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The Research on Concrete Construction Technology of Building

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High strength concrete is a new building material which is one of the main directions at present, the high-strength concrete the structure has excellent durability and safety in high-rise building, and reducing the size of section, so it has certain economic benefits to reduce weight. At the same time, High strength concrete reduces the amount of concrete, and energy saving protection which has a certain role. High strength concrete has brittle characteristics, which is mainly used for the vertical component in the civil buildings, and has high strength concrete hydration heat, small concrete heating and cooling fast in the civil construction. High strength concrete vertical and horizontal components that is ordinary concrete shrinkage on junction of different problems and which will lead to concrete cracking. At the same time, the construction method is different from ordinary concrete, which is including the preparation of concrete, and pouring, maintenance, etc. The research is great significance for the popularization and application about high strength concrete in modern civil engineering.

1. Introduction

With the rapid development of modern industry and science technology, the application field of concrete structure engineering extended uninterrupted, higher height is an important development direction is span bigger and heavier load, so common strength concrete has been unable to meet the economic and reasonable requirements (Han, 2016). If the structural design meets the condition of large span which will increase the section size of component in general, the will increase the weight of structure in civil engineering, the increasing the section size will lead to the use of indoor space narrowing, so we necessary to reduce the weight of the structure, and meet the needs of the project. The high-strength concrete use cement, sand, and stone is materials, which mainly rely on external super-plasticizer, plus a certain number of active mineral materials that has good performance, and has high performance in hardened concrete (Ondrejka et al, 2017; Tang et al., 2016).

2. The Shrinkage type of concrete

Concrete is closely related to the cracks of concrete members in civil engineering. However, the concrete shrinkage depends on the sum of shrinkage deformation. Therefore, it is very important to identify the types of shrinkage is concrete deformation. The proportion of shrinkage is different. We should pay attention to the individual possession of a high shrinkage category, which is very important to study the ordinary concrete by consulting the relevant literature, especially the dry shrinkage. The self-shrinkage factor is the most important factor for the high strength concrete, so Shrinkage deformation of concrete has the following five forms (Han, 2016).

2.1 The autogenously shrinkage

It is assumed that when the concrete is finished, which is forbidden to supply any other moisture. If the original moisture of the concrete is not diffused, that is no water exchange. In the closed environment, the hydration of the concrete will decrease the water content in the concrete, so this isolated case of cement hydration water

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consumption makes the internal relative humidity of concrete decreases. The lack of internal moisture and capillary pressure difference, which is due to self-desiccation, which as fellow:

$$\Delta \mathrm{P} = \frac{2\gamma \cos \alpha}{\gamma_0} \quad (1)$$

$\Delta \mathrm{P}$ -Capillary whole internal and external force difference; γ −Capillary pour water surface tension; α -Contact angle between water and wall; γ_0 − Critical hydraulic radius.

With the increase of the strength grade, the water to binder ratio became lower. The strength of high strength concrete rises rapidly in the early stage, and the water consumption is more. If we do not provide external warm water conservation, high strength concrete internal free water premature loss, and will lead to dry. Autogenously shrinkage is the main shrinkage type of high strength concrete with low water binder ratio, so we study the autogenously shrinkage of high strength concrete for the prevention of early cracks has great significance.

2.2 The carbonation shrinkage

Carbonation shrinkage refers to the contraction of the chemical reaction which between the surface of the concrete and the carbon dioxide in the atmosphere. The chemical reaction of the contraction mechanism is as follows:

$$H_2CO_3 + Ca\ \ OH)_3 = \mathrm{Ca}CO_3 + 2H_2O \quad (2)$$

The volume of the product becomes smaller, and the shape of the concrete changes gradually after the end of the reaction. The above is a brief description of concrete carbonation shrinkage. Carbonation shrinkage is a long process, which has little effect on the crack of concrete working period (Xu, 2015).

