No-Fine Concrete as a Road Pavement

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Abstract- *No-Fine concrete pavements are use mostly in rural area. This concept of pervious concrete is relatively new for rural road pavement. Pervious concrete has ability to flow water through it and this property help to recharge the ground water. Pervious concrete pavement is unique and effective technique to meet the future demand. Strength of the pervious concrete is low as compared to conventional concrete it is all due to high porosity. No-fines concrete is mostly used in non-pavements applications, limited use in pavements applications. This assignment purpose is to assess the suitability for no-fines concrete to be used for the construction of road pavement*

Keywords-*Pervious concrete, Strom water, porosity,*

I. INTRODUCTION

No-Fines concrete is a mixture of cement, water and a particular sized coarse aggregate combined to form a porous structural material. It has a high volume of voids, which is the factor responsible for the lower strength and its lightweight nature. No-fines concrete is also called porous concrete, zero-fines concrete and pervious concrete. Pervious concrete has the ability to allow water to permeate the material which reduces the environmental problems associated with asphalt and conventional concrete pavements. Porous concrete consists of a mixture of coarse single sized aggregate and a thin layer of cement paste about 1.3 mm thick. The most common application of no-fines concrete is in low traffic volume areas, such as: residential roads, driveways, parking lots and footpath. The force exerted by no-fines concrete on the foundations is approximately one third of that formed by the same structure constructed from conventional concrete. This difference may be of importance when structure is on a low bearing capacity ground. No-fines concrete is mostly used in non-pavements applications, limited use in pavements applications. This assignment purpose is to assess the suitability for no-fines concrete to be used for the construction of road pavements. This will include investigation of current literature on the topic and conducting standard concrete testing on no-fines concrete and conventional concrete to determine and evaluate their properties. With the help of tested data a conclusion is made on the usefulness of no-fines concrete pavements and it may be determined that further testing is required.

II. MATERIALS USED IN NO-FINE(PERVIOUS) CONCRETE

III. NEED OF PERVIOUS CONCRETE

No-fines concrete is mostly used in non-pavements applications and a limited use in pavements applications. This assignment purpose is to assess the suitability for no-fines concrete to be used for the construction of road pavements. This will include investigation of current literature on the topic and conducting standard concrete testing on no-fines concrete and conventional concrete to determine and evaluate their properties. With the help of tested data a conclusion is made on the usefulness of no-fines concrete pavements. The major usage of no-fines concrete is at low volume residential roads and ground level parking lots in America. No-fine concrete is used around the trees and vegetation without comprise their health because of the porous nature of the concrete allow water and air to reach the surface.

BENEFITS OF THE PERVIOUS CONCRETE

1. It reduces the runoff water on the pavement
2. Recharge the Aquifers and ground water table
3. Allow more efficient land development.
4. Prevent water for getting more pollute.
5. Ease surface runoff.
6. Also prevent water to runoff into the stream.

APPLICATION OF PERVIOUS CONCRTE

1. Pervious concrete as a road pavement.
2. Low volume pavement.
3. Side walk and pathways.
4. Tennis courts.
5. Slop stabilization.
6. Parking lots.

DIFFERENCE BETWEEN PERVIOUS CONCRETE AND CONVENTIONAL CONCRETE

VI. ENGINEERING PROPERTIES OF NO-FINE CONCRETE AND EXPERIMENTAL RESULTS

STRUCTURE:- The structure of no-fines concrete is different from conventional concrete. Permeability of no-fine concrete is very high but strength is low. Aggregate which are used in concrete are having a thin layer over them. The no-fine concrete has very high void ratio and due to this is a open structure. When the material is taken under the compression then the aggregate are come in contact with each other and improve the strength of structure.

SHAPE:- Spherical shape of aggregate is the ideal shape which is used in no fine concrete. Large number of bonds is developed by this shape particle which provides more strength to the concrete. Flaky or elongated particle are avoided because the strength provided by these particle is less than the rounded particle.

MIX PROPOTIONA:- The mix proportions which is used to form no-fines concrete depends predominantly on the final application of concrete. The aggregate-cement ratio used in buildings is, usually ranging from 6:1 to 10:1. This proportional mix ensures that the void ratio is high and prevents capillary transport of water. In pavement applications the strength of concrete is more critical and aggregate-cement mixes as low as 4:1 is used. This ratio will help to improve the bonding between the aggregate and cement which will improve the strength. Mix proportion used in no-fine concrete are following

Aggregate	**Cement**	Water
8	1	0.4
6	1	0.4
4.5	1	0.4
4.8	1	0.36

WATER CONTENT:- The water present in the mix is decide the most of the properties like strength, workability etc. If the water content present in the mix is more the limited valve then workability of the mix is also increase and aggregate are run out of the mix. If the water cement present in mix is lower than the optimum then mix will not be sufficiently adhesive to bond between cement and aggregate. The general range for water-cement ratio is among 0.38 and 0.52. The water content is also affected by the adsorption rate of aggregate and this should be taken into account for design mixes.

