SHRP2 Product R07 – Performance Specifications for Rapid Highway Renewal

Product Summary

The highway industry has begun a gradual shift away from contracting projects with specifications that are prescriptive (those that dictate means and methods to a contractor that are expected to achieve the desired outcome) towards contracting methods that instead specify what the agency expects as a final result and leaves the means and methods up to the contractor. The net result of this shift can be characterized as providing greater flexibility for contractors, less staff oversight by owners, a more efficient use of each contractor’s individual strengths and more reliable facility performance.

The R07 research project was tasked with assembling information on the state of practice for Performance Specifications, creating a series of model specifications for a broad range of highway elements (HMA and PCC Pavements, Bridge Decks, Earthwork Foundations and Work Zone Traffic Control), and preparing a Guideline on tailoring of these specifications to any particular projects’ needs and agency’s preference in contracting methods. Each specification can be adapted to traditional design/bid/build projects, design/build contracting, design/build/warrantee and design/build/operate/& maintain strategies, depending upon the agencies comfort level with each approach.

Many of these specifications have been tried as demonstration projects and are ready for implementation in the short term. Others rely on further development of promising emerging technology to fully realize the benefit of adopting such an approach. The range of implementation readiness has been described in Tiers, Tier 1 being ready for immediate implementation, Tier 2 representing approaches that require use of innovative non-destructive testing technology that is not widely available, and Tier 3 relies on further development of mechanistic-empirical design models to identify material characteristics that more accurately predict long term performance and their target values.

Table 1 below summarizes the range of model specifications developed under R07 (as well as some other related SHRP2 research) and categorizes them into levels of readiness for adoption, based on the availability of supporting technology. Charts 1 thru 4 on the following pages describe the various families of model specifications and their expected application in any of the 4 basic contracting approaches.
<table>
<thead>
<tr>
<th>Readiness for Use</th>
<th>Geotechnical Work Zone</th>
<th>Pavements</th>
<th>Bridge Deck</th>
<th>General</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (most)</td>
<td>- ProofRolling/Mapping (using IC)</td>
<td>- Work Zone Traffic Control • Minimize construction duration • A+B for project • A+B1+B2+B3 (critical segments)</td>
<td>- HMA Design-Bid-Build/Design-Build Tier 1 (durability parameters)</td>
<td>- QPM (Quality Management Plan)</td>
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<td></td>
<td></td>
<td></td>
<td>- PCC Cast-in-Place Deck Design-Build Design-Build Tier 1 (durability parameters)</td>
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<tr>
<td>2</td>
<td>- Subsurface Improvements for Existing Pavements</td>
<td></td>
<td>- PCC Modular Precast Bridge Deck</td>
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<td>3</td>
<td>- Earthwork/ Pavement Foundation Construction (using IC and other NDT)</td>
<td>- Minimize Delay through work zone • Travel time • Min speed • Max queue length</td>
<td>- HMA Design-Bid-Build/Design-Build Tier 2 (use of NDT)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>- PCC design-Bid-Build/Design-Build Tier 2 (use of NDT)</td>
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<td>4</td>
<td>- Ground Improvement using Vertical Support Elements</td>
<td>- Minimize ambient impacts • Light • Noise</td>
<td>- Design-Build-Operate-Maintain Pavement Performance Specification</td>
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<td>5 (least)</td>
<td></td>
<td></td>
<td>- PCC Cast-in-Place Deck Design-Build/Design-Build Tier 3 and other bridge components (health monitoring)</td>
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</tbody>
</table>

Notes: Tiers apply to pavements and bridge products
Tier 1 = Improved performance parameters and measurement practices
Tier 2 = Incorporating innovative non-destructive technology (NDT) performance measures
Tier 3 = performance based on mechanistic empirical design models, and bridge health monitoring technology
Chart 1: Bridge Related Performance Specifications

- Bridge Performance Specifications
  - Bridge Decks
    - Cast-in-Place
    - Precast
      - DBB/DB
      - DB/DBB
Chart 3: Work Zone Traffic Control Performance Specifications

Minimize Construction Duration
- Overall Time
- Critical stages

Minimize Delay
- Travel Time
- Traffic Volume
- Queue Length
- Short-term Closure

Maintain Access/Mobility
- Incidence Clearance
- Impacts of Detours

Ambient Impacts
- Noise
- Light
Chart 4: PCC and HMA Pavement Performance Specifications

- **Flexible**
  - DBB
  - DB
  - DBW
  - DBM

- **Rigid**
  - Cast-in-Place
  - Modular Precast

- **Pavement Performance Specifications**
  - DBB
  - DB
  - DBW
  - DBM