Experimental investigation of dowel action using advanced measurement techniques

Structural concrete laboratory
IBETON

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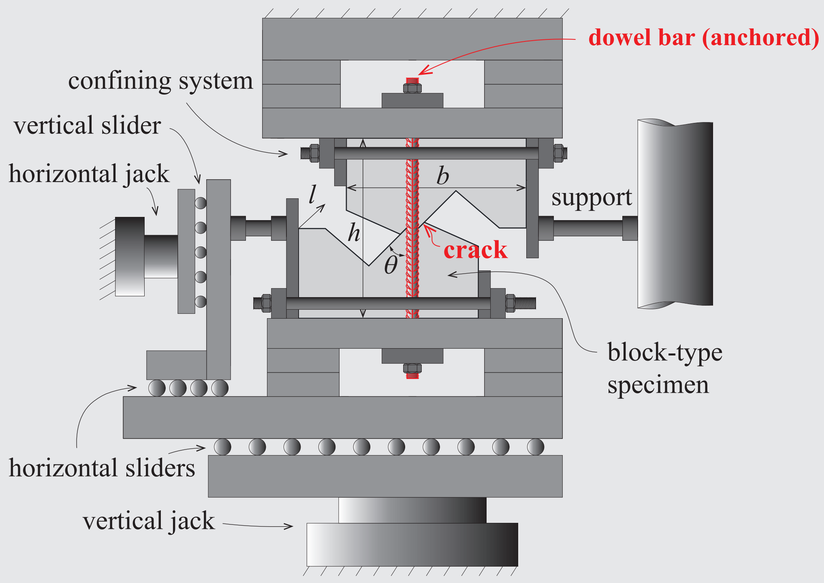
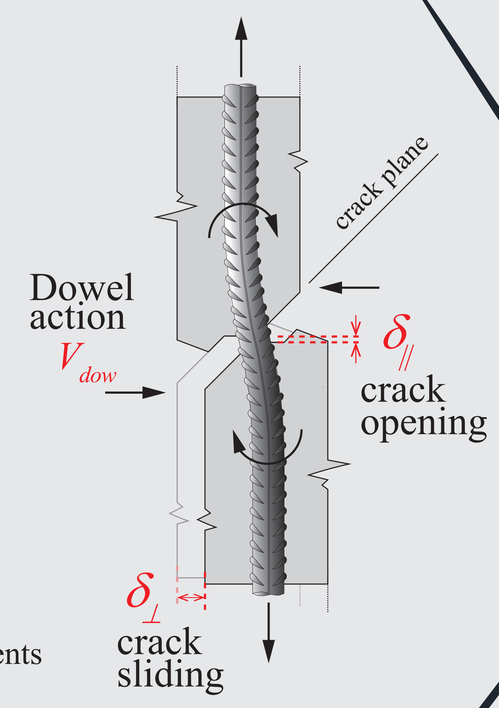
1 How to simulate dowel mechanism in the laboratory?

Tailor-made test set-up



The test machine enables to control the horizontal and the vertical displacements independently.

