VIBRO PILE SYSTEM IN THE PHILIPPINES

The Vibro system of forming concrete piles is new to the Philippines, although it has been firmly established for some years in many other parts of the world. Mr. H. D. S. Page of The Vibro Piling Company, Limited, concessionaires for Hongkong and South China, is now in Manila making surveys for the purpose of establishing the process in the Islands. Through a subsidiary company the Vibro process will be introduced to Philippine contractors; it is confidently believed that it will be found remarkably suitable for the many types of foundation work encountered in the Islands requiring the use of piles. The following description of the process was prepared for the Marsman Magazine by Mr. Page.

FIRM FOUNDATIONS

It will be generally admitted that the foundation of any building or structure is the most important section, and that which taxes the skill and ingenuity of the engineer to the utmost. No matter how fine and noble a building may be, if the foundations are unsound it very soon becomes an eyesore and possibly a danger. One of the greatest problems which a structural engineer has to handle is the designing of safe and economical foundations.

Buildings founded on rock, gravel or sand present very few difficulties but it is when we have to deal with poorer strata such as chalk and moist clay that real trouble arises, and it is a recognized fact that many sites of this nature have great value for building purposes due to their situation near harbours or rivers. They are generally alluvial deposits or reclamations.

It is almost a universal practice to carry heavy loads on bad ground by means of piled foundations, and these may be divided into three main types in general use at the present time (a) Timber piles (b) Pre-cast concrete piles and (c) Cast-in-situ concrete piles.

Timber piles have only one advantage in present day construction, they are relatively low priced in timber producing countries. This is really their only recommendation. To ensure preservation of the timber it is only safe to use timber piles in work where they will always be well below sub-soil water level. The successful driving of long timber piles requires very careful supervision as once the piles are in the ground it is impossible to inspect them. It is almost impossible to drive a long timber pile without damaging it to some extent; the tendency is for the timber to split under the hammer blows. If this occurs at the top or butt of the pile where it can be seen it is not so serious as the damaged portion of the pile can be sawn off with a consequent reduction in the load bearing capacity of the pile. The greatest danger is when the timber pile splits and breaks at the tip during driving operations. This is likely to occur if it strikes a boulder, three trunk or hard strata and as it is out of sight there is no practicable way of detecting or remedying the damage, with the result that there may be a number of defective piles in the foundation which are not capable of taking their designed share of the loading. This throws greater loads than they are designed to carry on the sound piles which may result in uneven settlement and cracking of the structure.

As reenforced concrete developed as a method of construction engineers realized the weakness of erecting buildings which were of imperishable materials on timber piles the life of which is an unknown quantity except under special conditions, and so pre-cast reinforced concrete piles were adopted for foundation work. As the name implies, pre-cast concrete piles are made up in moulds, and after the concrete is sufficiently seasoned they are driven in the required positions. This type of foundation is slow and expensive. Slow because the piles cannot be driven until the concrete is well seasoned. Expensive because the piles have to be designed to take the transporting and driving stresses irrespective of the loads they will ultimately have to carry when in position in the foundations of a building or structure. Pre-cast concrete piles almost invariably require

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more steel reenforcement to withstand the transporting and driving stresses than is necessary to carry the loads which they are designed to carry. This is very apparent in the case of a friction pile which theoretically requires no reenforcement whatsoever to carry its load but must of course be heavily reenforced to withstand the lifting and driving stresses.

In pile driving work it is not always possible to estimate with very great accuracy the length of piles required and unless in very special cases the lengths vary considerably, in pre-cast work this entails shortening or lengthening of the piles, the latter is a very slow process as the piles cannot be driven on until the fresh concrete has had sufficient time to set.

As with timber piles, there is always great danger of damaging pre-cast concrete piles during driving operations. When this damage occurs above ground level it can always be repaired at cost but the likelihood of damage below ground level where it cannot be detected and repaired is always present. When this occurs it causes unequal loading of the piles which in time causes unequal settlement of the structure and cracking.

It has long been recognized that if concrete could be deposited in cavities formed in the ground by temporarily driven tubes and the possibility of the encroachment or admixture of the surrounding earth could be excluded, a particularly simple and effective means of forming foundations could be produced. Experience has shown that to prevent such encroachment it is necessary in depositing the concrete to employ at the

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SECTION SHOWING TUBE IN UPWARD MOVEMENT. DEPOSITING A LAYER OF CONCRETE IN BUILDING UP THE PILE.

