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Research on a Network Algorithm for Crack Detection in Concrete Structures

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Abstract

With the development of the national construction industry, the requirements for building materials are getting higher and higher. Among them, concrete, as the main building material, not only requires strong firmness, but also has the characteristics of condensability, high flow and high durability. And pay attention to the cost of construction and the convenience of maintenance. Concrete is mainly composed of cement, sand, aggregate and mixed water additives. The quality of the materials used to configure the concrete is unqualified, which may cause cracks in the structure. The gravel particle size is too small, the gradation is poor and the porosity is large. This will increase the amount of cement and mixing water, affect the strength of the concrete and increase the shrinkage of the concrete. If you use ultra-fine sand that exceeds the regulations, the consequences will be more serious. The high content of mica in sand and gravel will weaken the bond between cement and aggregate and reduce the strength of concrete. The use of seawater or spring water containing alkali to mix concrete, or the use of additives containing alkali may have an impact on the alkali aggregate reaction. It is extremely important to detect cracks, which is helpful to realize its rapid control

Keywords: *Concrete, Structure, Crack;*

1. Introduction

Concrete is one of the most widely used materials in modern construction projects. The quality of concrete directly affects the strength, rigidity and durability of structures. Studies have shown that concrete is composed of coarse and fine aggregates, cement matrix and transition zones in various regions. The service performance of concrete structures is mainly related to the internal structure after setting and hardening. According to experimental results and engineering examples, the mechanical properties of the transition zone of each interface of concrete are the worst and the most prone to damage. The excessive interface bonding strength determines the mechanics of the structure. Performance, bonding strength of the interface and selected materials, construction environment, construction process, etc. It can be seen from the above that in the actual construction process, the mechanical properties of structures are not only related to the diversity of materials and the complexity of construction.

2. Overview of concrete

2.1. Concrete analysis

In order to improve the performance of fresh concrete, concrete admixtures are usually added before or during concrete mixing. Admixtures are auxiliary materials to improve the quality of

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concrete and their effects are different depending on their types. The functions of ordinary water-reducing agents, superplasticizers and high-performance water-reducing agents have the following aspects: they can well strengthen fresh concrete The ease of pouring and cohesion; saving the amount of cement, when the concrete slump is constant, the use of admixtures can well increase its strength and reduce costs; increase the durability of concrete, in the amount of cement and concrete slump When the temperature is constant, the water reducing agent can improve the durability of concrete, thereby enhancing the strength of concrete and increasing the service life of the building; increasing the fluidity of concrete, the use of water reducing agent can be used when the water consumption of cement and concrete is constant. It enhances its fluidity well, makes it easier to mix the concrete evenly and is more convenient for pouring and construction. The concrete industrial system is in the figure below.

Figure1 Concrete industrial system.

2.2. Improvement of concrete properties

Water reducing agent is used to improve concrete performance. The water reducing agent is used for concrete mixing, which can change the air content of the concrete and greatly reduce the crack rate inside the concrete. The influence of water-reducing agent on the fluidity of concrete is usually reflected in the numerical value of slump. When the ratio of water to cement used in concrete remains unchanged, the collapse of concrete can be greatly improved by adding precipitation agent.

Air-entraining admixture is used to improve concrete performance. Adding a certain proportion of air-entraining admixture to concrete can produce many independent bubbles inside the concrete. These bubbles can improve the soluble properties of concrete, increase the slump of concrete and reduce its bleeding. Regarding the addition of air-entraining agent, the setting time of concrete can be controlled through scientific proportion of addition control. Air-entraining agents can also reduce the strength of concrete under certain conditions, causing precipitation and increasing the strength of concrete.

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This is mainly caused by the formation of many bubbles inside the concrete. This requires that the use of air-entraining admixtures should be clearly selected according to different concrete performance requirements. The concrete management system is in the figure below.

