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THE STRENGTH DETERIORATION DUE TO WATER SORPTIVITY THROUGH CONCRETE SURFACE

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ABSTRACT
The durability of reinforced cement concrete constructions is, determined by the resistance to water penetration of it since it is due to the environment which accelerates the rate of corrosive processes and the factors allowing water penetration into concrete causing corrosion inside the elemental members. One of the main culprits in the deterioration of these structures is the ingress of water through the surface skin of concrete, which protects the steel. Hence, the parameter which is a fair predictor of the durability of concrete structures as well as their resistance to harmful and corrosive factors influences the sorptivity as a value defining the speed of water entry into concrete.
In this study it is investigated that the strength deterioration due to water sorptivity through the concrete surface, as durability of concrete structure depends upon the porosity and influence of water absorption of concrete materials. This study includes the detailed analysis of compressive strength and weight loss analysis for 3 different grades of concrete mix (M-25, M-30 & M-35), in the different pH water ie: (pH 4, pH5, pH6, pH7, pH8 & pH9). Cubes And cylinder were casted and cured for 28 days in the normal water, after that cylinders were cut in the form of disc having diameter 10 cm and height 5cm, weighed that disc and kept it in the oven at 60◦C temperature, until the constant weight is achieved, now the oven dried specimen got coated with wax from its three sides so that moisture can’t penetrate into the specimen other than the side exposed to pH solutions. It is found that Sorptivity values are less for higher grades of concrete as compared to lower grade of concrete, for different pH of water. Whereas, for pH 7 all the grades have approximate same sorptivity values, and There is no systematic co-relation in loss of compressive strength and water absorption. The SEM analysis were also performed for M-25 grade at 60 days immersion in the water for three different pH i.e. pH 4, pH 7 and pH 9. SEM results
concludes that a specimen having higher water cement ratio kept in acidic medium and basic medium doesn’t go through the proper hydration and voids were also seen which results in decrease in strength, micro cracks and higher porosity.

I. Introduction

Currently, there is worldwide concern about the lack of durability of many reinforced- concrete structures, particularly in connection with corrosion of the reinforcement. One of the main culprits in the deterioration of these structures is the ingress of water through the surface skin of concrete, which protects the steel. The situation is exacerbated by the presence of deleterious ionic species dissolved in the invading water, such as chlorides or sulfates. As a consequence, considerable effort is being directed toward investigating the surface characteristics of concrete. A number of tests have been developed to index the surface properties of concrete, most notably the initial surface absorption test.
The durability of reinforced cement concrete constructions is, determined by the resistance to water penetration of it since it is due to the environment which accelerates the rate of corrosive processes and the factors allowing water penetration into concrete causing corrosion inside the elemental members.
Sorptivity, which is an index of moisture penetration into unsaturated specimens, has been recognized as an important index of concrete durability, because this method is good measure of the

quality of the concrete near surface, which governs durability of concrete especially corrosion of concrete reinforcement. For example, the period of curing is considered to be a major influence on the quality of cover zone concrete, and sorptivity is very sensitive to the type and duration of curing.

Sorptivity Test: Sorptivity test is a very simple technique that measures the capillary suction of concrete when it comes in contact with water. The Sorptivity test was performed in accordance with the ASTM C 1585. This test is used to determine the rate of absorption (Sorptivity) of water by measuring the increase in the mass of a specimen resulting from absorption of water as a function of time when only one surface of the specimen is exposed to water ingress of unsaturated concrete by capillary suction during initial contact with water.

