Naval Facilities Engineering Command

**ENGINEERING SERVICE CENTER**
Port Hueneme, California 93043

# TECHNICAL REPORT
## TR-2363-SHR

# EVALUATION OF A CORROSION CONTROL MATERIAL FOR ASPHALT PRESERVATION OF DOD AIRFIELD PAVEMENTS

Prepared by
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**14. ABSTRACT**

With congressional funding and direction by the Office of Naval Research, NAVFAC ESC conducted field investigations of a propriety modified asphalt emulsion designed to extend the service life of aircraft pavements. Emphasis was placed the products suitability for use by Navy/DoD and the life-cycle cost. Pavements were treated at six different DoD installations. Skid resistance were measured and documented at 1, 4, and 90 days after treatment; results exceeded the minimum criteria for aircraft landing operations. This technical report documents results of the evaluations which were also used in preparing a Unified Facilities Guide Specification (UFGS) for emulsified asphalt based seal coat products.

**15. SUBJECT TERMS**

Pavement preservation, pavement management, bituminous seal coat, asphalt emulsion seal coat, Gilsonite, Criteria

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# EXECUTIVE SUMMARY

## EVALUATION OF A CORROSION CONTROL MATERIAL FOR ASPHALT PRESERVATION OF DOD AIRFIELD PAVEMENTS

NAVFAC ESC Project Engineer: Gregory D. Cline, P.E.

Preservation of the Department of Defense's (DoD) extensive airfield asphalt pavements is critical to the DoD's ability to perform its mission. Preservation has been shown to be more cost effective and readiness promoting than performing rehabilitation or reconstruction after extensive degradation has occurred, and could represent tens of millions of dollars in yearly savings for DoD.

There are two generic types of sealer/binders on the market: those made from asphalt and those made from coal tar. With congressional funding and direction by the Office of Naval Research (ONR), the Naval Facilities Engineering Service Center (NAVFAC ESC) conducted field investigations that were limited to a single product called GSB-88 Sealer Binder which is a modified asphalt emulsion. It is claimed by the manufacturer that the addition of gilsonite (a naturally occurring asphalt ore), light oils, and selected plasticizers results in an emulsion that has unique binding and preservation characteristics compared to conventional chip seal, seal coat and slurry seals used for preventative maintenance.

Application of the product began in April 2007 at MCAS Cherry Point, NC. Subsequent applications and evaluations included Avon Park AFR, FL, NASJRB Willow Grove, PA, NAS Fallon, NV, PMRF Barking Sands, HI, and NAWS China Lake which concluded in May 2008.

Historically the concern and restriction on the use of asphalt surface treatments for airfield pavements is that they are believed to reduce pavement friction which adversely affects aircraft landing conditions and stopping distances. Therefore, the primary focus of this investigation was to measure the resulting skid resistance pre and post application. Results were favorable, for example at NAS Fallon the friction coefficient of 0.77 Mu before application was reduced to 0.56 Mu when measured after 24 hours, but rebounded to 0.7 Mu after 4 days, and after 3 months, it was the same as pre application, 0.77 Mu. All of the post application coefficients exceeded the minimum allowed value of 0.50 Mu (at 40 mph). When selecting any preventative maintenance procedure the responsible airfield activity shall measure the resulting friction coefficient to verify that the resulting surface meets the operational criteria before resuming operations.

A final draft Unified Facilities Guide Specifications Section 32 01 13.00 20.00 20, Emulsified Asphalt Seal Coats was re-written based on information obtained from this evaluation and is available under separate cover.

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# 1.0 INTRODUCTION

## 1.1 Background

The Department of Defense (DoD) has an extensive Hot Mix Asphalt (HMA or asphalt) airfield pavement infrastructure. Normal traffic and natural environmental influences steadily increase the rate of deterioration of asphalt pavements, which in turn increases the susceptibility to raveling and potential of creating hazardous foreign object debris (FOD) thereby putting aircraft and personnel at risk. Past pavement management and engineering philosophies have primarily focused on pavement design life, which assumes routine maintenance such as crack filling, but also focused on waiting for deterioration to occur and then implementing costly corrective repair and replacement projects. A GAO Report to Congressional Committees, Defense Management [Ref. 1], states “DoD and military services do not have an effective approach to prevent and mitigate corrosion.” This GAO reports documents the cost of corrective maintenance to the DoD infrastructure, including pavements, which could be greatly reduced with relatively inexpensive preventive maintenance using sealers.

One example of a commercially available sealer is the proprietary product GSB-88 Sealer/Binder sold by Asphalt Systems, Incorporated (ASI). This product has “unique binding and preservation characteristics” attributed by the manufacturer because it incorporates “Gilsonite, light oils, and selected plasticizers”. The sealer has been demonstrated to significantly reduce the rate of pavement deterioration and to rebind selected raveling of airfield pavements. GSB-88 has been successfully placed on over 200 Federal Aviation Administration (FAA) general aviation airfields since 1990, including over 150 runways of varying use, design, and climate conditions [Ref. 2].

Although field observations and laboratory testing by the Army Corp of Engineers verified some unique benefits to GSB-88 in a March 2003 evaluation [Ref. 3 and 3a], the report also recommended further field evaluations of GSB-88 to confirm their findings. As such Congress allocated $1.7M in FY05 to the Office of Naval Research (ONR) who then tasked the Naval Facilities Engineering Command (NAVFAC) Engineering Service Center (ESC) in FY07 to oversee the application and evaluation of GSB-88 at various DoD airfields and report on its performance. The supposition has been that GSB-88 rejuvenates without softening the pavement, something critical for DoD airfields. It was the objective of this evaluation to verify this supposition.

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 tests must be performed to document that the value remains greater than the criteria of 0.50 Mu.

## 1.2 Objective

The objective of this field evaluation effort was to quantify the performance characteristics, costs, safety, and environmental aspects of GSB-88 when applied to DoD airfields. Of special interest is the ability to mitigate potential FOD and to document the effect on skid resistance.

### 1.3 Scope

The scope of this field investigation was limited the application and evaluation of a single proprietary product (GSB-88 Sealer/Binder). It was not compared side-by-side with other methods or materials typically used for preventative maintenance of asphalt pavements. Skid resistance testing was performed and evaluated to address safety concerns about loss of friction; both skid resistance immediately after application on runways and taxiways, and over the long-term were measured. In addition, information and data from previous applications of GSB-88, from FAA airfields where longer term applications were available, were gathered and evaluated.

## 2.0 TECHNICAL APPROACH/ANALYSIS

### 2.1 General

The NAVFAC and Tri-Service Airfield Pavement Teams assisted to locate facilities with pavement projects where GSB-88 could be applied following specific criteria. Projects consisted of airfield pavements, initially limited to shoulders, overruns, and low speed taxiways. Road and parking lot projects were considered for alternatives. Collective pavements within a project that would have GSB-88 applied were to total approximately 100,000 square yards in area or greater. 100,000 square yards is the minimum amount to economically mobilize for a project and was the budget of this evaluation effort. Projects were solicited for all regional areas and pavements from all three Services. The age of the pavements considered for treatment was/is irrelevant for project selection, but the pavement condition targeted was to be considered good/satisfactory (PCI > 60, preferably higher).

Actual projects included runway, taxiway, apron, shoulder, overrun, and emergency access airfield pavements; including 58 pavement sections/branches, with actual Pavement Condition Index greater than 90 to less than 10. Projects were in six locations with significant climate differences from one another which are shown on Figure 1, and the total area of pavement on which GSB-88 was applied at each location was between 100,000 and 300,000 square yards.

Participating activities were encouraged to use their own existing funds as matching funds to those provided by the program. This would encourage “owner buy-in effect” to continue proper preventive maintenance for pavement preservation. Pavement maintenance, repair, and preparation prior to application of GSB-88 were financially the responsibility of the local activity. Candidate projects included:

- Existing projects incorporating a general seal (CSS-1 or coal tar) that can be substituted with GSB-88 (leaving an area with CSS-1 or coal tar as control).
- Projects going out for bid where GSB-88 can be included as an addition or replacement prior to contract bid date and award.
- Existing projects that did not incorporate any surface treatment, where the sealer binder could be added (this would typically be on newer pavements).
- New projects, for the sole purpose of applying this sealer binder.

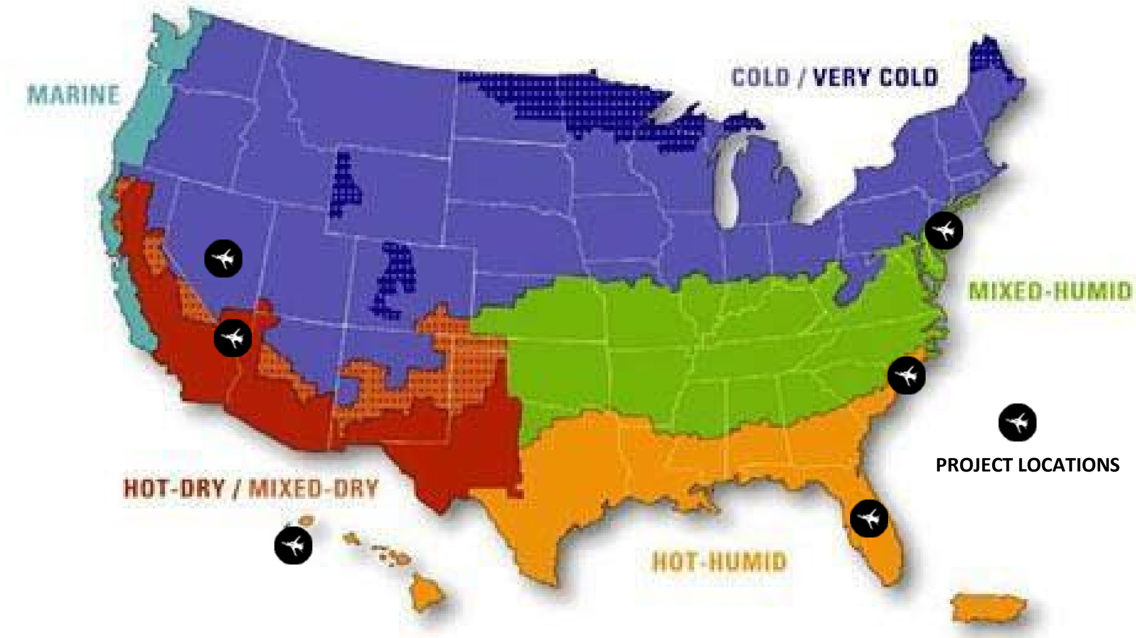


**Figure 1. Project locations in relationship to US Climatic Regional Zones.**

## 2.2 Material: Gsb-88 Sealer Binder

GSB-88 Sealer Binder (GSB-88 or GSB) is a specially engineered complex asphalt emulsion designed to be applied to asphalt pavements as a fog seal. Introduced to the market in 1988, GSB-88 is a cationic asphalt emulsion with light oils added to aid in the rejuvenation/flexibility characteristic, but additionally uses a naturally occurring asphalt known as Gilsonite as a modifier and selected plasticizers. The vast majority of airfield pavement deterioration can be attributed to surface oxidation, or aging. GSB-88 is specifically designed to significantly retard the natural surface oxidation process by rebinding the surface aggregate and sealing the pavement binder. A brief review is presented in Appendix A, GILSONITE.

GSB-88 is generally shipped long distances in concentrate form having a residue minimum of 57%. A Certificate Of Compliance (COC) is available with shipment if requested, as was for this project; and a typical COC provided on this project is presented in Appendix B MATERIALS. For most standard preservation applications, on relatively good pavements, a 1:1 dilution with potable water is recommended; however, on occasion a pavement in poorer condition and showing signs of raveling may be better served with a dilution rate (dilute) up to 2:1 concentrate to potable water. Standard application rates are between 0.10 gal square yard and 0.15 gal square yard. Some “tight” pavements may require a lower rate and some more porous and highly deteriorated pavements may require a greater application rate for best results. A manufacturer’s representative should be consulted when considering variations in dilution or application rates.

Cure time for GSB-88 is generally between 1 and 8 hours, and more commonly less than 2 hours, depending on weather conditions and application and dilution rates. The pavement should be clean and dry and have a minimum temperature of 13ºC (55ºF) and rising, with no anticipation of rain within 8 hours of application completion. Windy conditions may cause unwanted misting and uneven application. Weather conditions during the application of GSB-88 are presented in Appendix C CLIMATE AND WEATHER for each location.

Preventative maintenance techniques are not commonly used on DoD airfield pavements and are specifically not allowed on runways and high speed taxiways. The primary reason is that when spray applications of liquid materials are applied on the pavement surface, the potential to reduce the frictional characteristics of the pavement surface increases. "*The skid resistance can be significantly reduced for a substantial period of time when rejuvenators are applied especially when the rejuvenators do not penetrate. The data shows that most materials reduce the skid resistance for at least one year*" [Ref 4]. The second reason surface treatments are not allowed is that "*some surface treatments create a thin layer of binding product and fine aggregate on the pavement surface that is prone to delamination and subsequent FOD generation. Potential danger to aircraft engines has precluded the use of these types of systems* [Ref 5]". These reasons are justified by numerous past incidences throughout the previous three decades. However, these issues have primarily been associated with the surface treatments indicated: significant reduction in friction for a relatively long period of time when rejuvenators are used, and increased potential for surface delamination and subsequent FOD generation if slurry seals are used. GSB-88 Sealer Binder is not a traditional asphalt rejuvenator and is not designed to penetrate to the depth of a rejuvenator, and is not a slurry seal type treatment and does not create a thin layer of binding product and fine aggregate on the pavement surface. The only primary concern to evaluate is skid resistance.

A general philosophy in using seal coats is it is easier to keep a good pavement in good condition than it is to restore a poor pavement to good condition. Hence, GSB-88 should generally be applied to pavements in good condition with the idea of maintaining good pavements in good condition. At the present time, the cost of applying GSB-88 to 100,000 square yards of airfield pavement is around $1.00 per square yard, which makes it significantly less expensive and disruptive than more costly corrective and replacement alternatives and comparable to the cost of other designed seal coat products. However, costs can easily escalate to $3.00 per square yard or more when subjected to a prime contractor's unwarranted inflated costs which are billed for the sub contractor's work. Cost per square yard may also increase when total area of pavement to be treated is less than 100,000 square yards (in order to compensate for mobilization type costs), if a more concentrated dilute or heavier than normal application rate is specified, or if any other special requirements or tasks beyond the scope of application are requested. However, these costs remain similar to costs the Air Force bases had shown in 1985, when the cost for surface treatments varied between $1.00 and $3.00 per square yard [Ref 4].

Asphalt pavement deterioration accelerates with age as more of the interior binder is exposed to natural oxidizing elements it progressively loses its ability to hold the aggregate in place creating potentially serious asphalt FOD issues and even further acceleration of the deterioration process. Being able to decrease the deterioration process could have tremendous value for aged airfield pavements. It should be noted that GSB-88 has no structural benefit outside of rebinding the surface aggregate; issues such as base failure cannot be corrected with GSB-88.

### 2.3 Site Visit – Field Performance Evaluation

Site visits to airports that have incorporated GSB were completed to demonstrate the overall performance on similar use pavement. To assist in selecting sites to visit, ASI supplied a complete list of airport projects which had pavements treated with GSB-Emulsion products as of February 2004 [Ref. 2]. At the time, GSB had been used on over 100 airports, primarily in the West and upper Midwest, and over twenty-five percent listed indicated multiple year applications – with several showing consistent multi-year applications since the early nineties. The types of pavement surfaces included grooved runways, porous friction course runways, slurry sealed surfaces, and many other dense graded asphalt mixes; and the use (or traffic) on these pavements were from light general aviation to heavy commercial, civilian and freight aircraft.

Specific locations were determined based on regional areas, type and use of pavement, age of application, condition of existing pavement prior to application, and project documentation which can support dates, application rates, and prior pavement condition.

#### 2.3.1 Boeing Glasgow Flight Test Facility, Glasgow (St. Marie), Montana

One of the first field observations as part of this evaluation was at the Boeing Glasgow Flight Test Facility outside Glasgow, MT, near the Canadian border on May 15, 2006. The test facility, originally constructed as part of the Air Defense Command in the 1950's and transferred to and operated as a Strategic Air Command Base in the 1960's and part of the 1970's, sat idle for years until the Boeing Company began testing aircraft there in the 1990's (it continues to own most of the facility to date). This brief history is relative to help understand the condition of the airfield pavement when Boeing Company began using the facility with existing asphalt pavements that date back to the 1950s with no maintenance for many of the 50 years in existence.

The Boeing airfield manager provided information relative to their objective; which was to keep the airfield open for Boeing test flights as long as the airfield could remain in safe use without reconstruction or repaving. Therefore pavement preservation of extremely aged and poorly maintained pavement was a critical requirement to obtain their objective. Additional information reported that, beginning in 1990 and continuing for approximately ten years, numerous pavement preservation products and processes had been tried with poor to modest results, products including SS1h, latex modified emulsions, coal tars, rejuvenators, etc., and processes that included fog seals, slurry seals, chip seals and others. In 1993 and 1994 and again in 1998 and 1999, GSB-78 (the Gilsonite modified 'cutback' version of GSB-88) was used and reported as being the most effective material for maintaining the extremely poor pavement. Figure 2 illustrates the visual condition after a three year rotation.

Observations at the time of the site visit demonstrated significant differences between the benefits of GSB and standard asphalt, coal tar emulsions, and rejuvenators. Areas treated with materials other than GSB showed greater severity of distress. Many of the earlier applications were retreated with GSB. The pavement at the Boeing facility was badly aged and undoubtedly would have been unusable by now had it not been for the aggressive preservation measures on Boeing's part. This was the first opportunity to consider the possibility that GSB-88 may rebind deteriorating pavements.

**Figure 2. Boeing's 3-year cycle showing (left to right) application in 2006, 2004, and 2005.**

2.3.2 Portland International (PDX) and Portland-Mulino, Portland, Oregon

Portland - PDX is a Commercial Service airport and is the location of the Oregon Air National Guard. The PDX airfield pavements engineer/manager provided information relative to performance data from numerous ongoing surface treatment applications which included the application of GSB on runways, taxiways, and aprons, and encompassing initial and follow-on applications. Other products had also been applied and were being evaluated by the engineer. All efforts were funded by maintenance and preservation projects; therefore the evaluation was not officially funded. The only information available was recorded by populating the MicroPAVER Database with application dates and GSB was the only surface treatment specifically named. The manager indicated the database would be available upon request at a later date – the data was obtained, evaluated, and included in Sections 2.6 and 3.4 of this report. At the time of the site visit, GSB was the sole product being used and was reported as being the most effective material to date. It was reported that the initial application was due to the four year old grooved HMA runway experiencing raveling of surface aggregate that had recently become increasingly more severe, to the point that a few of the most severely raveled areas had been patched with HMA. Figures 3, 4, 5, and 6 illustrate that GSB was applied on two separate grooved runways and did not have any detrimental effect on the grooved pavement shape or 'pooling' of product within the grooves themselves. These two concerns are the most prevalent today relative to allowing or not allowing GSB or other seal coat type products on grooved runways.

Portland-Mulino Airport services local general aviation. The Runway was paved in 1991 after which "pop-outs" or "holes" started appearing on the pavement surface. This was determined to be the result of a dry mix and soft aggregate dissolving. In 1993 GSB-88 was applied to attempt to mitigate the problem. The number of pop-outs or holes stopped increasing and was controlled for over seven years, at which time a second GSB-88 application was completed. This is shown in Figures 7 and 8. In addition, the Army's evaluation in 2003 [3] indicated the pavement is in very good condition with an appearance that is relatively consistent throughout. The only noticeable defect was a short longitudinal construction joint crack. The most recent application was completed in 2005.

**Figure 3. PDX grooved runway with GSB.**

**Figure 4. PDX grooved runway with GSB.**

**Figure 5. Groove remained sharp and clean.**

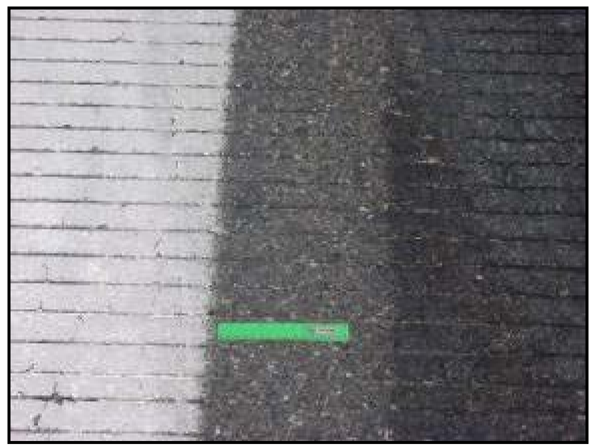

**Figure 6. Test area for control.**

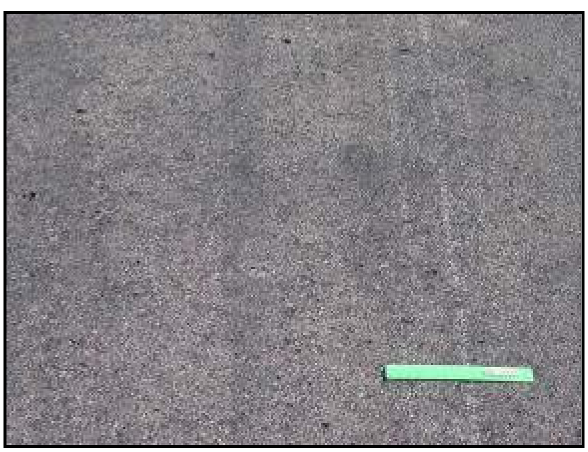

**Figure 7. Holes from dissolving aggregate.**

**Figure 8. Holes sealed from water intrusion.**

### 2.3.3 Others

*2.3.3.1 JFK International Airport, Taxiway Q*

In 2008 GSB-88 was applied to sections of Taxiway Q at JFK for the purpose of evaluating the product for the Port Authorities needs. Application was typical with the FAA Mod with a heavier application of 0.14 gal square yard 2:1 dilute and using 20/40 sand for aggregate. Figures 9 and 10 show the test area selected.

**Figure 9. Test area, Taxiway Q at JFK.**

**Figure 10. Original and GSB-88 test area.**

*2.3.3.2 Cedar Rapids, Iowa*

GSB has been applied in the Cedar Rapids Iowa area for almost 40 years and is where the oldest existing application remains. It has not been, or needed to be, overlaid since 1972. Although not on airfield pavement or roadway pavement, this parking area is used daily and the weather would be considered harsh for pavements. The pavement was constructed in 1972 and the first application of GSB was in 1976. After the first application, GSB was applied every four years, the last being in 2008. Figures 11, 12, and 13 show the pavement condition in 2010.

**Figure 11. Pavement constructed in 1972 with GSB-78 applied every four years.**

**Figure 12. GSB-78 has kept cracks sealed.**

**Figure 13. GSB-78 protects the "matrix."**

Additional pavements visited while in Cedar Rapids area include the following:

- Eastern Iowa Airport (CID) Commercial Parking Apron
    - 2006 PCC Crack and Seat with 4-inch HMA overlay
    - 2006 GSB-78 construction seal (seal coat) applied within the first few days
    - 2009 GSB-78 applied
- Westdale Mall & Adjoining Commercial Facility
    - Both constructed in 1978 with same material and by same contactor
    - One applied GSB every 4 to 5 years which is shown in Figure 14, while the other commercial facility did not (of any type) as shown in Figure 15

**Figure 14. GSB-78 applied every 4–5 year.**

**Figure 15. No treatment results in raveling.**

- Bank of the West parking area and thru way and city alley
    - Drive thru area had constant traffic and appeared to have more than the city alley.
    - 1989 Bank pavement and the city alley constructed at the same time.
    - City alley has had no surface treatments.
    - Bank's pavement: 1989 GSB-78 construction seal (seal coat) applied within days.

- GSB-78 applied in 1994, 1999, 2004, and 2009.

- Cedar Rapids church parking and driving areas
  - Constructed in 1978 and new construction added in 2000 (at the construction joint).
  - 1980 GSB-78 applied and then every five years after, last being 2010.
  - 2000 GSB-78 as a construction seal and applied in 2005 and 2010.
  - Figures 16 and 17 show that GSB will not stop structural distress but can seal the distress thus protecting the section from water intrusion.
  - Figures 18 - 21 present pavements, one at 32 years old and one at 10 years old

**Figure 16. GSB will not stop structural distress.**

**Figure 17. GSB seals and protects from water intrusion.**

**Figure 18. Pavement constructed in 1978.**

**Figure 19. Pavement constructed in 2000.**

**Figure 20. Constructed in 1978 or 2000?**

**Figure 21. Constructed in 1978 or 2000?**

### 2.4 Application Locations And Visual Evaluation

Depending on proximity to production facilities GSB-88 may be delivered in tanker trucks/containers to the application site already diluted and ready to apply, or in concentrate form and diluted with potable water on site. All applications of GSB-88 for the purpose of this evaluation were applied with equipment meeting the following criteria for standard application of the material. GSB-88 is applied to the pavement surface using a standard bituminous distributor as shown in Figures 22 and 23. Distributors are designed and capable of distributing GSB-88 uniformly, at controlled temperatures, accommodating varying widths at computer controlled application rates. The certified equipment has tank circulation and heating capabilities as well as accurate temperature gages for determining the temperature of the GSB-88 at application. Also a hose and spray attachment is needed to apply GSB-88 in areas the distributor spray bar cannot reach. The annual Department of Transportation (DOT) State Calibration Certification for the emulsified asphalt distributor, from the state providing that service, was provided; with the calibration date being within 6 months of the application, or up to 12 months when supporting documents substantiated continuous work using the same distributor.

In addition to the above, the distributor is modified with a sanding attachment on the rear of the bituminous distributor to allow a one pass application of GSB-88 and sand. This eliminates the need to drive over the still wet applied GSB-88 in order to apply sand as shown in Figures 24 and 25. The addition of sand is for the sole purpose of maintaining acceptable friction where friction may be critical; it has no other benefit to the application. For most circumstances an approximate sand application rate of 0.3 lbs per square yard (0.25 to 0.50 lbs per square yard) is sufficient; however, there are times when a heavier application of sand may be required and the sanding attachment must be able to accommodate such adjustments. Typical sand specification generally accepted in FAA modifications and used for a reference guide during this project is provided in Appendix A MATERIALS.

**Figure 22. Standard distribution truck.**

**Figure 23. Standard distribution truck.**

**Figure 24. Distribution truck with acceptable sanding equipment.**

**Figure 25. Distribution truck with acceptable sanding equipment.**

A staging area was established during the mobilization at each location with local engineering departments, air operations, and safety personnel. The area had to be accessible to tankers and sand suppliers for deliveries, as well as being large enough for temporary storage of the sand and tankers. The staging area had to accommodate the dilution process (when required) as well as the transfer of GSB-88 from tanker to distributor throughout the day; and transporting the sand from temporary storage to filling the sanding attachment bin. Figures 26 and 27 show typical staging areas, one already in operation while the other being set-up.

