Value Analysis on the Hong Kong-Zhuhai-Macau Bridge Project Documents

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Abstract

The Hong Kong-Zhuhai-Macau Bridge (HZMB) is the first mega cross-sea transportation link to be built jointly by the governments of Guangdong, Hong Kong and Marco under the "One Country, Two Systems" policy. The HZMB achieved many technological innovations, including 31 construction technologies, 13 software programs, 31 types of equipment, 3 products and 454 patents. Hidden behind these innovations are the HZMB project documents. It has great potential values because it recorded the stories, the cultures and the knowledge. After the definition of the HZMB project document, we introduced its archiving process which describes the document come from and indicates the document quality. Based on the types and quantity of the HZMB document, we analyzed the document value from fellow aspects: system integration and innovation, personnel training and academic value, operation and maintenance supports, and cultural innovation. We get the conclusion that the HZMB project documents is valuable like a gold mine.

Keywords

Document Value; Project Document; The Hong Kong-Zhuhai-Macau Bridge.

1. Introduction

As a real record of scientific and technological research activities, project document is very important information resource. It is not only an important basis and evidence for production technology management and scientific research management, but also a necessary condition for scientific research and engineering construction. For project construction enterprises, it helps to carry out production and construction activities, and improve the level of enterprise management to achieve production and construction results. What's more, project document records the whole construction process and management process of specific matters, technical problems. After the completion of construction, it provides significant support for the later operation and maintenance[5].

2. Connotation and characteristics of the HZMB project documents

2.1 Connotation of the HZMB Project Documents

Document refers to various forms of historical records, such as written charts, audio and video, which are directly formed by past and present state institutions, social organizations and individuals when they engaged in political, military, economic, scientific, technological, cultural, religious. It has preservation value for the state and society.

According to the "measures of Guangdong Provincial Department of transportation on the management of highway construction project documents" (YCB [2012] No. 406), the archival data of the HZMB belongs to the project documents in the "measures". Project record of highway construction project referred to in the "measures" is the historical records of various forms and carriers produced from the approval of project approval to the completion acceptance, which reflects the basic situation of project quality, progress, cost and safety management, and has preservation, examination and utilization value for the project management, operation, maintenance, reconstruction and expansion after completion.

In the document of "compilation method of main project documents of the HZMB (version v1.0)", the meaning of "project documents" of the HZMB is clearly defined that project document is the project record systematically sorted and archived according to the requirements of document filing. Project record is the historical records of various forms and carriers with preservation, examination and utilization value. It is formed in the whole process of project approval to completion acceptance, including text materials, drawings, charts, calculation materials, audio-visual materials in the whole process from planning, preliminary preparation to completion and use. Project document is an important basis for project completion acceptance, operation and maintenance.

The project documents of the HZMB bear four social functions: the first is the function of accumulating and managing the wealth of national documents; the second is the function of disseminating archival information to serve the society; the third is the function of providing original documents to maintain the original appearance of history; and the fourth is the function of publicity and education. The project documents of the HZMB are managed by the special management department. The specific collection scope and sorting unit are implemented according to “the filing scope, storage period and classification table of documents and materials of highway construction project in Guangdong Province”.

2.2 Filing of the HZMB Project Document

Before the completion and acceptance of each construction contract of the HZMB construction project, the project record together with the directory (including electronic directory) and description that have been systematized shall be submitted to the supervision unit for review. The supervision unit shall check and audit the integrity, accuracy and systematicness of its project documents to form an evaluation report[3]. For the documents that do not meet the requirements, the supervision unit shall supervise and urge the rectification until they meet the requirements. The construction unit shall hand over the original project documents and the catalogue to the HZMB Authority within one month after the contract passes the acceptance. If it’s necessary to copy the project record, the number of sets shall be determined by the HZMB Authority according to the actual needs. The Authority is responsible for keeping the full set of original project record. The process of document archiving is shown in Figure 1.

