Fatigue performance of single span wood-concrete-composite bridges

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Our goal is to use more wood in infrastructure

bridges

Topics

Introduction

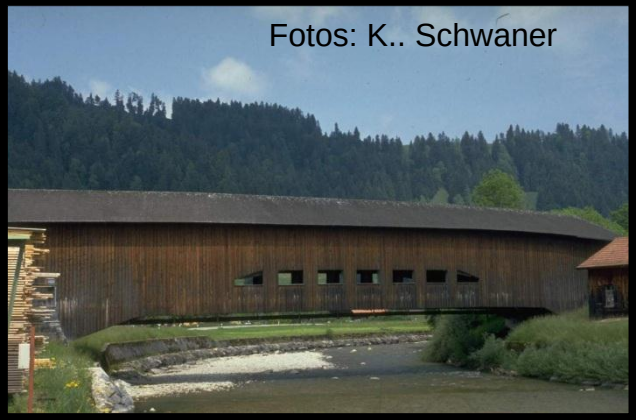
Composite System

Research and Design

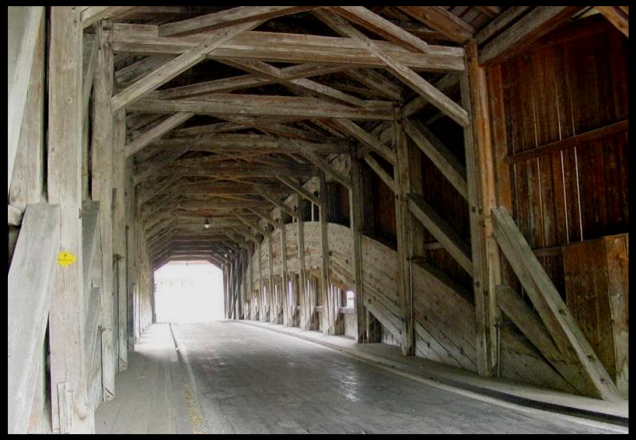
Applications

Conclusions

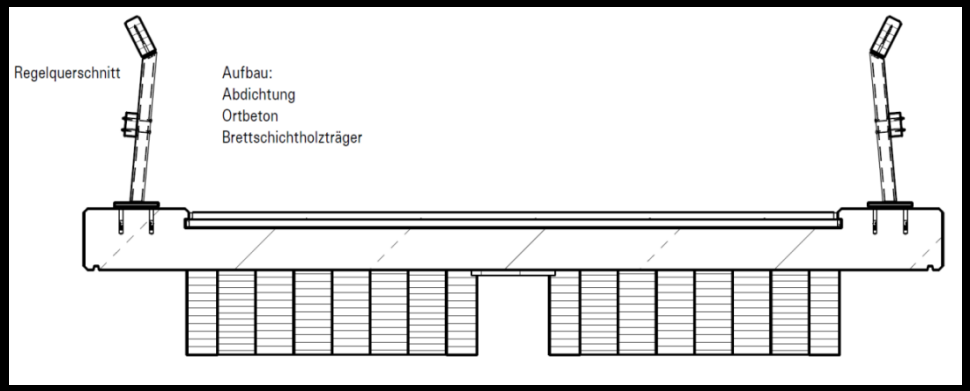
Schüpbach Bridge CH 1839



… Covered
… Connections under compression



Winschoten / Holland 2011



Concrete

compression zone