The above summary describes standard application of GSB-88. Variations are few and primarily center on application rates for sand or application and dilution rates for GSB-88. GSB-88 application rates are generally determined by test strips placed on the subject pavement and visually observed for absorption and runoff. Once a rate is determined, satisfactory application can proceed with possible adjustments if pavement changes are significant.

**Figure 26. Typical staging area in operation.**

**Figure 27. Typical staging area setting-up.**

Numerous application rates were adjusted throughout this project primarily for the sole purpose of evaluation of various rates for varying conditions. Each application location was inspected before application and test strips applied to determine proper overall application rates. Most were well within the standard recommended rates of 0.10 to 0.15 gal per square yard for 1:1 dilute; however, some extreme variations were employed for practical and experimental purposes. For example, an application on a Runway which was not part of this application program, but is included in this study in 2.4.7.1 of this report, was an extremely heavy 0.22 gal per square yard of 2:1 dilute because of the severe raveling and advanced deterioration of the pavement. In addition, varying application rates were used on the severely deteriorated pavements to determine long term effects of the varying rates on such pavements. The results and details of such variations are also included in this report. Figure 28 shows locations where GSB-88 was applied as well as locations where site visits were conducted, as previously discussed in this report.


**Figure 28. Location of application sites and site visits.**

Evaluation was primarily performed in the field. Existing pavement condition was photo documented and pavement conditions were verified to be consistent with PCI results previously calculated following ASTM D5340 [Ref. 6] and documented in the last and prior PCI Surveys performed [Ref. 7-27]. Additional information documented included maintenance and repair prior to application and relative data, such as age of pavement, weather, and any unusual conditions applicable. Applications were monitored and documented, and post application site visits for material performance and evaluation include photo documentation and general pavement condition. At the time of the last site visit at each location, the PCI was verified with most recent PCI survey performed after the application of GSB-88 or determined and are presented in Appendix D APPLICATION LOCATIONS.

Test methods and protocols for testing properties on this type product did not exist, however other programs, such as the Airfield Asphalt Pavement Technology Program (AAPTP), had projects such as Project 05-07 Techniques for Prevention and Remediation of Non-Load Related Distress on HMA Airport Pavements, to review this issue as part of the research [Ref. 28].

### 2.4.1 MCAS Cherry Point, NC

Applications of GSB-88 were completed April 6-13, 2007. GSB-88 was applied to Warm-Up Pad 3, Northeast Pad Taxiway, areas on the taxiway in front of the Crash Barn and near Warm-Up Pad 4 (avoiding the sections previously treated with other material), and Taxiways Echo and Delta. An actual rate of application and dilution on each pavement section, as well as the brief application summary submitted to ONR. Aggregate was Ultrablast 30/60 sand (nickel slag) obtained locally through Virginia Materials, Inc, Norfolk, VA. It was applied to all pavements with an application rate of 0.30 lbs per square yard, which varied for demonstration purposes, but was within standard rates of 0.25 to 0.50 lbs per square yard. The aggregate Technical Data Sheet, which indicates particle size analysis, chemical analysis, and material properties such as MOH hardness and specific gravity, is provided in Appendix A MATERIALS. Material was sampled and kept for testing.

### 2.4.2 Avon Park AFR, FL

Applications of GSB-88 were completed June 19-21, 2007. GSB-88 was applied to Taxiway Alpha, Taxiway Bravo, Taxiway Charlie, Taxiway 3, Taxiway 5 and Parallel Taxiway, Apron D, Inactive Runway 14/32,high FOD generating Fire Use Access Roads C, B, and A and Inactive 'Old' Taxiway B used for access to inactive R/W 14/32. Actual rates of application and dilution on each pavement section, as well as the brief application summary submitted to ONR. Aggregate was a local 30/65 silica sand obtained through Standard Sand Co., Davenport, FL; and was applied to all pavements with an application rate of 0.30 lbs per square yard, which varied for demonstration purposes, but was within standard rates of 0.25 to 0.50 lbs per square yard. The aggregate Technical Data Sheet, which indicates particle size analysis, chemical analysis, and material properties such as MOH hardness and specific gravity, is provided in Appendix A MATERIALS. Material was sampled and kept for testing.

Prior to application, Taxiway Alpha (T01A), Taxiway Bravo (T04A), and Taxiway Charlie (T05A) had a condition rating of a "Satisfactory" PCI (85-71) as of the most recent Airfield Pavement Condition Assessment, dated November 2006 [Ref. 25]. At the time of application, a cursory check to verify condition was completed using several sample units; and the PCI value representing only the cursory sample units indicate the condition had deteriorated to “Fair” (PCI equivalent of 56 - 70). Two small sections (T02A and T03A) that connect Alpha and Bravo had a lower rating of “Poor” PCI (41-55), confirmed by cursory check.

Prior to application, Taxiway 3 (T09C), Taxiway 5 (T08C), and Parallel Taxiway (T11B) had PCI values of 56, 55, and 58 respectively with condition ratings of “Fair” PCI (56-70) to “Poor” PCI (41-55) as of the most recent Airfield Pavement Condition Assessment, dated November 2006 [Ref. 25]. At the time of application, a cursory check to verify condition was completed using several sample units; and the PCI value representing only the cursory sample units indicate the condition was “Poor” (PCI equivalent of 41-55) on Taxiways 3 and 5, with Taxiway 3 significantly lower than reported. The Parallel Taxiway was significantly lower, indicating the condition had deteriorated significantly to “Very Poor” (PCI equivalent of 26-40).

Runway 14/32 (R09C) is inactive and presently closed with medium and high severity block cracking and weathering resulting from surface oxidation, but reportedly remains structurally sound. Prior to application, this runway pavement had a condition rating of “Very Poor” (40-26) as of the most recent Airfield Pavement Condition Assessment, dated November 2006 [Ref. 25]. At the time of application, a cursory check was completed to verify condition using several sample units resulting in a PCI condition rated as “Serious” (PCI equivalent of 11–25).

Access Roads C, B, and A were considered high FOD generating problems and are primarily for fire use and general operations. These roads did not have any past condition surveys; however, photo documentation may assist in future evaluations. In addition, “Old” Taxiway Bravo, the northern extension of pavement from Taxiway Bravo to Runway 14/32 (previously part of Taxiway Bravo but closed for a long time and used for an Access Road to the Runway) is in similar condition as Runway 14/32, however no pavement assessment had been completed, and therefore a cursory check was not completed. This pavement received a partial application of remaining GSB-88 and photo documentation may assist in future evaluations.

#### 2.4.3 NAS Fallon, NV

Applications of GSB-88 were completed September 28 - October 1, 2007. GSB-88 was applied to Runway 7/25, Taxiway Alpha, Taxiway Delta, and the shoulders of each. An actual rate of application and dilution on each pavement section, as well as the brief application summary submitted to ONR. Aggregate was Granusil 4075 silica (quartz) sand obtained through Unimin Corporation, Emmett, ID; and was applied to all pavements with an application rate of 0.30 lbs per square yard, which varied for demonstration purposes, but was within standard rates of 0.25 to 0.50 lbs per square yard. The aggregate Technical Data Sheet, which indicates particle size analysis, chemical analysis, and material properties such as MOH hardness and specific gravity, is provided in Appendix A MATERIALS. Material was sampled and kept for testing.

#### 2.4.4 NASJRB Willow Grove, PA

Applications of GSB-88 were completed October 9-12, 2007. GSB-88 was applied to Taxiways Golf, Juliet, Foxtrot, Hotel, Charlie and the Wash Rack. Total square yards of pavement treated was determined during application and submitted to ONR shortly after application was completed. An actual rate of application and dilution on each pavement section, as well as the brief application summary submitted to ONR. Aggregate was Ultrablast 30/60 sand (nickel slag) obtained locally through Virginia Materials, Inc, Norfolk, VA, and was applied to all pavements with an application rate of 0.30 lbs per square yard, which varied for demonstration purposes, but was within standard rates of 0.25 to 0.50 lbs per square yard. The aggregate Technical Data Sheet, which indicates particle size analysis, chemical analysis, and material properties such as MOH hardness and specific gravity, is provided in Appendix A MATERIALS. Material was sampled and kept for testing.

### 2.4.5 PMRF Barking Sands, HI

Applications of GSB-88 were completed December 14-17, 2007. GSB-88 was applied to Taxiways 1, 2, 3, and 4; Parking Aprons 1, 2, 3, and 4; Helipad and miscellaneous shoulders. An actual rate of application and dilution on each pavement section, as well as the brief application summary submitted to ONR. Aggregate was not applied because contractor was unable to locate appropriate aggregate in the time constraints placed by the Project Engineer. The Project Engineer also determined friction was not an issue based on existing surface conditions and weather conditions, and because there was no anticipated traffic on any of the subject pavements.

### 2.4.6 NAWS China Lake, CA

Applications of GSB-88 were completed May 15-17, 2008. GSB-88 was applied to Runway 8/26, Compass Rose Throat, Taxiway 8 (Sections T8-2 and T8-3), Taxiway Echo, Taxiway Delta, and Diagonal Taxiway (Sections T3-5, T3-7, and T3-10). An actual rate of application and dilution on each pavement section, as well as the brief application summary submitted to ONR. Aggregate was Granusil 4075 silica (quartz) sand obtained through Unimin Corporation, Emmett, ID; and was applied to all pavements with an application rate of 0.30 lbs per square yard, which varied for demonstration purposes, but was within standard rates of 0.25 to 0.50 lbs per square yard. The aggregate Technical Data Sheet, which indicates particle size analysis, chemical analysis, and material properties such as MOH hardness and specific gravity, is provided in Appendix A MATERIALS. Material was sampled and kept for testing.

Funding was not available to re-apply the critical airfield markings therefore application of GSB-88 excluded all critical airfield painted areas. This procedure was difficult and found to be highly sensitive to wind conditions. If even a slight breeze was present, overspray onto the markings would occur. The work plan was adjusted to accommodate for the wind.

### 2.4.7 Others

There are several other GSB-88 projects that occurred during the overall time of this program that the project engineer was either informed of or consulted with the local facilities in the application of GSB-88.

#### *2.4.7.1 Runway 31L/13R at NAS Fallon, NV*

The GSB-88 application to Runway 31L/13R occurred September 6-8, 2006, prior to any application or evaluation for this project, and was funded separately by the facility. It is included in this report because of the significant information gathered from the application.

Runway 31L/13R was prematurely deteriorating due to binder failure and attempts to mitigate the issue using generic fog seal applications had short term results as anticipated [Ref. 29]. However, areas with low to medium severity weathering/raveling distress, where seal coats would not be effective, were to be repaired (patched). Efforts to resolve global corrosion of the surface by applying typical fog seal coat material with normal procedures, and not repairing localized areas, resulted in high severity weathering/raveling. Although the rate of deterioration for the remaining pavement surface was slightly reduced, deterioration continued at a rate with and anticipated pavement life of about 9 years, which was the average life of pavement at Fallon. It should be noted that pavement life averaged 9 years since initially constructed in 1953 due to the severe vulnerability to thermal cracking in the area where Fallon is located. Although thermal cracking cannot be stopped, the rapid aging that results from open cracks and surface weathering can be significantly reduced, thereby extending the life of pavement if early preventative measures are taken. Critical operations and increasing concerns with FOD resulted in a sudden request for emergency repair and funding. The Project Engineer directed the application of GSB-88, at a significantly 'heavy' rate of application (0.22 gal square yard of 2:1 dilute). Although this action was not in accordance with normal protocol this engineer, based on previous professional experience and an observed understanding of other similarly resolved circumstances, felt confident GSB-88 would at least safely benefit the critical circumstances at NAS Fallon. GSB-88 may be able to inexpensively rebind the pavement and keep the runway in a state of readiness until a more permanent properly engineered and budgeted solution could be accomplished rather than proceeding with the significantly more expensive proposal.

GSB-88 was applied to the runway at a rate of 0.22 gal square yard of 2:1 dilute along with approximately 0.45 lbs square yard of Unimin 4095 Granusil sand in a one-pass application. Because of the heavy application, warm temperatures at time of application, and continued construction truck traffic some minor tacking occurred requiring the contractor to return October 8 to 9 to do touch up. Touch up resolved the problem and no further tacking issues occurred.

The recommended GSB-88 application proved to be extremely successful in mitigating the problem allowing normal timing for engineering and funding, saving the Navy emergency funding (in this case around $30M). Based on observed pavement condition with the facilities' pavement engineer at 18 months, two months prior to overlay, the GSB-88 application appeared to be able to continue to maintain the readiness of the runway for some time into the future (see 3.1.7.1 Raveling).

*2.4.7.2 Taxiway Mike, Hotel & Kilo and Taxiway Charlie at MCAS Cherry Point, NC*

The first application of GSB-88 at MCAS Cherry Point was in August 2004 using facility funding. At that time the shoulders of Taxiways Mike, Hotel, and Kilo were treated with a standard application of 1:1 dilute GSB-88 and 30/60 Black Beauty sand. During the June 8, 2009 site visit, observations showed the shoulders at taxiways Mike and Hotel were still well protected and showed no signs of surface oxidation. Observations at the same time on Taxiway Kilo still showed some of the Black Beauty sand imbedded in the binder, demonstrating the GSB-88 was still active. However, it was recommended that an additional application be scheduled because the 2004 application was beginning to lose it protective characteristics.

In 2004 a 10' x 10' test patch of GSB-88 was placed on a one week old asphalt shoulder on Taxiway November. Observations of that test patch during the 2009 and 2010 site visits demonstrate no deterioration of the treated section and graying and loss of fines in the untreated area.

In June 2009 MCAS Cherry Point engineered additional pavement projects using facility funding. GSB-88 was applied to Taxiway Charlie and High Power Run-up Ramp June 7-10, 2009. Application rates varied between 0.12 - 0.13 gal square yard, a 1:1 dilute, and aggregate was Ultrablast 30/60 sand obtained from Virginia Materials. Application is too early for aging assessment.

*2.4.7.3 Runway overruns at Tyndall AFB, FL*

Application of GSB-88 at Tyndall AFB took place June 12-16, 2007. Application was to new pavement on all four runway overruns and to the older pavements on parking lots and roads around the base hospital. Rate of application on the overruns was 0.13 gal square yard using a local available aggregate (30/60 sand). Application rates at the hospital varied but remained within standard application rates of 0.11 to 0.13 gals per square yard and aggregate was not used.

In addition, test strips at varying rates of 1:1 dilute were placed on the edge of the inboard (13R-31L) runway. Friction testing was performed within 30 days of application with anticipated reduction in friction but above minimums (See details in 2.5 FRICTION EVALUATION).

Evaluation of applications at Tyndall AFB was performed March 22-23, 2009. There appeared to be no surface deterioration on all overruns. Test strips on runway 13R-31L appear to have mitigated deterioration of edges of grooves on the runway in a manner similar to reports at Portland International Airport, OR (PDX) and as observed at Paine Field, Everett, WA.

## 2.5 Friction Evaluation

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. Airfield runways must provide adequate skid resistance to ensure the safe directional control and breaking of aircraft operating on the surface. The degree of skid resistance provided by a pavement surface is expressed in the terms of the surface “coefficient of friction” (COF). A simple definition of friction is: friction value (Mu) equals the force (F), needed to tow an object, divided by the applied pressure (N), against a flat horizontal surface. Mathematically this is defined as Mu = F/N. Friction values (Mu readings), measured by a CFME (Continuous Friction Measuring Equipment), can be used as guidelines for evaluating the surface friction of pavements.

To assist in friction testing and to keep consistent wherever skid testing would be performed, RPI, LP/Hi-Lite Markings, Inc.**,** performed all testing for this project. Friction testing was performed using a T6810 and a 6875 Dynatest CFME Runway Friction Tester and runway measuring system. This equipment meets the FAA and ICAO specifications for friction measuring devices [Ref. 30] as well as requirements of Air Force Engineering Technical Letter (ETL) 04-10 [Ref 31]. The first friction tests had to be started from inside the overrun, passing near pavement lighting, and completing the test to allow for the wheel to be raised prior to running over the arresting cable. Due to this limited area, testing was performed at 40 mph and wet; which was kept consistent for each test performed throughout the project for comparison purposes. Testing at 60 mph was considered unsafe due to conditions given relative to acceleration time as well as stopping time. Figures 29 and 30 represents the test vehicle, showing the proper tire size and the mechanism in which Mu is tested, and a typical test run to collect data. Friction tests were performed at locations having agreed to apply GSB-88 to a runway pavement with additional tests performed on Taxiways. This allows evaluation of different textured pavement with the same environment and same environmental conditions. In addition, San Augustine, TX, Airport was being completed shortly after NAS Fallon and therefore added to get additional friction results from another climate.


Figure 29. Test Equipment.

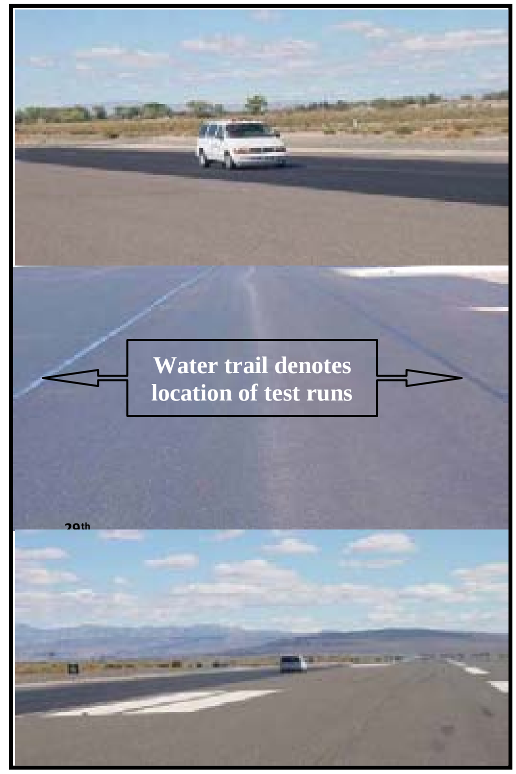


Figure 30. Typical test area showing wet track.

## 2.6 Review Of Databases For Performance After Application

Surface treatments are known to be good asphalt pavement preservation techniques, which can theoretically extend the life of a pavement indefinitely, providing the pavement is structurally sound and surface treatments are applied periodically. As such, surface treatments are believed to extend pavement life by 10% to 40%. To better understand potential benefits for application of GSB-88 to Navy/DoD airfields, under actual field conditions and with no bias of "special care" application typically incorporated for product presentation and 'controlled' testing and evaluation, the services of Applied Pavement Technologies, Inc. (APTech) were engaged to compare the performance of HMA airfield pavements under similar conditions that have received an application of GSB versus those that have not using data obtained from established MicroPAVER databases.

APTech was to identify and obtain available relevant MicroPAVER databases by canvassing the state aviation agencies as well as individual airport agencies identified by ASI to have had GSB applications; and determine whether the databases included work history information pertaining to surface treatments, information not typically populated into the databases. The existing MicroPAVER databases with work history information pertaining to the location and dates of GSB applications provided in the databases, and supplemented by information from the Port of Portland and by ASI distributors, were provided by the States of Oregon, Utah, Colorado, Washington, and Wyoming. Washington and Wyoming did not have enough application sites to be useful and were excluded from the study.

# 3.0 FINDINGS AND ANALYSIS

## 3.1 Visual Evaluation

It is typical in pavement assessment to place too much emphasis on the color or 'blackness' of the pavement and cosmetics, or aesthetics. Often a pavement preservation material, or process, is given greater consideration if it covers the top surface of the aggregate and remains black; such as a commercial retailer parking lot where remaining black is aesthetically pleasing and encourages customers into the business. Surface treatments may in some cases result in friction issues, which is why many products that do cover the aggregate, such as coal tar, are not recommended. In contrast an asphalt emulsion will penetrate and bind the aggregate. Thus, the evaluation protocol does not consider blackness. In spite of this, it should be pointed out that change in appearance or color difference is commonly used to assist in reviewing and explaining photo documentation, and therefore it should not be misunderstood that the blackness (or lack thereof) is not being assessed to evaluate the effectiveness of the sealer binder, but to elucidate the differences of pavement surfaces.

### 3.1.1 MCAS Cherry Point, NC

April 2009 and 2010 observations of GSB-88 indicated it remained effective in retarding surface oxidation on all treated pavements. However, it was noted that Taxiway Echo had some areas of pavement segregation and would have benefited from a heavier application than the 0.12 gal square yard applied in 2007.

### 3.1.2 Avon Park AFR, FL

The majority of the application was at a rate of 0.14 gal square yard of 2:1 dilute. On the NE end of the runway cross strips at varying rates of application from 0.14 to 0.20 in 0.01 increments were applied. Evaluation in March of 2009 and 2010 indicated significant reduction in surface oxidation due to the GSB-88 application for the whole of the runway with the exception of cracking that occurred on the areas that received a lighter application. As expected, on the NE end the heavier the application the more complete the preservation process.

Apron Delta and Taxiway 5:
Apron Delta has severe uniform block cracking reportedly caused by similar sized blocks used as base. The PCI at time of application for both Apron Delta and Taxiway 5 was "Poor" (55-41) with significant surface oxidation. GSB-88 application rate was 0.13 gal square yard of 1:1 dilute for both. Evaluation in June 2009 showed no continued surface oxidation. GSB-88 over the original binder was clearly evident when compared with control areas.

Parallel Taxiway and Taxiway 3:
Both Taxiways had a PCI of "Fair" (70-56) at time of GSB-88 application. The rate of application was 0.13 gal per square yard. The surfaces of both were badly oxidized and evaluation in March 2009 showed no continued surface oxidation. Numerous control areas were left and future inspections could be useful.

Taxiway Alpha (T01A), Taxiway Bravo (T04A), and Taxiway Charlie (T05A):

Rate of application was 0.12 gal square yard 1:1 dilute, with control areas left for future comparison. Evaluation on June 12, 2009 revealed no additional surface oxidation and GSB-88 still in place over the original binder. Note that the northern extension of Bravo is in bad need of repair, but a PCI was unavailable. This piece received a partial application of remaining GSB-88 and may, or may not, prove valuable for this evaluation.

Normal surface oxidation, as would be expected in such a hot/wet climate as south central Florida, appeared to have been significantly retarded on all GSB-88 applications at Avon Park AFR.

Application at Avon Park AFR produced cosmetic issues in the form of "blotching". The cause of this is currently unknown and not commonly observed on other GSB-88 airfield applications. It appears that the GSB-88 was able to absorb into the pavement unevenly leaving more residue on the surface in some areas and less in others. Time appears to be mitigating the blotchy appearance. This cosmetic issue at present appears to have no relevance to GSB-88's ability to preserve the asphalt.

### 3.1.3 NAS Fallon, NV

GSB-88 was applied Sep 28 to 30, 2007 and skid tests performed between Sep 29 and Oct 1, 2007; and again on May 21 and Dec 9, 2008.

Runway 7/25:
Test strips of GSB-88 were applied, and friction testing within 24 hours demonstrated no serious reduction in friction, so application to the rest of the runway commenced immediately (see section on Friction Testing). Although structurally sound, Runway 7/25 was in the early stages of binder failure and raveling when GSB-88 was applied at a rate of 0.13 gal square yard of 1:1 dilute with approximately 0.3 lbs of Unimin 4075 Granusil sand.

Taxiway Alpha:
Test strips were also applied to Taxiway Alpha and friction testing completed within 24 hours demonstrated no serious reduction in friction. Alpha was a much newer pavement and is serving as a more classic example of early intervention of preventive maintenance and the long term benefits of the same. Although other issues with the taxiway exist, to date there is no indication of surface oxidation since the application of GSB-88.

Taxiway Delta:
Delta was an aged pavement with serious cracking in areas and had been treated with a micro surface sometime in the past. To date, there is no indication of surface oxidation since application of GSB-88.

### 3.1.4 NASJRB Willow Grove, PA

Taxiway Juliet:
Taxiway Juliet had a PCI in 2004 of 83. The northern two thirds of the taxiway were treated with 0.12 gal square yard 2:1 dilute and the southern one third at 0.14 gal square yard 1:1 dilute. Both applications would have similar residue per square yard of pavement; however, delivery differences may provide additional information. The cycle course and ccp-2 at the east end of Juliet were left untreated per request to leave paint intact. The radius at junction with Runway 15-33 was left untreated as "control" for comparison. Evaluation of application on April, 2010,

shows no additional surface oxidation and GSB-88 performing as in other locations.Taxiway Hotel:
Portion of Hotel west of Parallel Taxiway was treated at different rates: first pass farthest south at .14 gal square yard of 2:1 dilute, adjacent pass just north 2:1 @ 0.16, pass just south of center 2:1 @0 .15, everything north of centerline treated with 2:1 @ 0.16. Portion east of Parallel Taxiway lost some of application from rain and was retreated with 2:1 dilute @ 0.04 two days later. Evaluation of application in April, 2010, shows no additional surface oxidation and GSB-88 performing as in other locations.

Taxiway Foxtrot:
Both sections were treated at a rate of 0.15 gal square yard at 2:1 dilute. Evaluation of application in April, 2010, showed no additional surface oxidation and GSB-88 performing as in other locations.

Wash Rack Taxiway (WRT):
North/South 16 ft single pass immediately adjacent to Parallel Taxiway was treated with 0.15 gal per square yard of 2:1 dilute. The rest of south half of WRT was treated with 2:1 @ 0.16. North half of WRT was treated with 2:1 @ 0.14. In addition, 16 ft by approximately 150 ft strip just off WRT on PA2-B (on very old pavement) was treated with 2:1 @ 0.20 to further demonstrate possible benefits to older, badly deteriorated pavements. Evaluation of application in April, 2010, showed no additional surface oxidation and GSB-88 performing as in other locations.

Taxiway Charlie:
This taxiway was treated with 0.15 gal square yard at 2:1 dilute. Evaluation of application in April, 2010, showed no additional surface oxidation and GSB-88 performing as in other locations.

Taxiway Golf-1 North of RW 15-33:
A portion between runway and parallel taxiway was treated at a rate of 0.12 gal square yard of 2:1 dilute for all radiuses and 0.15 of 2:1 dilute for the rest. The section between parallel taxiway and VR ramp was left untreated. Evaluation of application in April, 2010, shows no additional surface oxidation and GSB-88 performing as in other locations.

### 3.1.5 PMRF Barking Sands, HI

South Taxiway (TW2-01):
A single pass immediately parallel to Runway 16R was applied at a rate of 0.15 gal square yard of 2:1 dilute. The balance of the taxiway was shot from the runway towards PA2-02 at a rate of 0.17 gal/square yard at 2:1 dilute. Some streaking was observed on the southeast end.

