AIRFIELD ASPHALT PAVEMENT TECHNOLOGY PROGRAM

GUIDELINES FOR USE OF HIGHWAY SPECIFICATIONS FOR HMA AIRPORT PAVEMENTS

Final Report
Project 06-05

Co-Principal Investigators

Mark Buncher, Ph.D., P.E.

Bob Boyer, Ph.D., P.E.

2639 Research Park Drive

Lexington, KY 40511-8480

May 20, 2009

ACKNOWLEDGEMENT OF SPONSOR

This report has been prepared for Auburn University under the Airport Asphalt Pavement Technology Program (AAPTP). Funding is provided by the Federal Aviation Administration (FAA) under Cooperative Agreement Number 04-G-038. Dr. David Brill is the Contacting Officer's Technical Representative and a Program Manager in the FAA Airport Pavement Technology R & D Branch, at the William J. Hughes Technical Center. Mr. Monte Symons serves as the Project Director for this project (06-05).

The research team, AAPTP and the FAA thank the 06-05 Project Technical Panel that willingly gave of their expertise and time for the oversight and technical direction of this project. The names of those serving on the Project Technical Panel, and their employer affiliation, are:

1. Mr. Doug Johnson: FAA
2. Mr. Steve Lawrence: RW Armstrong, Inc
3. Mr. Stephen Moulton: Reynolds, Smith and Hills, Inc
4. Mr. John Longnaker: Delta Airports Consultants, Inc
5. Mr. Zhanping You: Michigan Technology University
6. Mr. Monte Symons: AAPTP

DISCLAIMER

TABLE OF CONTENTS

EXECUTIVE SUMMARY

AAPTP Project 06-05 calls for the development of guidelines to be used by practicing airport pavement design engineers on the utilization of state highway hot mix asphalt specifications for use in airport pavements. This report documents the fulfillment of all the tasks for this project, to include a Draft FAA Engineering Brief that serves as the guideline document.

Chapter I provides an introduction to the project, discusses the different challenges presented by airport pavements versus highway pavements, outlines the research approach and provides definitions used throughout the report. Chapter II compares FAA specifications, identifies current AAPTP projects that apply to this project, and lists the general topical areas within state highway specifications. Interviews were conducted with each FAA Region Engineer and select State Aviation Offices to gain a better insight as to when, how, which and where state specifications are utilized for airfield projects. The insights provided through these extensive interviews are covered in Chapters III and IV. A review of Public Law and FAA Orders that pertain to the use of state specifications for airfields are summarized in Chapter V and provided a clear strategy for the Research Team. This strategy, described in Chapter VI, was to develop a guideline document in the language and format of a draft FAA Engineering Brief (EB) that an experienced engineer can use to develop a state standard airport pavement (SSAP) specification for airports <60,000# aircraft gross weight (AGW). Chapter VI also provides a list of critical elements that the Draft EB-XX must address, along with the approach of how each critical element is to be addressed. One such element is traffic levels. Specifically, the rationale is provided for the necessary correlation between highway traffic levels (defined by ESALs) to Aircraft Gross Weight (AGW) levels. Other critical elements include materials, mix composition (mix design), construction (joint density, smoothness and grade), quality control, acceptance (QA), measurement and payment.

A Draft EB-XX was developed and then initially tested by first applying against the Florida DOT highway specification to develop a FL SSAP specification. Eight additional states (MN, PA, TX, VA, CA, MT, OH and WA) were then selected, representing a variety of FAA regions and climatic environments, for use of the Draft EB-XX to develop a SSAP specification for that state. Each of these additional test cases where performed as individual exercises by one of the Asphalt Institute's (AI) Regional Engineers located across the United States. Chapter VII explains the execution of these State test cases and the iterative revision process that occurred between the Draft EB-XX and the SSAP specifications. A brief summary written by the AI Engineers about each test case is provided to offer insight as to the challenges faced, engineering judgment used, and lessons learned through using the Draft EB-XX to develop the SSAP specifications. A tenth state, Missouri, had already developed an SSAP specification prior to this project, so this SSAP specification was examined to see if it met the guidelines and criteria in Draft EB-XX, which it generally did. Chapter VIII provides overall conclusions drawn from this project, along with a recommendation for the FAA to implement the final version of Draft EB-XX, which are approximately 17 pages. The

final Draft EB-XX is provided exclusively as Chapter X of this report for ease of implementation by the FAA, if they so choose. Chapter IX simply lists the references for this report.

The extensive set of appendices in this report is the final SSAP specification documents that were developed from the 9 individual State test cases, after all iterative adjustments. Each appendix letter represents one of the 9 states mentioned above (excluding MO), starting with Appendix A for FL and going through Appendix I for WA. Each appendix letter has a part 1 and a part 2 (i.e. Appendix A1 and Appendix A2). Part 1 appendices are the actual SSAP specifications that were developed by the individual AI engineers, while the corresponding Part 2 appendices are the current referenced State standard highway pavement (SSHP) specifications that were used and provide the basis for the SSAP specification. For example, Appendix A1 is State Test Case #1, FL: FDOT Section 334A. This 7-page SSAP specification serves as an amendment to FDOT's SECTION 334 Superpave Asphalt Concrete specification by modifying the critical portions of Section 334 to ensure good performance for airfields under 60,000# AGW. Section 334A was written to comply with the guidelines and criteria in the Draft EB-XX. Appendix A2 is simply the full unmodified 19-page FDOT Section 334, included as part of this report to provide the complete test case and revision process.

For the Florida test case only, a third appendix (Appendix A3) was created to list the titles of all other Sections in the FDOT State Standard Specifications Manual (SSSM) that are heavily referenced in Section 334. These references to the FDOT SSSM are an integral part of the new airfield specification package. This list in Appendix A3 is provided to illustrate the extensive interaction that takes place between State standards, including highway and new SSAP specifications. Even though this heavy interaction between State standards exists in all states, lists like Appendix A3 are not provided in this report as part of the other 8 test cases.

The nine State test cases represent real-life scenarios utilizing engineers knowledgeable about airfield and highway pavement materials, construction practices and specifications. These cases confirm that the final Draft EB-XX provides sufficient guidance to an experienced pavements engineer in order to develop SSAP specifications sufficient for < 60,000# AGW. As such, it is recommended that the Draft EB-XX, provided as Chapter 10 of this report, be considered for implementation and publication as an approved FAA Engineering Brief.

CHAPTER I. INTRODUCTION

Airport versus Highway Pavement

It is important to recognize that airport pavements are fundamentally different from highway pavements. Highway pavements are typically constructed to support a high volume of automobile and truck traffic that can amount to thousands of load repetitions per day. The vast majority of airport pavements see only a few dozen aircraft passes per day. For some airport pavements, such as overruns and shoulders, only a few dozen loadings may be experienced in an entire 20-year lifetime.

In the absence of high volume loading, the overriding cause of distress in these pavements is the continual exposure to the damaging effects of the sun, air, rain, and other climatic phenomena. Airport pavements predominately exhibit environmental associated distress types, such as weathering, raveling, and cracking. This is especially true for airfields designed to support relatively light weight aircraft, such as General Aviation (GA) airports. On the contrary, highway pavements are more prone to load associated distress types, such as rutting (permanent deformation) and fatigue cracking.

Foreign object damage (FOD) is of great concern to the safe operation of aircraft, while it is not a major issue on highway pavements. Loose aggregate particles from in-service airport pavements can be ingested into high thrust jet engines and/or impact critical aircraft surfaces. The FOD from loose aggregate particles has been identified as the cause of at least one airplane crash that resulted in loss of life. Due to the safety implications, minimizing FOD must be considered one of the primary goals of the airfield pavement design and construction processes.

Recognizing the specific challenges of airport pavements with regard to traffic volume, distress types, and FOD, the construction specifications must contain specific criteria to ensure that the airport pavement is stable, durable, and impermeable to permit safe, long term performance.

Problem Statement

Federal regulations permit the use of State Department of Transportation highway specifications for airports with runways less than 5,000 feet long and that service aircraft weighing less than 60,000 pounds (#). The use of the state specification provides opportunities to place high quality hot mix asphalt (HMA) pavements for airports at a more affordable cost. Since state specifications are primarily designed for highway pavements, selection of the proper specification and criteria for airport pavements is not always compatible. Specifications that do not consider key factors for airport pavement performance may result in lower airport pavement performance than typically achieved using Federal Aviation Administration (FAA) criteria.

This report has been prepared as a guideline for practicing airport pavement design engineers to ensure that the critical elements in the FAA's current HMA specifications

(P-401, P-401[Superpave] and P-403) are incorporated when state DOT highway pavement specifications are used.

Research Approach

The development of these guidelines for using highway HMA standard specifications for airports was directed by the tasks provided in this project's Request for Proposal. These are listed below:

Task 1 -- Review of FAA P-401, P-401[Superpave] (in FAA Engineering Brief 59A) and P-403 specifications along with latest research (including AAPTP on-going research) to determine the latest criteria and acceptable ranges of test values that provide quality pavement performance.

Task 2 -- Review of state DOT highway specifications to identify critical elements that are used to select specifications for specific applications.

Task 3 -- Development of a strategy and draft criteria for application of state specifications to asphalt airport pavements in categories based upon maximum aircraft gross weights and considering the following areas:

1. Material Selection
2. Composition (mix design)
3. Construction
4. Quality Control
5. Acceptance

Task 4 -- Provide a preliminary report and presentation presenting work to date and the list of states that the guidelines will be tested in the final stages of guideline development and any other future course of actions that are being considered.

Task 5 -- Revise criteria per technical panel's comments and apply guidelines to a minimum of 10 state highway specifications geographically distributed across the United States. Analyze results of the initial applications and evaluate the need for adjustments.

Task 6 -- Draft final reference document and specifications for technical panel review.

Task 7 -- Revise document and specification and provide final products including PowerPoint training materials.

Definitions: State Specification Documents

For use throughout this report, state specification documents shall be defined and referred to by acronyms as follows:

- "State Standard Highway Pavement (SSHP)" specifications – SSHP specifications is used throughout this document to identify the current State specifications for HMA highway pavements covering materials, mix design and selection, manufacture, transport, placement, compaction and acceptance of HMA pavement as well as the contractor's quality control plan and requirements.
- "State Standard Specifications Manual (SSSM)" - SSSM is used throughout this document to identify the current edition of the State Standard Specifications of Highway Construction, State Standard Specifications for Transportation Systems, State Standard Specification for Road and Bridge Construction, or any other title used for a SSSM.
- "State Standard Airport Pavement (SSAP)" specifications – SSAP specifications is used throughout this document to identify a State specifications for HMA airport pavements developed in accordance with the guidance provided by AC 150/5100-13A and submitted for FAA approval. The SSAP must comply with critical requirements for airport pavements and instructions on how to reference, or insert, portions of SSHP specifications.

These three acronyms (SSHP, SSSM and SSAP) are used extensively throughout the remainder of this report so it is important for the reader to know them before proceeding.

CHAPTER II. FAA & STATE SPECIFICATIONS/ CURRENT RESEARCH

FAA Specifications

The current FAA P-401, P-401[Superpave] and P-403 specifications were given a detailed review to establish criteria for <60,000# aircraft gross weight (AGW). The current criteria and acceptance procedures are as shown in Table 1 for airfield pavement in the areas associated with materials, composition, construction, quality control, and acceptance for <60,000# AGW. The P-401 and P-401[Superpave] criteria requirements are designated as airport pavement surface course. The P-403 specifications are applicable as airport pavement surface course for <12,500# AGW and all airport pavement base and leveling course for all AGW classifications.

FAA Research

The current information [draft or final reports] for AAPTP Projects related to construction specifications were reviewed, including:

- Project 04-02, PG Binder Grade Selection for Airfield Pavements
- Project 04-03, Implementation of Superpave Mix Design for Airfield Pavements
- Project 04-05, Improved Performance of Longitudinal Joints on Asphalt Airfield Pavements

In addition, there are two research projects, (one by US Army ERDC and the other by FAA) to determine the appropriate N_{des} levels [number of gyrations used to compact test specimens for a specified traffic level] that correlate with 50 and 75 –blow Marshall for airfield pavement mix design. These two projects are on-going and parallel AAPTP Project 04-03. Available information from these projects was reviewed. The preliminary results of Projects 04-02 and 04-03 are referenced later in this report, where background information and rationale for proposed specification criteria are provided.

SSHP Specifications

The SSHP specifications from the following 16 states were reviewed: AL, CA, FL, GA, KY, MO, MN, MS, MT, NC, OH, PA, SC, TN, TX and WA. It was verified that throughout the United States, the individual SSHP specifications covering HMA pavement have different titles, identification numbers, and a wide range of requirements and acceptance criteria. This is based on a number of reasons, such as local experience, different materials, environmental conditions, etc. The overall general requirements of a SSHP specification can be grouped under the following topical areas:

- **Description:** definitions, explanations, etc.
- **Materials:** normally covers coarse aggregate, fine aggregate, asphalt binder, reclaimed asphalt material, etc.
- **Composition:** includes information about the mix design and job mix formula. This is under MATERIALS in some SSHP specifications.

Table 1 – Summary of Criteria and Acceptance Procedures, Airport Pavement.