diaphrame

cover, wear and tear

Wood

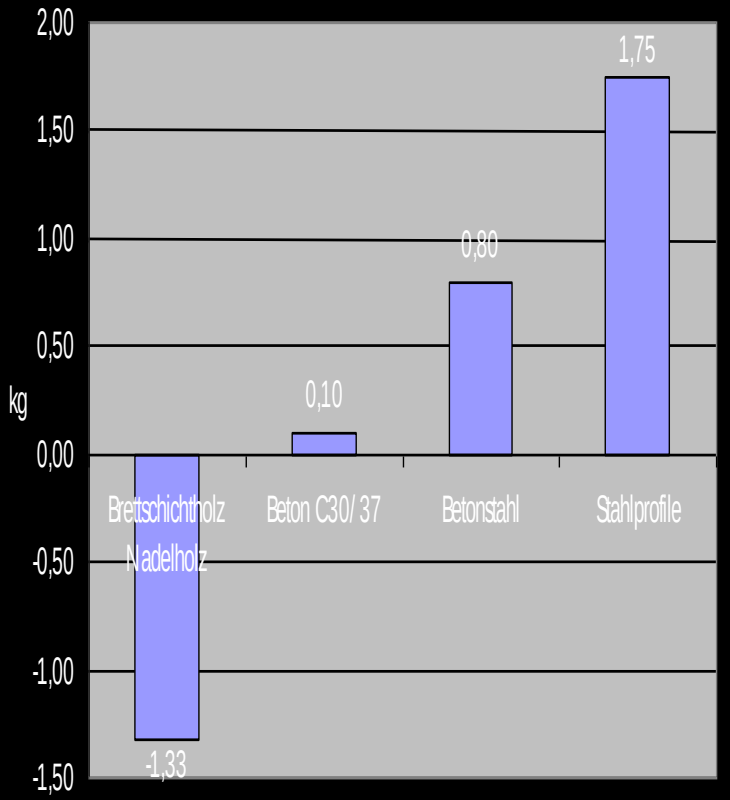
tension zone

weight reduction

carbon storache

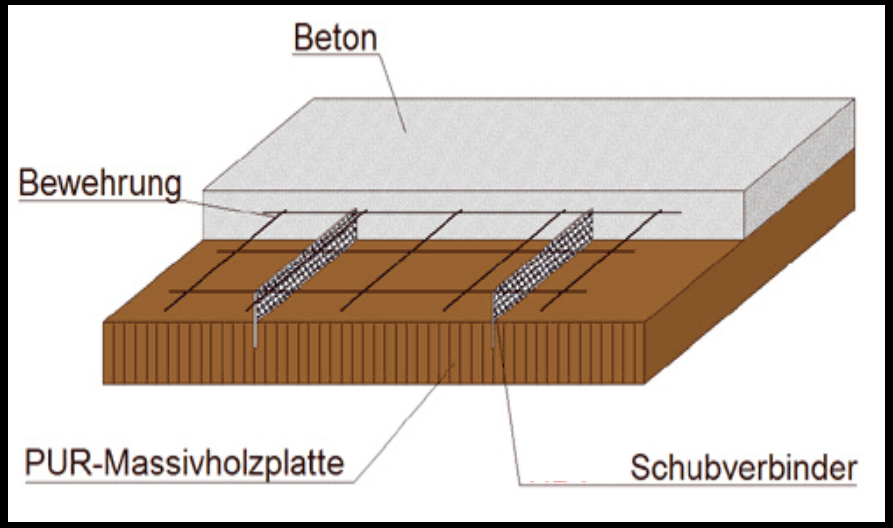
producion facility

wood - CO2-storage



carbon dioxide output in kg for 1 kg material!

Carbon balanced system (CBS)!



concrete (10 cm) ca. 100 kg

wood (16 cm) ca. 100 kg

The potential for wcc-bridges is there

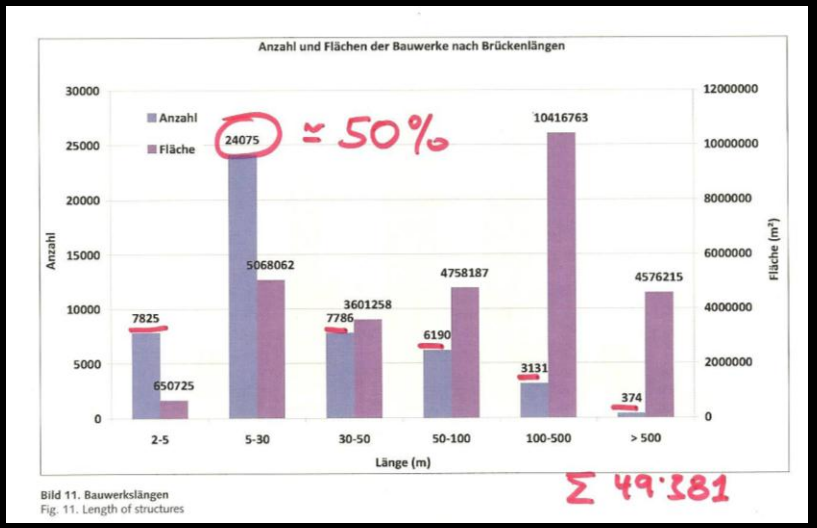
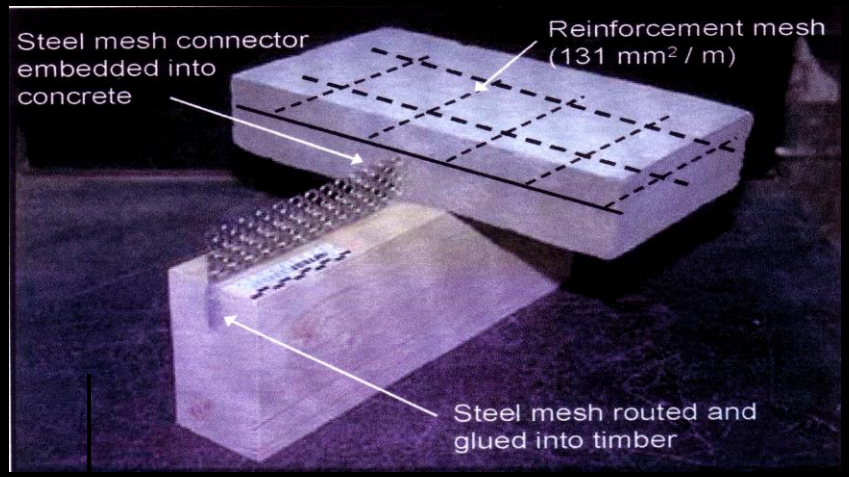
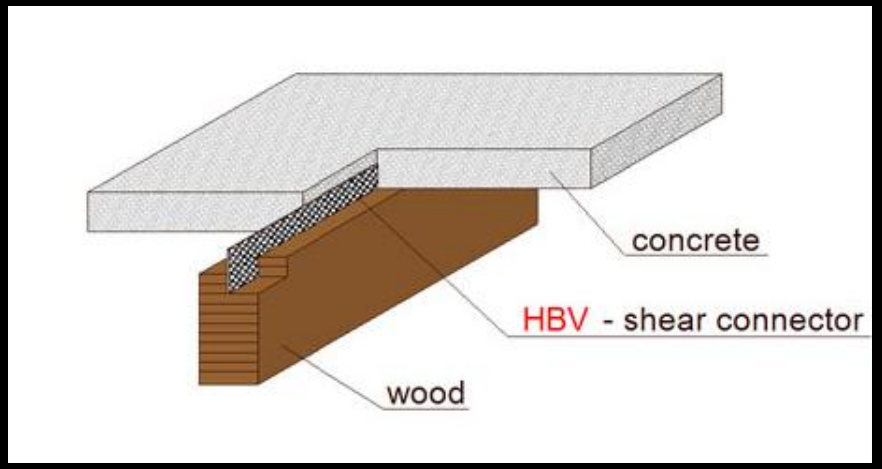


