# Zukunft Bau

# Short report

## title

Langfassung Titel: Neufassung der Richtlinie "Belastungsversuche an Betonbauwerken"

## Starting point

*The existing guideline [4] is the result of intensive research which was made simultaneously in the two German states in the mid-1980s by Prof. Steffens in Bremen and by Prof. Schmidt and Prof. Opitz in Dresden. After the reunification the two research projects were merged and widen into the cooperative project EXTRA I + II [2], [3]. Since then there is a constant further development of deformation criteria for structural elements with a possible britte failure. In addition there are numerous experiences from more than 2000 conducted load tests. This experiences have to be recorded and analysed and the results should be included into the new version of the guideline.*

## Description of the research project

*1. Analysis of existing tests*

*Compilation and preparation of implemented experimental investigations. Based on these tests critical bearing conditions have to been analysed and indicators have to been derived for the determination of the ultimate test load. The analysis is made by the involved engineering offices under scientific supervision by the 'Institute of Concrete Construction' of the Leibniz Universität Hannover.*

2. *Development of a specific partial safety concept*

*A specific partial safety concept is needed for load tests. This particularly insufficiently clarified question is that the results of a load test can apply to similar but not sampled components of a building. For this purpose the probabilistic foundations were lay and the partial safety factors were derived by the involved engineering office G+S (Prof. Grünberg).*

*3. Experimental goals and minimum requirements on loading*

*Load tests can be used for an evidence for a sufficiently serviceability and sustainability or for a system analysis of hybrid evidence. This different goals entail variable experimental layouts, procedure and assessments. Die Festlegung von Regeln zur Konzeption und Durchführung von Belastungsversuchen mit einer selbstsichernden hydraulischen Belastung inkl. Rückverankerung verhindert gefährliche Versuche mit Ballastbelastungen, wie sie immer wieder vorkommen.*
*Minimum requirements on the load regime ensure the gradual increase of the stress during the loading and unloading cycle. Only in this way an adequate advance notice of damage processes on lowest level are achieved so that a punctual abort of the test is ensured. This work step is made by the scientific participants of the LU Hannover and the HS Wismar.*

4. *Determination of critical bearing condition and metrological detectable criteria*

*One of the in [4] mentioned criteria for the detection of the test maximum load are difficult to apply or unsuitable. Therefore the load-bearing behaviour today is in general assess on the basis of deflection measurement. Out of the numerous implemented tests exist a large number of suitable evaluation criteria, which serve as basis, got unified and systematized. The in the research project 'Versuchsgrenzlastindikatoren für Belastungsversuche' [11], [12] developed indicators to evaluate the shear strength will be prepared in such a way, that criteria can be defined to identify the maximum test load. So components can be reliably assessed, which are not tested experimentally. The provisions of the criteria take place in close cooperation with all involved associates, research facilities and engineering offices.*

5. *Experiments to* verify *the criteria*

*Laboratory tests at reinforced concrete and prestressed concrete components were implemented to verify the finding indicators and criteria for the provision of the maximum load with regard to their suitability and significance. This test serve as a review of the criteria and their practical feasibility. Planned, implemented and evaluated were the tests at the 'Institut für Massivbau' from the LU Hannover.*

6. *Preliminary considerations for the extension of the experimental structural safety valuation on bridge constructions*

*It should be done preliminary considerations for the principal transmission of the regulation to implementation of load test at reinforced concrete and prestressed concrete constructions of building construction for the application in bridge building. Especially the question of nonstatic loads is taken into consideration. The works for extension of one application of the load test to the bridge construction are implemented by 'Ifem Ingenieurgesellschaft mbH, resp. Herrn Dr. Kapphahn'.*

## Conclusions

*The planned targets been fully implemented. The knowledge of the load-bearing behaviour of reinforced concrete components with low shear reinforcement can extended through implementation of laboratory test. Furthermore the formulate criteria of the maximum load were verified. The guideline activities were highly supported by the simultaneously research work.*

## Pictures:

Fig. 1:

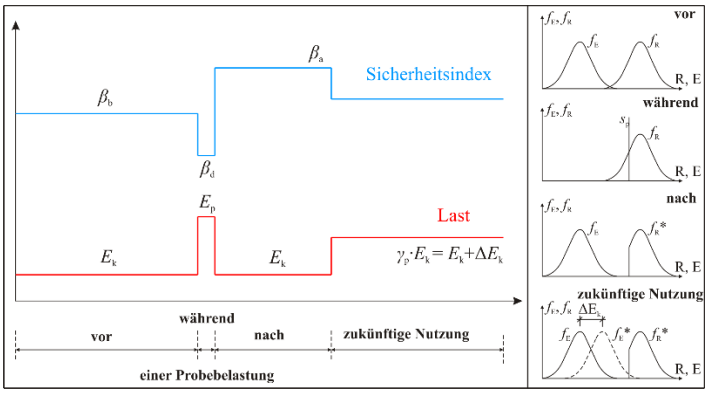
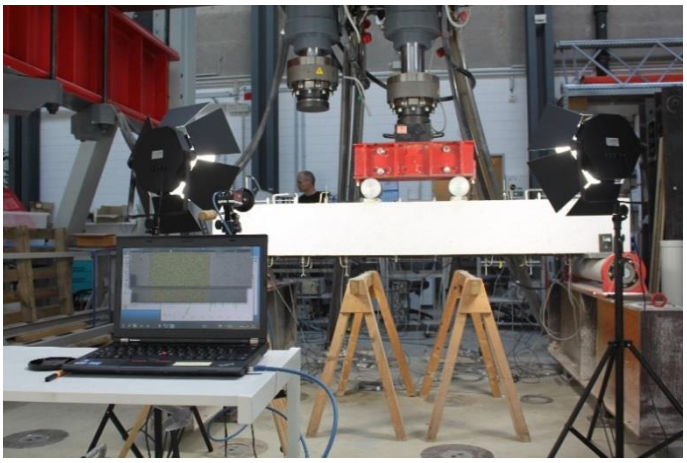



Bild 01.jpg

*Presentation of the safety theoretical connections in a load test*

Fig 2:



8433.jpg

*The use of the online- photogrammetry to monitor the crack development*

fig 3:

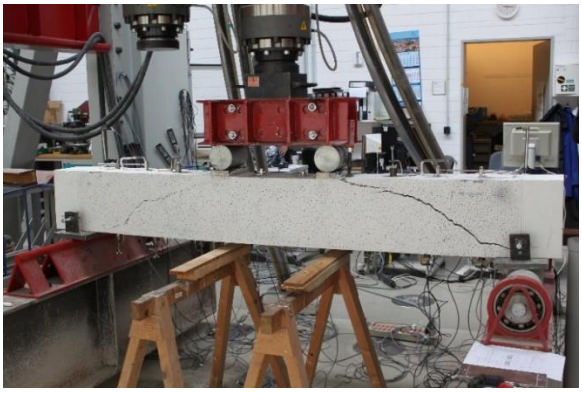


Bild 8461.jpg

*Shear failure of one reinforced concrete beam with low shear force reinforcement*

fig 4:

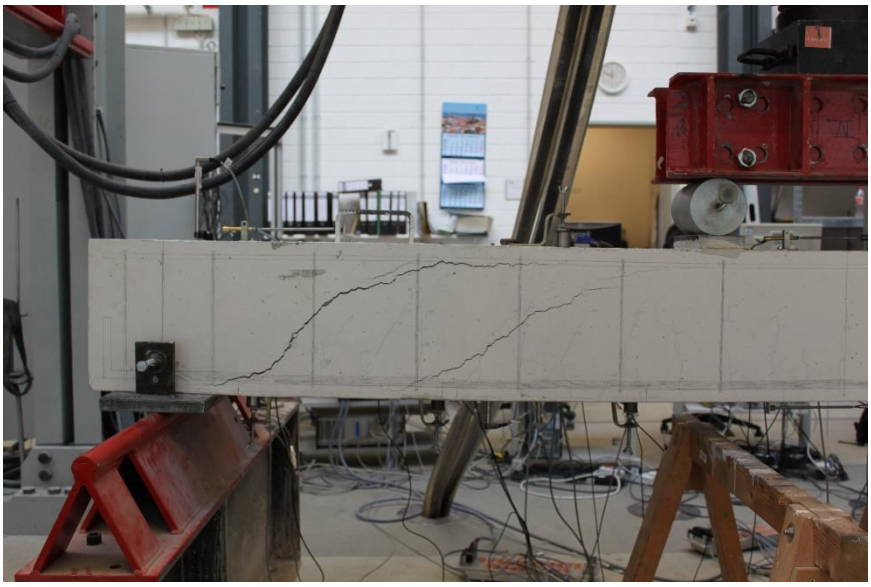


Bild 8867.jpg

*shear crack development in shear area of one reinforced concrete beam*

Bild 5:

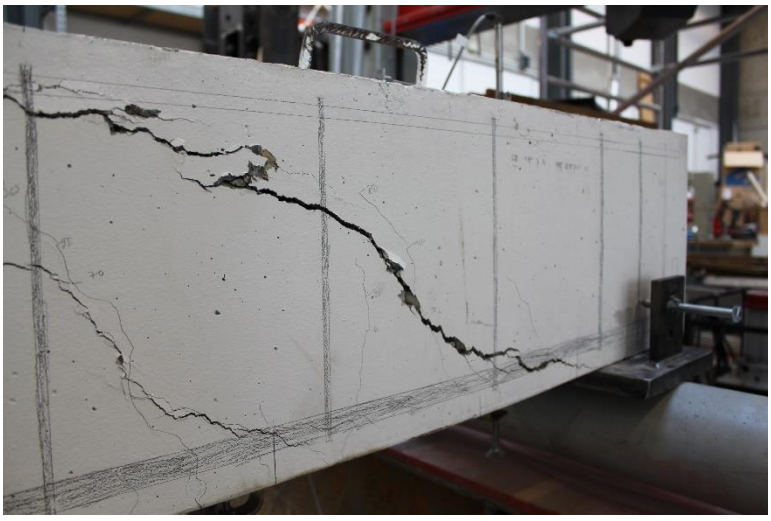


Bild 8874.jpg

*shear cracks in shear area of one reinforced concrete beam*

Bild 6:

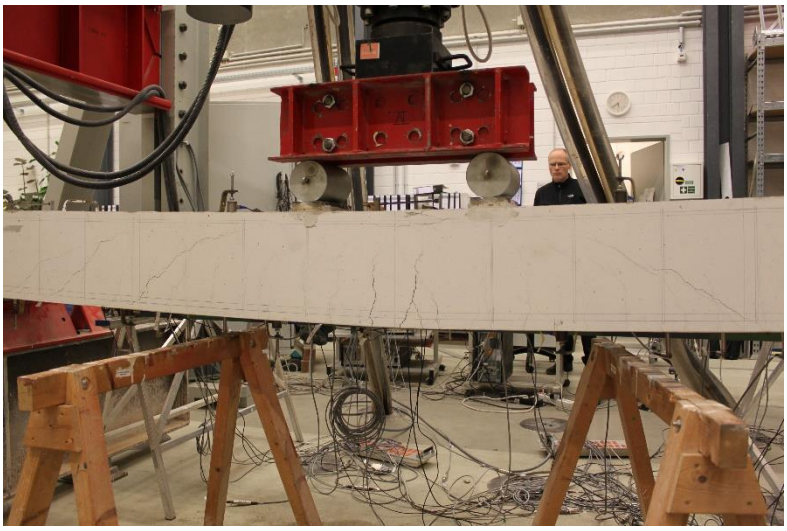


Bild 8920.jpg

*Switch of the crack activity out of the shear range into the bending area*

fig 7:

Bild 8936.jpg

*Secondary bending failure*