

## Note on Engineering Details

**No:** DWR-SBaa-extern-001

**Title:** **Quasi-permanent combination of actions for verification of concrete structures for the serviceability-limit-state (SLS)**

**Ref.:** GL's Wind "Guideline for the Certification of Wind Turbines", Edition 2003 with Supplement 2004, Section 5.4.3.3 (2) and 5.4.3.4

**Contact:** Stefan Baars, e-mail: stefan.baars@gl-group.com, phone: +49 40 36149-7560

**Key Words:** Concrete structures, quasi-permanent loads, DLC 1.1, SLS, stress and crack width limitation

The quasi-permanent combination of actions is required for several verifications of the serviceability-limit-state of concrete structures according to the standards Eurocode 2 and DIN 1045-1. This note shall clarify which load combination shall be used for concrete structures of wind turbines under high dynamic loading in the sense of quasi-permanent combinations of actions according to the above mentioned standards.

The quasi-permanent combination of actions is defined in GL's Wind "Guideline for the Certification of Wind Turbines", Edition 2003 with Supplement 2004, Section 5.4.3.3 (2) and 5.4.3.4 as "quasi-permanent combination of actions DLC 1.1".

The following two methods are acceptable for the evaluation of the quasi-permanent combination of actions from DLC 1.1:

- The maximum occurring action in DLC 1.1 can be taken.
- The actions of DLC 1.1 and DLC 6.4 with a probability of exceedance of  $p_f=10^{-2}$  (equivalent with 1750h in 20 years) can be evaluated and are accepted.

The interpretation of the quasi-permanent combination of actions with the specified probability of exceedance is also described in a similar manner in the DIBt-Guideline "Richtlinie für Windenergieanlagen", edition 2004 with amendments 2006 and is based on regulations found in ENV 1991-1.

Hamburg, 25.01.2010

Christian Nath  
Vice President Renewables Certification

Dr. Torsten Faber  
Head of Department

Stefan Baars  
Head of Group and Author

Mike Wöbbeking  
Head of Department

Andreas Anders  
Head of Department