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Inhalt des Berichts

Kurzfassung des Schlussberichts:
Dauerschwingfestigkeit von Spannstählen unter dynamischer Beanspruchung im eingebauten Zustand

Fatigue strength of prestressed concrete beams under dynamic loading

Bearbeiter

Jörn Remitz, M.Sc.
Univ.-Prof. Dr.-Ing. Martin Empelmann
TU Braunschweig
iBMB - Fachgebiet Massivbau
Beethovenstraße 52
38106 Braunschweig
☎ (05 31) 391-5409; Fax -8179
E-Mail: massivbau@ibmb.tu-bs.de

Die Kurzfassung darf nur ungekürzt veröffentlicht oder vervielfältigt werden; eine auszugsweise Wiedergabe bedarf der vorherigen schriftlichen Einwilligung.

In the research project "Fatigue strength of prestressed concrete beams under dynamic loading" theoretical and experimental investigations on the fatigue behaviour of prestressed concrete beams were carried out. The results of the experimental investigations were compared with experimental results from literature as well as the appropriate standards for fatigue strength (e.g. SN curves according to DIN EN 1992).

The first part presents a review of experimental studies on the fatigue behaviour of post- and pretensioned concrete beams. In addition to the essential knowledge, individual test results taking into account various influential factors were included in a database. Besides, the database was analyzed and compared to the aforementioned SN curves.

Furthermore the fatigue behaviour of strands under constant cyclic loading was investigated in four large-scale tests on post-tensioned concrete beams with curved tendons. The investigations were focussed on the influence of the concrete strength as well as effects of different curvature. The tests were performed with high numbers of load cycles at small stress ranges. In addition one prestressed concrete beam with straight strands was investigated.

Looking at the evaluation of the results and the comparison with the corresponding normative specifications, on the one hand knowledge gained from previous investigations was confirmed and on the other hand deficits in the normative specifications were detected.

Looking at the tests with post-tensioned tendons the following aspects can be determined:

- The test with a stress range of approximately 150 N/mm² showed a good compliance with the results of previous investigations.
- A reduction of the tendon curvature led to a significant increase of the fatigue strength.
- The use of high-strength concrete resulted in a slightly reduced number of load cycles (and thus the fatigue strength) compared to the use of normal-strength concrete.
- One of the test specimens showed a significant rotation (or twisting) of individual strands among themselves leading to intermittent stress concentrations at individual wires.

As a conclusion it should be noted that the existing transverse pressure (including the prestressing force and the curvature of the tendons) should be recorded in order to perform realistic (and economic) fatigue verification. Moreover, the influence of the concrete strength as well as the influence of building-practical aspects should be examined more extensively.

Looking at the tests with prestressed tendons the following aspects can be determined:

- The failure of the specimen occurred before reaching the number of load cycles expected according to DIN EN 1992. In the visual examination of the strands after the end of the test noticeable signs of corrosion were detected on the wires.
- So far only a few tests on prestressed concrete beams were carried out so that the shape of the SN curve is rarely validated.

According to the authors the results of these investigations on prestressed concrete beams show that further validation of the normative specifications performing additional tests is required.