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Research on the Detection Countermeasures of Building Concrete Raw Materials

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Abstract: The quality of concrete directly determines the quality, service life and safety of the building, so it is necessary to use concrete materials of excellent quality and performance in the building construction process. In addition to the production process of concrete, which directly affects its performance, the influence of raw materials is very significant. Nowadays, the production process has become more standardised and mechanised, so special attention needs to be paid to the influence of raw materials in the process of making concrete.Based on this, the article will focus on the analysis of countermeasures for the testing of raw materials for construction concrete. By the testing of raw materials, the selection of more suitable raw materials for making concrete, helps to improve the strength and quality of the concrete.The article begins with an analysis of the key points of concrete raw material testing, analysing the considerations in the selection and testing of fly ash, water, stone, cement, sand and admixtures; then analyses several methods of testing raw materials for construction concrete, such as backfill method, ultra-deep rebound synthesis method, post-loading pull-out method and core drilling method, which have their own advantages and disadvantages and need to be selected reasonably according to the testing requirements; finally proposes a few measures to increase the quality of construction concrete.

Keywords: Concrete; Raw materials; Testing

Today, concrete has a very wide range of applications in the construction industry and directly determines the quality and safety performance of buildings, so the quality requirements for concrete are more stringent. The main constituent materials of plain concrete are cement, sand, gravel, water, fly ash and other raw materials, and it is a synthetic man-made stone [1].A very important evaluation indicator in concrete is the strength grade. In general, the strength grade of concrete is divides into 14 grades, with the lowest grade being C15 and the highest being C80, with a strength grade set at 5 unit intervals between 15 and 80 [2-3].

In the raw materials for construction concrete, the aggregates are stone and sand, which mainly act as a skeleton. The cement and water are then mixed to form a cement slurry.When these materials are put together and mixed, the cement slurry comes into full contact with the skeleton and then fills the gaps between the skeletons, making the whole structure more homogeneous and delicate, moreover, the cement slurry has the additional function of acting as a lubricant, thus facilitating the

construction process [4]. when the whole structure has hardened, the cement mortar is able to provide some support and the concrete has a certain strength. Concrete in such a formation process, in which the quality and performance of raw materials directly determines the strength and quality of concrete, so it is very important to choose the most suitable raw materials, and so the raw materials need to be tested [5]. The article will focus on the analysis of countermeasures for the testing of raw materials for architectural concrete, with the aim of improving the quality of architectural concrete.

1. Key Points for Testing Raw Materials For Construction Concrete

1.1. Key Points for Testing Fly Ash

The different strength grade of the concrete requires different quality of fly ash. In addition, in the process of producing fly ash, there is variability in its quality due to different manufacturers and origins. Therefore, in the process of using fly ash, the fly ash needs to be tested according to the requirements of the concrete, and the testing process should be carried out in strict accordance with the relevant standards and specifications. For ordinary concrete, the fly ash used in it can be divided into three grades, namely Grade I, Grade II and Grade III [6]. When testing fly ash, one of the most important parameters to be tested is ignition loss, because this parameter is used as an important indicator for the quality classification of fly ash and it also affects the suitability of the gel material and admixture [7]. Of course other parameters of fly ash, such as fineness, water demand ratio, sulphur trioxide content, free calcium oxide, etc., need to be tested, and these parameters should not be ignored, as they also affect the quality and utilization of fly ash to a certain extent [8].In addition, attention needs to be paid to differentiating Class F and Class C fly ash in the testing process. The differentiation process requires a comprehensive examination of various parameters, not just in terms of colour, but also in terms of concrete mix tests if necessary. Some power plants treat fly ash emissions for denitrification or desulphurisation, with the aim of meeting environmental requirements. However, this kind of fly ash cannot be used in concrete and will seriously affect the quality of the concrete. Therefore, during use, user needs to be able to distinguish whether the fly ash has been desulphurised or denitrified, and if anomalies are found, qualitative tests should be required and then stop using that type of fly ash.

1.2. Key Points for Testing Cement

Cement plays a major role in concrete and can affect the safety and stability of a building. The use of cement needs to be strictly tested and the most suitable cement used as a raw material for concrete to improve the quality and strength of the concrete. The main points of testing cement are:

First of all, in the process of purchasing cement, choosing manufacturers with a good reputation and a complete quality assurance system for the purchase. When purchasing, manufacturers need to be able to provide relevant certificates of conformity, inspection reports and other materials, and then keep them for the record. When manufacturers have these materials, they are able to ensure that the quality of that cement is up to standard. In order to obtain a cement with better value for money, several cements that meet the criteria can be compared and then a cement with better strength, admixture suitability, stability and other parameters can be selected. To gain a more accurate understanding of the characteristics of each cement, concrete trial tests can be carried out and the quality of each concrete can then be analyzed to select the most suitable cement as a concrete component. Finally, incoming cement needs to be marked and sampled, each batch sampled and tested in accordance with national specifications and standards, and the results should be stored in case there are problems with the cement, which can be used as a reference basis.