1.1.1. Capillary suction and sorptivity

It is frequently found that in a mortar or concrete surface is exposed to wetting by water then the cumulative water absorption i is proportional, during the initial absorption period, to the square root of elapsed wetting time t:

$i=S\sqrt{t}$

S is the sorptivity measured in g per mm2 (of wetted area) per min1/2. It is easily determined from the slope of the linear part of the i versus √t curve. Some materials with extremely coarse pore structure experience little capillary suction and may show significant deviation from linearity after prolonged wetting. Capillary suction can only be measured in partially dry mortar or concrete. Sorption does not takes place in saturated materials, and in totally dry materials substantial absorption of water by the gel will distort the results. The sorptivity will depend on the initial water content and its uniformity throughout the specimen under test. It is important, therefore, to keep this in mind both when relating laboratory measurements to field behavior and also in ensuring a consistent and standardized drying procedure for all specimens. Furthermore, as water absorption and capillary suction depend on porosity, any non-uniformities in the latter could lead to different sorptivities in samples obtained from what is supposed to be the same material. It is, therefore, essential that materials under test be consistent and homogeneous. In practice the point of origin, and frequently the very early readings, are omitted when determining the slope of the graph. This is because there is an increase in the mass of the specimen caused by the filling of the open surface pores on the inflow face and the sides of the specimen when it is submerged. In order to reduce these effects to a minimum, it is essential that the specimen be submerged in water to no more than 2- 5 mm.

1.2. Materials Used in Concrete

- Cement
- Coarse aggregate
- Fine aggregate
- Water
- Super plasticizer

1.2.1. Cement

Cement is one of the most important components of concrete work as a binding material which is used in concrete to increase the strength of concrete. The cement used for this study Pozzolans Portland cement. PPC produces highly durable concrete as it has low water permeability compared to OPC. PPC has low initial setting strength compared to OPC but hardens over a period of time with proper curing. Portland Pozzolana Cement is a kind of Blended Cement which is produced by either intergrinding of OPC clinker along with gypsum and pozzolanic materials in certain proportions or grinding the OPC clinker, gypsum and Pozzolanic materials separately and thoroughly blending them in certain proportions. It improves the durability of structures and also the strength of concrete over a period of timeby making it more corrosion resistant and impermeable. It protects concrete against alkali- aggregate reaction. The minimum compressive strength of PPC after 28 days, as prescribed by BIS is 33 MPa or 330 kg / Cm2. Portland-pozzolana cement is produced by grinding together Portland cement clinker and artificial pozzolana (Fly ash) with addition of gypsumor calcium sulphate.

The history of pozzolanic material goes back to Roman"s time. Portland Pozzolana cement (PPC) is manufactured by intergrinding of OPC clinker with 10 to 25 percent of pozzolanic material (as per the latest amendment, it is 15 to 35%). A pozzolanic material is essentially a siliceous or aluminous material which while in itself possessing no cementitious properties, which will , in finely divided form and in the presence of water ,react with calcium hydroxide , liberated in the hydration process , at ordinary temperature , to form compound possessing cementitious properties. The pozzolanic material generally used for manufacture of PPC is calcined clay or fly ash (IS1489 part 1 of 1991)[1]. Fly ash is waste material, generated in the thermal power station, when powered coal is used as fuel. These are collected in the electrostatic precipitator.

1.2.1.1.Advantages of PPC

(i)In PPC, costly clinker is replaced by cheaper pozzolanic material – Hence economical.

(ii)Soluble calcium hydroxide is converted into insoluble cementitious products resulting in improvement of permeability. Hence it offers, all-round durability characteristics, particularly in hydraulic structures.

(iii)PPC consumes calcium hydroxide and does not produce calcium hydroxide as much as that of OPC.

(iv) It generates reduced heat of hydration and that too at a low rate.

(v) PPC being finer than OPC and also due to pozzolanic action.

(vi) Reduction in permeability of PPC offers many other advantages.

(vii) As the fly ash is finer and of lower density, the bulk volume of 50 kg bag is slightly more than OPC. Therefore, PPC gives more volume of mortar than OPC.

(viii) The long-term strength of PPC beyond a couple of month is higher than OPC if moisture is available for continued pozzolanic action.

