EVALUATION OF A CORROSION CONTROL MATERIAL FOR ASPHALT PRESERVATION OF DOD AIRFIELD FACILITIES (A REVIEW FOR DOD OFFICIALS)

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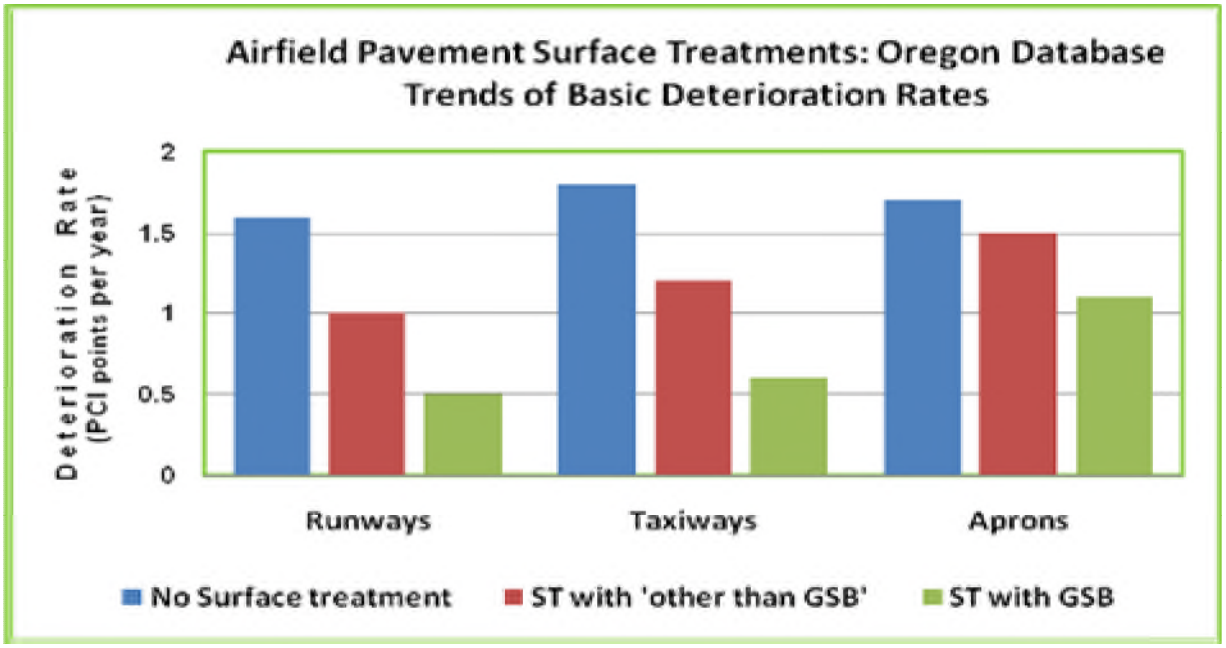
Preservation of the Department of Defense's (DOD) extensive asphalt pavement assets is critical to the DOD's ability to perform its mission. Preservation of these assets is significantly more cost effective, and readiness promoting, than costly corrective maintenance, or reconstruction. The cost of corrective maintenance to airfield asphalt pavements that could be greatly reduced with inexpensive early preventive maintenance is significant. Even a minimal 20% useful life extension of just DOD airfield asphalt assets could significantly increase readiness and save the DOD hundreds of millions of dollars a year in additional maintenance and replacement; however, it should be remembered that the vast majority of DOD asphalt pavement is not found on its airfields, but in its standard infrastructure, which was not addressed in this study.

