CHAPTER 2

LITERATURE REVIEW

2.1 GENERAL

All structures made up of concrete, steel and masonry undergo deterioration due to various elements present in the environment. This deterioration may occur due to weathering by wind, rain, snow and sunlight or by presence of environmental pollutants. The deterioration may also be caused by chemical or biological interactions or on account of thermal and mechanical stresses. These strains and stresses result in cracking and spalling of concrete structures. So the structural members do not have resistance to bending (i.e.) the flexural strength is decreased. This leads to the failure of the structure. This strength reduction has to be avoided. For increasing the flexural strength of the concrete various admixtures can be used. One of them is waterproofing admixture.

2.2 RESEARCH ON WATERPROOFING ADMIXTURES

Admixtures for use in concrete are defined in BS EN 206–1 as “material added during the mixing process of concrete in small quantities related to the mass of cement to modify the properties in the fresh or hardened state”. ACI Committee 515 defines waterproofing as a treatment of surface or a structure to prevent the passage of water under hydrostatic pressure and membrane waterproofing consists of surrounding the entire structure with a continuous barrier. Shetty (2000) clearly said that the waterproofing
admixtures are active pore fillers which make the concrete impervious increasing the strength of it.

Pradip Manjrekar and Rathi (2006) carried out some studies on waterproofing admixtures on concrete structures. In his paper he said that the superplasticizers generally work by giving better dispersion of cement and simultaneously reducing the surface tension of the water or aqueous phase. This results into better wetting and proper hydration at lesser water requirements. It was concluded that the addition of admixtures can offset various errors, increasing the possibility of producing concrete upto specifications. He also says that the waterproofing admixtures are pore filling and porosity reducing materials.

Asthana et al (2003) analysed about the problems and solutions for waterproofing in building. This paper says that one of the chronic problem in the construction industry is obtaining a defect free work, avoiding ingress of moisture in the buildings. If such seepage is allowed to continue, then unhygienic conditions will prevail and also the building may deteriorate to the extent that ultimately it becomes uninhabitable. In many cases the durability of the structure itself is seriously affected. Ingress of water or dampness or atmospheric pollution in the RCC structures results in corrosion of steel and spalling of concrete. It should be the deep of concern of every construction engineer to ensure that buildings are free from unwanted moisture or water. From that study it was observed that integral waterproofing admixtures fill up the pores in concrete preventing the passage of water into it thus increasing the strength and durability of concrete.

Raymond et al (2000) reported on concrete admixtures for waterproofing construction. In their paper, they reported that the integral waterproofing admixture is a combination of admixtures that have the ability
of producing concrete with reduced permeability. The presence of certain type of waterproofing admixtures, the surface of the concrete and the pores are coated with a layer of molecules in the case of steric acid and other fatty acids, or a layer of coalesced or separate particles of materials in the cases of waxes and bitumen. The addition of bituminous or wax emulsions to concrete results in colloidal particles collecting in the capillaries formed by bleed water. When subjected to water under pressure the emulsion particles are pushed into the capillaries to a point where they form a physical plug preventing further penetration. The effectiveness of such a system depends on the volume of the capillaries to be blocked and the amount of blocking materials added to the mix. From their study it was proclaimed that the use of waterproofing admixtures increase the strength of the concrete by reducing the pores. Many other engineers and researchers reveal that the waterproofing admixtures enhance the flexural strength of concrete and also modify many other properties of the concrete.

Effect of waterproofing admixture on the hydration of Portland cement was carried out by Mukesh Kumar et al (2000). In that study waterproofing agent with a brand name of KIM was used. Salient parameters such as standard water consistency, setting time, hydration process, non-evaporable water content, free lime availability, heat of hydration, water percolation, air content, compressive strength and microscopic observation were studied in that investigation. That particular admixture retarded the hydration process. In the presence of KIM, the setting time of cement was increased. Water percolation and expansion in the corrosive atmosphere are reduced whereas the compressive strength at 28 days was increased. Since the pores are blocked, the durability properties were also improved by the addition of waterproofing admixture. Hence finally it was concluded in that study that KIM was a good waterproofing admixture.
Oxygen diffusion through hydrophobic cement based materials was performed by Tittarelli et al (2009). In that investigation, the oxygen diffusion co-efficient through hydrophobic cement based materials fully immersed in water was determined by potentiostatic measurements on concrete. From the investigation, it was found that very high oxygen diffusion is occurred through cement paste, mortar and concrete made with hydrophobic admixture as opposed to negligible diffusion through the reference mortar without admixture. Also it was concluded that oxygen dissolved in water directly diffuses as a gaseous phase through the empty pores of a hydrophobic cement matrix.