2.3 The Plastic shrinkage

At present, there are many reasons for the plastic shrinkage of concrete, which is that the moisture content is released from the surface before the initial hardening, which results in the shrinkage of the concrete volume. The cracks exist is external surface of concrete in this stage. The Warm water conserve is the most effective way to prevent the plastic shrinkage of high strength concrete, which covers with damp cloth or plastic film to prevent moisture loss. When the temperature is higher, the surface water evaporation rate of concrete is more than $1\mathrm{kg} \bullet m^{-2} \bullet h^{-1}$, and the effective method should be used to maintain the moisture content of the external surface. The rate of water dispersion can be calculated by the external appearance of concrete:

$$\mathrm{E} = 5[(T_c + 18) - \gamma(T_a + 18)](\mathrm{V} + 4) \times 10^6 \quad (3)$$

E-Water emission rate; $\mathrm{T_c}$ -Concrete external appearance temperature; $\mathrm{T_a}$ -Atmospheric temperature; γ -Atmospheric relative humidity; V -wind speed. If ignoring the concrete strength, water cement ratio, admixture factors. ε_{pl}Plastic shrinkage concrete can be estimated by 4:

$$\varepsilon_{pl} = (E \times 2) - 0.5 \quad (4)$$

3. The Practical analysis of high strength concrete

3.1 The engineering summary

High strength concrete is a kind of new building materials which is due to the extensive use of industrial waste, and save cement for meeting the requirements of energy conservation and environmental protection at the same time era. High-strength concrete has high compressive strength, dense, hard, anti-permeability, frost resistance, so people pay more and more attention at this point. High strength concrete is mainly used for vertical bearing members, which has significant technical and economic benefits to the members under pressure. High strength concrete is not only reducing the cross section of components, which reduces the amount of concrete, but also reduces the cost. the poor ductility of high strength concrete improper control that will cause the components and crack for vertical and horizontal element binding sites, which due to the level of ordinary concrete component is usually the concrete strength grade of both vary greatly, how shrinkage strain of concrete is the vertical structure internal temperature and the surface temperature of the temperature difference is much. The square high-rise apartment building projects in Anhui city of Hefei Province, which measured the strain and temperature, and provides a reference for the design and construction, so it can be successfully applied in the area. The mountain Fast hotel (9024.5m^2) and apartments (43132 m^2) is composed of two parts when the square project, located in Hefei economic and Technological Development Zone and the five Jade Road interchange. Ground floor is 32 floors on the ground, the total construction area is 57176

m2, and the total cost is 6968 RMB, which as the frame shear wall structure. The strength grade of concrete column is the highest is C80, Beam slab basement is C40, and 1-32 floors are C30.

Table 1: Concrete strength design of main structure

elevation	floor	Column, shear wall	beam, plate	Floor expansion reinforcing band	Remarks
±0.000	Basement	C80, C60	C40	C45	Ring beam
±0.000-12.00	1-3	C80, C60			
12.00-21.00	4-6	C70, C60			Lintel
21.00-39.00	7-12	C60	C30	C35	Tailgate
39.00-60.00	13-19	C50			Concrete grade
60.00-81.00	20-26	C40			
81.00-top	27-32	C30			

3.2 The Selection of raw materials

The project adopts the high strength concrete produced by Taizhou special concrete company in Hefei city, whose raw materials are subjected to strict hoof and multiple tests, the result is shown in table 2 (Li and Wei, 2014):

Table 2: The raw material requirements of high strength concrete

Material name	quality requirements	representative performance index
Fine aggregate	Hard texture, good gradation of coarse sand	Fineness modulus: 2.7, gradation between: II and Saudi Arabia, mud content is≤0.6%.
coarse aggregate	Well graded gravel	Parent rock strength $> 150\mathrm{Mp}$, Apparent density: 2840kg, crushing value: 4.6%, Sediment percentage: ≤0.3%, Needle flake: ≤3.6%
Mineral admixtures	Fly ash, ground fly ash slag powder, natural boiling powder index	Fineness of fly ash: 11.0%, 7 day activity index: 74%, 28 day activity index: 102%
cement	Grade P2.5 cement	fineness: 1.0%, 3 day strength: 36.8Mpa, 28 day strength: 62.5Mpa

