



Performance Specification – What are they?

**ALDOT Bureau of Materials and Tests
Montgomery, Alabama**

**Victor (Lee) Gallivan, P.E.
Asphalt Pavement Engineer**

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Agenda

- What are *Performance Specifications*?
- Examples of Specifications
- Implementing *Performance Specifications*



Performance Specifications for Rapid Renewal (R07)

Challenge

- Conventional approaches to highway construction use prescriptive requirements that place the burden on owners to design, specify, and control the work.
- These requirements often hinder the innovation needed to deliver projects faster or find methods that minimize disruption.

Solution

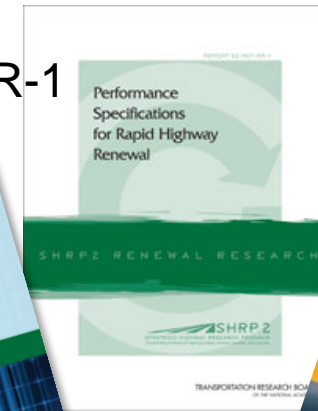
- Performance specifications that emphasize desired results and encourage innovation.



SHRP2 *Performance Specifications* Products

1. Final research report
2. *Strategies for Implementing Performance Specifications: A Guide for Executives and Project Managers*
3. *Developing and Drafting Effective Performance Specifications: A Guide for Specification Writers*
4. Guide performance specifications

S2-R07-RR-1



S2-R07-RR-2

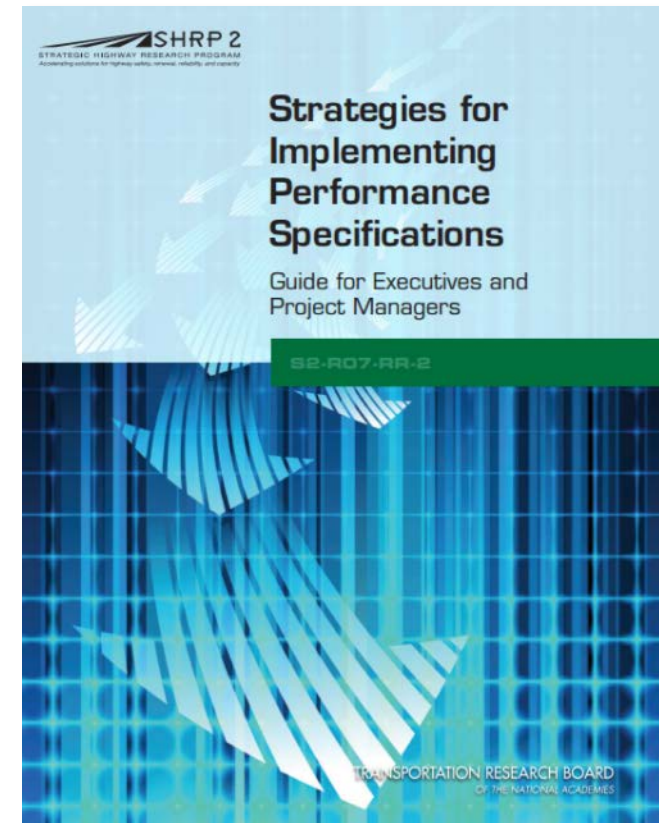


S2-R07-RR-3

Implementation Guidelines

Strategies for Executives & Project Managers

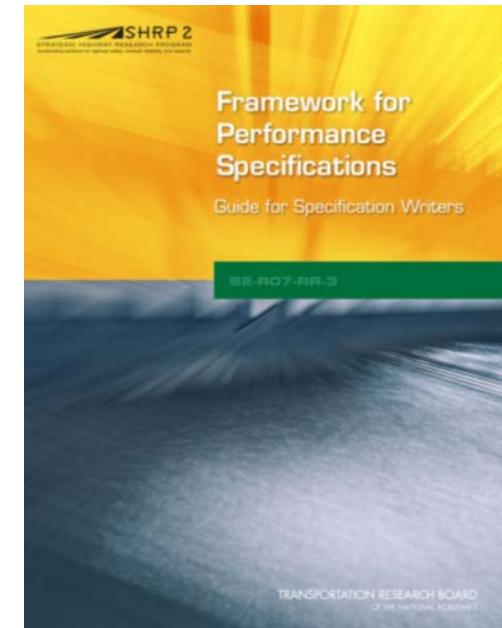
1. Rationale for using performance specifications
2. Organizational considerations
3. Industry considerations
4. Legal perspectives
5. Process for deciding to use performance specifications
6. Project delivery and procurement considerations



