

Research on Structural Integrity Management Technology in the Construction Stage of new Platform Engineering

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Abstract. The structural integrity management technology of offshore platform runs through the whole life cycle of the platform, including the stages of planning investment, engineering construction, operation and maintenance, and waste disposal. The earlier the offshore platform structural integrity management technology is developed, the richer the structural data will be, the more optimized the risk control will be, and the more complete the integrity system will be. The development of structural integrity management technology in the early construction stage of the platform can provide basic conditions for the management of the platform structure and realize the standardization and intelligence of structural data, which is of great significance for the safety and stability of the platform structure and the later production management and maintenance.

Keywords: Platform structure, Integrity management technology, safety life cycle, risk control.

1. Introduction

Platform as an important rely on offshore oil and gas development, provide offshore oil drilling equipment, facilities and personnel living space, due to long-term in the Marine environment, under the influence of environmental factors such as wind, waves, bad work environment, platform and structure component fatigue corrosion block growing. A platform in BoHai bay as an example, The upper part of the platform consists of helicopter deck, upper deck, middle deck and lower deck. Major facilities include oil and gas gathering equipment, utility system equipment, water injection system, opening and closing system, electrical, living room floor, etc. In the production management platform of the parts are susceptible to corrosion and damage, and carry out the construction stages platform structural integrity management technology research, improve the structure of platform data acquisition, processing, and make the platform integrity management framework, It can provide operation and maintenance strategy guidance for the later stage of facility operation and maintenance to ensure that all components of the platform are in safe and reliable service state.

2. Research status of platform structural integrity at home and abroad

According to the structural characteristics and working state, the offshore platform can be divided into three types: fixed, semi-fixed and mobile, among which the fixed type accounts for the majority. The fixed type platform uses steel pile legs to fix the seabed, the middle part is composed of conduit structure for transmission, and the upper part has a deck. Due to the harsh ocean environment, the platform is easy to be damaged by extreme environmental load, and then accidents occur. The safety of platform structure is concerned by the field of ocean engineering.

Risk-based inspection was developed in the field of Norwegian offshore engineering in the 1970s and developed guidance documents for platform construction and design. In the 1990s, the Institute of American Petroleum Institutes (API) and Det Norske Veritas (DNV) developed the key RBI technologies, issued API standards, and defined the evaluation and inspection standard system for the safe service of offshore structures. In China, the research based on risk test is late. Bingjun Qin stated the platform structure evaluation clearly. Qing Yu studied the process and theory based on risk testing. Guoming Chen analyzed the structural damage of offshore platforms, and studied the risk assessment and maintenance optimization of aging platforms. At present, The theory of platform structure safety in China is relatively perfect, and the corresponding professional analysis software is lacking. CNOOC conducts structural integrity management technology research on 11 platforms, and adopts the method of inspection and evaluation to complete the safety assessment of platform structure[1].

3. Technical process of platform structural integrity management

Platform structural integrity management is a process to show its applicability throughout the life cycle, including platform modification, damage, load change, storm resistance analysis and emergency response. Through the research on the structural integrity technology of Norway, America and CNOOC platform. According to the API-RP 2SIM standard commonly used internationally, the four elements of platform structural integrity management are data, evaluation, inspection plan and inspection implementation[2].