North Taxiway (TW1-01 & TW1-02): application rates varied between 0.15 and 0.17 at a dilute of both 1:1 and 2:1.

Hangar Apron (PA4-01):
Application was at a rate of 0.15 gal/square yard of 1:1 dilute.

Munitions Ramp (PA1-01):
Application rate was 0.15 gal/square yard of 2:1 dilute.

Test Strips:

One demonstration test strip was placed at the far south end of TX1 on the east side shoulder starting near the runway. This was badly deteriorated pavement and application rate was 0.20 gal/square yard of 2:1 dilute.

The second test strip was on badly deteriorated shoulder pavement on the north end of PA3-01. Application rate was .30 gal square yard of 2:1 dilute. The purpose of these test strips is to be able to evaluate the outside extremes of GSB-88's ability to "reclaim" badly deteriorated pavements.

### 3.1.6 NAWS China Lake, CA

GSB-88 was applied May 16 to 18, 2008, and skid tests performed between May 17 and 19, 2008, and again on December 7, 2008 and May 16, 2009.
Runway Section R8-2:
Test strips of GSB-88 were applied at rates of 0.10, 0.11, and 0.13 gal/square yard of 1:1 dilute and friction testing within 12 hours and 36 hours demonstrated no serious reduction in friction and application to the rest of the runway commenced immediately (see section on Friction Testing).

All applications were at a dilute of 1:1.
Rate of application was 0.10 gal/square yard on Taxiway Delta and between 0.10 and 0.14 gal square yard for all other pavements.

### 3.1.7 Other Observations

Asphalt Systems, Inc. claims GSB-88 was specifically engineered to be a unique early intervention preventive maintenance material that significantly reduces asphalt pavement deterioration with emphasis on preventing surface oxidation. This evaluation has primarily focused on that claim. However, during the course of this evaluation other positive aspects GSB-88 applications have been observed and should be discussed.

#### *3.1.7.1 Raveling*

A GSB-88 application at NAS Fallon, NV on Runway 31L/13R occurred September 6-8, 2006 on pavement that was prematurely deteriorating due to binder failure. A heavy application of GSB-88 was able to return Runway 31L/13R to full service and later site visits confirmed that the application remained effective up to the day it was replaced with an overlay 20 months later. Figure 31 shows the pavement condition before, during, and after the application of GSB-88; and the effectiveness up to 20 months after the application.

Avon Park AFR, FL provided another opportunity to observe various application rates of GSB-88 on badly deteriorated pavement of runway 14/32, which was reported to be in "Very Poor" condition, the heaviest being 0.22 gal sq/yd of 2:1 dilute. In the heavy application GSB-88 was observed to fill in the cracks, even with dirt and grass in some, while rebinding the surface aggregate. Since the pavement appeared to be structurally sound, but very badly affected by surface deterioration and oxidation, the heavier GSB-88 application appeared to sufficiently mitigate raveling and further surface deterioration as shown in Figure 32.

Similar results were observed at Mulino, OR, airport where early aggregate "popouts" were noticed and corrected for over seven years with a GSB-88 application, at which time a second GSB-88 application continued the process (See 2.2.2.3).

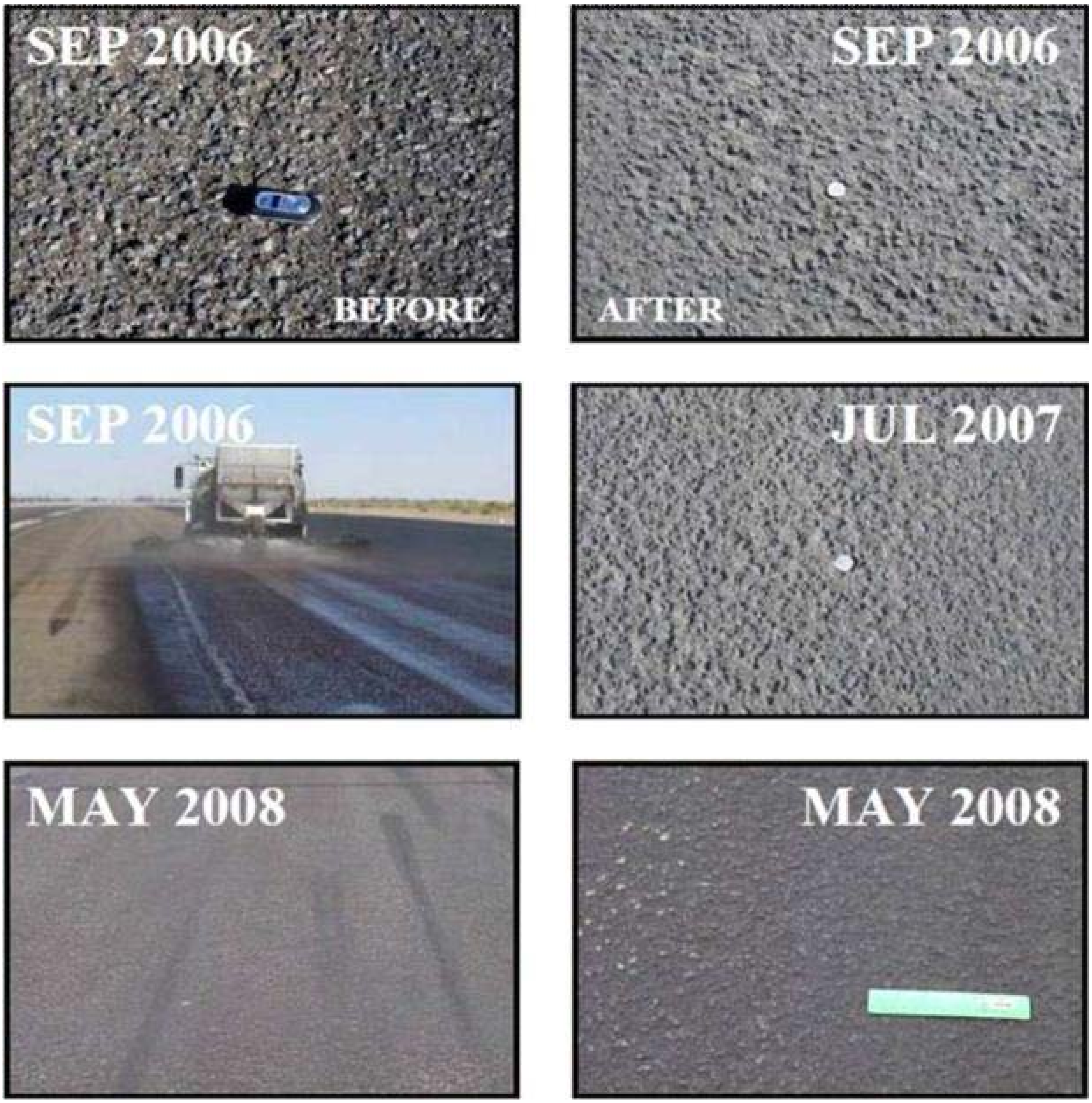


**Figure 31. Runway 31L/13R, NAS Fallon, NV.**


**Figure 32. Runway 14/32, Avon Park AFR: application rate evaluation strips.**

*3.1.7.2 Surface Segregation and Pre-Raveling*

Asphalt pavement surface segregation can occur during paving if the asphalt is either too hot or too cool at the time of rolling, and the pavement binder and fines are segregated from the larger aggregate on the surface. Figure 33 is typical segregation. Figures 34 and 35 show other causes include equipment not clean or operating properly, poor practice of raking, paving too quickly or not fast enough, and others. Pavement segregation typically presents vulnerability in the pavement to potential early raveling because of its exposure of the inner pavement and lack of fines and binder. Segregation areas are commonly more absorbent of moisture into the pavement interior and generally collect additional water in their larger voids, accelerating surface oxidation. GSB-88 application to areas of segregation appears to fill those voids, rebind the overexposed aggregate, and seal the interior from moisture and ultraviolet penetration.

In many cases segregation and premature loss of fines indicate a condition that one might call “Pre-Raveling”. The close observation of a pavement may indicate premature aging characteristics. In such cases early treatment with a quality material designed to re-bind and seal, such as GSB-88, is far better than the normal practice of waiting until the problem significantly manifests itself. Early application of such proven materials in circumstances such as these, will generally maintain the pavement in much better condition and cost much less to correct than waiting until the problem becomes a FOD issue. Preventing minor problems from becoming more serious in this manner is a critical aspect in objective preventive maintenance of significant airfield assets.

**Figure 33. GSB-88 applied to segregated area, resulting in control of pre-raveling.**

**Figure 34. Segregation treated with GSB.**

**Figure 35. Pavement scars treated with GSB.**

Due to a lack of funding to re-apply airfield markings at NAWS China Lake, CA, GSB-88 was not applied to areas immediately around the existing paint; as a result significant areas of runway and taxiway pavement were untreated. Although not apparent when viewing Figures 36 and 37, an on-site survey conducted in the spring of 2010 (two years after application) showed multiple areas of pavement contained FOD on the runway in the untreated areas, but no FOD was found in the areas treated with GSB-88.

**Figure 36. Pavement generated FOD on non-treated pavement.**

**Figure 37. Pavement generated FOD on non-treated pavement.**

*3.1.7.3 Retarding Crack Propagation*

GSB-88 is not recommended as standard crack filler. The viscosity of GSB-88 under normal dilution and application rates will only fill smaller cracks of little depth. However, Figures 38 and 39 show the sealing of "hairline" cracking can be of great benefit in preventing the hairline cracks from absorbing additional water and exposing the inside of the crack to detrimental ultraviolet rays. One type of crack distress commonly seen is "checking". Checking occurs when the pavement is too hot or too cool when final rolling is being completed. These cracks extend only a short depth into the pavement surface. Many experts do not consider these cracks detrimental to pavement life. However, when checking occurs, there are numerous cracks within the area affected and, as with the hairline cracking and as shown in Figures 40 and 41, GSB-88 can be of benefit in preventing the checking from absorbing additional water and exposing the inside of the crack to detrimental ultraviolet rays. GSB-88 appeared to be very effective in sealing the hairline cracking and mitigating accelerated oxidation of the pavement. Heavier applications of GSB-88, when appropriate, can further benefit cracking as describe above.

**Figure 38. Cracks filling at edge of application.**

**Figure 39. Partial filling with one coat.**

**Figure 40. GSB-88 seals 'checking' cracks.**

**Figure 41. 'Checking' and hairline cracks.**

*3.1.7.4 Rebinding Older Pavements*

One of the first site visits for this evaluation was to the Boeing Test Facility in Glasgow, MT (see 2.2.1). During the visit it was clear from simple observation and anecdotal testimony from the airfield manager that GSB-78, the cutback version of GSB-88, had done an exceptional job in holding a very old asphalt pavement together well enough to remain in service long after such a pavement would be expected to have fully failed. Boeing airfield manager also noted that other types of materials and processes had been tried, but failed to provide similar benefits relative to reducing or stopping the deteriorating process as the GSB had. Figure 42 shows this older, badly deteriorating pavement at a Boeing facility is being held together with multiple GSB-78 applications.

**Figure 42. Rebinding pavement at Boeing Facility, MT.**

In addition, with the observations at Boeing in mind, Figure 43 shows heavy applications of GSB-88 at NAS Fallon, NV, Avon Park AFR, and PMRF Barking Sands, HI, helped to provide evidence that older pavements could benefit from similar applications. The Navy/DoD has numerous airfields and other asphalt pavements in inventory that are badly aged and at varying stages of reserved readiness. In many cases there is still some degree of use that could be of benefit to the Navy/DoD, and expensive rehabilitation is not a reasonable option. In the process of evaluating GSB-88 applications it has been observed that many marginal pavements that remain structurally sound, but badly weathered and cracked, could be brought to a higher state of readiness and maintained at that higher state for significantly longer period of time with repeat applications of GSB-88.

**Figure 43. Rebinding pavement at Avon Park AFR, FL.**

## 3.2 Pavement Condition Assessments

Pavement Condition Assessments with the PCI index, and general condition of pavements prior to and during this evaluation program were previously discussed in 2.4 and 3.1. For this evaluation, PCI values were reviewed to establish pavement deterioration rate as a function of PCI, and as such, estimate a remaining pavement life prior to failure (PCI = 0-10) or to any minimum value of interest. Although PCI does not directly measure structural capacity or friction characteristics of a pavement, it is understood that PCI is the appropriate measure of condition and performance to use in this study.

The PCI distress index for airfield pavements [Ref. 32], ASTM D 5340, results in a value of 0 to 100 which is a measure of the pavements structural integrity (not capacity), and surface operational condition. It correlates the needed level of M&R and agrees closely with the collective judgment of experienced pavement engineers [Ref. 33]. The distress information obtained as part of the PCI condition survey provides insight into the causes of distress and whether it is related to load or climate. The degree of pavement deterioration is a function of distress type, distress severity, and amount or density of distress. To produce one index that would take into account all three factors, 'deduct values' were introduced as a type of weighing factors to indicate the degree of effect that each combination of distress type, severity level, and distress density has on pavement condition. The deduct values were developed based on in-depth knowledge of pavement behavior, input from many experienced pavement engineers, field testing and evaluation of the procedure, and accurate descriptions of distress types and severity levels. This brief background for PCI is relevant to help understand the difficulty of developing proper distresses and associations with other distress types and pavement management theory and practice.

Seal coats, fog coats, and the like have been misunderstood as to what they are capable of doing, or simply there has been no distress type associated with this type of product to measure, protect, or 'repair', as there is with most every other type of maintenance, wearing surface treatments, overlays and so on. Most reports, reviews, discussions and general misguided information indicates fogs, seal coats, and up through and including sealer-binder products such as GSB-88, have no structural benefit at all and are not performing as well as whatever other product is being discussed. These statements are correct and accepted in the pavement preservation community. However, the reason fog applied products will not perform as well is either the characteristic or performance being measured is specific to that other type product and its association with a distress which it is designed to repair; or the simple issue that there has been no distress associated with what a well designed fog applied surface treatment is to protect or repair; until now.

A fog applied surface treatment has little or no structural strength itself but by preventing the ingress of water it enables the inherent strength of the pavement and the subgrade to be preserved. However, more important is the over-riding 'distress' that water intrusion is part of oxidation, which is commonly referred to as 'weathering' in lay terms. Weathering however, is no longer just a lay term; weathering has become a separate distinguishable distress in the most recently released ASTM standard, specifically ASTM D5340–10.

Actual distress equations are not yet available in MicroPAVER and will not be until release of PAVER 7. To account for Weathering Distress, the existing Raveling/Weathering Distress was used for the model in this report as shown in Table 1.

**Table 1. Model Used For Relating Weathering Distress With Weathering/Raveling Distress**

| | |
|---|---|
| **Good**<br>**PCI > 85** | Added 5% of Low Severity Raveling/Weathering to represent 100% Low Severity Weathering (new distress in ASTM D5340 – 10 Standard Test Method for Airport Pavement Condition Index Surveys) |
| **Satisfactory**<br>**PCI = 71-85** | Added 20 or 100% of Low Severity Raveling/Weathering to represent 100% Low or Medium Severity Weathering, multiply the result by percent of CLIMATE characteristic (i.e., Climate = 90, Load = 0, Other = 10; factor = 0.90.) |
| **Fair**<br>**PCI = 56-70** | Added equal quantity of Low Severity Raveling/Weathering to the designated quantity of L and M Severity Block Cracking; to represent 100% Low-Medium Severity Weathering; or add 100% Low Severity Raveling/Weathering if no block cracking indicated. |

Appendix C presents data relative to PCIs from past evaluations, distress classification from most recent reports and PCIs before and after the application of GSB-88. Figures 44 - 50 represent projected PCI lines using actual PCI from each specific date evaluated the pre- and post inspection dates previously described, and projected values using condition analysis from time of application to 2012, which are also shown in Appendix C.

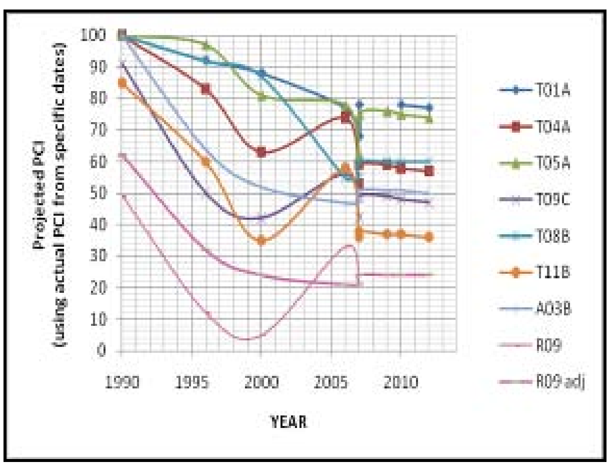


**Figure 44. Avon Park AFR, FL.**

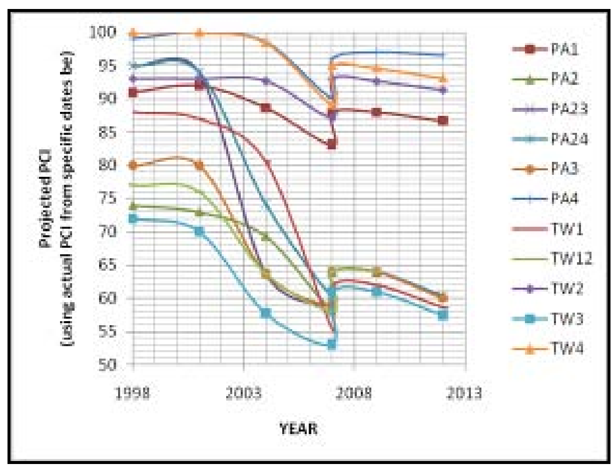


**Figure 45. PMRF Barking Sands, HI.**

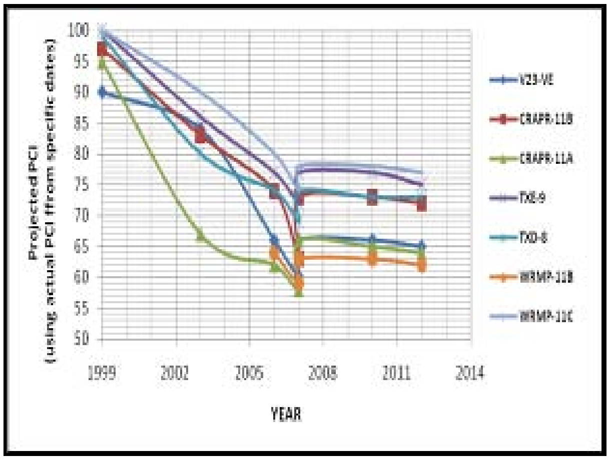


**Figure 46. MCAS Cherry Point.**

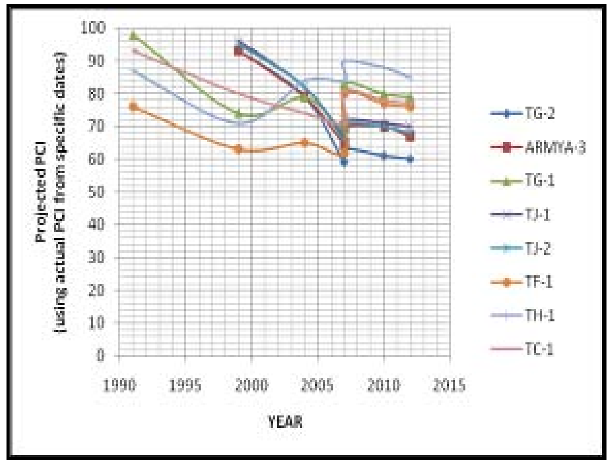


**Figure 47. NASJRB Willow Grove.**

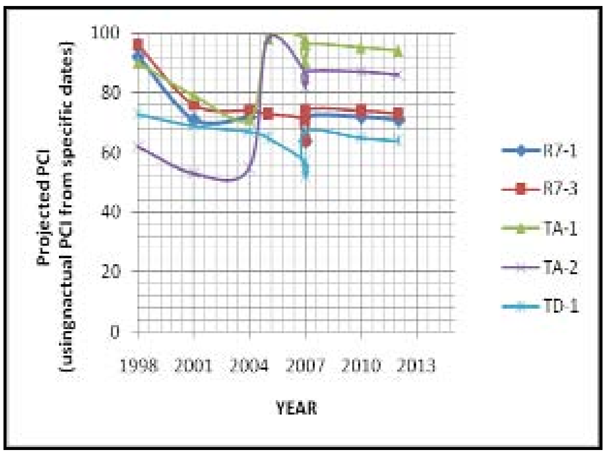


**Figure 48. NAS Fallon, NV.**

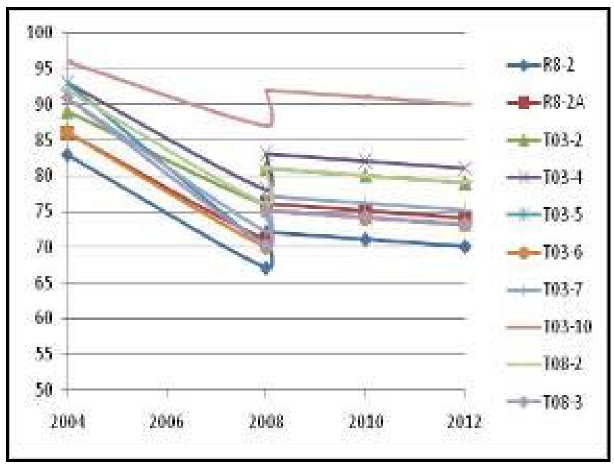


**Figure 49. NAWS China Lake, CA.**

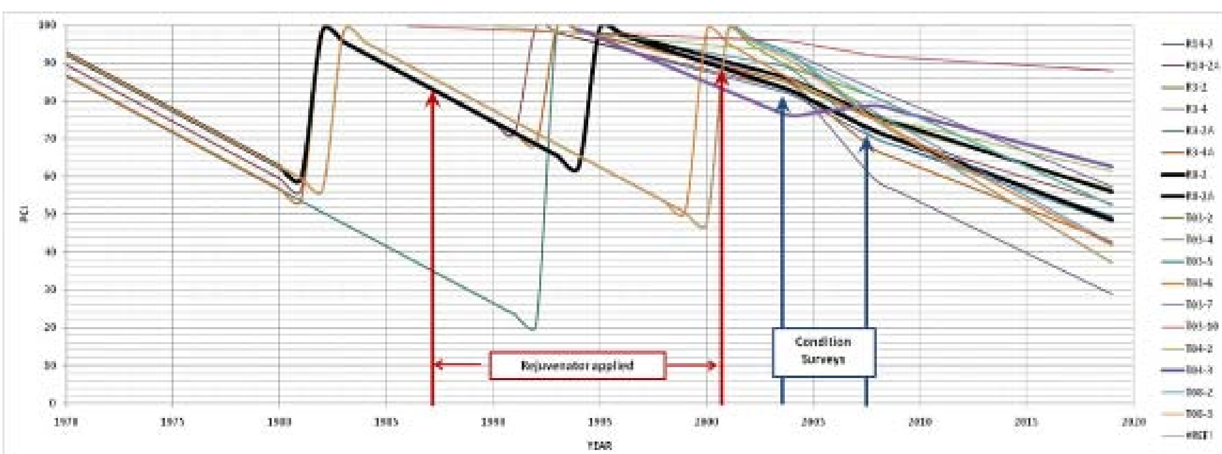


**Figure 50. NAWS China Lake historical overlay cycle and projection not including GSB-88.**

### 3.3 Friction Results

Friction averages for each 500-foot segment surface were within the required confidence level of 95.5 percent or two standard deviations of ±0.06 Mu numbers. Tables 3, 4, and 5 present the results obtained when testing at NAS Fallon, NV, and NAWS China Lake, CA. These sites represent the greatest extremes of climatic/weather conditions relative to asphalt pavement within the United States. In addition, San Augustine, TX, Airport was being completed shortly after NAS Fallon and is located along the same 'to' and 'from' travel route taken by the testing company when testing both at Fallon and China Lake. Approval for access was obtained for testing, providing this project with data from an additional climatic weather zone (previous attempts to locate a site early on in this project with similar climate was unsuccessful). Tyndall AFB applied GSB-88 on new overruns and had several test areas to evaluate friction results, so this also was added as a fourth climate zone covered for this project.

Friction data presented herein demonstrate GSB-88 can safely be applied to airfield pavements, including both runways and taxiways. Figure 51 is a collage of friction evaluation test areas from NAS Fallon and NAWS China from both short and longer term tests. Tables 2 - 5 and Figure 52 show the results of all tests performed from as early as 12 hours after application of GSB-88 to as long as 436 days after.


**Figure 51. Collage of friction evaluation test areas from NAS Fallon and NAWS China Lake.**

**Table 2. Friction Test Results at NAS Fallon, NV**

| NAS Fallon, Nevada | | | | | |
|---|---|---|---|---|---|
| **Time Frame of Testing relative to Application of GSB-88** | 40 MPH *Low Speed Friction* | | | | |
| | **Runway Test Area 1** | **Runway Test Area 2** | **Taxiway Test Area 1** | **Taxiway Test Area 2** | **Taxiway Test Area 3** |
| Control *Before* | .824 mu | | .854 mu | | |
| 24 Hours *After* | .501 mu | .502 mu | .605 mu | .642 mu | .598 mu |
| 48 Hours *After* | .648 mu | .695 mu | ***EQR*** | ***EQR*** | ***EQR*** |
| 72 Hours *After* | ***EQR*** | ***EQR*** | ***EQR*** | ***EQR*** | ***EQR*** |
| 96 Hours *After* | .685 mu | .725 mu | .728 mu | .741 mu | - |
| 117 Days *After* | .774 mu | .812 mu | .777 mu | ***.670 mu*** | ***.615 mu*** |
| 236 Days *After* | .765 mu | .751 mu | .836 mu | .799 mu | .696 mu |
| 436 Days *After* | .820 mu | .822 mu | .906 mu | .874 mu | .818 mu |

Friction results of ***.670 mu & .615 mu*** indicate data sensitive to pavement changes (nightly freeze/thaw detected at every crack in pavement). Using results between stations 1000 to 2000 feet, Taxiway Test Area 2 (where crack width is least) is .708 mu; with similar "correction," Test Area 3 is .655 mu.

Air temperatures at test were 60-70 °F (control & initial days); 27-30 °F (117 Days); 50-54 °F (236 Days); and 57-60 °F (436 Days).