Implementation Guidelines

Specification Writer's Guide

1. Introduction to performance specifications
 - How performance and method specifications differ
 - Deciding between method and performance specifications
2. Conceptual framework for developing specifications
 - Pyramid of Performance
 - 8-step process
3. Using the guide performance





Guide Performance Specifications

1. Asphalt pavement (DBB)
2. Asphalt pavement (DB)
3. Asphalt pavement (Warranty)
4. Concrete pavement (DBB)
5. Concrete pavement (DB)
6. Concrete pavement (Warranty)
7. Precast concrete pavement
8. Pavement (Design-Build-Operate-Maintain)
9. Concrete bridge deck
10. Vertical support elements
11. Subsurface improvements for existing pavements
12. Work zone traffic control
13. Quality management

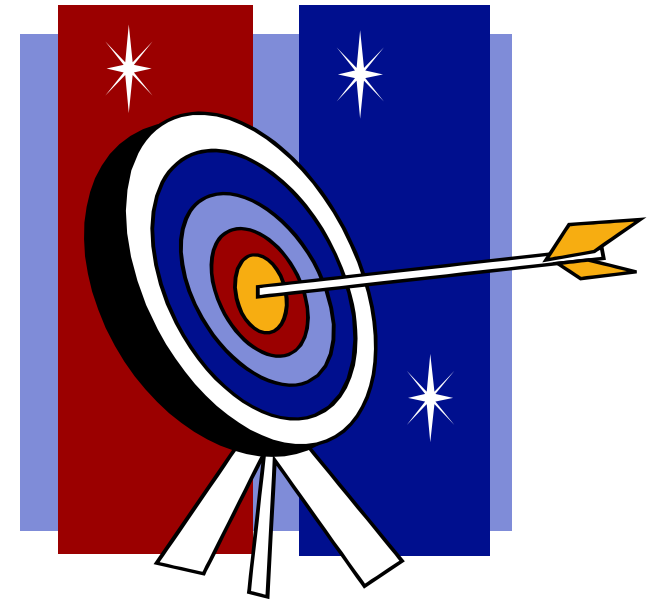
(Also, the Final Report appendices contain two additional “research” specs related to the use of intelligent compaction techniques for roadway ground improvement and proofmapping for acceptance purposes.)

Origin of Performance Specifications

Definition

- Transportation Research Board – Glossary of Transportation Construction Quality Assurance Terms – Sixth Edition:
(Elec Circular No. 173 [2013]) :

- Method
- End Result
- Performance Related
- Performance Based
- Quality Assurance
- Warranty



Definitions – Method Specification's

- Materials and methods specifications. Also called method specifications, recipe specifications, or prescriptive specifications. Specifications that require the contractor to use specified materials in definite proportions and specific types of equipment and methods to place the material. Each step is directed by a representative of the transportation agency. [Experience has shown this tends to obligate the agency to accept the completed work regardless of quality.]

Definitions – End Result Specification's

- End result specifications. Specifications that require the contractor to take the entire responsibility for supplying a product or an item of construction. The transportation agency's responsibility is to either accept or reject the final product or to apply a pay adjustment commensurate with the degree of compliance with the specifications. [End result specifications have the advantage of affording the contractor flexibility in exercising options for new materials, techniques, and procedures to improve the quality or economy, or both, of the end product.]

