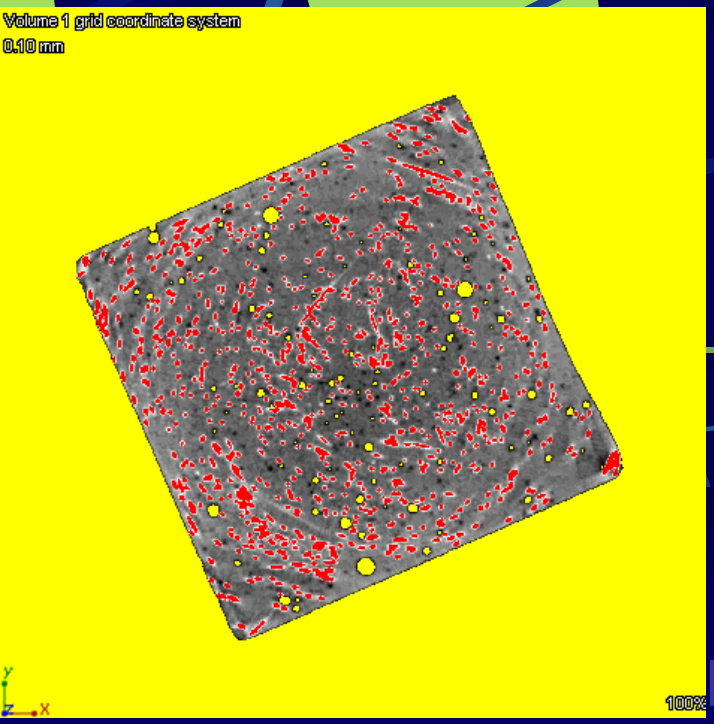
25. Conference Rheologische Messungen an mineralischen Baustoffen
Rheology of Building Materials 02. – 03. March 2016

# X-ray computed tomography of porosity in fibre reinforced self-compacting concrete

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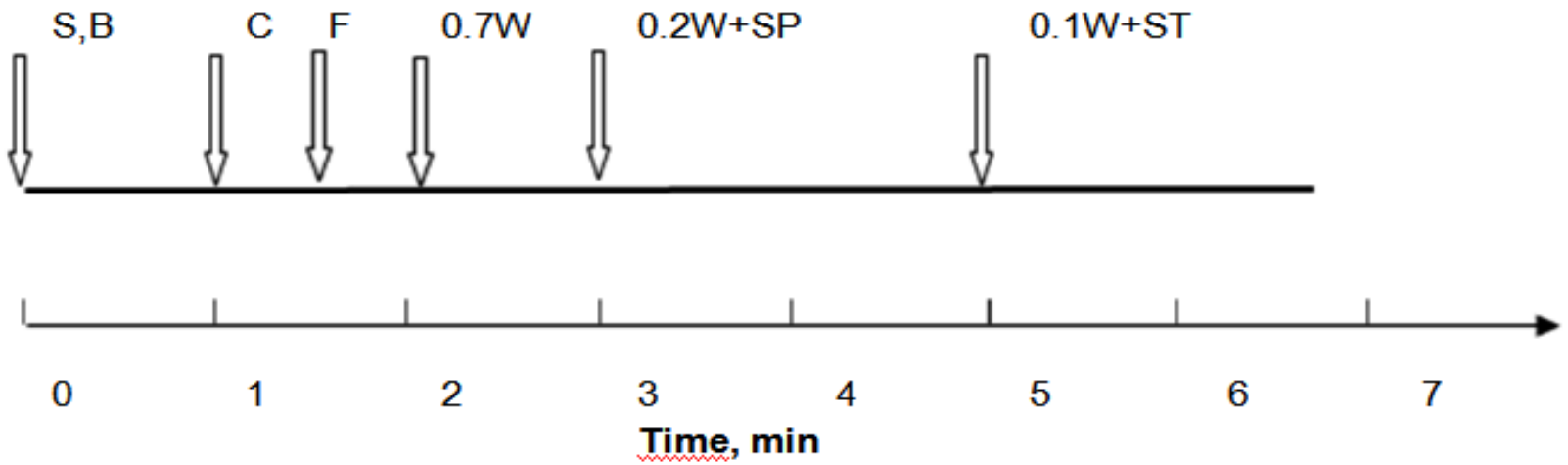
# INTRODUCTION - 1

