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Study on Pervious Block to Control Stagnation of Rainwater

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Abstract*: River sand is one of the constituents of concrete which acts as a filler material between the voids present in between the coarse aggregate. A present rate of construction is unimaginable without the use of fine aggregates. Unfortunately the unchecked excavation and use of river sand as a fine aggregate has led to the scarcity of this component. This problem is especially is severe in the state of Tamil Nadu where almost every major river bed has been stripped away of the fine river sand. This highlights the importance of judicious use of this precious material and also innovation and experimentation of replacement of fine aggregate as a component wherever necessary so as to preserve the river sand. Our project aims to use M-Sand in concrete and further use this type of concrete in highway to aid the speedy drainage of water from the pavement which will ultimately lead to longer lifespan of the road network.

***Keywords*: Porous Concrete, M-Sand, Concrete, Water, Aggregate**

I. INTRODUCTION

The basic constituents of concrete are cement, water and aggregate. Other constituents such as admixtures, pigments, fibres, polymers and reinforcement, can be incorporated to modify the properties of the plastic or hardened concrete. The properties of the plastic and hardened concrete are determined by the combination of constituents used. Concrete Mix Design is the name for the procedure for choosing a particular combination of constit Cement when mixed with water will form a paste that hardens into a strong rigid material. It is this paste that fills the voids between aggregate particles and binds them all together to form concrete. This hardening process (which occurs by a chemical reaction with water) is known as hydration. When water is added to cement, hydration products grow outwards around a cement particle as it takes up water. This zone of expanding hydration products will intersect and bind with those from other cement particles and firmly encase aggregate particles thus ‘binding’ the concrete together. Cement will hydrate under water. If there is an inadequate amount of water available hydration will stop and the concrete may be of poor quality. The process of keeping water in concrete to facilitate full hydration is known as curing.Until recently, the term ´cement´ was an abbreviation for Portland Cement. However, its meaning has now expanded to cover a greatly increased product range, in which Portland Cement is combined with other constituents such as fly ash, also known as pulverised fuel ash (pfa) and ground granulated blast furnace slag (GGBS). Pozzolans are natural or industrially produced materials that react with the lime released from the hydration of Portland Cement. Natural pozzollans occur in mainland Europe and other parts of the world and have been used in concrete since Roman times. Industrial pozzolans are normally the by-products of other processes and materials of this type include pulverised fuel ash, ground, granulated blast furnace slag, microsilica and metakaolin. They are widely used in the United Kingdom and elsewhere to improve the properties of concrete, usually by eliminating free lime and converting it into stable cementitious products.

II. PERVIOUS CONCRETE

Pervious concrete uses the same materials as conventional concrete, with the exceptions that the fine aggregate typically is eliminated entirely, and the size distribution (grading) of the coarse aggregate is kept narrow, allowing for relatively little particle packing. This provides the useful hardened properties, but also results in a mix that requires different considerations in mixing, placing, compaction, and curing. Proportioning pervious concrete mixtures is different compared to procedures used for conventional concrete and the mixture proportions are somewhat less forgiving than conventional concrete mixtures—tight controls on batching of all of the ingredients are necessary to provide the desired results. When developing pervious concrete mixtures, the goal is to obtain a target or design void content that will allow for the percolation of water. The void content of a pervious concrete mixture will depend on the characteristics of the ingredients, how they are proportioned and how the mixture is consolidated. Pervious concrete is typically designed for a void content in the range of 15% to 30%. Generally as the void content decreases, the strength increases and permeability decreases. For pervious concrete mixtures it is even more important to verify through trial batches that the mixture achieves the characteristics assumed or targeted when developing mixture proportions. Frequently one finds that even though the design void content is 20%, when the pervious concrete mixture is proportioned, the experimentally measured void content is considerably different. This depends on the workability of the mixture and amount of consolidation.

III. MATERIALS

Ordinary Portland cement (53 Grade) was used for casting all the specimens. The following experiments were conducted to find the properties of cement as per 18-4031.M-sand and coarse aggregate of sixe 6.5mm is used.