Definitions – Quality Assurance Specification's

- Quality assurance specifications. Specifications that require contractor QC and agency acceptance activities throughout production and placement of a product. **Final acceptance of the product is usually based on a statistical sampling of the measured quality level for key quality characteristics.** [QA specifications typically are statistically based specifications that use methods such as random sampling and lot-by-lot testing, which let the contractor know if the operations are producing an acceptable product.]

Definitions – Performance Specification's

- Performance specifications. Specifications that describe how the **finished product should perform over time**. [For highways, performance is typically described in terms of changes in physical condition of the surface and its response to load, or in terms of the cumulative traffic required to bring the pavement to a condition defined as “failure.” Specifications containing warranty/guarantee clauses are a form of performance specifications. Other than the warranty/guarantee type, performance specifications have not been used for major highway pavement components (subgrades, bases, riding surfaces) **because there have not been suitable nondestructive tests to measure long-term performance immediately after construction**. They have been used for some products (e.g., highway lighting, electrical components, and joint sealant materials) for which there are suitable tests of performance.]

Definitions – Performance Based Specification's

- Performance-based specifications. QA specifications that describe the **desired levels of fundamental engineering properties (e.g., resilient modulus, creep properties, and fatigue properties)** that are predictors of performance and appear in primary prediction relationships (i.e., models that can be used to predict pavement stress, distress, or performance from combinations of predictors that represent traffic, environmental, roadbed, and structural conditions). [Because most fundamental engineering properties associated with pavements are currently not amenable to timely acceptance testing, performance-based specifications have not found application in transportation construction.]

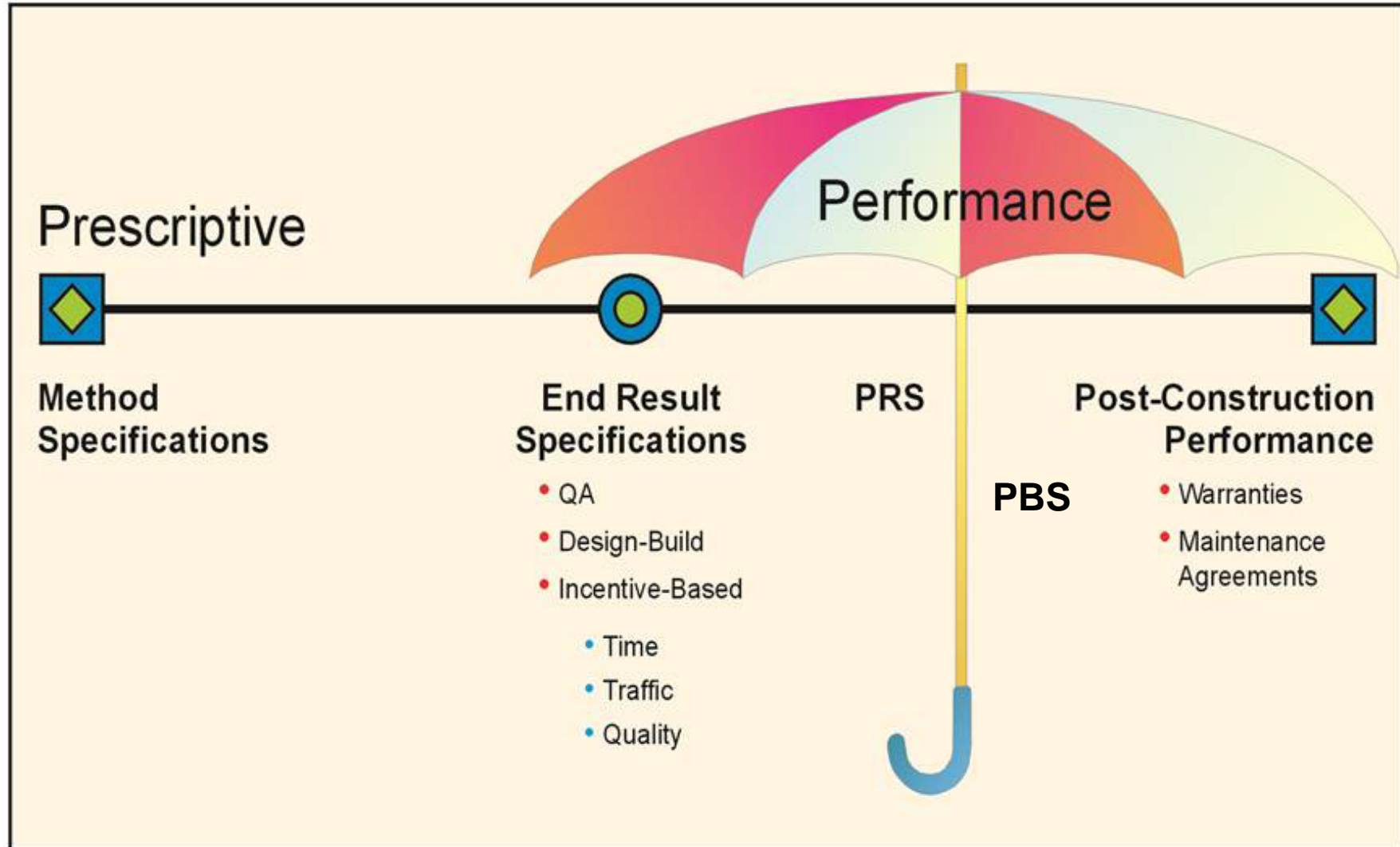
Definitions – Performance Related Specification's

