

Non-Destructive Testing in Civil Engineering



Ultrasonic Inspection of Tendon Ducts

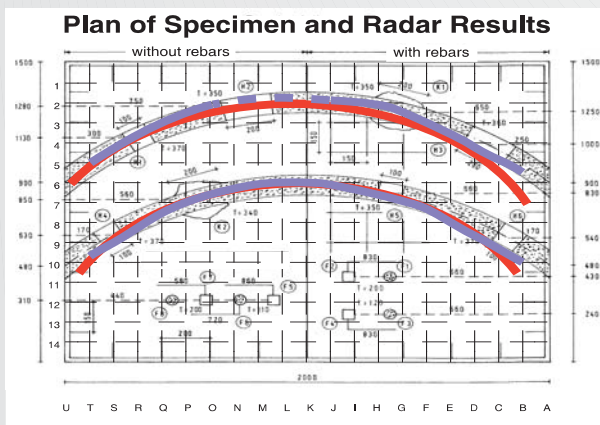
The main purposes for testing prestressed concrete components by means of pulse echo methods are:

- Localization of tendon ducts
- Localization of injection faults in tendon ducts
- Localization of compaction faults, specially around tendon ducts.

Recently, much progress was achieved to overcome the difficulties in applying ultrasonic echo methods to concrete.

The method described in this poster has been developed in a joint project by BAM and Fraunhofer IZFP. It involves the application of the technique of synthetic aperture with different sending and receiving positions, whereas a scanning laser vibrometer is used as ultrasonic receiver. The data are evaluated by means of 3D-reconstruction calculations.

The results presented here are part of a research project carried out by BAM and 9 working groups. It was funded by BASt (Federal Highway Research Institute).



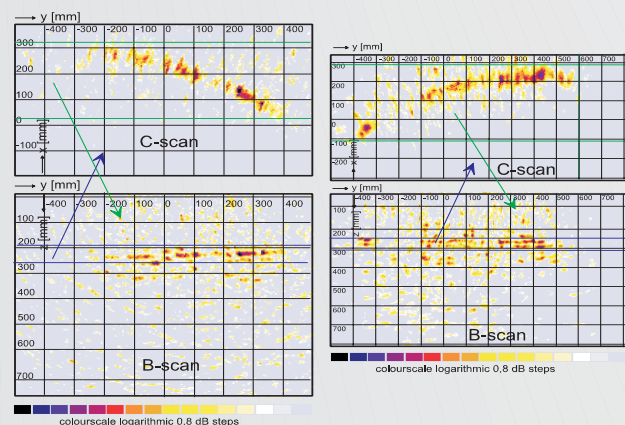
Test specimen containing 2 metallic ducts with intentionally placed defects (dimensions in mm). Prior to the ultrasonic testing the ducts were localized with impulse radar (coloured lines: results obtained by 2 different groups)

Ultrasonic Equipment

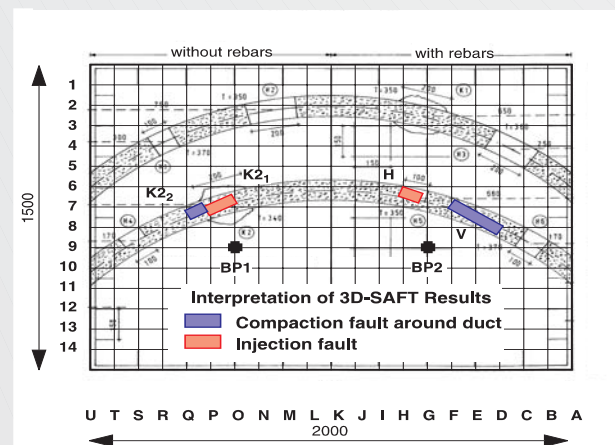


Ultrasonic echo experiment for testing concrete with optical signal detection. A broadband transducer (centre frequency 100 kHz) is in a fixed position and an aperture is scanned using a scanning doppler laservibrometer as ultrasonic signal detector.

3D-SAFT Reconstruction of Ultrasonic Data and Interpretation



Results of 3D-SAFT reconstruction calculations of several series of measurements obtained with the described ultrasonic method at the lower duct (SAFT: Synthetic Aperture Focusing Technique). The graphs show projection planes of the backscatter intensity from the inside of the specimen (C-scan: parallel to the surface, B-scan: perpendicular to the surface). The duct can clearly be localized. **Left side:** Result of the part without reinforcing bars (orientation point BP1). **Right side:** Result of the part containing reinforcing bars (orientation point BP2). The data were measured from the backside relative to the plan of construction.



Location of the defects in and around the lower duct interpreted from the 3D-SAFT reconstruction compared to the plan of construction (Dimensions in mm). BP*: Orientation points for the scanning laser vibrometer; K*, H*: Indication of compaction and injection faults, respectively. The results were analyzed prior to the unfolding of the actual construction drawings (blind-test). Two defects could be localized, a third one (V) has to be confirmed by destructive testing.