Specification Requirement	P- 401 Marshall <60,000 pounds	P- 401 Superpave <60,000 pounds	P-403 Marshall <12,500 pounds
Course	**Surface**	**Surface**	**Surface/All Base & Level**
MATERIALS			
Asphalt Binder	PG XX-XX/State Req'mt	PG XX-XX/State Req'mt	PG XX-XX/State Req'mt
1 Grade Bump*			
Aggregate [Coarse] Fractured Faces [FF]	1 FF 85% 2 FF 70% <60 K Aircraft 1 FF 65% 2 FF 50%	1 FF 85% 2 FF 80%	1 FF 85% 2 FF 70%
Aggregate [Fine] Sand Equivalent	45, or Greater	45, or Greater	45, or Greater
Fine Aggregate Angularity [FAA]		45, Minimum	45, Minimum
COMPOSITION			
Mix Designation	MAS	NMAS	MAS
Gradation	Table 3 - Spec 1.5", 1.0", 0.75", 0.50"	Table 3 - Spec 19.0mm,12.5mm	Table 3 - Spec 1.5", 1.0", 0.75", 0.50"
Design Compaction	50 Blows	60 Gyrations	50 Blows
Design Air Voids	3.50%	4.00%	3.50%
VMA	13, 14, 15, 16% Min	13, 14% Min	13, 14, 15, 16% Min
Tensile Strength Ratio	80% Minimum	80% Minimum	80% Minimum
CONSTRUCTION METHODS			
Test Section	[Yes] P-401 Spec	[Yes] P-401 (SP) Spec	[Yes] P-403 Spec
Full Production	[Yes] P-401 Spec	[Yes] P-401 (SP) Spec	[Yes] P-403 Spec
MATERIAL ACCEPTANCE			
Stability	1350 pounds	NA	1000 pounds
Flow	10-18, 0.01 in.	NA	8-20, 0.01 in.
Plant Air Voids	PWL Calcs on Plant Produced Material	PWL Calcs on Plant Produced Material	Calcs on Plant Produced Material
Mat Density	PWL Calcs: [Gmb Core ÷ Gmb of Plant	PWL Calcs: Gmb Core ÷ Gmm of Plant	>96%/Calcs: Gmb Core ÷Gmb of Plant
Joint Density	PWL Calcs: [Gmb Core ÷ Gmb of Plant	PWL Calcs: Gmb Core ÷Gmm of Plant	>94%/Calcs: Gmb Core ÷Gmb of Plant
CONTRACTOR QUALITY CONTROL			
Contractor QC	GP Section 110	GP Section 110	GP Section 110

*Grade Bump Required for 12,500# to <60,000# Gross Aircraft Weight.

- **Construction:** includes information on plant, equipment, placement and compaction procedures, etc.
- **Acceptance:** establishes the criteria and measure for material acceptance based on established sampling and testing requirements.
- **Quality Control:** information for contractor's quality control program.
- **Measurement:** identifies unit (units) for accountability.
- **Payment:** identifies item (items) per unit for payment calculation.

These topical areas will be utilized for the organization of the guidelines to use highway HMA standard specifications for airports, developed under this project.

In reviewing the SSHP specifications, it was clear that the formats from state to state are very different. Of even greater significance and an even greater challenge to this project is the multiple cross references in SSHP specifications to various sections of the state specific SSSM, state specific testing procedures, state specific nomenclature, etc. Some SSSMs and State test manuals are over 1000-pages in length. Many SSHP specifications reference state test methods versus ASTM or AASHTO test methods.

Based on this review and previous experience with SSHP specifications, the Research Team determined that interviews with each of the FAA Region Engineers were needed to provide additional information and insight that would help formulate the direction and strategy necessary to successfully execute this project.

CHAPTER III. FAA REGION ENGINEERS – INTERVIEWS

The FAA Region Engineers who prominently deal with airport pavements were individually interviewed by the Research Team to determine the following:

- Past history in regard to submittal and approval of modification to standards (MTS) for the use or adaptation of state highway pavement specifications to meet FAA requirements for <60,000# AGW.
- Activity to develop state standards for <60,000# AGW via the guidelines provided by AC 150/5100-13A, Development of State Standards for Nonprimary Airports (dated 9/28/1999).
- Identification of Block-Grant States [BGS], and the significance of BGS status with regards to the use of highway specifications for airports.
- Whether the P-401[Superpave] was being utilized as a MTS versus using P-401 or P-403. It was important to assess whether and how Superpave was being used by the different regions and state aviation offices.

The interviews also addressed three material acceptance related topical areas that the Research Team felt were critical to determine if a general consensus existed in order to know how the final technical guidance should be written. These three topical areas were:

- Importance of having a separate material acceptance pay item for joint density.
- Need to use the statistical percent within limits [PWL] procedure for material acceptance.
- Relying on Contractor's quality control (QC) test data as the basis for material acceptance/quality assurance (QA), versus independent QA testing overseen by the owner or owner authorized representative (OAR).

Current FAA specifications P-401, P-403 and P-401[Superpave] each have a joint density pay item; use PWL for pay and acceptance, and base pay and acceptance on independent QA testing.

Individual Interviews

A brief summary of the findings from each interview as they relate to this project are provided below. The FAA regions are listed in order of East to West. The FAA region name is shown first, followed by the region abbreviation, followed by a list of states in that region. States with BGS status are shown in ***blue bold italics***.

- FAA New England Region, ANE (CT, MA, ME, ***NH***, RI and VT: ANE indicates that state highway specifications are used for airport pavements serving <12,500# AGW. Most of the airports that use highway specifications in the ANE use Superpave with no special modifications or requirements. The ANE further reports no cost savings with using highway specifications in lieu of the FAA P-401. On the three material acceptance topics:

- Joint Density – Permits the use of highway specifications without a joint density requirement and understands these joints may not be as high of quality as P-401.
- PWL – If the State is in charge of material acceptance testing, PWL is not necessary. If the Contractor is in charge of testing, PWL should be required.
- Contractor QC for material acceptance – The owner, or authorized owner representative (OAR), should be in charge of material acceptance.

- FAA Eastern Region AEA (DC, DE, MD, NJ, NY, ***PA***, VA, and WV): States within the AEA generally follow the P-401 specification and AEA basically supports the P-401 criteria. On the three material acceptance topics:
  - Joint Density - Worth the investment.
  - PWL - Provides a better method for material acceptance; however, other procedures may be acceptable for <60,000# AGW.
  - Contractor QC for material acceptance – Has promising potential provided the owner (or OAR) demonstrates the technical expertise to oversee the Contractor QC testing program. The Contractor QC plan must be in compliance with ASTM 3666, Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials.

- FAA Southern Region, ASO (AL, FL, GA, KY, MS, ***NC***, SC, ***TN***, PR, and VI): Both the BGSs (NC and TN) operate independently of ASO Headquarters by implementing and managing the AIP Grant Program within their respective State DOT organization. This means minimal coordination with ASO regarding a MTS for use of P-401[Superpave]. On the three material acceptance topics:
  - Joint Density – Should retain this high standard for quality on airport pavements to ensure increased safety, decreased maintenance and decreased FOD.
  - PWL – Strongly supports PWL procedures as best method for determining material acceptance.
  - Contractor QC for material acceptance – Generally supports the owner (or OAR) maintaining control of material acceptance; however, making exceptions for pavement supporting <60,000# AGW is reasonable.

- Great Lakes Region, AGL (***IL***, IN, ***MI***, MN, ND, OH, SD and ***WI***): AGL reports that each of their BGSs (IL, MI and WI) use to some extent State DOT specifications with modifications to meet the critical P-401 criteria for <60,000# AGW. The modified specifications have been previously approved by the FAA Region in accordance with AC 150/5100-13A, so a MTS is not required for AIP projects. The non-BGS states generally follow the P-401 specification. On the three material acceptance topics:
  - Joint Density – Considers any extra cost associated with a joint density acceptance parameter to be fully justified. By minimizing joint distresses, there will be less maintenance and less FOD. Bad joints can be a safety hazard for small aircraft with very small tires.
  - PWL – Considered the best means of assessing material acceptance. Nationally recognized due to sampling criteria from ASTM D3665 and D3666.

  - Contractor QC for material acceptance – May be acceptable in the future, but consultants (as OAR) must first get up to speed to insure they have technical expertise to accomplish oversight of the Contractor QC testing.

- FAA Central Region, ACE (IA, KS, ***MO***, and NE): ACE reports that only their one BGS state (MO) has fully implemented the P-401[Superpave] specification for airports less than 60,000# AGW. The MODOT has developed modified specifications to comply with critical P-401[Superpave] requirements. The Item MO-401S has mat and joint density as the basis for acceptance of the field placed material and contractor quality control for the plant produced material. The Item MO-401F has mat and joint density and average smoothness profile index [California profilograph] as the basis for acceptance of the field placed material and contractor quality control for the plant produced material. This specification is available on the MODOT website.

  NE has fully implemented Superpave and uses a revised state DOT specification with a request for MTS on a project by project basis. KS is about 50% - 50% on P-401 versus P-401[Superpave], based on project by project. IA is transitioning to Superpave, but primarily uses the P-401 for airport projects. On the three material acceptance topics:
  - Joint Density – Not sure if Contractor's QC is sufficient to ensure quality joints that will not ravel. Joint raveling is exasperated in a wet-freeze climate, which is the case for ACE.
  - PWL – Fully support the PWL procedure as the best method to assess material acceptance.
  - Contractor QC for material acceptance – A technically proficient owner (or OAR) could provide responsible oversight to the Contractor's QC testing, and thus a reliable approach to this issue.

- FAA Southwest Region, ASW (AR, LA, NM, OK, and ***TX***): TX, the only BGS in ASW, uses highway specification criteria combined with the P-401 requirements on a project by project basis for airport pavement. Superpave mix design has not been used. TXDOT had extensive experience with the intermingling of criteria. LADOT had some recent experience in adapting the highway specifications to airport pavements. The other states in ASW use the P-401 specification for airport pavements. On the three material acceptance topics:
  - Joint Density – Separate pay item necessary to ensure durability on airfields.
  - PWL – Highly supports PWL, but may be eliminated for projects less that 3,000 tons HMA.
  - Contractor QC for material acceptance – Supports retaining material acceptance under Owner (or OAR), but technical proficiency of OAR (Consultants) is necessary. Using Contractor QC for material acceptance is feasible.

- FAA Northwest Mountain Region, ANM (CO, ID, MT, OR, UT, WA and WY: There are no BGS in ANM. For two perceived reasons the ANM primarily uses the P-401. These are: (1) Superpave has not reached implementation maturity throughout

most of the ANM and (2) excellent technical guidance is provided over the AIP Program in the ANM. ANM has published a FAA Northwest Mountain Region Construction Manual for Airport Pavements with basis in the P-401. All ANM states use the P-401 with the exception that CO has recently used the P-401[Superpave] with MTS approval by FAA ANM. The P-401[Superpave] specification is rarely used. On the three material acceptance topics:
  - Joint Density – Required for airport pavements for durability.
  - PWL – Highly supports PWL procedures, but may be eliminated for projects less that 3,000 tons HMA.
  - Contractor QC for material acceptance – Supports the overall FAA policy to retain material acceptance under Owner (or OAR), but technical proficiency of OAR is necessary. The use of Contractor QC for material acceptance is a feasible approach for <60,000# AGW.

- FAA Western Pacific Region, AWP (AZ, CA, HI, and NV): There are no BGS in the AWP. Superpave has not reached implementation throughout most of the AWP and the P-401 is the primary specification used for airport pavements. In CA, the Caltrans Division of Aeronautics is in the process of adapting the Caltrans highway specifications for use on airport pavements for less than 60,000# AGW. The University of Alaska - Fairbanks has been commissioned for this effort. The draft specification is being prepared for coordination prior to submittal to AWP for approval in accordance with AC 150/5100-13A. In AZ, HI, and NV, the P-401 specification is used for airport pavements. On the three material acceptance topics:
  - Joint Density – Retain as a pay factor item for airport pavement.
  - PWL Procedures – Highly supports PWL procedures for primary airport pavement, but may need other acceptance procedures for small projects and <60,000# AGW projects.
  - Contractor QC for Material Acceptance – Supports the overall FAA policy to retain material acceptance under Owner (OAR) oversight.

- FAA Alaska Region, AAL (AK): The AKDOT manages more than 200 airports, of which, most are gravel. They published *Standard Specifications for Airport Construction* in March 2006. The specifications are a modified version of Advisory Circular 150/5370-10B, *Standards for Specifying Construction of Airports*, and have been approved by the FAA for AIP projects in Alaska. This document contains a modified P-401 specification and is used in AK when HMA is placed on airports. The AK P-401 mandates joint density requirements, PWL procedures for material acceptance, and independent Owner (or OAR) oversight of material acceptance.

The Director of Technical Services for the National Association of State Aviation Officials (NASAO) was interviewed and confirmed that the BGS were more likely to be further along in the use of highway specifications for airport pavements.

Conclusions

Conclusions from these interviews with each FAA Region Office are:

- AC 150/5100-13A (dated 9/28/1999) provides a procedure for approval of State standards that is permitted under in US Code 47105(c).
- There has been very little response to AC 150/5100-13A, with the exception of some BGS. The BGS may use state highway specifications with modifications. In most other states the P-401 is predominantly being used.
- For <60,000# AGW projects, it appears that the use of P-401[Superpave] for airport pavement is occasionally being implemented in the Southeast; less often in other states East of the Mississippi; and least often West of the Mississippi.
- The P-401 is used much more often than P-401[Superpave]. The P-403, essentially P-401 without PWL, is being used as intended for <12,500# AGW pavement.
- FAA Region Engineer consensus on the three material acceptance issues is:
  - Joint Density – should remain a pay factor item for airport pavement.
  - PWL Procedures – Strongly support PWL procedures for primary airport pavement, but may endorse lifting of PWL on small projects and <60,000# AGW.
  - Contractor QC for material acceptance – Support the overall FAA policy to retain material acceptance under Owner (or OAR) oversight.

CHAPTER IV. STATE AVIATION OFFICES (SAOs) – INTERVIEWS

Through a series of conference calls, the Research Team concluded there was still not a clear understanding of the direction for Tasks 2 and 3 efforts, nor was there a clear vision of the end product from this project. It was decided that the following additional information needed to be sought through interviews with select SAOs:

- To what extent are SSHP specifications in your state being used on projects for pavements serving the following three AGW categories: <12,500#, 12,500 to 30,000#, and 30,000# to 60,000#?
- If SSHP specifications are used, which one(s) and under what conditions?
- Have SSHP specifications been modified for use on airport projects (as a SSAP specification)? If yes, has this modification been approved by FAA and is this modified specification available?
- If SSHP specifications are not used, which FAA specifications (P-401, P-401[Superpave] and P-403) are used for the three AGW categories above.
- Is the estimated quantity of the project a consideration in which specification is used?

The conclusions drawn from these interviews are:

- The SAOs, and specifically the supporting Consultants, are reluctant to submit a MTS for use of SSHP specifications modified as SSAP specifications for a specific project. This reluctance appears to be a result of the 10-year moratorium on future federal funding if State standards are used (see next chapter), although the authors are not aware of any instance where federal funding was denied.

- A few states, including NC, TN, FL, GA and MS, are using SSHP specifications for <12,500# AGW airport pavement projects. In some cases, the <12,500# AGW criteria may be stretched, normally through coordination with the FAA ADO of authority. This practice is being carried out with a 10-year moratorium on future federal funding imposed by Public Law 106-181 because there are no FAA approved SSAP specifications (see next chapter).

