www.abt.eu

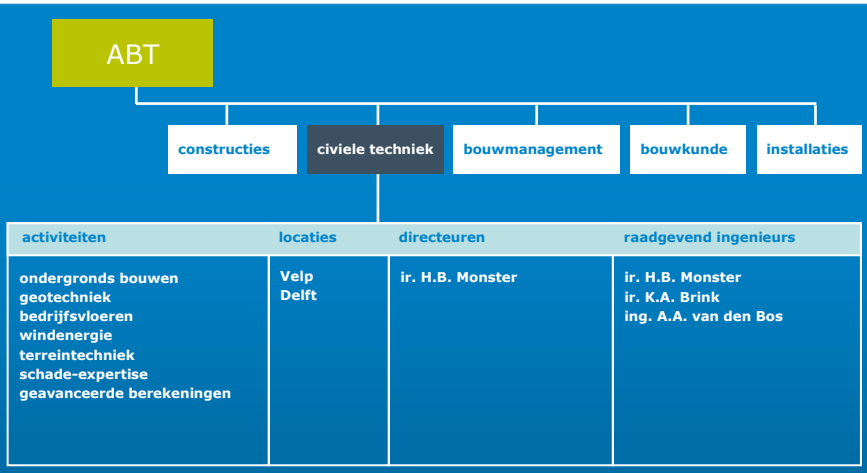
Snedecontrole bij scheurvorming

Ing. O. Joostensz

ABT bv

- Sinds 1953
- 220 medewerkers
- Vestigingen
  - Nederland: Velp en Delft
  - België: Antwerpen
- Adviesgroepen
  - Constructies
  - Civiele techniek
  - Bouwmanagement
  - Bouwkunde
  - Installaties

Civiele techniek

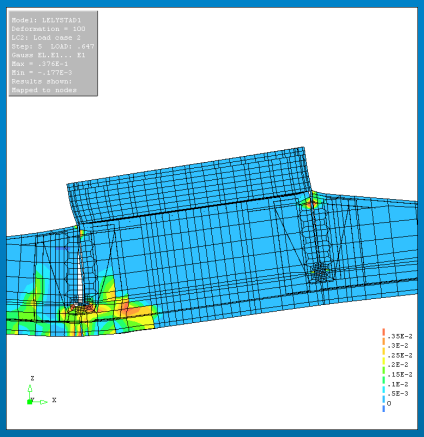


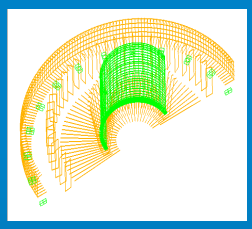
activiteiten	locaties	directeuren	raadgevend ingenieurs
ondergronds bouwen geotechniek bedrijfsvloeren windenergie terreintechniek schade-expertise geavanceerde berekeningen	Velp Delft	ir. H.B. Monster	ir. H.B. Monster ir. K.A. Brink ing. A.A. van den Bos

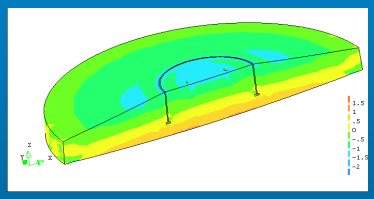
Inhoud

- Probleemstelling
- Theoretisch model
- Variantenstudie DIANA
- Conclusie

Probleem: dwarskracht







Eisen opdrachtgever

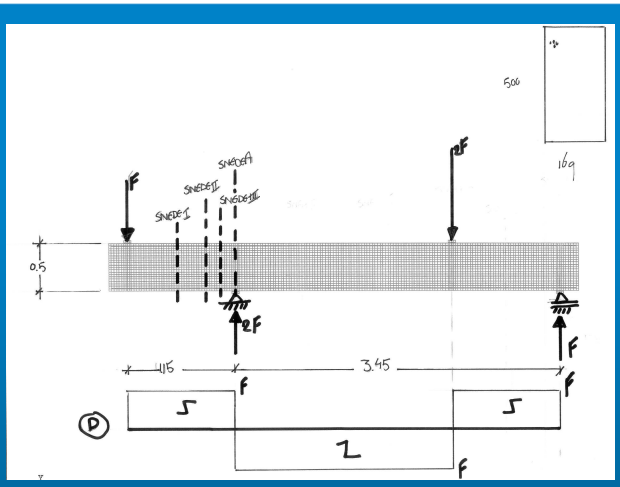
- Snedecontrole
- Dwarskrachten-/momentenlijn
- M-kappa diagram doorsnede
- $F_{actie} = F_{reactie}$
- Kortom: inzicht in het krachtenspel

