

Theory and Application of Programmable Management in Highway Project

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Abstract

The programmable management is a scientific and high-efficiency management model for highway projects. Because the construction of highway project is a dynamic process, the programmable management has particular characteristics and momentous significance for highway projects. It follows the principles of practicality, simplification, unity, coordination and optimization, guided by the standardization rule. The design supervision system, the supervision plan and the implementing regulations of supervision constitute the major contents of programmable management in highway project. The application of programmable management in Huangpu bridge of Pearl River project has brought lots of successful experiences which are worth studying for the project superintendents of highway engineering.

Keywords

Programmable management, highway project, supervision, management flow, project management.

1. Introduction

The programmable management of highway project refers to the process in which the owner of highway project makes contractors as well as other units involved in the construction clear about what they should do next through the documents of programmable management. They are supposed to strictly implement the concrete management programs and contents of construction in order to improve the quality and efficiency of project management effectively.

2. The characteristics of programmable management in highway project

As opposed to the programmable management in industrialization production, the object of project management of highway engineering is a dynamic construction process. The characteristics of programmable management in highway project are as the follows.

(1) Because of big quantities, complex work flows and high technology content of highway project, the diversification of management flows contributes to bring all or the majority of work flows into the programmable management in highway project.

(2) Some management flows change frequently. Because the duration is as long as several years and the application of new technology often brings some technological risks, the owner will adjust some management flows at any moment according to the construction progress on the spot[1].

(3) The mobilization of the forces of all the units involved in the construction is very important for the formulation of management flows. Depending only on owner is not enough. In the process of programmable management in highway project, the supervision plan is formulated mainly by owner, the implementing regulations of supervision are formulated mainly by those supervision institutions and the feedback on proposal for management flows is mainly from contractors.

(4) We should combine the absolute adherence to management flows with being capable of adapting to change or a variety of circumstances on rare occasions in the process of programmable management in highway project. The rigid enforcement of management flows will raise the managerial efficiency truly to achieve the goal of managerial innovation. But the implementation of highway's construction is more complex than the movement of the industrialized production line. The ossified execution of management flows will sometimes produce exactly the opposite results.

3. The significance of programmable management in highway project

(1) Make clear about the responsibilities and jurisdictions and standardize personnel behavior. The key to the implementation of programmable management lies in the formulation of scientific, rational, standardized and practical management flows which should stipulate specific target, responsibility and jurisdiction, method and program of each job. Thus, on the one hand the wrongful acts that the actor has no right to do would be prevent; On the other hand, cases like shifting one's responsibility to others or having no one take responsibility in project management of highway also would be prevent[2].

(2) Help arouse the enthusiasm of staff in highway project

Because the task, power and responsibility of programmable management is clear, therefore, one cannot wait for others to deal with the problem and also does not need to ask for instructions from a leader in principle so long as it is within the limits of his/her functions and responsibilities. In the process of programmable management in highway project, everyone will bring into full play his/her initiative and creativeness to put all positive factors into play and achieve better result in his/her work, following the fundamental methods and programs.

(3) Help put up labor productivity

Programmable management makes clear about the concrete methods and procedures of work and tries to standardize them. The personnel use the standardized methods and procedures to reduce the unnecessary recurring work and the loss created by improper methods of work to the full. Simultaneously, programmable management reduces the labor intensity to a certain extent to put up labor productivity finally.

(4) Provide a basis for the formulation of assessment standard of work

In the process of programmable management in highway project, the assessment standard of work which is objective, rational and operational and eliminates the casualness once generally existed in the assessment process and random factors affecting the fairness of assessment is stipulated according to the tasks and responsibilities of work. The programmable management enables the assessment of work to be the internal driving force to promote the management level of enterprise.

4. The principles of programmable management in highway project

The programmable management exists in all kinds of activities. The establishment of perfect management flows which is guided by the standardization rule and follows five principles (practicality, simplification, unity, coordination and optimization) is the center of enforcement of programmable management. We need to place the promotion of management level and working efficiency on the first place all the time in the process of programmable management in highway project [3].

