



# Implementing Service Life During Construction

## IBC Workshop: W-8 Service Life Design

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# Presentation Overview



This part of the worked example covers:

- Implementation of service life design during construction of concrete structures:
  - QA/QC process
  - Prequalification
  - Production inspection and testing
  - Verification
  - Non-conformances

# Quality Control and Quality Assurance

- Quality control and quality assurance during construction are essential to achieve the service life requirements.
- **Quality control:** activities carried out by the Contractor to ensure that the work complies with the project specifications
- **Quality assurance:** activities carried out by the Owner to verify that the Contractor's Quality Control process is effective
- For concrete structures, this process typically will consist of two phases:
  - Prequalification phase;
  - Production and construction phase.

# Prequalification Phase

- Prequalification phase:
  - Review of properties of the concrete mix constituents (aggregates, cementitious materials, admixtures, mix designs) to verify that what is proposed will meet the requirements of the project.
  - Review of data sheets, mill reports, aggregates source reports, etc. to verify the materials are in compliance with the Project Specifications.
  - Testing of constituent material properties if test data is missing.
  - When the constituents are confirmed to satisfy the requirements, a series of laboratory trial mixtures are completed using one or more of the proposed cementitious material combinations and appropriate testing is done to demonstrate that all requirements are met:
    - Compressive strength
    - Chloride migration coefficient – NT Build 492
    - Air void spacing factor – ASTM C457
    - Freeze-thaw and scaling resistance – ASTM C666 and C672

# Production and Construction Phase

- Production and construction phase:
  - During construction, monitoring of the key properties is done by testing samples obtained from production concrete:
    - Compressive strength
    - Plastic air content
    - Chloride migration coefficient
  - Pre-pour QC checks include:
    - Dimensional tolerances
    - Cover thickness
  - In some cases as-built concrete cover thickness is also measured.
  - Measured values from the construction phase are compared with design values to assess if the service life criteria will be met.

# Quality Control and Quality Assurance



- Other factors influencing the service life are subject to rigorous quality control:
  - placement, consolidation, finishing, and curing procedures for concrete
  - surface preparation, application procedures, weather conditions and monitoring procedures for coatings.
- The quality control and quality assurance of these operations should be described in the Project Specifications and the project Quality Management Plan.
- The Owner should implement effective Quality Assurance program to verify that the Contractor's Quality Control plan is effective



# Verification

- Who has responsibility?
  - Review of inspection and test reports
  - Tracking of test results – control charts
  - Who initiates action ???!!!
    - Accept and proceed
    - Non-conformance:
      - Remedial action to address the specific non-conformance
      - Corrective action to prevent further non-conformances



# Dealing With Non-Conformances

- Prevention vs reaction:
  - Review of test and inspection reports
  - Action? Who?
  - Control charts
- Assess consequences of non-conformance:
  - Maintenance and repair expectations
  - Local anomaly vs reduced service life
- Remediation measures:
  - Look at actual exposure conditions and material properties
  - Does it meet service life requirements?
  - What remediation is required (if any)?
  - Apply protection or repair as directed by designer