Casestudy: RB2 - basismodel

'mat'
young 36000
poison 0.15
totcrk rotate
tencrv expone
tenstr 3.79
GF1 0.084
comcrv consta
comstr 53

'data'
ninteg 3 3

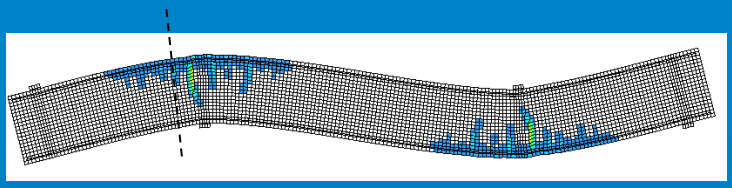
Convergentie met
Energy steps
Tolcon 1E-04
(energy en force)

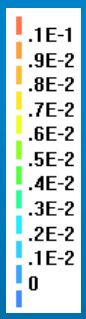


DIANA model RB2

- CQ16M / CL12I
- Embedded reinforcement
- 20 elementen over de hoogte
- Materiaalmodel totalcrack rotate
- Tension softening - exponential
- Gf=0.084 N/mm
- Default geen shear retention!

Resultaten basismodel

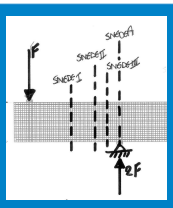


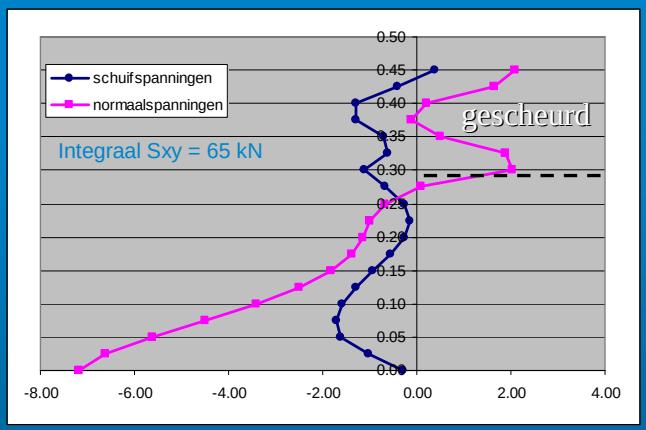


Loadstep 49 – F = 66,7 kN (laatst convergerende stap)

- Hoofdscheurrekken - EK1

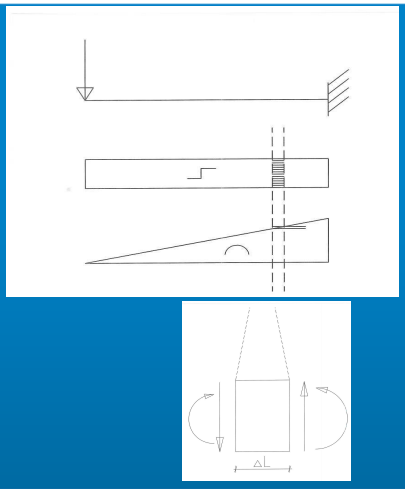
Snedeuitvoer Snede II



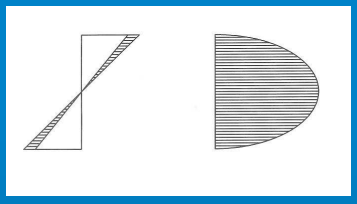


Mechanica schema

$\Delta M = F x \Delta L$



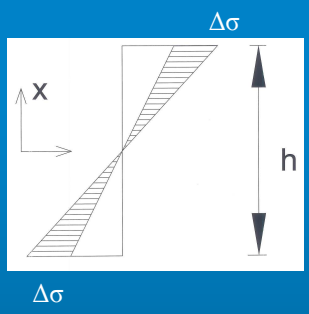
Relatie normaal- /schuifspanning



$\Delta\sigma = (F x \Delta L)y/I$

$\tau = \int(\Delta\sigma)\delta x$

Relatie normaal-/schuifspanning



$\Delta\sigma = \Delta Mx/I = 12(F^*\Delta L)x/bh^3$

$\tau = \int(\Delta\sigma)\delta x = 12(F^*\Delta L)/bh^3 \int(x)\delta x$

$\tau_{max} = 12(F^*\Delta L)/bh^3 \int_0^{1/2h}(1/2x^2)\delta x$

$\tau_{max} = 12(F^*\Delta L)h^2/8bh^3 = 3/2\ F/bh\ \Delta L$ (q.e.d)