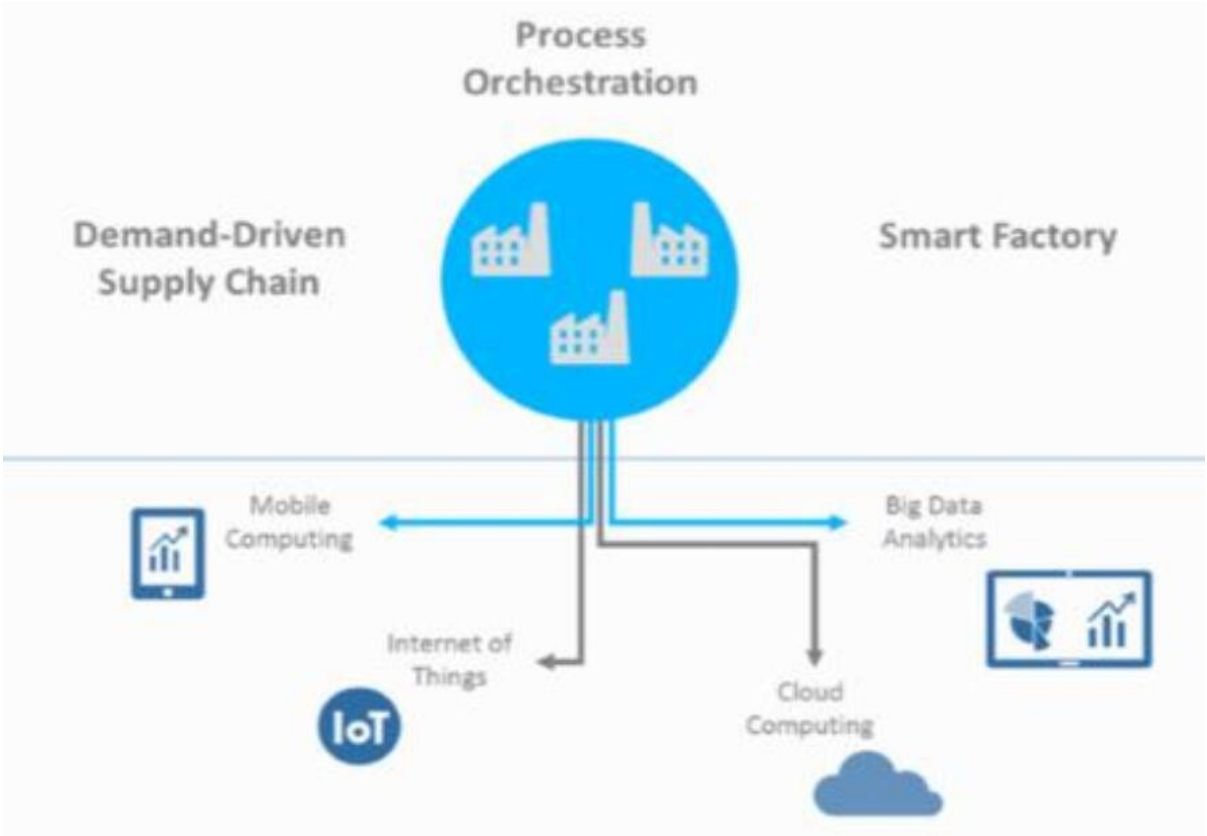

Figure2 Concrete management system.

Improvements in energy saving. The traditional way of using concrete cannot save the consumption, which is not conducive to the control of construction costs. Through the use of concrete admixtures, the improvement of various properties of concrete has been realized and the amount of concrete used can be reduced to a certain extent. This is conducive to the development of concrete energy-saving performance[1]. For example, in the construction of a certain project, if the concrete performance is improved through certain specific energy c3s, c3a, etc., using mineral slag as part of the raw material can reduce the amount of concrete while ensuring the stability of the concrete. , While reducing the weight of the concrete itself. The concrete system is in the figure below.

Figure3. Concrete system.