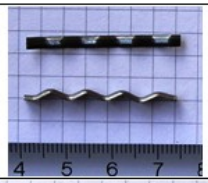
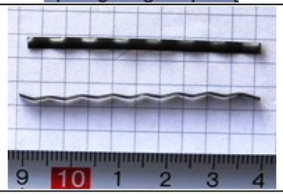
- The insufficient explored area in the production of steel fibres reinforced self-compacting concrete (SFRSCC) units is constituted by the influence of the casting method on their designed technological and mechanical properties.
- There is a lack of information on the homogeneity of air voids dispersion in the concrete mixture during mixing and casting.

# MATERIALS AND MIXING PROCEDURE

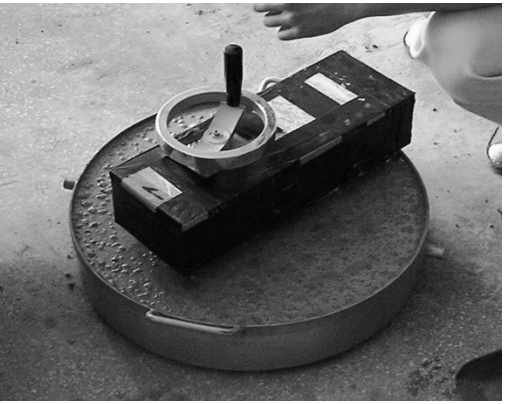
| Component | Symbol | Content kg/m³ |
|---|---|---|
| CEM I 42,5 R | C | 490,0 |
| Sand 0–2 mm | S | 800,0 |
| Aggregate 2–8 mm | B | 800,0 |
| Water | W | 200.9 |
| Steel fibres – kg/m³ (% by volume) | F | 40-80-120 (0.5-1.0-1.5) |
| Superplasicizer Glenium ACE 48 (3.5 % m.c.) | SP | 17.2 |
| Stabilizer RheoMatrix (0.4 % m.c.) | ST | 1.96 |
| W/(C+SF) | - | 0,41 |
| Slump-flow (SF) | - | SF3 |



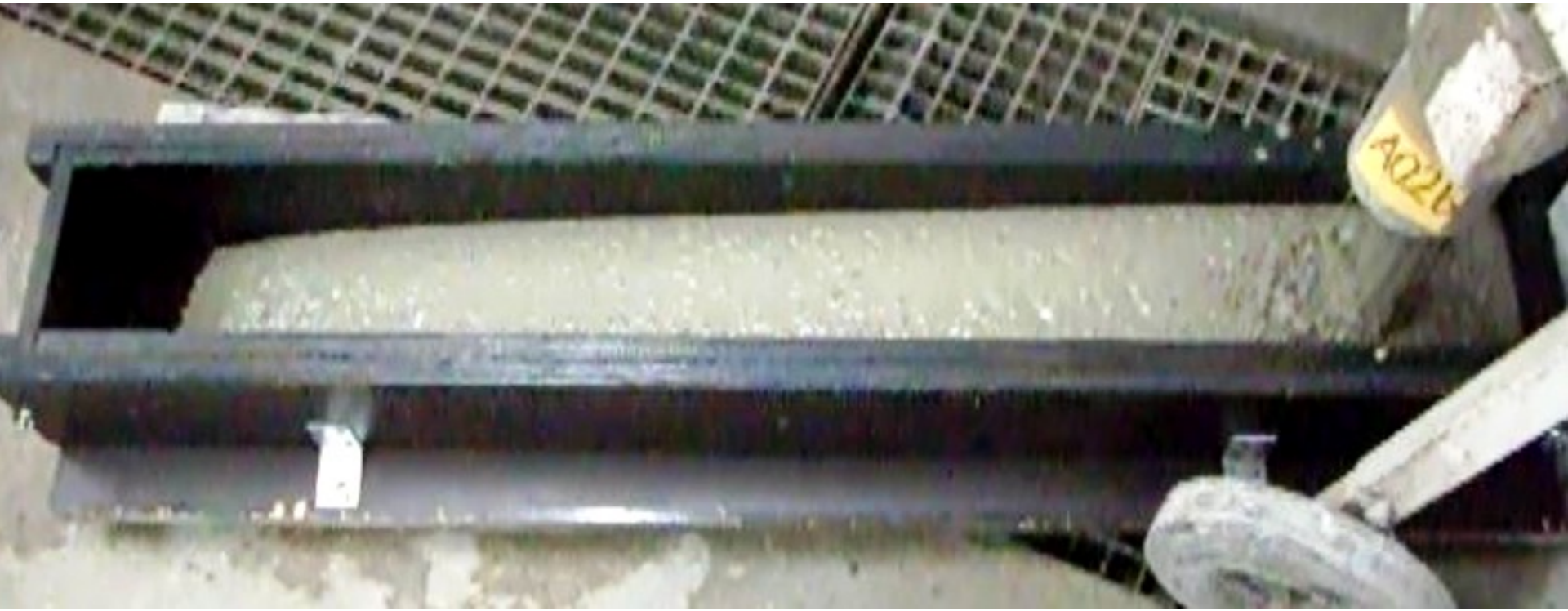
# CHARACTERISTICS OF APPLIED STEEL FIBRES