Kulkarni et al (1999) reported that admixtures have become an integral part of concrete mix design undoubtedly increases the durability of concrete. The admixtures are added basically to modify the properties of concrete. Their primary function is to improve the workability of concrete at low water cement ratios. They may be added to perform other functions also like retard the setting time or accelerate the setting time, air entrainment, improve cohesion etc. This is due to positive factors such as reduction in the water-cement ratio, increase in compressive strength, reduction in cement consumption, increase in slump and workability etc. The main role of admixture in enhancing durability is by producing good workable and cohesive concrete, which can be easily placed and compacted in position. They also pointed out that basically admixtures consists of several dispersing agents like various types of lignosulphonates, naphthalene sulphonates and melamine formaldehyde etc.

Shoya et al (1992) reported that one kind of water repellent admixture incorporating highly reactive silica powder was examined to confirm its effect on various concrete properties. The concept is not only to prevent water penetration due to water repellency provided by the siloxane
compound but also to compensate for the hindered hydration due to its absorption to cement particles by the use of highly reactive pozzolanic material. To study the effect of water repellent admixture with concrete, they have been conducted various tests such as setting time test, bleeding test, strength test, permeability test, freezing and thawing resistance test, drying shrinkage test and carbonation test. The dosage of water repellent admixture used in their experimental study was 1.50% to 3.0%. They have concluded the following statements such as that the addition of water repellent admixture decreases the setting and bleeding of concrete. It improves the water permeability without the lowering of compressive strength and also decreased the shrinkage strain. The use water repellent admixture was judged promising for the improvement of concrete performance.

Srinivasa Reddy (2000) presented a paper about elastomeric cementitious coatings for waterproofing and concrete protection. It deals about the importance of waterproofing of roof slabs, basements, floors, terrace gardens, sunken slabs etc. These are the major challenge to the Civil Engineers. Poor quality of waterproofing not only causes inconvenience to the occupants but also reduces the durability of structures by way of corrosion of rebars. Waterproofing like any other aspect of the construction engineering needs to be understood, analysed and designed for a suitable system on a case to case basis, before implementation through experienced professional applicators.

Early performance of structural concrete slabs treated with a hydrophobic admixture was carried out by Cusson et al (2005). Early stage results of the performance of reinforced concrete parking carriage slabs were carried out. Part of garage was rebuilt with a hydrophobic concrete to reduce shrinkage and delay in corrosion of the embedded reinforcement. From this field performance of concrete slabs and ramps, it was concluded that the use
of hydrophobic admixture had minimal effect on slump, shrinkage and compressive strength. Also it was reported that interactions with air-entraining agents seemed to reduce air-entraining effectiveness and freeze-thaw resistance. Drying shrinkage is occurred similarly in the control with hydrophobic concrete.

Effect of addition of admixtures on chloride and water ingress into concrete was carried out by Wee (2000). This work contained a study of the influence of various transport properties upon the movement of chloride and water in concrete mixes containing a proprietary hydrophobic admixture, silica fume and blast-furnace slag. For chloride ingress, experiments carried out included immersion, rapid chloride permeability, salt ponding as well as wetting and drying tests. For water movement, the properties examined included permeability, absorption, sorptivity, desorptivity, water vapour diffusion, moisture flow and wick action. From the extensive experimental works, it was concluded that the hydrophobic admixture significantly reduced water and chloride transport into the concrete.

Jayasree et al (2011) summarized in their paper that the current knowledge in the scientific community about the interaction between cement and high range water reducing admixture or superplasticisers. They have stated that the cement-superplasticiser interaction in concrete is a complex blend of chemical and physical mechanisms that are interdependent. The complicated nature of the problem prevents the development of simple solutions to address the field related issues of application of superplasticisers. Studies on cement-water reducer interactions limited to the workability evaluation of concretes containing these chemicals, in specific regions where rapid slump loss has been observed in concreting operations. There have not been any investigations to understand the physio-chemical nature of this interaction. There is a distinct need for the characterization of cement and
admixture properties, in order to understand the nature of their interactions. Moreover wide range of cement used, varying transportation durations and climatic conditions necessitate more fundamental studied that could explain the mechanisms of interaction and help establish methods for identifying incompatibility in practical solutions.