- Performance-related specifications. QA specifications that describe the desired levels of **key materials and construction quality characteristics that have been found to correlate with fundamental engineering properties that predict performance**. These characteristics [for example, air voids in asphalt concrete (AC) and compressive strength of PCC] are amenable to acceptance testing at the time of construction. [True performance-related specifications not only describe the desired levels of these quality characteristics but also employ the quantified relationships containing the characteristics to predict as-constructed pavement performance. They thus provide the basis for rational acceptance/pay adjustment decisions.]

Definitions – Warranty Specification's

- Warranty specifications. A type of performance specifications that guarantees the integrity of a product and assigns responsibility for the repair or replacement of defects to the contractor. [Warranty specifications can be written to guarantee either materials and workmanship or product performance.]
 - 2-4 years – Material and Workmanship
 - 5-10 years- Short Term Performance
 - 11-20 years – Long Term Performance

Performance Specification Continuum



Performance Specification Continuum



- In general, these specification types represent a **progression** toward increased use of higher-level acceptance parameters that are more indicative of how the finished product will perform over time.
- To varying degrees, they all attempt to **shift performance risk to the contractor** in exchange for limiting prescriptive requirements related to the selection of materials, techniques, and procedures.
- By relaxing such requirements, performance specifications have the potential to **foster contractor innovation and improve the quality or economy**, or both, of the end product.

