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STUDY ON BEHAVIOR OF CHLORINE EFFECT TO THE CONCRETE AND BEHAVIOR OF BOND STRESS OF CONCRETE.

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ABSTARCT

At low concentration, chloride ion has little or no effect on physical stability of concrete of concrete structure but it cause the corrosion of the reinforcement steel in the concrete. But at high concentration especially at low temperature it cause expansion and cracking in the concrete. The Chloride ions content of concrete is usually measured in the laboratory using wet conical analysis Although laboratory testing is the most accurate, it is time consuming and often taken several weeks before result are available as result field test kits has been developed, the Chloride ions content of concrete is using measured in the laboratory using wet chloride analysis although laboratory testing is the most accurate it is time consuming and often takes several weeks before result are available as a result, field test laid have been developed Permeability is an important property to consider when designing concrete for long service lives but unfortunately requires long-term testing to be accurately measured. Short-term test methods to estimate permeability such as rapid chloride permeability (RCP), bulk resistivity (BR), and surface resistivity (SR) have therefore been developed. In this study, three short-term test methods are performed, and the results compared, RCP testing is performed using accelerated curing to determine whether testing can be shortened, and the effects of SCMs on results are examined. It was observed that all three test methods had strong positive correlations with one another. RCP testing performed on specimens subjected to an accelerated-curing regime for 28 days had a strong positive correlation with specimens that were cured in standard conditions for 91 days. The addition of SCMs improves concrete permeability; the beneficial effect of SCMs increases with the maturity of the concrete.