| Name | Length (mm) | Width (mm) | Cross section | Shape | Material | Tensil strength ($N/mm^2$) |
|---|---|---|---|---|---|---|
| SW 35 | 35 ± 10% | 2.30 ÷ 2.95 | segment of a circle |  | low carbon steel wire | 800 ±15% |
| SW 50 | 50 ± 10% | 2.30 ÷ 2.95 | segment of a circle |  | low carbon steel wire | 800 ±15% |

# MEASURING PROCEDURE AND THE ROTARY RHEOMETERS



# CASTING OF SCC IN BEAMS



Cast method of concrete in the case of SFRSCC beam and location of concrete casting point CCP

# X-RAY COMPUTED TOMOGRAPHY

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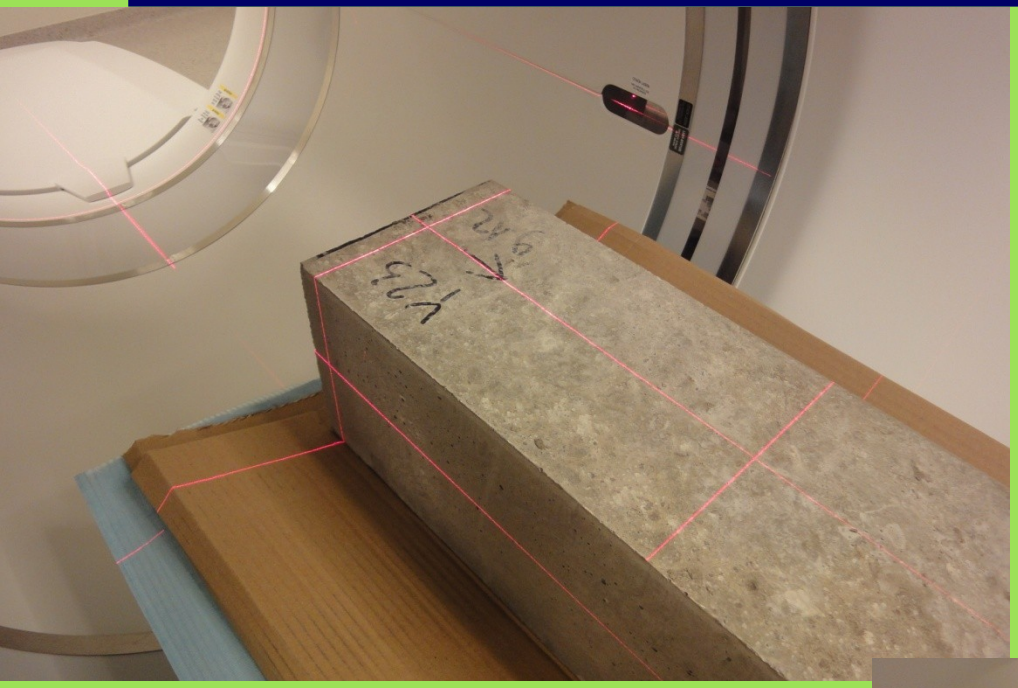
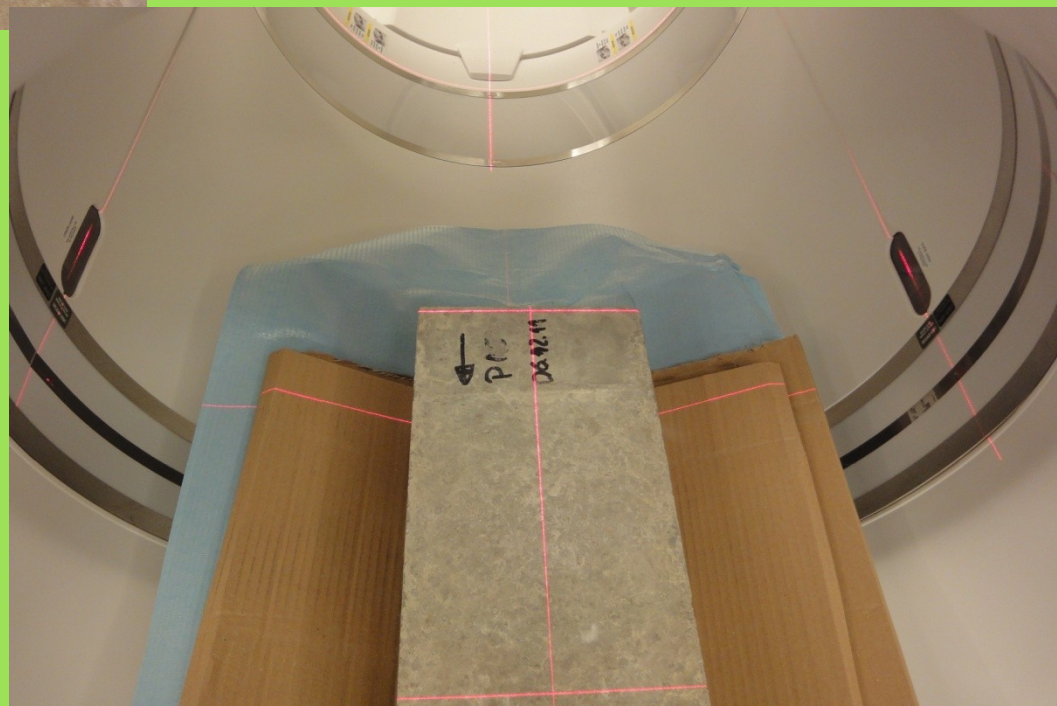
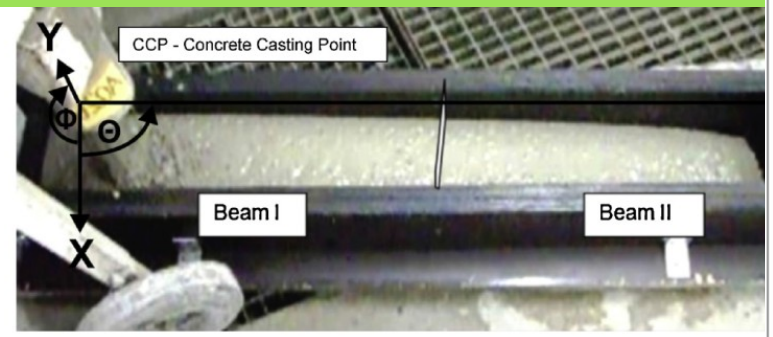
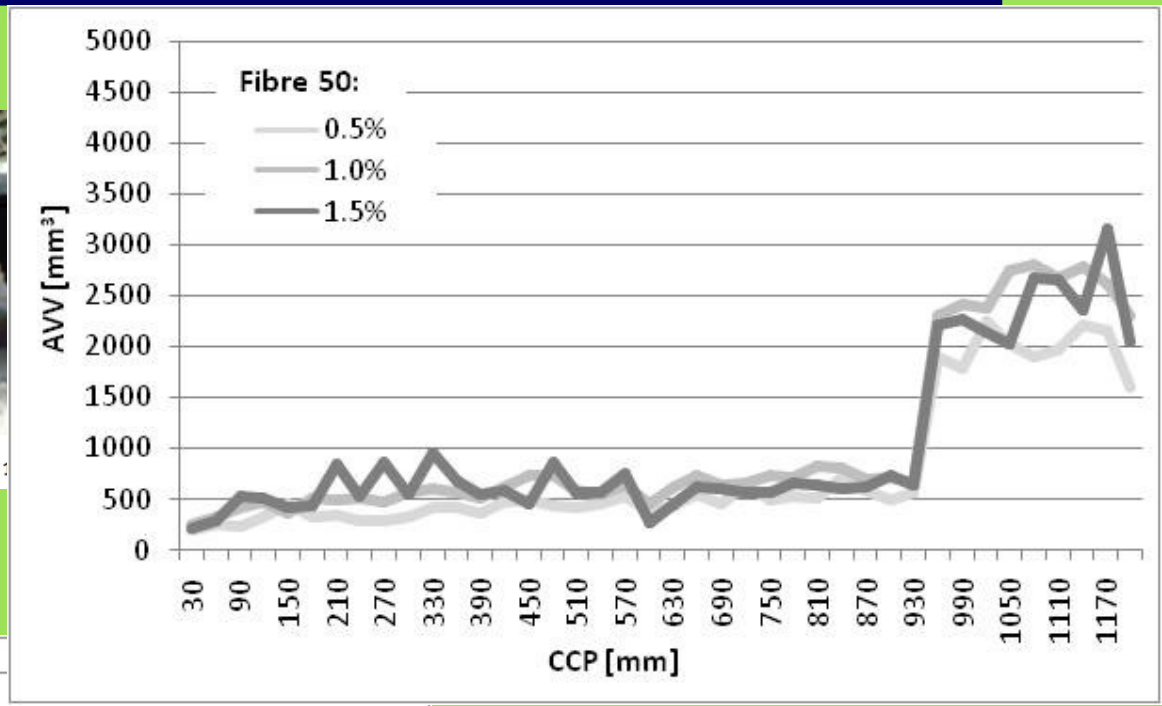