Pyramid of Performance

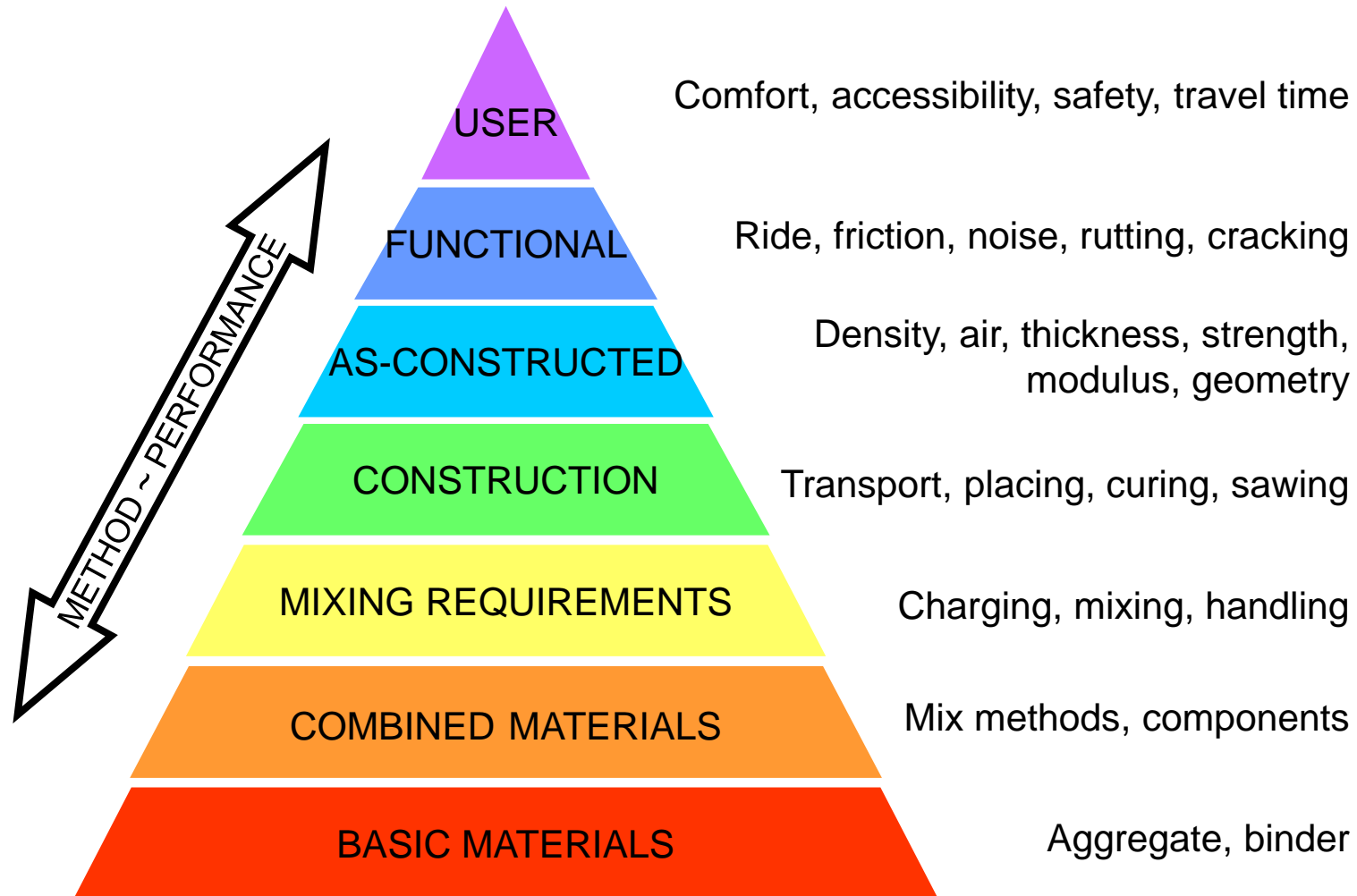


TABLE 1.1. ADVANTAGES AND DISADVANTAGES OF METHOD SPECIFICATIONS

Source: SHRP2 2014

Advantages	Disadvantages
<ul style="list-style-type: none">• Method specifications are well established, easily understood, and applicable to a wide range of topic areas.• The agency can exert significant control over the work (although this may come at the expense of increased agency inspection efforts).• Requirements are based on materials and methods that have worked in the past, minimizing risk associated with newer or less proven methods or varying contractor performance.	<ul style="list-style-type: none">• The contractor has little opportunity to deviate from the specifications and, provided that the specifications are met, is not responsible for performance deficiencies of the end product (i.e., the agency retains performance risk).• Method specifications lack built-in incentives for contractors to provide enhanced performance (e.g., cost, time, quality).• The prescribed procedures may prevent or discourage the contractor from using the most cost-effective or innovative procedures and equipment to perform the work.• Contractor payment is not tied to the performance or quality of the work.• Acceptance decisions based on test results of individual field samples can increase the potential for disputes.