Keywords: chloride, penetration, distilled water, concrete

1. INTRODUCTION

In this document, a review of the current common methods for determining chloride penetrability of concrete is presented. First, some theoretical background of what influences the penetration of chlorides into concrete is presented in Section 3. The different mechanisms of chloride penetration are presented, followed by a further elaboration of the chloride diffusion theory. The influence of basic properties of concrete on its chloride penetrability is also discussed. In Section 4, individual test procedures are presented. First, the existing longterm procedures are discussed, namely the salt pending (AASHTO T259) test and the Nordtest (NTBuild 443) bulk diffusion test. The existing short-term tests are then presented. For each test, the procedure, the theoretical basis, and any advantages and disadvantages are presented. Also included in this document as an appendix is a glossary of some of the common terms related to chloride ingress testing and measurement the interest of high strength concrete has increased considerably in the last few years. Several research works on this subject have contributed to a better understanding of the material properties and mechanical behavior in structural elements of high strength concrete. Reinforced concrete structures are exposed to harsh environments yet are often expected to last with little or no repair or maintenance for long periods of time (often 100 years or more). To do this, a durable structure needs to be produced. For reinforced concrete bridges, one of the major forms of environmental attack is chloride ingress, which leads to corrosion of the reinforcing steel and a subsequent reduction in the strength, serviceability, and aesthetics of the structure. This may lead to early repair or premature replacement of the structure. A common method of preventing such deterioration is to prevent chlorides from penetrating the structure to the level of the reinforcing steel bar by using relatively impenetrable concrete. The ability of chloride ions to penetrate the concrete must then be known for design as well as quality control purposes. The penetration of the concrete by chloride ions,however, is a slow process. It cannot be determined directly in a time frame that would be useful as a quality control measure. Therefore, in order to assess chloride penetration, a test method that accelerates the process is needed, to allow the determination of diffusion values in a reasonable timeOne subject, which needs some investigation as far as the use of high strength concrete in building construction is conceded, is the prediction of "in situ" concrete strength. It is known that the strength measured on standard specimens, at 28 days and cured in standard conditions, only gives the potential value of the concrete strength, which is useful for quality control purposes and for checking the acceptability of the concrete as it is produced (1, 2). However, this reference strength is normally achieved by the real structure at ages much higher than 28 days, depending on various parameters, mostly associated with curing conditions. On the other hand, it is often necessary to know the strength of concrete before 28 days to determine when the forms can be disassembled or to know the structure performance at certain age. As a way of estimating the "in situ" strength for high strength concrete, some techniques, previously used in normal strength concrete, have been adapted and used. One of those techniques consists on calibrating a relationship between the compressive strength of a given concrete and its resistance to penetration by a steel probe fired into the concrete surface. This test, generally known as Windsor Probe Test System, has only shown its applicability in concretes in which strengths are no more than 50 MPa (measured in cubes of 150 mm). In an attempt to use Windsor Probe Test System in high strength concrete, performed by the authors, it was found that the available probes and/or the power level are unsuitable; probes didn't penetrate the concrete surface. It means that probably a new probe and/or a new power level has to be provided by manufacturer in order to be possible its use in high strength concrete. On the present investigation the possibility of using an alternative firing apparatus to the traditional Windsor Probe Test System was evaluated for the range of concrete compressive strength varying from 50 MPa to 90 MPa. A previous study, comparing the reliability of both apparatus, is also presented for the range of concrete compressive strength up to 50 MPa. In an environment exposed to seawater, chloride-induced corrosion of reinforcing steel is the most important deterioration mechanism of reinforced concrete structures. Under chloride attack, the reinforcing steel corrodes more easily The volume of the corrosion products is about four to six times larger than the steel This volume increase would induce internal tensile stresses in the cover concrete, resulting in cracking, de lamination and spelling. Therefore, in the durability design of these structures, the most important factor that determines their service life is the chloride transport properties of the concrete. (Mehta and Monteiro, 2006). Concrete will shrink during the hydration process. If the shrinkage is restrained, tensile stress will develop. Once the stresses exceed the tensile strength of the concrete, cracks will occur Durability problems also can lead to cracks, such as freeze thaw action, alkali-aggregate reaction, sulfate ingress, and corrosion of reinforcement. Other reasons for concrete cracking could lie in poor construction practices, construction over load errors in design and externally applied loads (ACI 224.1R-07, 2007). Several studies have focused on the effect of cracks on the chloride transport properties of concrete using both experiments. Permeation is yet another mechanism by which penetration of chloride ions can occur which is driven by pressure gradients. Consider a closed volume made of concrete whose inside bottom face is under hydrostatic pressure caused due to a liquid and if the same also contain chloride ion then permeation would occur. Absorption through capillary is yet another mechanism through which chloride ingress occurs. Concrete surfaces that are exposed to alternate wetting & drying conditions often undergo chloride ingress by this mechanism. In such conditions, where concrete comes in contact with water containing chlorides then, as mentioned above, due to a moisture gradient capillary suction pressure develops and absorption of chloride ions through the pores occurs. Reinforced concrete structures are exposed to harsh environments yet is often expected to last with little or no repair or maintenance for long periods of time (often 100 years or more). To do this, a durable structure needs to be produced. For reinforced concrete bridges, one of the major forms of environmental attack is chloride ingress, which leads tocorrosion of the reinforcing steel and a subsequent reduction in the strength, serviceability, and aesthetics of the structure. This may lead to early repair or premature replacement of the structure. A common method of preventing such deterioration is to prevent chlorides from penetrating the structure to the level of the reinforcing steel bar by using relatively impenetrable concrete. The ability of chloride ions to penetrate the concrete must then be known for design as well as quality control purposes. The penetration of the concrete by chloride ions, however, is a slow process. It cannot be determined directly in a time frame that would be useful as a quality control measure. Therefore, in order to assess chloride penetration, a test method that accelerates the process is needed, to allow the determination of diffusion values in a reasonable time. Corrosion of Steel reinforcement is a civilian Concrete durability problem in New Zealand. IA common method of preventing such deterioration is to prevent chloride from penetrating the structure to the level of the reinforcing steel bar by using relatively impenetrable concrete. It cannot be determined directly in a time. Frame that would be useful as a quality control measures In general concrete is a heterogeneous mixture used is most of the construction works concrete has a complex nature in that it's properties in its fresh and hardened state are different This pores in the concrete pave way to water absorption and chloride ions penetration from the atmosphere which in turn leads to reinforcement corrosion but cementations composites are multiphase and multi - scaled material in nature with time variant characters annexing more complexities this has led to other studies focusing on the effect of Nano sized cementations composites on concrete. Chloride ions are among the primary cause of steel corrosion in reinforced concrete structures determination of the evaluating risk of corrosion the drawbacks of conventional techniques for determination chloride content call for reliable techniques. The performance of embedded chloride sensor in cementitious material depends on the physical condition of the interfaces at the sensor's surface as well as the fore solution compositions. The presence of different ions in the pore. Channels of this layer, subsequently affects the sensor's response this is mainly in view of pore solution composition and compactness of hydration products at the interface between sensor and cementations materials.

Advantages :

- It is relatively quick- can be used for quality control
- Has simple and convenient set up and procedures
- Provides results that are easy to interpret

Disadvantages

- Can cause physical and chemical changes in the specimen , result in unrealistic values
- Has low inherent repeatability and productivity.

