LOK-TEST & CAPO-TEST for in-situ strength

Section 3
Hardware
Testing Procedures
Instruments

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In-Situ Strength, why?

- Control of effects of transportation and compaction
- Effects of curing, quality of the cover layer protecting the reinforcement against chloride ingress
- Eliminate shortcomings of cylinders and cubes
- Low strength of laboratory specimens
- Changed mixes, intentionally / not intentional
- Strength of existing structures for load carrying capacity calculations
- Timing of safe and early loading operations
The two in place test systems presented

**LOK-TEST**

**CAPO-TEST**
LOK-TEST
LOK-TEST for new structures

- Install inserts
- Ready the testing
- Perform the LOK-TEST either to a required strength or to top-peak loading, with or without pull-out
- Transform the kN pullforce to compressive strength of lab cubes (or cores) or lab cylinders by general correlation
LOK-TEST

Diagram showing a disc with reaction rings and pullout force.
Clearance Requirements
ASTM C900

Insert clearance

>150 mm

25 mm

$\geq d_b$

or

NMSA

Reinforcement clearance

Edge distance

>100 mm
LOK-TEST Inserts, <60 MPa cyl, strength

Max pullforce 55 kN, equiv. to 60 MPa cylinder strength or 80 MPa cube strength

- L-40: Nailed to formwork
- L-42: Attached to formwork cutouts
- L-45: Or through a 7 mm hole in the form
- L-49: Floated into surface

Test smart — Build right
LOK-TEST inserts >60 MPa cyl. strength

Max pullforce 90 kN, equiv. to 105 MPa cylinder strength or 140 MPa cube strength
Note: Both sets of inserts <60 MPa and >60 MPa follow the general correlations(s)

Test smart – Build right
LOK-TEST Inserts

- L-42: Nailed to formwork
- L-44: Attached to formwork cutouts
- L-45: Or through a 7 mm hole in the form
- L-49: Floated into surface
L-40 insert for nailing to wooden formwork
"H" is the peak-load, saved in the memory with time and date of testing for documentation.

Duration of one tests including preparation is 3-5 minutes.
Correlating the kN to MPa using the general cylinder correlation

\[ f_{\text{cyl}} = 0.69 F^{1.12} \]

Compressive strength, MPa, Cylinder

Pullout load, kN

28.1 MPa

27.4 kN
L-42 Insert for safe and early formstripping

- Nailed to formwork
- Attached to formwork cutouts
- Or through a 7 mm hole in the form
- Floated into surface
Cut hole in formwork
Attach backing plate and fasten insert
• Attach insert support assembly to form
• Apply sealant
• Place concrete
Strength for Formwork Removal

Vice-President Mr. Sal Fasullo, C.E.T., Davroc & Associates Ltd., Canada

Mr. Sal Fasullo has during the years been in charge of and responsible for testing of +200,000 LOK-TEST's.
• Remove backing plate
• timed by maturity
• Attach loading system
• Apply load
• Measure pullout strength
Peak Load, example $H = 29.5 \text{ kN}$

- At peak load, $\approx 0.2 \text{ mm surface displacement}$
- Gradual decrease in load with continued displacement
Correlating the kN to MPa using the general cylinder correlation

![Graph showing general correlations for cylinder strength. The graph plots compressive strength in MPa against pullout load in kN. A line is drawn with the equation \( f_{cyl} = 0.69 F^{1.12} \). At 29.5 kN, the compressive strength is 30.6 MPa.]
Floating Inserts

- **L-40**
  - Nailed to formwork

- **L-42**
  - Attached to formwork cutouts
  - Or through a 7 mm hole in the form

- **L-45**

- **L-49**
  - Floated into surface
Placement of L-49 inserts
Testing of L-49 inserts floated in the top surface for QC
Testing of L-49 inserts floated in the top surface, tunnel slab
Deeper testing than at the surface 25 mm

Deeper embedment of the LOK-TEST insert can be made using e.g. the L-49 insert as illustrated adjacent.

Using this insert the testing surface will be lowered 20 mm from the surface.
CAPO-TEST
Cut And PullOut Test

Instruction video on Google
“CAPO-TEST ASTM-C900”
LOK-TEST to CAPO-TEST

Line of equality


Test smart – Build right
CAPO Test
CAPO-TEST Failure

"Leaves" from the 2nd crack pattern with the concrete in compression STRUT being intersected in the softening regime
CAPO-TEST
Procedure
Prepare Concrete

1. Core hole 18.4 mm dia.
2. Plane surface 100 mm dia.
3. Cut slot Dia 25 mm
Core Hole

Shown here using the vacuum plate, otherwise perform the coring handheld, stepping on the flange.
Plane surface

Use governing tap for centering if performed handheld.
Planed surface
Cut Slot

25 mm
Cut Slot
Cut Slot
Insert Expansion Cone with Coiled Split-Ring

Coiled ring
Cone
Ring Expansion Hardware

- Nut
- Coiled ring
- Cone
Expand Ring

Hold base/cone pullbolt in the same position and turn nut
Expand Ring

Hold base/cone pullbolt in the same position and turn nut with the 45 mm wrench 9 rotations clockwise. Back off slightly.
Couple instrument
Apply Pullout Force, slowly to failure
Pullout the Expanded Ring against the 55 mm counterpressure
Acceptable Test

Sharp 55 mm diameter edge from counterpressure

Crushed material
Criteria for correct CAPO testing

- Fully expanded ring, 25 mm dia.
- Plane surface
- 25 mm depth
- Sharp edge 55 mm dia.
**Max strength for CAPO-TEST and duration of test**

- Max pullforce for the CAPO-TEST is 90 kN, equiv. to 105 MPa cylinder strength or 140 MPa cube strength.
- Total duration of one test 15-20 minutes.
LOK-TEST and CAPO-TEST Instruments
LOK-TEST Instrument in a suitcase

Additional is needed inserts for casting-in, slide 11-12
CAPO-TEST Lite Instrument in a suitcase

For handheld use without the suction plate

The pull machine is the same as for LOK-TEST
Can also be used for BOND-TEST

Extra, C-112 Expandable inserts
CAPO Equipment, complete set

Prep. Kit

DSV Kit with Surface Planner and Suction Plate

Pullmachine

C-112 Expandable Inserts