- Missouri has two SSAP specifications, identified as Item MO-401F and Item MO-401S, which are available on the MODOT website.

- When SSHP specifications are used for airfields, they are normally based upon the Superpave Mix Design method since the majority of states have adopted Superpave. When FAA specifications are used, they are normally based upon the Marshall Mix Design method because that is the method that P-401 and P-403 utilizes. Projects that utilize P-401[Superpave] are the exception.

- For airport projects supporting 12,500# to 60,000# AGW, the P-401 is predominantly used in accordance with FAA standards.

- The SAOs, and specifically the supporting Consultants, are reluctant to submit a MTS for using the P-401[Superpave] specification in lieu of the P-401.

In summary, there appears to be only a few States using SSHP specifications, which are predominantly Superpave, and generally only when the project is for pavement <12,500# AGW. These individual projects using SSHP specifications are accomplished with the understanding that there is a 10-year moratorium for future federal funding (see next chapter). These interviews also revealed that the Research Team needed a better understanding of the Public Law and FAA Orders that currently pertain to and influence the use of state standards (and SSHP specifications) for airports. This turned out to be quite an entangled web of directives dating back to 1999. An attempt to sort, summarize and explain these turned into a substantial effort, and is summarized in the next chapter.

CHAPTER V. PUBLIC LAW AND FAA ORDERS

A chronological review of legal and authoritative directives impacting the authority, approval, funding, limitations and liability of using SSHP specifications for HMA airport pavement projects is as follows:

1999 AC 150/5100-13A, Development of State Standards for Nonprimary Airports

The AC was published on September 28, 1999, superseding AC 150/5100-13 dated March 1, 1977. This FAA advisory circular provides guidelines for the development of state standards for Nonprimary public-use airports as provided for in Title 49 United States Code, Section 47105 (c). Three categories of standards are mentioned; Configuration Standards, Design Standards, and Construction Standards. HMA specifications fall under Construction Standards. The 5100-13A includes guidance for incorporating SSHP specifications into state standards for pavements serving <60,000# AGW when the performance record under equivalent loadings and exposure has been satisfactory. The application process, approval authority, and necessary conditions are also provided.

As mentioned in the previous chapter, Missouri has developed SSAP specifications (Item MO-401F and Item MO-401S, Plant Mix Bituminous Pavement) for projects serving <60,000# AGW from their SSHP specifications, in accordance with AC 150/5100-13A.

2000 US Code 47114(d) (5) as amended by Public Law 106-181, April 5, 2000.

(1) IN GENERAL. — The Secretary may permit the use of State highway specifications for airfield pavement construction using funds made available under this subsection at Nonprimary airports with runways of 5,000 feet or shorter serving aircraft that do not exceed 60,000 pounds gross weight if the Secretary determines that—

(i) safety will not be negatively affected; and
(ii) the life of the pavement will not be shorter than it would be if constructed using Administration standards.

(2) LIMITATION. — An airport may not seek funds under this subchapter for runway rehabilitation or reconstruction of any such airfield pavement constructed using State highway specifications for a period of 10 years after construction is completed unless the Secretary determines that the rehabilitation or reconstruction is required for safety reasons.

2000 FAA Order 5300.1F, Modification to Agency Airport Design, Construction, and Equipment Standards, June 30, 2000.

13. STATE STANDARDS.
a. State standards may be developed for airports that are not primary airports in accordance with AC 150/5100-13A. State highway specifications may be

permitted for airfield pavement construction at Nonprimary airports in accordance with US Code 47114(d)(5) as amended by P.L. 106-181(April 2000). For all other airports, the FAA standards shall be used, except as modified in accordance with this Order.
b. Director of Airport Safety and Standards, AAS-1 (or designee), specifically reserves approval authority for State standards.
c. Standards developed under this section must be updated periodically and reflect FAA standards where applicable.

2005 FAA Order 5100.38C, Airport Improvement Program Handbook, June 28, 2005.

506.b. State Standards. FAA approval of State standards may have been accomplished for certain projects at Nonprimary airports, although such a standard cannot be approved with respect to safety of approaches. If a sponsor proposes to apply a State's standards that have not been approved, the region may encourage the State to prepare standards under an AIP system plan project. However, use of the State standards is generally not permitted until they have FAA approval. Additionally, State highway specifications are permitted for airfield pavement construction using funds made available under Section 47114 of the Act at Nonprimary airports with runways of 5,000 feet or shorter serving aircraft that do not exceed 60,000 pounds gross weight if the Secretary determines that (i) safety will not be negatively affected; and (ii) the life of the pavement will not be shorter than it would be if constructed using FAA standards. However, there is one limitation. An airport may not seek funds under this provision for runway rehabilitation or reconstruction of any such airfield pavement constructed using state highway specifications for a period of 10 years after construction is completed unless the FAA determines that the rehabilitation or reconstruction is required for safety reasons.

2005 US Code 47105(c)

State Standards for Airport Development.--The Secretary may approve standards (except standards for safety of approaches) that a State prescribes for airport development at Nonprimary public-use airports in the State. On approval under this subsection, a State's standards apply to the Nonprimary public-use airports in the State instead of the comparable standards prescribed by the Secretary under subsection (b)(3) of this section. The Secretary, or the State, with the approval of the Secretary, may revise standards approved under this subsection.

By understanding the legal and authoritative directives impacting the use of SSHP specifications for airports, a clear "strategy" as required by Task 3 was developed. This strategy is based on our understanding that:

– AC 150/5100-13A provides a procedure for approval of State standards that is permitted under in US Code 47105(c).

- A "State Standard Airport Pavement (SSAP)" specification can be developed by each state for HMA airport pavements developed in accordance with the guidance provided by AC 150/5100-13A and submitted for FAA approval. The SSAP must comply with critical requirements for airport pavements and instructions on how to reference, or insert, portions of SSHP specifications.
- In order for the 10-year limitation period on future federal funding to not apply, it is necessary that a State submit SSAP specifications in accordance with AC 150/5100-13A for approval by FAA Order 5300.1F. This premise is applicable for all weight categories of aircraft <60,000# AGW**.**
- By developing a SSAP specification and getting proper approval, the SAOs can then routinely use it on airport projects without being subject to the 10-year federal funding limitation. That is not the case if a single project uses a SSHP specification that has been used, modified or not modified, under MTS procedures as a SSAP specification for airport pavement.

Chapter VI. GUIDANCE STRATEGY AND DRAFT EB-XX

Strategy

The format for a guideline development strategy as required by Task 3 evolved from an in-depth review of the current FAA airport pavement specifications [P-401, P-401 (SP), and P-403] under Task 1 and the 16 individual SSHP specifications reviewed under Task 2. As a result of these SSHP specification reviews, it was determined that the SSHP specifications throughout the United States had different titles and identification numbers, diverse nomenclature and formats, and had a wide range of requirements and acceptance criteria. In addition, the SSHP specifications in all the 16 states had a rather complex matrix of cross referencing among other related SSSM standards, test methods, etc. However, the overall general requirements of the SSHP specifications could be grouped under the eight generic topical areas contained in the FAA specifications, and identified in Chapter II, as follows:

- Description.
- Materials.
- Composition.
- Construction.
- Acceptance.
- Quality Control.
- Measurement.
- Payment.

After in-depth discussions, the Research Team considered the above topical areas as the best link between SSHP and SSAP specifications to establish a checklist format for critical areas and to address the specific airport pavement requirements within the critical areas. With a checklist format established, the strategy shifted to examining past experience in the use of SSHP specifications for airport pavement construction and to refining the critical airport pavement requirements by initiating dialogue with the FAA Region Engineers. The dialogue consisted of interviews focused on examples of SSHP specification applications and material acceptance requirements for <60,000# AGW as summarized in Chapter III. Conclusions from these interviews with FAA Region Offices were as follows:

- AC 150/5100-13A provided a procedure for approval of State standards that is permitted under in US Code 47105(c).
- There has been very little response to AC 150/5100-13A, with the exception of some BGS. The BGS had occasional application of SSHP specifications with modifications for specific requirements. In most other states the P-401 was predominantly being used.
- For <60,000# AGW projects, the use of P-401[Superpave] for airport pavement appeared to be in the process of being implemented in the Southeast; less often used in other states East of the Mississippi; and least often used West of the Mississippi.
- The P-401 was used more often than P-401[Superpave]. The P-403, essentially P-401 without PWL procedures, was used as intended for <12,500# AGW airport pavement.
- FAA Region Engineer consensus on three critical material acceptance issues was:

- Joint density should remain a pay factor item for airport pavement.
- PWL procedures were strongly recommended for primary airport pavement, but endorsed lifting PWL procedures on small projects and <60,000# AGW.
- Unanimous support of the overall FAA policy to retain material acceptance under Owner (or OAR) oversight.

SAO discussions and a chronological review of the Public Law and FAA Orders, as recapped in Chapters IV and V, respectively, led the Research Team to conclude that a checklist document should be written in the format and language of a draft FAA Engineering Brief (EB). The Research Team concluded that providing the checklist document in the format of an EB would assist the FAA to facilitate implementation of SSAP specifications. The Team also thought the SAOs would be more likely to develop and use SSAP specifications on airport projects for <60,000# AGW if provided guidance in the form of an EB. The draft checklist document will be developed as a Draft EB-XX, and referred to as Draft EB-XX from this point forward in the report.

General Checklist Requirements for Developing a Draft EB-XX

In view of the strategy outlined above, the critical technical elements that the Draft EB-XX must address, along with the approach of how they will be addressed, are provided below for the eight topical areas, and listed as Element 1 through Element 8 for inclusion into a Draft EB-XX:

Element 1: Description – Correlation between Traffic ESALs to AGW <60,000#. It became very apparent that a correlation between aircraft loading levels and highway traffic levels was needed to bridge the criterion used in a highway specification (based on ESALs) and those used in airfield specifications (based on AGWs). The Research Team's approach and rationale in developing this necessary correlation are summarized in Table 2.

Starting from the left of Table 2, three AGW categories were mentioned in the RFP of this project (**Reference 1**); <12,500#, 12,500# to <30,000#, and 30,000# to < 60,000#. Maybe not coincidentally, these are the same categories as annotated in AC 150/5100-13A (**Reference 2**). It should be noted that AC/5100-13A covers three categories of standards; Configuration Standards, Design Standards, and Construction Standards. This project pertains to Construction Standards. AC 150/5320-6D (**Reference 3**) provides the FAA's pavement thickness design guidance. Essentially, the light aircraft charts are used for <30,000# while the LEDFAA software is used for >30,000#. There is a note providing guidelines for the use of state mixes for <12,500#.

Construction Standards having to do with asphalt binder selection and mix design criteria appear to be independent of the 30,000# breakpoint, as depicted by P-401, P-401 [Superpave], AAPTP Projects 04-02, AAPTP 04-03, AASHTO M-323, and AI SP-2 (**References 4 through 9**). For both P-401 and P-401[Superpave], grade bumping of the binder is recommended at >12,500#, and there is no other guidance change until >60,000#. There is no change at 30,000#. The mix design compaction level is constant

in P-401 and P-401[Superpave] for all AGWs <60,000#, being 50 blow Marshall and Ndes of 65 gyrations, respectively. In the Draft Final Report for AAPTP Project 04-02, the binder grade selection criteria changes at 12,500# and 60,000#, but not at 30,000#. In the latest Quarterly Progress Report for AAPTP 04-03, the suggested gyration levels also change at 12,500# and 60,000#, but not at 30,000#.

Table 2 –Approach to Correlate Between AGW and ESAL Categories.

Reference 1	Reference 2	Reference 3	Reference 4, 5, 6, 8, & 9	Reference 7	Reference 8 & 9	Reference 8 & 9
AGW Categories	AGW Categories	Thickness Criteria	Binder Criteria	Ndes Gyrations	Ndes Gyrations	ESAL Categories
0 to <12,500#	0 to <12,500#	Use Light A/C Charts(w/ Note)	Standard Grade	50	50	0 to <0.3 M
12,500# to <30,000#	12,500# to <30,000#	Use Light A/C Charts	Bump Grade	65	75	0.3M to <3.0M
30,000# to <60,000#	30,000# to <60,000#	Use LEDFAA Software				
Reference Guide [See Chapter 9 for Complete Reference Description]:						
1	**AAPTPT 06-05 RFP**					
2	**AC 150/5100-13A**					
3	**AC 150/5320-6D**					
4	**AC 150/5370-10C Item P-401**					
5	**AC 150/5370-10C Item P-401 (SP) [EB-59A]**					
6	**AAPTP 04-02 Final Report**					
7	**AAPTP 04-03 Final Report**					
8	**AASHTO M-323**					
9	**AI SP-2 Manual**					

Starting on the far right side of Table 2, the AASHTO highway ESAL traffic categories for binder selection and mix design guidance are: <0.3 million ESALs, 0.3 million to 3.0 million ESALS, and then higher ESAL levels (**Reference 8 and 9**). By bridging similar criterion regarding binder grade bumping and N-design levels, it becomes apparent that the 30,000# AGW breakpoint is not necessary for the Draft EB-XX and the correlation between AGW and ESAL categories should be as shown in Table 3, which will become part of the Draft EB-XX.

Table 3 – Traffic Level Correlation for Superpave HMA Mixtures

Traffic Level	Million ESALs	Aircraft Gross Weight, (#)
A	<0.3	<12,500
B	0.3 to <3.0	12,500 to <60,000

Element 2: Materials – Use of SSHP specifications for material requirements are recommended. This requirement should be sufficient in most State DOTs. Aggregate gradation shall be tied to AASHTO M 323 with the exception of NMAS 4.75 mm

mixtures, which are not recommended for airfields. Asphalt binders shall be as specified in AASHTO M 320. Use of SSHP specifications for tack coat requirement is recommended.

Element 3: Mix Composition (Mix Design) – Use of SSHP specifications requirements are recommended. The mix design and Job Mix Formula (JMF) procedures were sufficient in SSHP specifications reviewed under Task 2.

Element 4: Construction – Use of SSHP specifications for Contractor QC requirements are recommended. Preliminary review and past experience of the Research Team indicate that SSHP specification requirements were sufficient for SSAP specifications. Exceptions are in the case of joint density and smoothness and grade. These requirements are introduced here and the detailed acceptance criteria will be covered in the Draft EB-XX.

