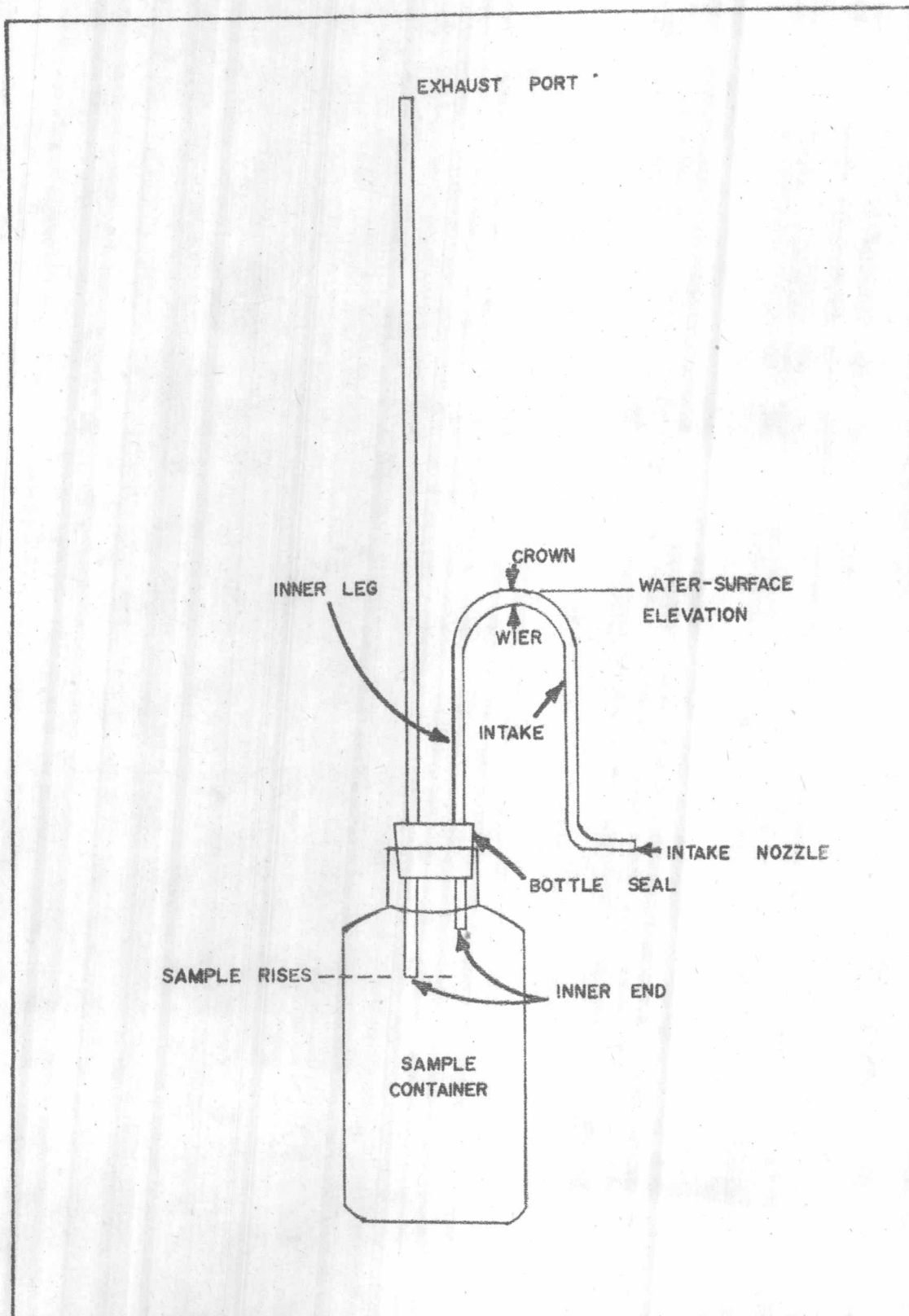


FIGURE 2.2.1. COMPONENTS AND DIMENSIONS OF THE BASIC SINGLE-STAGE SUSPENDED-SEDIMENT SAMPLER, ADAPTED FROM US U-59, GUY & NORMAN (1970, p.12).

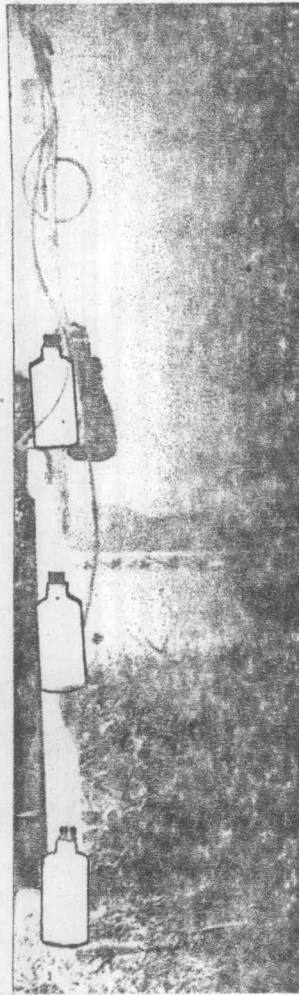


FIGURE 2.2.2. SUSPENDED SEDIMENTS SAMPLERS AT NEAR-SURFACE
MID-DEPTH AND NEAR-BOTTOM LEVELS.