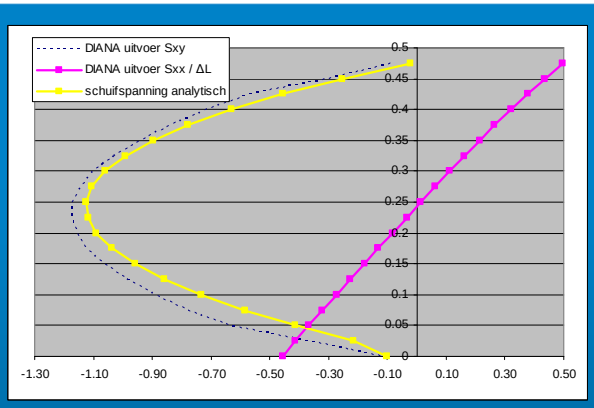
$\tau_{max} = DS/bI = 3/2\ F/bh$

Analytische methode

$$\tau=\int(\Delta\sigma)\delta x$$

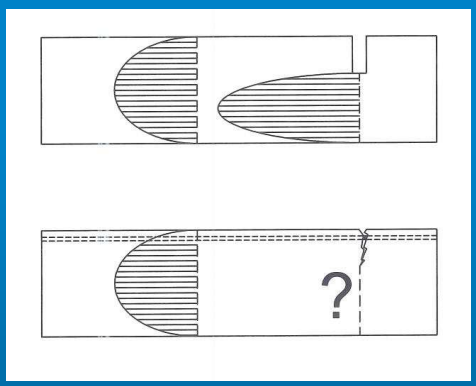
(Alleen beton!)

Ongescheurde doorsnede

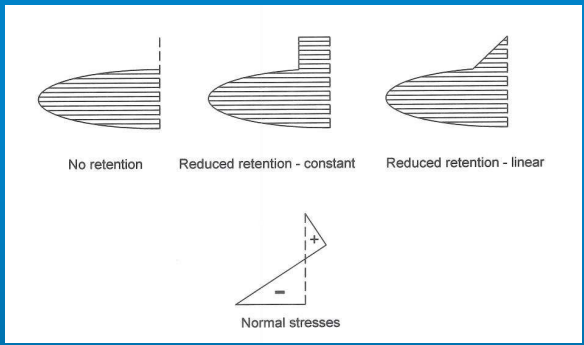


Analytische methode klopt!

