A Development of Transparent Concrete With Partial Replacement of Cement By Silica Fume For An Architectural Appearance And Compressive Strength Study In Coastal Area Structures At Kanyakumari

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Abstract- *Our world is moving towards using smart technologies in everything and the things which are thought not possible are made possible by the humans. As civil engineers we should contribute and support the world by doing things smarter. So In that way we can use waste plastic materials or optical fibers with concrete to get a better result with developed modern properties. By that way this transparent concrete technology was found. This type of concrete can be used in buildings to have a better look and wonderful attractions. Especially can be used in coastal area building to have a luxurious look to the building and to get a clear sunlight into the building rather than using lights.In this type of concrete, transparent fibers which are made out of silica glass or plastic with the diameter which is thicker than human hair. These glass fibers are flexible and it allows the sunlight between the two ends of the fiber. It requires around thousands of optical fiber strands are used in concrete to transmit light that can be a normal sunlight or electrical lights. Transparent concrete is made by adding 0%, 2%, 4%, 6%, 8% and 10% of optical fiber by the volume into the concrete mix and it contains only fine aggregates and no coarse aggregates are used in the concrete mixture. (Here we silica fume which develop the longevity and machine like properties of concrete). It gives a magnificent architectural appearance when it's used in the coaster building structures. This type of concrete can be applied to give an elongated life span to the building. Usually the coastal breeze contains excess amounts of salt content that easily affects the building architectural appearance and strength. So we should use, these type of special concrete technique coastal building construction to get rid of those problems. So In this report I described about the possibilities of using transparent concrete with the partial replacement of cement by using silica fume in the coastal regions especially in Kanyakumari district.*

Keywords- Transparent concrete, Architectural Appearance, optical fibre, coastal area structures, silica fume.

I. INTRODUCTION

In olden days concrete was only known as grey in color, heavy in mass and a structure which bears all the major loads in building. But day by day, the number of innovations and techniques were taken place in the history and transformed many things especially in concrete manufacturing technologies. Everyone knows a structure can't be imagined without concrete [2]. Then people started working to reduce the weight and some more disgusting properties to develop the concrete. We are facing more natural disasters now a days due to the heavy consumption of natural and its resources. The whole world is concentrating towards the reduction in the usage of natural resources as much as possible. In that way the technique of transparent concrete was made by an architect by mixing large quantity of glass fiber, which allows 80% of sunlight through it [3]. In coastal area if a wall or a structure is constructed with this type of concrete then the natural light comes easily through it. Transparent concrete is also considered as a green concrete which reduces the usage of electricity during daytime. Here these micro silica or silica fume is also known as a pozzolanic admixture the helps in developing synthetic longevity of concrete [1]

In this era the utilization of silica fume or micro silica is developing to export high strength concrete in a standard quality [1]. Normally silica plays three vital roles when it is mixed with concrete, first during the hydration of cement it mixes and oppose the lime content that are present in the mixture, Secondly the silica fume fills up the gaps and pores to obtain a well blends concrete mixture to get a better result and also it binds the aggregate and other materials as well this type of concrete is more suitable for hot weather environments.

II. LITERATURE RESEARCH

They had investigated about the properties and applications of this transparent concrete states that the light which comes indirectly from the sun provides excellent ambient effect to the structure and different attractive colours can be obtained by using different colour panels that gives more pleasant look to the structure[3]. They had done an experiment by replacing fly ash with the concrete mix and got better results with the development in compressive strength compared with normal conventional concrete. Here we have used silica fume for the better development in its properties[4].

Versha raina et al (2013). Researched about building smart construction technology to save electricity and other power sources which is necessary to save for future purposes. His motive is to use the natural light as a light origin to the interior structure of the building [5].

Amurag jain et.al., (2015) Had tested the silica fume concrete column that is 4 to 6years old and stated that there was no issues with the strength of the columns and assured that the concrete made up by the partial replacement of cement by silica fume is stronger than the conventional concrete after 28days of water curing[1].

K Amuthavalli had made an experiment with silica fume with concrete and stated that the compressive strength had increased by the partial replacement of 15% of silica fume by the weight of cement [6].

III. MATERIALS AND METHODS

A. Materials

Cement : The portland pozzolana cement with grade 53 is used with the concrete mix and the required quality testes are carried out as the is codes

Aggregates : Required quantity of aggregates are used during the mixing of concrete and the fundamental standard testes are made with satisfied results.

Silica fume : It is also used as a admixture which developers more special properties also known as mineral admixture or pozzolanic admixture[2]. In this experimental work we have used 20% of silica fume by weight of binder material.