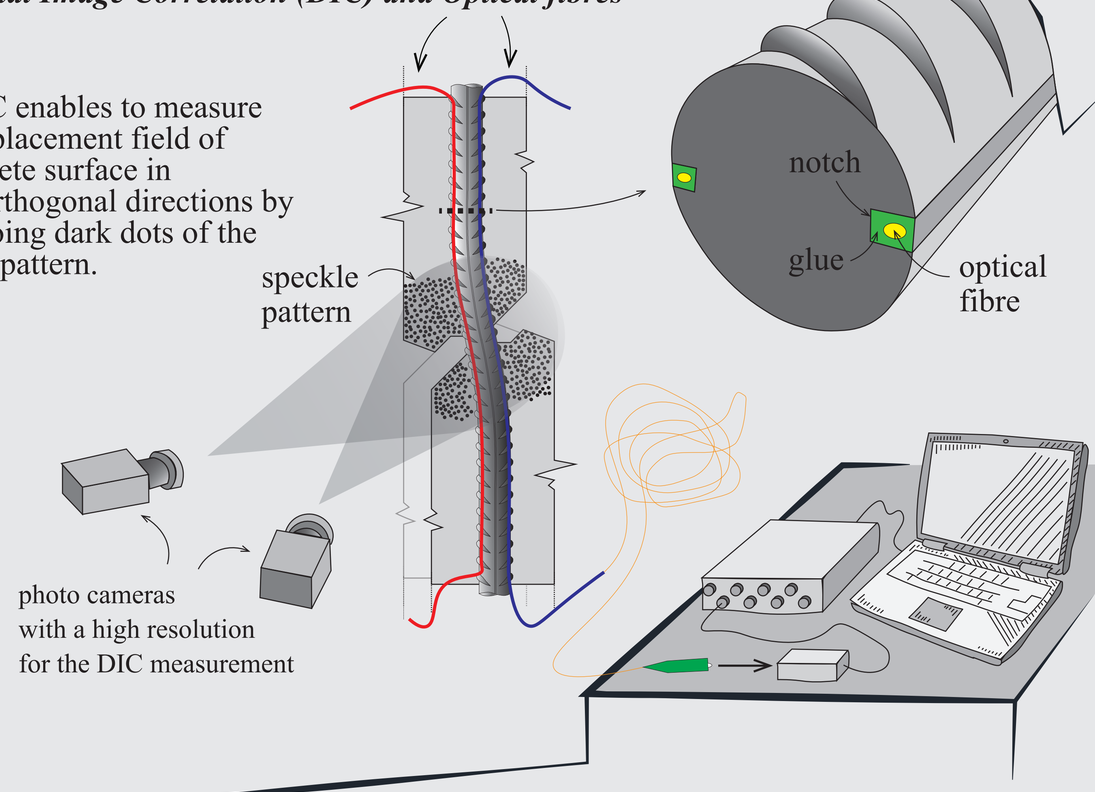
Dowel mechanism



2 How to measure dowel mechanism in the laboratory?

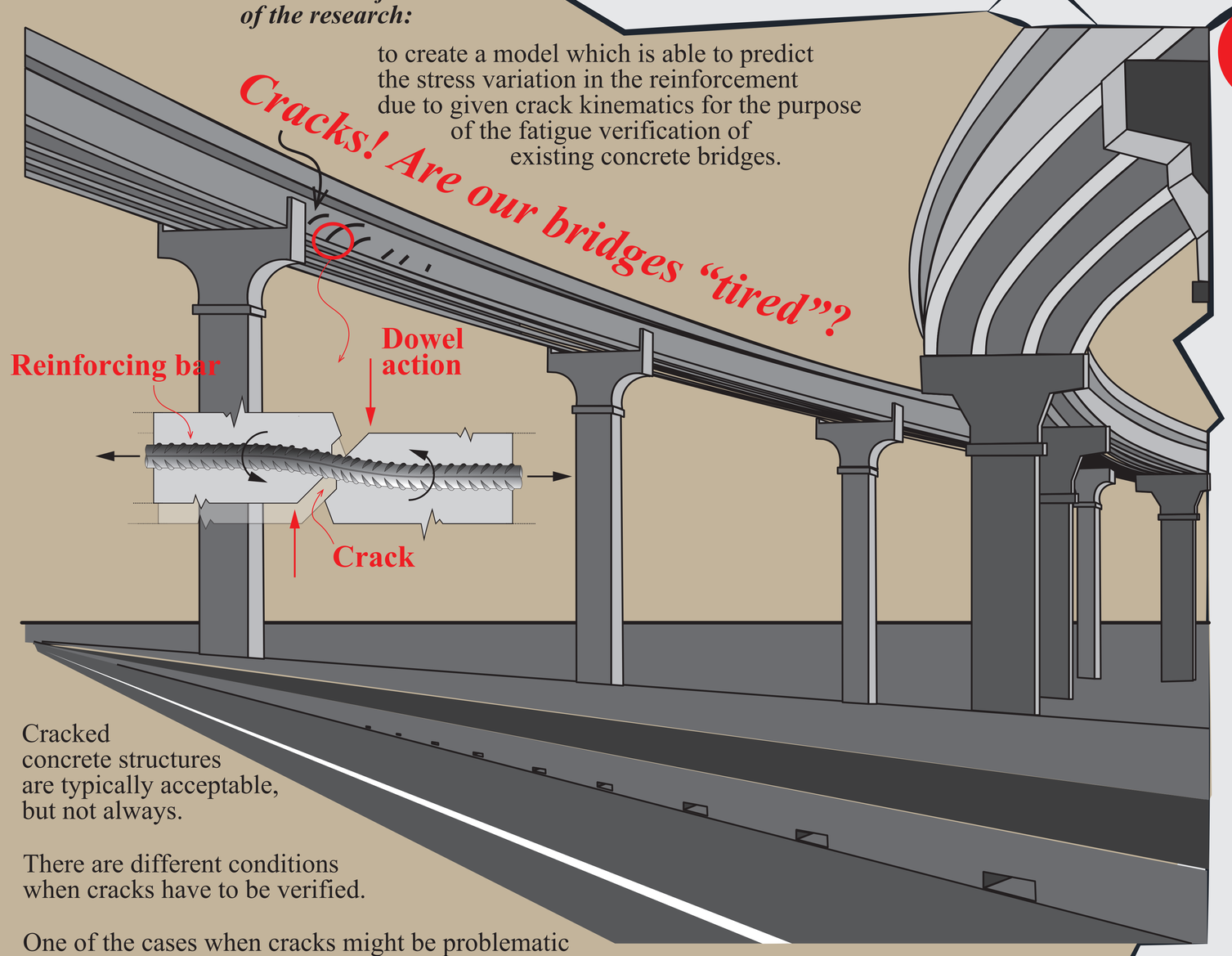
by 3D Digital Image Correlation (DIC) and Optical fibres