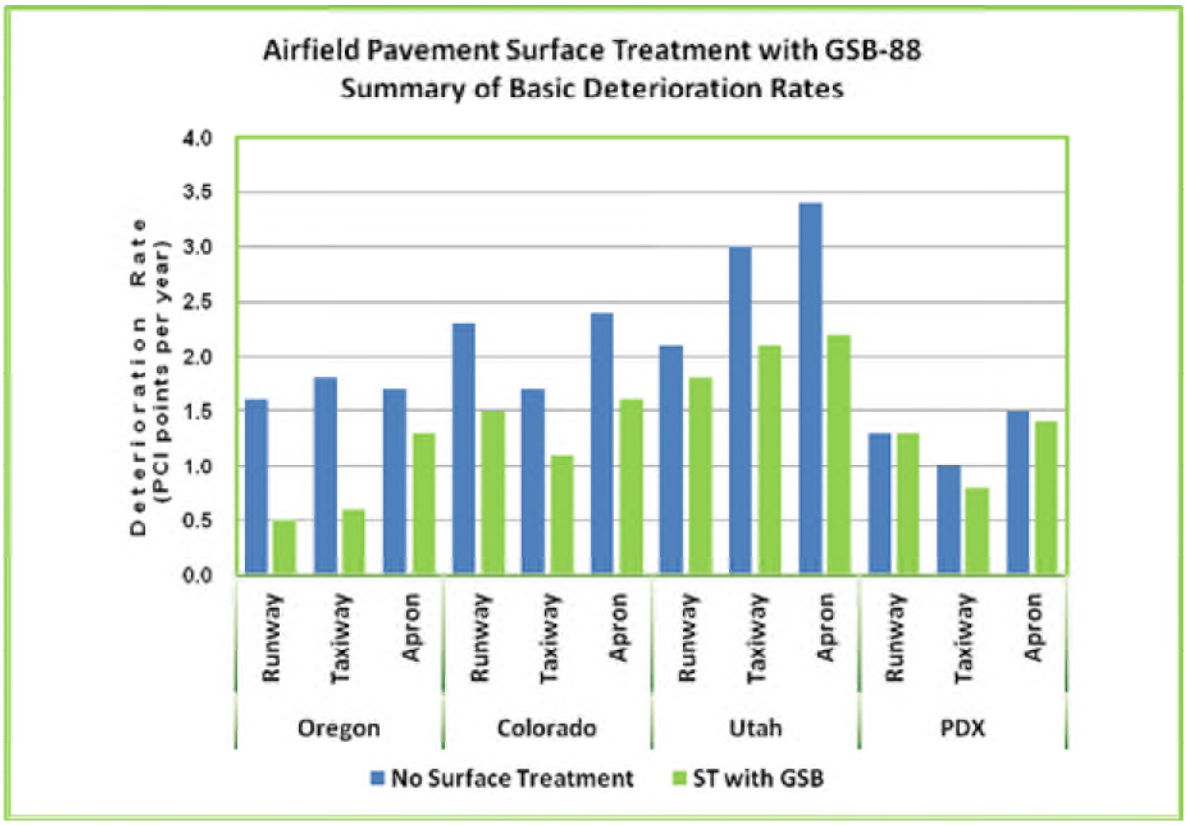
GSB-88 Sealer/Binder is a unique Gilsonite modified asphalt emulsion manufactured by Asphalt Systems, Inc. (ASI) Salt Lake City, Utah. It is claimed by the manufacturer that the addition of Gilsonite, light oils, and selected plasticizers used in the production of GSB-88 gives the emulsion unique binding and preservation characteristics. Previous evaluations of GSB-88 Sealer/Binder and widespread anecdotal evidences from multiple users of GSB-88 produced favorable possibilities for cost saving benefits from extensive application of GSB-88 to DOD asphalt assets, in particular mission critical asphalt airfield pavements. The study was a fulfillment of earlier recommendations from past Army Corps of Engineers' reports and was congressionally funded by a FY-05 DOD Appropriations Bill at $1.7 million. The first phase in the GSB-88 application evaluation program started in April 2007 at MCAS Cherry Point, NC, and continued through December 2007 at Avon Park AFR, FL, NASJRB Willow Grove, PA, NAS Fallon, NV, PMRF Barking Sands, HI, and final application at NAWS China Lake in May 2008. Evaluation of these applications were completed in early June, 2010 along with MicroPAVER database evaluation of 883 additional sections of GSB-88 applications on commercial airfields in three different states.