(1) Practicality

Proceeding from the realities of divisional management work, the form is subject to the requirements of content in the process of programmable management in highway project.

Narration type, diagram type, form type or other types will do. The management flows should not only show the problem and solve it but also be available for propaganda and execution.

(2) Simplification

We need to simplify all kinds of objects of programmable management and make the procedure constitution concise, succinct, reasonable and normative under the premise of giving full expression to the connotation of procedure.

(3) Unity

In order to make management flows have uniformity in connotation and constitution, the scientific and rational combination should be carried out for some scattered management items which have multiple, relevant and duplicated characteristics.

(4) Coordination

We should disposal the reciprocity between constituent parts of management flows based on the systematic viewpoint, establishing mutual adaptation and relative balance between them to realize the best functions of management system [4].

(5) Optimization

We are supposed to select, design, adjust and optimize the constitution factors and their reciprocity of management flows under controlled conditions to achieve a good management order, straighten out the relations among management sections and promote management level and working efficiency.

In brief, it's not difficult to deal with the reciprocity between management flows and management standards if we suit our measures to differing conditions in terms of locality, time, issue and persons involved according to the different scales of objects in programmable management.

5. The contents of programmable management in highway project

The programmable management in highway project which exercises a key and indispensable influence for the successful achievement of the goals of quality, progress, security and investment in highway project involves all the units and personnel involved in the construction of project throughout the whole process of construction of highway engineering. The owner entrusts design supervision institutions and construction supervision institutions to implement the design supervision system and formulate the supervision plan and the implementing regulations of supervision. The design supervision system, the supervision plan and the implementing regulations of supervision constitute the major contents of programmable management in highway project.

(1) The design supervision system

The owner selects design supervision institutions through entrusting or open tender in the process of programmable management in highway project. The design supervision institutions who take the joint and several liability to design quality complete the implementing regulations of supervision for design and apply standing-side supervision system, self-checking system and spot-check system in geological drilling, field investigation, control survey and cross section survey, as is commonly done by construction supervision institutions. The design supervision institutions formulate all kinds of general forms of design supervision for historic records on all design stages, field investigation and acceptance of engineering quality and so on and submit the summary reports of supervision on different design stages according to the program plan of design and design supervision management regulations. The design supervision system helps stamp out the most common mistakes in the quality of design effectively to guarantee the accuracy and rationality of design documents.

(2) The supervision plan

The supervision plan describes the principles, contents, management flows of supervision on each stage of construction in all bid lots with accurate detail as follows.

Tab.1 The specific contents of supervision

Supervision goals	Quality assurance system	Supervision principles
Supervision stage division	Supervision tasks	Supervision organization system and power and responsibilities
Basic systems of supervision	Project quality supervision	Project progress supervision
Construction cost supervision	Contract management	Project environment supervision
Construction security supervision	Information management of supervision	

(3) The implementing regulations of supervision

In the process of programmable management in highway project, the implementing regulations of supervision guide the work of each sub-item project. Through each kind of implementing regulations of supervision, supervision institutions make the contractors follow out the exact words of contracts in order to satisfy the requirements of quality, progress, investment, security, environmental protection of project. Each kind of implementing regulations of supervision probably includes the evidences for regulation, outline (including a project profile and main technical parameters), the construction stage division and process flows, main supervision tasks of construction for each sub-item project (including construction flow chart, supervision responsibilities of construction, the detailed description to construction procedures of each process flow), the main tasks of survey supervision and the forms of construction management (including the examination report of project quality, the examination data on-spot sheet and the evaluation table for project quality) and so on. The types of the implementing regulations of supervision are listed as follows.

