2014

ISSN : 0974 - 7435 Volume 10 Issue 9

BioTechnology

An Indian Journal

FULL PAPER

BTAIJ, 10(9), 2014 [3679-3687]

Research on key points of concrete construction technologies for building construction

Hengmao Niu[1,2]*, Wenhong Wu[3]

[1]College of Sciences, Inner Mongolia University of Technology, Huhehaote 010051, Inner Mongolia, (CHINA)

[2]Architecture Engineering Institute, Inner Mongolia Technical College of Construction, Huhehaote 010070, Inner Mongolia, (CHINA)

[3]College of Information Engineering, Inner Mongolia University of Technology, Huhehaote 010051, Inner Mongolia, (CHINA)

ABSTRACT

This review analyzed the construction of concrete on construction related technical points, we hope it will bring some reference to the relevant undertakings. In the 21st Century, human beings enter an era of high-speed development. In this era, various sciences and technologies are constantly updating, due to which dramatic changes have occurred to building industry. Currently, new materials and new technology has been introduced to the building of concrete construction, and rely on construction equipment and new technologies to improve the efficiency of the building's concrete construction. In addition, there is a certain plasticity of concrete mixture, so they can be firmly attached steel, which formed a solid, high strength, seismic performance, economy and durability of reinforced concrete structures. In construction projects, such structural model played a more important role. This study first analyze concrete building construction material selection, followed by quality control on concrete construction are discussed, and finally on the concrete construction elements were discussed.

KEYWORDS

Building engineering; Construction; Concrete construction technology; Key points.

INTRODUCTION

Concrete is one of the most important building materials all over the world at present, which has been indisputable. Despite concrete has been utilized for a long period, new materials and technologies have been continuously emerging. However, concrete and concrete technologies have never been abandoned, but gained rapid improvement in its properties and construction technologies, etc during continuous development and advancement, which is somewhat dependent upon the increasing development of science and technologies over the past few years. In the past, concrete construction wasn't quite recognizable, because many people felt it was a rough job and some even considered it was simply fulfilled by cement, sand and gravel with water, whereas no technologies were involved. Nonetheless, this is not the case, as higher criteria are required for the properties of concrete by modern science and technology. Besides, some complicated elements have been added to concrete. In this way, construction technologies become increasingly modernized and developed to be systematic. These years, great progress and development have been made theoretically and practically in terms of concrete construction, making great contributions to human beings' building business. Concrete has a long history, the development of which has been dramatically transformed since the last century. For instance, in 1950s and 1960s, the concrete commonly used for buildings was marked R10MPa~R20MPa, whereas the mark changed into R20MPa~R30Mpa after 1970s and 1980s. In 1990s, the concrete marked R40MPa or above was utilized, the use of which achieved ideal effects. At present, the concrete over R60MPa and even above R80MPa is gradually commonly applied in building engineering in China[1].

TABLE 1 : Concrete output and its growth of different cities and provinces of China in 2010

No	Areas	Output (10, 000 m^3)	Year-on-year Growth (%)	No.	Areas	Output (10, 000 m^3)	Year-on-year Growth (%)
1	Jiangsu	18, 526.11	45.52	17	Hebei	2, 500.00	25.00
2	Guangdong	11, 577.00	25.18	18	Shanxi	2, 178.00	11.29
3	Zhejiang	11, 058.00	32.57	19	Yunnan	2, 124.00	49.89
4	Shandong	10, 907	93.94	20	Guangxi	2, 046.53	44.12
5	Shanghai	5, 675.68	-6.30	21	Xinjiang	1, 596.00	59.60
6	Beijing	4, 986.00	25.66	22	Helongjiang	1, 400.00	60.18
7	Liaoning	4, 865.00	20.42	23	Inner Mongolia	1, 300.00	94.03
8	Anhui	4, 717.00	92.67	24	Hainan	971.66	45.02
9	Tianjin	3, 867.00	44.83	25	Jiangxi	960.00	52.38
10	Hubei	3, 627.22	130.30	26	Jinlin	900.00	44.23
11	Sichuan	3, 500.00	42.28	27	Gansu	700.00	150.00
12	Hunan	3, 000.00	216.46	28	Guizhou	700.00	104.08
13	Chongqing	2, 978.00	35.55	29	Ningxia	667.00	251.05
14	Shanxi	2, 800.00	37.93	30	Jihai	385.00	106.99
15	Henan	2, 737.00	45.99	31	Tibet	50.00	212.50
16	Fujian	2, 682.76	11.78		In total	115, 981.96	43.34

