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Causes of deterioration of concrete structures pdf

 It is important to identify these defects in time and plan appropriate repair strategies. In this article, I'll look at some of the most well-known mechanisms for deterioration. In doing so, I focused on the Ontario Structure Inspection Guide (OSIM, 2008). I also found this publication of the Portland Cement Association very helpful. The deterioration of concrete Before I begin this review, I would like to mention the definition of the following two terms under OSIM (2008): Defect: identifiable, undesirable conditions that were not part of the original design intention. Deterioration: A defect that occurred over a period of time Various defects can be involved in the deterioration of any given structure. The next review provides a brief summary of the most common defects observed in existing structures. Typically, one or more of these defects can be seen in structures; so you need to identify them correctly. You need to understand these different defects correctly in order to get a more realistic assessment of the structure. 1- SCALING Scaling refers to the loss of the surface part of the concrete (or solution) as a result of freezing and thawing (OSIM, 2008). It is a physical action that usually leaves the units clearly exposed. (PCA, 2001). Scaling occurs when hydraulic pressure from freezing water in concrete exceeds the stretching strength of concrete. Scaling is more common in non-air-entrained concrete, but can also occur in air-entrained concrete in a fully saturated state. 2- DISINTEGRATION Disintegration is a physical deterioration (such as scaling) or the destruction of concrete into small fragments or particles. It usually starts as a scaling. It can also be caused by icing chemicals, sulfates, chlorides or frost action. 3- ERATION erosion is the deterioration of the concrete surface as a result of particles in the moving water cleaning surface. When the concrete surface is exposed to water sand and gravel, the surface deteriorates as a result of cleaning particles from surfaces. Floating ice particles can also cause a problem. This is an indicator of the poor durability of concrete for this particular impact. 4- CORROSION OF REINFORCEMENT Corrosion is the wear of steel fittings in concrete. Corrosion can be caused by chloride or carbonation. Teh can lead to cracks in the concrete lid, devinination in concrete decks, etc. When the concentration of chloride ions above the surface of the rebar reaches the threshold (namely the amount needed to break the passive film) corrosion begins. 5- DELAMINATION Delamination is defined as a rupture of surface concrete that is essentially separated but not completely separated from the concrete below or above it. (OSIM, 2008). Delamination often identifies a hollow sound by tapping or chain dragging a concrete surface. Corrosion of the rebar and subsequent cracking of the lid can lead to delamination. When the rebar has a short distance, the cracking extends in the rebar plane parallel to the outer surface of the concrete. 6- Spalling Spalling can be considered an extended delamination. In fact, when the case continues, the concrete fragments are separated from the larger concrete mass. If the case is not restored in time, the progress of damage as a result of external loads, corrosion, freezing and thawing can break the delaminateed parts. 7- ALKALI-AGGREGATE REACTIONS This is an internal cracking of the concrete mass as a result of a chemical reaction between the lye in cement and silica in the aggregates. AAR/ASR cracking is very famous for its cracked patterns. The alkaline in cement can react with active silica in the aggregates to form swelling gel. When this gel absorbs water, it expands, and puts pressure on the environment, making the concrete crack. 8- CRACKING CONCRETE crack is a linear fracture in concrete that extends partially or completely through the penis. Some people believe that concrete is born with cracks; that its ingredients, and how it is produced - from the batch of the plant to the pouring, setting and treatment - depends on so many factors that cracking concrete doesn't come as a big surprise; and pretty much that may be true. Cracking concrete can occur at different stages: This can happen before the concrete hardens, and it can occur in an old concrete structure: Before the settlement within the concrete mass of plastic shrinkage after shrinkage shrinkage shrinkage of the thermal reduction Subgrade settlement Source: For effective evaluation, planning, preparation To execute a successful repair, protection and strengthening strategy (RPS) for concrete and/or masonry, it is important to understand the root cause of deterioration. Understanding the maintenance conditions of the design and meeting the relevant product (s) performance requirements will ensure a long-term repair tailored to the owner's specific needs. The two main factors influencing performance are that placement status problems associated with specific failures may be the result of a combination of placement and/or maintenance status issues. Cracking, spalling, leaking, premature or excessive wear, scaling, settling, deviating, and decaying are examples of conditions that lead to a particular failure. Understanding these failure modes and their root causes is necessary to develop a successful repair strategy. When planning an RPS strategy for deteriorated concrete, it is necessary to consider and consider the following factors in maintenance: Environmental conditions Chemical impact of water and mobile properties of debris (strength, type, unit, etc.) Proper specific placement is necessary not only to meet the design and maintenance requirements of the structure, but also to reduce the possibility of premature deterioration and shortening of lifespan. Identifying defects during the RPS project assessment phase is essential