Tab.2 The types of the implementing regulations of supervision

The implementing regulations of supervision for roadbed construction	The implementing regulations of supervision for moving die carrier	The implementing regulations of supervision for construction security
The implementing regulations of supervision for the filling pile of drilling	The implementing regulations of supervision for tunnel	The implementing regulations of supervision for building
The implementing regulations of supervision for construction experiment examination of main towers and host pillars	The implementing regulations of supervision for construction survey of main towers and host pillars	The implementing regulations of supervision for the prefabrication and installment of box beam
The implementing regulations of supervision for construction of main towers and host pillars	The implementing regulations of supervision for treatments of soft soil foundation	The implementing regulations of supervision for construction of cable support tower
The implementing regulations of supervision for construction of cast-in-place pre-stressed box beam	The implementing regulations of supervision for construction of bearing platform (tie beam)	The implementing regulations of supervision for foundation and infrastructure

The implementing regulations of supervision for construction of abutment wall	The implementing regulations of supervision for the anchor ground connecting wall	The implementing regulations of supervision for test
The implementing regulations of supervision for manufacturing of cable saddle and cable holder of suspension bridge	The implementing regulations of supervision for manufacturing of steel box beam of cable stayed bridge	The implementing regulations of supervision for manufacturing of steel box beam of suspension bridge
The implementing regulations of supervision for manufacturing of canting pull rope of cable stayed bridge	The implementing regulations of supervision for manufacturing of strand of wire rope of main cable in suspension bridge	The implementing regulations of supervision for manufacturing of crane rope of suspension bridge
The implementing regulations of supervision for construction of bearing platform of cable stayed bridge	The implementing regulations of supervision for charge, telecommunications, supervisory system and traffic safety facilities	The implementing regulations of supervision for power supply and lighting system

6. Case analysis——the application of programmable management in highway project

6.1. General Situation of Project

Huangpu bridge of Pearl River project in Guangzhou of China is a significant construction project which the State Council of China authorizes and then Guangdong Province obtains after the central government of China implements the macroscopic economy regulates. The project starts from Huo village of Guangzhou economic development area, links north second ring highway and Guangshen highway, goes south crossing Bi village, Huangpu Temple village, then passes main route of Pearl River to Caotang village of Hualong town in Panyu area, connects with East Guangzhu highway and Jinshan Road. Huangpu bridge of Pearl River project spans 18.694 km. This project is the east section of the city road in Guangzhou circles of Jingzhu highway host skeleton line which is the center of “five vertical and seven horizontal” built by Ministry of Communications of China. It holds the important position in the federal highway skeleton line and in the Guangzhou region highway network. The time limit of the project is 4 years. The overall investment is ¥4.115 billion by the Guangzhou Road Development company, ZhaoChen international investment Ltd., Guangdong highway construction Ltd. according to 6: 3: 1 investment ratio. The project adopts six traffic lanes (forward adopting eight traffic lanes) highway standard, the statistical driving speed is 100Km/h, the roadbed extends 34.5m. The project includes the maximum span (1108m) steel box beam suspension bridge in Guangdong Province, the maximum span (383m) single pylon and two cable planes cable-stayed bridge in China, the first detached tunnel with eight traffic lanes (only extends 2×18.0m) in China, the maximum span (62.5m) of moving die carrier of prestressed continuous rigid frame bridge in China. Moreover, it is the representative project which has the great span surmounting highway, railway and soft ground. Huangpu bridge of Pearl River project has achieved satisfactory results with systematic application of programmable management. The programmable management is of great significance not only for the success of the Huangpu bridge of Pearl River project but

also for the highway construction of Guangdong Province and the whole country. The programmable management has a broad prospect of application.

6.2. The programmable management in Huangpu bridge of Pearl River project

The Huangpu bridge construction company has formulated, standardized and optimized a great many management flows which were included into contracts through the project management handbook and tender documents. The Huangpu bridge construction company has implemented the supervision plans and the implementing regulations of supervision to standardize work flows and raise managerial efficiency.