- Joint Density [**Mandatory FAA acceptance requirement]**. FAA position is that the increase in cost for high quality joints is justified by decrease in maintenance and the absence of maintenance forces in the general aviation operations and inability to shut down pavement for maintenance in the case of air carrier operations.
- Smoothness and Grade [**Mandatory FAA acceptance requirement]**. Criteria in accordance with FAA Item P-401, Item P-401(SP), and/or Item P-403. The slope and grade requirements have been approved by aircraft manufacturers and operators, and require long-term coordination to facilitate a change.

Element 5: Acceptance (QA) [**Mandatory FAA acceptance requirement]**. It is a matter of placing the Airport Owner or Owner Authorized Representative (OAR) in the State DOT Contract Management position. Airport Owners do not have a link to State DOT Laboratories as in the case of State DOT Contract Management. The OAR (typically consultants) may not have the necessary expertise to oversee Contractor QC, so independent Owner QA testing appears to be the only acceptable approach, consistent with current FAA specifications. The FAA's current practice is to pay for independent Owner QA testing. It is beyond the scope of this project to change this situation. The SSAP specifications can use State procedures for Material Acceptance in most cases with exceptions annotated in the Draft EB-XX.

Element 6: Quality Control – Use of SSHP specifications for Contractor QC requirements are recommended. The Contractor QC requirements were sufficient in SSHP specifications reviewed under Task 2. Correlation with FAA specifications is recommended.

Element 7: Measurement – Use of SSHP specifications for measurement requirements are recommended. The measurement requirements were sufficient in SSHP specifications reviewed under Task 2.

Element 8: Payment – Use of SSHP specifications payment requirements are recommended. The payment requirements were sufficient in SSHP specifications

reviewed under Task 2; however, there are administrative restrictions when federal funds are involved. As indicated in previous guidance, it becomes necessary to understand that airports deal with administrative differences in addition to critical technical requirements. As examples,

- A bonus is not eligible for federal grants. A bonus is allowed, but requires an amendment to the federal grant, and is normally not standard practice in AIP Projects because Owners (or OARs) do not want the administrative hassle and the lead-time required for processing after Contract performance.
- State requirements for pavement density may have to be increased in the event SSHP specifications permit a density < 92.8% Gmm [i.e., the FAA requires reject action at PWL = 50 which is equivalent to the lower tolerance limit of 92.8% Gmm under the PWL procedures].

Draft EB-XX

Because of the complex cross referencing of SSHP specifications and test methods in SSSM standards, the Research Team envisioned that the development of the individual SSAP specifications would be performed by an experienced pavements engineer knowledgeable in asphalt materials (perhaps in the State DOT Material Division or a Consultant). It was envisioned that the actual SSAP specification may either follow the format of the SSHP specifications of a particular state, or the format of the checklist document [EB-XX] which would generally follow the FAA specifications format.

Based on the strategy and critical requirements annotated above, the initial Draft EB-XX was developed and tested by applying it to individual SSHP specifications. These individual State test cases are summarized in the next chapter, and are provided in their entirety as individual Appendices.

CHAPTER VII. APPLICATION TO STATE HIGHWAY SPECIFICATIONS

First State Test Case

After the initial Draft EB-XX was written, the first test case was performed for the Florida DOT (FDOT). The initial Draft EB-XX was applied to the standard FDOT Superpave specification, Section 334 in FDOT SSSM. The resulting SSAP specification for FDOT, labeled as Section 334A, is provided as Appendix A1. It is written as an amendment to FDOT Section 334, in part, because of the complexity of references in Section 334 to other sections in the FDOT SSSM and FDOT standard test methods. Section 334 is included as Appendix A2 to provide the reader with the entire new airfield specification package. In short, Section 334A modifies the critical portions of Section 334 to ensure good performance for airport pavements serving aircraft under 60,000# AGW. Other portions of Section 334, including all references to the FDOT SSSM and test methods, remain unchanged and become an integral part of the new airport pavement specification package, Section 334. To illustrate the complexity of cross referencing that exists in Section 334, a list of referenced sections from the FDOT SSSM is included as Appendix A3. Other states have similar levels of complexity regarding cross referencing within their SSSM, but similar lists for the other test cases are not be provided as part of this report.

Additional State Test Cases

Along with FL, the other states selected for developing SSAP specifications are PA, TX, VA, CA, MN, MT, OH and WA. A tenth state, MO, had already developed an SSAP specification prior to this project, so it was examined against the guidelines in Draft EB-XX. Figure 1 shows how these states represent a variety of FAA regions and climates.

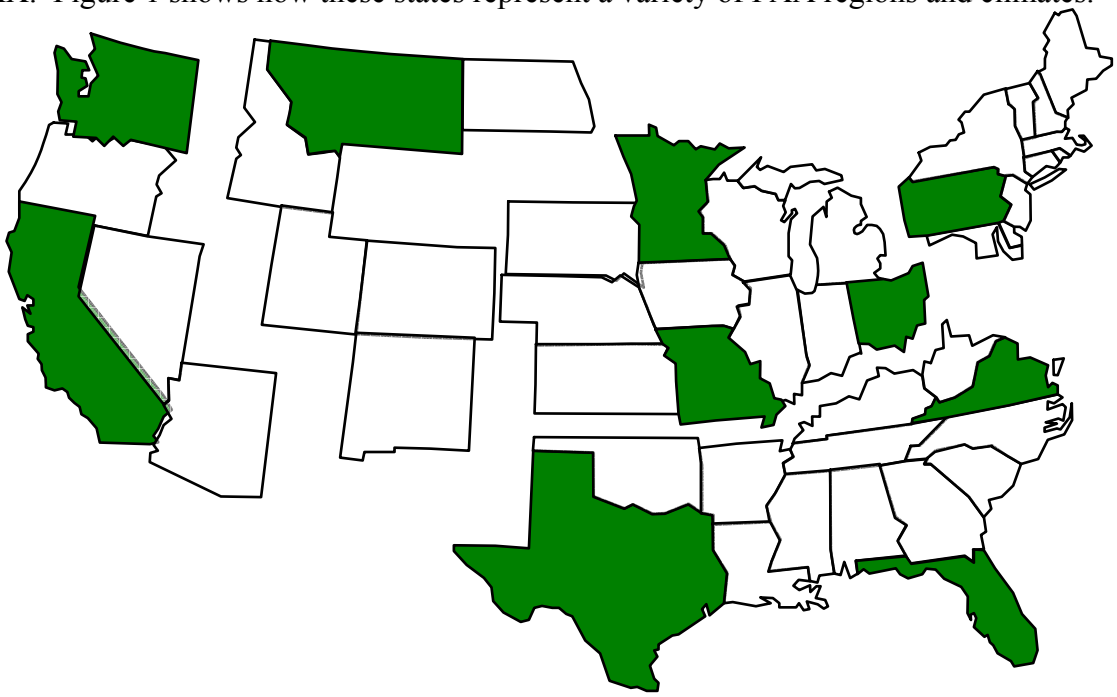

Figure 1 – Geographical Distribution of State Test Cases

Each of these additional test cases where performed as individual exercises by one of the Asphalt Institute's (AI) Regional Engineers located across the United States. Throughout the development of these SSAP specifications, iterative adjustments were made to both the SSAP specifications and the Draft EB-XX. The research team realized that each application of the Draft EB-XX to a particular state served as an independent assessment to determine the sufficiency of the Draft EB-XX in addressing the many complicated areas related to SSHP requirements, nomenclature, composition, and organization items. Each engineer performing the application had to determine whether each SSHP specification item requirement met or exceeded the comparable critical element requirement identified in the Draft EB-XX. If not, then the engineer had to amend the SSHP as necessary in accordance with the guidelines within the Draft EB-XX.

The complete and final SSAP specification documents developed by this Research Team for each of the nine test cases are provided in the extensive set of appendices for this report. Each Appendix letter represents one of the 9 states mentioned above starting with Appendix A for FL and going through Appendix I for WA. Each appendix letter has a part 1 and a part 2 (i.e. Appendix A1 and Appendix A2). Part 1 appendices are the actual SSAP specifications that were developed by the individual AI engineers, while the corresponding Part 2 appendices are the current unmodified State standard highway pavement (SSHP) specifications that were used in the conversion process and provide the basis for the SSAP specification. In most cases, Part 1 serves as an amendment to Part 2 (as in the FL test case). In a few test cases, such as OH, Part 1 is written to serve as a stand alone SSAP specification that does not need the parent SSHP specification. When this was the situation, the SSHP is still included as Part 2 of the test case in order to provide the complete test case and revision process for the reader.

The SSAP specification for MO is not included in the appendices of this report because it was already developed outside this project.

Engineers' Summary Statements on Each Test Case

A summary statement written by the engineer that performed each test case is provided below to offer additional insight as to challenges faced, engineering judgment used, and lessons learned through using the Draft EB-XX to develop a SSAP specification for their respective state test cases. It is emphasized that these summaries were written by different AI Regional Engineers, providing not only different writing styles, but also different approaches and perspectives on the task handed to each of them.

Florida

FDOT Section 334A (Appendix A1, 7 pages) was developed as a SSAP specification to amend the FDOT Section 334 highway specification (Appendix A2, 19 pages) of the FDOT SSSM. Seven other sections of the FDOT SSSM that were referenced in Section 334 are listed in Appendix A3 had to be reviewed for congruency with Section 334A. Initial review of the basic SSHP specifications presented some confusion for

transforming them into a viable SSAP specification that contained the critical elements required for airport pavements. However, the task became clearer after relying on the methodology provided in Section VII of the Draft EB-XX. A major point of confusion came from the major differences between highway and airfield terminology. The first element in Draft EB-XX, Description, addressed terminology to dispel the confusion with nomenclature and also provided a correlation between highway pavement traffic level ESALs and airport pavement AGWs. While it was difficult at times to locate the individual critical technical elements through the maze of referenced sections in the SSSM, the Draft EB-XX did provide straightforward guidance that was logically organized.

The FDOT SECTION 334 was established using three split samples for Contractor QC testing as the basis for material acceptance, owner verification; and resolution as necessary. Although resolving the critical element of QA appeared difficult at first, it became relatively easy by reversing Contractor and Owner roles in the acceptance testing. The FDOT SSHP specifications generally employ the PWL calculations to determine pay factors. Other minor changes were annotated without difficulty, such as laboratory, smoothness, grade, and skid surface requirements. Measurement and Payment were straightforward to address, except that provisions had to be added to include joint density under QA.

Minnesota:

The new SSAP specification that was developed under this task is provided in Appendix B1 and is titled: "Addendum to Mn/DOT 2360 Plant Mixed Asphalt Pavement for Airfields under 60,000# Gross Weight." The basic methodology was to delete or modify those sections of the existing Mn/DOT HMA spec 2360 (provided as Appendix B2) that are in direct conflict with the DRAFT EB-XX guidelines and insert those sections that are considered critical elements.

The Minnesota DOT has an in-depth, highly interwoven QC/QA process in their SSHP specifications that relies heavily on Contractor test results in acceptance decisions. In an effort to maintain the most economical and standard operating environment for the contracting industry, the existing QC testing plan was maintained, but removed from the acceptance decision in the SSAP specification. In an effort to maintain processes familiar to the local industry, it was decided that the existing SSHP acceptance tests and procedures (including those by the contractor) remain, but be required of the Airport Owners Authorized Representative (OAR). Minimal modifications to the existing SSHP specified tests, frequencies and thresholds were then necessary to meet the critical elements outlined in Draft EB-XX, since the acceptance testing is to be performed by the OAR.

It is felt that the complex Mn/DOT 2360 was modified sufficiently through the "Addendum" in Appendix B1 to still provide a familiar specification format and project requirements for the contractors in Minnesota while now meeting the quality requirements desired by the FAA on airfields carrying aircraft up to 60,000 pounds. It is

also anticipated that there will be no significant cost increase when using this SSAP specification.

Pennsylvania:

The initial Draft EB-XX was applied to the standard Pa DOT Superpave specification, Section 409 in Pa DOT SSSM. The resulting 8-page SSAP specification for Pa DOT, labeled here as Section 409AP, is provided as Appendix C1. The SSAP specification modifies certain sections to agree with the P 401 specification. All other sections of Pennsylvania Department of Transportation, standard Specifications for Road and Bridge Construction, Current Edition, Section 409, are applicable under this SECTION 409AP. Pa DOT Section 409 is included as Appendix C2 to provide the reader with the entire new airport pavement specification package.

Examples of critical modifications are:

- the addition of a longitudinal joint specification. Pa DOT 409 has a method specification for the construction of the longitudinal joint. It does not require a minimum density for acceptance. The 409AP modified the 409 specification to require longitudinal joint density cores be taken and tested to insure the joint meets a minimum density.
- insertion of Tables 1 and 2. These were required to correlate gyration levels and performance graded (PG) asphalt cement to airport pavement applications.

Section 409AP was reviewed by the PA SAO, and they concurred that it should ensure good performance for airport pavements under 60,000# AGW.

Texas:

TxDOT's HMA specifications are formatted differently than most state DOT specifications. The biggest difference is that TxDOT does not have a series of sections/Items that pertain strictly to materials requirements, but includes these within the HMA specification. Another difference is that TxDOT does not publish their Standard Specifications as frequently as other states. The most recent version was published in 2004; before that, the three previous Standard Specifications were published in 1993, 1982 and 1972. Consequently, Special Specifications may be issued to void an Item in the published standards when wholesale changes are necessary. Due to the wide range of conditions and HMA uses within Texas, local designers must identify some specific requirements using General (Plan) Notes, while modifications to the standards are made using Special Provisions.

The initial Draft EB-XX was applied to the TxDOT Item 341, "Dense-Graded Hot-Mix Asphalt (QC/QA)." The subsequent TxDOT SSAP is provided as Appendix D1 and referred to as "Special Provision, Item 341A, Dense-Graded Hot-Mix Asphalt (QC/QA), <60,000# AGW." TxDOT Item 341 is provided as Appendix D2. All other Items of the current TxDOT SSHP specifications are applicable under Item 341A.

The TxDOT Standard Specifications include three Items that cover "conventional" dense-graded HMA: Item 340 "Dense-Graded Hot-Mix Asphalt (Method)," Item 341 "Dense-Graded Hot-Mix Asphalt (QC/QA)," and Item 344, "Performance-Designed Mixtures." Item 341 is presently (October 2008) the predominate specification, accounting for over 85% of the tonnage of dense-graded mixtures. That is the reason Item 341 was selected as the basis for the SSAP specification.

