Study on Establishing Safety Standard System for Water Transport Engineering

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Abstract. Based on the present situation of safety standards for water transportation engineering in China, this paper comprehensively compares the advantages and disadvantages of domestic and foreign standards and standards system, and studies and builds the framework diagram of safety standards for water transportation engineering. Get to know and sort out the safety production standards for water transportation projects that have been issued in China. It discusses the new situation of the development of safe production in China, and the requirements of safety standards, safety standardization and safety standard system in the water transportation industry. The comparative study of water transport engineering standards and standards system at home and abroad is carried out. According to the requirements of relevant standards, this paper discusses the construction of the safety standard architecture of water transportation engineering, studies and proposes the safety standard architecture of water transportation engineering, which is composed of three dimensions: the type of water transportation engineering, the stages of the whole life cycle of the engineering, and the content involved in safety production, and analyzes the advantages of this architecture. This paper provides basic research for establishing the safety standard system table of water transportation engineering. The research results are of great significance to promote the establishment and perfection of the safety professional standard system, and to promote the construction of safety standardization in water transportation and port industry.

1. Introduction

Water transportation engineering safety standard is an important part of transportation industry and water transportation industry standard. Water transportation engineering safety standard system is an important part and structure of the transportation industry and water transportation industry standard, and it is the blueprint of the development of water transportation engineering safety standard. Table of the water transportation engineering safety standard system is the concrete embodiment of the standard system, is the basis of preparation of water transportation engineering safety standard project, carry out the work of water transportation engineering safety standard establishment is a guidance document, is the standard project and prepare the annual plan during a certain period of important basis, is also the foundation of scientific management standards.

As China's socialist market economic system gradually establish and perfect, the development of water transportation project construction, to meet under the condition of socialist market economy, the development of national economy in the requirement of water transportation industry safety standardization work, meet the safety industry of our country during the period of "much starkier choices-
and graver consequences-in” to put forward new requirements, an urgent need to comb in port &waterway engineering safety standard and system construction work, establish and perfect the water transportation engineering safety standard system. With the continuous development of the water transportation industry and the deepening of the standard system reform, in order to maintain the scientific and reasonable safety standards of water transportation engineering, from the perspective of dynamic standard management, it is also necessary to organize the standards and norms related to safety of water transportation engineering, and then establish the safety standard system of water transportation engineering. Standard in the developed countries in the port development has accumulated rich experience, with contrastive analysis of the overseas developed countries standards system, found that water transport engineering in our country at present the problems existing in the safety standard, absorbing their advantages and strengths, avoid and reduce the occurrence of similar accidents, for the safety of the waterway and port industry standardization construction in China lay the foundation.

Based on the national industry regulations and policies, this paper explores the current water transport safety standard system lack and need to supplement the standard project, to meet the needs of the actual operation of water transport projects, and appropriately introduce foreign advanced technical standards. The scope of the study covers all levels of the national industry, and the study focuses on the problems of the current implementation of the standard system, highlighting the integrity, operability and foresight of the standard system. The research results of this paper are conducive to improving the standard preparation level in China, meeting the needs of the transportation industry, and providing the technical basis for the standard preparation team. In the future, it will play an important role in avoiding the occurrence of "8.12" special major fire and explosion accidents, accelerating the construction of "safe and green transportation" by the Ministry of Transport, and improving the transportation safety standard system.

2. Policies and needs

In recent years, from national policy to industry management, China is strengthening the requirements and promotion of safety standardization and safety standard system construction. China’s national standardization system construction and development plan (2016-2020) (2015) calls for "deepening the standardization of work safety and strengthening the construction of standard system of disaster prevention, reduction and relief” [1]. The opinions of the CPC Central Committee and the State Council on promoting the reform and development of production safety (2016) calls for "improving the system of production safety laws, regulations and standards, accelerating the formulation, revision and integration of production safety standards, and establishing a system of production safety standards with mandatory national standards as the main body” [2]. China’s Ministry of Transport proposed in the "13th five-year development plan for transportation standardization" that "the standard system needs to be further improved, the total amount and quality of standards still cannot meet the development needs of the industry, the construction of the standard system should be strengthened, and the revision of standards in key areas such as transportation (Safety, emergency, etc) should be accelerated urgently” [3].