3D DIC enables to measure the displacement field of a concrete surface in three orthogonal directions by followoing dark dots of the specke pattern.



The main objective of the research:

to create a model which is able to predict the stress variation in the reinforcement due to given crack kinematics for the purpose of the fatigue verification of existing concrete bridges.



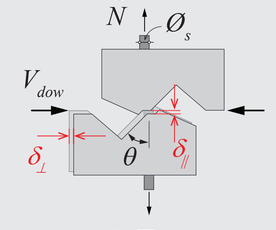
Cracked concrete structures are typically acceptable, but not always.

There are different conditions when cracks have to be verified.

One of the cases when cracks might be problematic refers to the stress concentration in steel reinforcing bars close to cracks due to the ***dowel action*** (the transverse force causing the local bending of the reinforcement).

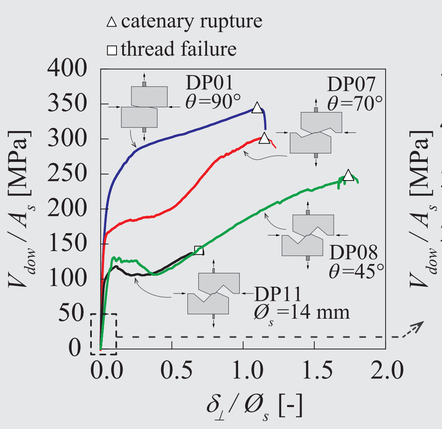
3 Results of monotonic and cyclic dowel tests What can we learn?

- Dowel action highly depends on the dowel diameter ($\varnothing_s$), imposed crack kinematics ($\delta_{//}$, $\delta_{\perp}$) and dowel-crack inclination (θ).
- Monotonic and cyclic tests are correspondant.
- A typical rupture mode is the local concrete crushing with the rupture of the dowel bar at the crack position.