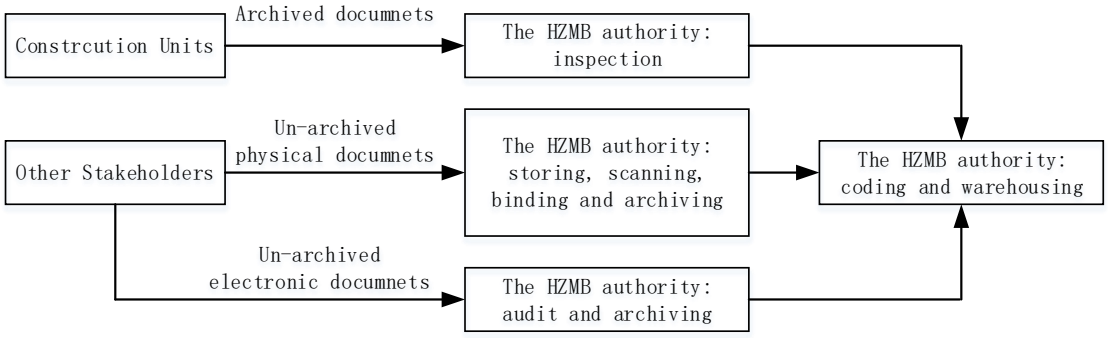

Figure 1. Archiving process of the HZMB project documents

The document filing for project document of the HZMB should follow the law of natural formation and principle of completeness in each stage of the highway engineering capital construction procedure. It can maintain the internal organic connection of the documents with scientific classification and reasonable composition. The documents consist of file materials, directory, cover, box and reference form, and its format conforms to “the general requirements for the file composition of science and technology documents”.

The general principles of arrangement of files in the project documents are as follows: Firstly, the documents are generally in front of the drawing; the translation file should be in the front of the original file. Nets, a single document should be printed before the final version; the original document

should be in front of the attachment. Finally, the reply to the correspondence should be in front of the request for instructions. The whole document include the files from project legal person, design unit, supervision unit and construction unit.

The contents of the documents include serial number, number, responsible person, document title, date, page number and remarks. Serial number, in accordance with the order of documents, marked with Arabic numerals from 1. Number, the original number or drawing number of the document. Responsible person, the main formation unit of the documents. Title of the document, the full name of the title of the document. Date, the final date of the formation of documents. Page number, the page number marked on the first page of each document. Remarks, the information to be noted.

The cover of the project document is composed of the title, filing unit, start and end date, storage period, secret level and file number. According to the requirements of classification and convenient access, the thickness of file box is 20, 30, 40, 50, 60 and 80 mm. The thickness of the file box is mainly based on the number of pieces in the test paper and the corresponding number of pages. In each file box, there is a "In volume reference sheet ", which is placed on the last page of the file box and used to indicate the documents in the volume and the filing status. Its content includes four parts: description of the volume, filing person, inspector and archiving time.

2.3 Type and Quantity of the HZMB Project Documents

According to the requirements of "eight categories" in the filing scope of "management measures of Guangdong Provincial Department of transportation on highway construction project documents" (yjtb [2012] No. 406), the project documents are divided into project approval documents, basic design documents, design documents, project management documents, construction documents, supervision documents, completion documents and scientific research project documents. The HZMB Authority receives all the project documents and does a good job in summarizing them. It compiles a complete set of files to be included in the file volume directory and compiles the project file arrangement description. Before filing the project documents, the collection unit shall classify and file according to the internal relationship of the documents.

As of February 20, 2021, the HZMB Authority has stored 22566 physical files, 614 tapes. 242869 PDF files are stored in the document server and 17849 AutoCAD electronic files are stored in the special computer. The overall situation of the archival data of the HZMB Authority is shown in Table 1.

Table 1. General situation of documents types and quantity

	Physical documents		Digital documents		Audio / Video
	Un-archived	Archived	PDF file	AutoCAD file	tape
Number	580	22566	242869	17849	614
Storage location	Storehouse B	Storehouse A	Network center server	Special computer in teh Documents Center	Storehouse A
Safety measures	document self	document self	Automatic backup by the software	Manual backup	Antimagnetic cabinet

The PDF file generated by the HZMB Authority meets the requirements of “GB / t23286.1-2009 document management long term electronic document format Part 1: use of pdf1.4 (PDF / A-1)”.