1.3. Key Points for Testing Stones

The choice of stone in the raw materials for building concrete must meet the quality requirements. Therefore, in carrying out the selection process, attention needs to be paid to the following points of testing.

The first preliminary judgement of the quality of the stone is made by testing the stone's needles, crushing value, clay content, grading and clod content. The first preliminary judgement of the quality of the stone is made by testing the stone's needle flakes,

crushing value, clay content, grading and clod content. Second,It is important to note that during the testing process, samples of stones need to be taken on a random basis, otherwise the samples taken will be inappropriate and lead to a misjudgement of the quality of the stones. A random sample of stones from the same manufacturer is also required, as the quality of stones from the same batch and the same manufacturer can vary considerably, so stones should not be taken from the same location when sampling. Finally, when testing the stone for various indicators, it cannot be assumed that the quality of the stone is good just because the mud content, crushing value and mud lump content are in line with the standards, but also that the testing of its grading and needle flake is important. This is because these two parameters have a direct impact on the water retention, compatibility, strength and other properties of the concrete to a certain extent.Therefore, when testing stones, the various influencing parameters should be taken into account.

1.4. Key Points for Sand Testing

As an important raw material for building concrete, sand with a fineness modulus of between 2.3 and 3.0 is preferred in the selection process, as it is more conducive to improving the strength and quality of the concrete, etc. Then it is also necessary to make the other parameters of the sand comply with the specifications, such as the clay content and clod content of the sand, according to the requirements of the strength class of the concrete. Then it is also necessary to make the other parameters of the sand comply with the specifications, such as the mud content and clod content of the sand, according to the requirements of the strength class of the concrete. For certain concrete with special requirements, the various parameters of the sand will be more strict. In addition, it should be noted that when controlling the gradation of the sand, it is necessary to make the amount of 0.315 mm sieve not less than 15%, because if this value is relatively low, it is easy to cause poor water retention of the concrete, and will also cause the phenomenon of pumping blockage, that is, it will seriously affect the pumpability of the concrete [9]. For some areas, mixed sands are used in large quantities, as natural sand resources are scarce, but it should be noted that the clod content and mud content of the mixed sand do not exceed that of any one type of sand. The stone dust content also needs to be controlled to prevent this value from exceeding the specification, and before this, the methylene blue value needs to be tested before the stone dust content can be determined.

1.5. Key Points For Water Testing

In general, the quality of water used in construction concrete is not very demanding and generally daily drinking water meets the requirements of concrete water quality. Water testing is only necessary in exceptional circumstances, such as when there is a severe shortage of drinking water or no drinking water at certain construction sites and other water is used instead. Water, as one of the necessary materials for concrete, can seriously affect the flow of construction concrete if there are too many impurities in it, so it is very necessary to test the water quality. The quality requirements for water used in construction concrete should meet certain requirements, as shown in **Table 1.** Once testing of the water has been completed, if the water is found not to meet regulatory standards, there are two ways to resolve the situation. One of the simplest ways is to abandon the use of this water source and use another type of water that meets the water quality requirements as a raw material for concrete. The second way is to purify the water that does not meet the standard requirements until it is ready for use. Both of these two solutions have their advantages and disadvantages, so the actual construction work needs to be taken into account in the selection process.

Table 1. Requirements for Water Quality in Concrete

Items	Prestressed Concrete	Reinforced Concrete	Plain Concrete
pH Value	>4.5	>4.5	>4.5
Insoluble Matter-mg/L	<2000	<2000	<5000
Soluble Matter-mg/L	<2000	<5000	<10000
Chloride(caculated by Cl^-)-mg/L	<500	<1000	<3500
Sulphate(caculated by SO_4^{2-})-mg/L	<600	<2000	<2700
Alkali Content(caculated by equivalent Na_2O)-mg/L	<1500	<1500	<1500

1.6. Key Points For Testing External Additives

There are more types of admixtures, and the performance varies greatly, so when choosing an admixture, the user needs to choose according to the construction requirements and engineering design. In order to choose a more suitable admixture, the user also needs to experiment and technical and economic comparison of several admixtures. In the process

of selecting admixtures, admixtures that will cause pollution to the environment or harm to humans should not be used as raw materials for concrete. When admixtures are added to concrete, their suitability to the cement needs to be tested. In general, when adding admixtures to concrete, the cement is preferably silicate cement, slag silicate cement, ordinary silicate cement, composite silicate cement, etc., because these cements and admixtures have better adaptability. The admixtures added to the concrete also have to meet the relevant specification requirements. In order to make the performance of admixture concrete more excellent, it needs to be tested, pay attention to compatibility, test the impact on the performance of concrete, in the testing process need to be based on construction conditions and relevant specifications for experiments, so as to get a more suitable admixture. The admixtures supplied by the supplier also need to have various relevant documents, such as product descriptions, test reports, main ingredients and certificates of conformity.