To meet increasingly higher requirements for building engineering, large amounts of studies have been conducted these years in China to explore the intensity of concrete, achieving certain outcomes as regards the working performances of concrete. For example, concrete pumped at high pressure, self-leveling concrete and fluid concrete have been practically used. Additionally, people pay increasingly closer attentions to the durability of concrete. They have generally acknowledged that only if the concrete has high performances can it be highly intense to improve the building quality, guarantee the quality of construction and durability of buildings, so as to ensure human beings' housing safety. On

the whole, there has always been an increase in Chinese output and consumption amount of concrete in recent years. As shown in TABLE 1, concrete output and its growth of different cities and provinces of China are presented. In some provinces, the year-on-year growth has reached 200.00% or a higher percentage. It is thus clear that Chinese building business has been still focusing on concrete buildings over the past few years. Hence, this study studies the key points of concrete construction technologies for building construction and discusses following issues. Firstly, the techniques for selecting concrete materials during building construction. Secondly, the control over the quality of concrete during building construction. Thirdly, key points of concrete construction during building construction. Through the study of this paper, the author hopes some references can be provided for relevant enterprises and organizations[2].

TECHNIQUES FOR SELECTING CONCRETE MATERIALS DURING BUILDING CONSTRUCTION

Techniques for selecting cement, sand and gravel

To ensure the quality and safety of construction projects, selecting materials is the first and foremost job, so there are pretty strict requirements for the selection of materials in building engineering. Only if concrete materials are properly selected in scientific ways during building construction can the quality of construction projects be essentially guaranteed. As regards concrete construction, materials are mostly cement, sand and gravel, so there is a need to make a good choice of these materials. To select cement, it is necessary to pay close attention to its type, ex-factory certification, quality certificate and service life, etc, particularly to reinforce the inspection of such aspects during transportation and delivery. In addition, sand and gravel shall be selected according to practical needs. For instance, their tenacity and quality shall be firstly considered when requirements for concrete are high, while the content of impurities and salt, etc are determined by specific conditions and requirements of concrete. In short, the cement, sand and gravel shall be rigorously inspected to control the overall quality and selected according to actual demands for concrete, for the purpose of guaranteeing the quality of construction projects as far as possible.

Techniques for selecting admixtures and major materials

In construction projects, concrete admixtures are mainly used for preventing concrete from deforming and cracking, among which coal ash has such functions. During the construction of a construction project, less heat of hydration will be generated if admixtures are added. Besides, the toughness and tenacity of concrete can also be changed. In this way, the quality of projects can be practically guaranteed to maximize the service life of buildings. During material placement, more efforts need to be made to control various indexes, in particular, to test all materials before construction to maximize the placement of concrete and related materials, in order to satisfy actual demands. Nonetheless, the specific proportion of mixtures is also affected by practical environment and other factors, so sometimes tests must be repetitively conducted and materials can’t be used until corresponding standards are met. During practical construction, measures must be taken to make sure of the intensity of concrete. For example, the cement content could be appropriately decreased to reduce the water-cement ratio[3].

Additionally, there are some other categories of concrete admixtures. 1) Concrete admixtures can be divided into inorganic electrolytes, organic surface-active agents and polymer electrolytes based on the differences of chemical formulas. 2) Based on different functions, they can be divided into four categories: First function of admixtures is to improve the rheological properties of fresh concrete, such as air-entraining agents, water reducing agent with the pumping, the other function of admixtures is to adjust setting time of concrete, hardened properties, such as retarders, early strength agent, the third function of admixtures is to improve the durability of concrete, such as waterproof agent, antifreeze and

rust agent, and its forth function of admixtures is to improve concrete admixtures, such as bulking agents, filling agents coloring agents. All of these admixtures are categorized in different ways and have its own respective functions. The types and functions of water reducing agents are shown in TABLE 2[4].

TABLE 2 : Types and functions of water reducing agents

Types	Functions
Ordinary Water Reducer	For reducing water and enhancement
High-efficiency Water Reducer	For greatly reducing water and enhancement
Dry Strengthening Water Reducer	For dry strengthening
Set-retarding Water Reducer	For set retarding
Air-entraining Water Reducer	For air entraining

CONTROL OVER THE QUALITY OF CONCRETE DURING BUILDING CONSTRUCTION

For building construction, the quality of concrete is primarily controlled from two perspectives. On one hand, the concrete shall satisfy the quality standards required by design. One the other hand, the project costs shall be reduced as much as possible on the premise that aforementioned quality criteria are met. The efforts made in these two aspects, in fact, are for the purpose of decreasing the standard difference of concrete as far as possible, namely minimizing the standard difference by scientific management. The standard difference of concrete can reflect if a construction unit's management is good or not. The better the management is, the smaller the standard difference of concrete. In other words, the quality control of concrete, in essence, is the control of standard difference which shall be realized from following aspects:

Rationally determining the mixture proportion of concrete

The intensity, tenacity and durability of concrete are influenced by the mixture proportion of concrete to certain extent, so a reasonable proportion of concrete is fairly critical for safeguarding the quality of concrete. In a word, experiments need to be firstly carried out to measure the mixture proportion of concrete. Only if several experiments are implemented can the optimum mixture proportion of concrete be determined. Regarding reasonable mixture proportion of concrete, in addition to the requirements for durability and saving materials, the conditions for constructions and convenience shall also be satisfied. Furthermore, the cement, sand, gravel and other materials provided shall be qualified. Meanwhile, efforts must be made to control the intensity of cement, fineness, mud and water content of sand, as well as content of water and mud content in gravel, etc. Only if materials are qualified could it possible to make the mixture proportion of concrete be as reasonable as possible to guarantee normal construction, so as to meet the standards for design, inspection and acceptance.

Implementing correct construction based on designed mixture proportion

The construction shall be implemented based on a rational mixture proportion of concrete. First of all, promptly measure the water content in sand and gravel, and transform the designed mixture proportion to the mixture proportion for construction. Next, it is necessary to adopt weight ratio rather than volume ratio. At last, there is a need to inspect whether the raw materials satisfy the requirements or not and suppliers are required to provide two batches of the same materials to experiment room and construction site respectively. Construction site personnel shall receive samples according to specific conditions when they receive these materials. They need to make prompt reports and modify the mixture proportion in time when they find anything unqualified. On the whole, buildings shall be correctly constructed according to designed mixture proportion to ensure the quality of construction[5].

Strengthening the management of raw materials

The intensity of concrete will be directly affected once the raw materials of concrete change in properties, so it is necessary to strengthen the management of raw materials. Relevant material receivers shall exert strict control and unqualified products are prohibited from entering the construction site. The personnel shall promptly report if they find any products unqualified and take measures to guarantee the quality of the raw materials of concrete. After receiving materials, attentions shall be paid to storage, short-term & long-term effects of raw materials and service life, etc, particularly the storing methods[6].

Enhancing the measurement of concrete intensity

In sum, the intensity of concrete, to a large extent, is closely related to the water content of concrete and intensity of cement, particularly impacted by the water/cement ratio directly, so the mixture proportion of water for concrete and cement is crucial. To guarantee the intensity of concrete, it is necessary to reinforce the measurement of intensity. In this study, the intensity within 28 days is used as criterion. In order that the construction can be conveniently carried out with high quality, several groups of tests are required. Then, the intensity of concrete is measured pursuant to the age of concrete, so as to clarify and determine the intensity and quality of concrete[7].

ANALYSIS ON KEY POINTS OF CONCRETE CONSTRUCTION DURING BUILDING

Key points of concrete construction

During the concrete construction of buildings, the mixture proportion of concrete shall be determined according to actual construction environment after ensuring that raw materials are qualified. In the process of mixing by a mixer, strict and precise computation is necessary for raw materials. Thus, the system for mixing concrete shall be designed. In this paper, the automatic control system of a concrete mixing plant is exemplified. As shown in Figure 1, only if these steps are completed can the concrete be smoothly mixed and its quality be ensured. In addition, it is necessary to inspect the quality of concrete strictly to supervise the concrete construction to fulfill relevant work such as sampling, transportation, on-site construction carefully and specifically. Shoddy work and inferior materials are prohibited and the construction shall be scientifically implemented according to regulations, in order that the construction can be completed with high quality efficiently[8].

Figure 1 : Automatic control system of a concrete mixing plant (note: all parts can be repeated)

Key points of steel fiber reinforced concrete construction

In construction sites, steel fiber reinforced concrete is commonly used. During the construction of such concrete, efforts shall be mainly made to supervise its mixing methods. In particular, it shall be guaranteed that steel fiber is evenly distributed during mixing. Besides, the concrete shall be compulsorily mixed and degree of uniform mixing needs to meet the requirements for construction. It shall be irregularly inspected by sampling and satisfy corresponding standards, or else it is impossible to meet the requirements for the quality of construction projects. Of course, there are also requirements for mixing steel fiber reinforced concrete during specific construction. For example, such concrete is mainly mixed by dry and wet mixing. Moreover, raw materials shall be put in order according to strict requirements and standards. Meanwhile, there are specific rules for mixing time, to make sure that the steel fiber in the concrete will not aggregate. In short, the sand and gravel shall be preliminarily added into the mixer. Subsequently, the steel fiber, cement and admixtures shall be added. Such order, to certain extent, is favorable for guaranteeing the quality of construction[9].

