Adaptive modularized constructions made in a flux

Modular Precast Segmental Bridges using CFRP and Computed Tomography

Prof. Dr. sc. techn. Mike Schlaich, Technische Universität Berlin
Prof. Dr.-Ing. Sven Simon, University of Stuttgart

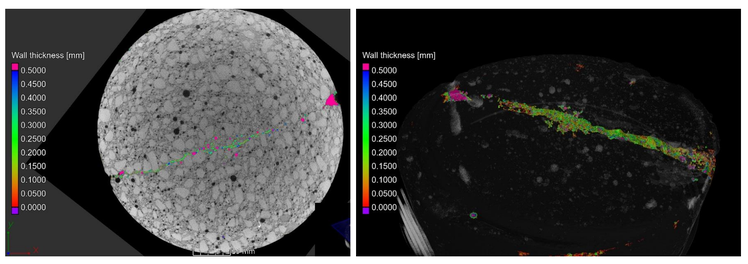
SPP 2187

Concept

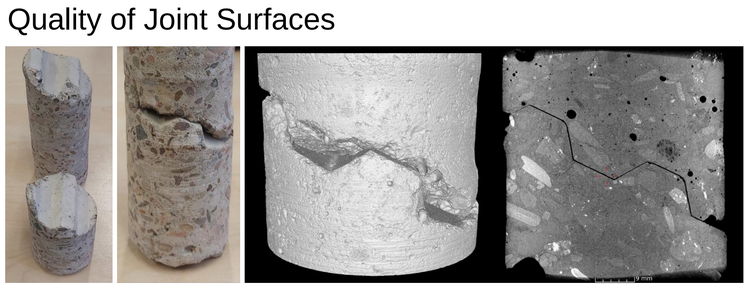
- Precast Segmental Construction allows for fast construction speed and small module sizes
- CFRP Post-tensioning removes the risk of tendon corrosion
- Dry Joints enable fast assembly, disassembly and reuse
- Structures are modular and modules are produced in flow production
- Computed Tomography is an integral part of the quality management in the production line
- Quality management reduces variation in the concrete quality and allows full utilization of the strength of concrete

Computed Tomography

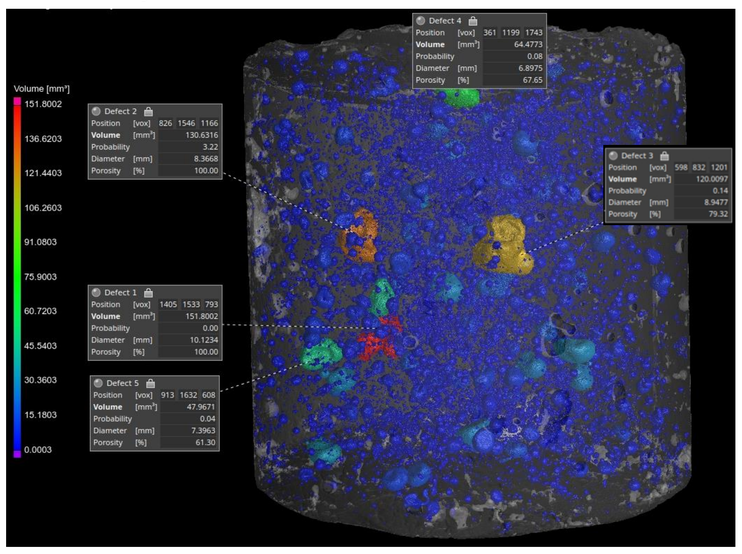
Detection of Cracks



Quality of Joint Surfaces



Pore Analysis



Computed Tomography (CT) for Concrete

- Computed Tomography allows 3D quality control of hardened concrete elements
- Data from CT can be utilized to analyze quality-related parameters:
  - Entrapped Air Content
  - Cracks
  - Surface Geometry
  - Position of Reinforcement
  - Contact Areas
- Long-term monitoring of data like entrapped air content can be correlated to production issues like changes in concrete mixture, workability, poor concrete compaction, etc.