Generally, 15-25% fly ash is mixed and grind together with 70-80% Portland clinker and 3- 6% gypsum to make the best PPC cement. It can be confidently employed in construction of hydraulic structures, marine works, mass concreting such as dams, dykes, retaining walls foundations and sewage pipes. It is also suitable for use in common applications such as masonry mortars and plastering.

1.2.2. Aggregate

Totals are for the most part considered as dormant filler inside a solid blend. But a closer lookreveals the major role and influence aggregate plays in the properties of both fresh and hardened concrete. Changes in degree, most extreme size, unit weight, and dampness substance would all be able to modify the character and execution of solid blend. Aggregates comprise as much as 60% to 80% of a typical concrete mix, so they must be properly selected to be durable, blended for optimum efficiency, and properly controlled to produce reliable solid strength, usefulness, finish capacity, and steadiness.

1.2.2.1 Coarse Aggregate

The aggregate which retained on IS sieve 4.75mm are known as coarse aggregate. Generally, 20mm size aggregate used but in mass concreting 40mm size aggregate are used. But in this study 20 mm size coarse aggregate used.

1.2.2.2. Fine Aggregate

Fine aggregates are usually sand or crushed stone that are less than 4.75mm. It helps the concrete glue to hard the coarse total particles and assists with forestalling conceivable isolation of glue and coarse total especially during the vehicle activity of cement for a significant distance. Fine aggregate reduces the shrinkage of binding material and prevents the development of a crack in the concrete. It fills the voids existing in the coarse aggregate. Hence, it helps in expanding the thickness of cement.

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1.2.3. Water

Concrete is produced by mixing binding materials and inert materials with water thus; water and its quality play an important role in determining the quality of concrete. Strength and durability of concrete is to a large extent determined by its water to cementious materials ratio. Water is required to wet the surface of aggregate to develop adhesive quality as the cement paste binds quickly and satisfactorily to the wet surface of the aggregates than to a dry surface. Also water is needed to make plastic mixture of the various ingredients so as impart workability to concrete to facilitate placing it in the desired position. Ultimately, by chemically reacting with cement water helps to produce the desired properties of the concrete. In spite of the fact that somewhat acidic water is innocuous, profoundly acidic or antacid water ought to be kept away from as it might have unfavourable impact over the solidifying of cement.

1.2.4. Super Plasticizer

Super plasticizer is an admixture used to modify the workability of concrete. It reduces the water content without negatively affecting the strength. Reduction in water content means reduction in cement content also. It makes concrete highly workable. It increases the flowabilty of concrete and also improves passing and filling ability of concrete. But higher dose of super plasticizer may lead to segregation and decrease in the compressive strength of concrete. There are many type of super plasticizer available depending on their chemical composition. In this study SIKAPLAST 5202 NS is used. Test of the materials are done such as sieve analysis, specific gravity, water absorption for aggregate and fineness, consistency and setting time of cement.

1.3. Outline of the Dissertation

This project has been structured as follows:

Chapter 2 introduces to the reader, various developments which have taken place in the earlier years. A comprehensive detail of stipulated work of various researchers has been incorporated in this Section.

Chapter 3. For conducting the experimental study a series of processes are done. In this study first of all materials are collected. Locally available fine aggregate and coarse aggregate is used and was collect from a local vendor. Cement used is pozzolana Portland cement.

On the basis of the properties of material trial mixes are prepared and tested. Out of those trial mixes the mix having desirable result is chosen for furthers study. In this study used grade of concrete are M25, M30 and M35.

After obtaining the mix of appropriate strength the sorptivity test is performed in the water of different Ph.

Chapter 4 deals with the results and discussion on the work carried out in the preceding section.

Chapter 5 a defining conclusion obtained from present study has been stipulated in this chapter.