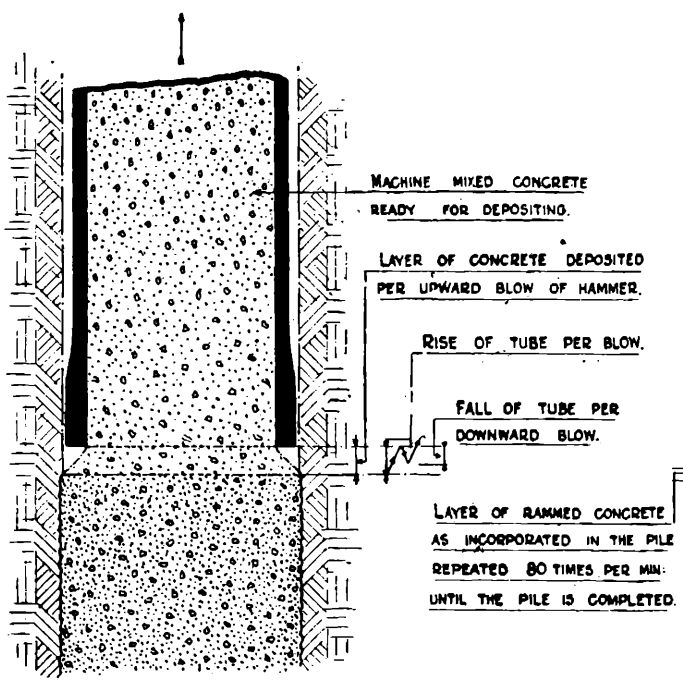

FIG. 4

SECTION SHOWING TUBE IN DOWNWARD MOVEMENT RAMMING OUT THE DEPOSITED LAYER & CONSOLIDATING THE PILE COLUMN.

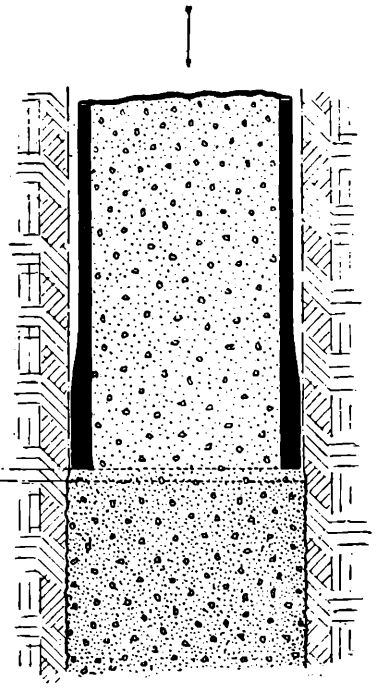

FIG. 5

his way of thinking Harvard by necessity must remain young and changeless, always filled with young men, with young ideas and aspirations, with young brains, with young gaiety, and he wanted to saturate himself once more with the feeling of the untrammeled vigor of youth that he believed to be Harvard's essence. And so he had come.

I saw him at the Tercentenary. At the meeting of the Associated Harvard Clubs he carried the banner of the Harvard Club of Manila. He sat out all of the rainy morning of September 18. He dined with his class. It was hard work for him to do all this, yet, when later I reproached him for having done more than was good for his health, he reminded me that the occasion was Harvard's Tercentenary and that he was a Harvard alumnus. There seemed nothing more to be said.

He left this country shortly afterwards, as quietly and unpretentiously as he came. He went to Barbados in search of a gentle climate. His death there has just been reported. I am sure that until the end he continued to think happily of Harvard, of Harvard's future, of his classmates, of the Yard, of the Tercentenary, of Harvard's vigor, of all the beacons of Harvard that on occasion had helped him to find his bearings. He was a valuable graduate. For he had Harvard Spirit.

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outlet of the tube a pressure exceeding the earth pressure acting on any part of the fresh concrete, as the tube has to be withdrawn when the concrete is deposited.

The cast-in-situ system of pile driving supplies this means most effectively and the VIBRO system has been developed to include almost all types of piled foundation work in the most efficient manner. In the VIBRO system a plain steel tube with a cast iron shoe is driven into the ground for the required depth or until the necessary set is obtained. Suitable reenforcement if required is then placed in position in the tube and the concrete poured. The tube is then extracted by means of a series of upward and downward blows of the steam hammer which while consolidating the concrete of the pile forces it into intimate contact with the surrounding strata and this close contact between the rough surface of the pile and the ground develops the skin friction of the pile to the greatest possible extent.

Cast-in-situ concrete piles have overcome almost all the difficulties and dangers of timber or pre-cast pile driving. There is no handling of the piles, such as transporting them to the site, and work can be started immediately a contract is arranged; no waiting for timber piles to arrive from the suppliers or concrete to set. Cast-in-situ piles can be driven to any length and can be cut off at ground level or at any level below ground level. They can be reenforced or be without reenforcement according to the work they are required for. There is no waste of materials and what is very important in all pile driving operations there is no danger of damaging the pile during driving as all driving stresses are taken by the steel VIBRO tube. The VIBRO cast-in-situ system of making concrete piles is the most up to date development in pile driving and can be employed efficiently in foundations of almost any type no matter how poor the ground.

PHILIPPINE SMELTING COMPANY *(Continued from page 13)*

does not contain over 40% Copper. In which case a ratio of 8 to 1 is obtained from a concentrate carrying 5% Copper.

In the blast furnace section adequate dust settling chambers with a 60-foot steel stack 54" in diameter is provided to take care of the fumes.

The sintering machines are also equipped with a dust collecting chamber, but has a steel stack 100 feet high to carry off the sulphur fumes.

At present, as a by-product, the smelter is making a small amount of lead bullion high in gold and silver. This is shipped to the lead smelter at Selby, California.