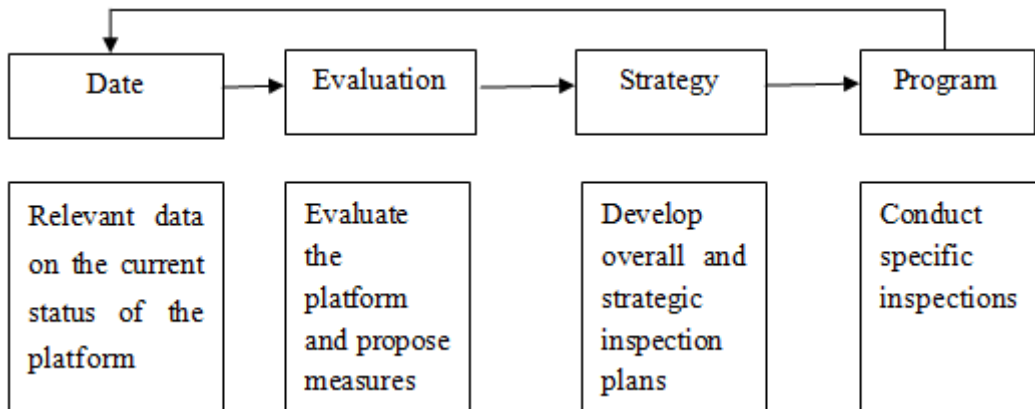


Figure 1. Technical flow chart of platform structural integrity management

4. Research on integrity management technology of platform structure

Based on the comparative investigation of platform structural integrity technologies at home and abroad, the method of inspection and evaluation commonly used by CNOOC in China is adopted to study platform structural integrity. Based on the process elements of platform structural integrity, the research scheme of platform structural integrity in the stage of platform engineering is improved, Carry out the inspection, collection, process and evaluation of platform structure data in the engineering construction stage, and formulate the later platform structure management guidelines..

4.1. Inspection of platform structure

Detection method of platform structure: Visual detection, view of detection, nondestructive flaw detection, steel structure detection, potential detection, anode block size detection, water filling component detection, defect detection and scour detection, etc. For the new platform in the engineering construction stage, generally use the method of visual inspection, under normal circumstances use the method of UT thickness, if find some defects flaw, use the method of photograph and MT. The detection method and means are simple and simple.

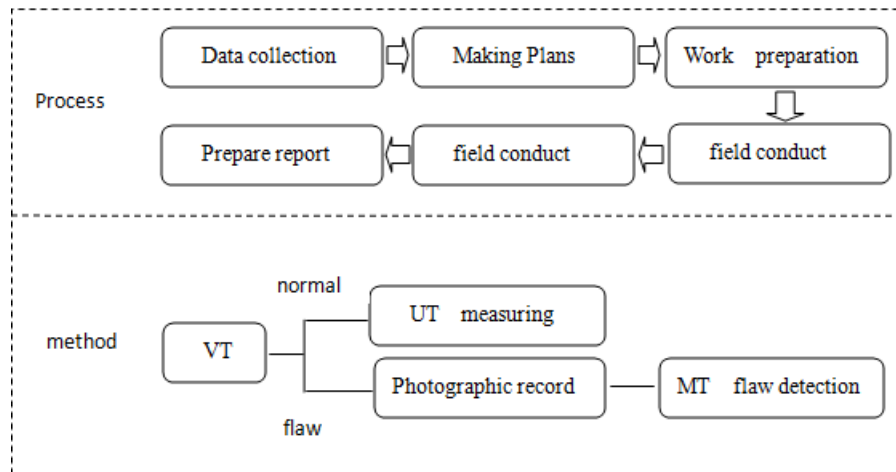


Figure 2. Implementation process and method of platform block baseline detection

4.2. Time and place of baseline data testing of platform structure

For the new building platform in the engineering construction stage, the baseline data of the platform structure shall be tested at the platform construction site and the offshore installation site. During the construction stage of the platform, inspection of appearance, weld and wall thickness should be carried out at the construction site of the platform. The most important thing for offshore installation is the baseline inspection of the platform structure.

Table 1. Baseline data detection time and location of platform blocks

detection task	detection time	detection site
weld inspection	After welding	Platform construction site
Structure wall thickness testing	After construction	Platform construction site
Appearance inspection after construction	Before the shipment	Platform construction site
Appearance inspection after installation	Platform acceptance	Offshore platform site
Monitoring device measurement	Platform acceptance	Offshore platform site
Platform structure data detection	Construction and installation	Construction and installation site

4.3. Platform structure data acquisition object

After passing the inspection of the platform structure, the platform structure data shall be collected, including column, main inclined support beam and support pipe, and main deck beam (H-beam).