2. REVIEW OF LITERATURE

Tarun Gehlot, Dr. Suresh Singh Sankhla, Krishan Kumar Saini (2009) [1] have studied that the effects of chloride ion penetration into the concrete with respect to the durability characteristics. Chloride-induced corrosion of steel reinforcement is one of the major threats to durability of reinforced concrete structures in a marine environment. Chloride environments pose a threat to the durability and service life of reinforced concrete structures It is therefore, necessary to use rapid chloride test methods to assess a concrete's potential to retard chloride ion diffusion, for design and quality assurance purposes. This research paper briefly explains the mechanism of various test which is conducted to evaluate chloride penetration of concrete.This paper explore role of mineral admixtures in concrete durability, the methods of measuring the chloride ingress into concrete, the challenges in assessing concrete durability from its chloride diffusivity, and the service life modeling of reinforced concrete in chloride-laden environments. Chloride penetration is ingress of chloride ions into the concrete and destroying the passivating layer surrounding the reinforcement leading to its corrosion. This condition aggravates when coupled with carbonation occurrence. RCPT has its shortcomings but still continues to be accepted as a major test for chloride ion penetrability and thus efforts are made to correlate its values with diffusion coefficients from other tests. 3. RCPT test method does not replicate Actual conditions that concrete would experience in the field. There is no condition where concrete is exposed to a 60-volt potential RCPT Test method does not measure concrete permeability. What it does measure is concrete resistivity. Resistance is calculated as volts divided by current. It has been shown that there is a fair correlation between concrete resistivity and concrete permeability Rapid chloride testing is necessary to be used in chloride environments. Due to the fast-paced nature of construction and precast operations, it is imperative that these methods can be conducted over a short period of time (i.e., obtaining results within, say, 40 days of casting)

Karthik Obla, Ph.D., P.E. Colin Lobo, Ph.D., P.E. Rongjin Hong have studied that intended solely for the use of professional personnel, competent to evaluate the significance and limitations of its content, and who will accept full responsibility for the application of the material it contains. The National Ready Mixed Concrete Association (NRMCA), the Ready Mixed Concrete (RMC) Research & Education Foundation, and any other organizations cooperating in the preparation of this report strive for accuracy but disclaim any and all responsibility for application of the stated principles or for the accuracy of the content or sources and shall not be liable for any loss or damage arising from reliance on or use of any content or principles contained in this presentation. Unless otherwise indicated, all materials in this presentation are copyrighted to the National Ready Mixed Concrete Association. All rights reserved. The measured acid-soluble, water-soluble chloride contents and the calculated total chloride contents were determined for a range of concrete mixtures consisting of different SCMs, Portland cement C3A content, w/cm, and aggregate types. The test data showed that the calculated total chloride contents of concrete mixtures were reasonably consistent with the measured acid-soluble chloride content. The ratio of the measured water-soluble chloride-to-calculated total chloride content was less than one which is as expected due to chloride binding in hydration products. A higher ratio was observed with increased chloride addition but this ratio was relatively constant when chloride content exceeded 1% by weight of cementations materials. A lower ratio of measured water-soluble to acid-soluble chloride contents suggests a greater amount of bound chloride. The results in this study suggest that there is no significant difference in the bound chloride content in mixtures depending on type of Portland cement, w/cm (0.40 and 0.50), and type and quantity of SCM used. The ratio of the measured water- soluble chloride to the calculated total chloride content was less than 1.0 for all mixtures. This supports the proposal that if the calculated total chloride content of concrete mixtures is less than the water-soluble chloride limits in the Building Code, it will be deemed to comply with the Code requirements on chloride limits based on measurement of water-soluble chlorides onhardened concrete.