2.3 RESEARCH ON POLYMER BASED SUPERPLASTICIZERS

Victor Pachade (2009) in his paper said that Polymers have been used as additives in cement mortars and concrete since the 1920s when natural rubber latex was added to road paving materials. Since then there has been a considerable development of polymer modification for cement and concrete. Polymer modification of cement mortar and concrete noticeably improves the application and performance characteristics. These property advancements include easier handling, better finishing, higher strength and adhesion and increased durability.

Ata et al (2000) in Geo Technical Testing Journal said in their paper that interface shear tests were performed in the laboratory to investigate the shear resistance between soil and a cement mortar interface after exposing the interface to high-molecular-weight polymer slurry. Two soil types were tested: stiff silty clay and medium-dense sand. Results show that for curing periods of 7 days the interface shear resistance was 28-46% higher when exposed to the polymer slurry relative to the interface shear strength of the standard unexposed samples. The ability of the polymer slurry to penetrate and stretch through the pores of silty clay and dense sandy soils is demonstrated using scanning electron microscopy. Exposing the outside surface of cement mortar specimens to the polymer slurry for 14 days caused pitting of the mortar surface, which explains the increased interface shear resistance between the soil and the cement mortar after exposure to polymer slurry.
Chong Yoon et al (1999) in their paper said that Ordinary Portland Cement mixed with various amounts of absorbent polymer in the form of sodium acrylate (\((-\text{CH}_2\)\(-\))\text{nCOONa})). As the content of absorbent polymer is increased, heat evolution of samples decreased up to 1.15% absorbent polymer addition and conversely increased over 1.75%. Flexural strength of cement paste with absorbent polymer was improved more than 20%. As the content of absorbent polymer is increased, the porosity values decreased and mean pore diameter shifted to small pore diameter region. Flexural strength of ordinary Portland cement paste had a linear correlation with non-evaporable water content but, that of cement paste with absorbent polymer deviated from a linear correlation with non-evaporable water content. The chemical difference between cement pastes with and without absorbent polymer was found by the inductively coupled plasma-atomic emission spectroscopy and the infrared spectroscopy. For the infrared spectra of absorbent polymer, bands at 1416 and 1560 cm\(^{-1}\) were assigned to C-O single bond and C=O double bond respectively, namely, unidentate complex. As the curing time being increased, the absorption bands near 1416 cm\(^{-1}\) shifted to longer wave number and the absorption bands near 1560 cm\(^{-1}\) to shorter wave number and finally bidentate complex was formed. Absorbent polymer released sodium ions to pore solution under the basic condition of pH 12.5-13.5 and became polyacrylic acid. Then some of these polyacrylic acids were cross linked with others by calcium ions leached from cement grains. Calcium ion was regarded as a central charge connecting the negative parts in carbon-oxygen polarization of absorbent polymer’s functional groups.

### 2.4 RESEARCH ON CORROSION OF REINFORCED CEMENT CONCRETE

Agarwal (2001) presented a work on developments in waterproofing of buildings. In this work the details of Integral waterproofers
and waterproofing coatings on buildings was studied and reported that the water repellents or hydrophobers are generally soaps - water soluble and sulphonium salts fatty acids, butyl stearate and selected petroleum products like mineral oil, waxes and emulsified asphalts etc. The chemicals in such waterproofers form a thin hydrophobic layer within the network of cement mass by coating the cement particles. Corrosion is controlled by using waterproofing admixture in concrete and coatings to reinforced steels. Waterproofing admixture is used to make the concrete hydrophobic and the organic paint coating in reinforced steel is used to prevent the formation of electrochemical cells on the metal surface.

Shri Ram Chaurasia (2001), in his paper said about the influence of water on concrete and the remedial measures. The deterioration of concrete falls into two categories. First one is the chemical or physical deterioration of the concrete itself and the second one is corrosion of the reinforcement. Yet moisture remains a common factor for the above deterioration. The chemical or physical deterioration of the concrete occurs due to sulphate attack, freezing/thawing damage, alkali-silica reaction, salt crystallisation, salt sealing, high alumina cement conversion etc. Corrosion of reinforcement occurs due to chloride ingress, carbonation, resistivity, gas diffusion etc. One of the main objectives of the controlling the ingress of water into concrete must be to try and achieve a steady and uniform state of moisture in the concrete, particularly as far as corrosion is concerned. He has conducted water absorption test for plain concrete and reinforced concrete to calculate the water absorption co-efficient.