4.4. Platform structure security risk assessment

The safety assessment of platform structure is to make a comprehensive check on the condition of platform structure and estimate the risk level. Mainly include: static, seismic, spectral fatigue, dynamic and collapse analysis. Based on the risk analysis of the platform structure, the probability of component failure and the influence of failure on the stability of the structure are obtained, and then the risk ranking is carried out, according to which the structural components are graded. Generally, there are qualitative risk assessment and quantitative risk assessment. For the structural risk assessment in the stage of platform construction, it is more important to establish the platform structure database and sort out the baseline data of the platform structure detection, so as to facilitate the application in the later production and maintenance process[3].

4.5. Platform structure digital data management applications

Platform structure data acquisition produces a large amount of data, which should be managed effectively. Through digital technology, it can manage institutional data such as design documents, structural drawings, structural forms and detection wall thickness, deepen the integration of key structural data of the platform, improve the integrity management information database of the platform structure, and facilitate the later management and maintenance of the platform structure. The whole database system has 3d model display, detailed information display of structural components, including structure type, wall thickness, material, length, design data, inspection data and related drawing data attachment archiving functions.

4.6. Platform structural integrity management guide

Establish the platform structure integrity management guide, clarify the key nodes and control requirements of platform structure integrity management in the engineering construction stage, carry out the application of structural integrity related technologies, and provide guidance for the maintenance and maintenance of offshore oil platform structure in the later period.

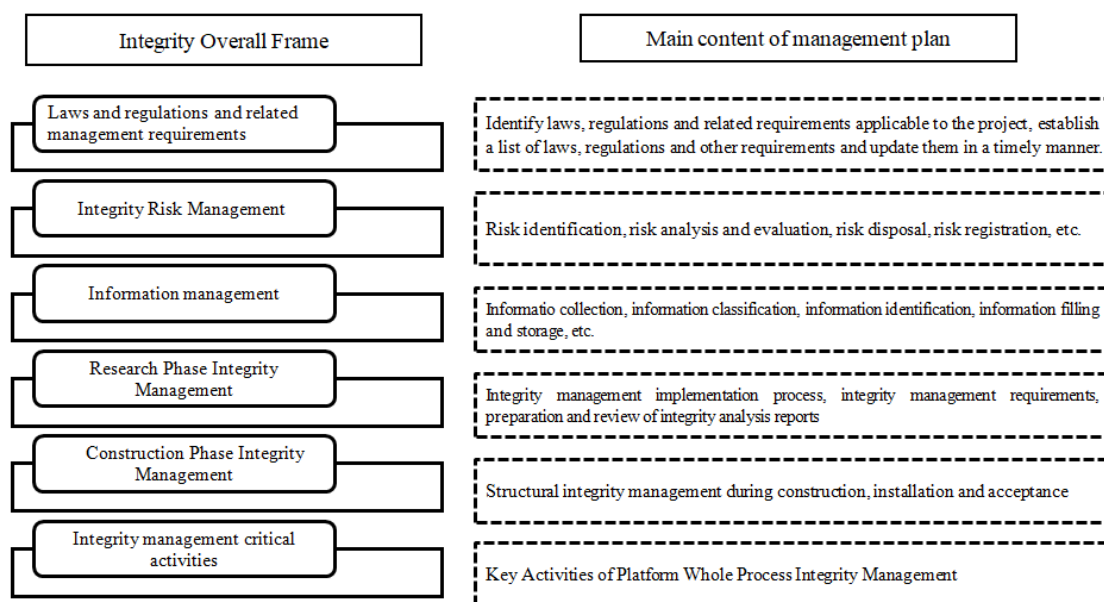


Figure 4. Technical framework of platform structural integrity management

5. Conclusion

(1) By investigating the status quo of the platform structure integrity at home and abroad and benchmarking advanced integrity management technology, it is concluded that the platform structure safety assessment can be completed by means of inspection and evaluation.

(2) According to the API-RP 2SIM standard, the four elements of platform structural integrity management are data, evaluation, inspection and implementation.

(3) As for the research on platform structural integrity in the construction stage, according to the four elements of structural integrity management, the platform structural data are detected, collected, processed and evaluated, and the later platform structural management guide is formulated to provide guidance for the later overhaul and maintenance of platform structural integrity.

References

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