Pumping agents are very common and heavily used admixtures in construction concrete. When testing this admixture, it is necessary to check not only its pH, slump increase, density and slump loss, but also whether the admixture has a good compatibility with the cement. This is because in actual projects there are more serious safety accidents due to the poor adaptation of cement and admixtures. Therefore, in order to avoid accidents, the raw materials consistent with the actual project will be experimented with and tested in various ways. It is possible to guarantee the high quality of the concrete used.

There are many types of admixtures, including antifreeze, expansion agents and water repellents, etc. When testing these admixtures, the relevant specifications must be strictly followed. If some composite admixtures need to be tested, they will need to be stacked according to the testing standards for each of them. Both two should meet the standard specifications, not just one of the admixtures for testing.

2. Methods Of Testing Raw Materials For Construction Concrete

The testing of concrete raw materials has many points and the process of testing can be very tedious. Various testing methods have been proposed in order to improve the efficiency of testing concrete raw materials. The article will analyse several common inspection methods, such as the rebound method, the combined ultra-deep rebound method, rear loading pull-out method and the core drilling method.

2.1. Rebound Method

The main purpose of using the rebound method in the testing of concrete raw materials is to check the strength and hardness of the concrete surface and also to check the compressive resistance of the concrete [10]. However, when this method is applied to the actual inspection process, if an integrated project is accepted in sections, the quality differences in the concrete raw materials are relatively small, and in such a case the results of the inspection will have certain limitations, so special attention needs to be paid to this situation.

2.2. Ultra-deep Rebound Synthesis Method

Using this test method in building concrete raw materials needs to be limited to a certain measuring range. Using the speed of sound propagated by ultrasound to check the quality of the concrete raw material. This type of inspection is non-destructive and also allows for repeated measurements, which is a better inspection method [11].

2.3. Rear-loading Pull-out Method

In this way, the strength of concrete can be measured by drilling holes in the surface of the hardened concrete, using the relevant tools and then mounting the pull-out instrument to test the pull-out force data on the concrete [12]. Setting the test benchmark between the pull-out strength and the standard compressive strength. Experiments need to be carried out in accordance with the relevant requirements during the testing process so that more accurate results can be obtained.

2.4. Core Drilling Method

This method involves drilling a hole in the concrete surface and obtaining a sample, which is then tested and inspected. As the sample material is obtained from the concrete, the application is simple and intuitive, and the results can be measured

accurately. The core-drilling method is a semi-breakage method, after the experiment is completed, it needs to be processed and repaired, so there is still a certain amount of technical content. In addition, the cost is still relatively high because of the detection and restoration process, so there are limitations in the practical application [13].

3. Measures to Improve the Quality of Construction Concrete

The article mainly analyzes the testing of raw materials for concrete to improve the quality of concrete through the testing of raw materials, as raw materials largely affect the quality of concrete. The article will focus on the different aspects that can be analysed to improve the quality of concrete.

3.1. Control the Raw Materials

The role of cement in the raw materials of concrete is considerable, being the main gel material and directly related to the lifeblood of concrete, so it is necessary to focus on the selection and testing of cement. There are three recommendations for the use of cement: firstly, choose a proper cement plant, secondly, familiarise the composition and proportions of the materials in the cement, thirdly, cement is alkaline, so contact with acidic substances is avoided to ensure its quality. Before using cement, it needs to be monitored and recorded properly.

3.2. Control the Quality of the Admixture

Although the proportion of admixtures in concrete raw materials is small, they play a very important role in the quality of concrete. Therefore, as with cement, the selection of admixtures needs to be made among regular, qualified manufacturers, and a quality guarantee is also required. Samples of different batches need to be taken and then tested for quality before they are used. The performance of each admixture will be different, so the selection also need to be based on the construction environment and use to choose the right admixture, the choice of admixture should also be able to have a good adaptability with the cement.

3.3. Control the Quality of Concrete Sand and Gravel

In concrete, more importance is attached to cement and admixtures, but sand and gravel also affect the quality of concrete, so these aspects should not be ignored. Moreover, as the current construction development makes it possible to use a very large amount of concrete, in some areas, due to the relatively low amount of sand and gravel, it is close to the point of depletion, so very poor quality sand and gravel will be used as a substitute, which will affect the quality of concrete. Therefore, before the sand and gravel come into the factory, they need to be strictly tested, and materials that do not meet the standards are firmly returned. It is also necessary to increase the testing of various indicators of sand and gravel, so that problems with raw materials can be detected in time to reduce the occurrence of poor concrete quality.

4. Conclusion

With the increasing requirements for construction work, being in a period of building development, the demand for concrete is very high and the requirements for its quality are quite strict. The quality of concrete raw materials plays a decisive role in the quality of concrete and the article discuss this issue with the aim of improving the quality of construction concrete. Through the analysis of the full text, there are more raw materials for construction concrete, and each raw material will affect the quality of concrete to a certain extent. Therefore, before use, each raw material needs to be tested so that a more suitable material can be selected as the raw material for concrete, which can help to improve the strength and quality of concrete and also play a role in promoting the development of construction projects. With the rapid development of science and technology, the testing methods for concrete raw materials will become more diverse, the results will be more accurate and the quality of concrete will be improved to a large extent.

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