

SUMMARY OF PRODUCT

SHRP2 PRODUCT CLOSE OUT REPORT

Performance Specifications for Rapid Renewal (R07)

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DATE	June 28, 2017
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REGARDING	Close Out of SHRP2 Product: Performance Specifications for Rapid Renewal (R07)

Background and Purpose

As a result of the Second Strategic Highway Research Program (SHRP2) program, the Federal Highway Administration (FHWA) and the American Association of State Highway and Transportation Officials (AASHTO) initiated the R07 product, *Performance Specifications for Rapid Renewal*, to advance the development of performance specifications for accelerated construction and/or rehabilitation of pavement infrastructure construction projects. The purpose of the R07 product was to advance the development of roadway/pavement related performance specifications directly with states through training and technical assistance in the preparation of state-specific implementing documents.

FHWA/AASHTO provided product implementation oversight to ensure consistent messaging throughout the implementation and to meet state's individual needs. Five States (Alabama, Maine, Missouri, Pennsylvania, and Vermont) were designated as lead adopters, as part of the R07 Implementation Assistance Program (IAP). Four states (Alabama, Maine, Missouri, and Vermont) choose to focus on roadway or pavement technologies. One state (Pennsylvania) choose to advance bridge structure related specifications. The FHWA Western Federal Lands Highway Division (WFLHD) also participated, recognizing the value of performance specifications in the administration of their highway program and desiring to advance pavement related technologies.

The R07 product focused on *outcomes* rather than *methods* to motivate contractors to find new and better ways to accelerate project delivery, minimize disruption, and build quality projects. This product transfers some responsibilities traditionally under state oversight to contractors. Performance specifications provide transportation agencies with specifications to obtain the quality and innovation they are seeking in their roadway or pavement construction projects.

The Transportation Research Board's published SHRP2 research documents provided guidance to the states on the development of performance specifications. There are three major elements included, specifically model performance specifications; a Decision Support Guide with strategies for using performance specifications, and a framework for tailoring performance specifications to specific construction projects. The individual documents provide:

- A complete description of the research and pilot project findings. This description is included in the initial publication *Performance Specifications for Rapid Renewal* (Report # S2-R07-RR-1).
- A broad overview of the benefits and challenges associated with implementing performance specifications. Strategies for Implementing *Performance Specifications: Guide for Executives and Project Managers* (Report # S2-R07-RR-2), provides recommendations on project selection criteria, procurement

and project delivery options, industry and legal considerations, and the various cultural and organizational changes needed to support the implementation of performance specifications.

- A flexible framework that specification writers can use to assess whether performance specifications represent a viable option for a particular project or project element and, if so, how performance specifications can then be developed and used to achieve project-specific goals and satisfy user needs. Framework for *Performance Specifications: Guide for Specification Writers* (Report # S2-R07-RR-3), offers a step-by-step “how-to” guide for developing performance specifications.

Executive Summary

The *Performance Specifications for Rapid Highway Renewal* product is one of several SHRP2 products that focus on achieving faster rehabilitation of the nation’s transportation infrastructure and provide transportation agencies with guidelines and specifications that will allow them to obtain the quality and innovation they are seeking on pavement and structural construction projects. Focusing on outcomes rather than methods, this product seeks to motivate contractors to find new and better ways to accelerate project delivery, minimize disruption, and build a better project.

The State of Vermont developed performance specifications for their Full Depth Reclamation (FDR) operations. Alabama, Missouri, and Maine concentrated their efforts on developing performance specifications for implementing intelligent compaction and infrared thermal profiling technology being advanced through the SHRP2 R06C program. Maine, Missouri, and FHWA WFHLD extended their performance specifications for asphalt mixtures designs to extend the service life of their pavements.

Alabama, Vermont, and FHWA WFLHD each focused on one construction project. Maine and Missouri used multiple projects. Missouri extended the use of the performance specifications in 2017 to an additional twelve projects, and plan for an additional 20 more projects in 2018, all including R07 specifications and R06C technologies. Pennsylvania’s work was anticipated to be focused on bridge structure related specifications.

The participating agencies achieved a better understanding of the needs, requirements, and applications of performance specifications. Their efforts to utilize the technologies helped create and improve the quality of the construction processes.