**EQR:** Vehicle repair required off site/no effect on test apparatus.

**Table 3. Friction Test Results at NAWS China Lake, CA**

| NAWS China Lake, CA | | | | | |
|---|---|---|---|---|---|
| **Time Frame of Testing relative to Application of GSB-88** | 40 MPH *Low Speed Friction* | | | | |
| | **R/W Pass 1 Shoulder** | **R/W Pass 2 E.O. Shoulder** | **R/W Pass 3 E.O. Runway** | **R/W Pass 4 Runway** | **Taxiway** |
| Control *Before* | .740 mu | | | | .709 mu |
| 24 Hours *After* | .535 mu | .563 mu | .365[12] mu | - | - |
| 48 Hours *After* | .570 mu | .582 mu | .456[36] mu | .491 mu | .483 mu |
| 72 Hours *After* | .609 mu | .623 mu | .520[60] mu | .576 mu | .525 mu |
| 96 Hours *After* | ***CPE*** | ***CPE*** | ***CPE*** | ***CPE*** | ***CPE*** |
| 90+/- Days *After* | ***CPE*** | ***CPE*** | ***CPE*** | ***CPE*** | ***CPE*** |
| 205 Days *After* | .799 mu | .772 mu | .747 mu | .726 mu | .707 mu |
| 365 Days *After* | .739 mu | .712 mu | ***EQF*** | ***EQF*** | ***EQF*** |

The superscript number represents time frame of testing if different than indicated for the specific row; as an example: ***.123*** [99] indicates friction test result is .123 mu, 99 hours after application.

***CPE***: Cancelled by Project Engineer. ***EQF***: Equipment Failure; believed to be heat related from high air temperatures.

Air temperatures at test were 90-95 °F (control & initial Days); 69-71 °F (205 Days); and 102-105 °F (365 Days).

**Table 4. Friction Test Results at San Augustine, TX**

| Time Frame | **40 MPH** *Low Speed Friction* | **60 MPH** *High Speed Friction* |
|---|---|---|
| Control *Before* | 1.08 mu | 1.01 mu |
| 24 Hours *After* | .886 mu | .823 mu |
| 48 Hours *After* | .867 mu | .820 mu |

(Runway application rate 0.14 gallons/SY) [2007]

**Table 5. Friction Test Results at Tyndall AFB, FL**

| Time Frame | **40 MPH** *Low Speed Friction* | **60 MPH** *High Speed Friction* |
|---|---|---|
| Control *Before* | .91 mu | .88 mu |
| 30 Days *After* | .78 mu | .77 mu |

(Grooved Runway test strips) [2007]

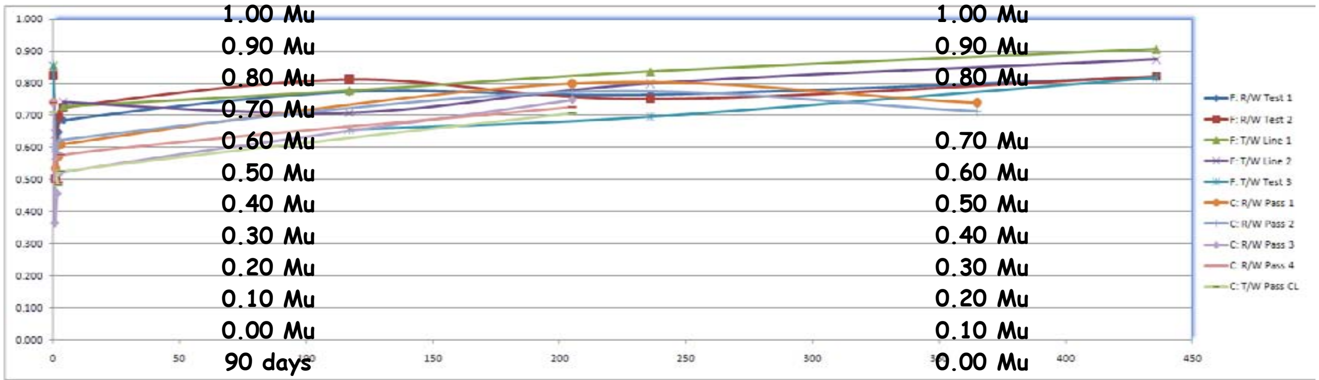


**Figure 52. Graphical representation of data presented in Tables 2 through 5 above.**

Figure 52 is the graphical representation of all the data from the sites indicated, which represent twelve test areas, ten of which are considered to be different conditions (i.e. aggregate varied between tests at Fallon), and four climate zones. Figure 53 is the final of several charts which step through the process of getting from Figure 50 to Figure 53. Resulting trendlines are represented in Figure 53 and Figure D-5 in Appendix D.

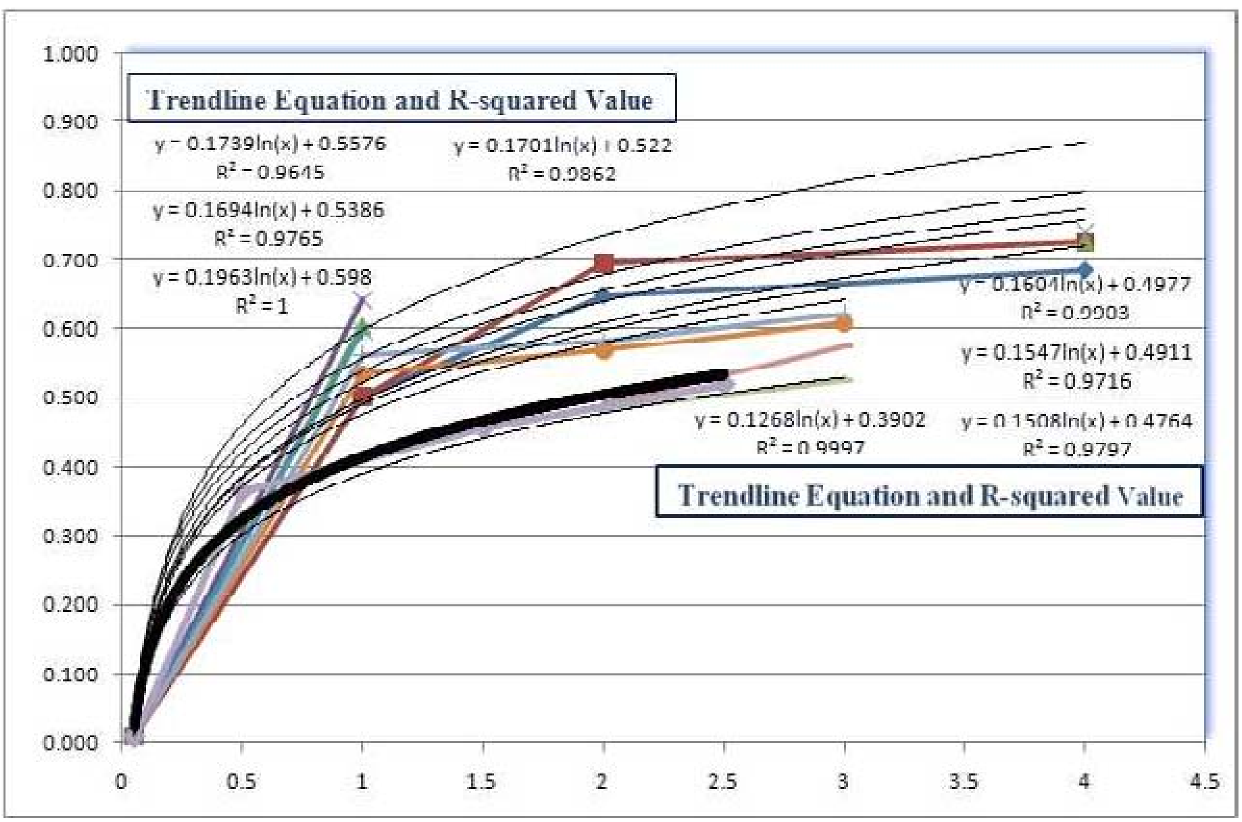


**Figure 53. Trendlines developed for each set of tests representing first 4 days after application (vertical axis indicates skid results in Mu; horizontal axis represents days after GSB-88application).**

## 3.4 Analysis Of Databases For Performance After Application

APTech identified and obtained relevant MicroPAVER Databases as previously discussed in paragraph 2.6 which were provided by the States of Oregon, Utah, and Colorado, as well as the Port of Portland, Oregon.

### 3.4.1 Overall Database

Pavement condition index (PCI) data for 167 airports were obtained from existing MicroPAVER pavement management databases provided by the States of Oregon, Utah, and Colorado, as well as the Port of Portland, Oregon. The dataset used in this study included 3,503 airport pavement sections. Of these, 1,844 sections had never received a surface treatment application, 883 sections had received GSB application(s), and 776 sections had received a surface treatment(s) other than GSB. Ultimately, the Oregon statewide database containing 67 airports with 1,727 sections; the Utah statewide database containing 43 airports with 252 sections; the Colorado database containing 56 airports with 531 sections; and, the Port of Portland database for PDX with 988 sections were selected for use in this study. These databases were established in 1984, 1988, 1991, and 1988, respectively.

Upon review of the data, as indicated in APTech's summary of findings [Ref. 34], it was found that pavements that received an application of GSB demonstrate lower rates of deterioration and appear to be performing better than those that did not. The data also indicated that the performance of GSB appears to be impacted by the overall PCI of the pavement at the time of application and the type of distress present at the time of application. The GSB sections had lower rates of deterioration when applied to pavements with PCI values above 60 and with less than a 10 percent deduct due to load (PDDL) related distress.

### 3.4.2 Performance Modeling and Analysis

When these databases were set-up over two decades ago, it was not for the purpose of monitoring the effectiveness of different maintenance and rehabilitation treatments, so modifications had to be made to the databases before proceeding with the analysis. First, the current zone field in MicroPAVER was populated with information on the last observed treatment type. Pavements were identified as having no surface treatment, a surface treatment other than GSB, and GSB. Next, three user fields at the section level were populated with Pavement Age (since last construction or major rehabilitation) at time of treatment application, Last Recorded PCI prior to the treatment application, and Last Recorded Percent Deduct due to load prior to the treatment application.

For pavement sections that had received GSB applications, further manual adjustments to the databases had to be made. It was important to make sure that the historical zone fields, which are associated with PCI events, be adjusted for each inspection date so that GSB did not show up as the treatment type for inspections conducted prior to the application of the GSB. This was done by going through each inspection date for GSB sections and selecting the appropriate surface type for each historical event. Using MicroPAVER modeling routines, APTech developed pavement performance models for pavements that have received GSB applications versus those that have not. The models were initially developed for each pavement use (runway, taxiway, and apron) within each database. A 95 percent confidence limit was used to statistically filter outliers from the model. The only other restriction made to the datasets was to limit them to pavements that are 40 years old or younger. The resulting formulas were reduced to straight-line equations to make the comparison of one model to another easier. Figures E-1 - E-12 in Appendix E REVIEW provide a graphical comparison of the pavement performance models developed for Oregon (excluding PDX), Utah, Colorado, and PDX. Tables 1 through 4 of Appendix E present the same models in mathematical terms. The performance models developed for those pavements having received GSB applications were refined further to compare the performance of pavements when GSB was applied at different condition levels and when GSB was applied on pavements exhibiting different levels and amounts of load-related distress.

A further analysis for pre- and post-GSB application on the same pavement section was conducted on just those sections that had ever received a GSB application using the Oregon and PDX databases. These databases were used for the wide range of airport size and pavement use within the same regional area havening similar climatic events; but more importantly, "cleanliness" of the database at the section level was good, meaning data being clearly stated without requiring additional information to clarify data indicated. This analysis requires an extensive amount of time even when the database requires little to no 'cleaning'; therefore, both databases were used because minimal assistance and effort was required to identify and verify pavement sections as having received a GSB application and which had PCI data for each specific section for both before and after each treatment.

### 3.4.3 Trends: Rate of Deterioration

The Oregon database contained half of all sections used in this analysis and required the least amount of assistance and effort to identify pavement sections as having no surface treatment, a surface treatment other than GSB, and GSB. Although no specific materials (other than GSB) or procedures were identified, and therefore no specific direct comparisons can be made between GSB-88 and any other material or process, it is interesting to note that other surface treatments successfully reduced the rate of deterioration on Oregon runways to 1.0 PCI points per year, compared to 1.6 for untreated, and 0.5 for GSB treated. Likewise, for taxiways the rate of deterioration for untreated , treated with other than GSB, and treated with GSB were 1.8, 1.2, and 0.6 PCI points per year respectively; and 1.7, 1.5, and 1.1 PCI points per year for aprons respectively. Figure 54 represents this trend; illustrating the reduction of deterioration rates on all airfield asphalt pavement when surface treatments are applied.

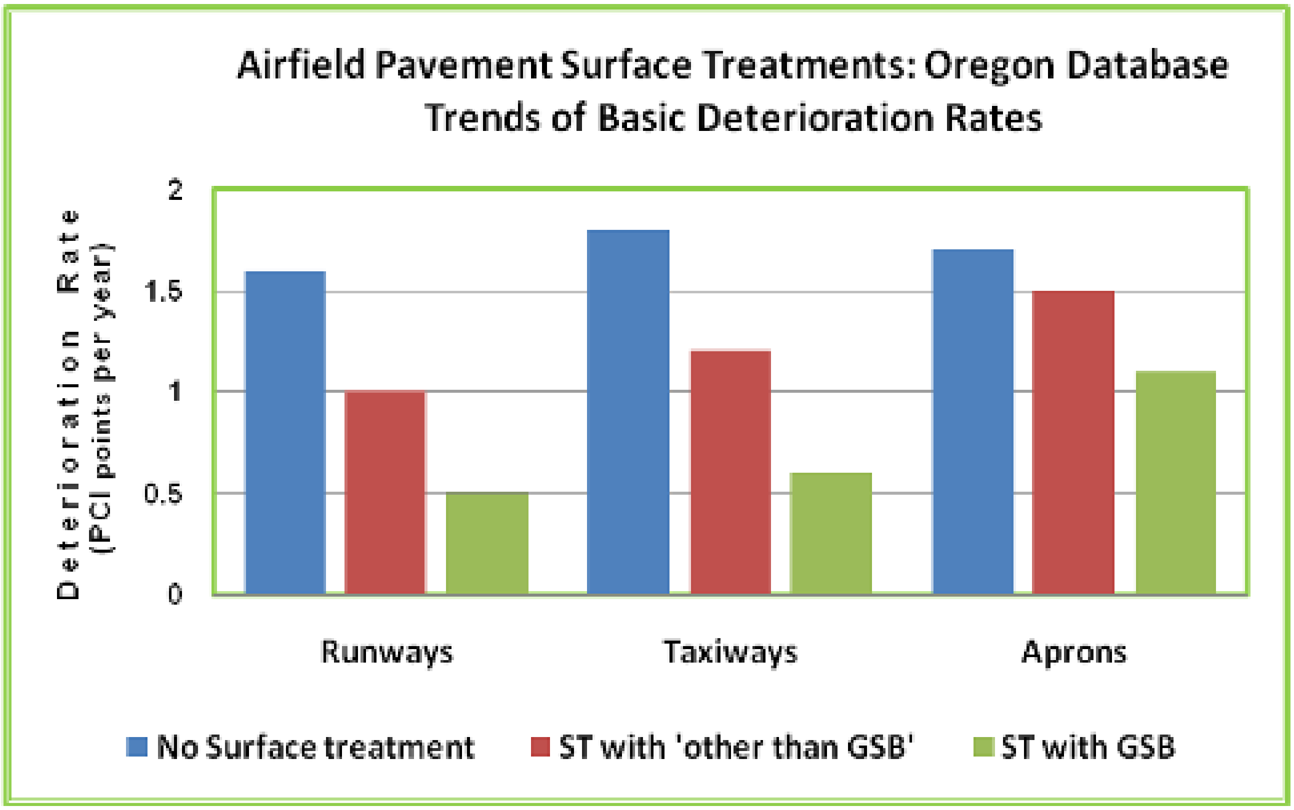


**Figure 54. Trends of basic deterioration rates.**

The Oregon and PDX databases contained 695 sections that received GSB applications and were used for the analysis to compare the deterioration rates for airfield asphalt pavement of pre- and post-GSB application. For those sections, the deterioration rate of the pavements prior to GSB application was compared to that after the application. As Table 6 shows for the Oregon and PDX databases, the deterioration rate decreased after the GSB application. Figures 55 and 56 provide graphical comparisons of deterioration rates prior to and after GSB application and Table 6 presents the same models in mathematical terms.

The deterioration rate after GSB application for Oregon runways was 64 percent less than before application; for taxiways it was 16 percent less than before application; and, for aprons it was 17 percent less than before application. For PDX runways, taxiways, and aprons, the deterioration rate after GSB application was 21, 26, and 24 percent less than before application respectively.

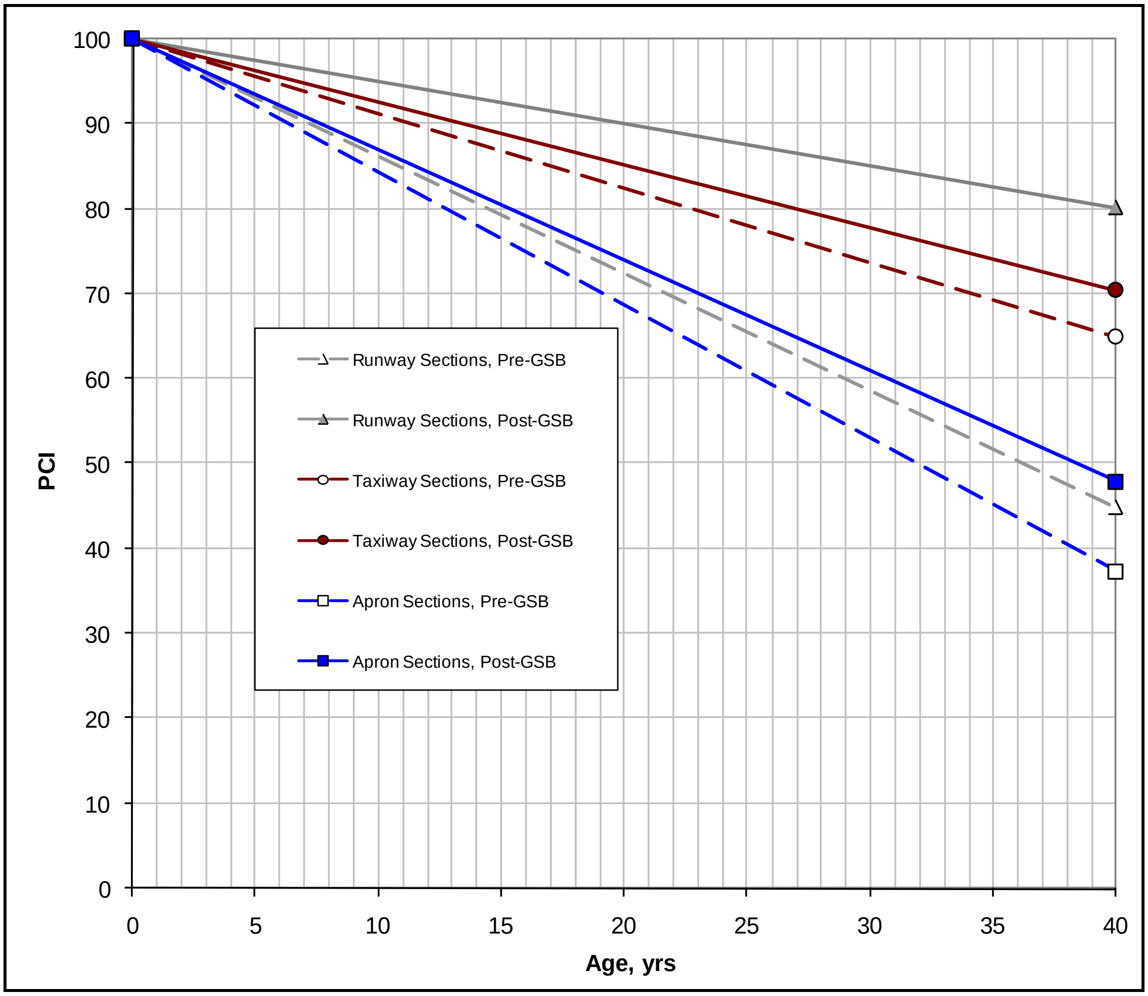


**Figure 55. Comparison of deterioration rates pre- and post-GSB for Oregon database.**

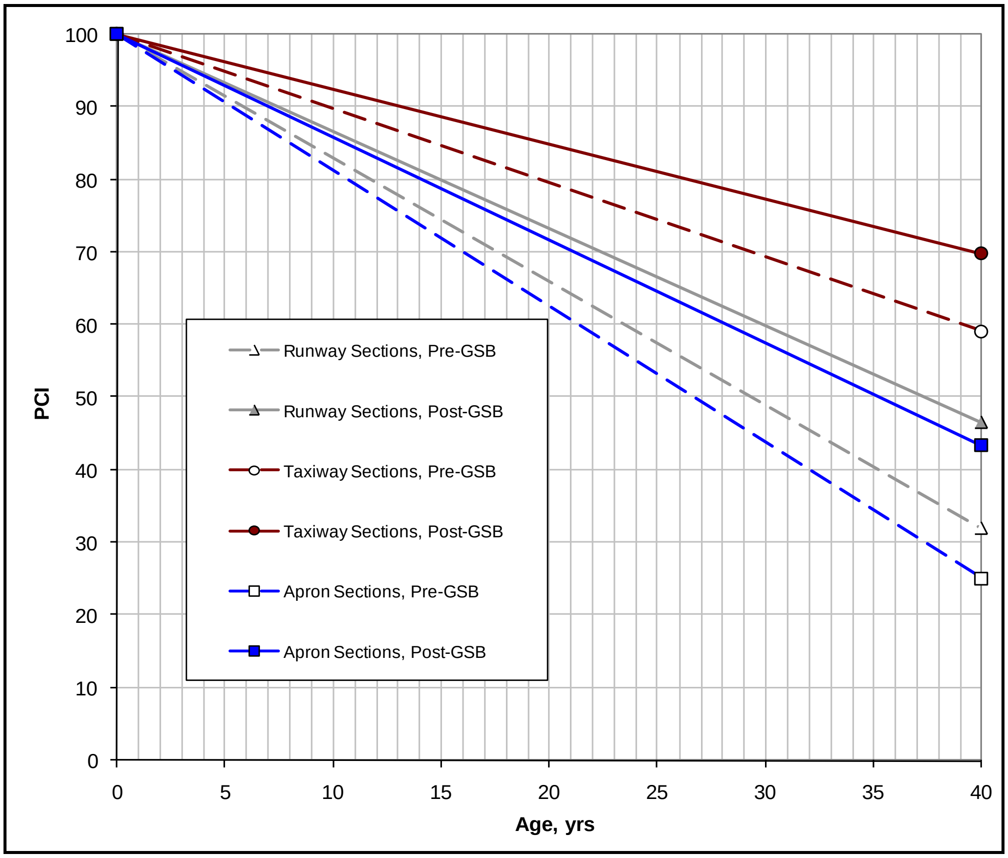


**Figure 56. Comparison of deterioration rates pre- and post-GSB for PDX database.**

**Table 6. Comparison of Deterioration Rates Prior to and After GSB Application**

| Family Description (GSB sections only) | Deterioration Equation (X = age in years) |
|---|---|
| Oregon GSB Runway Sections Pre-Application | 100 - 1.37923X |
| Oregon GSB Runway Sections Post-Application | 100 - 0.49612X |
| Oregon GSB Taxiway Sections Pre-Application | 100 - 0.87642X |
| Oregon GSB Taxiway Sections Post-Application | 100 - 0.73976X |
| Oregon GSB Apron Sections Pre-Application | 100 - 1.56521X |
| Oregon GSB Apron Sections Post-Application | 100 - 1.30108X |
| | |
| PDX GSB Runway Sections Pre-Application | 100 - 1.70041X |
| PDX GSB Runway Sections Post-Application | 100 - 1.33625X |
| PDX GSB Taxiway Sections Pre-Application | 100 - 1.02034X |
| PDX GSB Taxiway Sections Post-Application | 100 - 0.75451X |
| PDX GSB Apron Sections Pre-Application | 100 - 1.87230X |
| PDX GSB Apron Sections Post-Application | 100 - 1.41415X |

#### *3.4.3.1 Oregon Database: GSB Treated versus Non-GSB Treated Pavements*

Oregon runways treated with GSB had a deterioration rate of 0.5 PCI points per year versus 1.6 for non-treated runways; taxiways treated with GSB had a deterioration rate of 0.6 PCI points per year versus 1.8 for non-treated taxiways; and aprons treated with GSB had a deterioration rate of 1.3 PCI points per year versus 1.7 for non-treated aprons.

The performance of GSB improved when placed on pavements with a PCI greater than 60. The deterioration rates for runway sections treated with GSB and with a PCI greater than 60 at time of application was 0.4 PCI points per year versus 0.5 PCI points per year when applied to pavement with a PCI of 60 or lower. For taxiways the deterioration rate for treated sections with PCI greater than 60 was 0.57 PCI points per year versus 0.64 PCI points per year when GSB applied to pavements with a PCI of 60 or lower. There were insufficient data to make the comparison for aprons.

There were insufficient data to compare the performance of GSB when applied to sections with different levels of deduct due to load present except for taxiway sections. In this case the deterioration rate for GSB applied to sections with lower than 10 percent deduct due to load was 0.6 PCI points per year compared to 1.3 PCI when applied to sections with greater than or equal to 10 percent deduct due to load

Figures E-1 - E-3 in Appendix E provide a graphical comparison of pavement performance models developed for Oregon and Table E-1 presents the same models in mathematical terms.

#### *3.4.3.2 Colorado Database: GSB Treated versus Non-GSB Treated Pavements*

Colorado runways treated with GSB had a deterioration rate of 1.5 PCI points per year versus 2.3 for non-treated runways; taxiways treated with GSB had a deterioration rate of 1.1 PCI points per year versus 1.7 for non-treated taxiways; and aprons treated with GSB had a deterioration rate of 1.6 PCI points per year versus 2.4 for non-treated aprons.

There were insufficient data to compare if the performance of GSB improved when placed on pavements with a PCI greater than 60 versus GSB applied to pavements with PCI less than or equal to 60.

There were only sufficient data for taxiways to compare the performance of GSB when applied to sections with different levels of deduct due to load. The deterioration rate for GSB applications on taxiway pavements where PDDL was less than 10 percent was 1.0 PCI points per year versus 1.9 for applications where the PDDL was greater than or equal to 10 percent.

Figures E-4 - E-6 in Appendix E provide a graphical comparison of the pavement performance models developed for Colorado and Table E-2 presents the same models in mathematical terms.