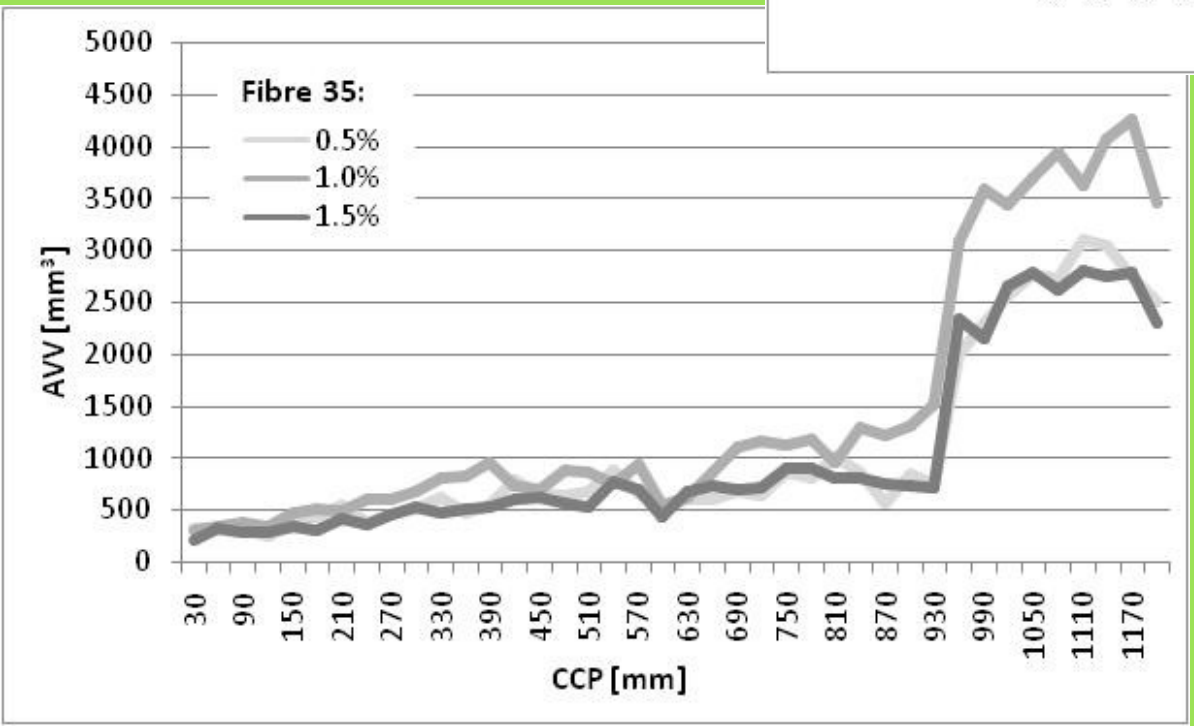


# RESULTS - BEAMS




2 – Methodology of casting concrete mix in case of SFRSCC 150 mm × 150 mm ×




Influence of distance from concrete casting point on air voids volume in SFRSCC beams