2.3 METEOROLOGICAL AND HYDROGRAPHICAL MONITORING SYSTEM.

Meteorological data throughout the one-year period of technical field survey and investigation were obtained from Klong Phai Meteorological Station, approximately 10 kms. northeast of the area studied and from the U-Tapao Meteorological station. Continuous recording on the wind direction and speed, barometric pressure, air temperature, humidity and precipitation were made.

Hydrographical data of the Sattapip Bay, especially for tides were obtained from the gage station, adjacent to the pier, operated by the Hydrographic Department of the Royal Thai Navy. (The information regarding water temperature, tides, currents and waves were randomly recorded during the period of study.)

2.4 ANALYTICAL PROCEDURES.

The data obtained from the beach topographic surveys were summarized and presented in terms of a series of beach profiles. Altogether 12 series of beach profiles A to L covering one year period (July 1975 to July 1976) were presented graphically using the mean sea level as a reference elevation. The mean sea level was indicated in each series of beach profile. Seasonal topographic changes were reported as "cut" and "fill" for each successive surveying programme.

Representative surface sediments collected from the beach were megascopically and microscopically examined for general characteristics.

It was found that the grain size of almost all samples varied between medium-and fine-sand of Wentworth Grade Scale. Silt and clay fraction was not at all present. The sediments were washed several times with water to remove soluble salts and dried in the oven at 110°C for 24 hours. After that the sediments were splitted using the Tyler mechanical sample splitter in order to obtain the representative fraction of approximately 100-200 gm. for further analysis.

Grain size analysis of the sandy materials were subsequently carried out using the standard sieving method. A series of screens of various aperture, namely, mesh nos. 5, 10, 18, 35, 60, 120 and 230 (ASTM) were used. The screens were placed in the Ro-Tap mechanical shaker and shook for 20 minutes.

The weight of the total sediments before sieving and the weight of each fraction after sieving were determined. The sieve-lost of less than 1 % were considered valid for the analysis.

In addition, the suspended load of the sea-water-sediment samples collected during the technical field survey programmes were determined. The suspended sediments were separated from the sea-water using pressure-filterthrough the gooch crucible lined with asbestos. The suspended sediments and the gooch crucibles were decanted to remove the soluble salts and then dry in the oven at 110° C for 2 hours. After drying the gooch crucibles and suspended sediments were kept in the dessicator for 1 day and the weight of total suspended sediments was determined. The total volume of the

sea-water was determined for each sample collected in addition to the salinity measurement using the refractometry method. The final results of the suspended load were calculated on the basis of ppm. by weight of the total suspended sediments against the total weight of the sediment-seawater for each sample.

2.5 STATISTICAL DEDUCTION AND GRAPHIC REPRESENTATION.

The diameters of the grain size of the surface sediments in this study were reported in the phi unit (Krumbein, 1934). The relationships between diameter of sediments in millimetre and in phi unit was as follows :

$$\bar{\Phi} = -\log_2 E$$

where E is the grain diameter in millimetre.

