INTRODUCTION TO APPLICATION OF FLOATING CONCRETE

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Abstract: This Project deals with the development of Floating type of concrete by using aggregate lessweighted aggregate and use of pumice stone powder as partial replacement and metakaolin powder to increase strength. There are many types of less weighted concrete which can be produced either by using less weighted aggregate or by using an admixtures. Pumice stone is a less weighted aggregate of less weighted. In this we do not use the traditional aggregate and replace it by the pumice stone. Pumice is the specimen of rocks having mass density approximately 600-700Kg/m3. Pumice has an average porosity of 65-85% and initially floats on water.

In this study, comparison has been made between P.C.C and less weighted concrete having different proportion of Aggregate size and fix quantity of metakaolin content by the weight of cement has been taken into account. It helps to increase volume of concrete and hence reduce the specific gravity.

1. Introduction:

Pumice stone is a very popular raw material as a lightweight rock, due to having desired properties for making the different products based on its physical, chemical and mechanical properties. For this reason, it has a large using area in civil industry as a construction material and it has been used for centuries in the world. Pumice aggregate can be found in many places around the world where volcanoes have been present. Pumice aggregates combined with Portland cement and water produces a lightweight thermal and sound insulating, fire-resistant lightweight concrete for roof decks, lightweight floor fills, insulating structural floor decks, curtain wall system, either prefabricated or in-situ, pumice aggregate masonry blocks and a variety of other permanent insulating applications.

It is a common practice to classify lightweight concrete into three categories. These are insulating concrete, intermediate concrete and constructional concrete. This classification is based on unit weights, and integrates between types and uses of aggregates. All the research studies, carried out to analyze the performance of the lightweight pumice concrete for stability and durability conditions, have showed that these concrete types could be achieved with pumice aggregates. It has been stated that, despite the different properties of porous aggregates, lightweight concretes have some common regularities and properties. Lightweight aggregates generally have an enormous advantage in comparison to natural aggregates due to their structural pores and their consistent properties.

Heat in building through roof is the major cause of unconditioned building or the major load for the air conditioned building. So we carried out the specific studies by comparing the two design methodologies in the same format in assigning the factors that would accept all the properties and statement. The designed mix and their following characteristics at different mix proportions are studied. Vermiculite is a inert material so to resist the heat penetration.

1.1 Properties of material properties:

(i) Cement:

The cement used was ordinary Portland cement of 53- grade conforming to IS 12269. The cement should be fresh and of uniform consistency. Where there is evidence of lumps or any foreign matter in the material, it should not be used. The cement should be stored under dry conditions and for as short duration as possible.

(ii) Aggregates:

- **Fine aggregates:**

Sand shall be obtained from a reliable supplier and shall comply with ASTM standard C- 33 for fine aggregates. It should be clean, hard, strong, and free of organic impurities and deleterious substance. It should inert with respect to other materials used and of suitable type with regard to strength, density, shrinkage and durability of mortar made with it Grading of the sand is to be such that a mortar of specified proportions is produced with a uniform distribution of the aggregate, which will have a high density and good workability and which will work into position without segregation and without use of high water content. The fineness of the sand should be such that 100% of it passes standard sieve No.8.

The fine aggregate which is the inert material occupying 60 to 75 percent of the volume of mortar must get hard strong nonporous and chemically inert. Fine aggregates conforming to grading zone II with particles greater than 2.36 mm and smaller than 150 mm removed are suitable

- **Normal weight coarse aggregate:**

Machine crushed hard granite chips of 67% passing through 20 mm sieve and retained on 12 mm sieve and 33% passing through 12 mm and retained on 10 mm sieve was used a coarse aggregate throughout the work.