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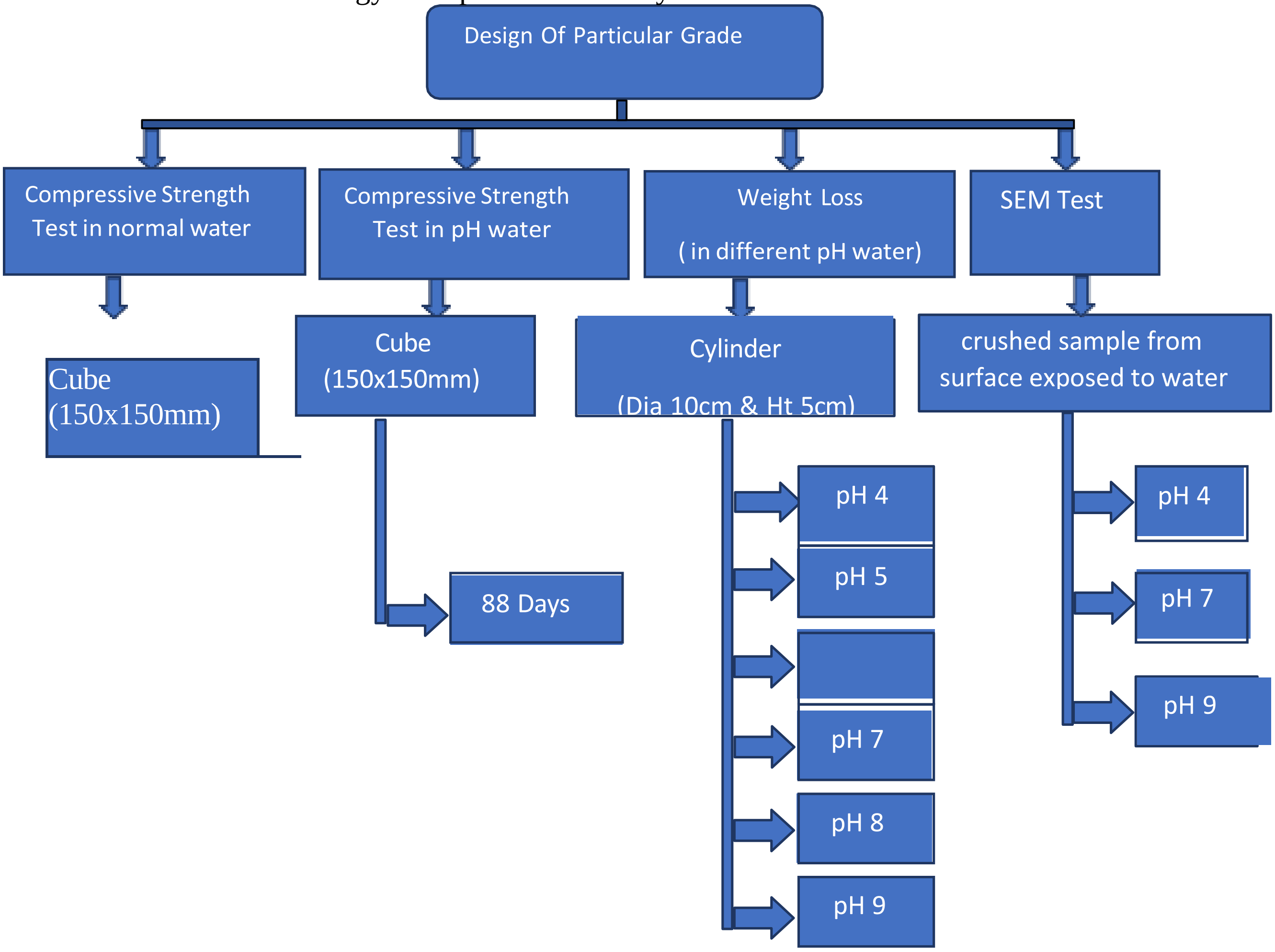
1.3. Flow Chart for Methodology of Experimental Study

The flow chart for methodology of experimental Study is shown below:



