

Security Control of Construction Site Based on the Hazard Source Management

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Abstract: Project Construction site security control issue is an important factor for project success. By identifying the hazard source on construction site, this paper establishes a hazard source management mode which is based on information technology. At the same time, the content, objectives, implementation methods, and basic operation process is also put up. In that mode, PDCA is used to enhance the safety control level on construction site continuously. Finally, a series of Safeguards be put forward to keep the management mode can be implement effectively.

Keywords: Construction Site; Hazard Source; Security Control

1 Introduction

Construction is a significant economic pillar industry in most countries in the world. However, due to the characteristics of this industry, its safety and health conditions have been unsatisfactory. That is why Construction industry always be accident-prone both at home and abroad. And it also seriously restricted the development of construction industry.

The frequency of casualty accidents in China's construction industry is very high, which is ranking the first position among the non-mining industries, accounting for about 35%. Table 1 shows the statistical data on accidents and deaths made by Ministry of Housing and Urban-Rural Development of the PRC. We can calculate from Table 1, the average of accidents in china's construction industry between 2001 -2007 is 1056 per year, and the average of death is 1205 per year. Therefore, it's an important task for construction enterprise to improve safety management level.

Table 1. The statistical data on accidents and deaths in China's construction industry between 2001 -2007

| Year | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|----------|------|------|------|------|------|------|------|
| Accident | 1004 | 1208 | 1278 | 1144 | 1010 | 888 | 859 |
| Death | 1045 | 1292 | 1521 | 1324 | 1195 | 1048 | 1012 |

Data source: Ministry of Housing and Urban-Rural Development of the PRC

There are a large number of workers, a lot of different types of materials and cross-operating mechanical equipments working on construction sites everyday. Thus many kinds of insecurity and potential occupational hazards, which can easily cause accidents, and endangering the lives of workers exists there. Most industry accidents occurred at construction sites; therefore, to prove project safety management, the key is to enhance construction site safety management research and practice.

2 Hazard Source on Construction Site

We know The core of security management is risk control, and hazard source is the main source of project risk. Hazard source is the source of danger, and is the root to cause injury, property damage, work environment destruction or the combinations of those states.

Hazard sources generally consist of three elements: the potential danger, the existence conditions and the triggering factors. All the sources can be classified into four aspects: unsafe behavior, unsafe use of objects, unsafe environment and management defects. Unsafe behaviors include illegal operations, use of unsafe equipment. Unsafe use of objects includes incorrect use, fatigue use, not using special tools. Unsafe environment includes rainy construction, winter construction etc. Management defects include irregular training, incompatible management, irrational construction process etc. All those aspects result in these problems: height fall, mechanical injury, struck by object, electrical contact and collapse.

According to certain statistics, more than 85% of the total accidents are caused by the above five problems. Figure 1 shows the various parts of accidents caused by each problem.

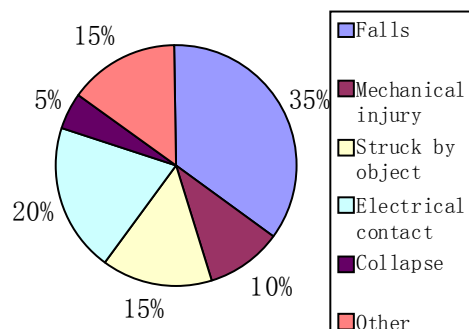


Figure 1. Accident ratio caused by each problem

Identifying the hazard sources correctly and comprehensively is critical to reduce the occurrence probability of accidents in projects. The objects to be identified include all the activities, facilities and materials. In the identifying process, hazard sources which exist in activities and facilities are found out and the accidents that could be caused are also analyzed. And then, whether the security accidents and hazard sources have been controlled effectively, whether they meet the evaluation criteria and match the actuality are identified according to the regulations, industry standards and the health, safety and environmental requirements.

