

Proceedings of the 2014 Offshore Structural Reliability Conference

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Introduction

The 2014 *Offshore Structural Reliability* conference was hosted by API for the same purposes as similar past events such as *DIRT (Design–Inspect–Redundancy–Triangle)* conference in 1983, the series of *Civil Engineering in the Oceans* conferences by the American Society of Civil Engineers (ASCE), and the *Reliability of offshore structures* workshop by the Association of Oil & Gas Producers (OGP) in 2012 [now the International Association of Oil & Gas Producers (IOGP)].

Practitioners and end-users of structural reliability methods were brought together for the purpose of sharing the collective knowledge of applying reliability theories and operating experiences in order to address the offshore design and operational challenges facing the industry.

These proceedings contain the material presented at this conference that included alternating sessions of instruction and topical papers starting with the history of offshore reliability studies, progressed to current activities, and then finally outlined issues for future resolution. This event was of interest for operators, engineers, regulators, academics, and anyone else involved in the design and operations of offshore structures.

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Keynote Paper 1

History behind the development of Limit State (LRFD) Offshore Structures Design Standards

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ABSTRACT

The manner in which reliability is applied to structural engineering is different from most other forms of engineering. Other engineering disciplines tend to consider reliability in the context of the performance of many thousands of identical precision made components where physical and performance tests can be used to quantify product reliability. Structures, which may involve many thousands of tonnes of material and site assembly, are not identical and cannot normally be physically tested on completion. Reliability is therefore addressed in the design and fabrication standards.

This paper addresses the early development of structural reliability as a concept, initial applications to standards development and how it has been incorporated in the International Standards Organisation (ISO) Offshore Structures Standard.

Offshore Structures designed and fabricated to current standards have in general a satisfactory reliability. An overview of where the industry is in terms of reliability is provided.

INTRODUCTION

The oil industry has built platforms offshore since 1947. Initially they were in very shallow water using dock piling technology. As they extended out into deeper water tubular jacket structures evolved. The oil first industry specific offshore structures design recommended practice API RP 2A

was developed in the early 1970's by the American Petroleum Institute (API) focusing on the US Gulf of Mexico. This RP has been actively developed with 20 further editions published up to the mid 1990's. Although written primarily for application to US waters it has been applied extensively to offshore structures design worldwide. With the discovery of oil and gas in the harsh waters of NW Europe other national practices and standards in the UK and Norway were developed reflecting the specific needs of this region.

Initially the objective of the oil industry standards was to address the key design issues such as marine loading, tubular joint design, fatigue, materials selection and fabrication tolerances with a conceptually very simple single WSD load factor. This resulted in an inconsistency in reliability depending on the accuracy with which the extreme marine load can be predicted and the ratio of the live load to the self-weight of the platform. The industry is now in the process of migrating to the slightly less simple but more consistent limit state (also LRFD) method for specifying load factors.

The oil industry has been behind other structural sectors in applying reliability based design. It is fast catching up. This paper outlines some of the history of the development of reliability based structural design standards and the adoption of them by the oil industry.

HISTORY OF STRUCTURAL STANDARDISATION

The development of standards in structural design has been a very long term process. Early examples of standardisation tended to be in the sphere of military engineering. The Romans had a systemised process operated by a corps of military