

Design of a gravity corer for near shore sediment sampling

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For the purpose of geotechnical investigation a gravity corer has been designed and fabricated to obtain undisturbed sediment core samples from near shore waters. The corer was successfully operated at 75 stations up to water depth 30 m. Simplicity of design adopted ensures minimum time in assembling and dismantling the corer in the field.

One of the methods of obtaining soil samples suitable for shear strength testing without drilling is by surface coring¹⁻³, gravity corer being one of them. Sample disturbance is only a relative term and it is not practical to obtain perfectly undisturbed samples^{4,5}. Disturbance can arise from various sources, important ones being a) disturbance due to environment changes, b) physical and/or mechanical disturbance causing a change in clay structure or fabric. This physical disturbance may be caused by improper design of sampler, handling and transportation of sediment core etc. Present note describes a new (modified) design of a gravity corer suitable for shallow penetration sediment sampling.

Parameters⁶ considered in the design (Fig. 1) are—

area ratio $C_a = (D_w^2 - D_e^2)/(D_e^2) \times 100$, inside clearance ratio $C_i = (D_s - D_e)/(D_e) \times 100$, outside clearance ratio $C_o = (D_w - D_t)/(D_t) \times 100$, safe length-diameter ratio $C_s = L_s/D_s$; where L_s = length of the sediment liner (1.8 m), D_s = the inside diameter of the core liner (5.62 cm), D_e = the inside diameter of the core cutter (5.55 cm), D_w = the outside diameter of the core cutter (8.1 cm), D_t = the outside diameter of the core barrel (7.6 cm). Recommended limits⁶ for the above parameters and the values obtained in the present design are given in Table 1.

The materials used in the design of the core are given in Table 2. The existing corers had complicated design for fitting and consumed more time in installation. The core catcher could not last for more than a few operations. The catcher plates used to bend and allowed the sediment to escape. The core barrel had threads which used to get damaged frequently and reduce the available thickness of the barrel further resulting in bending of the pipe. As the weights were designed to sit on the core barrel directly, addition and/or removal of the weights necessitated removal of threaded corer head which was a time consuming and heavy work.

The core catcher which helps in retaining the sediment during retrieval of the corer, plays vital role in proper functioning of the corer. The fingers of the

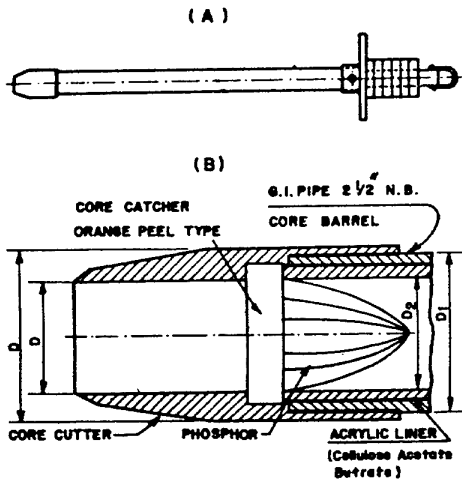


Fig. 1—Design of gravity corer (A) and bottom cross section of gravity corer (B)

Table 1—Parameters considered in designing the corer

Parameters	Recommended values	Evaluated values
Area ratio (C_a)	< 10	1.13
Inside clearance ratio (C_i)	0 to 1	1.0
Outside clearance ratio (C_o)	0 to 3	6.5
Safe length/diameter ratio (C_s)	< 20	32

Table 2—Material specification description

Items	Description	Specifications
1 Core barrel	G I pipe class A with 2.5" Nominal bore socket	weight 6.13 kg.m ⁻¹
2 Liner tube	Transparent cellulose acetate butrate (acrylic)	O.D. 63.5 mm I D 56.3 mm, wall thickness 3.5 mm, tolerance +0.3 mm
3 Weight stand	A—weighing 100 kg B—weighing 170 kg.	(See Fig. 3)
4 Weights	Cast iron round Lead weights with stand B	8 no. weighs-12 kg each 3 no. weighs-50 kg each
5 Core cutter	M S rod 3" diam. turned to specification, galvanised and threaded	(See Fig. 2)
6 Core catcher	Orange peel type	Phosphor bronze sheet 34SWG for fingers braced to gunmetal ring 68 mm O D

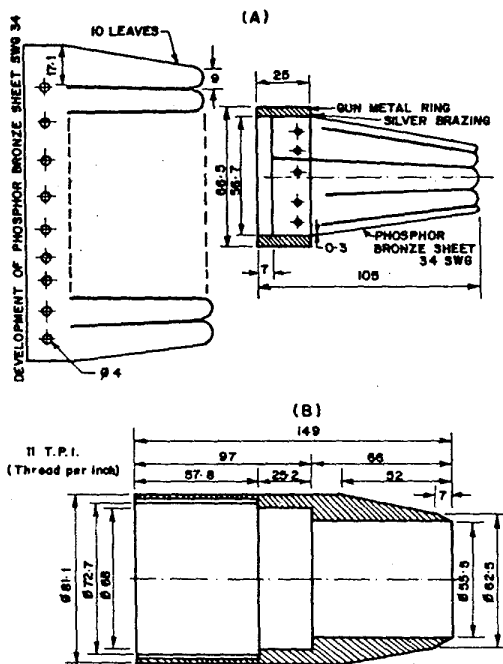


Fig. 2—(A) Core catcher: Material-Gun metal and Phosphor bronze. (B) Core cutter: Material—M S I.S. 226

core catcher should be so developed that when the pressure comes over it, the fingers get closed perfectly assuming the shape of a peeled off orange without having any space in between the fingers (Fig. 2A). For

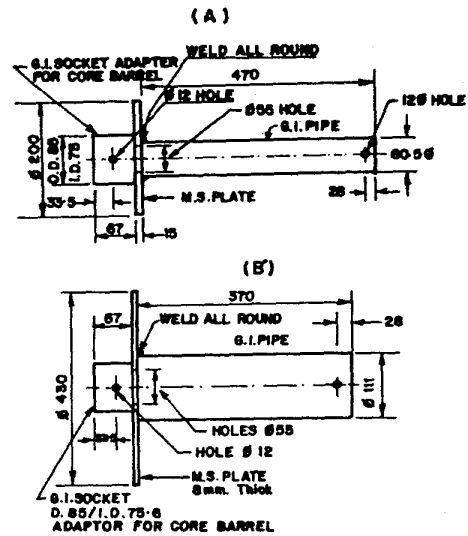


Fig. 3—Weight stands

this a height to diameter (of the base) ratio of 1.4 was found to be ideal for the core catcher and an optimum number of fingers to be 10. The material used for the fingers should have resilient characteristics for retaining the shape after each operation. Phosphor bronze metal was found to give the best results. Core barrel was threaded at the bottom to attach the cutter whereas a hole was provided at the upper end of the barrel to 'quick-fix' and/or removal (Fig. 1A) of the barrel with the weight stand.

Separate weight stands to accommodate different sizes/weights of weight-blocks were provided to suit different sea bed conditions (Fig. 3). Weights in the existing corer were stacked on the barrel itself which restricted addition/deletion of weights if needed. With the two sets of different weights ready on deck there was considerable flexibility to either increase or decrease the corer weights depending on the nature of soil and the penetration achieved.

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