According to the Tianjin port "8-12" special major fire and explosion accident report [4], a large number of safety risks exist for a long time due to the disordered safety management of enterprises. Diversification of relevant safety standards leads to opportunistic management; The responsibility of the administrative department is unclear, which leads to insufficient supervision and supervision.

To sum up, whether from the national policy level, or the level of development of the water transport industry, as well as the cause of the accident prone, it desiderates to study on safety standard system of water transportation engineering based on the standard of ‘principles and requirements for preparing diagrams of standard system (GBT13016-2009) [5].’ Through sort out and grasp the safety standards of water transport engineering, and make a thorough inquiry on the requirements of safety standards for water transport engineering, also research on establishing safety standard system of water transportation engineering, in addition compile safety standard system table of water transportation engineering, in order to promote the standardization of water transport and port safety, to improve the safety production
capacity of China's water transport industry, to improve the competitiveness of water transport and port enterprises in the international market.

3. Research status of standard system at home and abroad

In the ‘Standardized Development Plan of National Safety Production (Main Industry) in 2008-2010’ [6], safety standard system in China is composed of five subsystems, which are basic standards subsystem, management standards subsystem, technical standards subsystem, product standards subsystem and method standards subsystem.

In 1996, the Ministry of Transport of People’s Republic of China promulgated and implemented the ‘Construction Standard system table of water transportation engineering’ [7] for the first time, and revised in 2007 and revised again in 2016. This standard system is divided into three levels. The first level according to the management process is divided into engineering construction management, engineering construction technology and engineering maintenance technology category. The second level according to the construction procedure is divided into the comprehensive standard, the survey standards, the design standards, the construction standards, the test and inspection standards, the supervision standards, the quality inspection standards and the engineering quota standards. The third level consists of general, basic and special standards. In 2009, the Ministry of Transport of People’s Republic of China promulgated and implemented the ‘Standard for Quality Inspection of Port and Waterway Engineering Construction’ [8], and it is to unify the technical requirements of water quality inspection, and strengthen the quality management of water transport engineering. this standard mainly includes the testing methods, inspection procedures and quality standards for port engineering, waterway engineering and shipyard hydraulic structures and other waterway construction engineering quality.

In recent years, some scholars have carried out the research on the safety standard system for water transport engineering [9]. For the first time, it is a systematic study on the technical standards for safety of water transportation engineering be under construction. It puts forward trichotomy and four level structure of the constructing method for safety technical standard system of water transport engineering be under construction. And the safety standard system is established based on three levels: basic standard, general standard and special standard. The three levels of the standard system reflect the common characteristics of safety technology field in water transport engineering, and reflects the generality standard of safety technology for different objects of water transportation engineering, also reflects the professional property of safety technical standards for water transport engineering be under construction. At the same time, it also puts forward the orientation of water transportation engineering safety standards in the construction standard system of water transportation engineering. It provides research ideas, system hierarchical division, system construction methods, etc., to further establish safety standard system for water transport engineering. Although these standards and the standard system relate to the scope of the safety of water transport engineering, but mainly for the standard requirements in the design, be under construction and construction, acceptance for water transport engineering and safety standard system be under construction. Up to now, it has not yet promulgated and implemented the professional safety standard system of water transportation engineering in China [10].

Many developed countries have rich experience in the development of water transportation and port standards, but at present, it has not established the corresponding safety standard system in the field of water transportation engineering or port engineering [10]. The relevant safety standards are only distributed in the technical standard system. The requirements of the relevant safety standards are very detailed and in-depth to the safety and health of the relevant staff [11].

Comparative analysis of domestic and international standards, it can be concluded that the following problems exist in the safety standards of water transportation engineering: ① Compared with the western countries, it is lack of a perfect system of supervision and regulation at the national level in China [12]; ② The standard system of China is constructed by imitating the former Soviet Union standardization mode, but it has not realized ‘comprehensive application’ [10]; ③ Chinese enterprises rely on and direct use of national standards or industry standards, but lack of strength in the development
of enterprise standards, which is on behalf of advanced technology level, so make the enterprise standard failed to give full play to enhance the role of enterprise technology level, but the national standards to a certain extent, the technical requirements are low [13]; ④ Domestic standards are relatively rough compared with foreign standards, specific measures are not described in detail, there are no relevant provisions, and the guidance of standard is not strong [10]; ⑤ In China, the standard of personnel training certification has just started, compared with foreign standards, lack of standards, the requirements are not perfect, not exhaustive [9]; ⑥ Most of standard revision has no fixed cycle, but the foreign standard has the fixed revision cycle and so on [10].