IV. TESTING

A. Standard Consistency Test

The standard consistency of a cement paste is defined as that consistency which will permit a Vicat plunger having 10 mm diameter and 50 mm length to penetrate to a depth of 5-7 mm from the bottom of the mould shown in Fig. 4.1. The apparatus is called VicatAppartus. This apparatus is used to find out the percentage of water required to produce a cement paste of standard consistency. The standard consistency of the cement paste is some time called normal consistency . Take about 400gms of cement and prepare a paste with a weighed quantity of water for the first trial. The paste must be prepared in a standard manner and filled into the Vicat mould within 3-5 minutes. After completely filling the mould , shake the mould to expel air. quickly released allowing it to sink into the paste by its own weight. Take the reading by noting the depth of penetration of the plunger. Similarly,conduct trials with higher and higher water/cement ratio, till such time the plunger penetrates for a depth of 5-7 mm from the bottom of the mould. That particular percentage of water which allows the plunger to penetrate only to a depth of 5-7 mm from the bottom is known as the percentage of water required to produce a cement paste of standard consistency.

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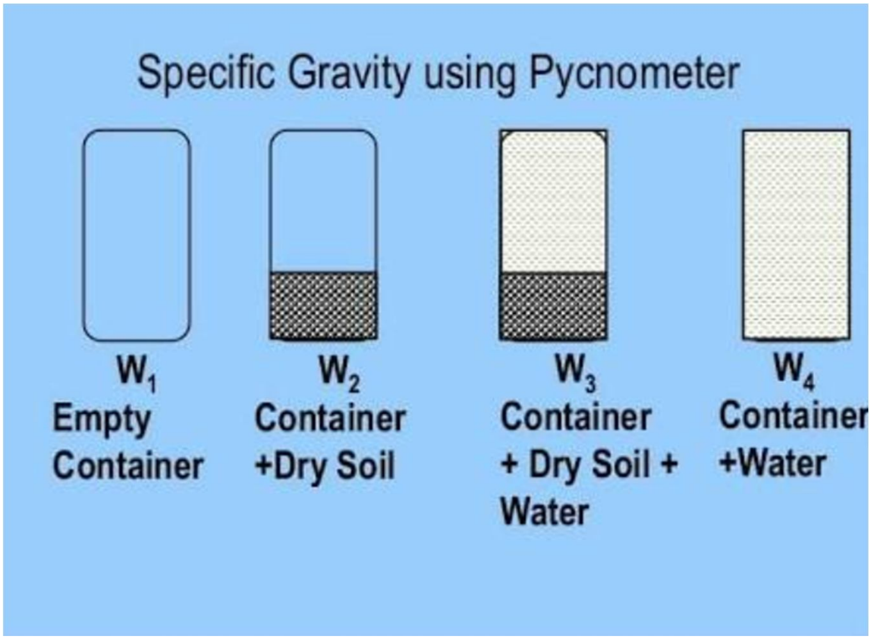
B. Specific Gravity Test

The following procedure is adopted to find the specific gravity of fine aggregate. First weigh clean and dry bottle (W1). Place a sample of fine aggregate up to half of the flask and weigh the bottle (w) , then add water to fine aggregate in bottle till is about half full. Mix thoroughly with glass rod to remove entrapped air ,continue stirring and add water till the bottle is full, and dry the outside and weigh (W3). Empty the bottle,clean it and refill with water. Dry the outside and weigh (W4).



C. Compression Strength Test

Comperssion testing is done to check the maximum strength the block can withstand here the pervious block can withstand 500KN which is enough to withstand a fully loaded truck on it.

VI. FUTURE SCOPE

This technology can be further extended to be used in places where rainwater harvested can be channeled into larger water storage systems which can be further used to replenish the ground water table. The methods enlightened can also be used in highway systems all over the world to reduce the water stagnation and hence reduce the chances of water stripping away the bituminous layer on the paved surfaces of the road. This would be a two pronged attack on saving water and also the water avoiding being wasted in the stagnation along the highway network.

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