Deliverables

SHRP2 Performance Specifications for Rapid Renewal (R07) Product Activities and Deliverables include:

- Participation in an FHWA/AASHTO coordination meeting in Washington, D.C.
- Multiple visits to the states of Maine, Missouri (2), and Vermont (2).
- Development of state specific contract ready documents.
- Development of presentation materials for the R07 states.
- On-call support for all of the R07 states.
- Hosting three regional R07 workshops:
 - Montgomery, Alabama
 - Burlington, Vermont
 - Salt Lake City, Utah (showcase)
- Preparation of Regional Workshops/Showcase Summary Reports.
- Preparation of five Case Studies representing Alabama, Maine, Missouri, Vermont, and WFLHD.

- Development of an Assessment and Recommendations for the SHRP2 Guidance Documents.
- Preparation of the SHRP2 Project Close Out Report.

Regional workshop summary reports including the specific agenda's, presentations, and attendee lists are posted together with all the Case Studies on the **AASHTO SHRP2 Performance Specifications (R07) Website**: http://shrp2.transportation.org/Pages/R07_PerformanceSpecificationsforRapidRenewal.aspx

Regional Workshops

The Alabama Peer-to-Peer Technical Meeting held on November 5 and 6, 2016, was attended by 22 representatives, representing six R07 IAP-implementing states plus technology specific invited guests. The purpose of the regional workshop was to promote the exchange of experiences and technical challenges of performance specifications within the R07 states.

The Vermont Peer-to-Peer Exchange held on November 20 and 21, 2016 was attended by 41 participants from the northeast, representing 14 states. The purpose of this meeting, was to expand and spread the knowledge of the R07 IAP states through the support of FHWA and AASHTO and the SHRP2 R07 product.

The Utah Product Showcase held on March 14 and 15, 2017 brought 47 participants from the west, representing 16 states to facilitate an open exchange among participants of current practices and promoting of the lessons learned using the SHRP2 guidance on performance specifications. The showcase was also intended to provide an opportunity for the IAP states to provide and show their updates of the final products from their states.

The Peer-to-Peer Exchanges were successful in creating opportunities for transportation agencies and invited guests to openly discuss the experiences and challenges they were having regarding the development of performance specifications within their respective states. Facilitated brainstorming sessions were effective at eliciting detailed feedback from participants on the R07 program. This input ranged from suggestions for improving the product to identifying the resources and policy changes required by transportation agencies to advance the product in their respective states. Detailed examples were provided, such as needing documented examples of the benefits of shifting from method to performance specifications and a simple, easy-to-read flow diagram illustrating the implementation of performance specifications. Additionally, participants noted the need for support and buy-in from agency upper management to transition from method to performance specifications and recommended that marketing be implemented to further advance *Performance Specifications for Rapid Renewal* beyond pavements. The regional meeting summary reports provide detailed information from states related to further marketing suggestions.

Field Activities

Field activities during construction of the projects were not evaluated as part of this effort. The SHRP2 R07 work concentrated on the development of performance specifications with the participating states related to the advancement of the technologies and the development of expertise within the state on the use of the advanced technology equipment.

Coordination with Other SHRP2 Implementation Efforts

The *Performance Specifications for Rapid Highway Renewal (R07)* effort is only one part of the SHRP2 suite of tools. All of the IAP states collaborated with other SHRP2 technologies, particularly R06C *Rapid Technologies to Enhance Quality Control on Asphalt Pavements*, that used infrared thermal profiling technology. Monthly conference calls among the other SHRP2 Subject Matter Expert (SME's) provided opportunity for collaborative efforts when applicable.

Implementation Assistance with the R07 IAP States

The participating IAP states received on-call Subject Matter Expert (SME) support including an onsite visit together with multiple conference calls. On-call SME support for non-IAP states was also provided to North Carolina, New Jersey, and California.

Detailed assistance was provided regarding the use of advancing technologies specifically related to pavements that included intelligent compaction and thermal profiling that included the development of contract ready specifications. The development of performance specifications ideology was also provided on pavement bases, specifically related to FDR in Vermont.

State-specific case studies of their program activities to advance *Performance Specifications for Rapid Renewal* and the related technologies and how they applied them were developed.

Benefits to Using Performance Specifications

The IAP agencies all understand the adaptability of the improved specifications to meet their overall agency needs and individually are moving towards additional projects. No specific analysis has been developed by the IAP states to quantify the benefits of the *Performance Specifications for Rapid Renewal* projects to date.