3. Concrete structure crack detection

3.1. Causes of cracks

First of all, because concrete itself has certain

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properties such as crack resistance, impermeability, frost resistance and corrosion resistance, it has been recognized by relevant personnel in the construction industry and is widely used in the construction industry. However, due to the unique shrinkage and deformation characteristics of concrete itself, the phenomenon of shrinkage deformation appears in the early stage of concrete engineering and finally cracks appear in the concrete.Secondly, concrete is often affected by external factors during the actual construction process, such as natural environment, climate environment and other factors. There is a certain difference in the temperature difference between the morning and the night of the concrete project during the construction operation, which leads to the gradual increase of the concrete tensile strength and causes the large area of the concrete project to crack[2]. Thirdly, during the construction process of the concrete project, the construction and pouring time of the side wall and the bottom plate is relatively long. In other words, the concrete of the side wall has already been poured during the concrete pouring construction work of the bottom plate and the shrinkage and deformation of the substrate are basically completed, which leads The side wall of the construction project has a stress concentration phenomenon under the restraint of the bottom plate, which eventually causes cracks in the concrete project.Finally, during the actual construction work of concrete, the construction work must be carried out in strict accordance with the operating specifications. Once the construction operation links are deviated, the concrete project is very likely to crack. It can be seen that in the process of concrete pouring, it is particularly important to use effective prevention methods to avoid cracks in concrete projects. The concrete control system is in the figure below.

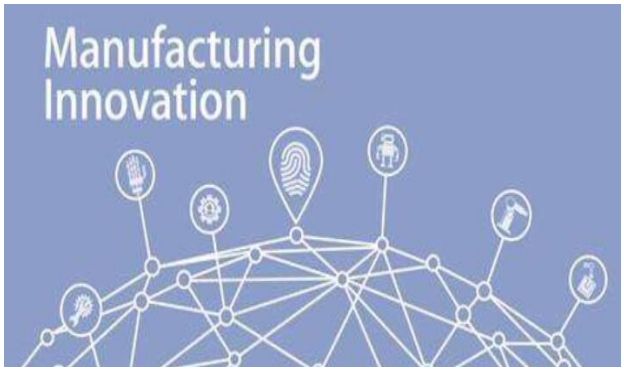

Figure4. Concrete control system.

3.2. Crack form

The occurrence of cracks is not just a reason, such as improper operation of the construction personnel during the construction process, or problems in the building maintenance afterwards. The main reason for the cracks is that the concrete structure is not well maintained and maintained in the later construction, which leads to the omission of cracks. In concrete structural engineering, the most common form of cracks is dry and wet cracks composed of multiple materials. Concrete pouring completed the concrete structure project. In this process, the addition of water is inevitable. After the concrete is poured, the water in the concrete should be able to evaporate slowly. But in actual operation, due to the contact of sunlight and air, the concrete structure cannot evaporate excess water[3]. However, compared with the outside world, the internal moisture evaporation rate is slower, which leads to a certain difference in internal and external moisture evaporation. Therefore, the internal and external tensile forces are significantly different, which will cause dry and wet cracks. Generally speaking, dry and wet cracks appear in groups, which seriously affect the beauty and quality of buildings. The main cause of chemical cracks is the concrete itself, its chemical composition is very unstable, but the real reason for the unstable chemical composition of concrete is still in the construction process. When pouring building components, workers should mix on-site, which requires high concrete quality. When

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mixing concrete, if the mix ratio is deviated, chemical cracks will appear. Compared with dry and wet cracks, most chemical cracks expand longitudinally, because the concrete mix is not right and long-term mixing will produce specific chemical ions, which will affect the concrete structure and make the concrete structure loose. It will not only affect the quality of project construction, but also make it unstable. The concrete supply system is in the figure below.