to develop an appropriate repair plan to address the specific cause of the damaged concrete. One of the most common defects of concrete is cracking. Cracking can be caused by insufficient substrate or preparation of subbase, high water-to-cement ratio, inadequate treatment methods, poor concrete consolidation, timing of control joints and many other placement factors. Cracking can also be caused by design-related issues such as insufficient reinforcement or insufficient distance between control and joints. Excess water increases the ratio of concrete between water and cement and improves efficiency; however, this advantage is not without cost. Additional water eventually evaporates during hydration (treatment), leaving a porous network of capillary voids and lower overall strength. Excess water can also lead to segregation or deposition by large units at the bottom of the matrix, which will reduce structural capacity and increase the likelihood of cracking. Proper treatment involves maintaining adequate moisture and temperature in freshly applied concrete to ensure full hydration (treatment) of cement, while concrete develops its intended strength structure. Lack of moisture stops the hydration process, which can lead to a decrease in strength. A rapid loss of moisture freshly kning out concrete can also lead to plastic shrinkage cracks that have occasional small cracks on Concrete. Bad consolidation may be the result of incorrect vibration and/or poor mix design. If If not fully consolidated around the strengthening steel, project power may not be achieved, and cracking can result. Concrete is also expanding and contracts with temperature changes. When these compression forces exceed the strength of the concrete, cracking can occur. To influence where this cracking will occur, the control joints are installed, but the design and timing of the joint installation management are vital to their effectiveness. Strengthening steel (rebar) is used to increase the strength of concrete. When the strenuous forces acting on a particular element exceed its outstretched strength, a crack may occur. Strengthening steel controls the width of the crack and can prevent the element from completely failing. Common placement problems with a specific cause: Capture air bubbles on a formed concrete surface. Effect: uneven concrete surface, increased porosity due to increased surface area and poor appearance. Reason: Incorrect consolidation between large aggregates and cement solution during the placement process creates large voids in the concrete. Effect: Reducing strength and increasing the potential for water intrusion, corrosion of strengthening steel and reduced abrasion resistance. Reason: Incorrect consolidation of concrete due to lack of vibration or incorrect mix design. Effect: Reduced strength and increased potential for water intrusion, corrosion of strengthening steel and reduced abrasion resistance. Reason: Delays in the placement of concrete, where the initial lifting of the concrete hardens before subsequent lifts are placed, leading to a visible line and substandard communication between the layers. Effect: Invasion water through a cold joint and corrosion of fortifying steel. The state of service issues general maintenance problems with specific causes: chloride intrusion, oxygen and water exposure, corrosive chemical environment, strengthening steel environment, drop in alkalinity, incorrect placement or concrete coating of steel rebar (rebar). Effects: Corrosion and subsequent expansion of strengthening steel leads to cracking and flushing, reducing the structural capacity of the concrete. The use of low-water-to-cement concrete and the proper placement of adequate concrete fittings are common measures used to prevent metal corrosion. Causes: Water-rich concrete, combined with the temperature of cycling above and below 32 degrees Fahrenheit (0 degrees Celsius). Effects: Concrete absorbs water into the pores. When the water in the pores freezes, it expands, causing scaling and de-vination. High-sound concrete structure blends that include air-entraining impurities give the best protection against freezing-thaw damage. Specialized coatings and water repellents are also widely used for absorbing water and preventing damage from freezing the thaw. Causes: Exposure to acid rain, de-icing salts, chemicals in operation and natural sulfates in soils and groundwater dissolves cement cement cement which leads to cumulative losses. Effects: Loss of concrete coating and subsequent corrosion of strengthening steel. Assessing the potential impact before construction or repair can prevent premature deterioration. Specific types of cement, water repellent sealants or chemically resistant barrier coatings are common preventive measures to protect concrete from chemical attack. Reason: The chemical reaction between the alkaline in cement and the high silica content of the unit forms a gel around the unit, preventing a proper connection between the unit and the cement. Effects: The gel expands in the presence of water, creating tension cracks around the surface of the unit and delaminations. Surface cracking contributes to water intrusion, which can lead to metal corrosion and spalling. Careful selection of aggregates and consideration of silica content can help prevent alkaline cumulative reactions. Causes: Airborne or water debris moving on a concrete surface. Consequences: Progressive loss of section can lead to insufficient concrete coatings and corrosion of reinforcement steel, reducing structural power. High strength, dense concrete and special abrasions of resistant coatings are the most effective means to prevent erosion and abrasions. Abrasion. causes of deterioration of concrete structures ppt. physical and chemical causes of deterioration of concrete structures. physical causes of deterioration of concrete structures. causes of deterioration of concrete structures pdf