

# Research on Construction Schedule Management of Subway Station and Tunnel Project

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**Abstract**— Schedule management is an effective scientific method to determine the progress of the target. Through breaking down the large duration of the objectives and tasks, a reasonable plan is developed and progress control management is implemented, so as to ultimately achieve the duration objectives. Based on the Hefei City Rail Transit Line 1 Zhugang, Dadongmei, Baogongyuan and Hefei University of South Campus as the research object, the schedule of the project problems in-depth according to the construction process sequence and shield construction characteristics was analyzed in this paper, and a reasonable schedule was developed to seize the key control points of the plan to carry out key breakthroughs through the WBS decomposition of the project. Finally, the author proposed to optimize the progress of station and tunnel schedule management, so as to ensure that the construction site can be carried out in strict accordance with the plan. This can improve the company's schedule management level greatly, and provide a basis to strengthen the modern construction management system

*Index Terms*— subway station; tunnel; project construction; schedule management

## **1. Concept definition of project schedule management**

Project schedule management refers to the process of planning, designing and strictly managing the project schedule according to the engineering objectives and the actual conditions. Schedule management can not only make the resources be used reasonably, but also ensure the successful completion of the project.

Project schedule aims to make reasonable progress plan according to the characteristics of the project, and complete it with relevant resources. In this process, theoretical schedule and actual progress shall be compared; reasons shall be found in the case of the discovery of inconsistencies, and solutions shall be formulated, so that the actual progress gradually approaches the schedule through reasonable arrangement of resources.

**Manuscript received Jun 16, 2017**

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Table 1: Main engineering quantity

Name	Unit	Quantity									
		Total	2012	2013				2014			
			Quarter 4	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Concrete	M <sup>3</sup>	62342	8824	2892	9401	9538	8518	7929	6374	2552	2314
Reinforcing bar	T	10948	2358	1265	1438	1531	1258	1103	1025	495	475
Duct piece	Ring	4088	0	0	0	0	1127	1000	875	921	165
Water	10 thousand and m <sup>3</sup>	65.38	1.35	1.13	1.04	1.12	16.1	14.2	12.8	13.9	3.74
Electric	10 thousand and degree	294.5	1.15	1.12	1.4	1.45	74.65	67.9	60.5	64.6	21.7

**2. Overview of the subway station and tunnel project**

Zhugang, Dadongmen, Baogongyuan and Hefei University of South Campus have similar landforms, located in Hefei fracture and Dongguan fracture. Zhugang Station shows "T-shaped" transfer with the transfer station of Line 6 and Taihulu of Line 1. For the intersection of Taihu Road and Ma'anshan Road, the station of Line 6 is set up around Taihu Road, while the station of Line 1 is set up around Ma'anshan Road. Dadongmen Station interval is located between Dadongmen Station and Wuhulu Station of Hefei Metro Line 1, constructed by shield tunneling method; the interval line is laid from north to south along the Ma'anshan Road. Baogongyuan Station interval is located between Baogongyuan Station and Hefei University of South Campus Station of Hefei Metro Line 1, mainly constructed by shield tunneling method; the interval line is laid from the north to the Ma'anshan Road. Hefei University of South Campus Station interval is located between Hefei University of South Campus Station and Zhugang Station of Metro Line 1, mainly constructed by shield tunneling method; the interval line is laid from the north to the Ma'anshan Road. The main engineering quantity is shown in Table 1.

**3. Problems in project schedule management**

**(1) The progress control goal of construction project was unscientific**

From the beginning of decision-making stage, the construction project was not subject to systematic operation according to the objective laws requirements of project management. The construction preparation stage was often conducted in the state of disorder, lack of control, lack of management or in a relaxed state, so that the elapsed time was too long, and there was not much time left for the construction phase. Therefore, determination of the construction schedule is unscientific regardless of the degree of complexity of the

project, climate, geological conditions and cooperation of related construction units. The total construction schedule will cause a series of problems in construction due to congenital defects.

**(2) The control basis of construction schedule was unscientific**

It was reflected in irrational use of resources and unreasonable arrangements of the construction schedule in the case of work order and determination of logical organization relationship. The construction schedule was too heavy in a short period of time, namely it was "short" in the peak, resulting in irrational allocation of resources and unideal schedule.

**(3) Construction schedule check was not conducted;**

The construction schedule was completely inconsistent with the actual progress, so that the construction schedule completely lost its role: "schedule your work, work based on the schedule". As a result, the project construction progress control was in the disordered state, and finally the control target of construction project schedule could not be completed, making the project a failure.