Other notes applicable to the TxDOT Standard Specifications include:

- TxDOT's specifications do not have tack coat as a separate Item. Tack coat requirements and pay are imbedded within the HMA specifications, such as Item 341. The SSAP Item 341A will remove reference to tack coat and refer to FAA P-603.
- The minimum VMA requirements were increased in SSAP Item 341A by 0.5% for all mixture classifications. This compensates for the modifications in lab molding parameters (compared to conventional Texas Gyratory).

Virginia:

VDOT Section 315A – Asphalt Concrete Pavement for Low Volume Airports (provided in Appendix E1) was developed, complying with the Draft EB-XX, to amend the basic VDOT Section 315 – Asphalt Concrete Pavement specification (provided in Appendix E2) of the VDOT SSSM.

Besides Section 315, another major section of VDOT specifications that needed to be revised was Section 211 – Asphalt Concrete. Section 315 primarily addresses construction and acceptance procedures while Section 211 addresses materials, mixture design, mixture production, mixture testing and acceptance. Both VDOT Section 211 and Section 315 heavily reference one another and both needed to be significantly revised to follow Draft EB-XX. In order to simplify the end product (Section 315A), language describing the necessary changes in Section 211 was inserted into the 315A specification as exceptions to Section 211. The revisions that were made to the VDOT 315 specification are italicized in the 315A document (Appendix E1) for the reader to understand what was changed. In addition, text in the 315A document describing the necessary changes is underlined, bolded and shown in red (i.e. on page 1, "***Eliminate Section 211.01 and replace with the following:***").

In order to identify specific VDOT mix designations that would be most appropriate for airport applications, a table of mix designations to use in specific applications (leveling, surface, intermediate/base in apron/taxiway or runway, as well as aircraft size) was developed and shown in Section 315A.02. Other major revisions that were made to VDOT Sections 315 and 211 were in modifying aggregate gradation to require the use of fine-graded mixes only, changing the acceptance testing responsibility from the contractor to the Engineer, and adding volumetric properties (air voids) and joint density test results to the acceptance criteria. Also, surface tolerances and grade language had to be adjusted to incorporate the language from the EB.

California:

The Draft EB-XX was used as a guide to amend the Caltrans Standard Specification Section 39 "Hot Mix Asphalt (HMA)" in order to be applicable as a SSAP Specification for projects at General Aviation Airports (AGW < 60,000 lbs.). The resulting example SSAP, labeled Caltrans SECTION 39A, is provided as Appendix F1. The Caltrans Standard Specifications, Section 39 "Hot Mix Asphalt (HMA)," is included as Appendix F2 to provide the reader with the complete specification package.

Challenges encountered and decisions made were:

- Correlating Maximum Aggregate Size (MAS) used in the Draft EB-XX with the MAS used in Caltrans Section 39 (which allows material to be retained on the MAS sieve) and understanding how this affects the requirements for VMA, VFA, and the Statistical Evaluations in Section 39-4.03F and Section 39-4.05B. Corrections were made in the Tables of Sections 39-2.03A, 39-4.03C, and 39-4.05A to bring the requirements in line with the Draft EB-XX recommendations.
- Caltrans no longer requires a test strip on any of its projects, assuming that the Contractor will want to conduct his own test strip. In section 39-1.07, the first sublot of 680 tones is used as a test strip of two paving lanes with a longitudinal joint. In section 39-2.03A and section 39-4.05B, it was decided to compound any pay adjustment for the joint with the pay adjustment for the lot that created the joint, because of the importance of durable, good performing joints.
- In Section 39-1.01, it was decided to make this SSAP applicable to dense graded mixes only. All references to Open Graded Friction Courses (OGFC) and Asphalt-Rubber mixes (RHMA-O, RHMA-O-HB, and RHMA-G) were deleted. This is because of the durability and FOD concerns with OGFC mixes, and the production and testing complications as well as the increased costs for the Asphalt-Rubber mixes.
- Selection of mix type and the Section 39 Specification method (3 options) required some engineering judgment, and is presented as an addition to Section 39-1.01.
- The maximum number of (680 tones) sublots to a lot was changed from 20 to 6, to make the QC/QA more applicable to the size and nature of GA Airport projects (see Section 39-4.05B). On large Caltrans projects, 20 sublots to a lot still results in a sufficient number of lots to properly control the project. The limited size (in tonnage) of GA Airport projects requires a much smaller number of sublots per lot. On the other hand, if mix production is cut short of the normal lot size, the Caltrans QA allows the use of less than 6 sublots. In this case, however, the statistics of Section 39-4.05 become less accurate. Caltrans can afford one inaccurate QA lot on a large project with many lots. On a (smaller) GA Airport project, this situation should be avoided. Section 39-4.05B was amended to allow a minimum of 4 and a maximum of 9 sublots to a lot in case of mix production stoppage.

Requirements for aggregate gradation, joints, skid resistant surfaces/saw-cut grooving, smoothness, and a maximum of 100% project payment were easily inserted.

It was decided that the SSHP aggregate gradations should not be modified because:

- The local HMA plants have their aggregate crushing operation set up and their aggregate stockpiles prepared for SSHP gradations.
- The Contractors' QC personnel are familiar with the SSHP specifications, aggregate gradations and HMA mix requirements.
- The SSHP aggregate gradations have evolved to be the most suitable for the local conditions.
- The SSHP aggregate tolerances and QC/QA requirements/criteria are based on the State aggregate gradations. Pairing the P-401 and P-401SP aggregate gradations with the SSHP QC/QA requirements and pay adjustments may create problems.
- The "best" SSHP mixes have successfully been used on heavily traveled highways, and should be expected to perform well for GA Airports.

While not necessary, the AI Regional Engineer sent Section 39A to the FAA Northwest Region Engineer for review. The following verbatim comments were provided:

- Paragraph 5-04.2- We would require the contractor to submit the mix design with materials that meet specification requirements. The FAA does not have a lab and we would not hire a lab to do any testing of contractor submitted materials. This paragraph should be modified.
- Paragraph 5-04.3(2) - We would recommend the load be covered when the temperature is below 70 degrees.
- Paragraph 5-04(5) B- We don't use prime coats for any asphalt pavements. The old cutback asphalt seemed to work; however the emulsified do not penetrate much and get picked up by equipment running over it. We also do not want to wait 5 days to work on a prime coated surface.
- Paragraph 5-04.3(5) C- What procedure would you use to fill cracks less than ¼ inch.
- Paragraph 5-04.3(7) A- We would require the anti-strip requirements be part of the contactors mix design that he submits for approval. We do not have a lab that would perform the test.
- Paragraph 5-04.3(8)A(3)- We would have an independent lab paid for by the airport sponsor do all the acceptance testing and not direct the contractor to do any acceptance sampling or testing. (5) Under Test Results it should be noted the FAA does not have a regional lab or use state labs.
- Paragraph 5-04.4- We would have a separate table in the specification to cover measurement and payment for all project quantities based unit prices and estimated quantity and would not address this as part of a specification.

Montana:

The majority of mixes for the Montana Department of Transportation's (MDT) are Superpave. A modification to the standard Superpave volumetric specification (401-1a) was made following the guidelines of the Draft EB-XX as offered by the research team for this project. For the purposes of this document, the moniker of 401-1c is used as the new SSAP specification (provided as Appendix G1) and 401-1a is the parent SSHP

specification (provided as Appendix G2). The parent specification is not a part of MDOT's Standard Specifications, but rather a part of what might be called their "Standard" Special Provisions. 401-1b is now an abandoned non-volumetric specification for Superpave.

Conversion of the highway specification 401-1a to match the guidelines of the Draft EB-XX was generally straight forward. The principal exception to this was the incorporation of Quality Assurance (QA).

Two items that were completely removed were language on rumble strips and on the use of the Hamburg testing device during mix design and as part of QA. Rumble strips are not a part of an airport facility and thus do not need to be addressed in 401-1c. The Hamburg is an integral part of MDT's mix design and QA processes. However, MDOT is the only owners of these testing machines in Montana. MDOT has them in two locations and will perform the tests for others if a contract is setup to do so. If an airport is being paved with Superpave mix, it is likely that MDT will have Hamburg test results for that mix during both mix design and production. In the event the airport owner would like this data, they can simply request copies of MDT's Hamburg test results for that mix. While MDT puts a lot of emphasis on Hamburg results, it seemed a bit onerous to carryover this testing requirement to GA airports, so it was removed.

Ohio.

The Draft EB-XX was applied to the standard Section 442 - Superpave Asphalt Concrete, as found in ODOT's SSSM. The resulting SSAP specification for ODOT, labeled as Section 442A, is 10 pages and is provided in Appendix H1. Section 442A is written specifically to modify ODOT Section 442. All other sections of ODOT's standard Specifications for Road and Bridge Construction, Section 400 Flexible Pavement, as referenced in SECTION 442A, are applicable. Recommended edits to these referenced sections are included in Section 442A.

ODOT Section 442 is provided as Appendix H2 to provide the reader with the entire new airfield specification package. Section 442A modifies the critical portions of Section 442 to ensure good performance for airfields under 60,000# AGW.

Examples of critical modifications include:

- Insertion of Table 442A.02-1 was required to correlate Traffic Level, Mix Type, and Aircraft Gross Weight
- Table 442A.02-2 was required to correlate Traffic Levels, Gyration Levels, and Aggregate Requirements to airfield applications
- Tables 442A.02-3 & -4 were required to change Aggregate Gradation and Mix Control Points
- Table 442a.02-5 was required for defining Performance Graded (PG) Asphalt Cement Requirements when Using Rap
- Adding these P-401 Requirements:
    1. 442A.19.3 Grade

2. 442A.19.2 Smoothness
3. 442A.07.2 Skid Resistance Surfaces/Saw-Cut Grooves.

Washington:

The draft EB-XX was used to amend the WSDOT Standard Specifications (M 41-10) Division 5-04 "Hot Mix Asphalt" and Division 9-03.8 "Aggregates for Hot Mix Asphalt" in order for these Divisions to be applicable as a SSAP specification for projects at General Aviation Airports (AGW < 60,000 lbs). The resulting example SSAP, labeled WSDOT Divisions 5-04A and 9-03.8A is provided as Appendix I1. The WSDOT Standard Specifications (M 41-10) Divisions 5-04 and 9-03.8 are provided as Appendix I2 to provide the reader with the complete specification package.

Challenges encountered and decisions made were:

- WSDOT performs all project testing in-house including JMF verification. The only submittal required from the Contractor is the proposed JMF. Additional text was inserted in Divisions 1-05.5(1), (2), and (3), and Division 5-04.3(7)A1 to assure sufficient QC testing by the Contractor, and the availability of a laboratory.
- WSDOT pays based on actual quantities used, as stated in 1-02.3 "Estimated Quantities". This may be a necessity on WSDOT type projects, but may lead to unacceptable over runs on GA Airport projects. New text for 1-02.3 "Quantities and Contract Price" has been included for optional use by the specifying Engineer. This text also clarifies that maximum total project pay is limited to 100% of the Contract Price (see also 1-06.2(2)B and 1-09.9). With that, the use of a "Force Account" had to be made more restrictive in Division 1-09.6.
- Although significantly different than the lot and sublot frame work of the P-401SP, the unique definition in the WSDOT SSHP of separate lots for Mix and for Density was left unchanged, because of its good logic, and also because of it being an integral part of the QA statistics. For Mix acceptance, the whole project can be one lot divided in 800 ton sublots, while for Density acceptance, lots are the lesser of 400 tons or a single day's production, each divided into 5 equal sublots.
- The WSDOT Specifications refer to three levels of Mix acceptance (see 5-04.3(8)A). It was decided that for all airfield projects (except minor repair work), the "statistical evaluation" procedures shall be used.
- WSDOT allows up to 20% RAP by total weight of aggregate in the mix for all courses. It was decided for 5-04.2 that this maximum limit be 15% RAP for the top course (per VII.3.E of the Draft EB-XX) and remain at 20% RAP for all the other intermediate and base layers to match WSDOT.
- The density requirements for the mat and joint have been tightened to a minimum of 92.0% and 91.0% of Gmm respectively (see Divisions 5-04.3(10)B1 and 5-04.3(10)B1b). For the mat density, a maximum of 97.0% of Gmm has been set. This upper limit was not set for the joints because it is intended to avoid mixes which compact to very low air void contents. This is controlled with the mat density and not joint density.

- In the Aggregate Gradation Table (see 9-03.8(6)); the WSDOT SSHP specification limit of 90% maximum passing one sieve smaller than the NMAS sieve was retained in the SSAP for its good logic, and to retain Contractor familiarity with the specification. Except for small differences in the % passing No. 200, the SSHP Specification for Aggregate Gradation is exactly the same as the Draft EB-XX proposed Aggregate Gradations.

Requirements for aggregate gradations, skid resistant surfaces/saw-cut grooving, smoothness, and a maximum of 100% project payment were easily inserted.

Missouri:

As mentioned earlier, the MODOT Aviation Section had already developed SSAP specifications prior to this project. This was possible since Missouri has been a Block Grant State since 1987. The MODOT SSAP specifications that were examined are Item MO-401F and Item MO-401S, Plant Mix Bituminous Pavement. The specifications are formatted similar to an FAA specification, but follows the material and mixture requirements of the Missouri Standard Specifications for Highway Construction. These SSAP specifications can be downloaded from the MODOT Aviation Section website at: http://www.modot.org/othertransportation/aviation/aviationgrantdoc.htm.
The Item MO-401F and Item MO-401S were examined under this project against the Draft EB-XX and generally followed those guidelines.

CHAPTER VIII. CONCLUSIONS AND RECOMMENDATION

Conclusions

- The SSHP specifications throughout the United States have different titles and identification numbers, diverse nomenclature and formats, and have a wide range of requirements and acceptance criteria. However, the overall general requirements could be grouped under the following eight critical elements to correlate with FAA pavement specifications:
  - Description.
  - Materials.
  - Composition.
  - Construction.
  - Acceptance.
  - Quality Control.
  - Measurement.
  - Payment.

- The SSHP specifications in all the states explored under this project involved a rather complex matrix of cross referencing among other related SSSM standards, test methods, etc.