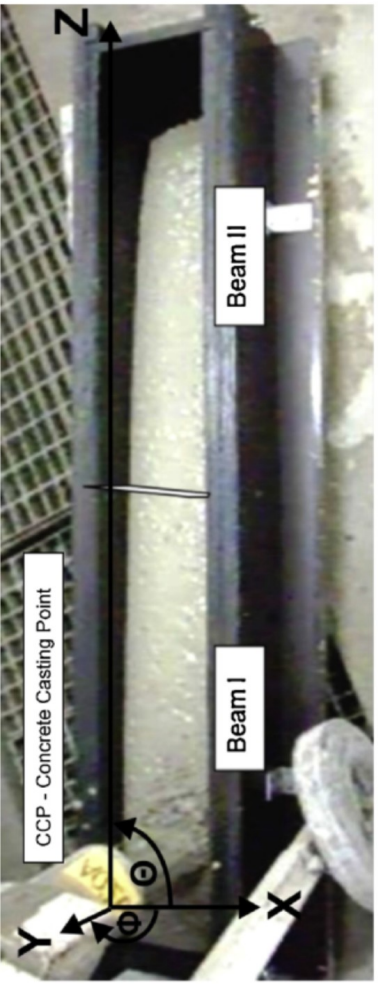



Fig. 2 – Methodology of casting concrete mix in case of SFRSCC 150 mm × 150 mm × 1200 mm beam.