- **Light weight coarse aggregate pumice stone:**

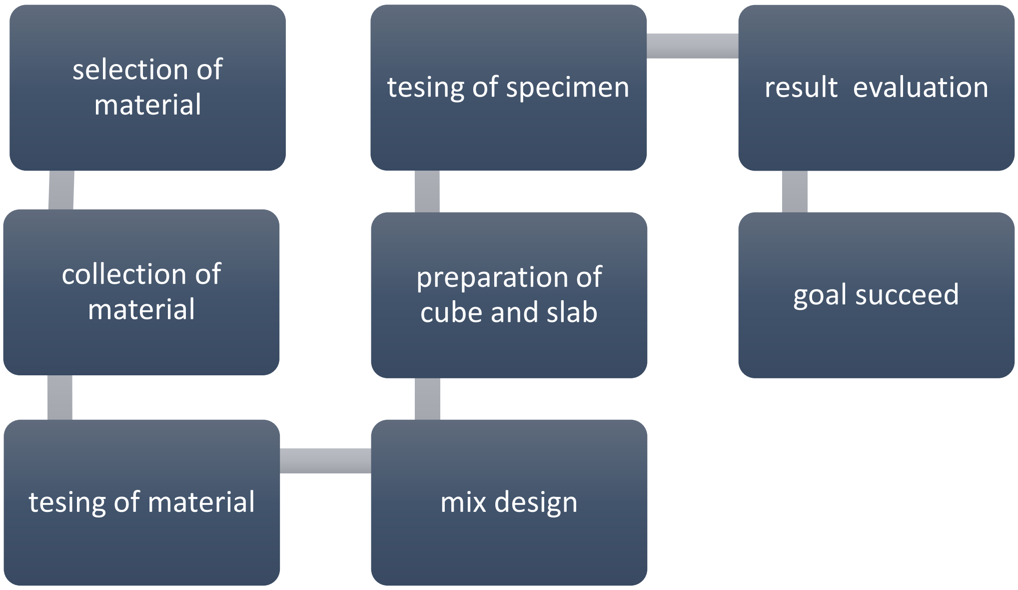
Figure 1: Pumice stone

(iii) **Water**: Water used in the mixing is to be fresh and free from any organic and harmful solutions which will lead to deterioration in the properties of the mortar. Salt water is not to be used. Potable water is fit for use mixing water as well as for curing of cubes.

(iv) **Admixtures:**

Special considerations shall be given to the addition of materials to the mortar for special purposes. Approval may be given by the consulting engineer, when the materials is to be added directly or indirectly to reduce the water to the cement ratio or according to approve standards, if any. In this work, the admixtures used are namely metakaolin powder and pumice powder.

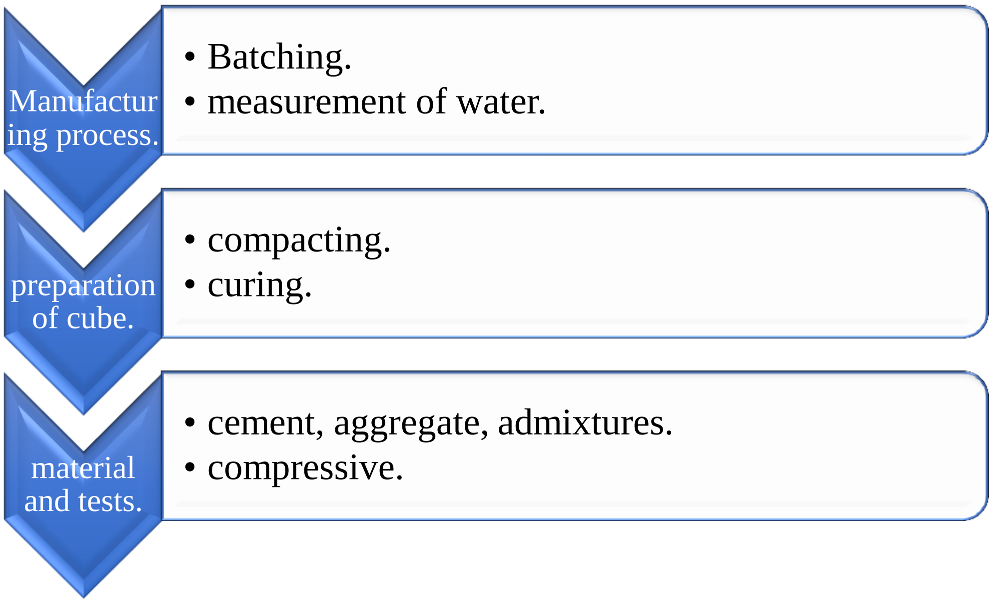
2 Methodology:



Flow chart 1: Process flow diagram of work

The design requirements can be developed from the following parameters:

- The seabed condition (soft - sand - rock).
- The type of mooring system (slide pile - mooring cables) is according to the water depth.
- The environmental loads determine the structure type (continuous - separate pontoon bridge, platform), the pontoon shape, and the connection type.
- The traffic discharge determines the structure width.
- The marine traffic determines the size of the navigational opening (if required).
- The tidal range determines the access structure length and shape.



Flow chart 2: Casting process

2.1 Manufacturing:

It is produced by including large quantities of air in the aggregate, matrix or in between the aggregate particles or by a combination of these processes. Lightweight aggregates require wetting prior to use to achieve a high degree of saturation. If the aggregates aren't fully saturated they have a tendency to float towards the surface of the mix after it has been placed.