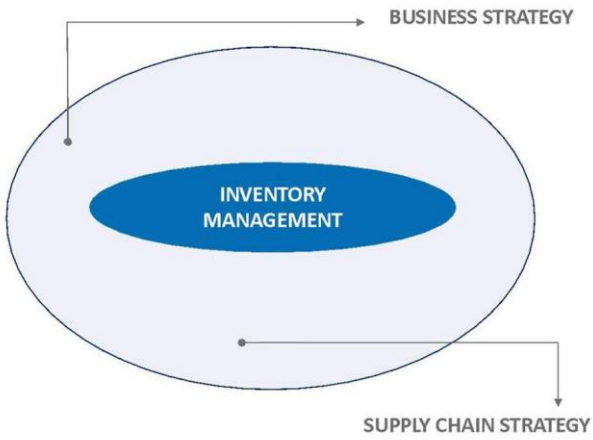

Figure5. Concrete supply system.

4. Network algorithm for crack detection

4.1. Detection network algorithm

The rebound detection method uses a rebound tester as the test tool and then the concrete is tested by the rebound tester. When testing, multiple measurements should be carried out and then the obtained data should be averaged to calculate the strength of concrete of different enterprises. The team members are required to use the instruments scientifically and not to try blindly. At present, people often adopt the combined detection method of ultrasonic method and rebound method, which not only improves the accuracy of the detection result, but also overcomes the disadvantage that some parts cannot be sampled. The ultrasonic method can not only measure the compressive strength of concrete, but also detect the internal structural defects of concrete. Therefore, combining the two is the most commonly used and most accurate method for testing. When using the core drilling method to detect concrete, first select representative concrete blocks and drill core samples at the most characteristic locations[4]. When sampling, you must first be familiar with the design drawings, open the embedded pipeline position and the main components, when drilling the core, control the drilling speed to ensure the integrity of the core sample and make a position record and code for the core sample. , Reasonable placement to avoid chaos causing damage, affecting the subsequent evaluation and analysis work of the inspectors and the accuracy of the concrete inspection data. Finally, it is necessary to repair the hole in the drilling hole in time. The core-drilling method can not only detect the strength of concrete structures, but also modify the conversion value of concrete compressive strength. The data is more accurate and it also responds to the cracks and holes inside the structure to a certain extent, but its engineering destructive power is greater than other methods[5]. It is easy to cause certain safety hazards.

4.2. Prevention strategy

In order to effectively reduce the occurrence of cracks in concrete projects, ensure that the water consumption remains unchanged during the concrete mixing process and then select a suitable expansion agent to mix it, so as to effectively control the water glue in the concrete and ensure the dry shrinkage of the concrete . After many tests, it has been shown that a highly effective anti-cracking agent has very different effects due to temperature differences. It can be seen that when concrete projects are constructed in different seasons, the proportion of expansion agent used is also very different and appropriate adjustments need to be made in accordance with the climate and temperature. In the whole process of concrete construction, it is an effective way to prevent cracks in concrete when choosing a reasonable concrete construction technology. Under normal circumstances, during the

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construction of concrete in summer, it is necessary to select the time period with the lowest temperature for concrete pouring, while the concrete construction operation in winter is the opposite of summer and the time period with the highest temperature is selected for concrete construction operation; protection of reinforced concrete The thickness of the layer is designed reasonably to ensure that the surface of the protective layer cracks. In addition, when concrete is constructed in summer, cold water is selected for concrete mixing and when concrete is mixed in winter, hot water is required for concrete mixing[6]. The concrete machine system is in the figure below.

Figure6. Concrete machine system.

5. Conclusion

It can be seen from actual engineering that the reasons that affect the service life of concrete structures are very complex and it is not possible to draw a conclusion by studying only one influencing factor, but a single deterioration factor is the basis for studying multiple complex deterioration factors, although the influence of a single deterioration factor has been achieved Some achievements have been made, but it should be further studied to provide experimental data for multiple coupling effects. In addition, all experiments in the laboratory are based on set experimental conditions and there is still a big gap between the uncontrollable external influences of the actual project at all times and it cannot fully simulate the complex environment and forces encountered by time structures during service. Therefore, how to set the experimental process and influencing factors so that the experimental results can be more accurate and closer to reality. This is also the content of further research.

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