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Evaluation of Corrosion Problem in Concrete Foundations

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ABSTRACT

In this paper, it has been tried to use methods and studies that have been carried out by experts and according to the empirical experiments carried out a concrete beam working- place in regional electricity company to provide methods that can be used to construct the concrete foundations that they reinforced by using type 2 cement against atmospheric and chemical agents.

Keywords: *Concrete Foundations; Chemical Agents; Atmospheric; Reinforced*

DESCRIPTION

The working-places for producing concrete beams in the regional power company produce 18 to 20 thousand concrete foundations in different lengths (9,12 and14 meters) and different tensile strengths (200,400 and 800 kilograms) are the main supply center of concrete foundations of distribution networks (Nobakht, S.Q and Zarif Atefi M.E. 1993).

Corrosion is a main component in the weakening of reinforced concrete constructions. To reduce this issue, steel bars can be substituted with glass-fiber-reinforced-polymer bars. But, the shortage of flexibility of glass-fiber-reinforced-polymer-reinforced concrete components has prohibited their application in many construction usages, particularly in seismic zones. In the route of their duty course, concrete constructions are exhibited to a diversity of effects. Composition of the show to assertive results, poorly built building components, carelessness of the permanence problems, building errors and underestimation of the significance of preservation can lead to the intense detriment of reinforced concrete which is applied for the building of these constructions. The reinforced concrete loss problems can be distributed into concrete harm and reinforcement loss. Some of the attacking results which can have an effect on the reinforced concrete bases, and which can be affected by soil, groundwater or weather. Fig 1. Shows Concrete depreciation affected by frost proceeding (Zoran Bonić, Gordana Topličić Ćurčić, et al. 2015). Fig 2. Shows Deprivation of concrete triggered by the tree roots and flora (Zoran Bonić, Gordana Topličić Ćurčić, et al. 2015).

Fig1. *Concrete depreciation affected by frost proceeding (Zoran Bonić, Gordana Topličić Ćurčić, et al. 2015).*

Fig2. *Deprivation of concrete triggered by the tree roots and flora (Zoran Bonić, Gordana Topličić Ćurčić, et al. 2015).*

The activity of these working-places is often based on the experience gained from many years of work that was carried out by the working-place manager and supervisors. Due to variety of raw materials that enter the working-places and the working-place officials are forced to carry out empirical experiments to obtain the strength and quality. Often, these experiments are based on a weak scientific basis. On the other hand, due to the different geographical conditions (climate, atmospheric conditions….) in the area it is necessary to perform basic production operations in such a way to coordinate with each geographical region. But since the raw materials come to working-place without regard to this, measures must be taken to ensure that even the required qualities are obtained elsewhere (Nobakht, S.Q and Zarif Atefi M.E. 1993).

The most important issue in this regard is the severe corrosion of the soils of southern of area which severely invade concrete foundations so that the useful life of the bases in some cases is reduced to less than half. These effects are so severe that they are not solved by the use of concrete made of type 2 cement that resistant to corrosion and chemical reactions. Also, despite severe regional and desert winds the chemical strength of network strongly depends on the strength of concrete in the base. Even the concrete made of cement 5 cannot answer it either (Nobakht, S.Q and Zarif Atefi M.E. 1993). Fig 3. Shows Deprivation by the aggregate development paving the way to the further concrete deprivation (Zoran Bonić, Gordana Topličić Ćurčić, et al. 2015). Fig 4. Shows Concrete degradation caused by crystallization of road defrosting salt (Zoran Bonić, Gordana Topličić Ćurčić, et al. 2015). Fig 5. Displays Concrete carbonation paved the system for frost accomplishment (Zoran Bonić, Gordana Topličić Ćurčić, et al. 2015). Fig 6. Shows Displays Leached salts and minerals on the concrete external (Zoran Bonić, Gordana Topličić Ćurčić, et al. 2015). Fig 7. Shows Expansion of erosion of a reinforcement bar in concrete (Zoran Bonić, Gordana Topličić Ćurčić, et al. 2015). Fig 8. Shows Reinforcement erosion of the construction sections in contact with soil (Zoran Bonić, Gordana Topličić Ćurčić, et al. 2015).

The available knowledge in building and facility of reinforced concrete constructions displays that there are many issues triggering severe harm, and often, compromising the enduring volume of constructions. The explanations for this should be required in the project of the construction or of its interface with soil, then in deteriorating to instrument the needed class of concrete, in unskilled building of structural components completed of reinforced concrete, etc. Often the reasons for construction detriment are connected to reinforced concrete bases. Most mostly, it is the inaccurate evaluation of moisture and water results on bases soil and Concrete of the bases. The detriment of concrete and reinforcement in concrete modifies the permanence and enduring capability of bases.

