



SHRP2 SOLUTIONS
STRATEGIC HIGHWAY RESEARCH PROGRAM

Service Life Design on Alternative Delivery Projects

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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

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.

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

Specifications

- Testing during construction can be specified:
  - Concrete durability properties
    - Rapid chloride migration NTBuild 492
    - Acid soluble chloride content ASTM C1152
    - Plastic air content
    - Hardened air content
    - 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

Public-Private-Partnership

- 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?

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

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