**(4) The construction schedule is out of step with the allocation of resources**

Implementation and completion of construction schedule shall depend on the reasonable and timely allocation of resources, including human resources, power resources, construction machinery equipment, environmental requirements, timely following up of construction methods. These shall be issued and reviewed together with the construction schedule, in order to make a basic guarantee to the construction schedule, otherwise it is a mere scrap of paper.

#### 4. Strategies to improve the schedule management of subway station and tunnel project

##### 4.1 Organization and management measures

Organization and coordination are the first step in order to achieve true control and management. In the process of implementation, the project will encounter various problems, so it is necessary to reasonably control the progress of the project.

(1) Improve the progress control organization system;  
The subway station and tunnel project constitutes an important component of the China Railway 16<sup>th</sup> Group project. The construction organization design shall comply with relevant requirements of the bidding documents. To take full account of the importance of the project, the company shall select professional backbone to participate in the project. In addition, it is necessary to equip relevant mechanical facilities in the process of implementation of the project, which can guarantee that the project will not be suspended because of facilities problems to some extent. The project management organization is shown in Fig. 1.

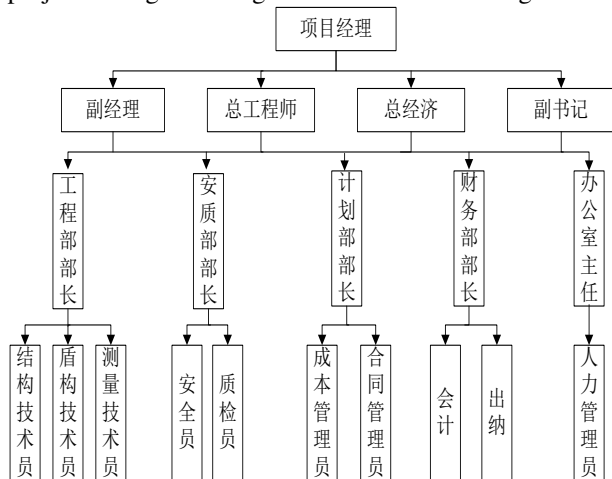


Fig. 1: Project management organization

##### (2) Quality management assurance measures

The company shall strictly follow the ISO9001 quality system, and various departments shall control the quality documents and information of their own. Relevant personnel can obtain the documents in time and accurately. Those obsolete documents need to be disposed in a timely manner to ensure orderly work as well as overall quality of the project is up to standard. The organization framework for quality management and quality assurance system are shown in Fig. 2.

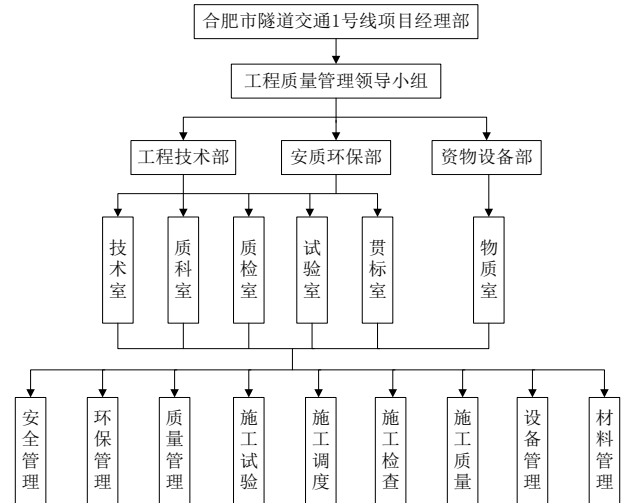


Fig. 2: Organization framework for quality management department

##### (3) Guarantee measures for construction resource management

Construction resource management mainly includes: guarantee measures for management of main supplies (materials), main construction machinery, environment and civilized construction and construction safety management measures. Main supplies (materials) such as construction materials and construction equipment need to be purchased and old materials and equipment cannot be used. Meanwhile, it shall ensure that their types and quality are up to standard when purchasing these materials.

The main construction machinery are dispatched from the Suzhou Metro Project Department, Wuxi Metro Project Department, Hangzhou Metro Project Department and Shanghai Metro Project Department, etc., because these sites have ready-made equipment available, and they are close to Hefei Metro Project Department. In addition, responsibility system for environmental protection shall be established. Starting from the actual situation of the project, the project manager needs to develop scientific, rational and effective environmental protection system. The project manager shall take the main responsibility of environmental protection and strengthen supervision and management in the daily work, so as to ensure the quality of the environment. For the construction safety management, the company shall promise that the project can achieve objectives of safe production and civilized construction: to ensure safe and civilized construction, in line with relevant provisions of the state, Anhui and Hefei, and achieve the "standard of safe and civilized site". Responsibility of safety protection: the responsibility of safety protection shall be actively assumed according to relevant provisions of this contract.