Hongyu Chen, Hongguang Zhu, Hongqiang Ma, Mingyue Zhang have studied that In order to investigate the chloride ion penetration resistance of coal gangue concrete under multi- factor comprehensive action, the non-steady-state accelerated chloride ion migration test was used to test the chloride diffusion law of coal gangue concrete specimens by crack width, curing temperature and water-cement ratio. Three groups of crack width (0 mm, 0.05 - 0.12 mm, 0.12- 0.2 mm), three curing temperatures (high temperature 45, medium temperature 25, low temperature 10), three water cement ratios (0.3, 0.4, 0.5) were set in the experiment. The results show that when the curing temperature and water cement ratio are constant, the crack width less than 0.12 mm has little effect on the chloride content and chloride diffusion coefficient. When the crack width is larger than 0.12 mm, the chloride penetration depth increases with the crack width. The resistance to chloride ion penetration of gangue concrete is greatly influenced by the water cement ratio. The influence degree of three factors on chloride ion migration coefficient of gangue concrete is as follows: water cement ratio > crack width > curing temperature. The chloride ion penetration resistance of gangue concrete is greatly affected by water cement ratio. The influence of three factors on chloride ion transfer coefficient of gangue concrete is as follows: water cement ratio > crack width > curing temperature. When the crack width is less than 0.12 mm, the difference is not significant. When the crack width is greater than 0.12 mm, the chloride ion content and migration coefficient increase significantly with the increase of the crack width It can be seen from the scanning electron microscope that the moisture absorption of coal gangue reduces the actual water cement ratio of concrete and the internal porosity of concrete. The close Distribution of C-S-H gel and Ca(OH)2 produced by the two hydration increased the density of the whole structure and enhanced the resistance to chloride ion penetration.

Farhad Pargar ID, Dessi A. Koleva and Klaas van Breugel have studied on the advantages and drawbacks of available test methods for the determination of chloride content in cementations materials in general, and the application of Ag/AgCl chloride sensors in particular. The main factors that affect the reliability of a chloride sensor are presented. The thermodynamic behavior of silver in the presence or absence of chloride ions is described and kinetic restrictions are addressed. The parameters that can affect the activity of chloride ions in the medium and/or the rate of ion exchange and dissolution/precipitation processes at the sensor’s surface are also considered. In this regard, the contribution of morphology and microstructure of the AgCl layer, binding of chloride ions and the compactness of hydration products around the chloride sensor are highlighted. The important parameters for a reliable sensor’s response are discussed and the possible causes of inaccuracies are evaluated. The available techniques for determination of the free chloride content in cementations materials are prone to several sources of errors. The potentiometric technique, using an Ag/AgCl chloride sensor, is one of the most promising methods for non-destructive in situ free chloride measurement. The deviation of the sensor’s OCP from Nernstian behavior has been considered as the main criterion for evaluation of the sensor performance. The causes of inaccurate sensor measurement are often a concern. The available studies superficially commented on the short-/long-term stability of the chloride sensor, paying little attention to the causes of inaccuracies. As a result, the identification of the underlying sources of inaccuracies is a prerequisite for the practical application of the sensor. A reliable and reproducible chloride sensor measurement requires knowledge of the environmental exposure condition and the inherent properties of thesensor.

Tipraj, E. Laxmi Prasanna, N. Prabhanjan, A. Shiva Krishna, M. Guru Prasad have studied that concrete is the most broadly utilized man made development material in the world & is second just to water as the used substance on the planet. It is obtained by mixing cementing materials, water & aggregate, & sometimes admixtures, in required proportion. The mixture when placed in forms & allowed to cure hardens into a rocklike mass known as concrete. Concrete is weak compared steel. It is also brittle. Yet it is most widely used building material. This is because of its versatility. It can be molded into any shape & the surface can be textured & colored for aesthetic purpose. Most importantly it is produced with cost effective materials. Concrete possesses very good water-resistant properties & hence, can be used in intake towers for drawing water, dames & water tanks for storing, & canal lining for transporting water. Concrete is a strong & tough materials. Reinforced concrete resists cyclones, earthquakes, blasts & fires much better timber & steel if designed properly. When compared to wood & steel, concrete has an inherent fire resisting properly. It regains its properties on cooling when the temperature reached & the duration of the fire is not abnormally high. From the compressive strength results, it can be observed that increase in concrete strength is observed on addition of a certain minimum quantity of Nano SiO2. The increase in strength is maximum for NS (nano silica) 1% b.w.c & least for NS 0.3% b.w.c (by dry weight of concrete). Addition of Nano silica (SiO2) there is considerable increase in the early-age strength of concrete when compared to the later strength of the concrete i.e. after 28 days strength. The strength of concrete for compression is increased because of the changes in microstructure of the concrete i.e. the filling of voids in the microstructure by the Nano SiO2 particles which avert the growth of Ca(OH)2 crystals. Apart from this the Nano silica readily under goes and reacts with calcium hydroxide crystals changing them into C-S-H gel. Decrease in the Ca(OH)2 content is the reason for increase in concrete compressive strength. Thangapandi, R. Amerada, N. Archana, P. Muthuraman , O. Awoyera Paul, and R. Gobinath Various challenges encountered in the construction industry has led to the production of concrete, with not just high strength, but also with enhanced durability properties. Several research works have been carried out using replacement of constituent materials and introduction of various admixtures in concrete. Alccofine is one of such promising micro fine material. This study investigates the performance of hardened concrete using nano materials. Effects of alccofine (AL) and zinc oxide (ZnO) on the durability and strength of hardened concrete were explored. Series of tests were conducted by substituting cement by weight with 10% AL and adding ZnO in proportions, 0.25%, 0.5%, 0.75% and 1%. Based on the results obtained, the strength properties of concrete reduced as cement replacement level rose beyond 10%. The durability performance of the concrete, in terms of rapid chloride permeability, water permeability test, sea water attack and chloride resistance, was within acceptable limits, even as the ZnO was increased. This study has generally proposed a sustainable solution to produce durable concrete that could have useful application in the construction industry. Considering the various strength tests, compressive, flexural and split-tensile, the modified concretes reached maximum strength after 10% replacement of Alccofine and 0.5% Zinc Oxide. Thus from the results obtained, it could be deduced that the optimum content of ZnO and alccofine could be demarcated to 0.5% considering the strength and durability properties of concrete. It is observed that conventional concrete has greater permeability when compared to the concrete containing Alccofine and Zinc Oxide. When cement is replaced by alccofine and Zinc Oxide, the permeability of concrete decreased. Also, the tensile strength, compressive strength and flexural strength are increased.