Key points on the transportation and pumping of concrete

During building construction, concrete is generally transported by a mixer truck. The time of transport shall be properly controlled, because it will impact the intensity of concrete. Hence, it is necessary to study the transport of concrete, particularly the relationship between the transportation distance and time, so as to make a complete plan to ensure the quality of construction won't be impacted by improper control of the time and distance. The concrete will usually become solid if it is transported for excessively long time. As a consequence, it will be rather hard to unload materials and influence the schedule of construction. Thus, the concrete can be mixed inside a tank during transportation to make sure the concrete is still even in structure in this period. Additionally, the concrete can be mixed for

another time on site, for the purpose of guaranteeing the even structure of concrete, in order that the concrete is qualified in terms of intensity and quality[10].

KEY POINTS OF ANTI-CRACK CONCRETE CONSTRUCTION

Anti-crack construction can be considered as one of the most important part of concrete construction in building engineering, so more emphasis shall be placed on it. The formation of concrete crack on buildings is mainly attributed to the changes in the humidity and temperature of concrete. The unsmoothness and brittleness and composite structure of concrete are major causes of crack. In addition, there are also some less important factors, such as poor quality of raw materials of concrete and uneven settlement of concrete formwork resulted from its deformation, etc. To solve this problem, the exploration and research on anti-crack concrete construction shall be strengthened. On the whole, scientifically reasonable construction technologies are of great significance for the entire building, which can not only effectively reduce building costs, but can also optimize the allocation of resources. The optimum building effects can be achieved once human, material and financial resources are properly distributed. Specifically, several aspects shall be well controlled as follows:

Key Points of Concrete Pouring Technologies: During building construction, the concrete shall be poured according to such procedure, namely natural flowing → horizontal stratification → inclined segmentation → constant traction → one-time pouring, etc. The concrete shall be transported to the mixing plant once it is found unqualified. Meanwhile, it is strictly prohibited from adding water to the concrete that has been well mixed during pouring. The thickness of stratified concrete shall be determined according to relevant rules. The pouring isn't allowed until the new layer of concrete is covered by the upper, in order that the pouring interval of upper and lower layers of concrete can be controlled within the initial setting time of concrete. Eventually effectively prevent the construction of the interval is too long to produce crack[11].

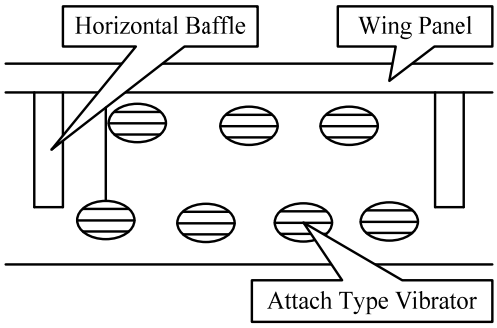

Figure 2 : Layout and Order of an Attached Type Vibrator

Key Points on Concrete Vibration Techniques: Generally speaking, concrete shall be vibrated in three parts which are the slope angle, mid-slope and slope crest. In practices, these three vibration parts need to be set according to related requirements. As shown in Figure 2, the layout and order of a vibrator are presented. Besides, proper proportion is required for ensuring that the vibration covers the entire sloping surface, so as to achieve expected or optimum effects. When a vibrator is used for vibrating during practical construction, it is necessary to control the depth that the vibrator is inserted into the concrete. In the mean time, the vibration time shall be well controlled, while the vibrator shall be rapidly inserted and slowly pulled out. Insert the vibrator into the lower layer of concrete for 50cm or over 50cm, and it is best to move the vibrator within 400mm or so for vibrating concrete. It is necessary to smooth the concrete surface by a scraper bar once the concrete is consolidated after vibration. Then, 5-

25mm thick gravel shall be scattered on the surface and filed smooth by a wood former before eventual setting. The concrete shall be filed twice or more than twice.

Key Points on Temperature Control Technologies for Concrete Construction: In general, concrete temperature can be controlled by multiple techniques during building construction. However, the concrete temperature is mainly controlled by improving the proportion of concrete aggregate materials. Detailed instructions are shown as follows. Firstly, relatively dry and stiff concrete is selected. Then, mixtures are added to reduce the amount of cement used in cement. Next, the gravel shall be cooled by water during mixing to decrease the pouring temperature. Of course, preparations must be made for temperature emission while taking aforementioned measures, in order that the concrete temperature can be efficiently controlled by developing more heat dissipation approaches.

