

Wedstrijd voorspellen bezwijkgedrag dwarskracht voorgespannen liggers

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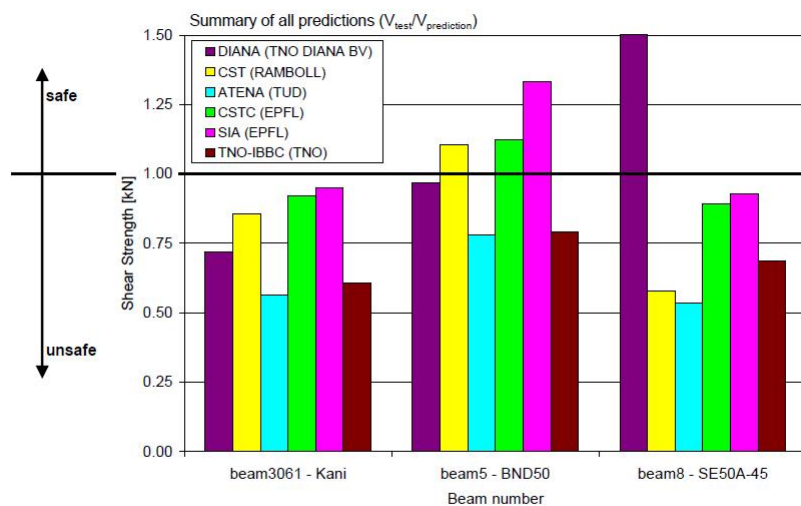


Figure 4.2: Summary of the round robin results

Ontwikkeling Guideline

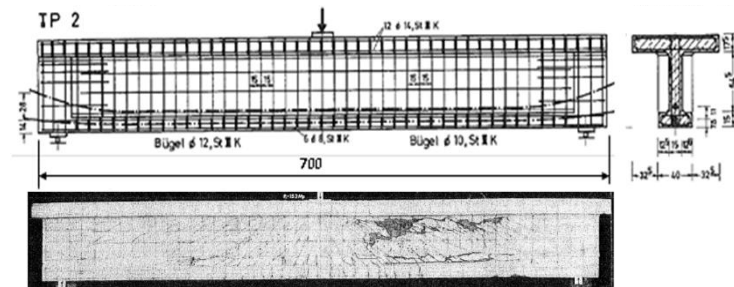


- Inhoud
 - Modelleren
 - Analyse
 - Verificatie grenstoestand
 - SLS
 - ULS: MC2010 methods: GRF, PF, ECOV
 - Resultaten

Analyses – prestressed girders

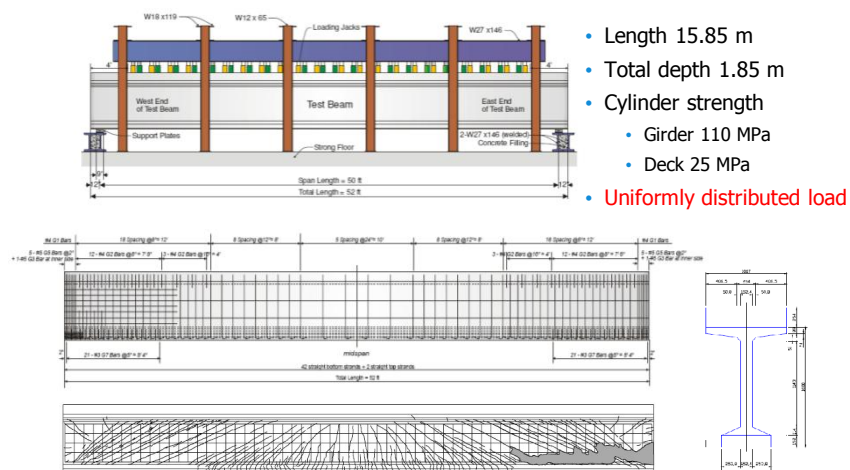
- 3 benchmark studies (ATENA, DIANA)
 - Shear compression failures from literature
 - Leonhardt 1973; beam TP2
 - Sun & Kuchma 2007; beam NSEL
 - Runzel et al. 2007; beam MNDOT
- 3 verification studies on existing bridges (ATENA)
 - Schellingwouderbrug in Amsterdam
 - Merwedeburg in Gorichem
 - Kruithuisweg in Delft