Based on engineering observations, data evaluation, and review of skid tests performed, GSB-88 is performing as well or better than expected based on both ASI's claims and literature, as well as past experience of the project engineer. Observations and discussions with facility personnel during field evaluations indicate that facility personnel had obviously evaluated the performance themselves because NAS Fallon, NAWS China Lake, MCAS Cherry Point, and PMRF Barking Sands had been satisfied with the previous applications of GSB-88 to the degree that they have completed additional GSB-88 projects with their own funding, are currently in the process of doing so, or both. Each facility has also become more preservation conscious as a result of the performance of the GSB-88 applications.

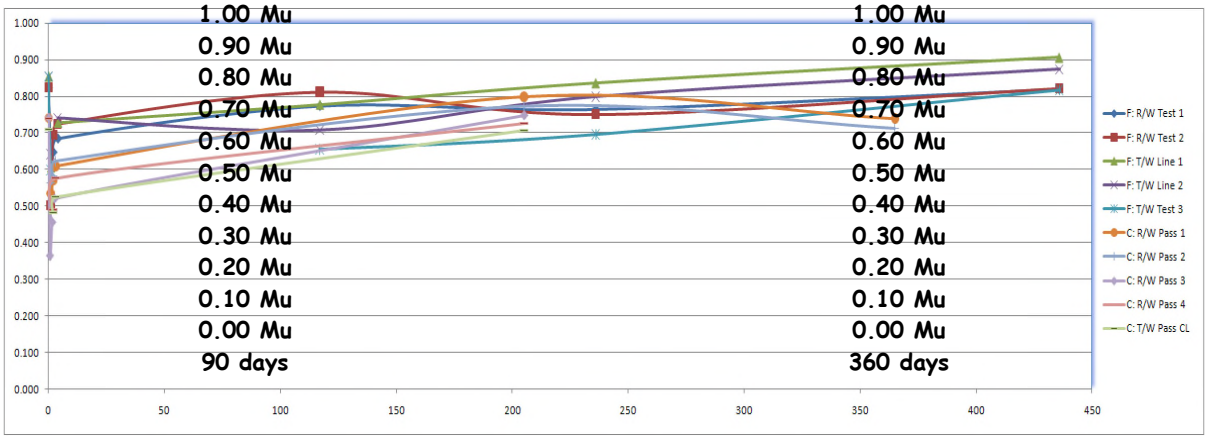
GSB-88 has been applied to more than 200 FAA/Commercial airfields. Review of this data from MicroPAVER databases by Applied Pavement Technologies, Inc., for the States of Oregon (including Portland International Airport, PDX), Utah, and Colorado, indicates application of GSB-88 has significantly reduced the rate of pavement deterioration of airfield pavement surfaces; thereby extending pavement service life to well beyond the design expectations. All databases (including PDX) for runways and taxiways with PCIs greater than 60 demonstrated