4. Construction technology of high strength concrete

4.1 The Shallow structure of high strength concrete

The main building with podium and engineering settlement, each layer of concrete strength grade up to 4.the columns, walls, beams and plates take the same time pouring scheme, and the basement、1 layers、2 layers without construction joints, each layer of one-time-concreting shaping, three layers and three layers above in the plane is divided into two sections. The following three layers use a car pump, a fixed pump in order to shorten the time, interval of different concrete interface. Three layer above has two fixed pump while pouring, pour C80, C60 pouring concrete, concrete pouring in from middle to both ends of beam slab to column (wall), plate core zone for tower crane lifting non pumping high strength concrete with the same level, prevent the inflow of low strength concrete beam slab high strength concrete area.

Table 3: The level of concrete (-5.600-±0.00)

Position	Order of construction	Remarks
Main part	→(1) pump1 column wall1→(2) pump1 column wall2→(3) pump1 beam plate →(1) pump2 column wall1→(2) pump2 column wall2→(3) pump2beam plate	Solid line is the order of pump 1 pouring sequence
The skirt part	→(1) pump1 column wall→(2) pump1 beam plate	The dotted line is the order of pump 2 pouring sequence

At the same time, the concrete shall not be mixed with other concrete with different mix proportion or different strength grade in the conveying pipeline, when the concrete with different mixing ratio or different strength grade is poured alternately at the same time. the basement of the negative layer, for example, the column and

the surrounding columns and shear walls, beams and plates, the expansion of the strengthening, and walls, beams, plates is not to leave the construction of cracks, the level of concrete (-5.600-±0.00) is shown in Table 3. The order of Concrete pouring sequence is shown in Figure 1.

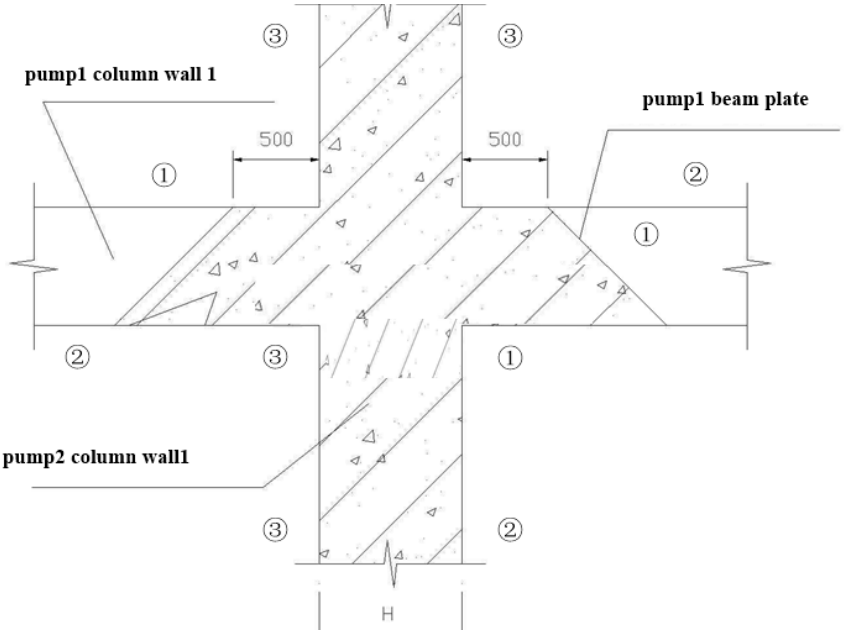

Figure 1: The order of Concrete pouring sequence (-5.600-±0.00)

4.2 Quality assurance measures of high strength concrete

High strength concrete construction management requirements are very strict, and otherwise it will cause insufficient strength. The following measures are adopted in this project.

