Service Life Design on Alternative Delivery Projects

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Anne-Marie Langlois, P.E.
What Is the Objective?

• Longer time before obsolescence and/or major rehabilitation:
  – Reduced maintenance and rehabilitation costs
  – Reduced disruption to users
  – Less reliance on outside contractors to do the work
  – No surprises re maintenance and rehab requirements

• Lower full-life costs… with reasonable initial cost premium

• Design, construction and quality management that provides confidence that the objectives will be achieved

• Scope: concrete, structural steel, cables, M&E systems, pavements and wearing courses

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What Do We Need for Specifications?

• Avoid vague statements like:

  ➢ "Bridges are to be designed with consideration given to the Department’s 100-year-bridge life initiative."

  ➢ "The service life of the structure shall be 100 years."
What Do We Need for Specifications?

- Definition for service life
- Design methodology
- A limit state

- Specific exposure conditions
- Acceptance testing to be performed during construction (tests and frequency)
Definition of Service Life

• CSA A23.1-14 and S6: Service life — the time during which the structure performs its design function without unforeseen maintenance or repair.

• ACI 365: Service life (…) is the period of time after (…) placement during which all the properties exceed the minimum acceptable values when routinely maintained.

• AASHTO LRFD: The period of time that the bridge is expected to be in operation.

• fib Bulletin 34 - Model Code for Service Life Design: Design Service Life – assumed period for which a structure or a part of it is to be used for its intended purpose.

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Design methodology

- fib Bulletin 34 Model Code for Service Life Design
- fib Model Code for Concrete Structures 2010
- ISO 16204:2012 Service Life Design of Concrete Structures
Limit State

• Concrete components must resist chloride ingress such that corrosion is not initiated within the service life based on a target confidence level of 90%.

• Specific service lives for different components:  
  – Non-replaceable components
  – Replaceable components:
    • Bearings
    • Expansion joints
    • Concrete barriers
    • Coatings for structural steel (paint system)
Specifications

• Service life is the actual period of time during which a structure performs its design function without unforeseen costs for maintenance and repair.

• Non-replaceable components (state which ones) shall be designed for a 100 year service life.

• The service life of concrete components shall be in accordance with Bulletin 34, Model Code for Service Life Design, written by the International Federation for Structural Concrete (fib), February 2006.

• Concrete components must resist chloride ingress such that corrosion is not initiated within the service life based on a target confidence level of 90%.
Specifications

- Specific service life for non-replaceable components
  - Bearings
  - Expansion joints
  - Concrete barriers
  - Coatings for structural steel (paint system)
    - add definition of service life for structural steel

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Specifications

• Testing during construction can be specified:
  – Concrete durability properties
    o Rapid chloride migration NTBuild 492
    o Acid soluble chloride content ASTM C1152
    o Plastic air content
    o Hardened air content
    o Aggregates properties (AAR)
  – As-built concrete covers
Specifications

• Clarify procedure for non-conformances
  – low cover
  – high concrete transport properties

• Expect deviations from Standard Specifications
  – type of cementitious materials and amount
  – tests types and acceptance limits
  – less prescriptive requirements in some instances
• Requirements at Handback
  – Condition of the component
  – Remaining service life criteria
  – Methodology?
  – Operating Company to submit a proposed methodology and Handback Plan 10 years prior to Handback?
Questions?

Anne-Marie Langlois
COWI North America
amln@cowi.com

Patricia Bush
AASHTO Program Manager for Engineering
phutton@aashto.org

Mike Bartholomew
CH2M
mike.bartholomew@ch2m.com

AASHTO SHRP2 R19A Website:
http://shrp2.transportation.org/Pages/ServiceLifeDesignforBridges.aspx

FHWA GoSHRP2 Website:
www.fhwa.dot.gov/GoSHRP2/

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