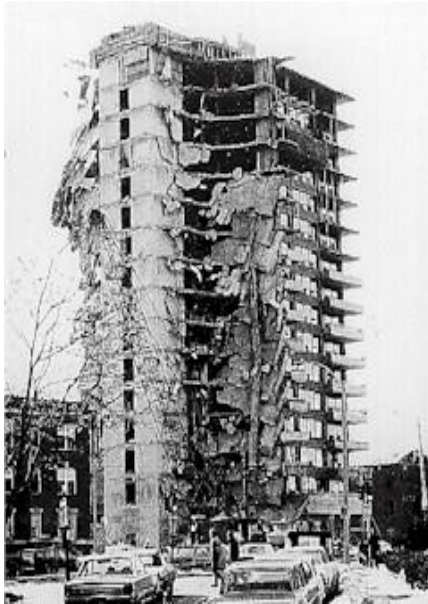
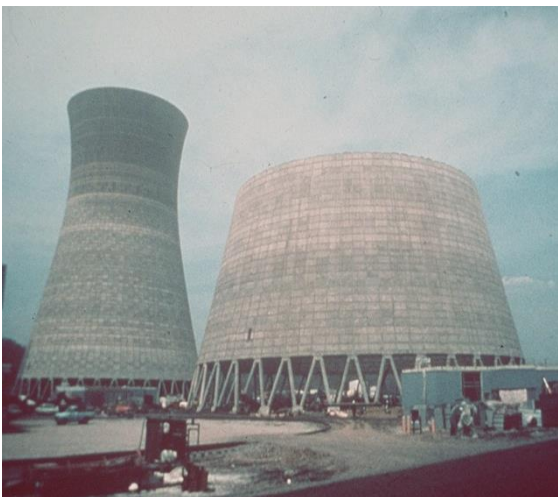


Examples of collapses / damages involving insufficient / changed strength in-place and insufficient quality of the cover layer



Collapse during formwork removal ,
Boston, USA.
6 fatalities
Standard cylinders tested had passed the
requirement.
Subsequent investigation showed the in-
place strength to be 50% of the cylinder
strength at the time of formwork
removal.

LOK-TEST used hereafter for timing of
safe and early loading.



Cooling tower collapse

Failure due to insufficient
strength to support the next “lift”,
West Virginia, USA
51 fatalities
Timing of next lift was
determined by cylinders.

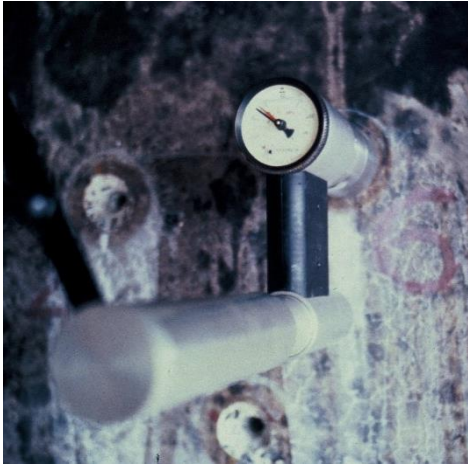
LOK-TEST in each lift was
subsequently used for timing of
lifting the form



Collapse of beams

Beams collapsed in a grocery
store, Moscow, Russia
7 fatalities
Lab cylinders had passed the
required strength of $f_c = 40$ MPa
Capo-Test showed 9 MPa
strength in-place after the
collapse.

Capo-Test being shown in
progress.



Fire damaged structure

Walls in a fire damaged apartment building, Denmark
Testing with CAPO-TEST being shown.

Cylinder strength $f_c = 40$ MPa, documented by the factory
CAPO-TEST showed 18 MPa, 17 MPa and 16 MPa for the three tests illustrated, averaging 16 MPa, indicating a 60% reduction in the strength caused by the fire.



Collapse of slabs

Slabs collapsed during construction in the wintertime of a hospital building, north part of Sweden.

No fatalities, as the construction workers had gone for lunch when collapse occurred

Form and supports removed 10 days after casting. No strength records available at the time of loading.

Capo-Test showed 3-5 MPa cube strength in-place and traces of ice-flowers in the concrete.



Collapse during tensioning

Bridge girder tensioning collapse in the trumpet zone, Denmark.

No fatalities

Time of tensioning decided upon by pre-established strength-maturity relation.

Actual in-place strength could have been established prior to tensioning by using pullout.



Textile factory collapse

RANA PLAZA COLLAPSE, Dhaka, Bangladesh

1,132 fatalities, and more than 2,500 injured

Another 3 stories were built on top of the existing factory. Cracking in the walls happened during activating electrical generators on top of the building.

Lab testing unknown.

Strength testing of the concrete quality months before the collapse was made by rebound hammer, UPV and cores.

CAPO-TEST has been acquired by the owner RAJUK and the University BUET, and is being applied at the moment in Bangladesh (1.2 million structures including 1200 high-rises)



Shotcrete lining collapse.

Canadian uranium mine shotcrete lining had collapsed due to low strength and flooded the mine. On trials CAPO-TEST was applied to ensure a minimum 30 MPa strength in-situ. Photos from CAPO-TEST testing of wet-sprayed shotcrete without fibers (32 MPa) and with steel fibers (48 MPa)

Non-durable, permeable cover layers



Examples of insufficient quality of cover layers causing reinforcement corrosion after 10-15 years of chloride exposure. Examples are from Dubai, from India and from USA. Testing for durability at the time of construction could have been done by CAPO-TEST, not at least to check the curing applied, if any

Tendon collapse in cable ducts caused by chlorides / moist / oxygen penetrating non-durable cover layers and construction joints.



Examples are from Italy, from ribbon bridge collapse in the Czech Republic and from Italy, the Genoa Morandi bridge collapse (42 fatalities)



Surfside condominium collapse, Miami, USA

98 fatalities

Collaps caused by several factors including long-term degradation of reinforced concrete structural support in the basement-level parking garage under the pool deck, due to water penetration and corrosion of the reinforcing steel from chlorides penetrating the cover layer