1. The high strength concrete pouring simulation test, early detection of problems, solve problems.
2. The concrete into the mold temperature is > 30°C, which is to avoid direct sunlight from formwork and freshly poured concrete Shoot, arrange in the evening and night pouring concrete.
3. The excellent performance of the coagulation pump equipment, maximum pump concrete delivery pump pressure maximum pressure is not more than 80%.
4. We want to prevent concrete cracks due to temperature stress, the first raw materials for temperature control, then the scene with wood template insulation, the maximum temperature inside the center concrete temperature and sea surface temperature and the maximum temperature and the surface temperature of the concrete surrounding gas should not be more than 25 °C.
5. Accurate calculation of the amount is to strengthen the construction organization and scheduling, and commodity concrete company closely with the guarantee of continuous casting.
6. The use of high frequency vibrator vibration, vibration compaction, and shall not leak, nor excessive vibration, that is to the surface of a flat pan pulp prevail, the vibration time of each point should not exceed 30 seconds. When the concrete is sticky, should be the vibration point.
7. Concrete free fall height of not more than 2 meters, with no segregation degree; when the falling height of over 1 meters, the string cylinder auxiliary whereabouts string cylinder outlet from the concrete surface height of not more than 1 meters.
8. Two layers of concrete pouring interval should not be greater ≤120 minutes, which is in order to ensure a good combination of upper and lower layers.
9. Vibration compaction concrete around the water stop is to ensure that water does not offset. In the removal or the lifting of other objects, do not touch the bad sealing belt.
10. We should grasp the weather forecast information, as far as possible to avoid rain, snow weather construction, construction site, such as plastic film cover, in case of concrete before the final coagulation by rain erosion, the Quality assurance measures of high strength concrete is shown in Figure 2.

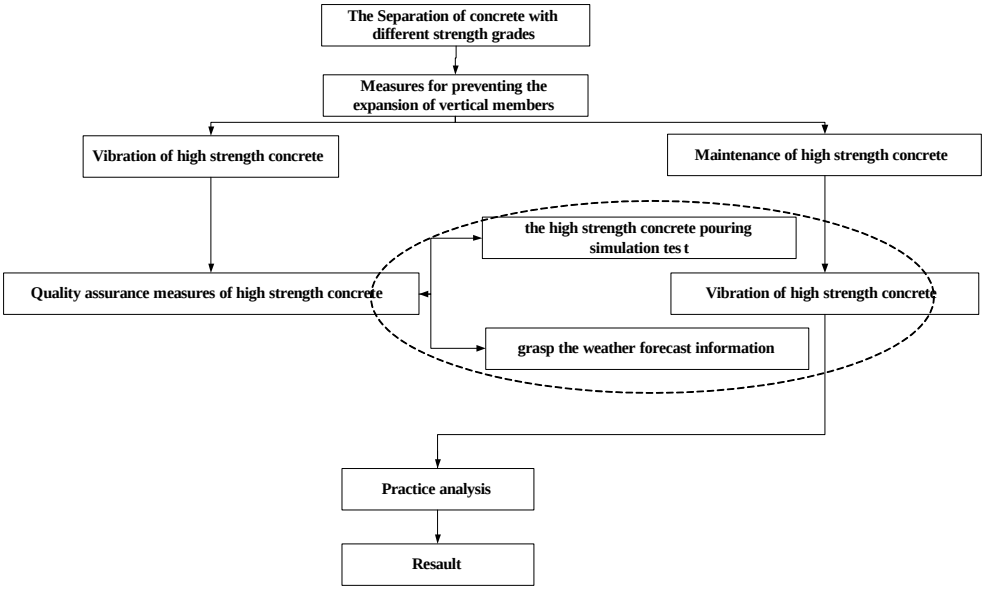

Figure 2: The Quality assurance measures of high strength concrete

5. The Analysis on strength and slump of high strength concrete

The strength of the structure is tested by rebound method in this project, we has standard curing test block and the same condition curing test block. The results are as follows.

5.1 Strength rebound and core measurement of high strength concrete

We use ZCI type high strength concrete rebound instrument, twenty-eighth days after the pouring of concrete, the first layer, the two or three layers of the C60, C80 components, randomly selected from the group of 13, after the rebound and conversion of the results as shown in table 6-8 (unit is Mpa). The Actual strength of high strength concrete is shown in Table 4.