II. Literature

The durability of mortar and concrete depends largely on the movement of water and gas enters and moves through it. The permeability is an indicator of concrete"s ability to transport water more precisely with both mechanism that is controlling the uptake and transport of water and gaseous substances into cementitious material. Permeability is a measure of flow of water under pressure in a saturated porous medium while sorptivity is materials ability to absorb and transmit water through it by capillary suction. Uptake of water by unsaturated, hardened concrete may be characterised by the sorptivity. This is a simple parameter to determine and is increasingly being used as a measure of concrete resistance to exposure in aggressive environments. sorptivity, or capillary suction, is the transport of liquids in porous solids due to surface tension acting in capillaries and is a function of the viscosity, density and surface tension of the liquid and also the pore structure (radius, tortuosity and continuity of capillaries) of the porous solid. It is measured as the rate of uptake of water.

2.2. Literature Review

Following are the previous works on durability of concrete considering sorptivity a major factor.

Akinkurolere, O.O. et al (2021) [3]studied the water absorption, sorptivity, and permeability using nine (9) trial mixes of different proportions of Calcined Clay (CC), Sawdust Ash (SDA), Crystalline Based Admixture (CBA), and Superplasticizer (SP). The results showed that treating concrete with 5% CC + 5% SDA+1% CBA combination gives optimum performance in terms of sorptivity with reduced water absorption value of 4.60%. While the permeability coefficient of concrete is reduced

when CC and SDA are added to concrete mix separately, the reactivity between their combination (CC and SDA) significantly increased permeability coefficient of the concrete.
Muazzam Ghous Sohail et al (2021) [4] in this literature author has done the study for some parameters of durability and comparison study of NSC (Normal Strength Concrete) HSC (High Strength Concrete) & UHPC (Ultra High Performance Concrete) which employs high cement content and SCM's, according to these comparative study they found that the UHPC is more efficient in every parameter like electrical resistivity, porosity, sorptivity, chloride penetration and in the case of UHPC there was no carbonation penetration after 6 months of exposure to a 50% CO2 environment.
Amy J. Moore et al (2020) [5] carried investigation on three concrete mixes of w/b 0.45, 0.5, and 0.55, to evaluate the adequacy of the saturation period. The specimens were prepared following the standard water sorptivity index (WSI) test procedure; however, in the final stage of specimen saturation, the initial period of 18 hours was extended further for about 10 days and the mass change was measured at regular 24-hour intervals. The results indicated that 18 hours of saturation is sufficient, practically, to measure the change of mass during the WSI test, as the rate of change of mass after 18 hours is negligibly small.
Ramasamy Gopalakrishnan et al (2020) [6] This study sets out the aim to enhance the resistance of Portland cement mortar to a combined chloride and sulfate attacks by the partial replacement of cement with nano and micro Pozzolanic Material. The durability of the OPC mortar mixes is investigated using Pozzolans, Fly Ash (FA), Metakaoline (MK), and Slag with nano additives namely, Nano silica (NS), Nano Titania (NT) and Nano alumina (NA) separately and in combined form. After proper curing, they are treated with aggressive chemicals 5%NaCl, 5% Na2SO4 and 5% NaCl–5%Na2SO4 and tested their compressive strength for shorter and longer duration (7–180 d).This study captures in detail, the ternary mixes behaviour of OPC blended with nano materials of silicious (NS), aluminate (NA) species as well as the compound form of all nano additives. It is concluded that the increase in the utilization of micro and nano materials for the replacing cement partially in producing durable mortars will greatly contribute to increasing the life time of the construction products.
Yong Yi et al (2020) [7] Durability of marine structures is a great challenge in civil engineering as it is found that marine structure have less life in compare with their design period due to several kind of chemical attacks and wave propagation. It has been seen that porosity and durability is assessed by the type of binding material used and aggregate in this paper it is also shown that the structure built in the year 1943 with the cover concrete of 25 mm thickness is still having strength whether the structure built up in 1968 and 1993 with more cover concrete are deteriorating it is also found that sea water have almost same ions throughout whereas contained different amount of salinity.
Rakesh Choudhary et al (2020) [8] carried out a study to find the surface water absorption characteristics of high strength self-consolidating concrete (HSSCC). A total of sixteen HSSCC mixes were prepared to investigate the effect of marble waste powder (MWP), Fly Ash (FA), and micro-silica (MS) as a partial replacement of cement on surface water absorption characteristics. Surface water absorption was evaluated using the sorptivity test after 28 days curing period. The initial and secondary rate of absorption was calculated for each HSSCC mix. Sorptivity test results indicated that the incorporation of supplementary cementitious materials in HSSCC resulted in increased resistance against surface water absorption. Incorporation of 5% MS in HSSCC resulted in reduced water absorption through the exposed surface. All the ternary mixes (made with Cement + MS + FA and Cement + MS+ MWP) and quaternary mixes (made with Cement + MS + FA + WMP) showed higher resistance against surface water absorption than the reference mixture. However, the highest surface water absorption resistance was found for a ternary mix made with 5% and 35% substitution of cement with MS and FA respectively. They concluded that the performance of concrete structures is largely affected by the susceptibility of the concrete to the penetration of water.