Tang Yu Ming et al (2008) said in their paper that the hardened cement paste and simulated concrete pore solution were prepared, and the effects of naphthalene based chemical added in the simulated concrete pore solution and hardened cement paste on the corrosion behavior of reinforcing
steels was studied. Results show that naphthalene based chemicals can slightly accelerate the corrosion of the reinforcing steel in the simulated concrete pore solution. However, the addition of the naphthalene reduces water content up to 0.50% in hardened cement paste led to a decrease of the corrosion rate of the reinforcing steel and the anti-rusting ability of naphthalene waterproofer for the reinforcing steel increased with increasing time. The reasons may be that the introduction of naphthalene based chemical contributed to reduced amount of pores and increased the density of the hardened cement paste, hence inhibiting the corrosion of the reinforcing steel.

Yamada et al (2001) said that it is important to understand the interaction mechanism between cements and superplasticizers is important to control the fluidity of concrete. In their study, the interaction mechanism between Portland cement and superplasticizers of poly naphthalene sulfonate and polycarboxylate were studied from the viewpoints of polymer adsorption on cement particles and solution chemistry. Two parameters are proposed in order to represent the performance of superplasticizers. Cement paste shows fluidity over a critical dosage of superplasticizers that depends on the combination of cement and superplasticizers. The fluidity of paste increases proportionally to the superplasticizers dosage over critical dosage. They defined the inclination of the line as the dispersing ability. From the results of regression analysis with cement characteristics, critical dosage shows a positive correlation with the hydration activity of cement dispersing ability shows a negative correlation with the sulfate ion concentration in the cement paste. Adsorption measurements of naphthalene sulfonate and superplasticizers make it clear that the sulfate ion in aqueous phase acts as a competitive adsorbate for naphthalene sulfonate and polycarboxylate. The mechanism of the dependence of fluidity on time is also discussed. This discussion is based on the data of surface area of cement hydrates and the sulfate ion concentration in cement paste.
A technical paper was presented by Chowdhry (2004) on strategies for resisting corrosion of reinforcement in concrete. In this paper the author stressed the importance of corrosion effect and the civil engineers refocus in corrosion reduction. Different products and technologies are available in the journal NBM & CW for corrosion reduction.

Hattori (1979) has investigated the corrosion of reinforcement in superplasticized concrete. In his investigation, a series of reinforced concrete piles of 300 mm outer diameter, 70mm wall thickness and 2300mm in length were prepared. The effect of three types of admixtures including a superplasticizer was investigated. The reinforcement consists of four steel bars. The piles were exposed to water for one year and left outdoor for four years. At the end of this period, the reinforcing rods were taken out for evaluation of rusting. He concluded that the incorporation of naphthalene based superplasticizer in concrete does not lead to any significant rust formation on reinforcement.

Concrete Admixtures Handbook by Ramachandran (1995) said that higher workability of concrete containing a superplasticizer is maintained for about 30-60 min, after which the slump value decreases. The factors that determine slump loss are type and amount of superplasticizer, type and amount of cement, time and addition of superplasticizer, humidity, temperature etc. In the period during which slump loss is occurring, the $C_3A$ reacts with gypsum. The extent of reaction of $C_3A$ and gypsum and the crystalline form of the product could have an important effect on the workability of concrete.

Axim Concrete Technologies manufactures a product called Catexol 1000R.H.E (Non chloride accelerating admixture) and Catexol 900 H.E (accelerating and water reducing admixture). Catexol 1000 is recommended where acceleration of setting reduced bleeding and segregation,
great impermeability, durability and strengths are desired. Catexol 900 is designed to accelerate setting of concrete, and provides high early and ultimate strength. By the use of this admixture, increased workability, finishability, pumping, strength and durability and reduced segregation and permeability are achieved the recommended dosage is 1000-2000 ml per 100 kg of cement.

2.5 RESEARCH ON VARIOUS STRENGTH TESTS

Srinivasa Rao and Saravana (2005) reported in their paper about the relation between splitting tensile strength and compressive strength since concrete is widely used structural material which is subjected to compressive strength and tensile strength. The direct tension test, the beam for modulus of rupture test, and the split cylinders test called Brazilian test are the three kinds of tests that have been used for finding the tensile strength. They have tested for the curing period of 7 days and 28 days. They have concluded that the ratio of the splitting tensile strength to the compressive strength of concrete decreases as the compressive strength increases. The splitting tensile strength increases more slowly than the compressive strength so that the ratio of splitting tensile strength to compressive strength decreases with time. They have proposed some relations between compressive and tensile strength for all ages of concrete.