Table 4: Actual strength of high strength concrete

Concrete strength grade	Rebound value							Max	Min	Mean
C60	74.2	72.5	69.3	70.5	68.1	67.2		74.3	67.8	70.4
C80	85.4	83.6	82.5	82.3	84.3	82.1	83.3	85.4	82.2	83.3

5.2 Tests block strength

Test block and the same conditions to maintain the test block in the basement and is standard, and the test its 3 days, 7 days, 14 days, 21 days and 28 days of strength.

1. Each of the strength is test block and the same condition maintenance test block in the basement, which are three kinds of concrete with strength grade of C40, C60 and C80 in the basement, and they are the standard test block and the same condition maintenance. The Compressive strength of concrete with different strength grades at different ages is shown in Figure 3.

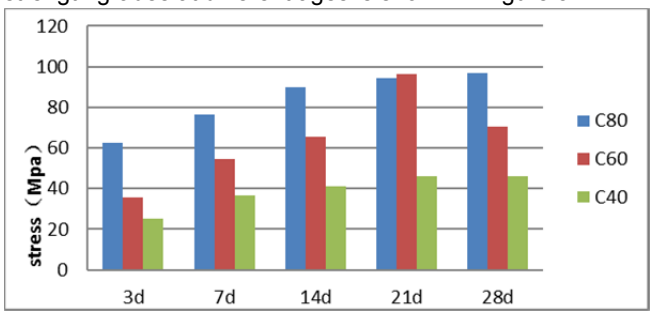

Figure 3: Compressive strength at different ages

The test results of concrete block can be seen:
1. The same condition curing strength is higher than the standard curing strength, the concrete pouring continuously after 10 days, the weather has been overcast and moist, the outdoor temperature at 15-23 degrees, it shows that the concrete strength increment and the outside temperature and humidity on.
2. Whether it is standard maintenance or the same conditions are in the maintenance reached about 14 days.
3. The higher the concrete strength grade is, the higher the strength growth rate is in the first 7 days after pouring.
Measurement of slump and fluidity of concrete
In the process of pouring concrete in C80, the slump of concrete with different train number is measured, and the slump value is within the range of high strength concrete, which indicates that the slump of C80 concrete is stable.

5.3 The measurement of C80 concrete drop and fluidity.

We accord the measurement of slump and fluidity, and high strength acid was that is used to prepare high strength concrete. Concrete slump retaining excellent performance in 2 hours basically no slump loss, 3-5 hour slump loss of 10-20cm, combined with concrete fluidity analysis, mixture in 5 hours after the slump, the fluidity decreased gradually after 7 hours, and significantly reduced, which is to ensure project quality. The project from the factory that is to the end of pouring concrete, which is according to the 5 hours for control. The measurement of C80 concrete drop and fluidity is shown in Figure 4.

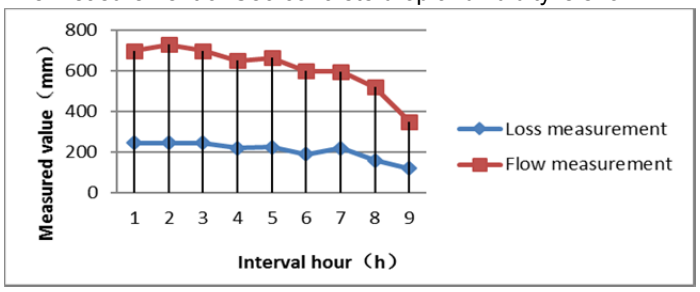

Figure 4: The measurement of C80 concrete drop and fluidity

6. Conclusion

This paper Analysis that high strength concrete as the research object for day square project in Hefei city. We through theoretical calculation, real-time monitoring and numerical simulation analysis method, and analysis hydration heat temperature and temperature stress changes. This paper is in order to avoid shrinkage cracking of high strength concrete basis. The characteristics of high strength concrete and ordinary concrete in structural design, economic benefits, comprehensive benefits and durability, long-term analysis, fully demonstrated the superiority of high-strength concrete. Finally, this paper summarizes the experience of the construction process, as well as the preparation of high-strength concrete, which high-strength concrete were tested.

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