Ingress of moisture or other aggressive liquids through the interconnected pores reaches to the inner part of the concrete structures and causes deterioration.
Mohammad Sheikh Hassani et al (2020) [9] according to this paper author has derived the conclusion for manufacturing the concrete sample through the sewage water and portable water and comparison in compressive strength is done for both the conditions and concluded that , concrete specimen manufactured by sewage having low compressive strength with minimum no of freeze and thaw cycle.
Pinghua Zhu et al (2020) [10] this paper intends to capture the effects of sodium sulfate solution concentration and erosion age on axial compressive strength, sulfate ion distribution, dynamic elastic modulus, electrochemical performance and load–displacement curves of concrete. The results reveal that the axial compressive strength and load–displacement curves go through a reversal of sorts. First increasing and thereafter decreasing with increasing sodium sulfate solution concentration. The main products of sulfate attack are AFt and gypsum. These two together play double effects on the performance of concrete. The transverse dynamic elastic modulus of concrete when it is exposed to sulfate solution shows an increase first and thereafter a decrease with the increase in the concentration of sulfate solution.
M. Papachristoforou et al (2020) [11] investigated the performance of concrete with Electric Arc Furnace (EAF) steel slag as coarse aggregate and steel fiber reinforcement. EAF slag was tested for suitability as concrete aggregate regarding chemical properties, granulometry, apparent specific density, water absorption and flakiness index. Test concrete mixtures were prepared with EAF slag as coarse aggregate with either no reinforcement, or with 30 mm or 60 mm steel fibers at a volume ratio of 0.7%.The results show that although EAF slag aggregates tend to form micro cracks at temperatures higher than 600 C and the rate of strength loss is increased, there is a reduced risk of spalling, fibers do not improve the compressive strength of concrete but they have been reported to improve flexural strength and post cracking behavior, increasing the toughness of concrete.
Tengjiao Wang et al (2020) [12] this study sets out the aim of studying the effect of carbon nanofiber (CNF) content on the durability of concrete, the shrinkage test, freeze-thaw cycle test, penetration test and carbonation test of carbon nanofiber reinforced concrete (CNFC) with different volume fractions (0.1%, 0.2%, 0.3%, 0.4%, 0.5%). The microscopic modification mechanism of carbon nanofibers (CNFs) to the durability of concrete was also explored by SEM test and MIP test. The results revealed that the microstructure of concrete can be improved and the pore structure can be refined by CNFs in two ways. First, by fibre bridging and pores filling, it significantly improves the durability of concrete. Second, the incorporation of appropriate amount of CNFs can significantly reduce the shrinkage rate, mass loss rate, compressive strength loss rate, seepage height, and relative permeability coefficient and carbonation depth of concrete. Furthermore, the frost resistance of concrete can be improved by CNFs. The modification effect is more pronounced and more significant as freeze-thaw cycles increase.
Nazanin Alaghebandian et al (2020) [13] studied the durability performance of self- compacting concrete and mortar blended with Silica fume(SF), natural zeolite(NZ), and limestone powder in the form of ternary or quaternary mixtures which behaves like a marine environment and assessment of durability is done in different exposure as tidal, splash and submerged environment, according to author the natural zeolite reduced the blend‟s conductivity and free chloride ions permeability and using NZ with SF can be considered beneficial regarding porosity and sorptivity properties, in all conditions, the performance of self-consolidating mortars was better than vibrated types. The deterioration was more in splash conditions samples followed by tidal and submerged conditioned samples. It is also found that Quaternary SCC mortars showed the lowest sorptivity.
May Huu Nguyen et al (2019) [14] durability index for quality classification of cover concrete ie,. cover concrete play an important role in the durability of concrete, the outer most layer or we can say the first layer of concrete structure. Structures remaining in the water having pores which comes in contact with the fluid effecting the cover concrete and reinforcement so this paper provides the