- Interviews with FAA Region Offices provided the following conclusions:
  - AC 150/5100-13A provides a procedure for approval of State standards that is permitted under in US Code 47105(c).
  - Response to AC 150/5100-13A has been essentially nil.
  - For <60,000# AGW projects, it appears that the use of P-401[Superpave] for airport pavement is occasionally being implemented in the Southeast; less often in other states East of the Mississippi; and least often West of the Mississippi.
  - The P-401 is used much more often than P-401[Superpave]. The P-403, essentially P-401 without PWL, is being used as intended for <12,500# AGW pavement.
  - FAA Region Engineer consensus on the three material acceptance issues is:
    - *Joint Density* – should remain a pay factor item for airport pavement.
    - *PWL Procedures* – Strongly support PWL procedures for primary airport pavement, but may endorse lifting of PWL on small projects and <60,000# AGW.
    - *Contractor QC for material acceptance* – Support the overall FAA policy to retain material acceptance under Owner (or AOR) oversight.

- Interviews with various SAO personnel revealed sensitivity to Public Law and FAA Orders over a 10-year moratorium for future federal funding associated with use of SSHP specifications.
  - A "State Standard Airport Pavement (SSAP)" specification can be developed by each state for HMA airport pavements developed in accordance with the guidance provided by AC 150/5100-13A and submitted for FAA approval. The SSAP must

comply with critical requirements for airport pavements and instructions on how to reference, or insert, portions of SSHP specifications.

- In order for the 10-year limitation period on future federal funding to not apply, it is necessary that a State submit SSAP specifications in accordance with AC 150/5100-13A for approval by FAA Order 5300.1F. This premise is applicable for all weight categories of aircraft <60,000# AGW**.**
- By developing a SSAP specification and getting proper approval, the SAOs can then routinely use it on airport projects without being subject to the 10-year federal funding limitation. That is not the case if a single project uses a SSHP specification that has been used, modified or not modified, under MTS procedures as a SSAP specification for airport pavement.

- From the determinations above, the Research Team concluded that the guideline document should be written as a Draft FAA Engineering Brief (EB-XX) in a checklist format addressing the eight critical elements identified earlier.

- The general suggested approach in the Draft EB-XX to each critical element is summarized as follows:
  - Description - Two categories of AGW were determined to be sufficient based on current FAA criteria; <12,500# AGW and 12,500# to <60,000# AGW categories.
  - Highway Traffic Levels were correlated with AWG, as follows:

Traffic Level	Million ESALs	Aircraft Gross Weight, (#)
A	<0.3	<12,500
B	0.3 to <3.0	12,500 to <60,000

  - Materials - Use SSHP specifications for material requirements. This should be sufficient in most State DOTs. Aggregate gradation tied to AASHTO M 323 with exception of NMAS 4.75 mm. Asphalt binder tied to AASHTO M 320. Reference AAPTP Project 04-02 for further guidance on PG binder selection.
  - Composition - Use SSHP specifications requirements. The mix design and Job Mix Formula procedures are sufficient in most States.
  - Construction - Use SSHP specifications, except:
    - Joint Density – **Mandatory FAA acceptance requirement**
    - Smoothness and Grade – **Mandatory FAA acceptance requirement**.
  - Acceptance (QA) – Independent owner QA acceptance testing, separate from the contractor's QC testing, is a **Mandatory FAA requirement**. The owner's QA testing is the basis for pay. The percent within limits (PWL) is **Not Mandatory**. State procedures for Material Acceptance can generally be used as long as the testing is not performed by the contractor.
  - Quality Control – Use Contractor QC requirements in the SSHP specifications. This should be sufficient in most State DOTs. Correlate with P-401 specification.
  - Measurement – Using SSHP specifications for measurement requirements should be sufficient in most cases. Correlate with P-401 specification.

  - Payment – Using SSHP specifications for payment requirements should be sufficient in most SSHP specifications. Special administrative restrictions on total payment may be applicable.

- The initial Draft EB-XX was developed and then tested by having experienced and knowledgeable pavement engineers apply the guidelines through nine individual State test cases. Revisions were made to both the EB-XX and the new SSAP specifications through an iterative process. Based on these nine test cases, and a tenth State that already had a SSAP specification, the final Draft EB-XX appeared to provide thorough guidance for converting a SSHP specification into a SSAP specification that will meet all the critical requirements for an airport pavement supporting AGW <60,000#.

- Only an engineer that possesses a strong understanding of hot mix asphalt materials, mix design properties, construction and specifications should be utilized for the task of converting a SSHP specification into a SSAP specification following the guidelines of Draft EB-XX.

- While the nine SSAP specifications developed as test cases are provided in their entirety as appendices of this report, they should not be construed as approved by the proper FAA authorities for immediate use. Only a few of these were actually reviewed by the FAA State Aviation Offices for comment. As with any specification, the SSAP specifications will need to be tested and refined over time.

Recommendation

- The final Draft EB-XX, Guidelines for Developing State Standard Airport Pavement (SSAP) specifications (Chapter 10 of this report), should be considered for implementation and publication as an approved FAA Engineering Brief.

CHAPTER IX. REFERENCES

Ref #1 – Request for Proposal, Project 06-05, Guidelines for Use of Highway Specifications for HMA Airport Pavements, July 27, 2007.

Ref #2 – FAA AC 150/5100-13A, Development of State Standards for Nonprimary Airports, September 28, 1999.

Ref #3 – FAA AC 150/5320-6D, Airport Pavement Design and Evaluation, Change 4, June 23, 2006.

Ref #4 – FAA AC 150/5370-10C, Standards for Specifying Construction of Airports, Item P-401, Plant Mix Bituminous Pavement, September 29, 2007.

Ref #5 – Engineering Brief No. 59A, Item P-401 (Superpave), Plant Mix Bituminous Pavement, May 12, 2006.

Ref #6 – Draft Final Report, Advanced Asphalt Technologies, LLC, Airfield Asphalt Pavement Technology Program Project 04-02: PG Binder Grade Selection for Airfield Pavements, November 15, 2007.

Ref #7 – Draft Final Report, Burns, Cooley, Dennis, Inc., Airfield Asphalt Pavement Technology Program Project 04-03: Implementation of Superpave Mix Design for Airfield Pavements, November, 2008.

Ref #8 – AASHTO, Standard Specifications for Transportation Materials and Methods of Sampling and Testing, Part 1B: Specifications, 25th Edition, 2006 - AASHTO M 323, Superpave Volumetric Mix Design, 2007.

Ref #9 – Asphalt Institute, Superpave Mix Design Manual (SP-2), Third Edition, 2001.

Ref #10 - Federal Aviation Administration Advisory Circular 150/5370-10C, Standards for Specifying Construction of Airports, Item P-403, Plant Mix Bituminous Pavement (Base, Leveling or Surface Course), September 27, 2007.

Ref #11 - Airfield Asphalt Pavement Technology Program, Project 06-05, Final Report, Use of Reclaimed Asphalt Pavements (RAP) in Airfields HMA Pavements, July, 2008.

CHAPTER X. DRAFT ENGINEERING BRIEF (EB)-XX

Guidelines for Developing State Standard Airport Pavement (SSAP) Specifications

I. Introduction.

Federal regulations permit the use of State Department of Transportation highway specifications for airports with runways less than 5,000 feet long and service aircraft weighing less than 60,000 pounds. The use of the state specification provides opportunities to obtain high quality hot mix asphalt (HMA) pavements for airports at a more affordable cost. Since state specifications are primarily designed for highway pavements, selection of the proper specification and criteria for airport pavements is not always compatible. Specifications that do not consider key factors for airport pavement may result in lower airport pavement performance than typically achieved using Federal Aviation Administration (FAA) criteria. This document has been prepared as guidelines to ensure that the critical elements in the FAA HMA specifications [P-401, P-401(SP), and P-403] are being addressed when state specifications are selected.

II. Purpose.

The purpose of this engineering brief is to provide interim guidance for developing a State Standard Airport Pavement (SSAP) specification in conjunction with supporting sections of the respective State Standard Highway Pavement (SSHP) specifications and State Standard Specifications Manual (SSSM). The SSAP specifications, after being developed with the use of this document, should include the elements necessary to insure good airport pavement performance. This engineering brief will be limited to HMA pavement for aircraft gross weight (AGW) less than 60,000 pounds. The guidelines are applicable to the Superpave (SP) Method and Marshall Method of mix design.

III. Difference between Airport and Highway Pavements.

It is important to recognize that airport pavements are fundamentally different from highway pavements. Highway pavements are typically constructed to support a high volume of automobile and truck traffic that can amount to thousands of load repetitions per day. The vast majority of airport pavements see only a few dozen aircraft passes per day. For some airport pavements, such as overruns and shoulders, only a few dozen loadings may be experienced in an entire 20-year lifetime.

In the absence of high volume loading, the overriding cause of distress in these pavements is the continual exposure to the damaging effects of the sun, air, rain, and other climatic phenomena. Airport pavements predominately exhibit environmental associated distress types, such as weathering, raveling, and cracking. This is especially

true for airfields designed to support relatively light weight aircraft, such as General Aviation (GA) airports. On the contrary, highway pavements are more prone to load associated distress types, such as rutting (permanent deformation) and fatigue cracking. Foreign object damage (FOD) is of great concern to the safe operation of aircraft, while it is not a major issue on highway pavements. Loose aggregate particles from in-service airport pavements can be ingested into high thrust jet engines and/or impact critical aircraft surfaces. The FOD from loose aggregate particles has been identified as the cause of at least one airplane crash that resulted in loss of life. Due to the safety implications, minimizing FOD must be considered one of the primary goals of the airfield pavement design and construction processes.

Recognizing the specific challenges of airport pavements with regard to traffic volume, distress types, and FOD, the construction specifications must contain specific criteria to ensure that the airport pavement is stable, durable, and impermeable to permit safe, long term performance.

IV. Definitions.

"State Standard Highway Pavement (SSHP)" specifications – SSHP specification is used throughout this document to identify the current State specifications for HMA highway pavements covering materials, mix design and selection, manufacture, transport, placement, compaction and acceptance of HMA pavement as well as the contractor's quality control plan and requirements.

"State Standard Specifications Manual (SSSM)" - SSSM is used throughout this document to identify the current edition of the State Standard Specifications of Highway Construction, State Standard Specifications for Transportation Systems, State Standard Specification for Road and Bridge Construction, or any other title used for a SSSM.

"State Standard Airport Pavement (SSAP)" specifications – SSAP specification is used throughout this document to identify a State specifications for HMA airport pavements developed in accordance with the guidance provided by AC 150/5100-13A and submitted for FAA approval. The SSAP specification must comply with critical requirements for airport pavements and instructions on how to reference, or insert, portions of SSHP specifications, or vice versa.

V. Background.

The provisions of US Code 47114(d) (5) are stated as follows:

> (1) IN GENERAL**.** — The Secretary may permit the use of State highway specifications for airfield pavement construction using funds made available under this subsection at nonprimary airports with runways of 5,000 feet or shorter serving aircraft that do not exceed 60,000 pounds gross weight if the Secretary determines that—
>
> (i) safety will not be negatively affected; and

(ii) the life of the pavement will not be shorter than it would be if constructed using Administration standards.

(2) LIMITATION. — An airport may not seek funds under this subchapter for runway rehabilitation or reconstruction of any such airfield pavement constructed using State highway specifications for a period of 10 years after construction is completed unless the Secretary determines that the rehabilitation or reconstruction is required for safety reasons.

The provisions of FAA Order 5300.1F are stated as follows:

13. STATE STANDARDS.
a. State standards may be developed for airports that are not primary airports, in accordance with 49 USC 47105(c) and AC 150/5100-13A, *Development of State Standards for Nonprimary Airports*. State highway specifications may be permitted for airfield pavement construction at Nonprimary airports in accordance with US Code 47114(d)(5) as amended by P.L. 106-181(April 2000). For all other airports, the FAA standards shall be used, except as modified in accordance with this Order.
b. Director of Airport Safety and Standards, AAS-1 (or designee), specifically reserves approval authority for State standards.
c. Standards developed under this section must be updated periodically and reflect FAA standards where applicable.

The provisions of US Code 47105(c) is stated as follows:

State Standards for Airport Development.--The Secretary may approve standards (except standards for safety of approaches) that a State prescribes for airport development at Nonprimary public-use airports in the State. On approval under this subsection, a State's standards apply to the Nonprimary public-use airports in the State instead of the comparable standards prescribed by the Secretary under subsection (b) (3) of this section. The Secretary, or the State, with the approval of the Secretary, may revise standards approved under this subsection.

Based on legal and authoritative directives impacting the use of SSHP specifications for airports, this Engineering Brief (EB)-XX establishes the guidelines for development of SSAP specifications according to the following conclusions:

- AC 150/5100-13A provides a procedure for approval of State standards that is permitted under in US Code 47105(c).
- SSAP specifications can be developed by each state for HMA airport pavements in accordance with the guidance provided by AC 150/5100-13A and submitted for FAA approval. The SSAP must comply with critical requirements for airport pavements and instructions on how to reference, or insert, portions of SSHP specifications, vice versa.

- In order for the 10-year limitation period on future federal funding to not apply, it is necessary that a State submit SSAP specifications in accordance with AC 150/5100-13A for approval under authority of FAA Order 5300.1F. This premise is applicable for all weight categories of aircraft <60,000# AGW**.**

By developing SSAP specifications and obtaining proper approval, the State Aviation Offices (SAO) can then routinely use the SSAP specifications on airport projects without being subject to the 10-year federal funding limitation. That is not the case if a single project uses a SSHP specification that has been used, modified or not modified, under MTS procedures as a SSAP specification for airport pavement

VI. Basis for Format Checklist Items for SSAP Specification.

Throughout the United States, the individual States' specifications covering HMA pavement generally have different titles, identification numbers, a range of criteria and requirements, and State-specific test methods which are based on local experience for material characteristics, environmental conditions, political considerations, etc. The overall general format and requirements for SSAP specifications can be grouped under the following topical areas:

- **Description:** definitions, explanations, etc.
- **Materials:** normally covers coarse aggregate, fine aggregate, asphalt binder, reclaimed asphalt material, etc.
- **Composition:** includes information about the mix design and job mix formula. This is under MATERIALS in some SSHP specifications.
- **Construction:** includes information on plant, equipment, placement and compaction procedures, etc.
- **Acceptance:** establishes the criteria and measure for material acceptance based on established sampling and testing requirements.
- **Quality Control:** information for contractor's quality control program.
- **Measurement:** identifies unit (units) for accountability.
- **Payment:** identifies item (items) per unit for payment calculation.