3. METHODOLOGY

PROCEDURE SAMPLING: The apparatus required for processing the sample shall be chosen for its suitability for the purposes of the investigation. A specimen to be tested for the determination of chlorides both acid and water-soluble shall not be removed from the structure until the concrete has become hard enough to permit removal without disturbing the bond between the mortar and the coarse aggregate. Normally concrete shall be 14days old before the specimens are removed. Specimens that show abnormal defects or have been damaged in removal shall not be used. A core drill shall be used for securing cylindrical core specimens (at least 100mmdiameter). The diameter of the core should be at least 2.5 times the maximum size of the aggregates and the length of the core should be at least 95 percent of core diameter. For specimens taken perpendicular to the horizontal surface, a short drill is sates factory. For inclined holes, a diamond drill is satisfactory. A saw having diamond or silicon carbide cutting edge shall be used for securing beam specimens from the structures or pavement. Samples morethan25 minimum maximum dimension shall be reduced in size by use of jaw crusher or broken into smaller pieces by hammering carefully to avoid loss of smaller pieces. Crush the particles to less than 25 minimum maximum dimensions using a rotating puck grinding apparatus or by using a disk pulverize operated to restrict to negligible levels the loss of fine particles. Sieve the crushed samples through 850~m IS Sieve. Thoroughly blend the material by transferring it from one glazed paper to another at least 10times

4. METHOD OF TEST

Reagents

1. Quality of Reagent

Unless otherwise specified, pure chemicals of analytical reagent grade and the test. 2. Nitric Acid (HN03) Concentrated Prepare the solution, 6N (approximately), by Ferric Alum [FeNH4(S04)212H20] Dissolve 10g of ferric alumni 100mlof distilled Potassium Chromate (K2 Cr0 4), 5 water. Unless otherwise specified, pure chemicals of analytical reagent grade and distilled water (see IS 1070) shal Concentrated (Specific Gravity 1.42) distilled water (see IS 1070) shall be used in by diluting 38 ml of concentrated nitric acid to) 00mlwithdistilled water. acid to) 00mlwithdistilled water. distilled water and add 1ml of nitric acid Percent Solution Dissolve 5 g of potassium chromate in 100ml of distilled chromate in 100ml of distilled Nitrobenzene (0°2) Silver Nitrate (AgN03) Solution, 0.02 N Weigh 1.7g, of silver nitrate, dissolve in distilled nitrate solution against 0.02 N sodium chloride solution using potassium chromate solution as indicator (in accordance with the procedure given in IS Ammonium Thiocyanate (NH4 SCN) Solution, Weigh 1.7 g of ammonium thiocyanate and standardize by titrating with 0.02 N silver nitrate solutions exactly to 0.02 N. in volumetric flask. Standardize the silver sodium chloride solution using potassium chromate solution as indicator (5 percent wlv) distilled water and dilute to 500 ml in volumetric flask. Standardize the silver sodium chloride solution using potassium chromate solution as indicator (IS 3025 (Part32). Solution, 0.02N. and dissolve in one liter of distilled watering volumetric flask.N silver nitrate solutions using ferric alum solution as an indicator. Adjust flask. Shake well and using ferric alum solution as an indicator. Adjust the normality Sodium Chloride (NaCI), 0.02 N Weigh 1.1692g of sodium chloride dried volumetric flask. dried at loss: I: 2°C dissolve in distilled water and make up to 1000 ml in a up to 1000 ml in a volumetric flask.