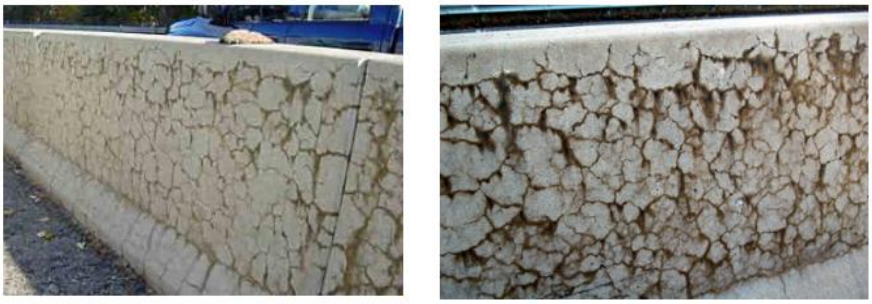

Fig3. *Deprivation by the aggregate development paving the way to the further concrete deprivation (Zoran Bonić, Gordana Topličić Ćurčić, et al. 2015).*

Fig4. *Concrete degradation caused by crystallization of road defrosting salt (Zoran Bonić, Gordana Topličić Ćurčić, et al. 2015).*

Fig5. *Concrete carbonation paved the system for frost accomplishment (Zoran Bonić, Gordana Topličić Ćurčić, et al. 2015).*

Fig6. *Leached salts and minerals on concrete external (Zoran Bonić, Gordana Topličić Ćurčić, et al. 2015).*

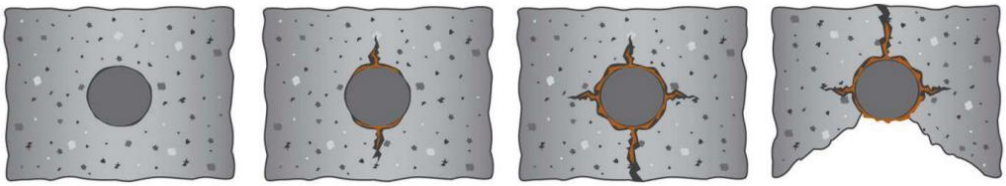

Fig7. *Expansion of erosion of a reinforcement bar in concrete (Zoran Bonić, Gordana Topličić Ćurčić, et al. 2015).*

Fig8. *Reinforcement erosion of the construction sections in contact with soil (Zoran Bonić, Gordana Topličić Ćurčić, et al. 2015).*

The issues which may happen on the built as well as substantial assets which must be prepared for the maintenances, specify that concrete and reinforcement as the material for building of the reinforced concrete constructions should be compensated due consideration, particularly when they are visible to destructive ecological properties. It is a tendency to attribute excessive importance to the plan of concrete combinations with distinct belongings so that they are best appropriate to the situation in which the construction is situated, thus enlightening the strength of constructions.

A construction constructed of reinforced concrete can during its task period be encountered to different offensive results. which can lead to the detriment. These impressions can begin in the surrounding or be connected to the application of the construction. They can be categorized into three fundamental categories: systemic, organic and Chemic results.

The most severe form of the physical impression conducting to concrete deprivation is frost accomplishment. Specifically, water which is reserved in holes and crashes restrictions in low temperatures and disclosures concrete to often very high compressions. Damaging frost achievement in the basis engineering is most regularly prohibited by the appropriate range of base depth, building of the gravel layer below the bases, building of the appropriate drainage and building of acceptable moist and water insulation of the sections of the structures which are in the land.

Check the quality of concrete foundations:

In order to evaluate the quality of concrete foundations it is necessary first to analyze the raw materials of the constituent (Nobakht, S.Q and Zarif Atefi M.E. 1993).

The other methods of physical deprivation of concrete and concrete constructions are connected to the onset of fractures owing to reduction, temperature differences and owing to diverse thermal development of the aggregate and cement rock etc. Furthermore, one should indication more than the concrete attitude capability and cyclic loading and unloading of the construction which reasons onset of fracures and paves the way for other violent results. The chemic results creating concrete depreciation are usually effects which are a result of chemic responses of offensive composites from the constructed surrounding and the components of the cement rock themselves.

Cement

Portland cement is produced from clinker milling which includes hydraulic calcium silicates and usually contains one or more types of calcium sulfate that they add during clinker milling (Nobakht, S.Q and Zarif Atefi M.E. 1993).

