DRAFT EB No. XX: Rejuvenation Product Qualification Procedure and Requirements

Description: This procedure is intended to evaluate and assess candidate rejuvenation products for possible use that lack the required documented 2 year minimum successful field performance required by paragraph 6XX-2.2 Performance Documentation, FAA 150/5370-10B, Item P-6XX, Bituminous Pavement Rejuvenation.

Rejuvenation products under this classification must be commercially available and fully developed, examples include: new and /or improved products of similar and current technology or new innovative products providing pavement rejuvenation. Products under development, prototype products, or experimental products will not be considered by the Engineer. The manufacturer of a candidate product is encouraged to pre-evaluate the product prior to submittal and consideration by the Engineer.

The performance criteria provides for a laboratory evaluation of candidate materials in an abbreviated time, approximately 4-6 months, with selected procedures and conditions to simulate actual field performance.

Scope: This test method covers the procedures and accelerated weathering criteria and subsequent evaluation of laboratory prepared specimens to determine a rejuvenation products application rate to achieve the required viscosity reduction of extracted and recovered binder while maintaining acceptable pavement performance properties.

It also covers the simulated field weathering via accelerated weathering procedures and the subsequent evaluation and assessment of treated specimens after accelerated weathering to provide the required field performance, rejuvenation, after specified time in lieu of documented field performance.

The data and results are to be used by the Engineer, to qualify candidate rejuvenation products lacking the documented 2 years of field performance.

This test method does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this procedure (s) to establish appropriate safety and health practices and determine the applicability of regulatory limitation prior to use.

Referenced Documents: FAA 150/5370-10B, Item P-6XX Bituminous Pavement Rejuvenation.

Summary of Test Method: Laboratory or field collected airport pavement specimens are evaluated before and after rejuvenation product treatment for effectiveness of the rejuvenation by rheological property assessments to provide initial and long term rejuvenation as measured by a defined set of criteria and procedures.

Significance of Use: It is not possible to provide a precise correlation between the laboratory evaluation and assessment and expected actual field performance because of variations associated with laboratory prepared or field obtained pavement specimens, accelerated weathering methodologies and the actual condition and nature of the pavement to be treated coupled with the

natural weathering, geographical climate variations, local weather variation from normal and local pollutants associated with that pavement.

This procedure, including the accelerated weathering is used for forecasting the potential efficacy of candidate rejuvenation products and comparing and assessing the rejuvenation performance. The data and results form this procedure are meant to provide the Engineer with sufficient information on which to make an informed decision in selecting and qualifying rejuvenation products for use on airport projects.

Apparatus: To be added after concept development [coordination with Testing Agency required].

Test Specimens: Unless otherwise agreed upon, a minimum12 each laboratory prepared compacted pavement specimens, 4" minimum (surface area for evaluation ≈ 150 in^2) or optionally 6" diameter (A ≈ 340 in^2) x 2-4" height, must be prepared to a selected FAA P-401 mix design and exhibit the volumetric and performance properties required.

Note: Because only the top 3/8" surface of each specimen is evaluated for binder rheological properties, multiple specimens (surface area) are required to provide sufficient recovered asphalt binder to satisfy the rheological testing requirements.

A minimum of 12 each aged field specimens representative of FAA P-401 pavement may be substituted for the laboratory prepared specimens when available or specified by the Engineer. Field specimens provide the evaluation and assessment of the rejuvenation product effectiveness with aged asphalt binders. The FAA P 401 volumetric and performance properties must be determined on companion specimens prior to processing. Pertinent information, such as pavement age, specific pavement location, and job site must be documented.

Unless otherwise specified, the 12 specimens must be divided into three sets of 4 each; one set will be used to determine selected rheological properties of the extracted and recovered asphalt binder before treatment with the rejuvenation product. A second set will be treated with the rejuvenation product at the manufacturers recommended application rate, followed by 8 hours of accelerated weathering exposure to simulate 48 hours of field exposure and evaluated for selected rheological properties post exposure. The third set will be treated with the rejuvenation product at the same application rate as used for the second set, followed by 2,000 hours of accelerated weathering, to simulate 2 years of field exposure, and evaluated for select rheological properties post exposure.