TABLE 1.2. ADVANTAGES AND DISADVANTAGES OF PERFORMANCE SPECIFICATIONS

Source: SHRP2 2014

Advantages	Disadvantages
<ul style="list-style-type: none">• Performance specifications promote contractor innovation.• The contractor assumes more performance risk.• Contractors have the flexibility to select materials, techniques, and procedures to improve the quality or economy, or both, of the end product.• A performance specification can provide a more rational mechanism for adjusting payment on the basis of the quality or performance of the as-constructed facility.	<ul style="list-style-type: none">• The agency can exert less control over the work.• Opportunities for smaller, local construction firms may be reduced.• Identifying all of the parameters critical to performance and establishing related thresholds can be challenging.• Roles and responsibilities of the contractor and agency can become blurred if not adequately defined in the specifications or contract documents.• Staff may be reluctant to assume new responsibilities.

Performance Specs Report Results

- Performance specifications can also serve as a worthy adjunct to other management philosophies, such as lean construction, although this aspect is not specifically addressed in these guidelines. Consistent with lean principles, performance specifications aim to:
 - Eliminate unnecessary and non-value-added requirements;
 - Result in continuous improvement;
 - Align parties around the needs of the end user; and
 - Place risk on the party best able to manage it.

Quick Questions

- Four examples of specifications are to follow:
- Please tell me if they are
 - Method
 - End Result
 - Performance, or a
 - Combination

Example No.1 (Asphalt Pvt. Scarification)

- The existing pavement shall be milled to the cross-slope as show on the plans and shall have a surface finish that does not vary longitudinally more 0.25 in. measured with a 16 ft. straight edge. The milled surface shall have a macrotexture equal to or greater that 2.2 for single course overlays and 1.8 for multiple course tested at a minimum of once per day. The cross-slope shall not vary more that 0.15 in. measured with a 10 ft. straight edge.
- Method, End Result, Performance, Combination?

Example No. 2 (Cold In Place Recycling)

- **Rollers.** 504.03.01. Use a combination of pneumatic and steel wheeled vibratory rollers to compact the CIR without unduly cracking the CIR. The pneumatic roller shall have a minimum gross operating weight of not less than 50,000 lbs. The steel-wheeled roller shall have a gross operating weight of not less than 24,000 lbs. and a width of 78 inches.
- Method, End Result, Performance, Combination?

Example No. 3 (SMA Asphalt)

- Acceptance for mixtures for binder content and gradation for each lot will be based on tests performed by the Engineer. The Engineer will randomly select two locations within each subplot for testing in accordance with DOT test 802. Payment adjustments will be based on the results of the subplot tests utilizing PWL specifications in accordance with DOT procedures.
- Method, End Result, Performance, Combination?

Example No. 4 (Portland Cement Pavement)

- Acceptance of the PCCP for flexural strength, air content, unit weight, water/cementitious ratio and thickness will be based on tests performed by the Contractor and verified by the Engineer. The Engineer will determine the testing locations for in accordance with the procedures for determining random locations.
- Method, End Result, Performance, Combination?

What's Missing?

- Independent testing of construction operations that represents the performance of the roadway.
- Advances in technologies have been made that allows for **key materials and construction quality characteristics that have been found to correlate with fundamental engineering properties that predict performance.**, i.e., Performance “Related” specifications.
- We are not there yet for Performance “Based” tests.
- Advances in SHRP2 products are can now be used

Implementing Performance Specifications

Source: Framework For Developing Performance Specifications: Guide For Specification Writers - S2-R07-RR-3

1. Identify User And Societal Needs And Goals
2. Translate User Needs And Goals To Functional Performance Parameters
3. Consider Project Delivery Approach
4. Determine The Appropriate Measurement Strategy
5. Structure Incentive Strategies And Payment Mechanisms
6. Identify Gaps
7. Identify And Evaluate Risks Related To Performance Requirements
8. Develop Specification Language

Thank You

Product Leads

Jennifer Balis

FHWA R07 Product Lead

(202) 493-7302

Jennifer.Balis@dot.gov

Evan Rothblatt

AASHTO R07 Lead

(202) 624-3648

ERothblatt@AASHTO.org

Victor (Lee) Gallivan, P.E.

Gallivan Consulting, Inc.

Asphalt Pavement Engineer

CL: 317-605-4704

E-mail: lee@gallivanconsultinginc.com



Alabama State Capital