Materials used in cement should have a good proportion of lime, iron, silica and aluminum.

Solidification time of the concrete is adjusted after converting the material into a clinker or adding lime or anhydride.

Admixtures are now an essential portion of respectable concreting exercise besides preparing the means of spreading the presentation of concretes, mortars, renders and grouts. Admixtures over the last 10 years have experienced important variations in relative to both constituents' kinds and the usages to which they are put. Nanotechnology is one of the greatest dynamic investigation zones that include an amount of corrections concluding civil engineering and building materials. In today's life, though operation of cement founded materials shows a dynamic role in the substructure expansion, it is contaminating the situation by producing CO_2. Depend on this opinion, investigators have been following to progress original or substitute material towards a green and maintainable explanation. It is determined that the improved considerate and engineering of multifaceted construction of cement-based material at nano-level will certainly consequence in an original group of building materials with improved features, viz., stability and toughness. Presently, the most dynamic investigation zones dealing with cement and concrete are: considerate of the hydration of cement elements and the usage of nano-size elements. Concrete knowledge is a multidisciplinary zone of investigation where nanotechnology possibly proposals the chance to improve the thoughtful of concrete performance, to engineer its features and to lower construction and environmental price of building materials.

Portland cement

Portland cement has four main components as follows (Nobakht, S.Q and Zarif Atefi M.E. 1993):

- tri-calcium silicate: 3Cao, Sio_2 = C3s
- di-calcium silicate: 2Cao, Sio_2 = C2s

- tri-calcium aluminate:3Cao, Al_2O_3 = C3A
- tetra-calcium aluminate ferrit:4Cao, Al_2O_3, Fe_2O_3=C4AF
  - Tri-calcium silicate makes the cement rapidly harden and the solidification time and initial resistance is further attributed to this compound.
  - Di-calcium silicate causes the cement to slowly harden and further affects the strength after 7 days.
  - Tri-calcium aluminate causes the cement to release a lot of heat during the first few days. This compound has a small effect on initial resistance. The lack of this material in cement leads to resistance against soil and water containing sulfates.
  - Tetra-calcium aluminous ferrite reduces the clinker temperature. This compound is used as a lubricant for clinker baking.

The tests carried out at beam working-place on concrete made of type5 and type2 cement have following results (Nobakht, S.Q and Zarif Atefi M.E. 1993):

- For displacement of concrete made from type2 cement at least 48 hours are needed to do this without cracking in concrete. in the case of concrete with same aggregate and type5 cement it takes at least 72 hours.
- Based on worksheets available to working-place supervisors concrete beam made of type2 cement after 28 days obtains approximately 95% of its final strength and it ready for use. However, concrete beams made of type5 cement come to this state after 42 days. It is necessary to explain that remaining 5% is achieved by reaching the total final strength slowly over a long period of time (about 90 to 100 years) in which case concrete converted into rock.

The marketplace portion of diverse kinds of mixed cements is growing year by year. Usually, mixed cements are ground to advanced quality and display a slower expansion of mechanical features contrasted to Normal Portland Cement, which might modify the concrete efficiency in terms of contraction cracking at primary ages. Concretes completed of more sensitive cement, in specific with advanced clinker content, are less disposed to plastic contraction fracturing. The stability features of cement concrete applying squeezed rock sand is better and homogeneous to the normal concrete. compressed stone dust can be applied as promptly existing solid waste as an another to normal sand in cement concrete building work and it can decrease the value of material and building value and can assist to remake the problems of the surrounding. Calcium sulfoaluminate cement can be applied in concrete as another binder, as full or sectional substitution of Portland cement. This provides decreasing CO_2 discharges from cement generation and suggests other benefits, e.g. fast gain of mechanical features. brucite nano-fiber is provided and applied as reinforcement to amend the hardness of road cement concrete substance. Nano-fiber concrete has a powerful capacity to withstand dry shrinkage, freeze-thaw detriment, thermal development and bending tiredness compressions. Nano-fiber concrete is generally better to usual fiber concrete and simple concrete in value proficiency.

2-effective solutions to increase the physical and chemical resistance of concrete:

Today, in addition to the main constituents of concrete (aggregates, cement and water) other materials used in concrete are generally referred to as secondary materials. These materials are used in two ways (Nobakht, S.Q and Zarif Atefi M.E. 1993):

- Improving the quality of concrete such as improving the psychological state and performance of concrete, raising strength of concrete, increase the final resistance of concrete to frost and other climate and atmospheric factor.
- Reducing the inadequacy of concrete such as reducing permeability and so on.