B. Methodology

The manufacturing of transparent concrete nearly same as the normal conventional concrete. The minor difference is here we added optical fibers with the concrete mix which is not present in the normal concrete mix. And this type of concrete does not contain any coarse aggregate material with the mixture. The transparent concrete is manufactured by placing 0%, 2%, 4%, 6%, 8% and 10% of the optical fiber with the concrete mix. The main ingredients of this concrete are cement, fine aggregate, and optical fiber. The Portland pozzolana cement is used in the mix with the required ration of the mix design.

C. Mix Design

The concrete was carried out with proper mix design for the M50 grade which is known as the high strength concrete based on the IS code guidelines. In order to check the effect of micro silica or silica fume in the concrete it is tested with various different proportion concrete. Normally there are three methods are currently in use to collaborate silica fume with concrete mix. First is to add silica fume to the cement and concrete is mixed. Second thing is adding partial replacing cement material by accurate weight of cement and third thing is partially replacing cement by low amount silica by its weight. Here high strength concrete was proposed and casted with silica fume level of 20% with the concrete mix and Portland pozzolana cement was used for casting. The quantity level of adding superplasticizers were modified for every mix proportion of transparent concrete. These special type of concrete can be used in the buildings which are closer to the seashore to get wonderful appearance.

D. Casting and curing of Transparent Concrete

The concrete casting mould that we have used is 150mm X 150mm X150mm. the mould was cleaned completely and the bolts are fixed properly. The interior of the mould is covered and applied with oil. Here the optical fiber was placed in the uniform pattern in three layers and each layer was given with 25blows to get a proper compaction with concrete. After filling the concrete mix blows were given to 25times in each layer remove the gapes and air voids present in the concrete and to get good bonding between all the particles. Then after 24hrs the concrete casted mould was removed carefully and it is allowed for the curing purpose in water at the room temperature. The curing period was carried out for 7 days and 28 days. Optical fiber was added in different ratios in the concrete mix. Here Three cubes are made in each ratio with 0%, 2%, 4%, 6%, 8% and 10% by the weight of cement with optical fibers in the mix. So here all together we have casted three cubes in each ratio totally 18 cubes.

IV. EXPERIMENTAL PROGRAMME

A. Compressive strength test

For the M50 grade concrete which is also referred as a high strength concrete , the mold with 0%, 2%, 4%, 6%, 8% and 10% of optical fiber by the weight of cement , the compressive strength test was conducted after the curing of 7 days and 28days. Cubes were tested in compression testing machine to obtain the compressive strength of the concrete mold with fiber. The results of the compressive strength test for the concrete cube with silica fume states, maximum compressive strength Attained at 8% replacement of silica fume with concrete.

V. RESULT AND DISCUSSION

The results table-1 of the compressive strength test is tabulated below and from the results values clearly shows that the addition of 8% silica fume with the partial replacement of cement has got more compressive strength compared with normal concrete and the further addition of silica decreases the strength of the concrete rapidly.

Table-1 Compressive strength test result

SL.NO	Specimen	Average strength (MPa)	Average strength (MPa)
1	S.F 0%	40.76	63.56
2.	S.F 2%	43.14	64.23
3.	S.F 4%	44.86	66.30
4.	S.F 6%	45.98	67.28
5.	S.F 8%	48.24	69.09
6.	S.F 10%	46.19	67.04

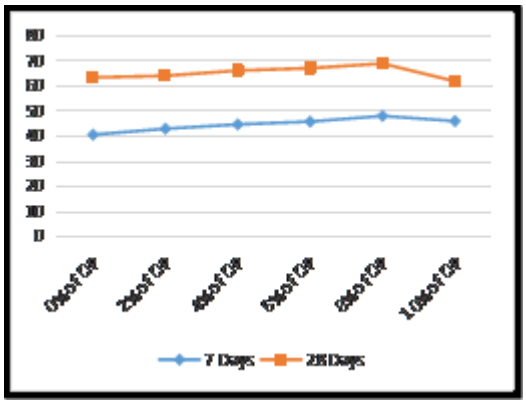

Fig-2 Compressive strength of transparent concrete

VI. CONCLUSION

Now we are living in a modern world and things are getting smarter day by day. So as a professional civil engineers we should give our contribution to build our nation in a smartest way. For that transparent concrete can be one of the excellent technique to improve the architectural appearance to the buildings which are especially in the coastal area.by using these modern methods building strength and the architectural appearance also develops.

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