Through comparative studies, the requirements and development direction of standards and standards system in the safety field of water transportation engineering are pointed out. The research results provide basic support for the research and establishment of safety standard architecture of water transportation engineering.

Figure 1  Comparison of Chinese and foreign safety standard system of water transport engineering

4. Safety Standard system for Water Transport Engineering

4.1. Positioning of standard system
The safety standard system of water transportation engineering, is positioned as safety field, professional standard system.

In recent years, with the national and social attention to safety production in China, and related measures taken, the multiple momentum of heavy and serious accidents has been effectively curbed; But heavy and serious accidents happen now and then, so the situation of production safety is still grim in China. From the national policy level, to the level on the development of the water transport industry, both are strengthening the requirement and promote the safety standardization and safety standard system. It is urgent to establish a professional safety standard system for water transport engineering.

4.2. Standard system structure setting
The structure for safety standard system of water transportation engineering is divided into three dimensions. The first dimension reflects the different functions, structural forms, and industry characteristics of water transport engineering, and the first dimension is named Waterway Engineering Type. The second dimension reflects the different stages of the life cycle of water transport engineering, including planning, design, construction, maintenance, operation, etc., and The second dimension is named Engineering Life Cycle Stage. The third dimension reflects the content and scope of safety, and is named Safety Content and Scope.
The structure for safety standard system of water transportation engineering is divided into three dimensions, which is referred to structure setting of the ‘Construction Standard system table of water transportation engineering (2016)’ (Its system is divided into three levels). But the structure is not exactly the same. The contents of the three dimensions are related to the issue of three professional, but the contents three construction levels are existence the problem of crossing each other (non defect or deficiency), which are due to the different positioning of these two systems. The safety standard system of water transportation engineering is a professional standard system, yet the construction standard system is a comprehensive standard system for water transportation engineering construction.

The first dimension is divided into six categories which are including port engineering, waterway engineering, building engineering and shipping hub, shipyard hydraulic engineering, shipping equipment installation engineering and water traffic control engineering. These six categories derive from the first level of the ‘Construction Standard system table of water transportation engineering (2016)’ [7].

The second dimension is divided into four categories which are including planning and design, construction and acceptance, engineering operations, engineering maintenance. These four categories derive from and combined with different stages of the life cycle of water transport engineering, which are planning, surveying, design, construction, maintenance, operation, management and related activities.

The third dimension is divided into eight elements which are including work safety, equipment and facilities safety, fire and explosion prevention, individual protection, occupational health, emergency response, safety management, safety technology services. These eight elements derive from all kinds of safety activities in the production process of water transport engineering.

4.3. Standard system structural framework
According to the three dimensions of the safety standard system of water transportation engineering, the structural framework of the safety standard system is established (Showing in figure 2).

5. Advantages of safety standard system
This safety Standard system for Water Transport Engineering has the following advantages. ① Divided into three separate dimensions, the representative content of each dimension does not cross each other; ② To highlight the importance of any dimension, this dimension as the mainly role can be used to compile the system table; ③ Existing safety standards for waterborne engineering can be located in appropriate locations; ④ According to the parameters for the three dimensions, respectively, three dimensions are combined into a new safety standards, then combined with the actual needs and rationality, the new safety standards name can be formation; ⑤ Compared the new safety standards with the existing safety standards, and with the development situation for safety production and water transport industry, the safety standards which are urgently needed in the next few years are extracted; ⑥ To provide a basis for enriching and improving the safety standards of water transport engineering.

6. Conclusion
In order to meet the new situation of China's safety production development and the new demand of the development of water transport industry, the safety standards of waterborne engineering have been published, and the requirements of safety standards and safety standards system of waterborne engineering have been discussed and summarized. This paper compares the domestic and foreign standards and standards system, and discusses the advantages and disadvantages of each other, it provides some ideas and references for the establishment and improvement of safety standard and standard system of water transportation engineering. The safety standard architecture composed of three dimensions is proposed, and the connotation and content of the three dimensions are clearly endowed. The advantages of safety standard system for water transportation engineering are discussed and analyzed.
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Figure 2  The structural framework for the safety standard system of water transportation engineering

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