Due to the higher moisture content of light-weight concrete, drying times are typically longer than regular concrete. Typically, a 0.5 water to cement ratio slurry is used as a base mixture for lightweight concrete. The water cement ratio varies according to specific project requirements.

Note that lightweight concrete obtains its natural fluidity from the air bubble structure, not from excess water content.

Process of manufacture of concrete: [7]

(i)Batching:

The measurement of materials for making concrete is known as Batching.

(ii)Weigh Batching:

Weigh is the correct method of measuring the material. Use of weight system is batching, facilitates accuracy, flexibility and simplicity

(iii) Measurement of water:

When weigh batching is adopted, the measurement of water must be done accurately. Addition of water by graduated bucket in terms of liters will not be accurate enough for the reason of spillage of water etc.

2.2 Preparation of concrete cubes:

Metal moulds, preferably steel or cast iron, strong enough to prevent distortion is required. They are made in such a manner as to facility the removal of the moulded. Specimen without damage and are so maintained that, when it is assembled, the dimensions and internal faces are required to be accurate with in the following limits.

(i)Compacting:

The testing cube specimens are made as soon as possible after mixing and in such a manner to produce full compaction of the concrete with neither segregation nor excessive bleeding.

(ii)Curing:

The test specimens are stored in a place free from vibration in moist air of at least 90% relative humidity and at a temperature of 27 ºC for 24 hours from the time of addition of water to the dry ingredients. After this period, the specimens are marked and removed from the moulds.

Photo 1: Crushed aggregate

Photo 2: Pumice stone cube

Material and test:

- Cement- Portland type 2 cement.
- Aggregate- Pumice stone, Vermiculite.
- Other- Pumice powder.
- Admixture- Metakaoline powder.
- Compaction- Table vibrator.
- Test- Compression test.
- Cube size- 150mm×150mm×150mm.
- Mixing- Mixer mixing.

- Test for cement- Standard consistency test, fineness test, Soundness.
- **Testing:**

- **Compressive Strength:**

After 28 days curing, cubical specimens are placed on compression testing machine having a maximum capacity of 2000 KN and a constant rate of loading of 40 kg/m2 per minute is applied on test specimen. Ultimate load at which the cubical specimen fails is noted down from dial gauge reading. This ultimate load divided by the area of specimen gives the compressive strength of each cube.

(v) Metakaolin powder:

Photo 3: Metakaolin powder

In construction Industry, consumption of cement is increasing day by day as well as cost is also increasing so to reduce the consumption of cement, partial replacement with Metakaolin and Marble powder was done in this study. Metakaolin is a calcinied clay and easily available in Gujarat, Maharashtra & Bombay etc. It is a Dehydroxylated form of the clay mineral Kaolinite. Stone having higher percentage of Kaolinite are known as china clay or kaolin was traditionally used in the manufacture of porcelain i.e. ceramic material. The particle size of Metakaolin is smaller than cement particles [1].

Considered to have twice the reactivity of most other pozzolans, metakaolin is a valuable admixture for concrete/cement applications. Replacing Portland cement with 8–20% (by weight) metakaolin produces a concrete mix, which exhibits favorable engineering properties, including: the filler effect, the acceleration of OPC hydration, and the pozzolanic reaction. The filler effect is immediate, while the effect of pozzolanic reaction occurs between 3 and 14 days.

3. CONCLUSIONS

- In this study, the influences of aggregate types and the amount on the compressive strength of concrete were investigated. Using different aggregate proportions (pumice) and five different lightweight concrete mixtures were produced with a satisfied strength.

- The result of the investigation showed that aggregate size and proportion influenced the unit weight and compressive strength of concrete. Moreover, the result showed that it is possible to produce a Floating and satisfied strength concrete by using pumice as aggregate.

- It was also seen that, using light weight aggregate in the concrete mixture can reduce the dead load but decreases the concrete strength. However, for the sample 7 it is Reverse, because this proportion gives compressive strength 4 N/mm2, which is good for the light weight concrete. From cost analysis it is proved that the cost of our project is less than that of brick masonry.

- The study showed that using pumice aggregate as a commixture enable to produce different strength grade lightweight concrete with different unit weight. These concrete does not satisfy the strength requirements for load bearing structural elements. In this study only strength and unit weight were considered, other properties including carbonation and drying shrinkage, thermal conductivity and sound insulation properties can be investigated as a further study.