#### *3.4.3.3 Utah Database: GSB Treated versus Non-GSB Treated Pavements*

Utah runways treated with GSB had a deterioration rate of 1.8 PCI points per year versus 2.1 for non-treated runways; taxiways treated with GSB had a deterioration rate of 2.1 PCI points per year versus 3.0 for non-treated taxiways; and aprons treated with GSB had a deterioration rate of 2.2 PCI points per year versus 3.4 for non-treated aprons. With the exception of taxiways, the performance of GSB improved when placed on pavements with a PCI greater than 60. The GSB deterioration rates for runway sections with a PCI greater than 60 at time of application was 1.7 PCI points per year versus 2.3 PCI points per year when applied to pavement with a PCI of 60 or lower. For taxiways the deterioration rate for treated sections with PCI greater than 60 was 2.4

PCI points per year versus 1.9 PCI points per year when GSB was applied to pavements with a PCI of 60 or lower. For aprons the deterioration rate for treated sections with PCI greater than 60 was 1.5 PCI points per year versus 2.4 PCI points per year when GSB was applied to pavements with a PCI of 60 or lower.

The comparison of the performance of GSB when applied to sections with different levels of deduct due to load was inconclusive. For taxiways the rate of deterioration for PDDL less than 10 percent was 2.2 PCI points per year versus PDDL greater than or equal to 10 percent of 1.9. For aprons the rate of deterioration for GSB applications on pavements where the PDDL was less than 10 percent was 1.9 PCI points per year and in cases where the PDDL was greater than or equal to 10 percent was 2.5. There were insufficient data to compare performance of the runway sections.

Figures E-7 through E-9 in Appendix E provide a graphical comparison of the pavement performance models developed for Utah and Table E-3 presents the same models in mathematical terms.

#### *3.4.3.4 PDX Deterioration Rates of GSB Treated versus Non-GSB Treated Pavements*

PDX runways treated with GSB had a deterioration rate of 1.3 PCI points per year versus 1.3 for non-treated runways; taxiways treated with GSB had a deterioration rate of 0.8 PCI points per year versus 1.0 for non-treated taxiways, and aprons treated with GSB had a deterioration rate of 1.4 PCI points per year versus 1.5 for non-treated aprons.

There were only sufficient data to compare if the performance of GSB improved when placed on pavements with a PCI greater than 60 versus GSB applied to pavements with PCI less than or equal to 60 for taxiway pavements. The deterioration rate for GSB applications on taxiway pavements where PCI was greater than 60 was 0.75 PCI points per year versus 1.0 for applications where the PCI was less than or equal to 60 percent.

There were insufficient data to compare the deterioration of sections where GSB was applied on pavements with different levels of PDDL. Figures E-10 - E-12 in EF provide a graphical comparison of the pavement performance models developed for Portland International Airport (PDX) and Table E-4 presents the same models in mathematical terms.

The differences in deterioration rates between GSB and non-GSB treated pavements were more marked for the airports contained in the statewide Oregon database than for the PDX database. The cause of this difference in impact is unknown since this was not a controlled test. It could be related to any number of factors, including conditions during placement (such as precipitation and temperature), quality control during placement, materials used during the original construction, traffic levels and type of traffic, and so on. A summary of all the basic deterioration rates discussed are shown in Figure 57.

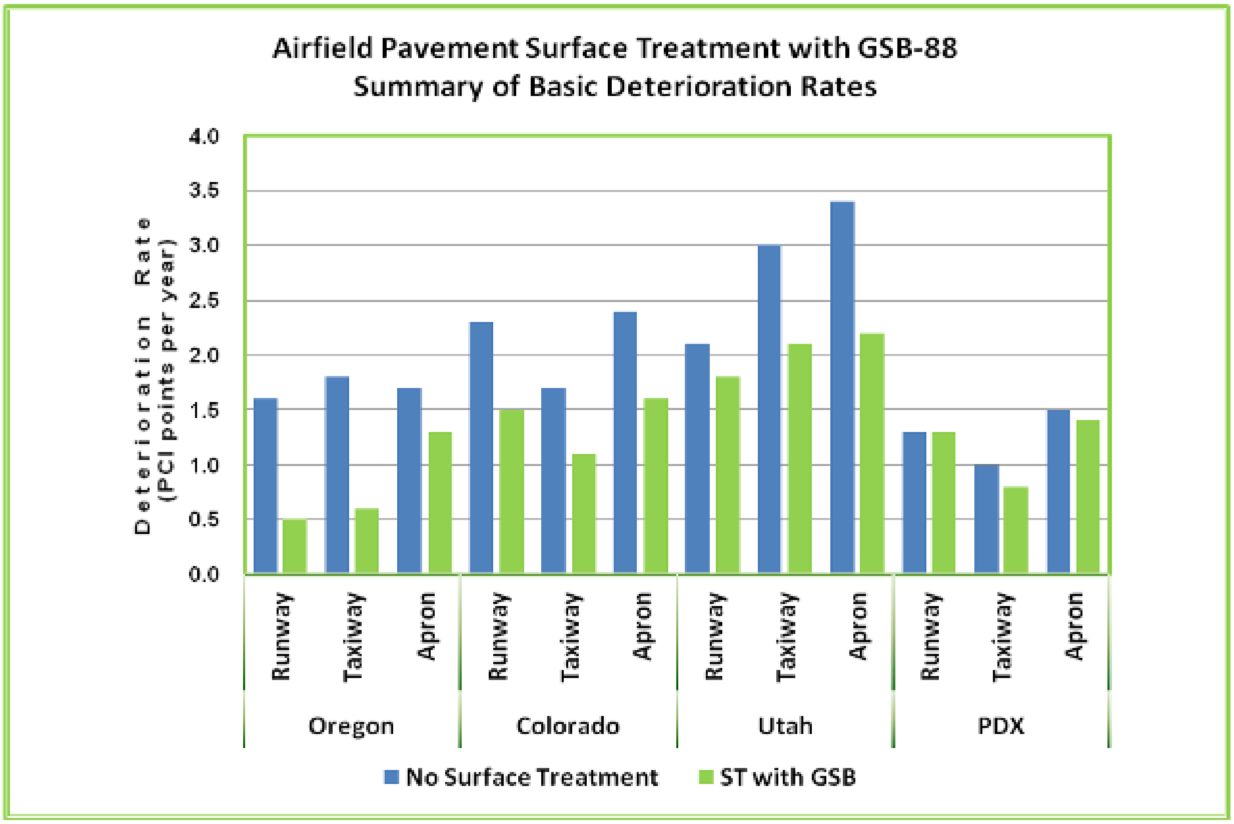


**Figure 57. Basic Deterioration Rates.**

### 3.5 Economic/Costs

Economic analysis for return on investment of GSB-88 was completed and compared to what is now commonly done for pavement construction alternatives using ECONPACK 4.0.1[Ref. 35] and following the policy and guidance of OMB Circular No. A-94 [Ref. 36], DoDINST 7041.3 [Ref. 37], and NAVFAC P-442 [Ref. 38]. Based on Navy Policy, the 30-year real discount rate of 2.8% which is located in OMB Circular No. A-94 Appendix B (revised January 2009) was used to discount constant dollars. A real discount rate has been adjusted from a nominal discount rate to eliminate the effect of expected inflation. The economic life of airfield pavements is 25 years. Reference Code A1 of the NAVFAC Economic Life Analysis Consolidated Report.

Descriptions, information, and data used in ECONPACK for the economic analysis of GSB-88 as an alternative is presented in Appendix F ECONOMIC ANALYSIS AND LIFE CYCLE COST. Economic analysis and life cycle cost is calculated using Cumulative Net Present Value (NPV). Figure 58 shows a graphical representation of a 25-year economic analysis following, in general, typical parameters required in a construction project as previously referenced. Life of pavement (time between overlays) averages less than a 20 year design life and significantly less than a 25 year economic life (15 year average for runways, which was used for this analysis, and 18 year average for other). Therefore a surface treatment designed for preservation (to extend pavement life) would not be a viable alternative under past and present guidelines and requirements; primarily due to projects being required prior to the design life, alternatives are focused on construction type and mission scenarios, and assumption of proper maintenance are included. This is the philosophy of engineering – design to failure, but in the case of airfield pavements, failure is primarily surface distresses and not structural defects or fatigue. In addition, the philosophies supporting life cycle analysis and requirements coincide with engineering.

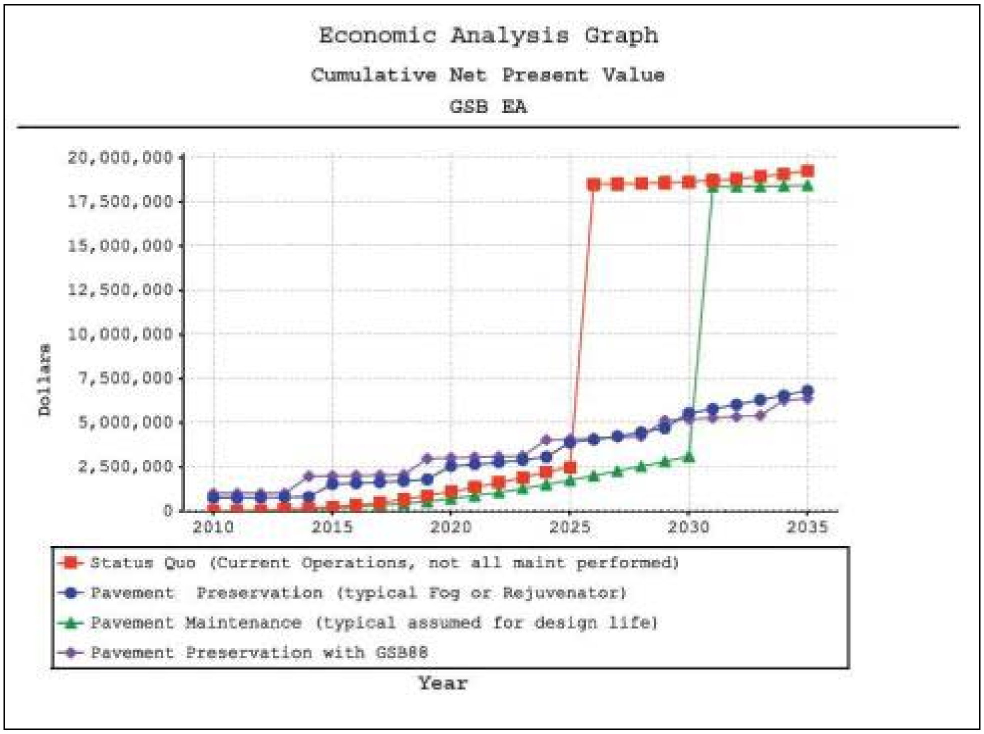


**Figure 58. Economic Analysis Graph, 25-yr Life Cycle.**

Following engineering philosophies as in the past or changing those engineering alternatives but keeping with life cycle cost philosophies as Figure 58 represents, do not adequately provide information relative to what GSB-88 or pavement preservation in general will provide and save. Therefore, an additional analysis was performed, without inflation for simplicity of comparison, for both 25-yr and 50-yr life cycles, and is presented in Figures 59 and 60.

Review of figures support using a 50-yr cycle emphasized on preservation, and not design to failure. However, these also show inflation does need to be accounted for; when comparing to the 50-yr life cycle with inflation, presented in Figure 61, where two alternatives 'flip-flop' in rating by NPV. All results are also presented in Appendix F.

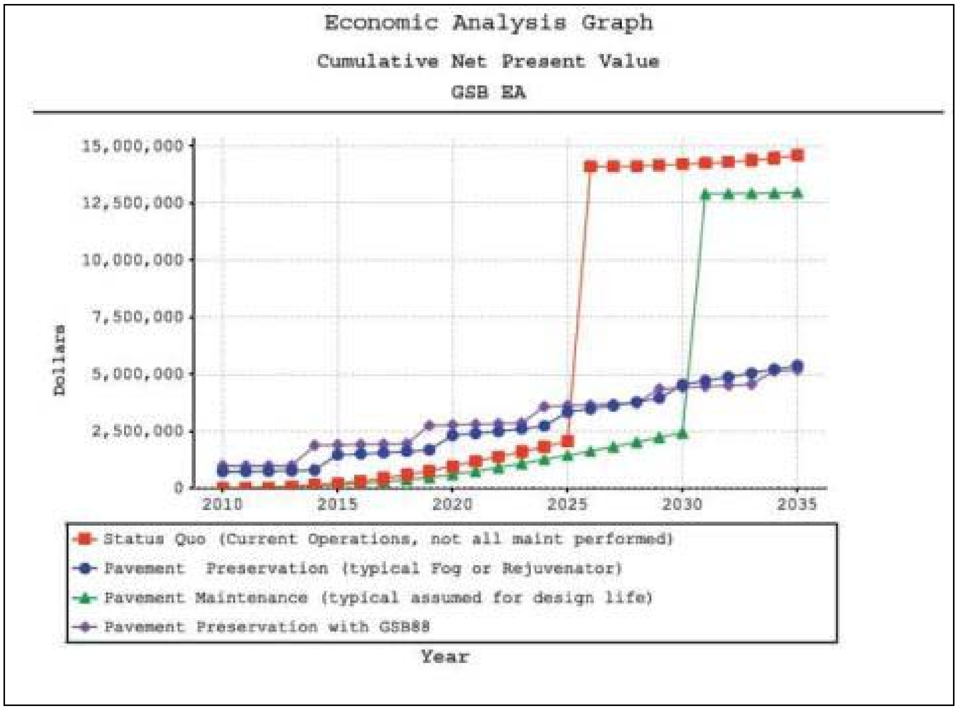


**Figure 59. Economic Analysis Graph, 25-yr Life Cycle w/o inflation.**

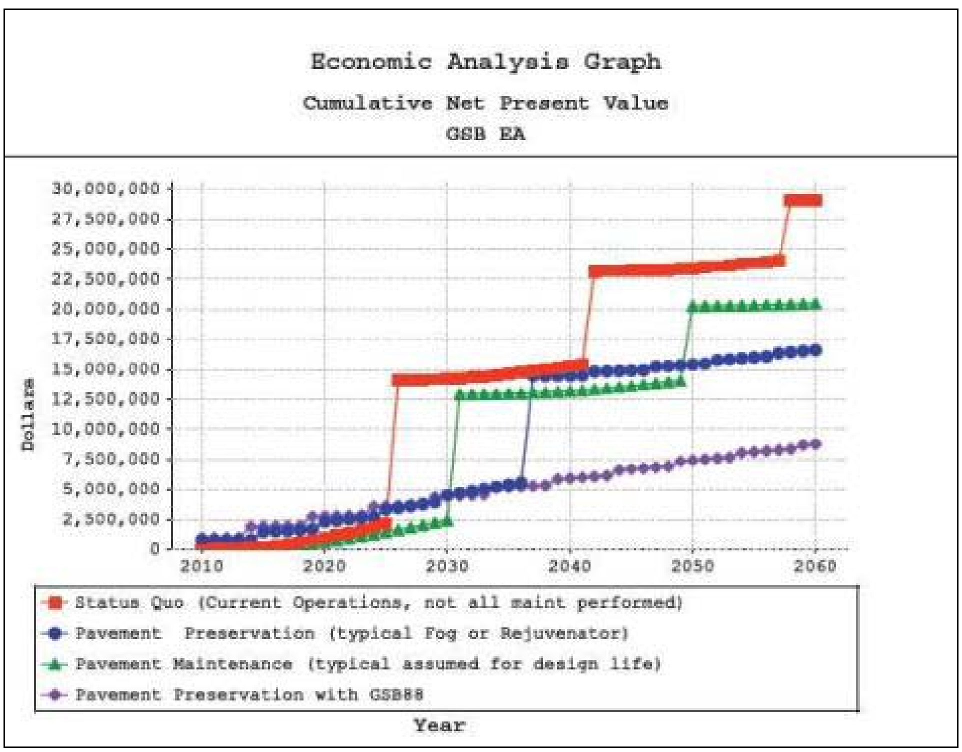


**Figure 60. Economic Analysis Graph, 50-yr Life Cycle w/o inflation.**

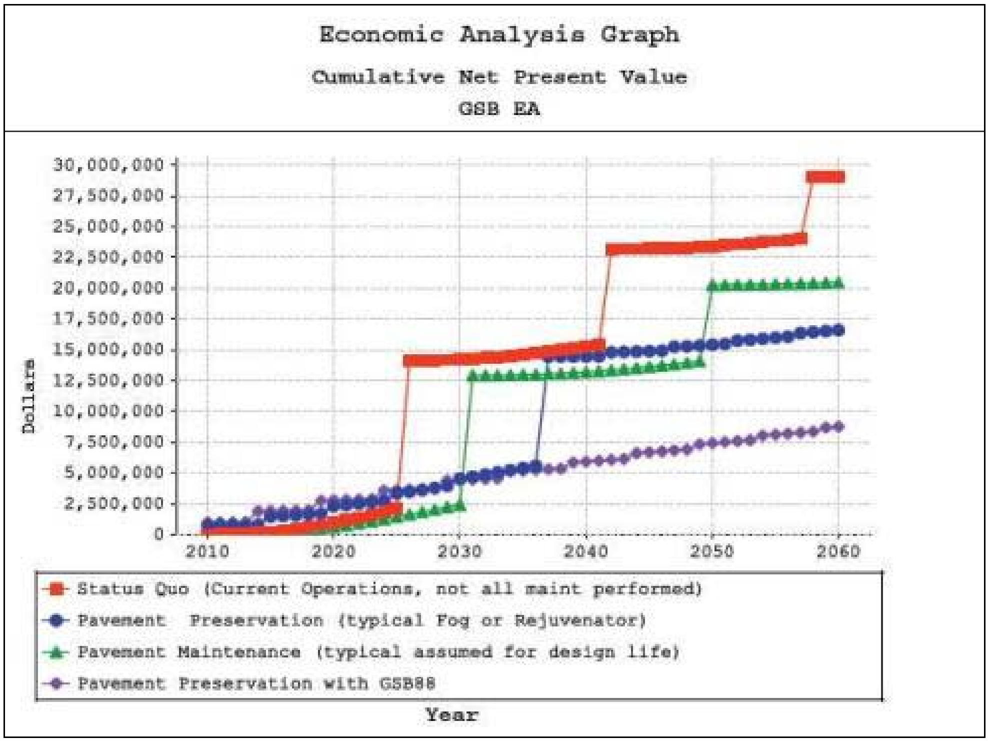


**Figure 61. Economic Analysis Graph, 50-yr Life Cycle with inflation.**

Table 7 presents the 50-yr Life Cycle Cost NPV for each alternative. Pavement preservation with GSB-88 NPV ($13.4M) is approximately $34.5M less than the Status Quo NPV ($47.9M). 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 savings of $34.5M represents a savings of approximately $700M from the status quo (~ $950M). The analysis also shows a Savings-to-Investment Ratio (SIR) of 5.0 and Return on Investment (ROI) is 400%.

**Table 7. Economic Analysis, 50-yr Life Cycle Cost**

| **LIFE CYCLE COST (50 Years)** | | | | |
|---|---|---|---|---|
| Results represent costs per million square yards; analysis, or life cycle begins immediately after new asphalt pavement construction or overlay; and GSB-88, fog, or rejuvenator applied within the first year after new pavement completed. | **Costs ($1,000) NPV** | | | **Life Cycle Cost NPV ($1,000)** |
| **Alternative** | **Initial Const.** | **M & R** | **O &M** | |
| Status Quo (Current Ops, not all maintenance performed) | 0 | 6,462 | 41,455 | 47,917 |
| Pavement Maintenance (typical assumed for design life) | 0 | 5,907 | 27,692 | 33,599 |
| Pavement Preservation with GSB-88 | 0 | 4,803 | 8,604 | 13,407 |
| Pavement Preservation (typical Fog or Rejuvenator) | 0 | 5,964 | 19,774 | 25,738 |

Discounted Payback Period (DPP) is a negative number of years indicating pay back is instantaneous relative to preserving pavement.

A Cost-Benefit Analysis (Dollarization) was completed similar to that completed for some State and local Agencies for roads and highways; and data presented may be more readily understandable than other ways in which to support the cost of preservation when the benefit is difficult to realize.

Dollarization simply considers a maintenance strategy associated with a condition of the pavement; and takes the cost of the strategy over an assigned useful life f that strategy and determines an annual cost. The biggest problem associated with Dollarization is similar to all cost-benefit and economic analysis methods; which is determining the useful life of a surface treatment. Table 8 and Figures 62 and 63 are presented below and represent Dollarization for GSB-88 with useful life of 4 years as discussed prior, and a various sources for useful life of all strategies shown.

**Table 8. Maintenance Strategy Cost Table**

| Maintenance Strategy | Cost per Year | Cost per SqYd | Avg Useful Life |
|---|---|---|---|
| Surface Seal - Fog Seal | $0.50 | $0.50 | 1 |
| Surface Seal - Rejuvenating | $0.75 | $0.75 | 1 |
| Surface Seal - Emulsified Asphalt Seal Coat | $0.38 | $0.75 | 2 |
| Surface Treatment - Modified Seal Coat | $0.33 | $1.00 | 3 |
| Surface Treatment - GSB-88 Sealer Binder | $0.25 | $1.00 | 4 |
| Surface Treatment - Slurry Seal | $0.50 | $1.50 | 3 |
| Surface Treament- Single Chip Seal | $0.67 | $2.00 | 3 |
| Micro Surfacing | $0.56 | $2.25 | 4 |
| Overlay - AC Thin (Global) | $2.38 | $19.00 | 8 |
| Patching +Crack Sealing + or Surface Treatment | $1.35 | $6.75 | 5 |
| Note: OL is cost by condition from PAVER with condition being 5 PCI below min. i.e. R/W is a 70 therefore cost from table is average of the cost at 70 and 60. | | | |

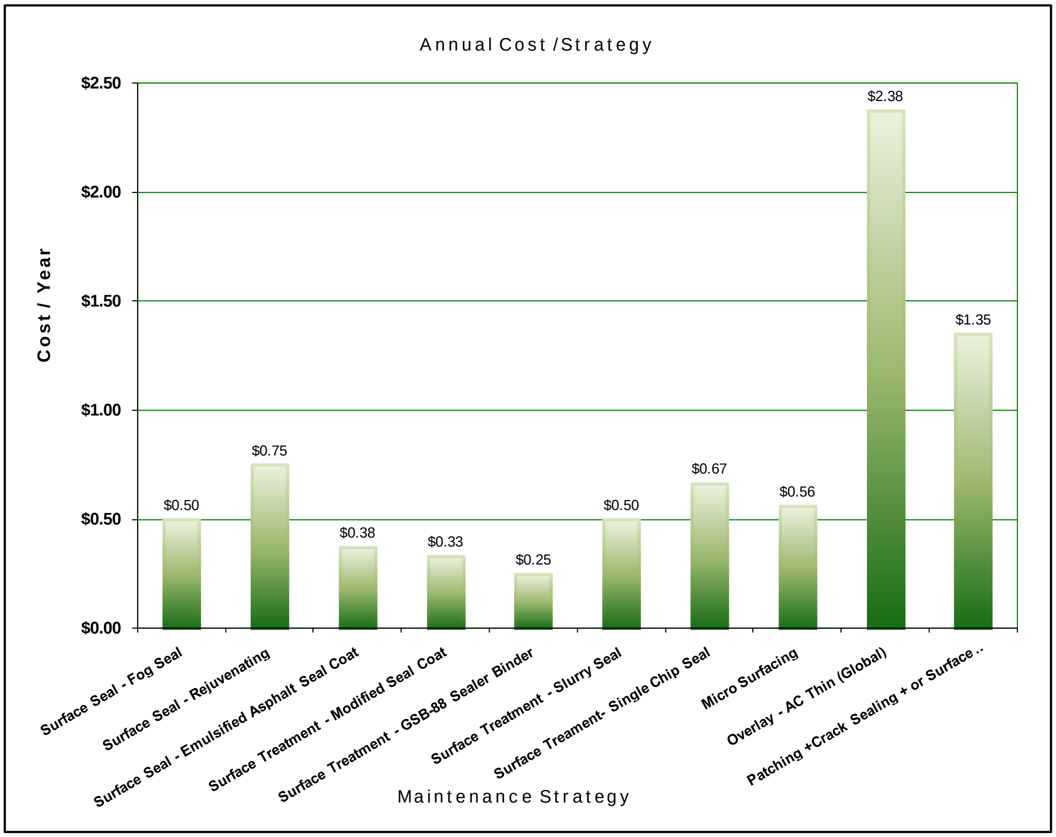


**Figure 62. Annual Cost per Maintenance Strategy.**

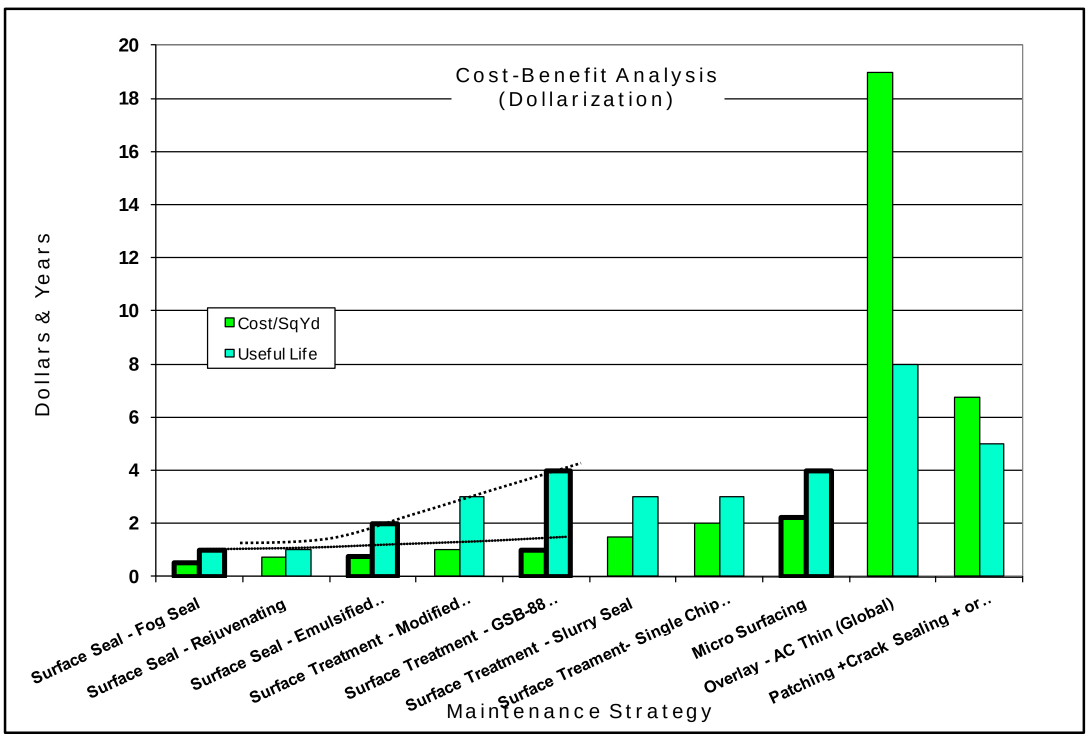


**Figure 63. Dollarization Cost-Benefit Analysis.**

## 4.0 CONCLUSIONS/RECOMMENDATIONS

### 4.1 Economic Analysis

Economic analysis and life cycle cost was calculated using Cumulative Net Present Value (NPV). The life cycle cost for each alternative is shown in Table 7 and is summarized as follows:

| ALTERNATIVE | (NPV) |
|---|---|
| Status Quo (Current Ops, not all maintenance performed) | $47.9M |
| Pavement Maintenance (typical assumed for design life) | $33.6M |
| Pavement Preservation with GSB-88 | $13.4M |
| Pavement Preservation (typical Fog or Rejuvenator) | $25.7M |

The Status Quo was based on data from beginning in the mid 1940's up to and including present day policy and procedures. Pavement Preservation with GSB-88 is approximately $34.5M per million square yards less than the Status Quo NPV ($47.9M), or a 72 percent 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 savings of $34.5M represents a savings of approximately $700M from the status quo (~ $950M). The analysis also shows a Savings-to-Investment Ratio (SIR) of 5.0 and Return on Investment (ROI) is 400%.

