

DESIGN OF OFFSHORE CONCRETE STRUCTURES

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Abstract

Contractors and investors have lately shown a renewed interest in concept development of reinforced concrete structures in the marine environment. Examples of such concepts are: fixed gravity platform in arctic areas, terminals for LNG/LPG offshore, offshore harbours general, foundations for windmills offshore, deep caisson type bridge foundations and floating foundations for harbours, warehouses, car parks etc in major cities around the world.

Based on the renewed interest in the use of concrete for structures in the marine environment also in new types of concepts, DNV is issuing an Offshore Standard for Offshore Concrete Structures. The aim of the standard is general and makes an attempt to cover special marine considerations in the design and construction of mostly all variants of marine concrete structures, i.e. fixed oil producing installations, floating oil producing installations, LNG/LPG terminals, Offshore harbours, foundations for large bridges, windmills founded offshore etc.

The DNV Offshore standard for offshore Concrete Structures is based on the earlier Rules for Design of Concrete in the marine environment, i.e. the 1974 rules, the 1977 rules and the 1993 FOf Rules. The Offshore standard is further founded on the experience gained with the used of these standards and the durability of existing platforms built in the period after the installation of the first concrete platform at Ekofisk in 1973.

Keywords: concrete structures, design standard, offshore, LNG Terminals

1. Introduction

Some offshore concrete structures are large and complex in their geometric shape. These structures are to-day designed using the best available techniques [1] to [16]. This includes predictions of the force resultants in the structure using FE analysis with up to 1.5 million degrees of freedom, code checking of the FE results using special dedicated post-processing software, local capacity evaluations in areas where the linear FE analysis is known to be inaccurate. Special analyses are carried out for predictions of response from earthquake, wave induced dynamic actions, foundation design and geometric non-linear action.

DNV developed in 1974 its first Offshore Rules covering both steel and concrete structures. This Rule was developed in line with the Rules issued by DNV for classification of ships and the purpose of the Rules was to ensure a common safety level for structures designed and constructed where DNV was involved in the role as 3rd Party verification. The DNV Rules formed early the standard for the design of offshore concrete structures in the North Sea, both in British and in Norwegian waters. The latest issue of DNV FOf Rules [19] was issued in 1995.

DNV issued in 1979 "Tentative Rules for the Construction and Classification of Floating Facilities for Hydrocarbon Processing and Storage". This tentative rules covered classification of LNG terminals. In 2002 DNV issued the Offshore Service Specification DNV-OSS-102 [20] "Rules for the Classification of Floating Production and Storage Units", in 2001 DNV-OSS-103 [21] "Rules for

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