TP2 beam



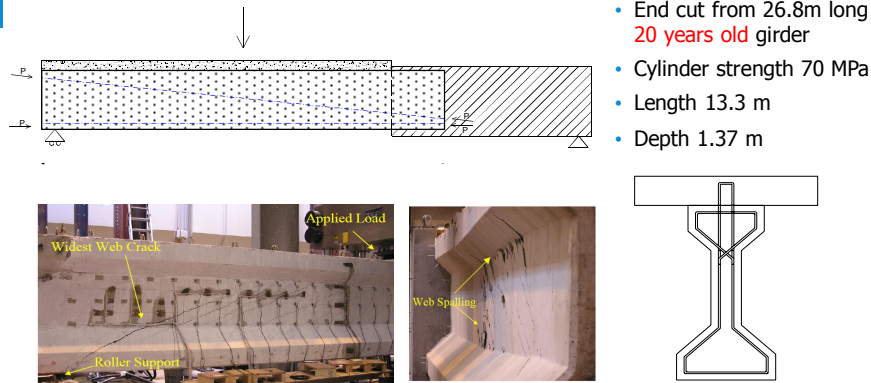
- Length 7 m, depth 0.97 m; stirrups right side Ø10-150, left side Ø12-150
- Cube strength 29 MPa
- 3-point bending; **shear compression failure** at 1491 kN

NSEL beam



- Length 15.85 m
- Total depth 1.85 m
- Cylinder strength
 - Girder 110 MPa
 - Deck 25 MPa
- **Uniformly distributed load**

MNDOT beam



fib Model Code 2010 – analytical shear capacity

- Level of approximation
(Max shear resistance is limited by shear compression failure)
 - Level I
 - No concrete contribution
 - Variable stress field inclination; min depends on longitudinal stress
 - Level II
 - No concrete contribution
 - Variable stress field inclination; min is a function of longitudinal strain at mid-depth
 - Level III
 - Variable stress field inclination; min is a function of longitudinal strain at mid-depth
 - Concrete contribution
 - if design shear force < max shear resistance at min stress field inclination, otherwise Level II
 - is a function of longitudinal strain at mid-depth

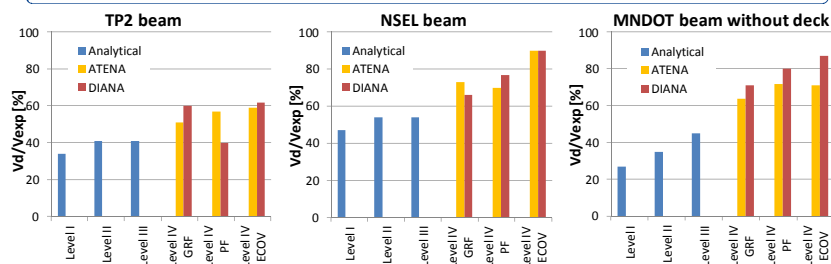
fib Model Code 2010 - NLEEA

- Level of approximation (cont.)
 - Level IV - NLFEA
- Safety format (aims at reliability required by MC)
 - Global resistance factor (GRF)
 - "Average strength"; $f_{sm} = 1.1f_{sk}$, $f_{cm} = 0.85f_{ck}$
 - $R_d = R_m / \gamma_R \gamma_{Rd}$ with $\gamma_R = 1.2$ and $\gamma_{Rd} = 1.06$; $\gamma_R \gamma_{Rd} = 1.27$
 - Partial factor (PF)
 - Design strength values (characteristic value/material factor)
 - $R_d = R_m$
 - Estimation of coefficient of variation of resistance (ECOV)
 - Analyses for average (measured) and characteristic values
 - $V_R = \ln(R_m/R_k)/1.65$
 - $\gamma_R = \exp(\alpha_R \beta V_R) = \exp(3.04 V_R)$

Results according to MC2010 (den Uijl)

Level IV/Level III = 1,37 1,44 1,53

Cylinder strength = 25 MPa 110 MPa 70 MPa



- Conclusions
 - Level II en III > level I, sometimes level II = level III
 - Level IV > level III except TP2 DIANA PF (other failure type)
 - Level IV at least 37% larger than level III

4 gelijke liggers tot bezwijken beproefd

- Berekening volgens Guideline
- Informatie over spreiding resultaten
- Betere voorspelling en minder spreiding bezwijkbelasting mogelijk



**Internationale wedstrijd , workshop november 2014 Parma
Resultaten inleveren voor 15 augustus.**