Technical Document Assessment

The IAP R07 states referred to TRB, National Cooperative Highway Research Program (NCHRP), FHWA, and AASHTO documents during implementation. However, the following Transportation Research Board (TRB) technical documents formed the basis for the execution of the SHRP2 R07 product:

- [Performance Specifications for Rapid Highway Renewal \(Report S2-R07-RR-1\)](#)
- [Strategies for Implementing Performance Specifications \(i.e., Guide for Executives and Project Managers, Report S2-R07-RR-2\)](#)
- [Framework for Performance Specifications \(i.e., Guide for Specifications Writers, Report S2-R07-RR-3\)](#)

These documents were developed as a first step for states to accelerate their construction programs and minimize disruptions on their roadways while improving mobility, safety, and long-term performance of the facilities. A review of these three documents was completed as part of the implementation of this R07 product. The IAP R07 States included intelligent compaction technology for asphalt materials for their performance specifications. The AASHTO Subcommittee on Materials Provisional Standard PP 81-14 in *Standard Practice for Intelligent Compaction Technology for Embankment and Asphalt Pavement Applications* was used by all the states.

The states were also interested in combining technologies from other SHRP2 programs including the R06C program specifically regarding the use of the infrared thermal profiling technology addressed by the AASHTO Subcommittee on Materials Provisional Standard AASHTO PP80-14 in *Standard Practice for Continuous Thermal Profile of Asphalt Mixture Construction*.

Additional documents from TRB, National Cooperative Highway Research Program (NCHRP), and the FHWA including FHWA pool-funded efforts regarding the implementation of intelligent compaction, and ongoing FHWA Research efforts on Performance Based Asphalt Mixtures were used.

1. Assessment to Improve the TRB Guidance Documents.

The three TRB guidance documents listed above were discussed and used at various opportunities at on-site state meetings, and conference calls as well as during the regional workshops. In general, the documents were deemed to be satisfactory for academic use and national implementation, but not state implementation, due to lack of state-specific and applicable examples. For instance, Figure 2.1 - Pyramid of Performance of S2-R07-RR-3 of the Guide for Specification Writer was discussed at many meetings and needs to be revised to provide specific examples and clarification as to state level adaptation. The national level intent of the



pyramid is understood but is not applicable to states. Another example is the development steps listed in flow chart in Figure 2.2 of the same S2-R07-RR-3 Guide for Specification Writers.

In summary, complementary resources are needed to provide user friendly guidance based on current research. These resources should integrate specific examples and recommendations for state-level implementation.

2. Gaps and Customization Needs for the Performance Specifications.

Customization of performance specifications by the states is critical, since each state has different processes within their agencies to address specification development and information. Many states do not address introducing innovations and new technologies; this represents a major process and policy gap. Not all states include necessary representatives from multiple divisions, such as planning, research, materials, and construction, which is essential to implementing improved performance specification. Wider distribution of the SHRP2 documents to all state DOTs and multiple departments within each is recommended.

The project identified a general lack of knowledge among states on how to take the first step regarding advancing performance specifications, what historical data to collect and analyze, how to work with industry, how to develop a specification, and what terms or elements to include.

State agencies need to develop realistic goals and expectations for their own performance specifications implementation. This effort needs state champions, which to date has been limited. 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, these specifications 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. Additional training on the benefits is necessary for increased acceptance.

To assist in the advancement of the SHRP2 program, peer-to-peer regional meetings between the R07 IAP states were very successful in identifying current gaps, real world examples, and successful approaches undertaken by states. State DOT staff recommended that engagement and interaction is also needed among the different offices within states to advance the collective knowledge of the program. The extension of this process was not included in the SHRP2 R07 program and would need to be developed.

3. Recommendations on development of a Web-based decision support application tool.

A Web-based decision support application tool was not deemed applicable to the states because every state has their own processes for the development of specifications and a “national” tool could not address state issues. But what was requested by the states was the development of webinars for not only for the technical writers of the specifications but for decision makers and managers as well. Webinars and specific training that communicates comprehensive, high-level ideas and benefits is necessary for technical writers as well as executives and project managers is currently not available and would need to be developed.

Implementation Metrics

The development of performance specifications for the SHRP2 R07 program differed by state. In some cases, there was a working relationship between the research, design, materials, and construction offices that made it easier. Other than in Missouri, each state is limiting the advance of performance specifications to just the pilot projects. In Missouri, the technology was expanded beyond the pilot project stage and is moving towards full implementation in a couple of years.