There are two basic methods to identify hazard source: Visual Experience method and System Safety Analysis method. Visual Experience method: conducting hazard identification according to those existing safety standards, safety rules, safety checklist, analysis of past incidents, work experience and expert advice. System Safety Analysis method includes the event tree analysis, fault tree analysis method. At present, some domestic research has been done on the hazard identification, but

it doesn't draw enough conclusions to settle how to manage hazards and how to apply it into practice effectively. Therefore, this paper will use both methods to establish the process of hazard source identify, and realize the hazard source management by using information technology, so as to achieve effective control of construction site safety^[1].

3 Construction Site Hazard Source Management Mode

The basis of construction site safety management is to establish a system of hazard management mode and the purpose is to standardize construction process, take away dangerous source and reduce project risk. In the hazard source management, the information plays a vital role. Constructing an information system of hazard source management is the main trend of the development. In this paper, a IT -based hazard source management mode is put forward, which listed in Table 2.

Table 2. The content of hazard source management mode

| | Mode content | Manifestations |
|---|------------------------|---|
| 1 | Purpose | Effective implementation of safety management |
| 2 | Implementation methods | The core part of the current construction, Before and after expansion |
| 3 | Process method | PDCA continuous improvement methods |
| 4 | Content Management | Hazard management, safety assessment and early warning |
| 5 | Vector | Hazard management information system |
| 6 | Implementation phase | Project life cycle |
| 7 | Result | Hazard source knowledge, regular safety report, automatic security alerts |

There are two key points in this hazard management mode, one is the establishment of hazard source database, and the other is the construction of hazard source information management system^[2].

The establishment of hazard source database is not only the information collection of hazard sources. Considering from the characteristics of the project environment, the process goes through the data screening, assessment, category judges, and expert evaluation and so on. The whole system contains public data, professional data and their own company data. It also forms the hazard source observation and treatment program. The establishment of hazard source database is achieved by dynamic information input, query and database management technology, and its purpose is to provide the most suitable hazard source database for each project. Figure 3 shows the establishing process of hazard source database.

Hazard source information management system is a platform which is based on the source database and information technology, including hardware and software. Through that platform, security problems can be predicted, real-time safety data can be achieved, rapid security analysis and early warning can be implementing, and the systematic training also can be provided. PDCA continuous improvement method is used in the management

system Operation process.

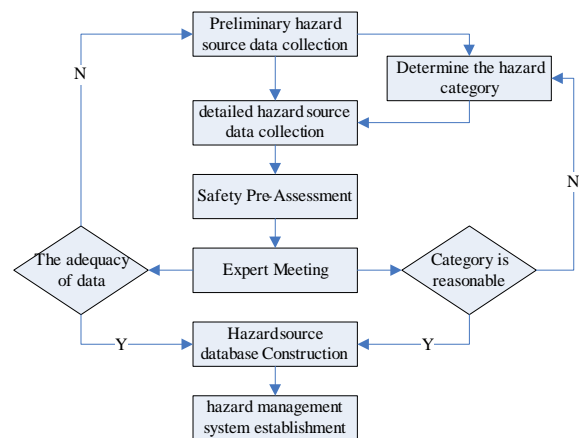


Figure 2. The establish process of hazard source database

In the P (Plan) stage, the main task of the security responsible party is to analyze the reasons to impact security and to develop safety management plans. In D (Do) phase, the main task of the security responsible party is to carry out safety management plan, implement safety management training and to take safety measures into the project. In C (Check) phase, the main task of the security responsible party is to implement safety inspection,

safety assessment and prediction according to the requirements of safety management. This process should be implemented regularly according to the requirements of safety management, and information is also should be input timely to ensure finding safety problems immediately. In A (Action) stage, the main task of the responsible party security is to correct and deal with the problems finding in C (Check) phase, and to amend the hazard source database, optimize the importance and the observation period of all kinds of hazard sources. Figure 4 describes the basic operation process of hazard source management system.