Use of Filter Paper In the methods prescribed in this standard, relative numbers of what man filter these are commonly used. However, any other Chemicals we are used in

Table No-1 List of Chemicals

SR. NO	MATERIAL DISCRIPTION	Quantity / Unit
1	Nitric Acid	500 ml.
2	Silver Nitrate	10 Gram.
3	Ferric Alum	50 Gram
4	Nitrobenzene	500 ml.
5	Ammonium thiocyanate	250 Gram.

Data for Mix Proportioning

following data arc required for mix proportioning of a particular grade of concrete:

Grade designation:

Type of cement;

Maximum nominal size of aggregate;

Minimum cement content:

Maximum water-cement ratio;

Workability;

Exposure conditions as per Table 4 and Table 5

Maximum temperature of concrete at the time

Method of Tran sporting and placing;

Early age strength requirements, if required:

Type of aggregate;

Maximum cement content; and

Whether an ad mixture shall or shall not lx' used and the type of admixture and thecondition of use

Selection of mix proportions

Different cements, supplementary cementations materials and aggregates of differentmaximum size, grading, surface texture, shape and other characteristics may produce concretes of different compressive strength for the same free water cement ratio. Therefore.The relationship between strength and free water-cement ratio should preferably be established for the materials actually to be used. In the absence of such data, the preliminary free watercement ratio (by mass) corresponding to the target strength at 28 days may be selected from the established relationship, if available. Otherwise. The water-cement ratiogiven in Table 5 of IS 456 for respective environment exposure conditions may be used asstarting point.

Selection of Water Content

The water content of concrete is influenced by a number of factors, such as aggregate size,aggregate shape, aggregate texture, workability, water-cement ratio, cement and other supplementary cementations material type and content, chemical admixture and environmental conditions. An increase in aggregates size, a reduction in water-cement ratio and slump, and use of rounded aggregate and water reducing admixtures will reduce the water demand. On the other hand increased temperature, cement content, slump, water- cement ratio, aggregate angularity and a decrease in the proportion of the coarse aggregate to fine aggregate will increase water demand. The quantity of maximum mixing water perunit volume of concrete may be determined from Table 2. The water content in Table 2 is for angular coarse aggregate and for 25 to 50 mm slump range. The water estimate in Table2 can be reduced by approximately 10 kg for sub-angular aggregates, 20 kg for gravel with some crushed particles and 25 kg for rounded gravel to produce same workability. For the desired workability (other than 25 to 50 mm slump range), the required water content may be established by trial or an increase by about 3 percent for every additional 25 mm slump or alternatively by use of chemical admixtures conforming to IS 9103. This illustrates the need for trial batch testing of local materials as each

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aggregate source is different and can influence concrete properties differently. Water reducing admixtures or super plasticizing admixtures usually decrease water content by 5 to 10 percent and 20 percent and above respectively at appropriate dosages.

5. RESULTS

A=I STIPULATIONS FOR PROPORTIONING

1. Grade designation : M20
2. Type of cement : OPC 43 grade conforming to IS 8112
3. Maximum nominal size of aggregate : 20mm
4. Minimum cement content : 300 kg/m'
5. Maximum water-cement ratio : 0.55
6. Workability : 100 mm (slump)
7. Exposure condition : Mild (RCC IS 456:2000 Table No. 5)
8. Method of concrete placing : Pumping
9. Degree of supervision : Good
10. Type of aggregate : Crushed angular aggregate
11. Maximum cement content : 450 kg/m?

Preliminary investigation of natural aggregates

Various tests were carried out natural aggregates to study different physical properties there of

1. Fine aggregates (sand):

Locally available fine aggregates i.e. sand obtained from the nearby river of NASHIK was used.

The following necessary and important tests were carried out on sand

1. Specific gravity
2. Water absorption
3. Sieve analysis and fineness modulus. These tests were carried out as per the relevant IS code of practice. The test result indicated that, the sand was satisfying the requirement according IS code.The salt content and clay lumps were within the limits. Same sand was used throughout all concrete mix.