For specimen preparation, the laboratory prepared or field obtained specimens, are saw cut to provide the top surface for rejuvenation treatment and evaluation and specimens (slices) 2 ± 1/16" in overall thickness for evaluation and accelerated weathering exposure and post exposure evaluations.

Other than the top surface, other specimen sizes may be used when agreed upon to investigate a rejuvenation product performance at depths greater than 3/8" or on additional pavement types and surfaces.

The top surface of the specimens must be cleaned of dust and dirt but may not be abraded, scored or otherwise pre-conditioned that would facilitate the absorption and/or penetration of the rejuvenation product.

The test specimens must be preconditioned by oven drying at 220-230°F to constant weight to remove any moisture. After pre-conditioning the specimens must be allowed to equilibrate to and maintained at standard conditions, 25 ±2°C, 50 ± 5 % RH, prior to evaluation or rejuvenation treatment.

Procedure:

Set 1, - Control Specimens:

Remove the top 3/8 ± 1/16" of each specimen of Set 1 (slice). Do not use water when saw cutting.

Weigh, 0.01 g, and record the combined weigh of the four slices. Extract the asphalt binder per ASTM D 2172, Method A using toluene. Recover the asphalt binder from the asphalt – toluene solution using ASTM D 1856, Abson Recovery or ASTM D 5404, Roto-Vap Recovery.

Determine and record the following rheological properties:

Rheological Property		Test Method	Notes
Absolute Viscosity, P	60°C	ASTM D 2171	
Complex Modulus (G*), kPa	60°C	AASHTO T 315, 1 rad/s	
Phase Angle (δ), °			

Set 2 - Application Rate Verification:

To each of the specimens in Set 2, weight, .01 g, and record the weight before rejuvenator application.

Using either the manufacturer method of application or a suitable spray bottle, apply a uniform film of the rejuvenator to the top surface. Reweigh the samples after application and calculate the volume and weigh of rejuvenator applied as a function of top surface area. Convert calculated application rate and compare to the manufacturer's recommended rate, the laboratory application rate must be within ± 5%. If the application rate is ≤ 95%, additional rejuvenator may be applied in a uniform application over the entire surface area. If the application rate is ≥ 105%, specimens are to be discarded and new specimens prepared.

The treated specimens must be maintained at standard condition for 24 ± 1 hr, and observed for rejuvenator penetration. If the rejuvenator has not penetrated, (remains on the surface), the testing must be suspended and the Engineer immediately notified for further directions. If the rejuvenator has penetrated the surface in a satisfactory manner as evaluated by observation, the specimens must be submitted to accelerated weathering cycle, ASTM D 4798, using weathering devices that permit top surface weathering (specimens are positioned horizontally and on a substrate that prevents ponding water) for 8 hours (8 cycles),

After accelerated weathering, the specimens are removed and prepared and evaluated per Set 1:

Weigh, 0.01 g, and record the combined weigh of the four slices. Extract the asphalt binder per ASTM D 2172, Method A using toluene. Recover the asphalt binder from the asphalt – toluene solution using ASTM D 1856, Abson Recovery or ASTM D 5404, Roto-Vap Recovery.

Determine and record the following rheological properties:

Rheological Property		Test Method	Notes
Absolute Viscosity, P	60°C	ASTM D 2171	
Complex Modulus (G*), kPa	60°C	AASHTO T 315, 1 rad/s	
Phase Angle (δ), °			

Set 3: Acceptance Qualification

To each of the specimens in Set 3, weight and record the weight before rejuvenator application.

Using application procedure defined for Set 2; apply a uniform film / application of the rejuvenator to the top surface. Reweigh the samples after application and calculate the volume and weigh of rejuvenator applied as a function of top surface area. Convert calculated application rate and compare to the manufacturer's recommended rate, the laboratory application rate must be within ± 5%. If the application rate is ≤ 95%, additional rejuvenator may be applied in a uniform application over the entire surface area. If the application rate is ≥ 105%, specimens are to be discarded and new specimens prepare.