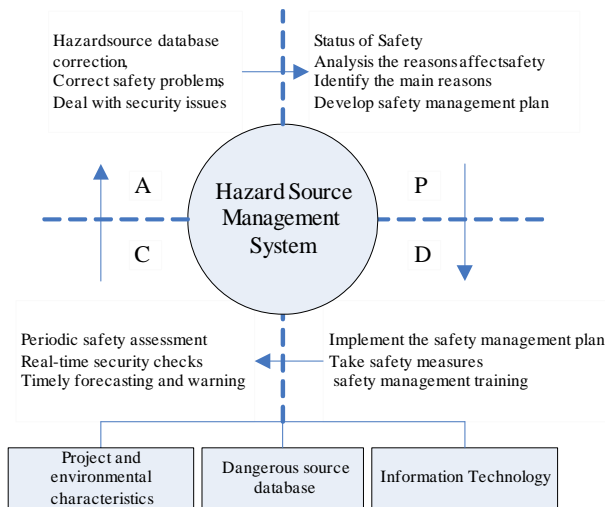


Figure 3. Process of hazard source management system

In hazard source management information system, data entry, logging, standard query, dynamic reminding safety management status need to be achieved. And the safety management should be extended into two or even more stages before and after the current construction stage. Thus the system can form a coherent safety management route, which could avoid blind investment of security management.

4 Safeguards for construction site hazard management

Project management is a complex integrated system, and any effective models and methods are affected by a number of links and constraints. So in order to achieve the project construction site hazard effective management, a series of security measures must be taken to promote the project safety management's smooth implementation.

1) Enhancing security awareness is the focus of safety management. Currently, the lack of security awareness is one of the most obvious reasons which cause safety accidents. Through simple training and experience to solid security awareness is not enough. It is a

continuous behavior in every stage of project.

2) Safety training is the key to solving security issues. All the content, object, time, period, methods, assessment, target and so on needs to be designed systematically. Only in this way, can the goal of the security training be achieved. At present, many safety trainings lack continuity which makes managers, technical staff and construction personnel safety awareness declining. This leads to security incident happening easily.

3) Safety is the key element to ensure project cost, schedule and quality management. Therefore, adequate money input should be provided for the security system. This includes security training, security equipments, security measures, security check and other inputs, which require a series of detailed plans of safety management and expenditure program before the start of construction.

4) Information Technology has already been used widely in project management, but the depth and scope is limited. It should be not only used in files dealing and modification, but also in every aspect of project management.

5) A special security management department is essential to be set up on construction sites. The staff in that department should master comprehensive security management knowledge and construction technology knowledge. The security management course should be carried out orderly to ensure the smooth implementation of project. In the mean while, how to optimize the design of security management makes a very high demand capability of the overall staff.

6) The security management ought to be institutionalized. It includes hazard forecasting, security assessment, periodic safety management, safety warning, safety evaluation, safety implementation, security processing, contingency plans and other aspects of the system. At the same time, safeguard measures, binding credit, capital and other aspects of reward and punishment mechanism are also needed.

5 Conclusion

In summary, the security management on construction site is a very important factor that deeply affects the efficiency and benefit of project. It's an effective way to establish a hazard source management system which is based on information technology. A lot of resource such as training, capital, human, organization and institution and so on is demanded to support the system.

Once all the resource is taken into the right place, in the whole project life, the system will provide safety forecast, management, assessment, early warning and treatment to reduce probability of occurrence of security issues. And it can also protect the life and property, thus promote to realize all the goals in the project.

References

- [1] Kyoo-Jin Yi, David Langford, Scheduling-Based Risk Estimation and Safety Planning for Construction Projects, *Journal of Construction Engineering and Management*, 6, 2006, pp. 626-635
- [2] Li Jianpu, Research on Hazard Identification and Safety Management of Building Construction, *Tianjin University*, Tianjin, 2007, pp. 10-20.