3. Analysis on the value of the HZMB project documents

The archival data of the HZMB is of great value and needs to be developed. From system integration to innovation, academic research to achievement publication, personnel training to education base, operation and maintenance support to social service, all these proved the great value of the HZMB archival data.

3.1 System Integration and Innovation

The biggest characteristic of the HZMB is that it is jointly built by three cities under the condition of "one country, two systems". How to deal with the relationship with the three governments and win

the trust has become the most difficult and important issue. The HZMB Authority adheres to strictly abide by the agreement and the articles of association, and conscientiously implements a series of management systems approved by the three governments. The Authority is fully transparent to the three governments, which enables them to keep abreast of the decision-making process and implementation results. Archival data carries a series of systems and measures, and leaves valuable wealth of institutional innovation.

The documents of the HZMB witness the progressiveness of the project. A series of innovations and practices, such as management system, technical standard system, quality assurance system, HSE (health, safety and environment Trinity) operation system, have set a world benchmark.

3.2 Talent Cultivation and Academic Value

The project documents of the HZMB set a good example for cultivation of talents. As of February 26, 2021, academic search in the digital library with the title of "Hong Kong Zhuhai Macao Bridge" has found 2136 journal literatures, 221 conference literatures, 61 dissertations, 44 books and 9 laws and regulations. Among them, there are 446 core journals of Peking University, 150 journals of CSCD, 31 journals of CSSCI, 1 Journal of EI and 1 Journal of SCI. The search results also show that the HZMB has important academic research value.

Taking South China University of technology as an example, as of 2018, under the careful guidance of the master's supervisors of the school of civil engineering and communications, 56 builders of the HZMB have completed their studies one after another and successfully obtained the master's degree in engineering. It can be seen from the titles of master's dissertations that the research contents of the dissertations are all around the HZMB project. These papers discussed the technical and management problems involved in the construction process of this super project from the perspectives of management, cost control and construction detection.

3.3 Operation Support and Cultural Creative

The HZMB is the first modern sea crossing project integrating bridge, island and tunnel in China. In order to "make good use of and manage" this world-class modern cross sea channel project and realize the industrial transformation of operation and maintenance management of China's cross sea channel project, it is urgent to promote the technical innovation of operation and maintenance management for the bridge, and form a modern engineering technology system for operation and maintenance management.

In order to meet the needs of operation and maintenance, the Chinese science and Technology Department issued the project of "integrated application of intelligent operation and maintenance technology of Hong Kong Zhuhai Macao Bridge". Aiming at the major needs of operation, maintenance and safety guarantee of the whole life cycle of the HZMB, the project build a modern engineering technology of maintaining the service performance of cross sea cluster facilities, ensuring the safe operation of cross sea cluster facilities, and realizing the active management and control of emergency response. The intelligent diagnosis, operation and emergency technology platform are constructed by breaking through the scientific and technical problems of holographic perception of service state, whole process cognition of service performance, intelligent diagnosis of defect state, optimization decision of early warning and maintenance, and independent management and control of emergency disposal of "bridge Island tunnel" cross sea cluster facilities [1]. In the operation and maintenance project, the integration of static file data and dynamic monitoring data, the combination of unstructured file data and structured historical data can effectively support the maintenance of the bridge.

Cultural and creative industry is the trend of economic development in the world. It contains economic and cultural values, and becomes the carrier of cultural identity, value through cultural embodiment and inheritance[6]. The HZMB, known as one of the "seven new wonders of the modern world", is the longest, largest investment, highest standard and most difficult bridge in the history of bridge construction in China[4]. The HZMB brings not only together a number of cutting-edge

technologies of island, tunnel and Bridge in the world, but also condenses the wisdom and strength of scientists, engineers and managers. It has great cultural innovation value. Promoting the development of cultural innovation industry and creating the brand of the HZMB are not only conducive to promoting economic development, but also meet the diversified needs of the public, such as aesthetic taste, knowledge and spirit. It reflects the cultural development level of the society and improves the added value of cultural products[7]. The culture contained in documents is the source of cultural and creative products. Therefore, it is of great significance for the research and development of documents cultural creative products to excavate the deep cultural connotation of the documents of the HZMB project and promote the inheritance of the advanced archival culture[8].

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