These topical areas form the outline for the next section, which represents a checklist of specification requirements that should be met when developing SSAP specifications, or amending SSHP specifications, for airport pavement applications [AGW <60,000#].

VII. Checklist of SSAP Specification Requirements.

1. Description.

A. General. This section should describe airport pavement courses as composed of mineral aggregate and asphalt binder mixed in a central mixing plant and placed on a prepared course in accordance with these specifications and must conform to the lines, grades, thicknesses, and typical cross sections shown on the plans. Each course must be constructed to the depth, typical section, and elevation required by the plans and must be rolled, finished, and approved before the placement of the next course. The materials and composition must meet the appropriate requirements in the SSSM and SSHP specifications, except as modified herein.

B. Terminology. There are terms used in SSHP specifications which are synonymous with airport pavement terminology that should be identified in the development of SSAP specifications, or in amending SSHP specifications for airport pavement applications. Common examples of the synonymous terms include:

- Department, synonymous with airport owner [or owner authorized representative (OAR)]
- Engineer, synonymous with airport owner [or OAR]
- Roadway, synonymous with airport pavement

C. Traffic Levels. Performance-Graded (PG) asphalt binder, Superpave (SP) aggregate consensus properties, and SP mix design requirements in SSHP specifications are all determined based on traffic levels defined in terms of 18,000 pound Equivalent Single Axle Loads (ESALs). In order to bridge the criterion placed in highway specifications and criterion used in airfield specifications, a correlation was established between ESALs and AGW less than 60,000#. This correlation is shown in Table 1 which establishes a Traffic Level A and a Traffic Level B.

Table 1 – Traffic Level Correlation for Superpave HMA Mixtures.

Traffic Level	Million ESALs	Aircraft Gross Weight, (#)
A	<0.3	<12,500
B	0.3 to <3.0	12,500 to <60,000

2. Materials.

A. General Requirements. Meet the material requirements in the appropriate sections of the SSHP and SSSM, except as modified herein, for the following:

- Coarse Aggregate
- Fine Aggregate
- Mineral Filler
- Performance-Graded (PG) Asphalt Binder.

B. Asphalt Binder. The PG asphalt binder must conform to the requirements of AASHTO M-320 and any additional SSHP specifications, or referenced sections of the SSSM requirements. The PG grade specified should be the standard grade normally required by the State DOT for the project's geographic location and traffic level. A PG asphalt binder grade bump is required for Traffic Level B, Table 1; i.e., one PC binder grade adjustment of +6 degrees centigrade on the high temperature grade. The low temperature grade should remain the same..

3. Composition.

A. Mix Composition and Lab Compaction Level. The HMA plant mix must be composed of a mixture of well-graded aggregate, filler, asphalt binder and anti-strip agent **(**if required). The several aggregate fractions must be sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula (JMF) as specified in the SSHP specifications, except as modified herein. For Marshall Method mix design, a 50-Blow mixture shall be used for Traffic Level A and B. For Superpave Method mix design, Ndes = 50 gyrations is to be used for Traffic Level A and Ndes = 65 gyrations is to be used for Traffic Level B.

B. Job Mix Formula (JMF). No HMA mixture for payment will be produced until a JMF has been approved in writing by the Engineer. The HMA mixture shall be designed using Superpave Method, or Marshall Method, of mix design in accordance with SSHP specifications requirements. The JMF must be submitted to the Engineer at least 15 days prior to the start of paving operations. The JMF shall have been developed no more than three months prior to submittal and must include as a minimum:

- Percent passing each sieve size for total combined gradation, individual gradation of all aggregate stockpiles and percent by weight of each stockpile used in the job mix formula.
- Percent of asphalt binder.
- PG asphalt binder used, and type of modifier, if used.
- Mixing temperature.
- Compaction temperature.
- Temperature of mix when discharged from the mixer.
- Temperature-viscosity relationship of the asphalt binder.
- Plot of the combined gradation on the Federal Highway Administration (FHWA) 45 power gradation curve.
- Graphical plots of air voids, voids in the mineral aggregate, and unit weight versus asphalt binder content.
- Percent natural sand, if used.
- Percent fractured faces.
- Antistrip agent (if required).
- Date the job mix formula was developed.

C. JMF Test Submittal. The Contractor must submit to the Engineer the results of verification testing of three (3) HMA samples prepared at the optimum asphalt content. The average of the results of this testing must indicate conformance with the JMF requirements, except as modified herein, for criteria listed as follows:

- **Marshall Method** - Traffic Level A and B: Mix Design @ 50-Blow Marshall – Stability [pounds], Flow [0.01 in], Air Voids [percent], and Voids in Mineral Aggregate [percent], Tensile Strength Ratio [percent].

- **Superpave Method** - Ndes Gyrations, Nini Gyrations, Nmax Gyrations, Air Voids @Ndes [percent], Voids Filled with Asphalt @ Ndes [percent], Dust Proportion [percent], Fine Aggregate Angularity, %Gmm@Nini, %Gmm@Nmax, Tensile Strength Ratio [percent].

D. JMF Aggregate Gradation.

- **Marshall Method** - The aggregate gradation must be specified from Table 2. The gradations are defined by maximum aggregate size (MAS), which is the sieve size that is one size larger than the first sieve to retain material. Table 2 gradation bands are from the FAA P-401 and P-403 specifications and provide a 1½-inch, 1.0-inch, ¾-inch, and ½-inch MAS. The 1½-inch MAS (from P-403) is normally reserved for base course layers while the ½-inch MAS (from P-403) is primary used as a leveling material for very thin lifts. The ¾-inch MAS and the 1-inch MAS (from P-401 and P-403) are the dominant aggregate gradations used for base and surface course mixes.

Table 2 - Aggregate Gradation, After FAA Item P-401 & P-403.

Sieve Size	All Pavements			
	Percent by Weight Passing Sieves			
	1.5 in. MAS	1.0 in. MAS	3/4 in. MAS	1/2 in. MAS
1.5 in.(37.5 mm)	100	100	100	100
1.0 in.(25.0 mm)	86 to 98	100	100	100
¾ in.(19.0 mm)	68 to 93	76 to 98	100	100
½ in.(12.5 mm)	57 to 81	66 to 86	79 to 99	100
⅜ in.(9.5 mm)	49 to 69	57 to 77	68 to 88	79 to 99
No. 4(4.75 mm)	34 to 54	40 to 60	48 to 68	58 to 78
No. 8(2.36 mm)	22 to 42	26 to 46	33 to 53	39 to 59
No. 16(1.18 mm)	13 to 33	17 to 37	20 to 40	26 to 46
No. 30(0.600 mm)	8 to 24	8 to 24	14 to 30	19 to 35
No. 50 (0.300 mm)	6 to 18	4 to 12	9 to 21	12 to 24
No. 100(0.150 mm)	4 to 12	6 to 16	6 to 16	7 to 17
No. 200 (0.075 mm)	3 to 6	3 to 6	3 to 6	3 to 6

- **Superpave Method** - The aggregate gradations must be specified from Table 3. The gradations are defined by nominal maximum aggregate size (NMAS), which is one sieve size larger than the first sieve to retain more than 10 percent. Generally, the NMAS is one sieve size smaller that the MAS. Table 3 aggregate gradations are representative of the NMAS Superpave mixtures with gradations requirements based on control points established by AASHTO M 323.

Table 3 - Aggregate Gradation Control Points, After AASHTO M 323.

Sieve Size	All Pavements				
	Percent by Weight Passing Sieves				
	1 1/2 in NMAS (37.5 mm) Control Points	1.0 in. NMAS (25.0 mm) Control Points	3/4 in NMAS (19 mm) Control Points	1/2 in NMAS (12.5 mm) Control Points	3/8 in NMAS (9.5 mm) Control Points
1.5 in (50.0 mm)	100 to 100				
1.25 in (37.5 mm)	90 to 100	100 to 100			
1.0 in.(25.0 mm)		90 to 100	100 to 100		
¾ in.(19.0 mm)	90 to 100		90 to 100	100 to 100	
½ in.(12.5 mm)				90 to 100	100 to 100
⅜ in.(9.5 mm)					90 to 100
No. 4(4.75 mm)					
No. 8(2.36 mm)	15 to 41	19 to 45	23 to 49	28 to 58	32 to 67
No. 16(1.18 mm)					
No. 30(0.600 mm)					
No. 50 (0.300 mm)					
No. 100(0.150 mm)					
No. 200 (0.075 mm)	0 to 6	1 to 7	2 to 8	2 to 10	2 to 10

The combined aggregate gradation shall be classified as coarse-graded when it passes below the Primary Control Sieve (PCS) control point as defined in Table #4. All other gradations shall be classified as fine-graded.

Table 4 - Gradation Classification, After AASHTO M 323.

PCS Control Point for Mixture Nominal Maximum Aggregate Size (% Passing)					
Nominal Maximum Aggregate Size	37.5 mm	25.0mm	19.0 mm	12.5 mm	9.5 mm
Primary Control Sieve	9.5 mm	4.75 mm	4.75 mm	2.36 mm	2.36 mm
PCS Control Point (% Passing)	47	40	47	39	47

At the discretion of the design engineer, the 37.5 mm, 25.0 mm, and 19.0 mm NMAS gradations may be used for base and/or intermediate course layers; the 9.5 mm and 12.5 mm NMAS gradations may be used for leveling course layers; and the 12.5 mm and 19.0 mm NMAS gradations are normally specified for surface course layers. All surface course layers must be specified as the fine-graded aggregate classification.

E. Reclaimed Asphalt Pavement (RAP) Material. RAP material may be used in the JMF in accordance with the following provisions:

- The RAP shall not contain any material that has been treated with a coal-tar sealer rejuvenator or material that contains coal-tar.
- The maximum percent of RAP allowed in the Job Mix Formula is 15% which may be increase up to 30% if the asphalt binder grade is lowered by one grade to account for hardening with the addition of the RAP according to Table 5 [After AAPTP 05-06, Final Report, Use of Reclaimed Asphalt Pavements (RAP) in HMA Mixes of Asphalt Pavements, July, 2008].

Table 5 – Recommendation on the use of RAP [After AAPTP 05-06, July 2008].

Type of Mix	Recommended Virgin Binder Grade	RAP Percentage		
		Recovered RAP Grade		
		PGXX-22 Or Lower	PGXX-16	PGXX-10 Or Higher
Surface and Base Mix	No Change in Binder Selection	<20%	<15%	--
Base Mix	Select virgin binder in grade softer than normal (i.e. select a PG58-28 if a PG64-22 would normally be used)	15%-30%	15%-30%	--
Surface and Base Mix	Follow recommendations from blending charts	--	--	<10%

4. Construction.

A. Plant and Equipment. Comply with requirements contained in SSHP specifications, or as specified in other sections referenced in the SSSM, for plants and methods of operation for preparing all plant-mixed HMA mixtures, and the requirements for the equipment to be used in the construction of the pavement layers, except as modified herein.

B. General Construction Requirements. Construction of plant-mixed HMA pavement layers must be in accordance with SSHP specifications, or as specified in

other sections referenced in the SSSM, except as modified herein. The construction requirements are normally associated with, but not limited to, contractor quality control and acceptance testing; limitations placed on construction operations; preparation of asphalt binder, aggregates, and HMA composition; transportation of HMA; preparation of application surface, including placement of bituminous tack coat; placing the HMA mixture; compaction operations; and protection of the finished surface.

C. Joint Construction. High quality joint construction is required for airport pavement. The formation of all joints shall be made in such manner as to ensure a continuous bond between the courses and obtain the required density for acceptance. All joints shall have the same texture as other sections of the course and meet the acceptance requirements for smoothness and grade. Most SSHP specifications do not contain acceptance criteria for joint density; however, for airport pavement, the joint construction quality warrants acceptance criteria and consideration when pay factor, sliding scale, pass/fail, and/or other acceptance/payment methodologies are used in SSHP specifications, or as referenced in other sections in the SSSM.

D. Test Section [or Initial Production Lot]. Prior to full production, the contractor shall prepare and place a quantity of HMA mixture according to the JMF. As a minimum, and since joint density is require for acceptance, the amount of mixture shall be sufficient to construct a test section a minimum of 300 ft. long and 30 ft. wide**,** placed in two lanes, with a longitudinal cold joint, and shall be of the same depth specified for the construction of the course which it represents. A cold joint is an exposed construction joint at least 4 hours old or whose mat has cooled to less than 160° F. The underlying grade or pavement structure upon which the test section is to be constructed shall be the same as the remainder of the course represented by the test section. The equipment used in construction of the test section shall be the same type and weight to be used on the remainder of the course represented by the test section. The test section must be evaluated for acceptance as a single lot in accordance with the acceptance criteria specified in the SSHP specifications, or as specified in other sections referenced in the SSSM, except as modified herein. The test section shall be divided into equal sublots. As a minimum, the test section shall consist of three sublots. The test section shall be considered acceptable if it meets the acceptance criteria specified in the SSHP specification, or as specified in other sections referenced in the SSSM, or as modified herein.

E. Skid Resistance Surfaces/Saw-Cut Grooves. If shown on the plans, skid resistant surfaces for HMA pavements shall be provided by construction of saw-cut grooves. Pavement shall not be grooved within 15-days after placement of the surface course, of as approved by the Engineer. Transverse grooves shall be saw-cut in the pavement forming a ¼ inch wide by ¼ inch deep by 1-½ inches center to center configuration. The grooves shall be continuous for the entire length of the groove. They shall be saw-cut transversely in the pavement to within 10 feet of the pavement edge to allow adequate space for equipment operation. The tolerances for saw-cut grooves shall meet the following:

- **Alignment tolerance** – Plus or minus 1-½ inches in alignment for 75 feet.
- **Groove tolerance** – Minimum depth 3/16 inch, except that not more than 60 percent of the grooves shall be less than ¼ inch. Maximum depth 5/16 inch. Minimum width ¼ inches. Maximum width 5/16 inch.
- **Center-to-center spacing** – Minimum spacing 1-3/8 inches. Maximum spacing 1-5/8 inches.

