Zeitschrift: IABSE congress report = Rapport du congrès AIPC = IVBH Kongressbericht

Band: 8 (1968)

Rubrik: Free discussion

Vc

DISCUSSION LIBRE / FREIE DISKUSSION / FREE DISCUSSION

The Impact Resistance of Prestressed Concrete

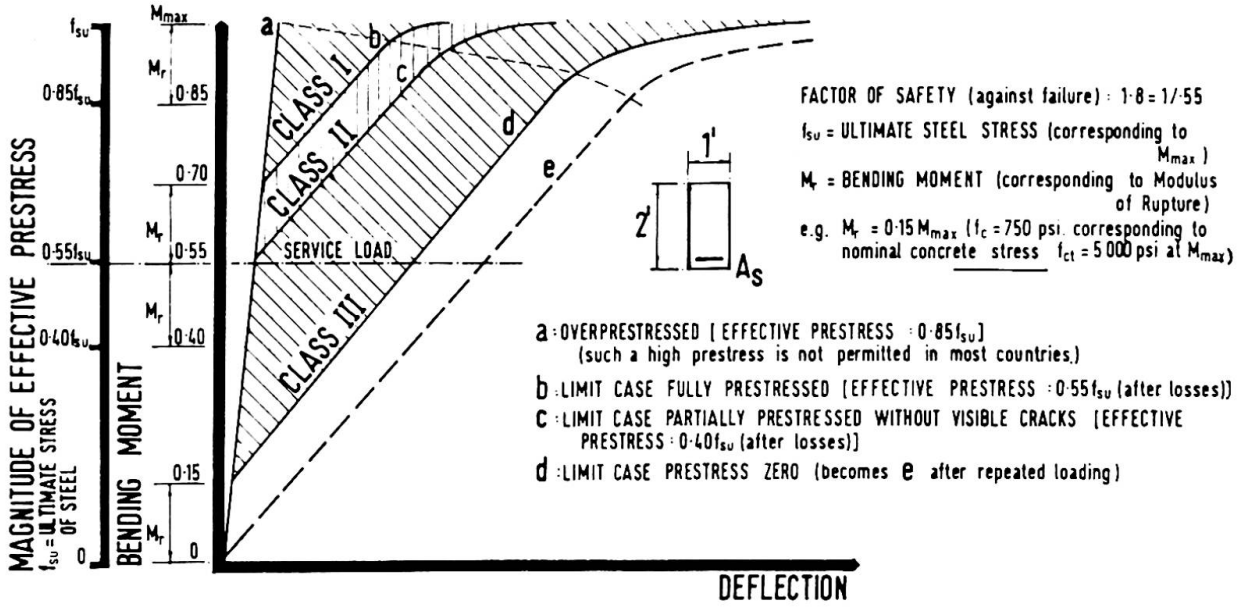
Résistance aux chocs du béton précontraint

Der Stoßwiderstand des vorgespannten Betons

P.W. ABELES

The contribution by Professors Newmark and Hall shows clearly the ductility of under-reinforced concrete members. It is remarkable that even without a favourable compressive reinforcement "the removal and re-application of load had little or no effect on either the load carrying capacity or the ultimate ductility". The title of the paper covers the "dynamic behavior of reinforced and prestressed concrete". Mr. Rogers in his contribution stated that prestressed concrete should not be used for earthquake frame structures. However, I should like to point out that the conditions with prestressed concrete may vary to a great extent dependent on the degree of prestress. In the figure below comparative bending moment deflection curves of under-reinforced rectangular prestressed concrete beams are shown in which all steel members are tensioned. Curve (a) presents a case at which cracking and failure occur simultaneously. This would be only obtained if the steel were over-prestressed and an effective prestress of 85% of the maximum were available which is not permitted in most countries. However, type (b) shows the limit case of fully prestressed concrete at which under service load which is supposed to be 55% of the failure load no tensile stresses occur. Curve (c) refers to a partially prestressed construction Class II of FIP-CEB at which the effective prestress is 40% of the maximum steel stress and under service load the first cracks just become visible, whereas type (d) relates to the limit case at which the effective prestress is zero. After repeated loading this case may become identical with type (e). It is seen that the ductility is greatly increased by reduction of the effective prestress. In the diagram the classification of FIP-CEB I, II and III is indicated.

COMPARATIVE BENDING MOMENT - DEFLECTION CURVES OF UNDER-REINFORCED RECTANGULAR PRESTRESSED CONCRETE BEAMS [ALL STEEL MEMBERS TENSIONED]



The ductility of prestressed concrete is essential where impact has to be absored. This has been demonstrated by impact tests on partially prestressed poles which I had shown at the Lisbon Congress twelve years ago. Reference is made to Figs. 5-7 in publication (1), the first shows the impact when a wagon of 45 kips weight was propagated with a speed of 10 miles per hour into a pole and cut off part of the flange. The pole was still capable of carrying the design load in spite of some wires in the flange being cut off. This demonstrates the ductility to impact.

---

(1) Impact Resistance of Prestressed Concrete Masts" by P. W. Abeles, 17th Volume of Publications of IABSE (originally presented at Lisbon Congress at theme (b)