Bild 11. Bauwerkslängen
Fig. 11. Length of structures

HBV-System

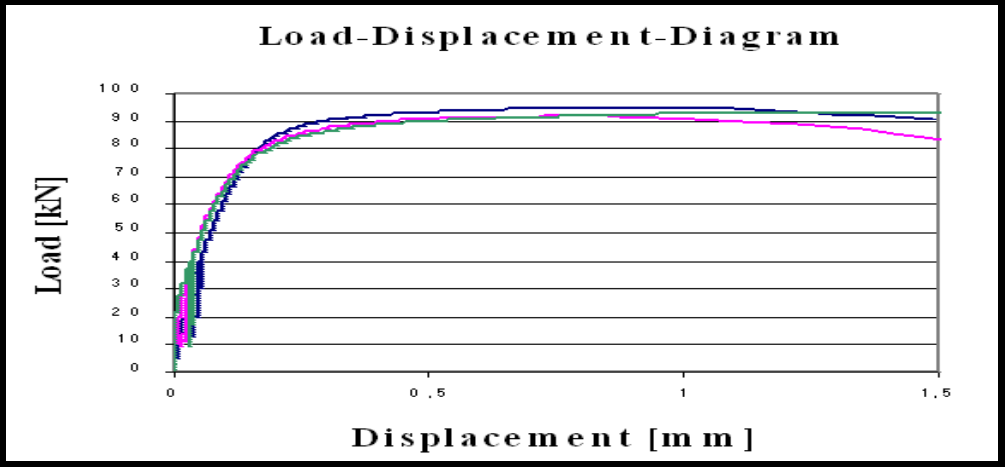
shear connection based on adhesive action