Summary evaluations from the regional meetings reported a significant gain in knowledge of performance specifications and appreciation for the opportunity to participate. Participant responses regarding improved knowledge and ideas centered around the following themes:

- Understanding the difference between performance-based and performance-related specifications and their implementation; recognition that a change in this process takes time.
- Understanding the steps and resources necessary for states to move toward performance specifications; recognition that transitioning towards performance specification use is a process.
- Recognizing the role of and steps necessary to incentivize performance using less prescriptive methods and how to tie them into actual performance service life of pavement to verify incentive/disincentive amounts. If the contractor is required to do quality control, quality improves therefore performance can improve (workmanship).
- Understanding how to develop performance specifications and apply them for demonstration.
- Becoming aware of state benefits derived from using performance specifications; actual state experience using performance specifications.
- Understanding that performance specifications can be considered an upgrade of quality assurance and implementable through balanced mix designs in HMA.
- Understanding performance specifications for CIR and CCPR asphalt and recognizing industry approaches for performance-based mix designs.

Outcomes and Conclusions

The SHRP2 R07 Rapid Renewal project provided a critical foundation for using performance specifications. Given the long-term nature involved in assessing impacts, continued work is necessary to fully build a case for integrating its use into state DOTs. However, the product was well received and successfully implemented by IAP states, many of whom intend to continue the SHRP2 program.

Summary

IAP states proactively advanced the use of innovative technologies, providing staff who directly supported the projects. While this product successfully advanced the concept and increased the use of performance specifications, additional long-term follow up is necessary to evaluate and compare the benefits of using performance versus conventional specifications. There is ongoing work involving the development of Performance-Based Asphalt Mixture designs, which may benefit states well into the future.

Suggested Future Activities or Needs to Support State Efforts

The peer-to-peer regional meetings, workshops, and conference calls provided the opportunity for active and informed collaboration. Many of the discussions centered around identifying current gaps, real world examples, and success during the project that the other states used during the R07 project. During the course of implementation, a number of key themes were identified related activities necessary to improve state's abilities to adopt performance-based specification. Participant responses are noted in the regional meeting summary reports and summarized herein.

- **Planning Required at the State Level.** States need to develop realistic goals and expectations for incorporating performance specifications. Short- and long-term goals and objectives need to be developed and transmitted by the appropriate staff and communicated throughout the agency.
- **Internal Peer-to-Peer Meetings are Recommended** to address institutional issues within each state. These opportunities can provide working definitions to clarify the differences between performance-related and performance-based related specifications and show successful examples of how each work.
- **State Decision-Makers Need Awareness and Understanding of Performance Specifications.** The development of new or updated specifications is a challenge for most agencies. States need to have a better understanding of the basic definition of the different types of specifications including Method, End Result, and Quality Assurance specifications as well as their relationships to Performance specifications. Training

on statistical acceptance programs was acknowledged as a need. Cost benefits of the program is critical for influencing DOTs to move towards Performance Specification and needs to be expanded upon.

- **Technical Training is Necessary.** Training is necessary in the application of new technologies including intelligent compaction and the thermal profiling, and for asphalt materials designs using advanced testing protocols, such as the Asphalt Mixture Performance Tester (AMPT) testing.
- **Marketing to Promote Awareness Necessary.** Marketing materials should include FHWA technical briefs, a simple, short document that clearly defines/explains what performance specifications are and key elements to address, state peer-to-peer workshops with case studies highlighting benefits and cost impacts of not using the specifications, webinar on next steps to implementation, technical briefs of individual components, methods, models, and trials (different media), case study success stories (five case studies were developed for R07), state examples of performance specifications applications, and videos. Additionally, a national/state resource library for performance specifications and train the trainer materials and real-life checklist for performance specifications will be useful. Industry participation in showcases and events where product is being promoted to provide an understanding of the value of performance specifications.
- **Guiding States through Implementation is Essential.** The project identified a general lack of knowledge among states as to how to initiate advancing performance specifications. States need information that addresses, among others, collecting and analyzing historical data, working with industry, developing specifications, and terms and elements to include. State agencies also need to develop realistic goals and expectations for their own performance specifications implementation. This effort needs state champions, which to date is limited.
- **Shift in Approach Requires Collaboration with Industry.** In general, Performance Specification represent a progression toward increased use of higher-level acceptance parameters that are more indicative of how the finished product will perform over time. These specifications 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. Additional training on the benefits is necessary for increased acceptance.