

## Case 4.4 In-Situ compressive strength testing of quarantened precast concrete tunnel lining segments using CAPO-test.

Tunnel elements were produced at the Translink Joint Venture, Isle of Grain, UK, and hardened in a heating tunnel on a moving conveyer belt.

For strength estimation cubes were placed alongside. The production took place in large numbers, automatically. The cube strength, after heating, was specified to be 60 MPa. During a period, the cube strength dropped, but production continued until the drop was realized.

All the element produced in that period was quarantined.

Scrutinizing the reason, it was later established that the reason fro the drop was a change in the cement used in the mix, the gypsum component in the cement had been changed..

To test the final strength of the quarantined elements two systems were selected as candidates, coring or CAPO-TEST.

Elements tested with cores could not be used in the tunnel as the coring would have to be trough-going. CAPO-TEST was selected.

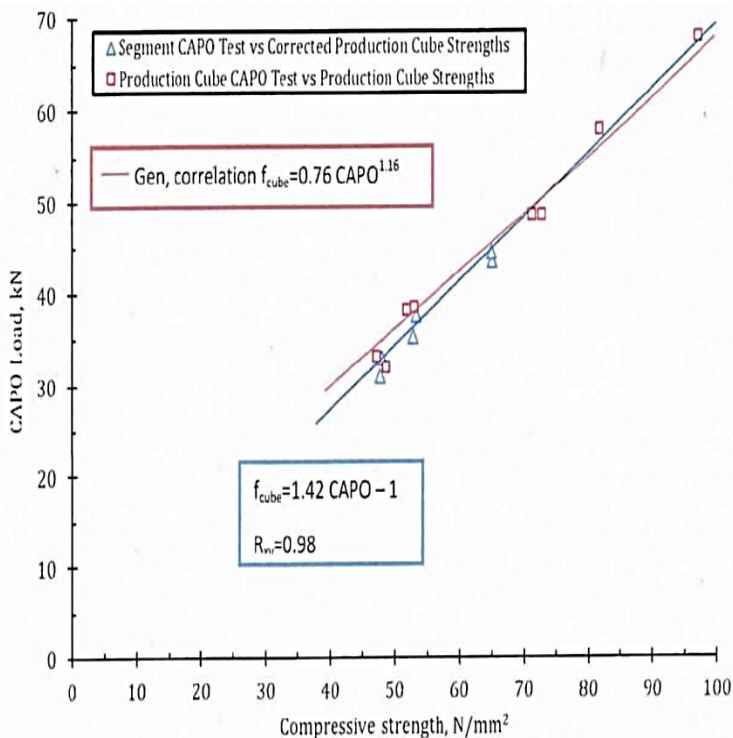
A calibration program was conducted in relation to cube strength ranging from 35 MPa to 100 MPa, partly between production cured cubes and CAPO-TEST, and partly between standard cured cubes and CAPO-TEST.

Testing was made in relation to maturity at 4, 7, 28, 154 and 329 actual days.

The correlation obtained (blue), matched perfectly the general one between CAPO-TEST and cube strength (red)

Subsequently, the quarantined elements were tested at random in a statistical valid manner with three CAPO-TEST's in each element.

All quarantened elements, >2 month old, were accepted for erection in the tunnel, as the strength with CAPO-TEST related to cube strength showed strength > 60 MPa from 150 days and onwards.



**Certified CAPO-TEST technician Henrik Kristensen performing the CAPO-TEST on the tunnel elements.**

Reported by **NDTitan Claus Germann Petersen**