Some secondary materials such as paste-producing materials or materials are affective in solidifying improve or change the natural properties of concrete through a physical or chemical effect. But they themselves do not directly play a role in that characteristic. These materials are called additives. Some other materials directly play a role in characteristic. These are included: steel fibers, asbestos fibers and colors which they call subsidiary materials. The additives are divided into three categories (Nobakht, S.Q and Zarif Atefi M.E. 1993):

- Certain materials or detonators:

In a very low amount (less than 5% of the weight of the cement) added to concrete during mixing. Due to low weight, the calculations are not included.

- Additives:

They are substances with small grains which are added significantly and limited to concrete mixture during mixing and are being investigated in the calculations. Volcanic ashes are among these materials (Nobakht, S.Q and Zarif Atefi M.E. 1993).

- Various materials added to the cement in the factory. These materials play a role in concrete rather than additives or certain substances such as slags. The effect of additives on fresh and hardened concrete is different. This effect on concrete or fresh slurry includes increasing the efficiency of concrete without increasing water, improving pumping capacity and so on. Also this effect on concrete with mortar and tight slurry included increase the tensile, flexural and compression strength increased durability and reduced fluid permeability, prevent corrosion of metals in soil, improved shock and abrasive resistance, control of expansion caused by alkaline reactions. In beam working-places in area the powdered material is used that called malmant. This substance was used as additive and its role was to increase lubrication without increasing water. This material increased the final strength of concrete by 1.5 times (Nobakht, S.Q and Zarif Atefi M.E. 1993).

As you can see, cement growth does not always increase concrete strength. But in a particular state it reaches its maximum. But as the imprisoned air and the amount of water mixed in the unit volume of cement is reduced the compressive strength of concrete will be increase. Therefore, additives that affect the reduction of mixing water will increase the compressive strength of concrete by themselves (malment effect).

Water-reducing additives include various compounds of organic matter that the most common of these are calcium, sodium or ammonium legnosulfanates. In general, to increase cement performance (deposition of molds in concrete) the water should be increased which reduces the strength of concrete. By using effective factor in reducing water using water to increase the efficiency has positive effect on concrete. finally, it can be mentioned that the use of water-reducing additives leads to an increase in the lack of permeability of concrete against water and chemical solutions. As a results the durability of concrete increase against freezing, melting and penetration of water, oxygen, carbon dioxide and other in appropriate factors (Nobakht, S.Q and Zarif Atefi M.E. 1993).

Concrete carbonation is observed as a important reason of reinforcement erosion in structures. a greater carbonation depth in the concrete triggered more concrete mounting, and that sulfate crystals were also recognized in the carbonated concrete. Owing to their vulnerability to carbonation, mixed concretes comprising fly ash and slag displayed more scaling than Portland concrete. So, the "physical sulfate occurrence on concrete" can be more precisely defined as the "physical sulfate occurrence on carbonated concrete." There is presently a dearth of data on the permanence of two-stage concrete to physical and chemical sulfate disposal. Two-stage concrete alters from usual concrete in many procedures containing its assignment method, high aggregate constituents and the application of very flowable grout. Concrete is the furthermost extensively applied building material gained after the situation of the combination collected development and fine aggregates, cement and water. The key features of concrete are defined by the superiority and features of aggregates, w/c proportion, and the consistency of combination compression. Slag also integrates to improve the routine and maintenance of the concrete combinations. The hemp fibers were partly decomposed within the concrete after being warmed; therefore, dissipated hemp fibers could decrease fracture ratio at high temperatures thus amending the fire persistence of concrete. Use of microbial persuaded calcium carbonate rainfall through the biomineralization procedure has been examined as a new procedure in amending stability features of concrete. Concrete is an integrally tough element. The problem of maintenance is also inseparably connected with that of toughness, and this is now one of the main apprehensions of the cement and concrete productions. Industrial solid losses are making intense environmental issues, but the issue can be dominated by reusing them as building materials. Anyway, of the kind and quantity of solid losses materials, the substitutions of cement by solid losses materials show an established effect on the sulfate offensive persistence. Thus, maintainable concrete including solid losses materials can not only help the reprocessing of solid losses but also prepare high sulfate attack persistence. The accumulation of metalized plastic waste into the

conservative concrete can spread a dual advantage of decreased dangers on the situation and enhanced mechanical and toughness features of concrete. Cyclical thermal loads practiced in facility by castable obstinate concrete often reason tiredness catastrophe. The option of terminative time can affect salt scaling persistence by modifying friction persistence of concrete combinations.

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