AGGREGATE GRADING:- The aggregate which are generally used in no fine concrete are in the range of 10 mm to 20 mm. The aggregate which are 5% oversized and 10% undersized are acceptable but it is necessary that no aggregate is of size less than 5 mm. If the size of the aggregate is smaller than the 5 mm then it will fill the void of the mix which affects the desirable properties.

DENSITY:- The density of no-fines concrete is changes with the change in void ratio. No fine concrete has a density of 2/3 to conventional concrete and it is due to the presence of air content more in no fine concrete. The density of no-fines concrete normally ranges between 1600 and 1900 kg/m^3. This is dependent upon the shape, size and density of the aggregate, the aggregate-cement-water ratio and the compaction exerted on the concrete.

AIR-VOID CONTENT:- The cement paste is only a thin layer and does not contain air bubbles, so the voids are obtained mostly through the interconnected spaces of the aggregate particles. The air content is by definition the sum of the available voids between the aggregate particles and any entrained or entrapped air within the cement paste. The void content is dependent upon the aggregate-cement ratio and thus varies greatly. The air content of no-fines concrete ranges from 13 to 28 percent for aggregate-cement ratios between 4:1 and 6:1.

SHRINKAGE:- Drying shrinkage in no-fines concrete is relatively small but does vary depending on the aggregate-cement ratio. The difference in the amount of shrinkage can be attributed to the following factors. A reduction in the aggregate-cement ratio means there is more cement paste available to undergo volumetric contraction and shrinkage. At the same time, the decrease in aggregate-cement ratio causes the aggregate particles to induce a restraint on the drying shrinkage since they are in contact.

COMPARISION OF SHAPE OF NO-FINE CONCRETE AND CONVENTIONAL CONCRETA

SLUMP TEST:-The slump test is a method of testing the fresh concrete for particular characteristics including workability. It is a simple method of determining if different batches of concrete are the same. This is determined if the same constituents in the same proportions do not vary the characteristics of the concrete sample.

	NO-FINE CONCRETE	CONVENTIONAL CONCRETE
SLUMP (mm)	165	67
	157	64

COMPECTION FACTOR TEST OF THE ENTIRE SAMPLE

	Partially Compacted (m1)	Fully Compacted (m2)	Compacting Factor
No-Fines concrete	10.825	11.335	0.94
Conventional concrete	13.085	13.465	0.96

RESULT FOR THE INDIRECT TENSILE TEST

The tensile strength of concrete cannot be measured directly. This leads to the need to determine the tensile strength through indirect methods. The indirect tensile test is also referred to as the 'Brazil' or splitting test, where a cylinder is placed on its side and broken in the compression machine. This test can also be used to determine the modulus of elasticity of the concrete sample.

Test No.	Specimen Type	Force, P (kN)	Length, L (mm)	Diameter, D (mm)	Indirect Tensile Strength, T (MPa)	Average Tensile Strength (MPa)
1	No-Fines	116	300	150	1.64	2.21
2	No-Fines	150	300	150	2.12	
3	No-Fines	188	300	150	2.66	
4	No-Fines	111	300	150	1.57	
5	No-Fines	182	300	150	2.57	
6	No-Fines	190	300	150	2.69	
7	Conventional	253	300	150	3.58	3.39
8	Conventional	226	300	150	3.20	
9	Conventional	232	300	150	3.28	
10	Conventional	248	300	150	3.51	

V. CONCLUSIONS

There was a considerable difference in the compressive strength between the concrete samples but this does not affect the outcome as it was the relationships between the characteristics that were assessed. The relationships showed that no-fines concrete acts in a manner similar to what was found in the conventional concrete sample. A major difference found was that the no-fines concrete deformed more than the conventional sample before failure. This shows that a no-fines pavement has the ability to deform under the loading of traffic. The deformation should not affect the performance of the pavement providing its capacity is not exceeded. No-fines concrete is a viable material that has the potential to replace the use of traditional concrete pavements in situations where heavy traffic is limited, such as car parks, residential streets and driveways. The varying compressive strengths obtained from the different aggregate samples shows that the shape of the aggregate particles used can dramatically affect the strength of the concrete. The increased skid resistance that the no-fines concrete possesses is an extremely valuable characteristic that increases the safety of all road users. No-fines concrete has many positive attributes that make its use beneficial to society. However, it is in its early stages of development and requires more research before it is readily available and used extensively.

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