Segment Joints

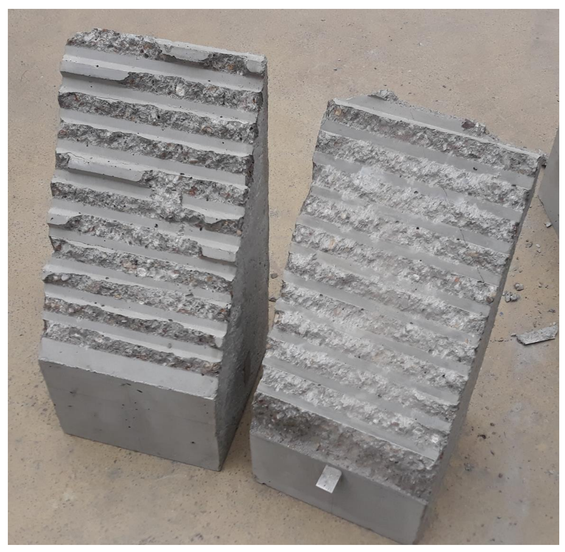
- Testing of dry joints for segmental construction
- Combination of shear and normal force in the joint is controlled by the inclination of the joint surface in the test specimen
- Joints with profiled surfaces inclined 0°, 25°, 35°, 45°, 55°, 65°, joints with smooth surfaces inclined 0°, 25°, 35°, 45°, reference samples without joint.

First Results

- Joints with surfaces inclined 0° and 25° have the same load capacity as reference samples and fail in compression
- Profiled joints 35° and 45° have combined failure compression / shear, 55° and 65° fail in shear
- Shear capacity given in EC 2 is conservative compared to other sources and the conducted tests

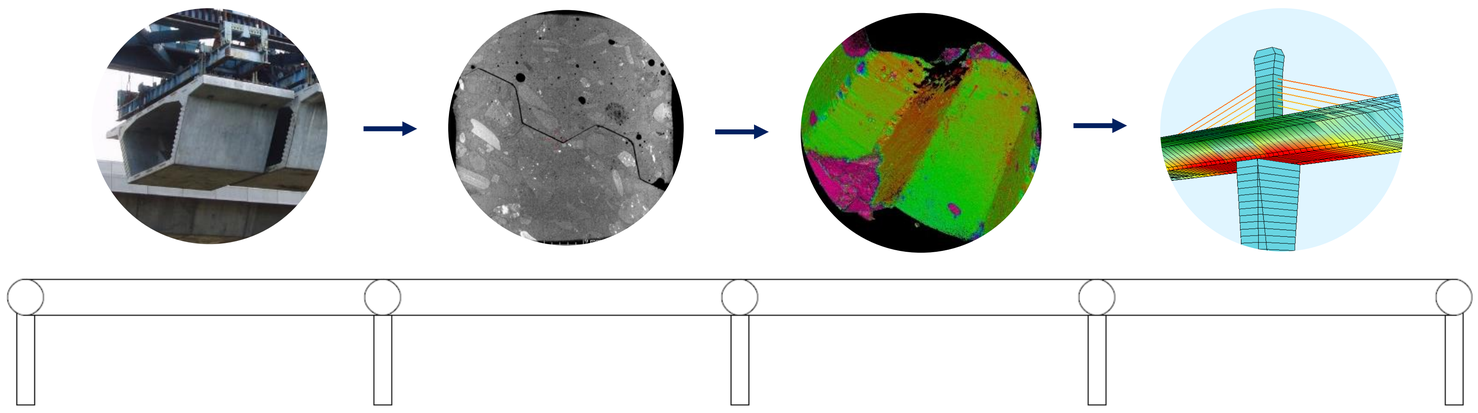
Compression Failure

Combined Failure



Shear Failure

Outlook



Flow Production of Segmental Concrete Bridges with integrated CT-Quality-Control

Contact

ENTWERFEN UND KONSTRUIEREN
Institut für Bauingenieurwesen
Technische Universität Berlin

Martin Rettinger
martin.rettinger@tu-berlin.de

IPVS Institut für Parallele und Verteilte Systeme
Universität Stuttgart

Jajnabalkya Guhathakurta
guhathakurta@ipvs.uni-stuttgart.de