DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE CIVIL ENGINEER SUPPORT AGENCY

FROM: HQ AFCESA/CESC
139 Barnes Drive
Tyndall AFB FL 32403-5319

SUBJECT: **Engineering Technical Letter (ETL) 03-8, Rejuvenation of Hot-Mix Asphalt (HMA) Pavements**

1. Purpose. This ETL provides a guide specification for the application of a rejuvenator or rejuvenator/sealer to existing HMA pavements.

2. Application. This ETL is applicable to all Air Force organizations with pavement maintenance and repair responsibility.

2.1. Authority: Air Force Policy Directive (AFPD) 32-10, *Installations and Facilities.*

2.2. Effective Date: Immediately.

2.3. Intended Users: Base civil engineers (BCE) responsible for maintenance and repair of pavements.

2.4. Coordination: Major command (MAJCOM) pavement engineers.

3. Acronyms and Terms:

AASHTO	– American Association of State Highway and Transportation Officials
AFPD	– Air Force Policy Directive
ASTM	– American Society for Testing and Materials
BCE	– base civil engineer
C	– Celsius
DSR	– Dynamic Shear Rheometer
ETL	– Engineering Technical Letter
F	– Fahrenheit
FOD	– foreign object damage
HMA	– hot-mix asphalt
HQ AFCESA	– Headquarters, Air Force Civil Engineer Support Agency
kg/m^2	– kilograms per square meter
lb/yd^2	– pounds per square yard
MAJCOM	– major command
mm	– millimeters
UFC	– Unified Facilities Criteria

UFGS – Unified Facilities Guide Specification

4. Referenced Publications:

4.1. Department of the Air Force:

- AFPD 32-10, *Installations and Facilities*, available at http://www.e-publishing.af.mil/

4.2. Joint-Service Publications:

- Unified Facilities Criteria (UFC) 3-270-01, *Asphalt Maintenance and Repair*, available at http://65.204.17.188//report/doc_ufc.html

5. Explanation.

5.1. General. For structurally sound HMA airfield pavements, the majority of distresses are related to environmental effects. The environmental distresses that occur include: raveling, weathering, block cracking, longitudinal cracking, and transverse cracking. These distresses occur because the asphalt cement that binds the pavement together ages (hardens) with time due to the oxidation process. Over time, this process causes a decrease in the binder's ability to hold aggregate particles together (raveling) and the HMA becomes unable to withstand the effects of thermal or moisture stresses (cracking). When these distresses become severe enough, they can create the potential for foreign object damage (FOD) and cause a decrease in pavement serviceability, which will reduce the life of the pavement. The pavement's life will be extended if the asphalt binder can be softened or "rejuvenated" to obtain material properties similar to those when the HMA was originally placed.

5.2. Products. A number of proprietary products are currently produced for HMA pavements. These materials can be categorized into three general groups: rejuvenators, rejuvenators/sealers, and seal coats. This ETL addresses the first two categories of materials because these are materials that have the potential to rejuvenate the HMA. The use of seal coat materials is addressed in UFC 3-270-01, *Asphalt Maintenance and Repair*.

5.2.1. Rejuvenators. This first group contains products that leave no or relatively little residual material on the surface of the pavement. Rejuvenators will only rejuvenate the asphalt binder in the top surface of the pavement, usually to a depth of 3 to 6 millimeters (0.125 to 0.25 inches). Because these products leave almost no residual material, they can be reapplied as necessary.

5.2.2. Rejuvenator/Sealer Materials. This second group of products can perform a dual function. These are often (but not exclusively) coal tar-based materials that leave a substantial amount of residual material on the surface. These materials not only rejuvenate the pavement, but the residual material acts to seal the surface. If the rejuvenator/sealer is a coal tar-based material, it will also provide some fuel resistance

to the surface. The durability of this fuel resistance is largely dependent upon the level of traffic; when the seal begins to wear off, it will no longer be fuel resistant.

5.3. Performance. Recent research with a number of rejuvenator and rejuvenator/sealers has shown that they all provide some rejuvenation to the asphalt binder in the pavements surface; however, the long-term performance of these materials has not been completely determined. One major concern is the long-term effect of the residual material deposited on the surface by the rejuvenator/sealer materials. The experience of one state department of transportation was that a coal tar-based rejuvenator/sealer initially rejuvenated the pavement, but after repeated applications, the treated section showed higher viscosity results (harder asphalt) than that of the untreated sections of the pavement. It was surmised that the residual material from the initial application had hardened to a degree that affected the test results on the binder extracted after the second application. Additionally, rejuvenators will, at least somewhat, reduce the skid resistance of a pavement surface, as would the application of any material without the use of additional aggregate. This reduction does not have to be significant or long lasting, depending on factors such as the condition of the pavement, the properties of the rejuvenator, and the amount of rejuvenator applied. Skid testing of rejuvenated pavements with the Air Force GripTester has shown a minimal reduction in the short term following application. Rejuvenator/sealers leave enough residual material on the pavement surface to allow the application of aggregate (medium to fine sand [<1.18 mm], in limited quantity [<0.54 kg/m^2 (1.0 lb/yd^2)], to prevent the potential for FOD) immediately after application of the material. With this light coating of aggregate, the skid numbers can remain satisfactory, exceeding minimum requirements for airfield pavements. **Because of the concerns with skid resistance effects, particularly in areas of high traffic speeds such as runways and high-speed taxiways, the responsible Air Force MAJCOM pavement engineer must approve the use of rejuvenators or rejuvenator/sealers on these airfield pavement features.**

5.4. Requirements. Due to the proprietary nature of the rejuvenator and rejuvenator/sealer materials, United States Air Force Guide Specification, *Bituminous Rejuvenation*, does not include material ingredient requirements. This guide specification requires a percentage reduction in the viscosity or phase angle of the surface asphalt binder and evidence of long-term performance in similar applications, supplied by the manufacturer.

5.5. Applications. A rejuvenator should be applied to pavements after a few years of service. The pavement surface can have some small hairline cracks, often the beginning of block cracking, but should not show evidence of medium or high severity raveling. Pavement surfaces that are experiencing low severity raveling and low severity cracking can benefit from a rejuvenator/sealer application. This would help to seal loose surface aggregate, rejuvenate the surface binder, and protect the pavement from future damage from environmental factors.

5.6. Guide Specification. A copy of United States Air Force Guide Specification, *Bituminous Rejuvenation*, is provided as Attachment 1.

6. Point of Contact: Recommendations for improvements to this ETL are encouraged and should be furnished to Mr. Jim Greene, HQ AFCESA/CESC, 139 Barnes Drive, Suite 1, Tyndall AFB, FL 32408-5319, DSN 523-6334, commercial (850) 283-6334, FAX DSN 523-6219, Internet james.greene.@tyndall.af.mil.

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1. United States Air Force Guide Specification, *Bituminous Rejuvenation*
2. Distribution List