##### 4.2 Technical measures

###### (1) Technical measures in the process

In the construction of silt soil layer, bored piles shall be strictly controlled according to the slurry supply; typically, the drilling speed shall not be more than 1m/min. In the course of drilling, the performance of slurry will change, so it is necessary to test the performance of the slurry. If the slurry index does not meet the specified standard, it needs to be adjusted accordingly.

(2) Technical and organizational measures in construction methods

The soil excavation is conducted based on the method of vertical delamination, longitudinal block and transverse extension. Streamline production is carried out to accelerate the schedule. The length of the main structure and construction unit shall be standardized so as to facilitate construction operation and material processing to speed up the progress. Side wall structure is constructed with the company's moving steel formwork, thus effectively speeding up the construction.

(3) Technical and organizational measures in material selection

The quality, type and requirements of the materials required by the project shall be clearly stipulated in the contract. Samples of the materials mentioned in the contract need to be provided in advance, and sent to the construction units for inspection within twenty-eight days before the construction. The materials can be applied to the project if the samples meet the requirements and are approved by the Project Supervisor.

(4) Technical and organizational measures in labor arrangements

Site workers shall be required to be familiar with relevant business interfaces as soon as possible; external coordination, contact and communication shall be strengthened, and internal work shall be implemented. In the initial stage of the project, strict organization and ordered management of the project shall be conducted. The time ahead shall be taken into account, and preparations of the project shall be made, so that the project will be carried out in full accordance with the required nodes of the owners and the construction organization schedule.

#### 4.3 Economic measures

(1) Specify liability for breach of project duration

The construction progress shall be guaranteed according to the construction schedule. The payment of liquidated damages shall be made according to the contract in case of overtime or unreasonable work arrangements in strict accordance with the schedule, in order to actively and effectively improve the project. Liquidated damages shall be effectively returned, and shall be detained and fined in case of default.

(2) Introduce reward and punishment incentive mechanism

The construction team must specify its own responsibilities and tasks in the construction process in strictly accordance with the provisions of the contract. Once the project schedule is difficult to meet the actual situation, it is necessary to make clear the responsibilities and tasks through the form of fines, but the effect of this form is poor. If the project is completed ahead of time, it is necessary to effectively reward the construction team according to relevant provisions of the contract, so as to actively improve the enthusiasm of the staff, and improve the overall project schedule and quality.

#### 4.4 Information measures

(1) Information gathering

Quality control information includes the information in different aspects, including the local laws and regulations, quality standards and objectives of policy projects issued by the state, various standard documents of quality control, process quality accident records, quality acceptance documents and materials. Schedule control information is mainly collected from the actual data of the project progress, including level 1 network schedule, project milestone

schedule, engineering change request and project progress adjustment schedule.

(2) Information management

Information management aims to understand the actual progress of equipment engineering, conduct positive control and collect various information based on the knowledge demand of project construction and from the macroscopic point of view, so as to improve the efficiency of management. In addition, it is also necessary to conduct different data statistics and comparison as well as update relevant information for the project schedule, so as to guarantee the decision management.

#### CONCLUSION

Project schedule management involves different contents, which is a complex system. Therefore, rationality of schedule cannot be guaranteed and effective implementation of the whole project cannot be promoted without scientific and rational methods. In this paper, it was effectively analyzed on the basis of the actual situation of shield project; scientificity and rationality of schedule management were guaranteed; the actual project schedule was decomposed and refined; key links were effectively controlled and strengthened through choosing scientific and reasonable critical path. Implementation of the project was guaranteed effectively from the point view of safety, quality, technology, organization, mechanism and resource utilization.

#### REFERENCES

- [1]Liu Mian. Discussion on Project Construction Schedule Management [J]. Industrial Architecture, 2011(1):1037-1039.
- [2]Yang Yajun. Some Considerations on Construction Schedule Management of Civil Engineering [J]. Jiangxi Building Materials, 2015, 18:289.
- [3]Chen Wenjian, Wang Jingran and He Lianglin. Discussion on Construction Schedule Management of Architectural Engineering Project [J]. Journal of Sichuan Vocational and Technical College, 2014, 01:159-162.
- [4]Han Chi. Research on Construction Schedule Management and Control of Road and Bridge Project [D]. Xi'an Polytechnic University, 2016.
- [5]Huang Yijia. Research on Construction Schedule Management of Expressway Project [J]. Entrepreneur World (second half of the month), 2014, 05:115-116.
- [6]Huang Yijia. Study on Construction Schedule Management of A8 Project on Zhongxian County to Wanzhou Expressway [D]. Changsha University of Science and Technology, 2014.