Doorsnede reductie

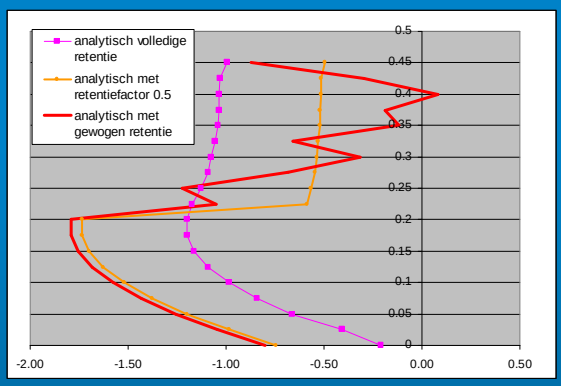


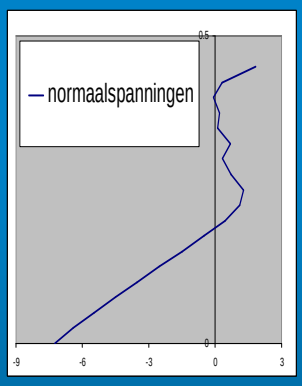
Modellen voor shear-retention



Geen deuvelwerking

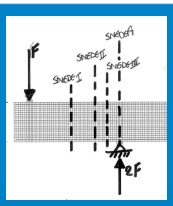
Theoretisch model

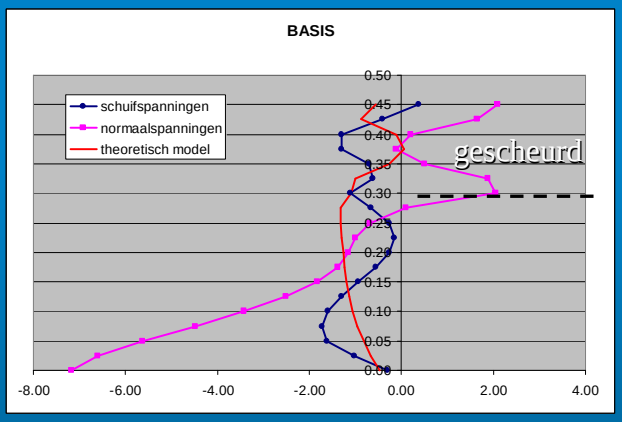




$\tau = \int(\Delta\sigma)\delta x$

Terug naar RB2





Shear retention - DIANA

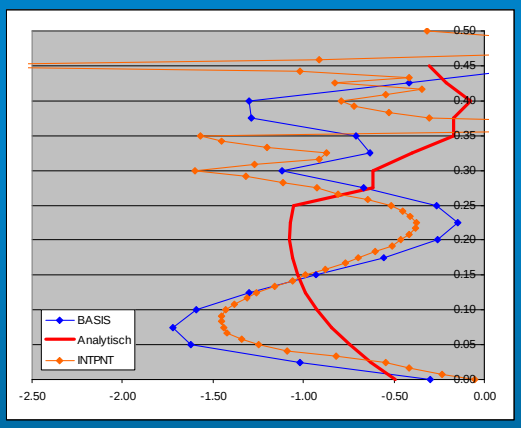
- Beta factor
- Rotate/fixed crack model
- Spanning- / rek gestuurd? (EKNN1?)
- Convergentie op energy/force/displacement
- Deuvelwerking embedded reinforcement?

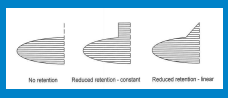
Variantenstudie

Basismodel: rotate crack

- Rotate crack model vs fixed crack model
- Poired damage vs geen poired
- Tolcon 1E-4, 350 iteraties vs
  Tolcon 1E-2, 20 iteraties
- Fixed crack (no shear retention vs beta = 0.2)
- Elementresults vs. integration points
- Reduction curve

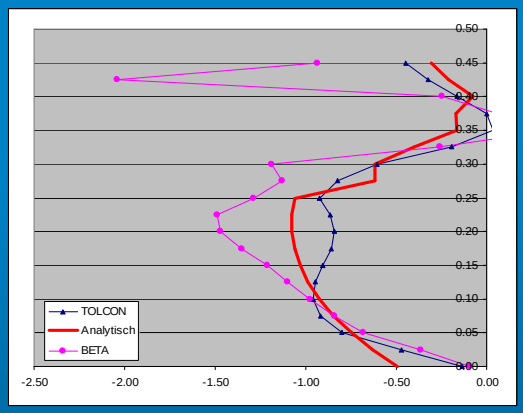
Vergelijking alternatieven

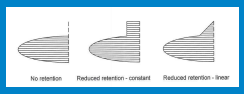




(Alle varianten geconvergeerd!- energy tolcon 1E-04)

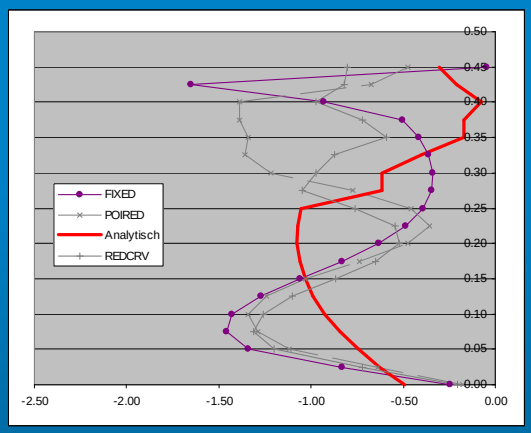
Vergelijking alternatieven

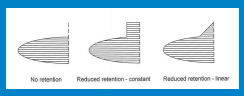




(Alle varianten geconvergeerd!)

Vergelijking alternatieven





(Alle varianten geconvergeerd!- energy tolcon 1E-04)

Conclusie / oplossing

- Huidig materiaalmodel ontoereikend

- Crackwidth – shear retention koppeling
- Terugkoppeling met theoretisch model
- Expliciet beta factor invoeren
- Overige parameters van invloed?
- Deuvelwerking embedded reinforcement

Snedecontrole bij scheurvorming

Dank voor uw aandacht