information of water ingresses into the structure with the help of water spraying index test and others test . Amount of water which penetrates into the first layer defines the durability related with it, because penetration of water shows the pore and permeation study about the structure. Several test methods are used for determining the water absorption this then be directly result in durability of structure quality, through the total amount of sprayed water index (rW) , "repetition number of water spraying" index (rN) and the coefficient of air permeability, kT.

Hassan Baji et al (2019) [15] presents an analytical model for evaluating effective hydraulic conductivity, diffusivity and sorptivity of concrete considering the properties of the Interfacial Transition Zone (ITZ) and the aggregate size distribution. Results of the proposed model is compared with the experimental results and those obtained from rigorous numerical Finite Element (FE) analysis. They found that a change of Interfacial Transition Zone (ITZ) properties has more influence on the effective hydraulic conductivity than it has on the effective hydraulic sorptivity. The proposed model is significant to estimate the hydraulic sorptivity and diffusivity of concrete by only knowing the hydraulic properties of mortar.

Dezhi Wang et al (2017) [16] this paper intends to understand the durability of concrete containing fly ash (FA) and silica fume (SF) against combined freezing-thawing and sulfate attack was studied in this paper. The studies revealed that when exposed to 5% sodium sulfate solution, both FA and SF can enhance concrete‟s resistance to sulfate attack and in comparison SF performed better than FA. to conclude both FA and SF as the concrete admixture can enhance concrete‟s resistance against the combined freezing thawing and sulfate attack with 25% FA and 5–8% leading to significant improvement in concrete durability.

Alena Sicakovaa et al (2017) [17] based on the this particular research paper we got to know that water absorption is the main parameter which effects the durability of concrete according to this, if the building mix contains the finer particle as a filler material then as a result finer material or small size aggregate particle have lower water absorption and the larger aggregate size, in this they use glass powder and brick powder as a substitute filler material and concrete powder, among all these concrete powder provides the positive result in reference with the glass powder or brick powder whereas curing time effects the durability of time.

Hailong Ye et al (2017) [18] in this research paper the author has given two different types of study Series A and Series b. In series A the study is done on the capillary action of concrete with the addition of SCMS in the different curing conditions and in Series B the author has performed the concrete durability analysis focusing on chloride penetration , in his research paper he has used gravimetric method and Electronic method for the capillary test and chloride penetration analysis. The curing Condition which has been considered in this paper is based on three different regimes:

Regime I: sample will be soaked in 20C as considering the environment of harbor structure or partially tidal zone.

Regime II: Sample curing was done by covering the stack of humidity sponges 20C & RH 95%, as in some of the construction site uses gunny bags for the curing purpose.

Regime III: Sample curing is dine in the temperature of 40C - 48C & RH 25-43%with the air flow of 1,67-1,75m/sec, ie. the naturally inappropriate curing condition of concrete which is available on most of the sites.