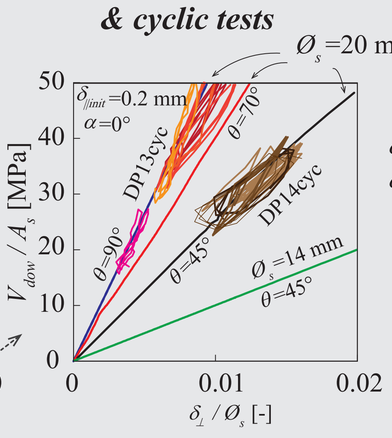


$$A_s = \frac{\pi \cdot \varnothing_s^2}{4}$$

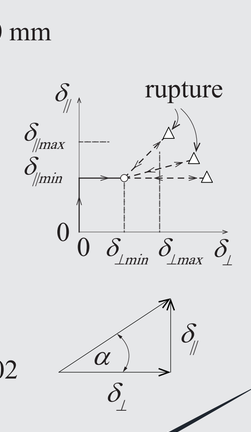
a) Monotonic tests



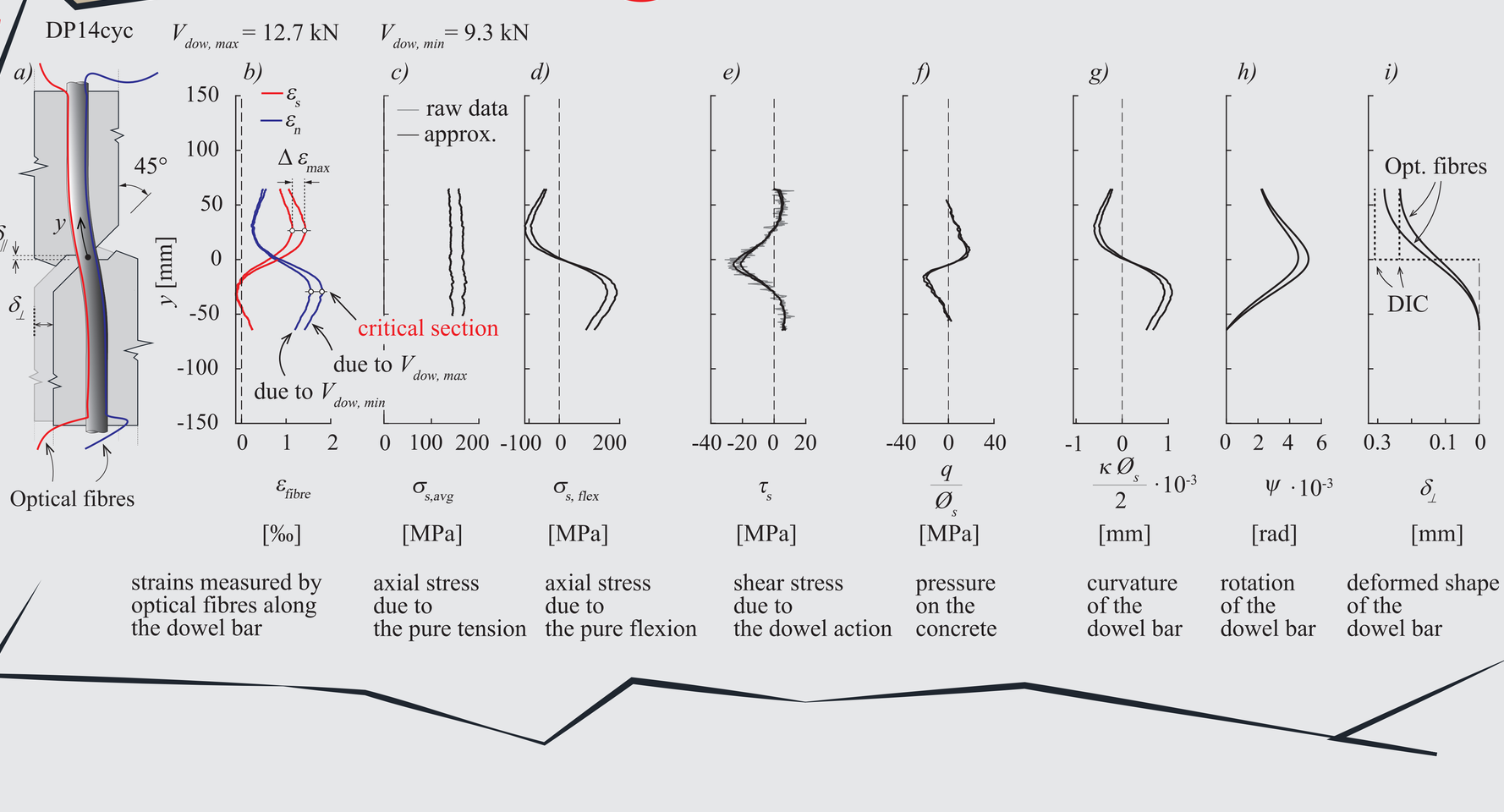
b) Monotonic & cyclic tests



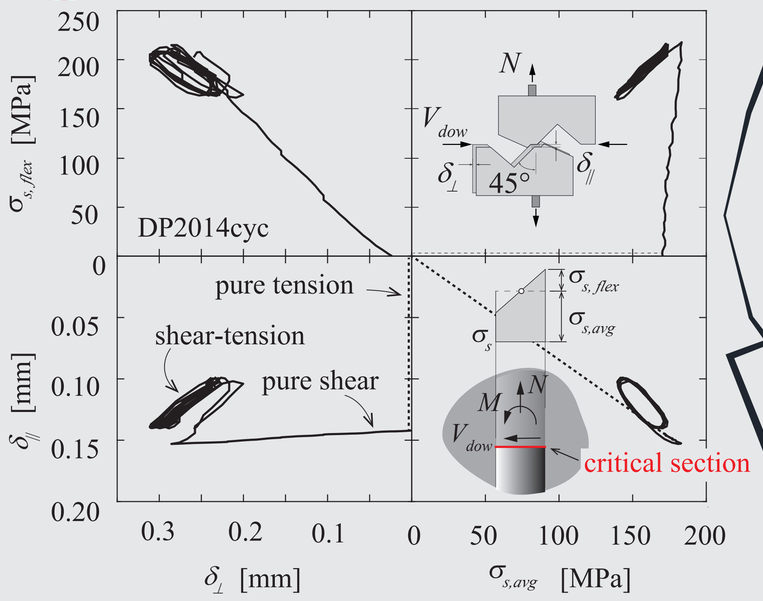
c) Test protocol



4 Optical fibres-based test results



5 Stress vs. kinematic components



On the basis of these results including sufficient additional tests, a model can be created enabling to predict stress variations in the reinforcement due to different crack kinematics.

(The research is ongoing)

6 Start a discussion Ask a question