2. Coarse aggregate:

Coarse aggregate (natural aggregate) used was a crushed volcanic basalt rock. The following tests were carried out for the both natural and recycled coarse aggregates as per the procedure given is relevant IS code of practice

1. Sieve analysis and fineness modules
2. Specific gravity
3. Water absorption
4. Mechanical properties
5. The test result is described in the Table No. 2.2 and Table No. 2.3

Natural Aggregates:

Table 2.1: Properties of natural aggregates

Test	Result
Specific gravity	2.7
Water absorption	3.06%
Fineness modulus	3.09%
Aggregate crushing value	11.26%
Aggregate impact value	11.11%

Existing test methods for chloride penetration test:

1. AASHTO T259 (Salt Pounding Test)
2. Bulk Diffusion Test (Nordtest NTBuild 443)
3. AASHTO T277 (Rapid Chloride Permeability Test)
4. Electrical Migration Techniques

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5. Rapid Migration Test (CTH Test)
6. Resistivity Techniques
7. Pressure Penetration Techniques
8. Indirect Measurement Techniques
9. Sorptivity

Testing for accurate M20 Grade concrete Mixture

For accurate m20 grade concrete admixture we need to 3 test (T1, T2, T3) every test we have to cast 3 cubes of concert. The size of cube is 150x150x150mm and the ratio of cement, fine and coarse aggregate we used is as per the calculations of the following ratio.

Test No.	Concrete	Super plaster	Admixture
1	1	2.73	3.71
2	1	2.65	3.75
3	1	2.83	3.70

Calculations :

1: 2.73: 3.71

1 + 2.73 +3.71= 7.44

3 x (0.15)3 x 2580 = 26.12

Cement = 1 /7.44 x 26.12 = 3.5 x 1.15 = 4 kg

Fine aggregate = 4 x 2.73 = 10.92 kg

Coarse aggregate = 3.71 x 4 = 14.84 kg

Chemical admixture = 3 /100 x 4 = 0.12 kg

Water = 4 /0.58 = 6.80 kg

1: 2.65: 3.75

1 + 2.65 + 3.75 = 7.4 3 x (0.15)3 x 2580 = 26.12

Cement = 1 /7.4 x 26.12 = 3.52 x 1.15 = 4.128 kg

Fine aggregate = 4.128 x 2.65 = 10.93 kg

Coarse aggregate = 3.75 x 4.128 = 15.22 kg

Chemical admixture = 3 /100 x 4 = 0.12 kg

Water content = 4 /0.52 = 7.70 kg

1: 2.65: 3.75

1 + 2.65 + 3.75 = 7.4 3 x (0.15)3 x 2580 = 26.12

Cement = 1 /7.4 x 26.12 = 3.52 x 1.15 = 4.128 kg

Fine aggregate = 4.128 x 2.65 = 10.93 kg

Coarse aggregate = 3.75 x 4.128 = 15.22 kg

Chemical admixture = 3 /100 x 4 = 0.12 kg

Water content = 4 /0.52 = 7.70 kg

Testing for accurate M30 Grade concrete Mixture

As like m20 grade of concrete, for accurate m30 grade concrete admixture we need to 3 test (T1, T2, T3) every test we have to cast 3 cubes of concert. The size of cube is 150x150x150mm and the ratio of cement, fine and coarse aggregate we used is as per the calculations of the following ratio.

Test No.	Concrete	Super plaster	Admixture
1	1	2.36	3.45
2	1	2.45	3.60
3	1	2.30	3.40

Calculations

1: 2.36: 3.45

1 + 2.36 + 3.45 = 6.81

3 x (0.15)3 x 2580 = 26.12

Cement = 1/6.81 x 26.12 = 3.83 x 1.15 = 4.5 kg

Fine aggregate = 4.5 x 2.36 = 10.60 kg

Coarse aggregate = 3.45 x 4.5 = 15.5 kg

Chemical admixture = 3/100 x 4.5 = 0.135 kg

Water content = 4.5/0.45 = 10 kg

1: 2.45: 3.60

1 + 2.45 + 3.60 = 7.05

3 x (0.15)3 x 2580 = 26.12

Cement = 1/7.05 x 26.12 = 3.70 x 1.15 = 4.5 kg

Fine aggregate = 4.5 x 2.45 = 11.05 kg

Coarse aggregate = 4.5 x 3.60 = 16.2 kg

Chemical admixture = 3/100 x 4.5 = 0.135 kg

Water content = 4.5/0.42 = 10.71 kg

1: 2.30: 3.40

1 + 2.30 + 3.40 = 6.7

3 x (0.15)3 x 2580 = 26.12

Cement = 1/6.7 x 26.12 = 3.89 x 1.15 = 4.5 kg

Fine aggregate = 4.5 x 2.36 = 10.60 kg

Coarse aggregate = 3.45 x 4.5 = 15.5 kg

Chemical admixture = 3/100 x 4.5 = 0.135 kg

Water content = 4.5/0.45 = 10 kg

Amount of Material we used for accurate amount and ratio od m20 and m30 grade of concrete

