ENERGY

IMPROVED UNDERSTANDING OF CONCRETE FATIGUE ALLOWING MORE OPTIMIZED DESIGN

Joint Industry Project – Call for Partners

DNV GL is inviting parties with an interest in gaining and benefiting from new knowledge regarding concrete compression fatigue to participate in a new Joint Industry Project. The intention with the JIP is to develop a standardized test method for concrete compression fatigue with the aim to gain further knowledge of the behaviour and eventually allow the industry to go beyond current standards with more optimized concrete fatigue design rules.

Background

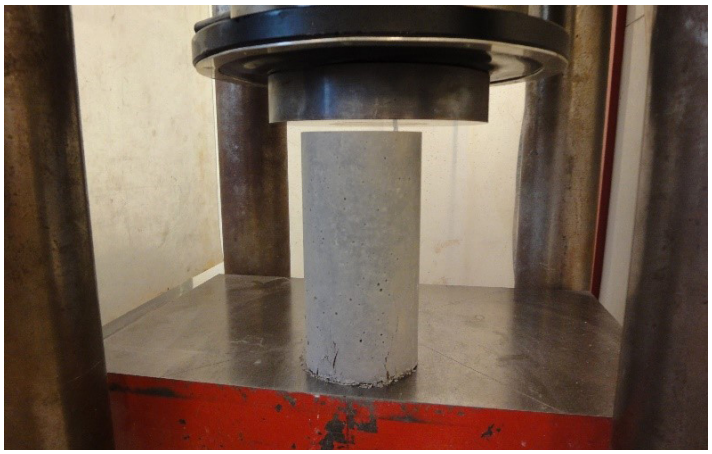
The currently available tests for concrete compression fatigue are based on rather different test set-ups. It is sometimes unclear how the data have been evaluated and how/if the data from different test series can be compared. Additionally, the available design methods for concrete compression fatigue vary with respect to which parameters to consider and the influence of these parameters.

Aim

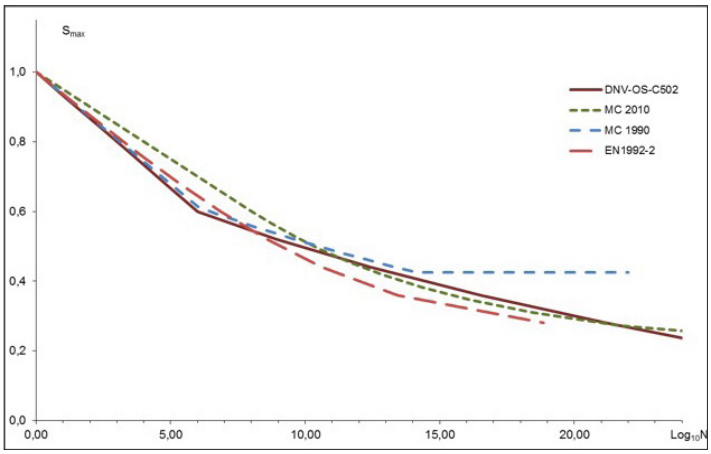
The goal of the proposed JIP will be to develop a standardized testing method for concrete compression fatigue, which currently is not available. A standardized testing method can be used to go beyond current standards and can form the basis for the future development of the fatigue design methods including determining more precise safety factors. This will benefit concrete designs where fatigue is a design driver (e.g. many wind turbine structures).

Potential JIP partners

Relevant JIP partners are developers, owners and manufacturers who develop and operate wind turbines with concrete support structures, as well as designers, universities and test institutes who have an expertise on and a desire for acquiring further insight into the subject. The intention is to involve stakeholders with an interest in bringing together available knowledge and data and benefitting from moving the discipline further.



Standardized testing of extreme concrete strength



Example of variation in SN-curves (characteristic curve for S_{min} = 0.2)

Benefits

A standardized testing method for concrete compression fatigue will enable more optimized concrete structures by reducing the uncertainty in concrete fatigue design. Thereby the JIP partners can get a competitive edge by being able to utilize acquired knowledge and get opportunities:

- to reduce cost of new constructions
- to facilitate lifetime extensions of existing installations.

A standardized test method will further enable the industry both to evaluate specific materials with respect to current fatigue design methods and to produce more test data which is directly comparable for future development of the methods. On the long-term perspective, the concrete industry can benefit from being able to supply competitive support structures for wind turbines and the society at large can make use of cost reduction in energy production.

Deliverables and project scope

First step of the JIP will be to collect and investigate available test data and systematically assess all major design parameters by studying the test set-ups, the test results, and the performed data evaluations. This will enable the JIP partners to evaluate which parameters are important to consider in a standardized test method and discuss an appropriate test set-up and test procedure.

New testing should be performed in the JIP programme to try out possible test methods. Scope for testing will depend on the budget established for the JIP. A test procedure shall be drafted incuding specification of for example specimen geometry and preparation, testing velocity and data evaluation method.
The standardized test method should, when developed, be presented in for example DNVGL-ST-0126 "Support structures for wind turbines" or a new DNV GL Recommended Practice to be used for optimization of concrete designs.
A potential extension of the JIP could be to perform a calibration of the safety factors to be applied in concrete fatigue design if it is found that sufficient comparable data exist.

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