Strengthening the Key Points of Construction Management: Constructors need to keep o learning, striving to improve their specialized knowledge and skills. During construction, steel protection personnel shall loosen the steel plate and adjust the displacement according to practical conditions to try best to prevent the steel from being trodden. At all events, construction management is indispensible, which is mainly implemented for ensuring that the buildings are constructed in order according to related rules to prevent severe accidents from happening. During construction management, efforts shall also be further made to inspect and accept the concealed reinforcement projects, in order that the intensity and thickness of reinforced concrete floor as well as the anchorage length and height of steel bar satisfy specific requirements for construction. Furthermore, the troweling layer of floor shall be well adjusted to meet the requirements for design, and it shall not be too thick. In addition, the concrete shall be promptly smoothed and polished. It would be better if these tasks are fulfilled one time, in order that the anti-crack properties of concrete surface can be optimum.

Key Points on Tube Laying Technologies: In addition to aforementioned aspects, the use of tube laying technologies shall be strengthened to take preventive measures for crack during concrete construction. Tubes are strictly prohibited from being arranged closely in parallel positions, because the place where multiple tubes are distributed together presents a radial pattern. Hence, parallel arrangement hinders the pouring of concrete at the bottom of tubes. To preliminarily embed and lay tubes, it is necessary to take fixing measures. Attempts shall be made to make sure tubes go through the middle part of panel to avoid vertical crossing. Besides, regular maintenance is needed, in order that the concrete remains humid. After the concrete surface is pressed smooth, water shall be firstly sprinkled over it. Meanwhile, a layer of plastic film needs to be covered on the surface for maintenance, which absolutely can be replaced by insulation materials.

CONCLUSION

In sum, during modernized building construction, it is necessary to enhance the management and control of some aforementioned key points of concrete construction. Furthermore, attentions shall be paid to the construction safety while guaranteeing the schedule and quality of engineering projects. There is a need to strengthen the quality control of concrete from different perspectives to ensure the engineering quality, corporate reputation and development because the safety of construction and buildings depends on the quality of concrete.

REFERENCES

[1] Zhou Xianlin; Analysis on Concrete Construction Technologies in Building Engineering [J]. Modern Business Trade Industry, **23(16)**, 285-286 **(2011)**.

[2] Li Guowei, Yao Dongmin; Exploration on the Concrete Pouring Technology at Building Construction [J]. China Homes, **8**, 688-699 **(2011)**.

[3] Duo Cong; Exploration on Key Points of Concrete Construction Technologies for Building Construction [J]. Landbridge Horizon, **8**, 139 **(2012)**.

[4] Zhang Ying; Exploration on the Controllability of Concrete Construction Technologies for Buildings [J]. Journal of Taiyuan Urban Vocational College, **3**, 155-156 **(2012)**.

[5] P.Papadopoulos, H.Xenidis, P.Lazaridis, A.Diamantopoulos, P.Lambrou, Y.Arethas; Achievements of Truss Models for Reinforced Concrete Structures, Open Journal of Civil Engineering, **2(3)**, 125-131 **(2012)**.

[6] Huang Shiyuan; Exploration on the Construction Technologies and Preventive Measures for Concrete Crack in Building Construction [J]. China Homes, **10**, 233-234 **(2011)**.

[7] Y.Tang; Knowledge Transferring Features in Traditional Construction Project Team in China: Based on SNA, Technology and Investment, **3(4)**, 230-235 **(2012)**.

[8] H.Bourray, A.Boutoulout, M.Baddi; Regional Boundary Observability with Constraints of the Gradient, Intelligent Control and Automation, **3(4)**, 319-328 **(2012)**.

[9] Diugwu, D.Baba, A.Egila; Effective Regulation and Level of Awareness: An Exposé of the Nigeria's Construction Industry, Open Journal of Safety Science and Technology, **2(4)**, 140-146 **(2012)**.

[10] S.Majumdar, M.Sarkar, T.Chowdhury, B.Chattopadhyay, S.Mandal; Use of Bacterial Protein Powder in Commercial Fly Ash Pozzolana Cements for High Performance Construction Materials, Open Journal of Civil Engineering, **2(4)**, 218-228 **(2012)**.

[11] S.Datta; Construction of Zero Autocorrelation Stochastic Waveforms, Advances in Pure Mathematics, **2(6)**, 428-440 **(2012)**.