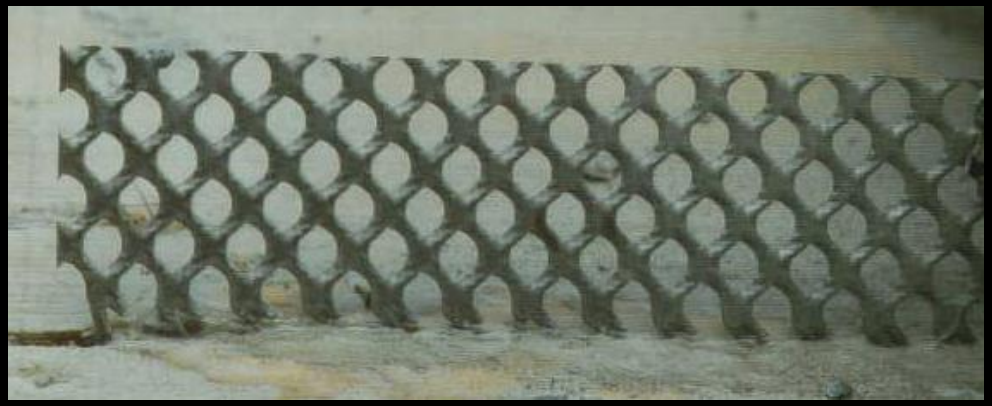


installation

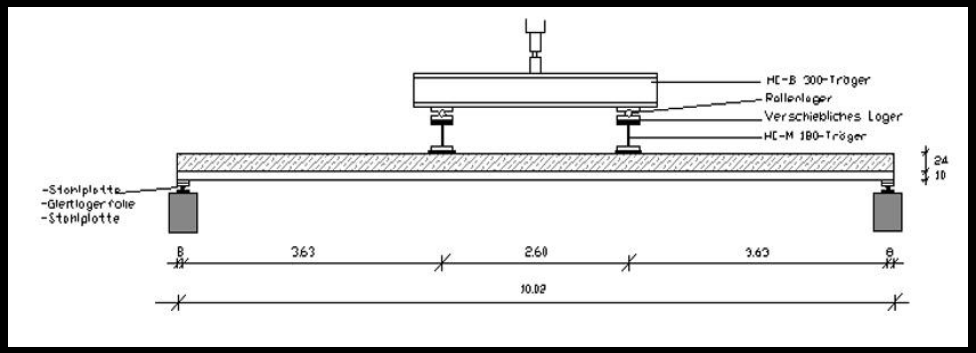
Shear Test

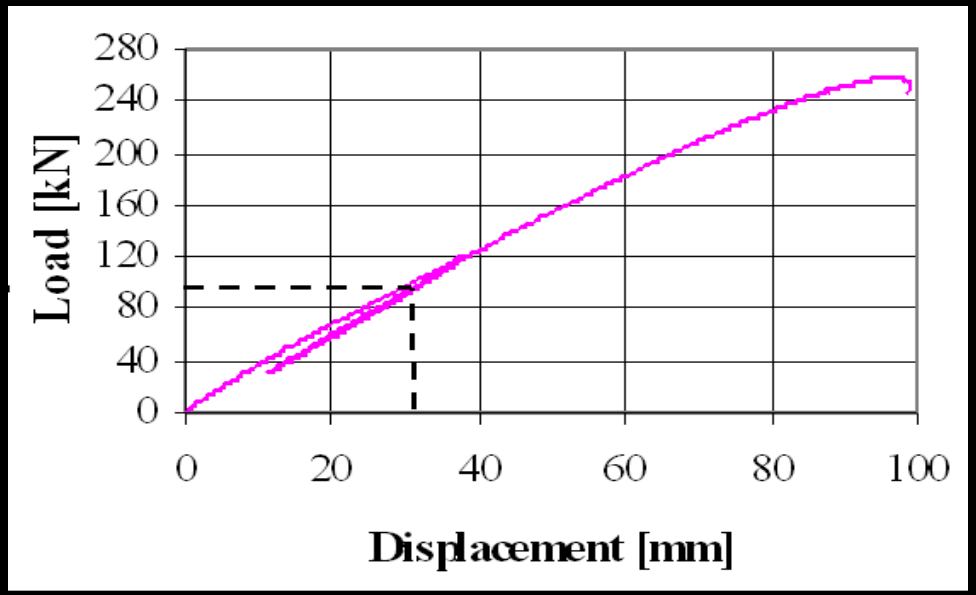


stiff and ductil



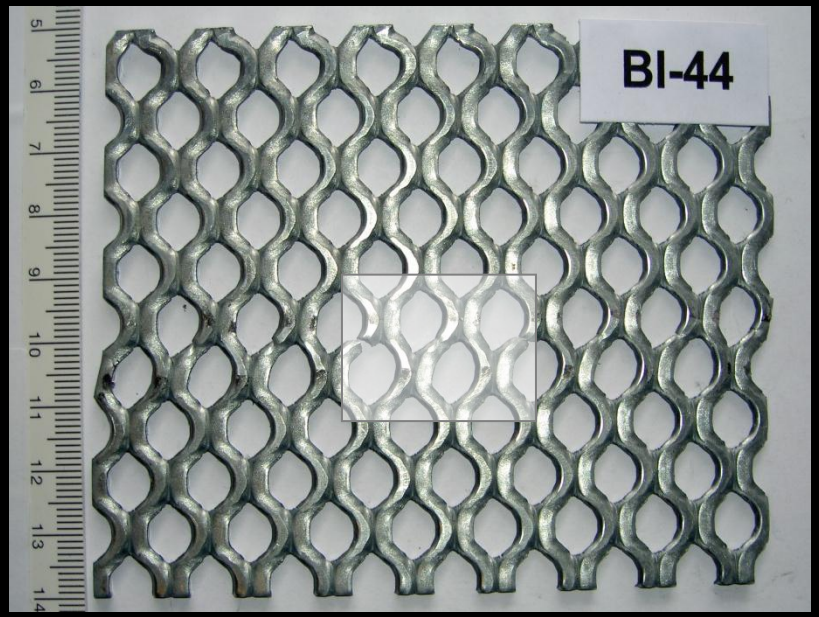
Bending Test