Davood Mostofinejad et al (2016) [19] the author concluded the result of durability index for different concentration of magenisum sulphate in the water and their compressive strength. Durability of 36 concrete mix designs was investigated in three sulphate environments at different interval of 140, 210 & 280 days . Durability of the concretes was compared using a proposed durability index. Replacing 10% cement by micro-silica reduced the durability in magnesium sulphate. Replacing 15% cement by limestone powder increased the durability of concrete. The 5% magnesium sulphate solution was the most deteriorating environment, it was specified that the most durable concrete in all three magnesium sulphate environments have the lowest w/c.

S. P. Zhang and L. Zong (2014) [20] performed an experimental study of the influence of water absorption on the durability of concrete materials. Concrete specimens of different water absorption were prepared through different curing conditions. SEM photos also showed that different curing conditions caused different microstructure. After 28-days curing, compressive strength, permeability, sulfate attack, and chloride ion diffusion of concrete samples were investigated. As a result, both of surface sorptivity and internal sorptivity have no clear relationship with compressive strength. Results obtained also showed that only surface water absorption related to the performance of concrete including permeability, sulfate attack, and chloride ion diffusion.
Peter A Claisse et al (2014) [21] studied and compared the absorption characteristics and sorptivity of cover concrete obtained by the Initial Surface Absorption Test (ISAT), the Covercrete Absorption Test (CAT). Two types of concrete, namely OPC control and Low Water Concrete (LWC) of grade 35 have been tested. They have found close agreement between the ISAT and sorption results but the CAT yields higher results.
Wojciech Kubissa and Roman Jaskulski (2013) [22] in this paper measurements of sorptivity is performed, not only, as usual, after 28 days, but also after longer periods of time (2, 3, 6, 9, 12, 24 months) on samples made of the same concrete. Four different concretes were researched. Differences between the initial value of sorptivity and further measured ones were statistically tested. Results of measurements and tests proved that the initial value of sorptivity is increased upto 2 months. However in subsequent measurement periods, the results of sorptivity measurements do not significantly differ from the initial one. In general, on the basis of the research findings, it can be concluded that the sorptivity measured in case of young concrete is its representative later on as well.

III. Conclusion

Based on the data obtained from this study, the following conclusion can be made:
•The water absorption and sorptivity index both for M-35 concrete shows better result in saline as well as in acidic water as compared to M-25 and M-30
•For M-25 & M-30 specimen kept in acidic water (pH4, pH5, pH6) have less water absorption as compare to specimen kept in saline water (pH8 and pH9).
•M-35 specimen kept in acidic water (pH4, pH5 and pH6) have more water absorption as compare to specimen kept in saline water (pH8 and pH9) so it is concluded that acidic water is more harmful than saline water.
•Sorptivity Values are less for higher grades of concrete, for different pH of water, whereas for pH 7 all the grades have approximate same sorptivity value which indicates that in neutral water there is no need to provide higher grade of concrete unless the design required.
•There is no systematic co-relation in loss of compressive strength and water absorption.
•Water absorption is higher in case of lower grade of concrete in comparison to higher grades this may be due to low density (more air voids) of lower grade concrete.
•Sorptivity value is lower for higher grade of concrete it means that higher grade concrete should be used in the humid areas where probability of moisture ingress is comparatively high.
•The data shows that the sorptivity value increases initially with time upto 28 days afterward it becomes constant or decreasing with the passage of time mainly.
•It is also found in this study that sorptivity value increases for the saline water as compares to acidic water.
•SEM results concludes that a specimen having higher water cement ratio kept in acidic medium and basic medium doesn‟t go through the proper hydration and voids were also seen which results in micro cracks and higher porosity leads to lower bonding in interfacial transition zone. Interfacial transition zone exists between large particles of aggregate and the hydrated cement paste, due to which compressive strength gets decrease for such grade in both acidic and basic medium.

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