Discounted Payback Period (DPP) is a negative number of years which is believed to be indicating pay back is instantaneous relative to preserving pavement.

## 4.2 Recommendations

### 4.2.1 Documents Update

Recommend a section be added emphasizing pavement preservation in UFC 3-260-03, *Airfield Pavement Evaluation*, available at http://www.wbdg.org.

Recommend a section be added recommending or requiring pavement preservation in UFC 3-260-01 *Airfield and Heliport Planning and Design*, and UFC 3-260-02 *Pavement Design for Airfields* also both available at http://www.wbdg.org.

### 4.2.2 Pavement Preservation/Preventive Maintenance

DoD and Federal Government Regulations' as well as Navy (and other services) various Instructions, Policies, etc., have discouraged asphalt pavement preservation via sealants for numerous reasons, including the technical issues of friction and FOD generation

NAVFAC ESC recommends reasonable changes in budget and policy that would allow for the use of asphalt preservation methods and materials. Based on the results of this evaluation it appears that requiring facilities to apply proven materials to all asphalt while the pavement is still in good condition (PCI > 60) would increase readiness and reduce life cycle costs.

When selecting any preventative maintenance procedure the responsible airfield activity shall measure the resulting friction coefficient to verify that the resulting surface meets the operational criteria before resuming operations.

### 4.2.3 Rebinding and Protecting Aged Pavement

Recommend further evaluations be performed for GSB-88 use as a possible alternative to AM-2 matting where pavement is structurally sound, but surface oxidation has resulted in a high risk of FOD damage. As specified herein GSB-88 showed positive results when applied on aged pavements, or other pavements where binder issues exist. The scope of this evaluation only provides limited information on what could be of benefit to aged pavements within the DoD.

### 4.2.4 Further Studies

Recommend extending this study to other pavement sealant materials and updating the criteria and guide specifications accordingly.

## 5.0 ACKNOWLEDGMENTS

With Congressional funding to the Office of Naval Research, this pavement preservation project started with the objective to establish a pilot application program applying GSB-88 Sealer Binder to various asphalt pavement assets in the Navy/DoD and to evaluate both its suitability for use by Navy/DoD and the cost saving benefits of such applications. It is gratefully acknowledged that this effort was made possible with the support, coordination, and professionalism of Asphalt Systems, Inc. (ASI) of Salt Lake City, Utah, in particular from Mr. Gail Porritt.

Special thanks are due to the following facilities and their representatives who supported and shared in the efforts to facilitate the application of GSB-88 on their airfield pavements and follow-up site visit evaluations:

- MCAS Cherry Point, NC: Phil Fisher, Joe Meadows
- Avon Park AFR, FL: Ron Riedel, Tony Baksh
- NAS Fallon, NV: Del Pursel, John Dickinson, Bill Tackett
- NASJRB Willow Grove, PA: John DiBuono
- PMRF Barking Sands, HI: Scott Zenger
- NAWS China Lake, CA: Dean Chase

Special thanks are due also to the following which facilitated site visits that were other than the six application site:

- Boeing Glasgow Flight Test Facility, Glasgow (St. Marie), Montana
- Portland International (PDX), Portland, Oregon
- JFK International Airport
- GEE Asphalt Systems of Cedar Rapids, Iowa
- Tyndall AFB, FL

Technical support from the Tri-Service group is also gratefully acknowledged, in particular from Darrell Bryan (NAVFAC Atlantic), Cliff Sander (Air Force HQ ACC), Kerry Nothnagle (TranSystems Corporation – previously NAVFAC Atlantic), and Charlie Schiavino (Consultant – previously NAVFAC Engineering Service Center).

Thanks are due to Maggie Covalt of Applied Pavement Technologies, Inc., for identifying and obtaining MicroPAVER databases for the intense technical work performed as well as obtaining the permission from the state aviation agencies and the Port of Portland. Furthermore, thanks are due to the aviation agencies of the States of Oregon, Utah, Colorado, Washington, and Wyoming, and the Port of Portland Oregon.

Finally, a special thanks for the interest and support throughout this project to OSD Installations and Environment staff experts on asphalt, and Dan Dunmire, Director, Corrosion Policy and Oversight Office of the Undersecretary of Defense for Acquisition, Technology, and Logistics; asphalt experts from the Army Corps of Engineers, Greg Hughes and Michael Dean; Air Force managers of airfield pavements Jim Greene, Craig Rutland, and George Vansteenburg; Mr. Steven R. Beattie, PE, Facilities Management and Sustainment PLL, Public Works Business Line, NAVFAC; and Mr. B. J. Penn, former Assistant Secretary of the Navy, Installations and Environment; among others.

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# APPENDIX A

# MATERIALS

asphalt systems inc.
ASPHALT PRESERVATION MATERIALS
P.O.Box 25511 • Salt Lake City, Utah 54125
Phone: 801/972-2757 • Fax: 801/972-6453

## CERTIFICATE OF COMPLIANCE

DATE: 9/27/2007

PRODUCT: GSB-88 9,049 gallons 1:1 dilute BOL #07-369
CUSTOMER: Asphalt Systems Inc.

JOB #: Fallon Nevada

CERTIFICATION IS HEREBY GIVEN THAT THE ABOVE REFERENCED PRODUCT MEETS ALL STANDARDS AS SET FORTH IN ASPHALT SYSTEMS, INC. AS FOLLOWS:

SAYBOLT FUROL VISCOSITY AT 77°F (ASTM D-244)......10-50 SEC.
RESIDUE BY DISTILLATION OR EVAPORATION............28% TO 38%
PUMPING STABILITY TEST *........................PASS

TESTS ON RESIDUE

VISCOSITY AT 275°F BROOKFIELD. . . . . . . . . . 1750 CPS MAX.
SOLUBILITY IN TRICH. % . . . . . . . . . . . . . 97.5 MIN.
PENETRATION AT 77"F . . . . . . . . . . . . . . . . 50 DMM MAX.
ASPHALTENES . . . . . . . . . . . . . . . . . . . . 15 MIN.
SATURATES . . . . . . . . . . . . . . . . . . . . . 15 MAX.
POLAR COMPOUNDS . . . . . . . . . . . . . . . . . . 25 MIN.
AROMATICS . . . . . . . . . . . . . . . . . . . . . 15 MIN.

pH may be used in lieu of the particle charge test which is sometimes inconclusive in slow setting, bituminous emulsions.

ASTM D-244 is modified by reducing the temperature to 300°F (149°C) in distillation and evaporation test methods to protect the integrity of the rejuvenating agents that are present in rejuvenating emulsions.

Contact your Brookfield representative for the proper spindle for your specific model viscometer with this viscosity.1750 cps Max.

SIGNED: ______________________________ TITLE: Technical Director

# Material Safety Data Sheet

asphalt systems inc.
ASPHALT PRESERVATION MATERIALS
GSB Products

# Asphalt Emulsion

**Revision Date: 01/20/2010**

## Section 1. PRODUCT IDENTIFICATION / COMPANY INFORMATION

Trade Name: Asphalt Emulsion
CAS Number: Mixture

Synonyms: Asphalt Emulsion, CSS-1H, CSS, GSB-88, GSB-78e, B-mod, Type B, Type A, Type C, Tack coat, Chip-lok, ASC-31.

Appearance and Odor: Brown liquid with slight resinous odor

ANSI: Caution! May cause eye and skin irritation

| | | | |
|---|---|---|---|
| Technical Contact: | (800) 972-2757 | Medical Emergency: | (800) 424-9300 |
| Chemtrec Emergency: | (800) 424-9300 | ( United States Only) | |

## Section 2. COMPOSITION

| Component Name (s) | CAS Registry No. | Concentration (%) | TLV | PEL |
|---|---|---|---|---|
| Asphalt | 8052-42-4 | 58-70 | 5mg/m3 N/E | |
| Gilsonite (GSB 88, 78e, B-Mod, Type C) | 12002-43-6 | Proprietary | 5mg/m3 N/E | |
| Aromatic Oil | 8008-30-6 | 0-12 | .2mg/m3 | N/E |
| Water & Emulsifier | Mixture | 18-40 | N/E | N/E |

Caution: there maybe the possibility of volatile vapors developing under extreme heat conditions

## Section 3. HAZARD IDENTIFICATION

**Major Route(s) of Entry:** Inhalation, Skin, Eyes, Ingestion.

**Signs and Symptoms of Acute Exposure**

**Eye Contact:** Hot material can cause burns to the eye. This material can cause eye irritation with tearing, redness, or a stinging or burning feeling. Effects may become more serious with repeated or prolonged contact.

**Skin Contact:** Hot material can cause burns to the skin. May cause skin irritation with redness, an itching or burning feeling, and swelling of the skin. Effects may become more serious with repeated or prolonged contact. Skin contact may cause harmful effects in other parts of the body.

**Inhalation:** No significant adverse health effects are expected to occur upon short-term exposure to this product at ambient temperatures. Breathing fumes from heating of the cured product can irritate the mucous membranes of the nose, throat, Bronchi and lungs.

**Ingestion:** Contact with hot material may cause thermal burns. Swallowing large amounts of this material may cause stomach or intestinal upset with pain, nausea, vomiting, and /or Diarrhea.

**Medical Conditions aggravated by exposure:** Disorders of the following organs or organ systems that may be aggravated by significant exposure to this material or its components include: Skin, eyes

**Other Health Warnings:** Health studies shown that many petroleum hydrocarbons and synthetic lubricants pose potential human risks which may vary from person to person. As a precaution, exposure to liquids vapors, mists or fumes should be minimized.

## Section 4. FIRST AID MEASURES

**Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid.**

**Eye Contact:** If hot product enters the eyes, irrigate with large amounts of room-temperature water. Seek medical attention immediately. If product at ambient temperatures enters eyes, check for and remove contact lenses. Flush eyes with cool, clean, low-pressure water while occasionally lifting and lowering eyelids. Seek medical attention if excessive tearing, redness or pain persists.

**Skin Contact:** If burned by hot material, cool skin by quenching with large amounts of cool water. Seek medical attention if tissue appears damaged or if pain or irritation persists. For contact with product at ambient temperatures, remove contaminated shoes

and clothing. Wipe off excess material. Wash exposed skin with soap and water. Thoroughly clean contaminated clothing before reuses. Discard contaminated leather goods.
**Inhalation:** Move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately. Keep the affected individual warm and at rest.
**Ingestion:** Do not induce vomiting unless dire3cted to by a physician. Do not give anything to drink unless directed by a physician. Never give anything by mouth to a person who is not fully conscious. If significant amounts are swallowed or irritation or discomfort occurs, seek medical attention immediately.
**Note to physicians:** Treat symptomatically.

## Section 5. FIRE FIGHTING MEASURES

| | |
|---|---|
| NFPA Flammability classification: | NFPA Class IIIB combustible material |
| Flash Point | 450°F Minimum |
| Lower Flammable Limit | NA |
| Upper Flammable Limit | NA |
| Auto-ignition Temperature | NA |

**Special Fire Fighting Procedures:** Do not enter any enclosed or confined space without proper protection equipment. This may include SCBA. Cool tanks and containers exposed to fire with water. Improper use of water and extinguishing media containing water may cause frothing which can spread the fire over a larger area.

**Extinguishing Media:** Use dry chemical and carbon dioxide. Foam and water are effective, but may cause frothing.

**Unusual Fire Fighting Procedures:** The flash point displayed above refers to only the petroleum components of this product. When heated above its flash point or when held in storage at elevated temperatures, this material can release flammable vapors which can burn in the open or be explosive in confined spaces if exposed to an ignition source. Studies have shown that relatively low flash point substances, such as hydrogen sulfide and low-boiling hydrocarbons, may accumulate in the vapor space of hot asphalt tanks and bulk transport compartments. As a precaution, keep ignition sources away from vents and openings.

**Hazardous combustion products:** Carbon dioxide, carbon monoxide, smoke, fumes, unburned hydrocarbons and oxides of sulfur and /or nitrogen. Hydrogen sulfide and other sulfur-containing gases can evolve from this product particularly at elevated temperatures.

**Special Properties:** At elevated temperatures, asphalt emulsions may separate, forming al layer of asphalt and a layer of water in the storage tanks. Fire impinging upon storage tanks may cause a boiling liquid-expanding vapor explosion (BLEVE). Asphalt emulsion normally will not ignite. Asphalt residues will burn if heated. Always check for flammable vapors and ignitable residue before commencing hot work on storage tanks.

## Section 6. ACCIDENTAL RELEASE MEASURES

**Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information refer to the emergency Overview on page 1, Exposure Controls/Personal Protections in Section 8 and Disposal Considerations in Section 13 of this MSDS.**
Do not touch damaged containers or spilled material unless wearing appropriate protective equipment. Slipping hazard – do not walk through spilled material. Stop leak if you can without risk. For small spills, absorb or cover with dry earth, sand, or other non-combustible absorbent material and place into waste containers for later disposal. Contain large spills to maximize product recovery or disposal. Prevent entry into waterways or sewers. In urban area, cleanup spills as soon as possible. In natural environment, seek cleanup advice from specialists to maintain habitat and minimize damage.

## Section 7. HANDLING AND STORAGE

**Handling:** Avoid contamination and extreme temperatures to minimize product degradation. Empty containers may contain product residues that can ignite with explosive force. Do not pressurize, cut, weld, braze solder, drill, grind, or expose containers to flames, sparks, heat or other potential ignition sources. Consult appropriate federal, state, and local authorities before reusing, reconditioning, reclaiming, recycling or disposing of empty containers and/or waste residues of this product.
**Storage:** For ease of handling and to avoid breaking the emulsion, store product between 70 and 130°F.

## Section 8. EXPOSURE CONTROLS / PERSON PROTECTION

**Engineering Controls:** Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of mists and/or vapors below the recommended exposure limits. An eye wash station and safety shower should be located near the work-station.

**Personal Protective Equipment (PPE):** Personal protective equipment (PPE's) should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The minimum requirements for PPE are:

Protective eyewear
Protective gloves
Protective clothing

For certain operations, additional PPE may be required.

**Eye Protection:** Use a full face shield and chemical safety goggles is handling heated material. With product at ambient temperatures, safety glasses equipped with side shields are recommended as a minimum protection in industrial settings. Keep a suitable eye wash station immediately available to work area.

**Hand Protection:** When handling product at elevated temperatures, use long cuffed leather or heat-resistant gloves. When product is at ambient temperatures, use gloves constructed of chemical resistant materials such as heavy nitrile rubber if frequent or prolonged contact is expected.

**Ventilation:** Use local exhaust to capture fumes when handling hot product in confined spaces.

**Body Protection:** Prevent skin contact when handling heated material. Use insulated, heat-resistant clothing such as a chemical resistant apron or slicker suit. Use a full-body heat-resistant or internally cooled suit when work conditions dictate.

**Respiratory:** With adequate ventilation, no respirator is needed. If exposure exceeds the occupational control limits, wear a NIOSH-approved, air-purifying, particulate filter respirator suitable for dusts, fumes and mists. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134).

**General Comments:** Use good personal hygiene practices. Wash hands and other exposed skin areas with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities, or leaving work. **Do Not** use gasoline, kerosene, solvents or harsh abrasive skin cleaners.

**Occupational exposure guidelines**

| **Substance** | Applicable workplace exposure levels |
|---|---|
| Asphalt | ACGIH TLV (United States)<br>TWA: 0.5 mg/m$^3$ 8 hours |

## Section 9. PHYSICAL AND CHEMICAL PROPERTIES

Attention: the data below are typical values and do not constitute a specification.

Appearance: Black color: semi-solid when cold, viscous fluid when hot

| | | |
|---|---|---|
| **pH:** 2-7 | **Vapor Pressure:** 60 @ 100$^o$F | **Vapor Density (air = 1):** NA |
| **Boiling Point:** 212$^o$F | **Solubility:** Readily Dispersible | **Melting point:** NA |
| **Specific Gravity:** 1.0100 | **Viscosity:** NA | **Odor:** Asphalt Petroleum Odor |

## Section 10. STABILITY AND REACTIVITY

**Chemical Stability:** Stable. DO NOT heat this material above 200$^o$F avoid contact of hot asphalt with water or light hydrocarbons which may create a violent eruption.

**Incompatibility with other materials:** Avoid contact with strong oxidants such as liquid chlorine, concentrated oxygen, sodium hypochlorite, or calcium hypochlorite. Hot product ( above 230$^o$F) in contact with water can cause foaming or sudden evolution of steam, which could cause pressure build-up and possibly rupture a tank or vessel. Warm product below 200$^o$F will mix freely with water and create a larger cleanup effort.

**Hazardous Decomposition Products:** Combustion may product carbon monoxide, oxides of sulfur, and asphyxiates.

**Hazardous Polymerization:** Hazard polymerization will not occur.

**Conditions to avoid:** Keep away from extreme heat, strong acids, and strong oxidizing conditions.

## Section 11. TOXICOLOGICAL INFORMATION

**Toxicity Data: Asphalt**

ORAL (LD50): Acute>5000 mg/kg [Rat]

Dermal (LD50): Acute: .2000 mg/kg [Rabbit]

Asphalt fumes have been associated with eye, skin and respiratory tract irritation. Repeated or prolonged contact with asphalt at ambient temperatures can result in skin irritation. Long-term exposure can cause dermatitis, acne, photosensitization and more rarely, pigmentation of the skin. The international agency for Research on Cancer (IARC) has determined that there is sufficient evidence for the carcinogenicity of extracts of steam-refined bitumen's in experimental animals. Further IARC has determined that there is limited evidence for the carcinogenicity of undiluted steam-refined bitumen's in experimental animals. Also, IARC determined that there is inadequate evidence that bitumen alone is carcinogenic to humans.

**Water**

ORAL LDL: Acute: 42900 m/kg [Human]

## Section 12. ECOLOGICAL INFORMATION

**Ecotoxicity:** This product is soluble in water and is expected to readily disperse in marine environments. As it mixes with water, water insoluble hydrocarbon in this material will separate and float on the water layer. Analysis for ecological effects has not been conducted on this product. However, if spilled, this product and any contaminated soil or water may be harmful to human, animal, and aquatic life. Also, the coating action associated with petroleum and petroleum products can be harmful or fatal to aquatic life and waterfowl.

**Environmental Fate:** This product is estimated to have a slow rate of biodegradation. This product is not expected to bioaccumulation through food chains in the environment.

## Section 13. DISPOSAL CONSIDERATIONS

**HAZARD CHARACTERISTICA AND REULATORY WASTE STREAM CLASSIFICATION CAN CHANGE WITH PRODUCT USE. ACCORDINGLY, IT IS THE RESPONSIBILITY OF THE USER TO DTERMINE THE PROPER STORAGE, TRANSPORTATION, TREATMENT AND/OR DISPOSAL METHODOLOGIES FOR SPENT MATERIALS AND RESIDUES AT THE TIME OF DISPOSITION.**

Maximize material recovery for reuse or recycling. Conditions of use may cause this material to become a hazardous waste, as defined by federal or state regulations. It is the responsibility of the user to determine if the material is a hazardous waste at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR 260 through 40 CFR 271). State and/or local regulations may be more restrictive. Contact your regional US EPA office for guidance concerning case specific disposal issues.

## Section 14. TRANSPORTATION INFORMATION

The shipping description below may not represent requirements for all modes of transportation, shipping methods or locations outside the United States.

DOT Shipping Name: Not regulated

DOT Hazard Class: Not Regulated

DOT Identification Number:

Placard: None Required

DOT Packing Group: Not Applicable

Emergency Response Guide No.: Not Applicable

## Section 15. REGULATORY INFORMATION

**TSCA Inventory**

All of the components of this material are on the toxic Substance Control ACT (TSCA) Chemical Inventory

**SARA 302/304 Emergency Planning and Notification**

The Superfund Amendments and Reauthorization act of 1986 (SARA) Title III requires facilities subject to subpart 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) for "Extremely Hazardous Substances" Listed in 40 CFR 302.4 and 40 CFR 355.

**SARA 311/312 Hazard Identification**

The Superfund Amendments and Reauthorization act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories:

ACUTE (Immediate) Health Hazard, Chronic (delayed) Health hazard

**CERCLA**

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. This product or refinery stream Is known to contain chemical substances subject to this statue. However,, it is recommended that you contact state and local authorities to determine if there are any other reporting requirements in the event of a spill.

## Section 16. ADDITIONAL INFORMATION

**Scale for NFPA and HMIS Ratings:**

0-least, 1-Slight, 2-Moderate, 3-High, 4-Extreme, PPE- Personal Protective Equipment Index Recommendation, *-Chronic Effect Indicator. These values are obtained using the guidelines or published evaluations prepared by the National Fire Protections Association (NFPA) or the National Paint and Coatings Association (for HMIS ratings).

ABBREVIATIONS USED IN THIS DOCUMENT:

**TLV** – Threshold Limit Value **TWA** – Time Weighted Average

**STEL** – Short-term Exposure Limit

**REL/PEL** – Recommended/ Permissible Exposure Limit

**NA** – Not Applicable

**CAS** – Chemical Abstract Service Number

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**The information in this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. This MSDS was prepared and is to be used only for the products listed. If the product is used as a component in another product, this MSDS information may not be applicable. Users should make their own investigations to determine the suitability of the information or products for their particular purpose.**

**The conditions or methods of handling, storage, use and disposal or the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of the product.**

**ASPHALT SYSTEMS, INC.**
**2775 WEST 1500 SOUTH**
**P.O. BOX 25511**
**SALT LAKE CITY, UTAH 84104**

**24 HOUR EMERGENCY RESPONSE NUMBER**
**CHEMTREC**
**1-800-424-9300**

# MATERIAL SAFETY DATA SHEET

MSDS NO. 99-2003
DATE: 3-1-99


## I. PRODUCT DESCRIPTION

**GSB – 88**
Appearance and odor: Brown liquid with slight resinous odor.

| Hazard Rating: | | |
|---|---|---|
| | Health | 1 |
| | Fire | 0 |
| | Reactivity | 0 |

ANSI: Caution! May cause eye and skin irritation.

## 11. HAZARDOUS COMPONENTS

| INGREDIENT | CAS No. | PERCENT | TLV | PEL |
|---|---|---|---|---|
| Gilsonite | 12002-43-6 | Proprietary | 5mg/m3 | N/E |
| Aromatic Oil | 64741-59-9 | information | .2mg/m3 | N/E |
| Petroleum Asphalt | 8052-42-4 | | 5mg/m3 | N/E |
| Additives | N/A | | N/E | N/E |
| Water | 7732-18-5 | | N/E | N/E |

CAUTION: There maybe the possibility of volatile vapors developing under extreme heat conditions while being stored in bulk containers.

## III. OVERVIEW & HEALTH INFORMATION

GSB – 88 is a colloidal dispersion of Gilsonite, asphalt and aromatic oil in water and additives.

After the water has been removed and the temperature of the bitumen exceeds 400°F (204°C) may burn if ignited.

The product contains small amounts of additives, which can vary in composition quantities. These additives are not hazardous in the small quantities used.

N/E=None Established N/A=Not Applicable N/D=No Data Available D-3/99

# 'TYPICAL' FAA MODIFICATION OF AIRPORT DESIGN STANDARDS FOR FAA STANDARD AC 150/5370-1OC

## REQUIREMENT: P-609 SEAL COATS AND BITUMINOUS SURFACE TREATMENTS

## PROPOSED REQUIREMENT: P-609 EMULSIFIED PAVEMENT SEALER

**USER'S GUIDE**
**MODIFICATION OF AIRPORT DESIGN STANDARDS FORM**

ITEMS 1-17 ARE TO BE COMPLETED BY THE AIRPORT SPONSOR (ORIGINATOR). ALL OTHER ITEMS WILL BE COMPLETEC BY THE FAA.

THE COMPLETED FORM WILL BE TRANSMITTED BY THE ORIGINATOR TO THE APPLICABLE ADO/AFO. THE ADO/AFO WILL TRANSMIT THE FINAL FAA DETERMINATION TO THE ORIGINATOR.

MODIFICATION TO AIRPORT DESIGN STANDARDS REQUESTS SHOULD INCLUDE SKETCHES OR DRAWINGS WHICH CLEARLY ILLUSTRATE THE NONSTANDARD CONDITION.

ITEMS

1. LEGAL NAME OF AIRPORT.
2. ASSOCIATED CITY.
3. AIRPORT LOCATION IDENTIFIER (SEE APPROACH PLATES/AIRPORT FACILITY DIRECTORY).
4. IDENTIFY THE RUNWAY(S), TAXIWAY(S) OR OTHER FACILITIES EFFECTED BY THE PROPOSED MODIFICATION TO STANDARDS REQUEST.
5. IDENTIFY THE MOST CRITICAL APPROACH FOR EACH RUNWAY IDENTIFIED IN #4.
6. AIRPORT REFERENCE CODE – SEE PARAGRAPH 2, PAGE 1 AC 150/5300-13 (CHANGE 4) – I.E., C-II, B-II, A-I (SMALL).
7. NOTE THE DESIGN AIRCRAFT (ARC OR SPECIFIC AIRCRAFT) FOR EACH FACILITY IDENTIFIED IN $4. A DESIGN AIRCRAFT MUST MAKE REGULAR USE OF THE FACILITY. NORMALLY, FAA CONSIDERS REGULAR USE TO BE 500 OR MORE ANNUAL INTERERANT OPERATIONS.