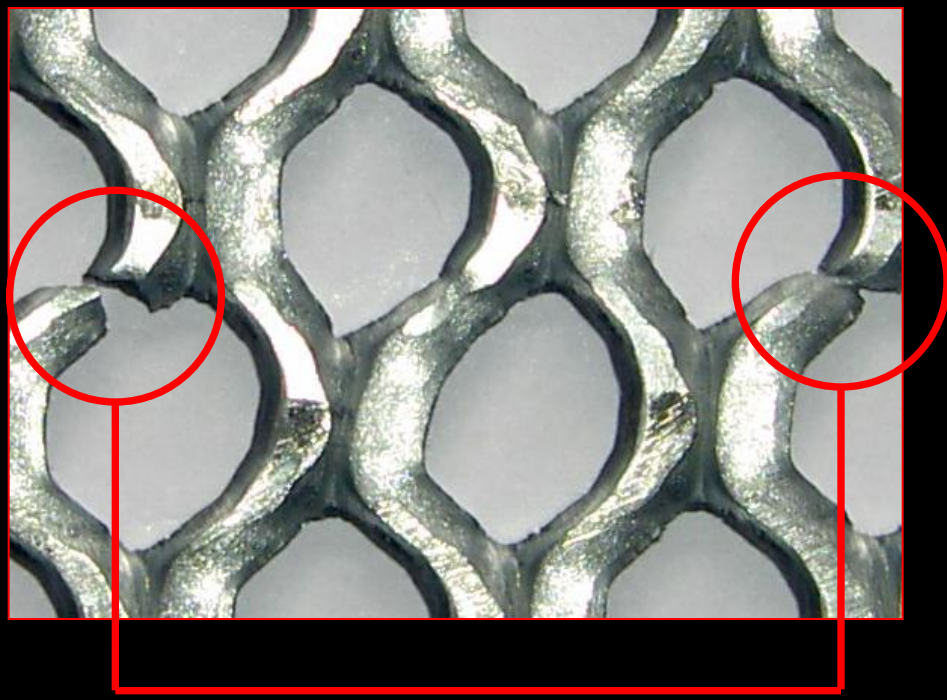




Fatigue Test on the shear connector

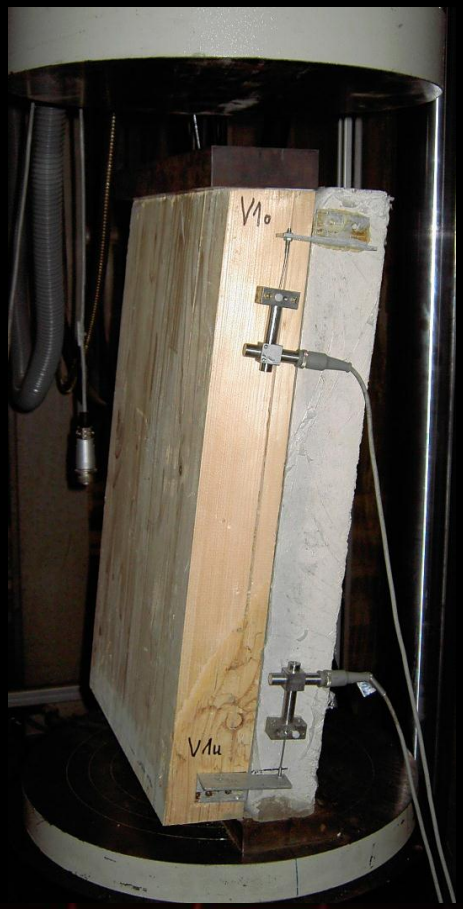
Failure Mechanism

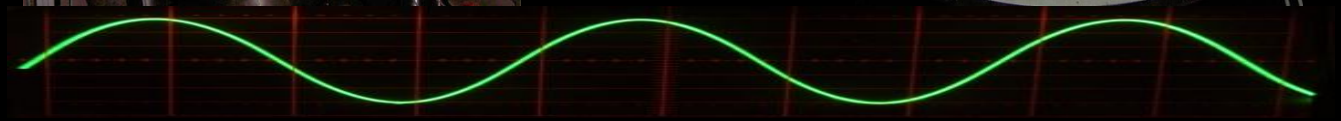




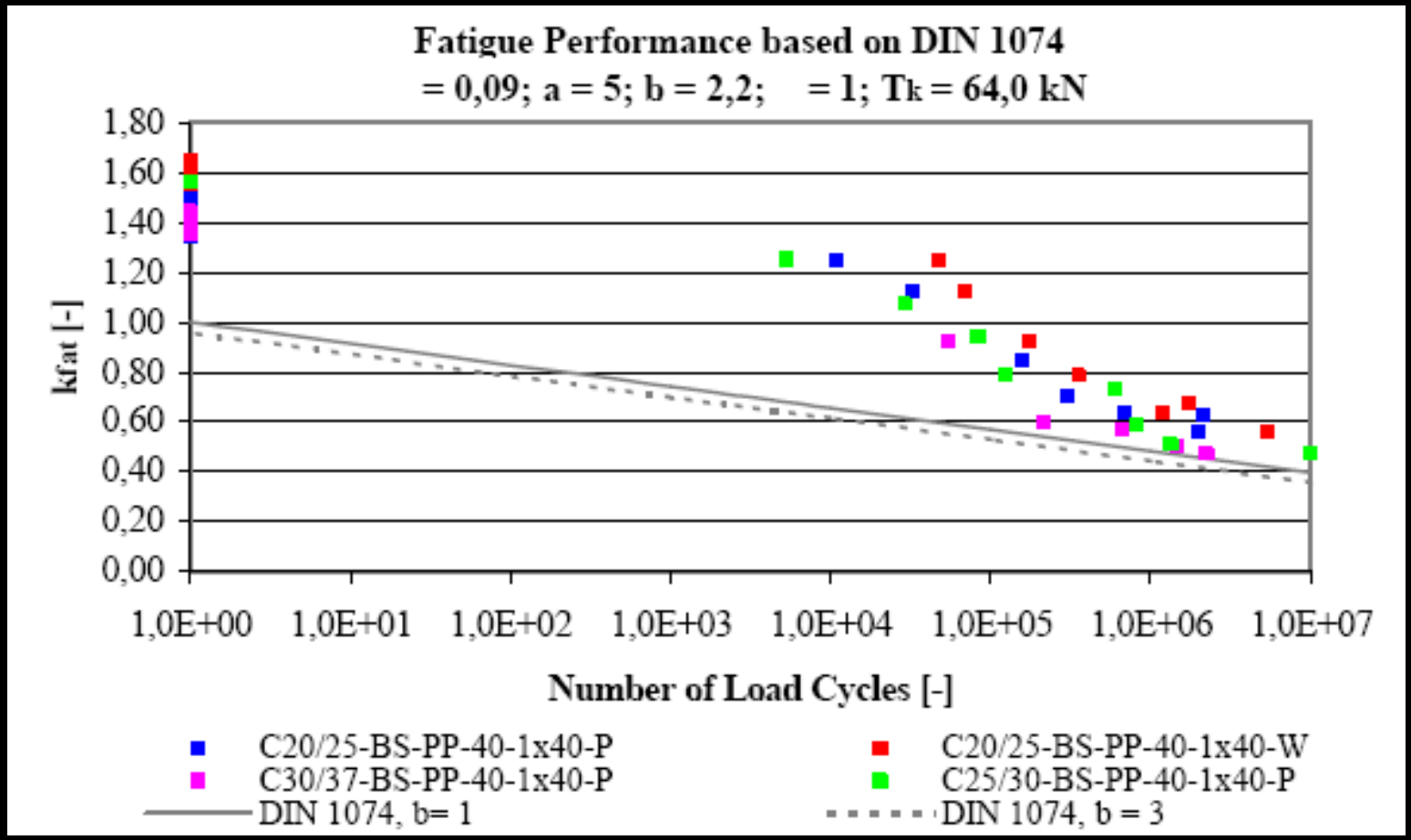
fatigue failure of tension cords

Fatigue Test on the composite system





Fatigue Performance



Euro code

Formel
$\sigma_{d,max} \leq f_{fat,d}$
$f_{fat,d} = k_{fat} \frac{f_k}{\gamma_{M,fat}}$
$k_{fat} = 1 - \frac{1-R}{a(b-R)} \log(\beta N_{obs} t_L)$ jedoch $k_{fat} \geq 0{,}15$