Chemrouk and Hamrat (1984) proposed various relationships between compressive strength, split tensile strength, modulus of elasticity and poison’s ratio for concrete with superplasticizers (High performance concrete). In his paper the author’s models is compared with various models namely French code BAEL 91, ACI (318-92) and Yaya Diata and these models give better predictions with the experimental results.
In the brittle material concrete, where there is little redistribution of stresses the direct tensile test usually results in under estimation of tensile strength. The under estimation of stress arises from the difficulties in ensuring that the applied load is truly axial. This is because of the development of minute invisible micro cracks, the load act first crack is difficult to establish. The ultimate load used in estimating the modulus of rupture is therefore not the same as the loads in which cracking first occur. Because of this fact the non linearity of the stress strain curve for concrete in tension, the modulus of rupture has been found to over estimate the tensile strength of concrete. It is pointed out that the concrete is very weak in tension, the direct tension test strength being only about 7 to 15% of the compressive strength.

It is difficult to perform the direct tension test on a concrete specimen as it requires a purely axial tensile force to be applied free of any secondary stresses and the grip of the testing machine. Hence indirect tension tests are carried among the indirect tests, cylindrically splitting test is favoured. An accurate prediction of tensile strength of concrete will help in mitigating cracking problems which improve the strength prediction, and minimizes the failure of concrete in tension.

Prakash and Patil (2005) pointed out that the compressive strength of concrete is the most important and significant property of concrete. The tensile strength of concrete depends on flexural strength and split tensile strength. The cracks due to deflection are developed by flexural strength of concrete and cracks due to shrinkage are due to split tensile strength of concrete. This shrinkage is an inherent property of concrete which influences its shrinkage characteristics. Due to this effect the volume changes occur. Excessive volume change is detrimental to concrete. They have carried out the shrinkage test on slabs of size 300mmx500mm with and without admixture for the curing period of 7 days, 27 days. Cracks are thus formed,
which is a weakening factor that may affect the ability of concrete to withstand its design loads. It also may seriously detract from durability and its appearance. To prevent this type of problem in concrete, integral waterproofing admixtures conforming to IS 2645 is used in this study.

Kamran and Nemati (2000) discussed in their paper that the relationship between the compressive strength and modulus of elasticity of high-strength concrete. The modulus of elasticity of concrete is frequently expressed in terms of compressive strength. While many empirical equations for predicting the modulus of elasticity have been proposed by many investigators, few equations are considered to cover all the data because the mechanical properties of concrete are highly dependent on the properties and proportions of binders and aggregates. More than 3,000 data points, obtained by many investigators using various materials, on the relationship between compressive strength and modulus of elasticity were collected and analyzed statistically. The compressive strength of investigated concretes ranged from 20 to 160 MPa. As a result, a practical and universal equation is proposed that takes into consideration, types of coarse aggregates and mineral admixtures.

2.6 RESEARCH ON PERMEABILITY OF CONCRETE

Nevillie (2000) said in his book Concrete technology and Practice under the heading ‘Permeability and Absorption’ about admixtures like waterproofing agents are sold for use as admixtures to improve the water tightness of concrete. Many of them produce lime soaps which form hydrophobic or water repellent linings in the pores of the concrete. Water repellent compounds consist of butyl, aluminium, calcium, or ammonium soap of the fatty acid type, e.g., stearate and oleates. The amount of active constituent used being about 0.40% (e.g., butyl stearate) by weight of cement, bituminous and wax emulsions are sometimes incorporated in these
compounds. These components are known for their plasticising effect and hence the quantity of mixing water should be reduced. The best use of water repellent compounds appears to be in walls, slabs, and sections that are not subjected to tension or hydrostatic pressure and where vapourproofness is not required.

Performance and compatibility of permeability reducing and other chemical admixtures were carried on Concrete by Robert et al (1999). A sustainable research program was undertaken to determine the benefits resulting from the use of permeability reducing admixture as integral components of concrete required to demonstrate superior durability in aggressive environment. In that investigation, conventional concretes which contained commercial water reducing admixture, different types of supplementary cementitious materials and permeability reducing admixtures at various dosages. Both the plastic and hardened state properties such as setting time, strength, drying shrinkage, chloride resistance and sulphate resistance were assessed and found improvement in all the parameters. They have concluded that the impermeability characterization and various strength of concrete is increased by the addition of chemical admixtures.