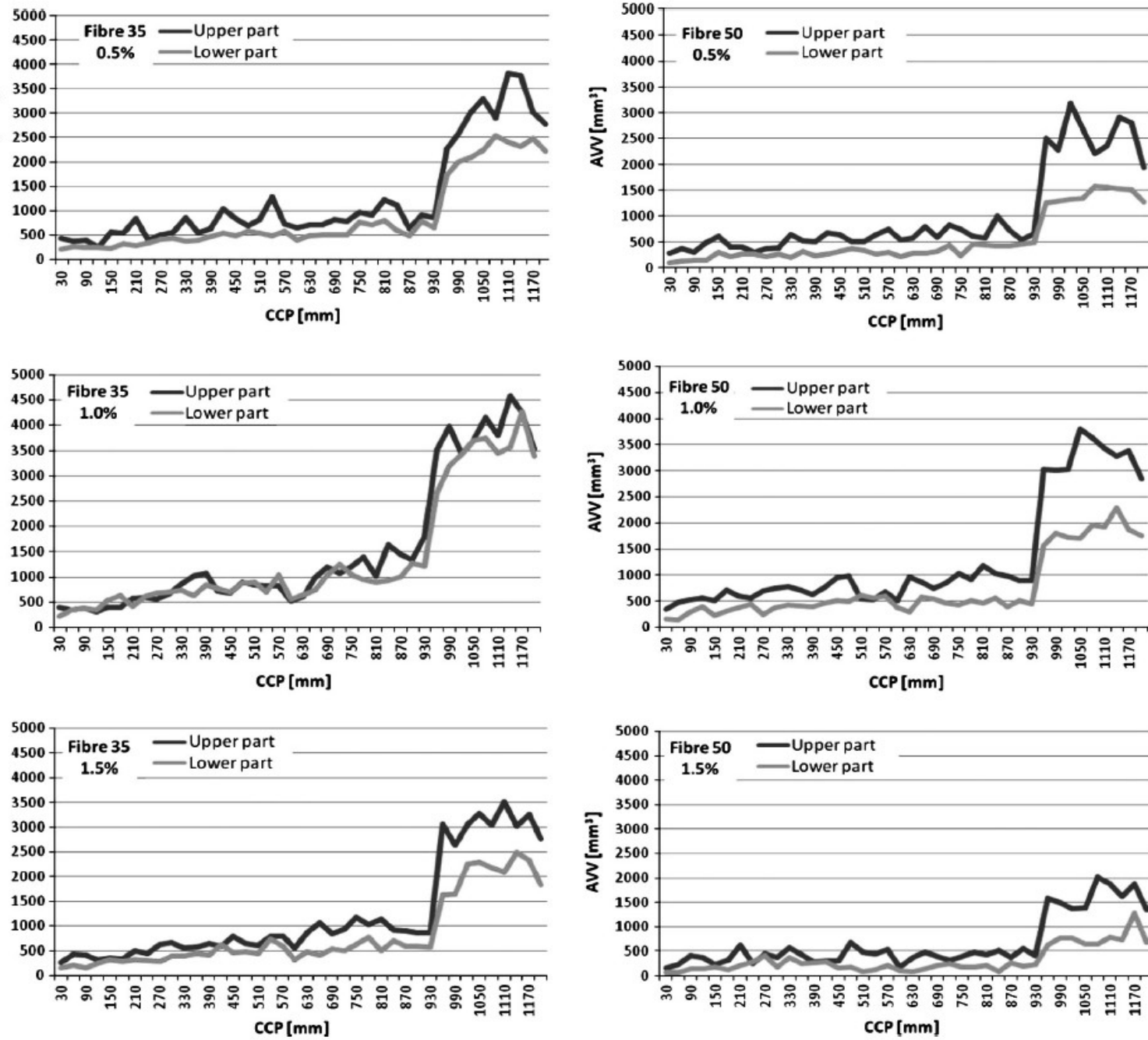



Fig. 9. Influence of distance from CCP on AVV in the upper and lower part of FRC–SCC beams.

# CONCLUSIONS

- The study confirms the technological problems connected with uneven distribution of air voids in SFRSCC matrix.
- X-ray medical CT is a feasible method for revealing the air voids structure in cement composites
- SFRSCC modified by Fibre 50 are characterized by statistically significantly smaller air voids volume, than SFRSCC modified by Fibre 35.

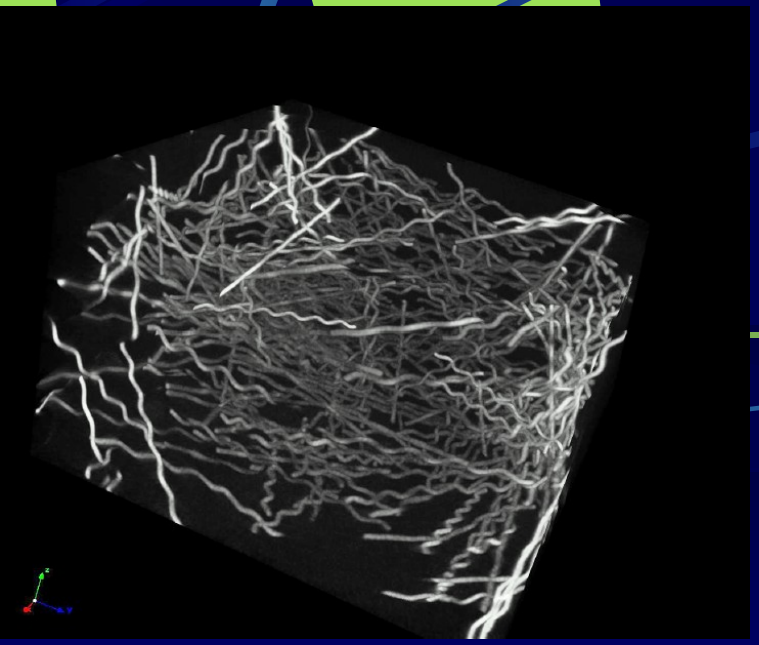
# CONCLUSIONS

- Less air is trapped in the lower part of beams.
- The volume of trapped air is not uniform along the beam length (possible influence of a “wave” of fresh mix bouncing back from the end of a mould).

# CONCLUSIONS

- Areas 900 mm from the CCP occurs a rapid (almost tenfold) increase of the air voids volume (needs further investigation).
- The future research programme dealing with SFRSCC should be focused on air voids smaller than 1 $mm^3$ and different shapes and sizes of cast elements.

# THANK YOU FOR YOUR ATTENTION



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