fatigue factors

a = 2,5
b = 4,0

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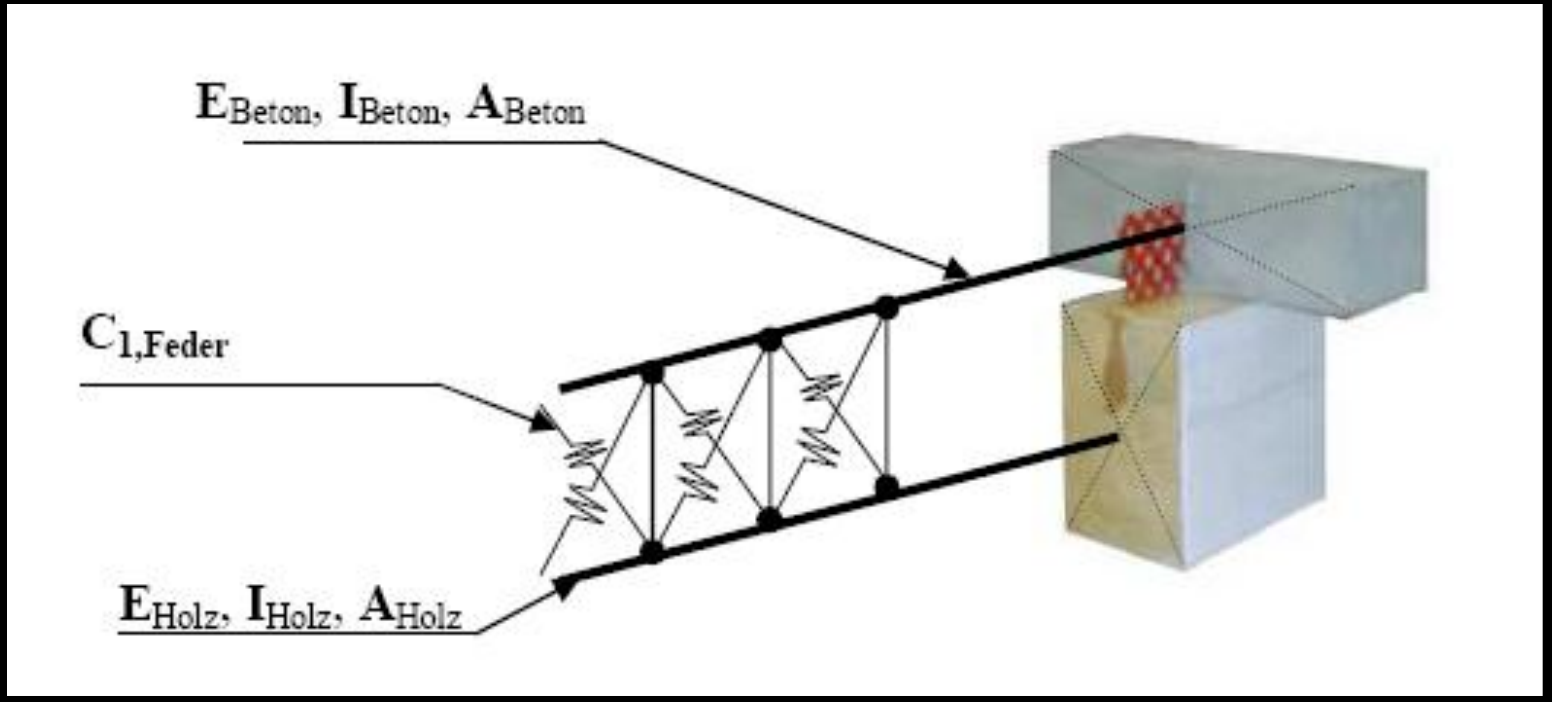
Analysis



Truss Model

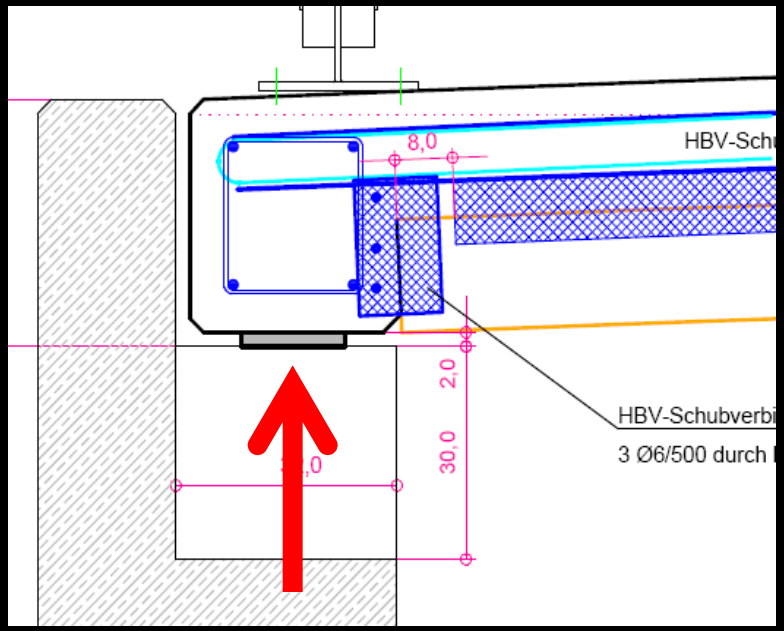
Bridge in Kayl / Luxemburg

span: 9,70 m

width: 4,00 m

Yes we can!