(1) Standardize the procedures of measurement and payment strictly

The Huangpu bridge construction company has adopted the rigorous and detailed management regulations of measurement and payment to enhance the controlling force of investment goal through programmable management and informationization management system. The censor system and reexamining system are aimed strictly at the measurement and payment of project quantity in construction. Firstly, the staff of project management department tally up the completed project quantities according to middle measurement certificate and the measurement application of sub-item project and so on which are approved by supervision institutions. Then, the material man of the plan and contract department makes adjustment to material unit price and calculates the progress payment which must be paid. Finally the finance department provides the project funds. The payment of project funds which obeys the principle of the lowest quota should establish close contact with the progress schedule of contractor. The payment depends on the report form of payment of the plan and contract department. One cycle of measurement and payment probably is as long as 20 days. Because the finance department may notify the bank in advance according to the planning chart of funds from the plan and contract department each month, owner's funds can arrive at the contractors promptly.

(2) Carry out the engineering changing process normatively

The Huangpu bridge construction company has made massive revisions and supplement to the engineering changing process and related articles in contract and tender documents to avoid the loss caused by the nonstandard behavior to owner. The supervision institutions have enforced strictly the intact engineering changing process in construction according to the implementing regulations of supervision and the related stipulations in contract, which locks the investment and progress of project in owner's grasp.

(3) Implement the programmable management rigidly

In the process of programmable management, the responsibilities and jurisdictions of various departments of the Huangpu bridge construction company are clear quietly and the department personnel are familiar with management flows and work procedures very much. Reflected generally by contractors, the Huangpu bridge construction company has gotten hold of the workspaces of project quality and progress accurately through each kind of supervision plans and implementing regulations of supervision. The Huangpu bridge construction company has divided the responsibilities of contractors, supervision institutions and owner reasonably, knowing when should carry on the monitoring and when should carry on the assistance. The owner is very clear about the control points of project quality in every bid lot. The owner has organized many expert consultations, aiming at the critical processes like the construction of cofferdam of platform, the excavation of 73m circular anchor foundation ditch and so on. The owner frequently got to the construction site to inspect project quality. The manager of project management department has been patrolling in the construction site during critical construction processes. All this play a very good role to promote the work of contractors.

6.3. The Effectiveness and Enlightenment of the programmable management in Huangpu bridge of Pearl River project

The Huangpu bridge construction company has paid great attention to integrate programmable management with actual situations of project to carry out each management flow strictly. They have made a notable progress in the programmable management of Huangpu bridge of Pearl River project, bringing a precious enlightenment for other highway projects. The Huangpu bridge construction company held the operation ceremony in December 23, 2004. The comprehensive operation of main bridge began in March, 2005. The duration approved by the Ministry of Communications of China is four years. The overall progress of project is always at the state of being in control. Achievements have been made in the overall construction quality and the control of outward appearance of Huangpu bridge of Pearl River project, particularly with good outward appearances of box beam in S11 and S12 bid lot obtaining a strong approval from all parties. The Huangpu bridge of Pearl River project has undergone the thorough examinations organized by the Ministry of Communications of China and passed smoothly for two times. The project quality has obtained the approval from the general station of quality monitoring of Ministry of Communications of China and the station of quality monitoring of traffic engineering in Guangdong Province.

The application of programmable management in Huangpu bridge of Pearl River project has brought lots of successful experiences which are worth studying for the project superintendents of highway engineering. According to the practice of programmable management in Huangpu bridge of Pearl River project, we have summarized the following measures to obviously raise the efficiency of programmable management in highway project.

- ① Proceeding from reality, we should bring perfect information feedback and strict surveillance into interlinking management flows to enable them to have scientific nature and maneuverability in the process of programmable management.
- ② Reform shall be intensified with regard to payment and personnel management policies and reasonable income distribution systems will be adopted to arouse the initiatives of the personnel. This measure has a positive function of value guidance.
- ③ It is very important to establish a scientific and rational performance appraisal system for company and individual. The uniform, concrete and operable criteria of assessment and scoring means can provide the appraisal basis. The comprehensive inspection network, inspection principles and model can provide a sound foundation for scientific management. The strict performance appraisal system can bring the wisdom and creativity of everyone into full play and let everyone make an individual contribution toward an overall effort.

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