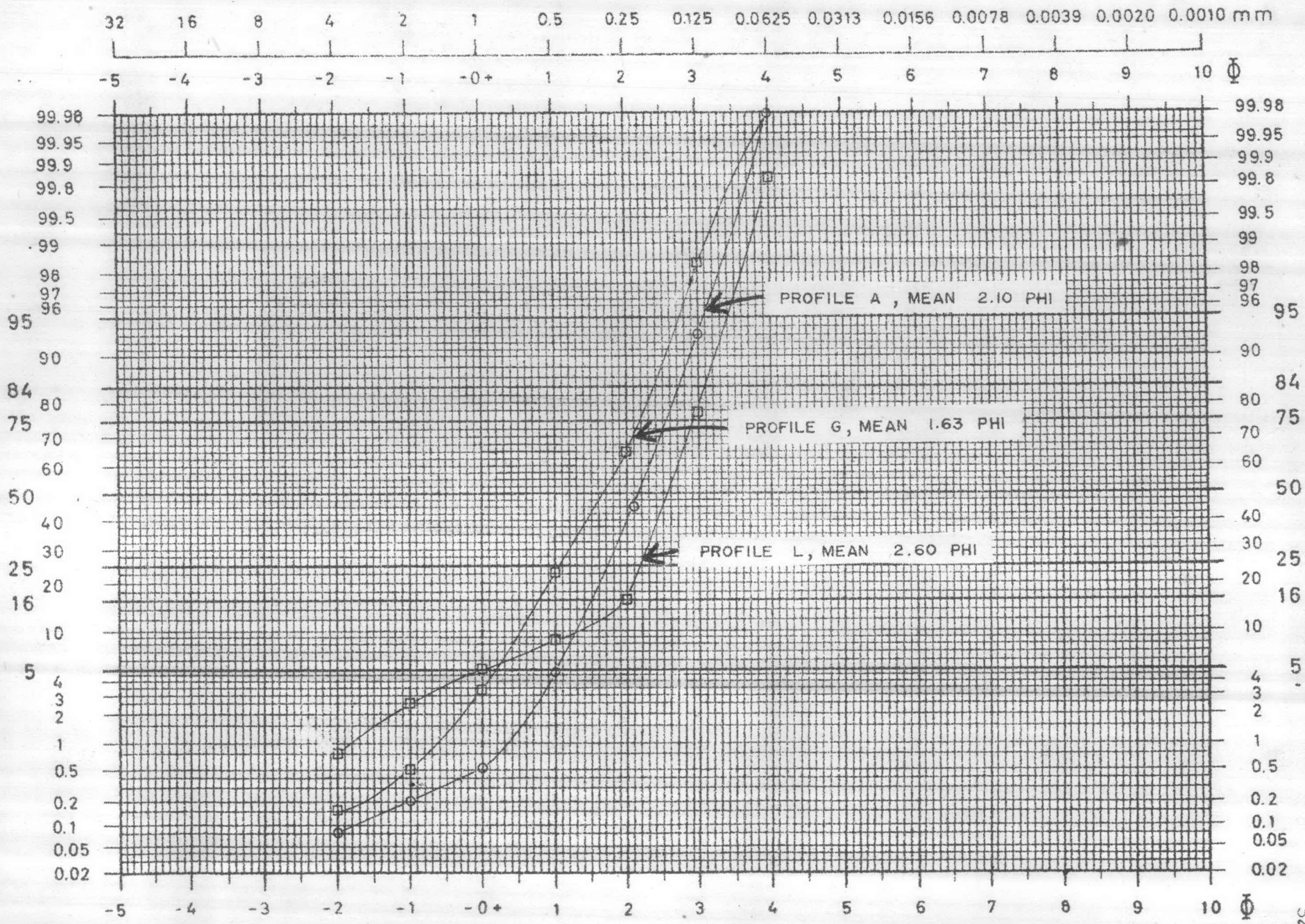
The analytical results of grain size by sieving were calculated on the weight percentages for each grade. The grain size distributions were represented by a cumulative curves on a probability paper (Fig.2.5). From the cumulative curve several graphic measures for average grain size, sorting, etc. had been considered. The mean grain size was determined using Folk and Ward (1957) method as follows :

$$M_z = \frac{\bar{\Phi}_{16} + \bar{\Phi}_{50} + \bar{\Phi}_{84}}{3}$$

where M_z is the mean size,

$\bar{\Phi}_{16}$, $\bar{\Phi}_{50}$ and $\bar{\Phi}_{84}$ are the 16th percentile, 50th percentile and 84th percentile respectively.

CUMULATIVE WEIGHT PERCENT



DIAMETER IN PHI UNITS

FIGURE 2-5. PROBABILITY PAPER

By this method, the mean size reflects the overall average size of a sediment. In addition the median grain size was also determined from the cumulative curve using the 50th percentile value.

As a measure of the sorting of a sediment or number of grades composing a grain population, the inclusive graphic standard deviation was used, (Folk and Ward, 1957).

Calculation was done on the following basis :

$$\delta = \frac{\Phi_{84} - \Phi_{16}}{4} + \frac{\Phi_{95} - \Phi_5}{6.6}$$

The verbal scale for sorting is shown in Table 2.5.

TABLE 2.5 Scale for sorting (Folk & Ward, 1957)

Sorting Terms	δ
very well sorted	< 0.35
well sorted	0.35 - 0.50
moderately well sorted	0.50 - 0.70
moderately sorted	0.70 - 1.00
poorly sorted	1.00 - 2.00
very poorly sorted	2.00 - 4.00
extremely poorly sorted	> 4.00

The analytical data regarding grain size distribution, notably, mean, median and sorting were tabulated in an Appendix B. These values were also graphically integrated into the appropriate beach profiles and maps in order to allow proper interpretation of the result to be done later on.

The analytical data for suspended load were also tabulated in an Appendices C and D.

The data on wind direction and wind speed were tabulated in the Appendix F-1 and Appendix G-2. Apart from this, the wind direction were also summarized and presented as wind rose diagrams, wind speed were summarized and presented as histograms.

Tidal data regarding maximum, minimum and mean sea levels were tabulated in an Appendix H-1 and graphically summarized.

The precipitation within the study area were tabulated in an Appendix G-3 and summarized as the histogram. Last, the temperature throughout the period of study were tabulated in an Appendix G-3.