Concrete Bearings



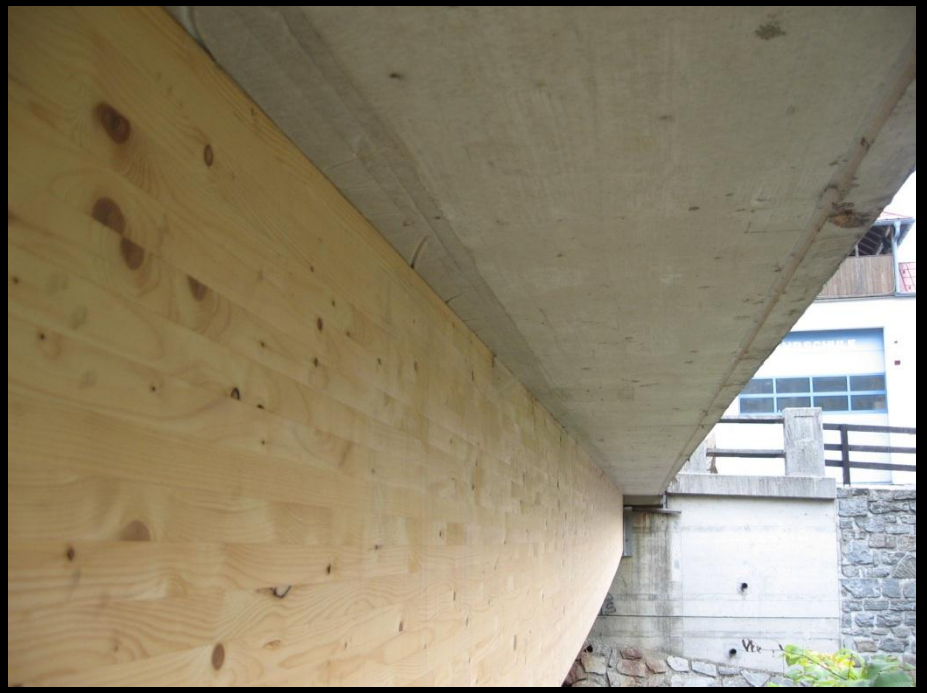
Unidobridge / Austria

span: 17,60 m

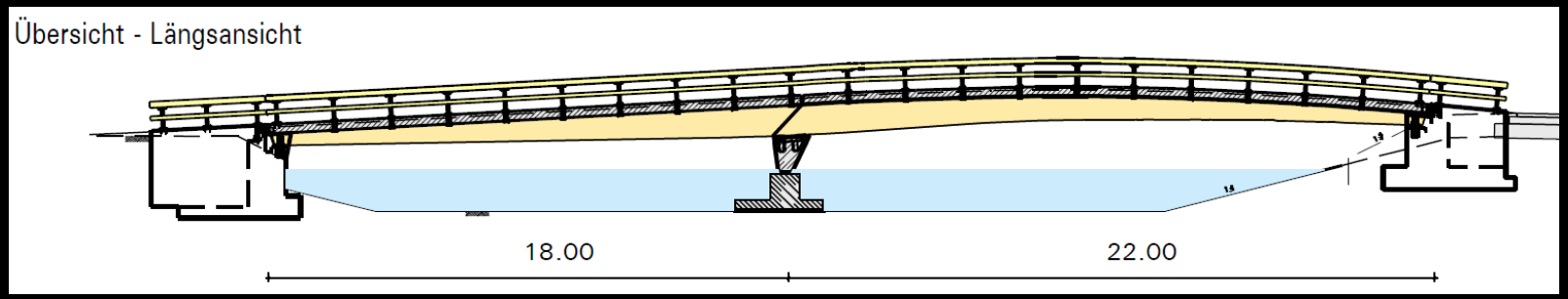
width: 3,50 m

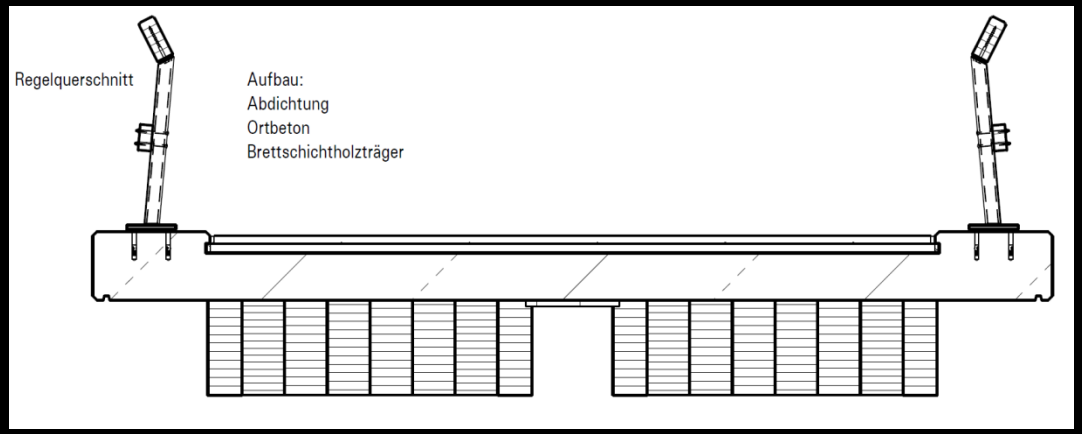
Covered Bridge !

Concrete protects timber



Winschoten / Holland





length: 40,0 m

Span 1: 18,0 m

Span 2: 22,0 m

width: 4,0 m

Winschoten / Holland

Conclusion

… there is great potential to use more timber in bridges

… the composite approach will allow „main stream“

… research has been done

… pilot projects have been completed succesfully

... from now on it is all about marketing and acceptance

Thank you very much for your interest !

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