1. Cement = 26 kg x 4 = 104 kg
2. Fine aggregate = 67 kg x 4 = 268 kg
3. Coarse aggregate = 92 x 4 = 368 kg
4. Chemical Admixture (Super plasticizer) = 0.765 kg x 4 = Approx 10 kg
5. Water content (distilled water) = 56 kg

For which the accurate M20 grade is used for final testing is when the ratio of load carried by the cube of concrete and strength is up to the 26.6 and for the M30 grade is to be close to the 38.25 All the cubes which are cast by the ratio and proper admixtures are placed under water for next 28 days curing in water to get maximum strength there were 3 cubes of test 1 M20, 3 are test 2 M20 and 3 cubes are of test 3 M20 as well there are more 3 cubes are of test 1 M30 and 3 are test 2 of M30 and 3 cubes are more of test 3 M30

M20		
Test 1	Test 2	Test 3
Cube 1	Cube 1	Cube 1
Cube 2	Cube 2	Cube 2
Cube 1	Cube 1	Cube 1

M30		
Test 1	Test 2	Test 3
Cube 1	Cube 1	Cube 1
Cube 2	Cube 2	Cube 2
Cube 3	Cube 3	Cube 3

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After 28 days of curing the cubes are placed under sunlight for up to the 2 hours until total water is evaporated. Weight all the cubes on weight machine, note down all the weight in book.After that to calculate the actual strength of the cube the (UTM) Universal Testing Machine is used. The cubes are placed in the machinery one by one and put pressure on it until the cubes getting cracks on surface, note down the strength of cube in KN this is used to calculate the ratio of load carried by the cube and strength of cube.

Grade	M20		
Test No.	Test 1	Test 2	Test 3
Cube 1	413 KN	477 KN	698 KN
Cube 2	450 KN	415 KN	570 KN
Cube 3	368 KN	341 KN	376 KN

Garde	M30		
Test No.	Test 1	Test 2	Test 3
Cube 1	1047 KN	403 KN	616 KN
Cube 2	774 KN	368 KN	829 KN
Cube 3	973 KN	410 KN	882 KN

Get the average of the weight of all cube of test 1, test 2 and test 3 of both m20 and 30 grade cubes 413+450+368 3

M20		
Test 1	Test 2	Test 3
410.33 KN	411 KN	548 KN

M30		
Test 1	Test 2	Test 3
931.33 KN	393.66 KN	775.67 KN

To calculate the accurate M20 grade and M30 grade the average weight or load is divided by the size of the cube

$$\frac{410.33}{0.150 \times 0.150 \times 0.150}$$

After calculating all the load the nearest to 26.6 and 38.25 is accurate grade of M20 and M30 respectively

Calculations

For M20

I. 410.33/0.150X0.150X0.150 = 61.5495 KN/M2

II. 411/0.150X0.150X0.150 = 61.54 KN/M2

III. 548/0.150X0.150X0.150 = 82.22 KN/M2

For M30

I. 931.33/0.150X0.150X0.150 = 139.69 KN/M2

II. 393.66/0.150X0.150X0.150 = 59.04 KN/M2

III. 775.67/0.150X0.150X0.150 = 116.35 KN/M2

All above calculations conclude that for penetration test on concrete Test 1 of m20 grade cubemixture is use and for m30 Test 2 cube mixture is use

6. CONCLUSION

First of all I chose a topic and it was called Study on behavior of chlorine effect to the concrete and behavior of bond stress of concrete. I have studied all the research papers related to that topic. I took the help of IS Code-14959 Part 2 (2001) and 10262 (2009) to check the concrete. A lot of information was obtained from it, which was useful for me to do my project. I was using some chemicals to test the concrete; I bought those chemicals from the market. With the help of those chemicals I was perform the test on concrete through which I am come to a conclusion.

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The conclusion is

1)Higher the grade of concrete and mixture higher the strength and durability of concrete in construction and vise versa

2) Sometimes chloride ions cause corrosion in steel which are used in construction as material with the concrete to prevent this chloride penetration test we done

3) High-volume fly ash replacing cement helps to improve the fluidity, volume stability, durability, and economy of concrete.

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