better (lower) deterioration rates for GSB-88 treated pavements than GBS-88 treated pavements with lower than 60 PCIs. This data tends to support the overall pavement philosophy that early intervention of proven pavement preservation technologies produces the greatest long term benefits. In addition, it is suggested from this sampling that pavements with a percent deduct due to load at less than 10 percent, and PCIs greater than 60, the lower the natural (untreated) deterioration rate of the pavement the greater the benefits of GSB-88 treatment. The Oregon average natural untreated deterioration rate for all three types of pavements was 1.7 PCI points per year with approximately 300% decrease in pavement deterioration for pavements treated with GSB-88. Colorado's average untreated deterioration rate was 2.1 PCI points per year with approximately 34% decrease in pavement deterioration for all three types of pavements treated with GSB-88. Utah had the highest natural rate of deterioration for untreated pavements with an average of 2.8 PCI points per year – with GSB-88 treatment there was a 16% deterioration reduction for runways, 29% for taxiways, and 36% for aprons. The database contained 776 sections treated with surface treatments different from GSB-88. Although no specific materials or procedures were identified, and therefore no direct comparisons can be made, it is interesting to note that GSB-88 treated runways and taxiways demonstrated roughly half the deterioration rate of other surface treatments (approx 30% better for aprons). Although the other surface treatments did not reduce the deterioration rate as much as GSB-88 the data does support the benefits of surface treatments in general. This analysis tends to support widespread anecdotal evidence that GSB-88 applications to airfield pavements can have a significant preservation influence on a wide variety of asphalt pavements and generally outperforms other standard surface treatments. The repeat widespread use of GSB-88 over other surface treatments taken from the subject databases is also supported by repeat use by most of the more than 200 commercial airfields that have had GSB-88 applications. For example, in the observed Oregon, Utah, and Colorado MicroPAVER databases it was found there were more overall GSB-88 applications (883) than there were overall combined surface treatments not GSB-88 (776). (Data depicted in the two graphs immediately below.)





The primary issue with the application of surface treatments on airfield pavement is the reduction in pavement friction and subsequent maintenance for skid-resistant airport pavement surfaces. Friction data from Skid Resistance testing performed at NAS Fallon, for example, indicated the friction coefficient was reduced from ~ 0.77 Mu to ~ 0.56 Mu after 24 hours, which was better than anticipated and above 0.50 Mu, the required minimum for asphalt pavement. After 4 days the average was ~ 0.7 Mu, and after 3 months, back to ~ 0.77 Mu. Additional friction testing produced similar satisfactory results. Graph below depicts actual friction testing for GSB-88 runway and taxiway applications. As can be seen, an initial drop in friction is followed by an immediate recovery to near previous numbers and a continued progressive increase in friction.



As previously stated ASI designed GSB-88 as an early intervention preventive maintenance material to be applied on pavement still in good condition to help maintain and preserve

pavement in that high quality state. However, the characteristics of GSB-88 that facilitate its ability to preserve pavement also appear to have some significant ability to mitigate certain pavement deficiencies such as raveling, issues with segregation, and other binder issues. At NAS Fallon, NV, Avon Park AFR, FL, NAWS China Lake, CA, PMRF Barking Sands, HI, Boeing Flight Test Facility, MT, and other locations, heavy applications of GSB-88 were able to rebind surface aggregate mitigating actual and potential Foreign Object Debris (FOD) and significantly retard accelerated surface deterioration. In addition, areas of concern such as pavement segregation which are likely to accelerate deterioration, and in time potentially contribute to FOD, appear to be controlled with GSB-88 applications. With the high inventory of aged and weathered asphalt pavements within the DOD, the ability to inexpensively rebind and protect such pavements, extending their useful life, could be of unique benefit to the DOD. As one example at NAS Fallon the "Inboard" runway had deteriorated from premature raveling and weathering. This resulted in concerns regarding pavement FOD and approximately $30M of emergency repairs and maintenance funding was requested; $3.5M to $10M specifically for the pavement repair. In September 2006, a heavy application of GSB-88 was directly recommended to be applied. Observations at 18 months indicate that rebinding of the surface with GSB-88 was successful and raveling was mitigated allowing the runway to meet design life expectations. A newly constructed surface was completed in 2008. Due to successful results from previous GSB-88 applications, in April 2010 NAS Fallon NAVFAC Engineers applied GSB-88 to the new pavement surface to minimize the degradation/oxidation of the overlay asphalts at an early age, thereby maximizing the new asphalt pavement life. Due to a lack of funding to re-apply airfield markings at NAWS China Lake, GSB-88 was not applied to areas immediately around the existing paint; as a result significant areas of runway and taxiway pavement were untreated. Site evaluation two years after application show multiple areas of pavement produced FOD on the runway in these untreated areas and no FOD in the GSB-88 treated areas; demonstrating the preservation and FOD-reducing benefits of GSB-88 for that pavement.