Grooves shall not be less than 6.0 inches and not more than 18.0 inches from in-pavement light fixtures. Cleanup of waste material shall be continuous during the grooving operation. All waste material shall be removed from the pavement surface and disposed of off-site in accordance with governing laws and regulations. All arrangements for disposal of waste material shall be made prior to the start of grooving. Waste material shall not be allowed to enter the airport storm or sanitary sewer system.

5. Material Acceptance.

A. Acceptance Sampling and Testing. Unless otherwise specified, all acceptance sampling and testing necessary to determine conformance with the requirements specified in this section will be performed by the engineer at no cost to the contractor except that coring as required in this section shall be completed and paid for by the contractor. Testing organizations performing these tests must meet the requirements of ASTM D 3666. All equipment in contractor furnished laboratories shall be calibrated by an independent testing organization prior to the start of operations at the contractor's expense.

B. Plant Produced Material (PPM). The PPM shall be tested by the engineer for air voids in accordance with requirements of SSHP specifications on lot basis. The lot will be consistent with that defined by the SSHP specifications and as a guideline may be considered as:

- One day's production not to exceed 2,000 tons, or
- A half day's production where a day's production is expected to consist of between 2,000 and 4,000 tons, or
- Similar subdivision for tonnages over 4,000 tons.

Each lot will consist of four equal sublots. Sufficient material for testing and/or preparation of test specimens for all testing will be sampled by the engineer for each sublot on a random basis, in accordance with the procedures contained in ASTM D 3665. The engineer shall prepare laboratory compacted test specimens in accordance with procedures outlined in the SSHP specifications, or as specified in other sections referenced in the SSSM. Each set of laboratory compacted specimens will consist of two test portions prepared from the same sample increment.

As an option, if required by the SSHP specifications, the material passing the #8 sieve and/or the #200 sieve will be determined by the engineer.

C. Field Placed Material (FPM). Material placed in the field shall be tested for mat and joint density by the engineer on a lot basis.

- **Mat Density.** The lot size shall be the same as that determined for the PPM and shall be divided into four equal sublots. Core(s) shall be taken, as required by the SSHP specifications, from each sublot.
- **Joint Density.** The lot size shall be the total length of longitudinal joints constructed by the same lot determined for the PPM and shall be divided into four equal sublots. For each sublot, the same number of joint core(s) shall be taken, as required by the SSHP specifications for the mat.

D. Acceptance Criteria. Acceptance will be based on the following characteristics of the HMA mixture and completed pavement as well as the implementation of the contractor quality control plan and engineer acceptance test results:

****

NOTE TO THE ENGINEER: The engineer should exercise judgment to use similar acceptance criteria from SSHP specifications, or other sections referenced in the SSSM, for SSAP specifications. Specific acceptance criteria have been labeled as **Mandatory**; whereas, the remaining criteria must be considered as **Optional**, at the discretion of the engineer. The **Optional** criterion is predicated on the engineers' judgment that the SSHP specifications, or other sections referenced in the SSSM, have demonstrated reasonable confidence in their application for well-performing pavements.

****

- **Air Voids [Mandatory].** Evaluation for acceptance of each lot of PPM for air voids shall be based on criteria provided by the SSHP specifications. As a guideline for airport pavement, the target PPM air voids is 3.5 ± 1.0 percent for Marshall Method mixtures and 4.0 ± 1.0 percent for the Superpave Method mixtures.
- **Pass #8 Sieves [Optional].** If and as required by SSHP specifications, or other sections referenced in the SSSM.
- **Pass #200 Sieves [Optional].** Optional, if and as required by SSHP specifications, or other sections referenced in the SSSM..
- **Mat Density [Mandatory]**. Evaluation for acceptance of each FPM lot for mat density shall be based on criteria provided by the SSHP specifications. As a guideline for airport pavement, the average in-place mat density is expressed as a percentage of the average theoretical maximum density (TMD) for the lot. The average TMD for each lot will be determined as the average TMD of the sublots.

The average in-place mat density for a lot shall be 94.5% ± 1.0% TMD with the allowable tolerance from 92.0% to 97.0% of TMD for individual tests.

- **Joint Density [Mandatory].** Evaluation for acceptance of each FPM lot for joint density shall be based on the average in-place joint density expressed as a percentage of the average TMD for the lot. As a guideline for airport pavement, the average TMD for each lot will be determined as the average TMD of the sublots. The average in-place joint density for a lot shall be 93.0% ± 2.0% TMD with the allowable tolerance of 91.0% to 97.0% of TMD for individual tests.
- **Thickness [Optional].** Thickness shall be evaluated for compliance by the Engineer to the requirements shown on the plans. Measurements of thickness shall be made by the Engineer using cores extracted for each sublot for density measurement, or as required by SSHP specifications, or as specified in other sections referenced in the SSSM.
- **Smoothness [Mandatory].** The final surface shall be free from roller marks. The finished surfaces of each course of the pavement, except the finished surface of the final course, shall not vary more than ⅜ inch when evaluated with a 16 foot straightedge. The finished surface of the final course of pavement shall not vary more than ¼ inch when evaluated with a 16 foot straightedge. The lot size shall be 2,000 square yards. Smoothness measurements shall be made at 50 foot intervals and as determined by the Engineer. In the longitudinal direction, a smoothness reading shall be made at the center of each paving lane. In the transverse direction, smoothness readings shall be made continuously across the full width of the pavement. However, transverse smoothness readings shall not be made across designed grade changes. At warped transition areas, straightedge position shall be adjusted to measure surface smoothness and not design grade transitions. When more than 15 percent of all measurements within a lot exceed the specified tolerance, the Contractor shall remove the deficient area to the depth of the final course of pavement and replace with new material. Skin patching shall not be permitted. Isolated high points may be ground off providing the course thickness complies with the thickness specified on the plans. High point grinding will be limited to 15 square yards. Areas in excess of 15 square yards will require removal and replacement of the pavement in accordance with the limitations noted above.
- **Grade [Mandatory].** The finished surface of the pavement shall not vary from the grade line elevations and cross sections shown on the plans by more than ½ inch (12.70 mm). The finished grade of each lot will be determined by running levels at intervals of 50 feet (15.2 m) or less longitudinally and all breaks in grade transversely (not to exceed 50 feet) to determine the elevation of the completed pavement. The Contractor shall pay the cost of surveying of the level runs that shall be performed by a licensed surveyor. The documentation, stamped and signed by a licensed surveyor, shall be provided by the Contractor to the Engineer. The lot size shall be 2,000 square yards (square meters). When more than 15 percent of all the measurements within a lot are outside the specified tolerance, or if any one shot within the lot deviates ¾ inch or more from planned

grade, the Contractor shall remove the deficient area to the depth of the final course of pavement and replace with new material. Skin patching shall not be permitted. Isolated high points may be ground off providing the course thickness complies with the thickness specified on the plans. The surface of the ground pavement shall have a texture consisting of grooves between 0.090 and 0.130 inches wide. The peaks and ridges shall be approximately 1/32 inch higher than the bottom of the grooves. The pavement shall be left in a clean condition. The removal of all of the slurry resulting form the grinding operation shall be continuous The grinding operation should be controlled so the residue from the operation does not flow across other lanes of pavement. High point grinding will be limited to 15 square yards. Areas in excess of 15 square yards will require removal and replacement of the pavement in accordance with the limitations noted above.

6. Contractor Quality Control.

A. General. The contractor shall develop a Quality Control Program in accordance with:

1. FAA AC 150/5320-10C - Standards for Specifying Construction of Airports, Section 100 - Contractor Quality Control, of the General Provisions

or

2. the Section specifying Contractor Quality Control in the SSHP specification requirements, or as specified in other sections referenced in the SSSM, except as modified herein.

The program shall address all elements which affect the quality of the pavement including, but not limited to:

- Mix Design
- Aggregate Grading
- Quality of Materials
- Stockpile Management
- Proportioning
- Mixing and Transportation
- Placing and Finishing
- Joints
- Compaction
- Surface Smoothness

B. Laboratory Testing. The contractor shall provide a fully equipped asphalt laboratory located at the plant or job site. It shall be available for joint use by the contractor for quality control testing and by the engineer for acceptance testing and must have adequate equipment for the performance of the tests required by these specifications. The engineer shall have priority in use of the equipment necessary for acceptance testing.

- The effective working area of the laboratory shall be a minimum of 150 square feet with a ceiling height of not less than 7.5 feet. Lighting shall be adequate to illuminate all working areas. It shall be equipped with heating and air conditioning units to maintain a temperature of 70 degrees F + 5 degrees.
- Laboratory facilities shall be kept clean and all equipment shall be maintained in proper working condition. The engineer shall be permitted unrestricted access to inspect the contractor's laboratory facility and witness quality control activities. The engineer will advise the contractor in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to be adversely affecting test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are satisfactorily corrected.

C. Quality Control Testing. The contractor shall perform all quality control tests necessary to control the production and construction processes applicable to these specifications and as set forth in the Quality Control Program. The testing program shall include, but not necessarily limited to, tests for the control of asphalt content, aggregate gradation, temperatures, aggregate moisture, field compaction, and surface smoothness. A Quality Control Testing Plan shall be developed as part of the Quality Control Program.

- Asphalt Content. A minimum of two extraction tests shall be performed per lot in accordance with ASTM D 2172 for determination of asphalt content. The weight of ash portion of the extraction test, as described in ASTM D 2172, shall be determined as part of the first extraction test performed at the beginning of plant production; and as part of every tenth extraction test performed thereafter, for the duration of plant production. The last weight of ash value obtained shall be used in the calculation of the asphalt content for the mixture.
- Gradation. Aggregate gradations shall be determined a minimum of twice per lot from mechanical analysis of extracted aggregate in accordance with AASHTO T 30 and ASTM C 136 (dry sieve). When asphalt content is determined by the nuclear method, aggregate gradation shall be determined from hot bin samples on batch plants, or from the cold feed on drum mix or continuous mix plants, and tested in accordance with ASTM C 136 (dry sieve) using actual batch weights to determine the combined aggregate gradation of the mixture.

- Moisture Content of Aggregate. The moisture content of aggregate used for production shall be determined a minimum of once per lot in accordance with ASTM C 566.
- Moisture Content of Mixture. The moisture content of the mixture shall be determined once per lot in accordance with ASTM D 1461.
- Temperatures. Temperatures shall be checked, at least four times per lot, at necessary locations to determine the temperatures of the dryer, the bitumen in the storage tank, the mixture at the plant, and the mixture at the job site.
- In-Place Density Monitoring. The contractor shall conduct any necessary testing to ensure that the specified density is being achieved. A nuclear gauge may be used to monitor the pavement density in accordance with ASTM D 2950.
- Additional Testing. Any additional testing that the contractor deems necessary to control the process may be performed at the contractor's option.
- Monitoring. The engineer reserves the right to monitor any or all of the above testing.
- Aggregate Quality. The contractor shall perform specific gravity and absorption tests on all aggregates used. These tests will be run at least once per week. If the specific gravity parameters vary more than plus or minus 10 percent of the values obtained in the mix design, the contractor will be required to submit a new job mix formula.

D. Sampling. When directed by the engineer, the contractor shall sample and test any material which appears inconsistent with similar material being sampled, unless such material is voluntarily removed and replaced or deficiencies corrected by the contractor. All sampling shall be in accordance with standard procedures specified.

E. Control Charts. Subject to the direction of the engineer the contractor shall maintain linear control charts both for individual measurements and range (i.e., difference between highest and lowest measurements) for aggregate gradation and asphalt content. Control charts shall be posted in a location satisfactory to the engineer and shall be kept current. As a minimum, the control charts shall identify the project number, the contract item number, the test number, each test parameter, the Action and Suspension Limits applicable to each test parameter, and the contractor's test results. The contractor shall use the control charts as part of a process control system for identifying potential problems and assignable causes before they occur. If the contractor's projected data during production indicates a problem and the contractor is not taking satisfactory corrective action, the engineer may suspend production or acceptance of the material.

7. Measurement. The HMA placed shall be measured by the number of tons mixture used in the accepted work, or other unit(s) of measurement specified by the SSHP specifications, or as specified in other sections referenced in the SSSM.

8. Payment.

A. Payment. Payment for an accepted lot of HMA pavement shall be made at the contract unit price per ton, or in accordance with requirements contained in SSHP specifications, or as specified in other sections referenced in the SSSM.

B. Basis for Adjusted Pay Factor. The pay factor for each individual lot shall be calculated in accordance with the procedures outlined in the SSHP specifications, or as specified in other sections referenced in the SSSM.

C. Total Project Payment. The total project payment for HMA pavement shall not exceed 100 percent of the product of the contract unit price and the total number of tons of HMA mixture used in the accepted work. Payment in excess of 100 percent for accepted lots of HMA pavement shall be used to offset payment for accepted lots of HMA pavement that achieve a lot pay factor less than 100 percent. The calculation of excess and offset shall be applied as equivalent amounts. In the event a lot is identified for removal and replacement in accordance with criteria specified in the SSHP specifications, or as specified in other sections referenced in the SSSM, the engineer may decide to allow the rejected lot to remain. In that case, if the engineer and the contractor agree in writing that the lot shall not be removed, it shall be paid for at 50 percent of the contract unit price AND THE TOTAL PROJECT PAYMENT LIMITATION SHALL BE REDUCED BY THE AMOUNT WITHHELD FOR THE REJECTED LOT.

VIII. References.

A. Federal Aviation Administration Advisory Circular 150/5370-10C, Standards for Specifying Construction of Airports, Item P-401, Plant Mix Bituminous Pavement, September 27, 2007.

B. Federal Aviation Administration Engineering Brief No. 59A, Item P-401 (Superpave), Plant Mix Bituminous Pavement, May 12, 2006.

C. Federal Aviation Administration Advisory Circular 150/5370-10C, Standards for Specifying Construction of Airports, Item P-403, Plant Mix Bituminous Pavement (Base, Leveling or Surface Course), September 27, 2007.

D. Association of State Highway and Transportation Officials M 323, Superpave Mix Design, 2006.

E. Asphalt Institute, Manual Series No. 2, Mix Design Methods, 1997, 6th Edition.

F. Airfield Asphalt Pavement Technology Program, Final Report Project 05-06, Use of Reclaimed Asphalt Pavements (RAP) in Airfields HMA Pavements, July 2008.