   IF THE AIRPORT SERVES A WHOLE FAMILY OF AIRCRAFT IN A PARTICULAR GROUP, THE ARC (I.E. B-II) SHOULD BE SPECIFIED. IF, HOWEVER, THE AIRPORT IS USED BY ONLY 1 OR 2 OF A FAMILY OF AIRCRAFT (IX-BEECH KING AIRCRAFT SHOULD BE SPECIFIED).
8. IDENTIFY THE SPECIFIC NAME OF THE STANDARD THAT IS PROPOSED TO BE MODIFIED FOR THE SUBJECT LOCAL CONDITION.
9. DESCRIBE (WORDS AND NUMBERS) THE DIMENSIONS AND REQUIREMENTS OF THE STANDARD AS PROVIDED IN AC 150/5300-13.
10. STATE THE PROPOSED MODIFICATION TO THE STANDARD.
11. DISCUSS THE LOCAL CONDITIONS THAT MAKE IT IMPRACTICAL OR IMPOSSIBLE TO MEET THE STANDARD.
12. IDENTIFY ALTERNATIVES TO THE SUBJECT PROPOSED MODIFICATION, AND SHOW WHY THESE ALTERNATIVES ARE NOT VIABLE.
13. DISCUSS HOW THE PORPOSED MODIFICATION WOULD IMPACT AIRPORT SAFETY AND EXPLAIN WHY AND ACCEPTABLE LEVEL OF SAFETY WOULD STILL EXIST.
14. TYPED NAME AND SIGNATURE OF AIRPORT AUTHORITY REPRESENTATIVE.
15. SELF-EXPLANATORY.
16. SELF-EXPLANATORY.
17. SELF-EXPLANATORY.
18. TO BE COMPLETED BY FAA.

# MODIFICATION OF AIRPORT DESIGN STANDARDS

## BACKGROUND

| 1. AIRPORT: | 2. LOCATION(CITY,STATE): | 3. LOC ID: |
|---|---|---|
| Anywhere Airport | | F12 |

| 4. EFFECTED RUNWAY/TAXIWAY: | 5. APPROACH (EACH RUNWAY): | 6. AIRPORT REF. CODE (ARC): |
|---|---|---|
| Runways 16-34,<br>Runway 12-30,<br>Taxiway A, B and Apron | ☐ PIR<br>☒ NPI<br>☒ VISUAL | BII |

7. DESIGN AIRCRAFT (EACH RUNWAY/TAXIWAY):

## MODIFICATION OF STANDARDS

8. TITLE OF STANDARD BEING MODIFIED (CITE REFERENCE DOCUMENT):
**AC 150/5370-10C**

9. STANDARD/REQUIREMENT:
**P-609 SEAL COATS AND BITUMINOUS SURFACE TREATMENTS**

10. PROPOSED:
**P-609 EMULSIFIED PAVEMENT SEALER (See Attached)**

11. EXPLAIN WHY STANDARD CANNOT BE MET (FAA ORDER 5300.1E):
**An alternate specification is proposed to provide a protective sealer to extend the life of the pavement.**

12. DISCUSS VIABLE ALTERNATIVES (FAA ORDER 5300.1E):
**Alternates investigated included a Slurry Seal and an Overlay. The alternates were eliminated due to potential FOD issues and costs**

13. STATE WHY MODIFICATION WOULD PROVIDE ACCEPTABLE LEVEL OF SAFETY (FAA ORDER 5300.1E):
**The material has been successfully used on over 150 airports. It has recently been through the modification to standard process in the Southwest Region for the Gilmer Municipal Airport, TxDOT CSJ Project No. ( FAA R. Friction results Anywhere Airport Project Name and Number s used. Included in the results is a Texas airport that was funded with State Funding. Friction testing critieria has b Stat luded in the modification.**

**ATTACH ADDITIONAL SHEETS AS NECESSARY – INCLUDE SKETCH/PLAN**

# MODIFICATION OF AIRPORT DESIGN STANDARDS

| MODIFICATION: P-609 | LOCATION: Anywhere Airport | PAGE 2 OF 2 |
|---|---|---|
| 14. SIGNATURE OF ORIGINATOR: | 15. ORIGINATOR'S ORGANIZATION: | 16. TELEPHONE: |
| 17. DATE OF LATEST FAA SIGNED ALP: Date | | |
| 18. ADO RECOMMENDATION: | 19. SIGNATURE | 20. DATE: |
| 21. FAA DIVISIONAL REVIEW (AT, AF, FS): | | |

| ROUTING SYMBOL | SIGNATURE | DATE | CONCUR | NON-CONCUR |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |

COMMENTS

22. AIRPORTS' DIVISION FINAL ACTION:

| ☐ UNCONDITIONAL APPROVAL | ☐ CONDITIONAL APPROVAL | ☐ DISAPPROVAL |
|---|---|---|
| DATE: | SIGNATURE: | TITLE: |

CONDITIONS OF APPROVAL:

## ITEM P-609 EMULSIFIED PAVEMENT SEALER

### DESCRIPTION

**609-1.1** This item shall consist of preparing and applying a bituminous surface treatment in accordance with these specifications and in reasonably close conformity to the lines shown on the plans.

### MATERIALS

**609-2.1 BITUMINOUS MATERIALS.** The emulsion concentrate, in the undiluted state, shall have the following salient properties:

| | |
|---|---|
| Saybolt furol viscosity: 77°F (25°C) ASTM D-244 | 20-100 seconds |
| Residue by distillation or evaporation | 57 percent, minimum |
| Sieve test | 0.2 percent maximum |
| pH, cationic | 2 to 6.5 |

The emulsion concentrate, when diluted in the proportion of one part of concentrate to one part of hot water, by volume and ready to apply, shall have the following properties:

| | |
|---|---|
| Saybolt furol viscosity: 77°F (25°C) ASTM D-244 | 10-50 seconds |
| Residue from Distillation, or Evaporation | 28-42 percent, minimum |
| Sieve test | 0.1 percent, maximum |
| Pumping stability test | pass |

Hot water temperature at or above 100 degrees.

Tests on Residue from Distillation, or Evaporation:

| | |
|---|---|
| Viscosity at 275°F (135°C) ASTM D-4402 | 1750 cts maximum |
| Solubility in 1,1,1 trichloroethylene ASTM D-2042 | 97.5 percent minimum |
| Penetration ASTM D-5 | 50 dmm maximum |
| Asphaltenes ASTM D-2007 | 15 percent minimum |
| Saturates ASTM D-2007 | 15 percent maximum |
| Polar Compounds ASTM D-2007 | 25 percent minimum |
| Aromatics ASTM D-2007 | 15 percent minimum |

(1) pH may be used in lieu of the particle charge test which is sometimes inconclusive in slow setting bituminous emulsions.

(2) Pumping stability is tested by pumping 1 pint, (475 ml) of sealer material diluted 1 part concentrate to 1 part water, at 77°F (25°C), through a ¼-inch gear pump operating 1750 rpm for 10 minutes with no significant separation or coagulation.

The bituminous base residue shall contain not less than 20 percent asphaltum, uintahite or uintaite (which is commonly referred in the trade as gilsonite), and will not contain any tall oil pitch or coal tar material. It shall be compatible with asphalt concrete and have a 4-year, minimum, proven performance record at airports with similar climatic conditions. Curing time, under recommended application conditions, shall not exceed 4 hours.

The Contractor shall furnish and submit to the Engineer, manufacturer's certification that the material is the type, grade, and quality specified for each loads of bituminous material delivered. The certification shall show the shipment number, refinery, consignee, destination, contract number, and date of shipment. Submit one 1-gallon samples of diluted, ready-to-apply bituminous material for each load delivered.

**609-2.2 SAND.** The sand material, which shall be accepted by the Engineer prior to use on the project, shall be a dry, clean, angular, dust-free with a Mohs hardness of 6-8. The sand shall meet the following gradation analysis per ASTM D 451:

| Sieve Size | Percentage Retained By Weight |
|---|---|
| No. 16 | 0-1 |
| No. 20 | 0-1 |
| No. 30 | 5-20 |
| No 40 | 40-65 |
| No. 50 | 20-40 |
| No 60 | 0-5 |
| No. 100 | 0-3 |
| Pan | 0-0.2 |

The Contractor shall include the sand gradation with the Job Mix Formula and shall submit a sample to the Engineer for verification testing prior to construction of the test strip.

## CONSTRUCTION METHODS

**609-3.1 WEATHER LIMITATIONS.** The Emulsion shall be applied only when the existing surface is dry and the pavement surface temperature is 50° F and rising. Application shall be scheduled so that at least three hours of daylight should remain after completing Emulsion application.

**609-3.2 MIXING.** The sealing material shall be obtained by blending bituminous concentrate material and water. Mix one part bituminous emulsion concentrate to one part water, by volume. Add (one) percent polymer, by volume, to the mix if recommended by manufacturer's representative. If the polymer is added to the mix at the plant, submit weigh scale tickets to the Engineer. As an option, the polymer may be added to the mix at the job site provided the polymer is added while the circulating pump is running, the mix is agitated for a minimum of 15 minutes, and the polymer is mixed to the satisfaction of the Engineer.

**609-3.3 PAVEMENT PREPARATION.** The asphalt surface to be treated shall be free of all dirt, sand, weeds, grass and excessive oil and/or grease. The surface shall be cleaned with a power broom, power blower supplemented by a hand sweeping, power vacuum, or any other means required to remove deleterious matter to the satisfaction of the Engineer or Owner. Multiple passes may be required. This work shall not be paid for directly but shall be considered subsidiary to this item of work. All crack sealing shall be completed and surface cleaned prior to applying pavement sealer. Crack cleaning, routing and sealing shall be paid in accordance with ITEM P-605 JOINT SEALING FILLER.

Cover as necessary existing runway edge lights, taxiway edge lights, informational signs, retro-reflective marking and in-pavement duct markers before applying the seal. If the seal gets on any light or marker clean immediately. The Contractor shall replace any light, sign or marker with equal equipment at no cost to the Owner if cleaning is not satisfactory to the Owner.

**609-3.4 EQUIPMENT.** The emulsion may be applied with manufacturer-approved standard bituminous distributors. The equipment shall be in good working order and contain no contaminants or diluents in the tank. Truck must be computer rate controlled, or have a current TxDOT application rate certification with the truck at the time of application. Any type of tip or pressure source is suitable that will maintain a constant flow through the nozzles during the application process regardless of the speed of the truck. Test the equipment under pressure for leaks and to ensure it is in good working order before use.

The distributor truck shall be equipped with a 12-foot (3.6 m), minimum, spreader bar with individual nozzle control. It shall be capable of specific application rates in the range of 0.05 to 0.25 gallons per square yard (0.15 to 0.80 liters per square meter). These rates shall be computer-controlled rather than mechanical. It shall have an easily accessible thermometer that constantly monitors the temperature of the seal coat.

In the event there is a temperature problem a distributor truck will be provided that is equipped to effectively heat and mix the material to the required temperature prior to application. Heating and mixing will be done in accordance with the manufacturer's recommendations. Care shall be taken not to over heat or over mix material.

The distributor shall be equipped to hand spray the seal coat areas identified by the Engineer.

**609-3.5 APPLICATION.** The sealing product shall be uniformly applied using equipment as described in Section 609-3.4 and in accordance with the manufacturer's recommendations. Apply the emulsion only when the existing surface is clean and dry as described in Section 609-3.3. The application target range is **0.15 gallons** per square yard.

**APPLICATION TEST SECTION.** A qualified manufacturer's Representative shall be present in the field to assist the Contractor in carrying out a test strips on the pavement to be sealed to determine the optimum application rate of both sealant and sand. This shall be done just prior to the full application or any time there is a change in the consistency of the pavement surface. The final application rate of both sealant and sand shall be approved by the engineer.

**609-3.6 TEST SECTION FOR FRICTION SURVEYS.** Prior to full application on any runway or high speed taxiway exit, the Contractor must apply the material to a test section for friction survey testing at the application rate approved by the Engineer in paragraph 3.5. The area to be tested will be designated and tested by the Engineer and located on the existing runway or high speed taxiway exit pavement. Application rates that result in an average Mu value on the wet runway pavement surface less than the Maintenance Planning Friction Level in Table 3-2 of Federal Aviation Advisory Circular 150/5320-12, "Measurement, Construction, and Maintenance of Skid Resistant Airport Pavement Surfaces" must not be approved for full application.

**609-3.7 SANDING.** The sanding shall be done immediately after application of the sealant material. The speed of the distributor shall be such that the sanding material shall be applied before the sealant begins to break. Apply sand at the rate of 0.25 to 0.50 pounds per square yard as determined by the sealant Manufacturer Representative.

Sanding shall be accomplished by using a drop type sander or by the use of spinner or whirly-bird type sanders. The sanding unit must have the ability to apply sand in both the forward and backward direction in order to minimize driving on the freshly applied sealant and to enable negotiating sand application onto areas where turning around is not possible. The sander must have finite controls to regulate sand distribution. Push-type hand sanders will be allowed for use around lights, signs and other obstructions.

Contractor shall schedule this work so the sealant application and the sanding operation work as a cohesive unit with the sanding unit immediately following the sealant distributor. Sanding will be done in a manner so as to prevent any sand from going onto any pavement prior to the sealant being applied.

Clean up areas with excess or loose sand and dispose of off airport property.

**609-3.8 FREIGHT AND WEIGH BILLS.** Before the final estimate is allowed, the Contractor shall file with the Owner certified weigh bills of the emulsion materials and cover sand actually used in the construction covered by the contract. Copies of weigh bills shall be furnished to the Owner during the progress of the work to verify the application rates.

## METHOD OF MEASUREMENT

**609-4.1** The quantity of Emulsified Pavement Sealer to be paid for will be the number of square yards of material actually applied and accepted by the Engineer as complying with the plans and specifications.

## BASIS OF PAYMENT

**609-5.1** Payment will be made at the contract unit price per square yard for Emulsified Pavement Sealer actually applied and accepted by the Engineer. This price will be full compensation for furnishing all materials, for all preparation, delivery, and application of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item, including the furnishing, and placing of sand and any other work necessary to complete this item.

Payment will be made under:

| | |
|---|---|
| Item P-609-5.1 | Emulsified Pavement Sealer -- per square yard |
| Item P-609-5.2 | Runway Friction Testing -- per lump sum |

## TESTING REQUIREMENTS

| | |
|---|---|
| ASTM D 244 | Standard Test Methods and Practices for Emulsified Asphalts |
| ASTM D 4402 | Standard Test Method for Viscosity Determination of Asphalt at Elevated Temperatures Using a Rotational Viscometer |
| ASTM D 2042 | Standard Test Method for Solubility of Asphalt materials in Trichloroethylene |
| ASTM D 5 | Standard Test Method for Penetration of Bituminous Materials |
| ASTM D 2007 | Standard Test Method for Characteristic Groups in Rubber Extender and Processing Oils and Other Petroleum-Derived Oils by the Clay-Gel Absorption Chromatographic Method |

**END OF ITEM P-609**

# AGGREGATE TECHNICAL DATA

## ULTRABLAST Blasting Abrasive (Nickel Slag)
## STANDARD (SS&S) Industrial Silica Sand / Blasting Abrasive (Silica Sand)
## Granusil Mineral Filler (Silica Quartz)

**Products not discussed in this report are included below for future reference. There are other products that may be acceptable (such as other type slag products); but the products listed are most common and are presented principally to highlight the difference in key properties values.**

**Commonly used in seal coat applications. Is Acceptable as an aggregate for skid resistance.**

| | | |
|---|---|---|
| BLACK BEAUTY® ABRASIVE<br>Mesh Sizes: 30/60; 20/40; 12/40 | Coal Slag<br>Hardness Moh's scale: 6 to 7 | Specific Gravity: 2.73<br>Moisture Content: < 0.5% |

**Common use is as soft blast abrasives. NOT Acceptable as an aggregate for skid resistance.**

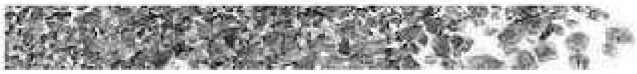
| | | |
|---|---|---|
| **Black Walnut Shell Grit**<br>Mesh Sizes: 35/60; 18/40; 12/20 | **Black Walnut Shell**<br>Hardness Moh's scale: 3 | Specific Gravity: 1.2 to 1.4<br>Moisture Content: 8 to 11% |
| Grit-o'cobs Corncob Granules<br>Mesh Sizes: 40/60; 20/40 | Corncob Woody Ring<br>Hardness Moh's scale: 4.5 | Specific Gravity: 1 to 1.2<br>Moisture Content: 7 to 9% |

**Commonly used as a Non-Skid additive in coatings. NOT Acceptable as an aggregate for skid resistance.**

| | | |
|---|---|---|
| PLASTI-GRIT<br>Mesh Sizes: 40/60; 20/40 | Thermoset Plastics (Acrylic)<br>Hardness Moh's scale: 3 to 3.5 | Specific Gravity: 1.1 to 1.2<br>Moisture Content: 2% |

# Ultrablast - Nickel Slag

Ultrablast is a high-density disposable blasting slag made from a by-product of nickel production. It is an ideal abrasive for general-purpose use, including shipyards, bridges and general industrial blast cleaning. Tests have shown nickel slag to provide high productivity improvements over traditional abrasives.



## ADVANTAGES OF ULTRABLAST - NICKEL SLAG

- High density slag for higher production rates
- Non reactant - will not interfere with coatings
- Non detectable free crystalline silica

## AVAILABLE SIZES AND GRADES

| Size | Profile | Use |
|---|---|---|
| #UB 12-40 | 4.0-5.0 Mil | Heavy-duty size for the removal of thick, tough old paint, heavy rust from ships, bridges, tanks, rail cars, etc., and for achieving a coarse profile |
| #UB 16-40 | 3.5–4.5 Mil | All-Purpose size for cleaning structural steel, bridges, tanks, ships, water towers, etc. |
| #UB 30-60 | 2.5–3.5 Mil | Utility size for the removal of light rust, paint and mill scale |
| #UB Fine | 2.2–3.2 Mil | Our finest nickel slag, for achieving a smoother profile |

## HOW DOES ULTRABLAST – NICKEL SLAG PERFORM?*

| | |
|---|---|
| Cleaning rate: | 295-415 $ft^2$/hour |
| Consumption: | 3.0-5.0 lb/$ft^2$ |

*Based on internal tests. Rates vary based on blasting pressure and nozzle size.*

## TECHNICAL SPECIFICATIONS (IN %)

| Symbol | Name | Percentage |
|---|---|---|
| $Fe_2O_3$ + FeO | (Iron Oxide) | 30-37% |
| $SiO_2$ (total) | (Silicon Dioxide) | 32-42% |
| $AL_2O_3$ | (Aluminum Oxide) | 3-10% |



## TECHNICAL SPECIFICATIONS (IN %)

| Symbol | Name | Percentage |
|---|---|---|
| MgO | (Magnesium Oxide) | 5-12% |
| CaO | (Calcium Oxide) | 3-6% |
| $Cr_2O_3$ | (Chromium Oxide) | 2-3% |
| Ni | (Nickel) | 0.1-1.0% |
| $SiO_2$ | (Crystalline Silica) | 0.3% |

## CHARACTERISTICS

| | |
|---|---|
| Colour: | Black |
| Bulk Density: | 115 lbs/$ft^3$ |
| Specific Gravity: | 3.5 |
| Grain Shape: | Angular |
| Solubility: | Insoluble |
| Hardness: | > 7 Mohs |

## PACKAGING

55 lb paper bags, 56 bags/pallet
3000 lb Super Sacs
Bulk (blower truck or rail hopper cars)

# STANDARD SAND & SILICA CO.

STANDARD SAND AND SILICA CO.
"Standard"
TRADE MARK
QUALITY AND SERVICE

Serving Florida and the Caribbean Since 1945

## TYPICAL CHEMICAL ANALYSIS

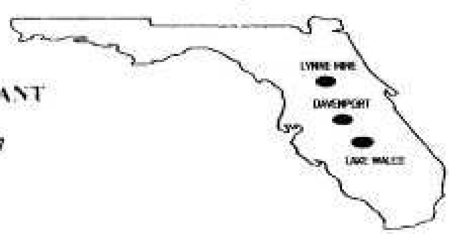
| | | |
|---|---|---|
| Silicon Dioxide | ($SiO_2$) | 99.59% |
| Iron Oxide | ($Fe_2O_3$) | 0.037% |
| Aluminum Oxide | (Al2O3) | 0.28% |
| Titanium Oxide | ($TiO_2$) | 0.0024% |
| Calcium Oxide | (CaO) | 0.0081% |
| Magnesium Oxide | (MgO) | 0.0058% |
| Potassium Oxide | ($K_2O$) | 0.017% |
| Sodium Oxide | ($Na_2O$) | 0.010% |
| Chromium Oxide | ($Cr_2O_3$) | 0.0011% |
| Clay and Silt | | <.5% |
| Loss of Ignition | (LOI) | 0.1 Max |
| Hardness (MOH Value) | | 7 |
| Moisture Content | | <.1% |
| Specific Gravity | | $\geq$ 2.65 |
| Acid Solubility | | $\leq$ 1% |

## PLANT LOCATIONS

**MAIN OFFICE**
Highway 17-92 North
Davenport, Florida 33837
Phone: 863-422-7100
Phone: 877-444-7263
Fax: 863-421-7349
Email: info@standardsand.com

**FLINT/BARBER GREEN**
2200 Highway 17-92 North
Davenport, Florida 33837

**LAKE WALES SILICA PLANT**
524 Story Road
Lake Wales, Florida 33853



**DAVENPORT SILICA PLANT**
200 Lem Carnes Road
Davenport, Florida 33837

**LYNNE MINE**
15450 NE 14th Street Road
Lynne, Florida 34488

Standardsand.com 877-444-7263

STANDARD SAND AND SILICA CO.

TESTING DEPARTMENT

## Typical Sieve Analysis

| | | | |
|---|---|---|---|
| Report For: | Asphalt Systems | | |
| Material Tested: | 30 / 65 | DATE | 06/19/2007 |
| Identification: | DSP | Order# | |
| Samples By: | GB | PO# | |
| Tested By: | GB | | |

| Sieve Size | mm | Cum. % Retained | % Passing |
|---|---|---|---|
| 16 | 1.19 | - | - |
| 20 | 0.84 | 0.1 | 99.9 |
| 25 | 0.71 | 0.7 | 99.3 |
| 30 | 0.59 | 10.1 | 89.9 |
| 35 | 0.50 | 26.8 | 73.2 |
| 40 | 0.420 | 44.5 | 55.5 |
| 45 | 0.350 | 61.0 | 39.0 |
| 50 | 0.297 | 71.2 | 28.8 |
| 60 | 0.250 | 84.0 | 16.0 |
| 70 | 0.210 | 90.7 | 9.3 |
| 100 | 0.149 | 97.6 | 2.4 |

Effective Size: 0.22 Uniformity Coef: 2.04

* - All values shown are averages and do not necessarily reflect a specific sample.

| Standard Sand and Silica Co. | | | Davenport Silica Plant | | Lake Wales Silica Plant | |
|---|---|---|---|---|---|---|
| Material Grade | Sieve Size (U.S. standard) | Opening (mm) | cum. % Retained | % Passing | cum. % Retained | % Passing |
| 6/20 | 4 | 4.76 | - | - | - | - |
| | 6 | 3.36 | - | - | 0.1 | 99.9 |
| | 8 | 2.38 | 4.5 | 95.5 | 2.1 | 97.9 |
| | 12 | 1.68 | 26.0 | 74.0 | 14.2 | 85.8 |
| | 14 | 1.41 | 54.0 | 46.0 | 29.6 | 70.4 |
| | 16 | 1.190 | 85.1 | 14.9 | 51.5 | 48.5 |
| | 18 | 1.000 | 96.1 | 3.9 | 79.3 | 20.7 |
| | 20 | 0.840 | 97.8 | 2.2 | 94.0 | 6.0 |
| | 25 | 0.710 | 98.4 | 1.6 | 97.6 | 2.4 |
| | 30 | 0.590 | 98.8 | 1.2 | 98.7 | 1.3 |
| | 40 | 0.420 | 99.4 | 0.6 | 99.5 | 0.5 |
| | 50 | 0.297 | 99.6 | 0.4 | 99.8 | 0.2 |
| 20/30 | 8 | 2.38 | - | - | - | - |
| | 12 | 1.68 | - | - | - | - |
| | 16 | 1.19 | 4.6 | 95.4 | 0.5 | 99.5 |
| | 18 | 1.00 | 19.6 | 80.4 | 5.8 | 94.2 |
| | 20 | 0.84 | 41.5 | 58.5 | 26.7 | 73.3 |
| | 25 | 0.710 | 63.5 | 36.5 | 58.3 | 41.7 |
| | 30 | 0.590 | 83.6 | 16.4 | 86.2 | 13.8 |
| | 35 | 0.500 | 94.1 | 5.9 | 96.4 | 3.6 |
| | 40 | 0.420 | 97.0 | 3.0 | 98.8 | 1.2 |
| | 50 | 0.297 | 98.8 | 1.2 | 99.8 | 0.2 |
| 30/45 | 18 | 1.00 | - | - | - | - |
| | 20 | 0.84 | 1.4 | 98.6 | 0.3 | 99.7 |
| | 25 | 0.71 | 2.9 | 97.1 | 1.4 | 98.6 |
| | 30 | 0.59 | 8.5 | 91.5 | 13.2 | 86.8 |
| | 35 | 0.50 | 30.6 | 69.4 | 50.6 | 49.4 |
| | 40 | 0.420 | 59.6 | 40.4 | 81.7 | 18.3 |
| | 45 | 0.350 | 76.1 | 23.9 | 93.3 | 6.7 |
| | 50 | 0.297 | 87.2 | 12.8 | 98.2 | 1.8 |
| | 60 | 0.250 | 93.6 | 6.4 | 99.6 | 0.4 |
| | 70 | 0.210 | 96.4 | 3.6 | 99.8 | 0.2 |
| | 100 | 0.149 | 99.5 | 0.5 | 100.0 | 0.0 |
| 30/65 | 16 | 1.19 | - | - | | |
| | 20 | 0.84 | 0.5 | 99.5 | | |
| | 25 | 0.71 | 1.3 | 98.7 | | |
| | 30 | 0.59 | 4.6 | 95.4 | | |
| | 35 | 0.50 | 13.9 | 86.1 | | |
| | 40 | 0.420 | 27.0 | 73.0 | | |
| | 45 | 0.350 | 38.1 | 61.9 | | |
| | 50 | 0.297 | 49.8 | 50.2 | | |
| | 60 | 0.250 | 63.7 | 36.3 | | |
| | 70 | 0.210 | 73.8 | 26.2 | | |
| | 100 | 0.149 | 94.9 | 5.1 | | |
| 40F | 20 | 0.84 | - | - | - | - |
| | 30 | 0.59 | 0.2 | 99.8 | 0.1 | 99.9 |
| | 40 | 0.42 | 6.2 | 93.8 | 7.1 | 92.9 |
| | 45 | 0.35 | 15.9 | 84.1 | 23.4 | 76.6 |
| | 50 | 0.297 | 31.1 | 68.9 | 46.8 | 53.2 |
| | 60 | 0.250 | 52.2 | 47.8 | 71.6 | 28.4 |
| | 70 | 0.210 | 65.4 | 34.6 | 81.9 | 18.1 |
| | 80 | 0.177 | 82.3 | 17.7 | 92.3 | 7.7 |
| | 100 | 0.149 | 93.4 | 6.6 | 97.3 | 2.7 |
| | 140 | 0.105 | 99.4 | 0.6 | 98.6 | 1.4 |
| | 200 | 0.074 | 99.8 | 0.2 | 99.9 | 0.1 |

## TECHNICAL DATA

# Granusil®

MINERAL FILLERS

### FEATURES AND BENEFITS

EMMETT, ID

GRANUSIL® Mineral Fillers are produced from high purity industrial quartz sands for a wide variety of industrial and contractor mixed applications which need a reliable silica contribution or require a chemically inert structural filler. Consistently uniform grain shapes and particle size distributions offer excellent placement, compaction and mechanical properties. High silica content combined with low level soluble ions, alkalis and alkaline oxides provide non-reactive service in most corrosive and exposed environments.