In summary, based on data evaluated and site observations, there is no doubt that the Navy and DOD would significantly benefit from applications of materials (with a proven record) such as GSB-88 Sealer/Binder. With a relatively low cost of approximately $1 per square yard applied for projects of 100K square yards or greater, GSB-88 appears to provide a unique solution, previously unavailable to the Navy/DOD, for long-term preservation of critical runways, taxiways, and other asphalt infrastructure. It is estimated that just a 20% increase in asphalt pavement life (from 20 to 25 years) of just Navy airfields could provide savings greater than $125M. Air Force (and Army) airfields would exceed that number. In addition, it should be noted the vast majority of DOD asphalt is not on airfields. MicroPAVER data demonstrated GSB-88 applications can significantly exceed 20% pavement life extensions by reducing the rate of deterioration. Economic calculations performed for this report show applications of proven materials such as GSB-88 could provide the DOD with significant cost savings. With approximately 20 Million Square Yards of asphalt concrete airfield pavements owned by the Navy and Marine Corps (not including shoulders, overruns or any vehicle traffic pavement) the Net Present Value (NPV) savings of $34.5M per million yards represents a life cycle cost savings of approximately $700M. The analysis also shows a Savings-to-Investment Ratio (SIR) of 5.0 and a Return on Investment (ROI) of 400%. Additional benefits would include increased sustainment and operational readiness while decreasing potential damage to aircraft and flight personnel from asphalt produced FOD and inexpensive correction of some potentially serious pavement issues. Therefore, a unified facility guide specification (UFGS) covering 'Fog Seals' is

currently being completed to include the use of GSB-88 on Airfield Pavements and will include past performance requirements and equipment requirements specific for runway and taxiway application.

At present there are bureaucratic obstacles preventing widespread use of unique materials such as GSB-88 within the DOD. Though GSB-88 is not a proprietary material because it is not patented, ASI is the sole manufacturer of the specific formula for production of GSB-88. In addition, the use of surface treatments on DOD airfield pavements has not been common practice, particularly for mission critical runways and taxiways; therefore, overcoming previous practice and funding surface treatments is frequently an issue. As clearly pointed out in the 2003 GAO report on corrosion control within the DOD, limited maintenance funding at most facilities is being used to correct problems, meaning few if any funds are being used to prevent those problems. In other words in some cases the DOD is spending $5 to correct a problem that could have been prevented for $1. It should be noted that as inexpensive as GSB-88 appears to be (approximately $220k for a 10,000-foot standard runway), particularly when compared to standard pavement maintenance and replacement costs, serious consideration should be given to overcoming the inherent obstacles and streamlining processes to allow more aggressive use of cost saving, readiness increasing, unique proven materials such as GSB-88.

Systemic obstacles inherent to design life philosophies of the past have created processes and budgeting that make it difficult for DOD pavement specialists to use modern cost saving preventive maintenance materials and technologies. O&M budgets are primarily structured for repair and replace philosophies with little to no emphasis on preventive maintenance. Often those in control of budgets have greater focus on repair projects and immediacy overwhelms necessary prevention programs. Reasonable budget additions and requirements for preventive maintenance would likely facilitate significant improvement. The size and type of project surface treatments fall between the O&M funding and Project Funding. Therefore it is recommended that efforts be made to open-up the possibility of preservation by increasing budgets of bases with airfields and develop a way through contracting personnel to assist in regularly scheduled preservation programs. Reasonable changes in budget and policy should be developed that would require the Services and their various facilities to adopt standardized asphalt preservation programs.

In addition, DOD purchasing requirements tend not to be small business friendly, particularly for sole source type materials such as GSB-88. As a result, the DOD is often required to use materials on the back end of the innovation curve. The DOD should provide ways for proven, uniquely beneficial, and environmentally friendly materials such as GSB-88 to be more easily integrated into the procurement process.