Ravi Kumar (2005) said that mineral admixtures are compatible with all types of cements that are available in the market. They are used for making high performance concrete and under water concreting. Since the addition of commercial mineral admixtures which are react with the hydrated particles of cement and forms the hydrophobic film on the aggregate media. Hence the pores are blocked and give a resistance to penetration. Because of the reducing pores, a dense concrete mass is developed with high strength.
2.7 RESEARCH ON DRYING SHRINKAGE OF CONCRETE

Tareq Salih Al-Attar (2008) in his paper on “Effect of Coarse Aggregate Characteristics on Drying Shrinkage of Concrete” said that Concrete is a composite material, consisting, mainly, of three phases: coarse aggregate, cement mortar and the interface zone between them. The characteristics of the interface zone largely govern the bond between cement paste or mortar and aggregate. The restraining effect of aggregate to drying shrinkage strain depends much on the bond between aggregate and cement paste. In this paper, it is aimed to investigate the effect of coarse aggregate characteristics that affect bond strength, such as type, shape, surface texture and moisture content, on drying shrinkage is investigated. Four types of coarse aggregate were used. Three of them were normal-weight, while the fourth was a light-weight one. Each type of coarse aggregate was used with two moisture conditions, dry and saturated. The testing program extended to 150-days age and comprised of length change, modulus of elasticity, compressive and splitting tensile strength of concrete. It is concluded that using saturated coarse aggregate always yields higher shrinkage strain than dry aggregate. The percentage increase seems to be affected by the aggregate water absorption at the early ages. After 28 days, there are large differences in relative shrinkage for different mixes. Later than 28 days, the variation in ratios settled to approximately fixed values.

2.8 RESEARCH ON ACID RESISTANCE OF CONCRETE

Ward and Malisch (2000) published an article titled “Using admixture to improve chemical resistance of concrete”. They reported that if concrete will be exposed to aggressive chemicals in a natural or an industrial environment, the role of admixtures are significant. Chemical attack almost occurs when the chemicals are in solution. Because these solutions can deeply penetrate the concrete, production of high quality, low permeability is the first
line of defense. Crack control is also an important defensive measure to limit internal exposure of concrete to aggressive chemicals. The degree to which lowered permeability improves concrete service life in an aggressive chemical environment depend largely on the type of chemical and its concentration. They also reported that the acid attack concrete by dissolving cement hydration products or through acid–base chemical reactions. Calcium hydroxide the reaction product that is most readily dissolved is attacked even by mild or low concentration acid solutions. Stronger and more concentrated acids attack all calcium silicate hydrates. Because no Portland cement concrete is totally immune to acid attack, admixtures can be used only to slow the rate of deterioration. Water reducing admixtures including superplasticizers reduce the water cement ratio and thus permeability. Reducing concrete permeability with water reducers, pozzolans or both increases resistance to chemical attack. However in some chemical exposures, even highly dosed concrete deteriorates rapidly so that the high dosage rates provides no measurable benefit.

Ramachandran (2001) said that the loss of durability by the attack of aggressive chemicals can be either due to the destructive internal expansion caused by chemical reactions in the paste or by both combined actions. Deletarious chemicals such as acid solutions can react with Ca(OH)_2 to form water soluble salts that can leach out of the concrete hence increasing the permeability of the concrete thus aggravating attack by increased and faster ingress of harmful chemicals, sulfates can react with Ca(OH)_2 to form calcium sulfoaluminate that can cause swelling and internal disruption of concrete.

2.9 RESEARCH ON CHLORIDE PENETRATION TEST IN CONCRETE

A rapid test method developed by Whiting (1990) has widely been used in the United States and Canada. According to this test method, the
chloride ion penetrability of latex modified concrete is determined by the total charge passed through the specimens and evaluated by the required chloride ion penetrability ratings. The test method has recently been published as ASTM C 1202. Five types of latex modified concrete with a polymer-cement ratio of 15% is adopted to evaluate the chloride ion penetration. This experimental investigation says that the latex modified concrete minimize the chloride ion penetration into them compared with the conventional concrete.

One of the popular methods of determining the permeability of chloride is the rapid test prescribed by ASTM C 1202-91 and AASHTO T277. It takes the current measures upto 6 hours. Recent work by Feldman et al (1993) has suggested that this test induces changes in the pore structure and resistivity of the concrete specimens. They found that the determination of the instantaneous current provides reliable data on chloride permeation.