The treated specimens must be maintained at standard condition for 24 ± 1 hr, and observed for rejuvenator penetration. If the rejuvenator has not penetrated (remains on the surface) for any reason, the testing must be suspended and the Field Engineer immediately notified for further directions. If the rejuvenator has penetrated the surface in a satisfactory manner and similar manner as Set 2, as evaluated by observation, the specimens must be submitted to accelerated weathering cycle, ASTM D 4798, using weathering devices (**list – to be added**) that permit top surface weathering (specimens are positioned horizontally and on a substrate that prevents ponding water) for 2,000 hours (2,000 cycles),

After accelerated weathering, the specimens are removed and prepared and evaluated per Set 1:

Weigh, 0.01 g, and record the combined weigh of the four slices. Extract the asphalt binder per ASTM D 2172, Method A using toluene. Recover the asphalt binder from the asphalt – toluene solution using ASTM D 1856, Abson Recovery or ASTM D 5404, Roto-Vap Recovery.

Determine and record the following rheological properties:

Rheological Property		Test Method	Notes
Absolute Viscosity, P	60°C	ASTM D 2171	
Complex Modulus (G*), kPa	60°C	AASHTO T 315, 1 rad/s	
Phase Angle (δ), °			

Period and Conditions of Accelerated Weathering Exposure:
The duration and conditions of exposure for Application Rate Verification and Acceptance Qualification must be one of the following:

A mutually agreed upon number of 1 hour default cycles, defined as 51 minutes of sunlight and 9 minutes of water spray at a black box temperature of 140°F , XX ± Y % RH [depending on geographic and climatic area].

The number of predefined 1 hour cycles required to produce a mutually agreed upon minimum amount of change in the test specimen's binder rejuvenation.

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A mutually agreed upon number of cycles and duration of sunlight and water spray must be determined that may better represent the geographic and climatic area of the specific application.

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Report: The attached EB-XX Form No. 1 - Rejuvenation Product Evaluation must be used to document the qualification testing.

Precision and Bias:

Precision: The repeatability of results obtained in this evaluation will vary with the materials being tested, the material properties measured, and the accelerated weathering conditions selected. It is essential to determine reproducibility of property measurement process when using this evaluations data and information in product specifications.

Bias: Bias cannot be determined at this time because no acceptable standard reference materials are available

FAA INFORMATION: Receiving Qualification Report				
Office:		Contact Info.	Name:	
Contact Person:			Address	
Date Received:				
Date of Review:			Tel #	
Qualification Status:			Fax #	
			Contact Person:	
			Email	

REJUVENATOR INFORMATION:				
Product Name:		Manufacturer's	Name:	
Recommended Application Rate:			Address	
Type:				
MSDS: Yes / No			Tel #	
Technical Data Sheet: Yes / No			Fax #	
Application Instruction: Yes / No			Contact Person:	
			Email	

TESTING LABORATORY:				
Name:		Testing Lab	Address	
Contact Person:				
Accredited by:				
Other:			Tel #	
			Fax #	
			Email:	

TEST & EVALUATION RESULTS:	**Date Started: _____ ; Date Completed: _____**			
Specimens Info:	Type: Lab of Field	Mix Design Used / Info:		
	Volumetric Data:	% Voids:	% Asphalt:	% VMA:
	Type / Number / Area	4" dia: / /	6" dia: / /	'Slabs': / /
EVALUATION DATA:				
Property / Item	Controls (Set 1)	Application Rate (Set 2)	Acceptance (Set 3)	Status / Comments
Asphalt Recovered, g				
% Asphalt Binder				
Rejuvenator Application and Accelerated Weathering Data & Information:				
Rate, gals/yd ^{2} (g /m^2)	Not Applicable			
24 h Observation				
Device Used: Name / Mfgr. / Model				
Cycle Used: Minutes Sunlight/Water Spray				
Cycle Parameters:	Level of irradiation			
	Temperature			
	Humidity			
	Sample Rotation			
Exposure Time, hrs				
Rheological Properties:				
Abs Visc 60°C, P				Record Capillary Tube
Complex Modulus, kPa				ώ = 1 rad/s
Complex Visc $_{60°C}$, P				η* = G*/ώ;
Phase Angle $_{60°C}$, °				
Calculations / Information:				
Rejuvenator Applied/Binder Recovered, %				Wt basis (g/g)
Absolute Viscosity Reduction, %				
Complex Viscosity Reduction, %				
Phase Angle Change 60°C, ° (+ / -)				

EB No. XX - Form 1 Rejuvenation Product Evaluation.