These durable monocrystalline structures resist abrasion in high traffic-excessive wear applications and provide the stability formulators seek in high solids emulsions, elastomerics, cemented and modified cementious systems. GRANUSIL® is the preferred structural component in systems ranging from polymerized floor overlays to artificial sports turf.

All GRANUSIL® grades are processed and sized under rigid SPC and UNIMIN QIP℠ statistical and quality assurance programs. The result is chemical purity and consistently uniform particle size distributions for predictable performance in either manufactured or site-prepared products.

### PARTICLE SIZE ANALYSIS AND PROPERTIES

Mean Values. These Do Not Represent A Specification.

| | Mesh ASTM E-11 | 2095 | 2075 | 4095 | 4075 | 4060 | 4010 | 7030 |
|---|---|---|---|---|---|---|---|---|
| | 8 | 3.5 | — | — | — | — | — | — |
| Typical Mean % | 16 | 70.5 | 12.9 | .4 | .2 | .1 | — | — |
| Retained on | 20 | 22.8 | 59.9 | 19.6 | 8.8 | .3 | — | — |
| Individual Sieves | 30 | 2.1 | 18.4 | 58.5 | 30.8 | 13.3 | TR | — |
| | 40 | .8 | 7.1 | 19.5 | 50.4 | 70.4 | 12.4 | .2 |
| | 50 | .2 | 1.3 | 1.6 | 8.8 | 14.1 | 38.4 | 1.9 |
| | 70 | .1 | .3 | .3 | .7 | 1.2 | 28.7 | 38.7 |
| | 100 | — | .1 | .1 | .2 | .3 | 13.4 | 36.3 |
| | 140 | — | TR | TR | .1 | .2 | 6.0 | 19.2 |
| | 200 | — | — | TR | TR | .1 | .9 | 3.1 |
| | PAN | — | — | — | — | TR | .2 | .6 |

| | | |
|---|---|---|
| Grain Shape | Subangular | Visual |
| Hardness | 7.0 Mohs | Mohs Scale |
| Moisture Content | <0.1% | ASTM C-566 |
| Specific Gravity | 2.65 g/cm$^3$ | ASTM C-128 |
| Bulk Density, aerated | 92-95 lb/ft$^3$ | ASTM C-29 |
| Bulk Density, compacted | 98-100 lb/ft$^3$ | ASTM C-29 |

TECHNICAL DATA

# Granusil

## CHEMICAL ANALYSIS

**Mean Values. These Do Not Represent A Specification.**

| | Mean Percent by Weight | |
|---|---|---|
| | 2095-2075 | 4095-7030 |
| Silicon Dioxide ($SiO_2$) | 90.484 | 87.263 |
| Iron Oxide ($Fe_2O_3$) | .095 | .113 |
| Aluminum Oxide ($Al_2O_3$) | 5.451 | 7.244 |
| Calcium Oxide (CaO) | .358 | .609 |
| Titanium Dioxide ($TiO_2$) | .016 | .018 |
| Magnesium Oxide (MgO) | .021 | .024 |
| Potassium Oxide ($K_2O$) | 2.536 | 2.819 |
| Sodium Oxide ($Na_2O$) | .714 | 1.672 |
| Loss on Ignition (LOI) | .325 | .238 |

## ORDERING INFORMATION

**Shipping Point:** EMMETT, ID
ORIGINATING CARRIER: UNION PACIFIC

**Availability:** BULK, 100# BAGS, AND IBC'S
TRUCK AND RAIL


UNIMIN

UNIMIN CORPORATION

FOR PRODUCT INFORMATION AND CUSTOMER SERVICE:
U.S. and CANADA 800-243-9004 - FAX 800-243-9005
WORLDWIDE 203-966-1306 - FAX 203-972-1378


Silica Sands - Ground Silica - Feldspar - Ball Clay - Kaolin - Nepheline Syenite - High Purity Quartz - Olivine - Microcrystalline Silica - Bentonite Clay - Dolomite

GRADE NUMBERS INDICATE RELATIVE VALUES OR RESULTS. THEY ARE NOT A SPECIFICATION OR WARRANTY OF PERFORMANCE.

HEALTH HAZARD WARNING: Prolonged inhalation of dust associated with the materials described in this data sheet can cause delayed lung injury including Silicosis, a progressive, disabling and sometimes fatal lung disease. IARC has determined that crystalline silica, inhaled from occupational sources, can cause cancer in humans. Risk of injury is dependent on the duration and level of exposure. Follow OSHA or other relevant safety and health standards for the form of crystalline silica called Quartz. Current material safety data sheets, containing safety information, is available and should be consulted before usage.

# APPENDIX B

# CLIMATE AND WEATHER

| MCAS Cherry Point, NC: April 2007 Dates of GSB-88 Application | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2007 | Temp. (°F) | | | Dew Point (°F) | | | Humidity (%) | | | Pressure (in) | | | Visibility (mi) | | | Wind (mph) | | Gust | Precip |
| Apr-07 | high | avg | low | high | avg | low | high | avg | low | high | avg | low | high | avg | low | high | avg | (mph) | (in) |
| 1 | 77 | 64 | 52 | 58 | 54 | 51 | 93 | 72 | 51 | 30.2 | 30.2 | 30.1 | 10 | 9 | 6 | 17 | 5 | 28 | 0 |
| 2 | 80 | 70 | 59 | 63 | 59 | 57 | 100 | 76 | 47 | 30.1 | 30.1 | 30.0 | 10 | 10 | 5 | 18 | 10 | 24 | 0.11 |
| 3 | 82 | 69 | 57 | 57 | 48 | 38 | 94 | 59 | 23 | 30.1 | 30.1 | 30.0 | 10 | 9 | 2 | 14 | 0 | 21 | 0.01 |
| 4 | 84 | 74 | 63 | 64 | 59 | 37 | 94 | 68 | 30 | 30.0 | 29.8 | 29.6 | 10 | 9 | 5 | 22 | 5 | 29 | 0.01 |
| 5 | 66 | 58 | 48 | 49 | 29 | 20 | 60 | 36 | 20 | 29.9 | 29.8 | 29.7 | 10 | 10 | 10 | 17 | 13 | 23 | 0 |
| 6 | 57 | 49 | 41 | 36 | 25 | 21 | 73 | 43 | 26 | 30.0 | 29.9 | 29.7 | 10 | 10 | 10 | 15 | 12 | - | 0 |
| 7 | 51 | 42 | 32 | 37 | 22 | 9 | 73 | 48 | 20 | 30.0 | 29.8 | 29.6 | 10 | 10 | 10 | 30 | 13 | 41 | 0 |

| Avon Park AFR, FL: June 2007 Dates of GSB-88 Application | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2007 | Temp. (°F) | | | Dew Point (°F) | | | Humidity (%) | | | Pressure (in) | | | Visibility (mi) | | | Wind (mph) | | Gust | Precip |
| Jun-07 | high | avg | low | high | avg | low | high | avg | low | high | avg | low | high | avg | low | high | avg | (mph) | (in) |
| 17 | 91 | 80 | 68 | 73 | 70 | 68 | 100 | 75 | 49 | 30.1 | 30.1 | 30.0 | 10 | 8 | 1 | 14 | 0 | 24 | 0 |
| 18 | 91 | 81 | 71 | 77 | 73 | 72 | 100 | 83 | 55 | 30.1 | 30.1 | 30.1 | 10 | 8 | 1 | 12 | 0 | - | 0.09 |
| 19 | 91 | 80 | 69 | 77 | 71 | 68 | 100 | 79 | 49 | 30.1 | 30.1 | 30.1 | 10 | 8 | 2 | 7 | 0 | - | 0.01 |
| 20 | 91 | 81 | 71 | 73 | 70 | 64 | 100 | 70 | 41 | 30.1 | 30.1 | 30.0 | 10 | 9 | 7 | 10 | 0 | 16 | 0 |
| 21 | 87 | 80 | 73 | 77 | 72 | 72 | 100 | 81 | 62 | 30.0 | 30.0 | 29.9 | 10 | 8 | 3 | 16 | 5 | 24 | 0.64 |
| 22 | 93 | 82 | 71 | 75 | 74 | 69 | 100 | 70 | 44 | 30.0 | 30.0 | 29.9 | 10 | 7 | 2 | 13 | 7 | 18 | 0 |
| 23 | 91 | 80 | 69 | 73 | 73 | 59 | 100 | 70 | 38 | 30.0 | 30.0 | 29.9 | 10 | 8 | 2 | 9 | 4 | - | 0 |

| NAS Fallon, NV: September 2007 Dates of GSB-88 Application | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2007 | Temp. (°F) | | | Dew Point (°F) | | | Humidity (%) | | | Pressure (in) | | | Visibility (mi) | | | Wind (mph) | | Gust | Precip |
| Sep-07 | high | avg | low | high | avg | low | high | avg | low | high | avg | low | high | avg | low | high | avg | (mph) | (in) |
| 26 | 75 | 55 | 35 | 32 | 27 | 21 | 73 | 42 | 13 | 30.2 | 30.1 | 30.0 | 10 | 10 | 10 | 6 | 6 | - | 0 |
| 27 | 78 | 58 | 37 | 33 | 28 | 24 | 68 | 34 | 14 | 30.0 | 29.9 | 29.8 | 10 | 10 | 10 | 7 | 5 | - | 0 |
| 28 | 73 | 58 | 42 | 35 | 31 | 22 | 70 | 39 | 15 | 29.8 | 29.7 | 29.6 | 10 | 10 | 4 | 34 | 5 | 44 | 0 |
| 29 | 57 | 46 | 34 | 34 | 26 | 14 | 82 | 49 | 22 | 30.0 | 30.0 | 29.8 | 10 | 10 | 10 | 12 | 7 | 18 | 0 |
| 30 | 79 | 56 | 32 | 21 | 16 | 14 | 56 | 26 | 9 | 30.0 | 30.0 | 29.8 | 10 | 10 | 10 | 12 | 5 | 22 | 0 |
| 1-Oct | 63 | 52 | 37 | 45 | 33 | 18 | 83 | 48 | 27 | 30.2 | 30.1 | 29.9 | 10 | 10 | 6 | 16 | 5 | 23 | 0.03 |
| 2 | 73 | 52 | 32 | 31 | 27 | 24 | 79 | 47 | 16 | 30.2 | 30.1 | 29.9 | 10 | 10 | 9 | 8 | 3 | - | 0 |
| 3 | 84 | 62 | 41 | 32 | 26 | 23 | 60 | 32 | 14 | 29.9 | 29.8 | 29.7 | 10 | 10 | 10 | 24 | 6 | 31 | 0 |

| NASJRB Willow Grove, PA: October 2007 Dates of GSB-88 Application | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2007 | Temp. (°F) | | | Dew Point (°F) | | | Humidity (%) | | | Pressure (in) | | | Visibility (mi) | | | Wind (mph) | | Gust | Precip |
| Oct-07 | high | avg | low | high | avg | low | high | avg | low | high | avg | low | high | avg | low | high | avg | (mph) | (in) |
| 7 | 82 | 74 | 66 | 65 | 64 | 60 | 89 | 77 | 62 | 30.1 | 30.1 | 30.0 | 10 | 10 | 9 | 12 | 6 | - | 0 |
| 8 | 89 | 77 | 66 | 65 | 65 | 62 | 94 | 75 | 42 | 30.1 | 30.0 | 29.9 | 10 | 8 | 6 | 15 | 6 | 22 | 0 |
| 9 | 84 | 72 | 62 | 66 | 63 | 60 | 96 | 80 | 54 | 29.9 | 29.9 | 29.8 | 10 | 8 | 3 | 20 | 7 | 25 | 0 |
| 10 | 78 | 70 | 60 | 63 | 61 | 49 | 100 | 82 | 37 | 29.8 | 29.8 | 29.7 | 10 | 6 | 0 | 7 | 0 | - | 0 |
| 11 | 64 | 58 | 52 | 61 | 57 | 46 | 94 | 91 | 77 | 29.7 | 29.7 | 29.5 | 10 | 8 | 2 | 14 | 5 | 23 | 0 |
| 12 | 61 | 53 | 45 | 50 | 45 | 33 | 94 | 70 | 40 | 30.0 | 29.7 | 29.5 | 10 | 9 | 5 | 20 | 10 | 32 | 0 |
| 13 | 61 | 51 | 41 | 39 | 35 | 34 | 79 | 58 | 36 | 30.1 | 30.0 | 30.0 | 10 | 10 | 10 | 12 | 5 | 18 | 0 |

| PMRF Barking Sands, HI: December 2007 Dates of GSB-88 Application | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2007 | Temp. (°F) | | | Dew Point (°F) | | | Humidity (%) | | | Pressure (in) | | | Visibility (mi) | | | Wind (mph) | | Gust | Precip |
| Dec-07 | high | avg | low | high | avg | low | high | avg | low | high | avg | low | high | avg | low | high | avg | (mph) | (in) |
| 12 | 80 | 74 | 68 | 66 | 63 | 60 | 78 | 69 | 58 | 30.2 | 30.1 | 30.1 | 10 | 10 | 10 | 9 | 5 | - | 0 |
| 13 | 81 | 74 | 66 | 65 | 61 | 57 | 75 | 66 | 58 | 30.2 | 30.2 | 30.1 | 10 | 9.9 | 8 | 12 | 4 | - | 0.01 |
| 14 | 82 | 75 | 68 | 65 | 61 | 59 | 78 | 65 | 47 | 30.2 | 30.2 | 30.1 | 10 | 10 | 10 | 10 | 3 | - | 0 |
| 15 | 81 | 74 | 66 | 65 | 60 | 52 | 73 | 60 | 42 | 30.2 | 30.2 | 30.1 | 10 | 10 | 10 | 10 | 4 | - | 0 |
| 16 | 81 | 74 | 66 | 62 | 60 | 55 | 76 | 62 | 50 | 30.2 | 30.2 | 30.1 | 10 | 10 | 10 | 10 | 4 | - | 0 |
| 17 | 80 | 73 | 66 | 59 | 56 | 51 | 70 | 57 | 44 | 30.2 | 30.2 | 30.1 | 10 | 10 | 10 | 9 | 3 | - | 0 |
| 18 | 82 | 74 | 66 | 63 | 58 | 53 | 75 | 59 | 43 | 30.2 | 30.2 | 30.1 | 10 | 10 | 10 | 16 | 3 | - | 0 |
| 19 | 81 | 74 | 68 | 66 | 62 | 59 | 81 | 69 | 52 | 30.2 | 30.2 | 30.1 | 10 | 10 | 10 | 10 | 4 | - | 0 |

| NAWS China Lake, CA: May 2008 Dates of GSB-88 Application | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2008 | Temp. (°F) | | | Dew Point (°F) | | | Humidity (%) | | | Pressure (in) | | | Visibility (mi) | | | Wind (mph) | | Gust | Precip |
| May-08 | high | avg | low | high | avg | low | high | avg | low | high | avg | low | high | avg | low | high | avg | (mph) | (in) |
| 14 | 91 | 72 | 54 | 34 | 20 | 7 | 20 | 13 | 8 | 30.0 | 30.0 | 29.9 | 10 | 10 | 10 | 17 | 5 | 24 | 0 |
| 15 | 97 | 86 | 75 | 36 | 34 | 31 | 23 | 18 | 10 | 30.0 | 29.9 | 29.8 | 10 | 10 | 9 | 17 | 12 | 29 | 0 |
| 16 | 96 | 80 | 64 | 33 | 26 | 19 | 31 | 16 | 6 | 30.1 | 30.1 | 30.0 | 10 | 10 | 10 | 15 | 7 | 24 | 0 |
| 17 | 102 | 80 | 57 | 44 | 27 | 20 | 29 | 15 | 6 | 30.1 | 30.0 | 29.9 | 10 | 10 | 10 | 13 | 6 | - | 0 |
| 18 | 106 | 84 | 64 | 45 | 37 | 18 | 42 | 20 | 5 | 30.0 | 29.9 | 29.8 | 10 | 10 | 10 | 18 | 5 | 23 | 0 |
| 19 | 107 | 86 | 66 | 41 | 36 | 24 | 33 | 18 | 6 | 29.8 | 29.8 | 29.7 | 10 | 10 | 8 | 16 | 3 | 22 | 0 |
| 20 | 100 | 84 | 68 | 35 | 27 | 20 | 25 | 14 | 6 | 29.8 | 29.7 | 29.6 | 10 | 10 | 7 | 39 | 12 | 53 | 0 |

**NAS Fallon, NV: September 2007 Dates of GSB-88 Application and Friction Evaluation**

| 2007 | Temp. (°F) | | | Dew Point (°F) | | | Humidity (%) | | | Pressure (in) | | | Visibility (mi) | | | Wind (mph) | | Gust | Precip |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sep-07 | high | avg | low | high | avg | low | high | avg | low | high | avg | low | high | avg | low | high | avg | (mph) | (in) |
| 26 | 75 | 56 | 36 | 32 | 27 | 21 | 73 | 42 | 13 | 30.2 | 30.1 | 30.0 | 10 | 10 | 10 | 6 | 6 | - | 0 |
| 27 | 78 | 58 | 37 | 33 | 28 | 24 | 68 | 34 | 14 | 30.0 | 29.9 | 29.8 | 10 | 10 | 10 | 7 | 5 | - | 0 |
| 28 | 73 | 58 | 42 | 35 | 31 | 22 | 70 | 39 | 15 | 29.8 | 29.7 | 29.6 | 10 | 10 | 4 | 34 | 5 | 44 | 0 |
| 29 | 57 | 46 | 34 | 34 | 26 | 14 | 82 | 49 | 22 | 30.0 | 30.0 | 29.8 | 10 | 10 | 10 | 12 | 7 | 18 | 0 |
| 30 | 79 | 56 | 32 | 21 | 16 | 14 | 56 | 26 | 9 | 30.0 | 30.0 | 29.8 | 10 | 10 | 10 | 12 | 5 | 22 | 0 |
| 1-Oct | 63 | 52 | 37 | 45 | 33 | 18 | 83 | 48 | 27 | 30.2 | 30.1 | 29.9 | 10 | 10 | 6 | 16 | 5 | 23 | 0.03 |
| 2 | 73 | 52 | 32 | 31 | 27 | 24 | 79 | 47 | 16 | 30.2 | 30.1 | 29.9 | 10 | 10 | 9 | 8 | 3 | - | 0 |
| 3 | 84 | 62 | 41 | 32 | 26 | 23 | 60 | 32 | 14 | 29.9 | 29.8 | 29.7 | 10 | 10 | 10 | 24 | 6 | 31 | 0 |

**NAS Fallon, NV: May 21, 2008: Friction Evaluation 0.75 Years After Date of GSB-88 Application**

| 2008 | Temp. (°F) | | | Dew Point (°F) | | | Humidity (%) | | | Pressure (in) | | | Visibility (mi) | | | Wind (mph) | | Gust | Precip |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| May-08 | high | avg | low | high | avg | low | high | avg | low | high | avg | low | high | avg | low | high | avg | (mph) | (in) |
| 21 | 61 | 54 | 46 | 44 | 28 | 20 | 74 | 39 | 21 | 29.9 | 29.8 | 29.7 | 10 | 9 | 4 | 28 | 11 | 34 | 0 |

**NAS Fallon, NV: December 9, 2008: Friction Evaluation 1.25 Years After Date of GSB-88 Application**

| 2008 | Temp. (°F) | | | Dew Point (°F) | | | Humidity (%) | | | Pressure (in) | | | Visibility (mi) | | | Wind (mph) | | Gust | Precip |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dec-08 | high | avg | low | high | avg | low | high | avg | low | high | avg | low | high | avg | low | high | avg | (mph) | (in) |
| 9 | 44 | 30 | 15 | 18 | 12 | 9 | 77 | 56 | 35 | 30.4 | 30.3 | 30.2 | 10 | 9 | 6 | 9 | 3 | - | 0 |

**NAWS China Lake, CA: May 2008 Dates of GSB-88 Application and Friction Evaluation**

| 2008 | Temp. (°F) | | | Dew Point (°F) | | | Humidity (%) | | | Pressure (in) | | | Visibility (mi) | | | Wind (mph) | | Gust | Precip |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| May-08 | high | avg | low | high | avg | low | high | avg | low | high | avg | low | high | avg | low | high | avg | (mph) | (in) |
| 14 | 91 | 72 | 54 | 34 | 20 | 7 | 20 | 13 | 8 | 30.0 | 30.0 | 29.9 | 10 | 10 | 10 | 17 | 5 | 24 | 0 |
| 15 | 97 | 86 | 75 | 36 | 34 | 31 | 23 | 18 | 10 | 30.0 | 29.9 | 29.8 | 10 | 10 | 9 | 17 | 12 | 29 | 0 |
| 16 | 96 | 80 | 64 | 33 | 26 | 19 | 31 | 16 | 6 | 30.1 | 30.1 | 30.0 | 10 | 10 | 10 | 15 | 7 | 24 | 0 |
| 17 | 102 | 80 | 57 | 44 | 27 | 20 | 29 | 15 | 6 | 30.1 | 30.0 | 29.9 | 10 | 10 | 10 | 13 | 6 | - | 0 |
| 18 | 106 | 84 | 64 | 45 | 37 | 18 | 42 | 20 | 5 | 30.0 | 29.9 | 29.8 | 10 | 10 | 10 | 18 | 5 | 23 | 0 |
| 19 | 107 | 86 | 66 | 41 | 36 | 24 | 33 | 18 | 6 | 29.8 | 29.8 | 29.7 | 10 | 10 | 8 | 16 | 3 | 22 | 0 |
| 20 | 100 | 84 | 68 | 35 | 27 | 20 | 25 | 14 | 6 | 29.8 | 29.7 | 29.6 | 10 | 10 | 7 | 39 | 12 | 53 | 0 |

**NAWS China Lake, CA: December 7, 2008: Friction Evaluation 0.5 Years After Date of GSB-88 Application**

| 2008 | Temp. (°F) | | | Dew Point (°F) | | | Humidity (%) | | | Pressure (in) | | | Visibility (mi) | | | Wind (mph) | | Gust | Precip |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dec-08 | high | avg | low | high | avg | low | high | avg | low | high | avg | low | high | avg | low | high | avg | (mph) | (in) |
| 7 | 55 | 49 | 41 | 44 | 36 | 29 | 96 | 67 | 37 | 30.2 | 30.1 | 30.0 | 10 | 10 | 10 | 8 | 3 | - | 0.02 |

**NAWS China Lake, CA: May 16, 2009: Friction Evaluation 1.0 Years After Date of GSB-88 Application**

| 2009 | Temp. (°F) | | | Dew Point (°F) | | | Humidity (%) | | | Pressure (in) | | | Visibility (mi) | | | Wind (mph) | | Gust | Precip |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| May-09 | high | avg | low | high | avg | low | high | avg | low | high | avg | low | high | avg | low | high | avg | (mph) | (in) |
| 16 | 100 | 81 | 62 | - | - | - | - | - | - | 29.9 | 29.9 | 29.8 | 10 | 10 | 10 | 14 | 3 | 20 | 0 |

| Fallon May 21, 2008 .75 yr skid | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Time (PDT) | Temp °F | Dew Point °F | Humidity % | Pressure in | Visibility miles | Wind | | | Precip in | Conditions |
| | | | | | | Direction | Speed | Gusts | | |
| 12:56 AM | 52.0 | 44.1 | 74 | 29.84 in | 6 | NW | 5.8 | - | N/A | Haze |
| 1:56 AM | 51.1 | 43.0 | 74 | 29.83 in | 6 | NNW | 5.8 | - | N/A | Haze |
| 2:56 AM | 48.9 | 39.0 | 69 | 29.83 in | 4 | NNW | 6.9 | - | N/A | Haze |
| 3:56 AM | 48.0 | 37.0 | 66 | 29.83 in | 6 | NNW | 10.4 | - | N/A | Haze |
| 4:56 AM | 48.9 | 33.1 | 54 | 29.84 in | 10 | NNW | 11.5 | - | N/A | Mostly Cloudy |
| 5:56 AM | 46.0 | 30.9 | 56 | 29.86 in | 10 | NNW | 11.5 | - | N/A | Clear |
| 6:56 AM | 46.9 | 30.9 | 54 | 29.88 in | 10 | NNW | 12.7 | - | N/A | Scattered Clouds |
| 7:56 AM | 48.9 | 28.0 | 44 | 29.89 in | 10 | NNW | 27.6 | 34.5 | N/A | Scattered Clouds |
| 8:56 AM | 51.1 | 26.1 | 38 | 29.90 in | 10 | NNW | 24.2 | 34.5 | N/A | Scattered Clouds |
| 9:56 AM | 53.1 | 25.0 | 34 | 29.90 in | 10 | North | 16.1 | 27.6 | N/A | Mostly Cloudy |
| 10:56 AM | 55.0 | 24.1 | 30 | 29.89 in | 10 | North | 19.6 | 33.4 | N/A | Mostly Cloudy |
| 11:56 AM | 55.0 | 24.1 | 30 | 29.89 in | 10 | North | 23.0 | 28.8 | N/A | Mostly Cloudy |
| 12:56 PM | 57.9 | 21.9 | 25 | 29.87 in | 10 | NNW | 16.1 | 33.4 | N/A | Mostly Cloudy |
| 1:56 PM | 60.1 | 21.9 | 23 | 29.85 in | 10 | North | 12.7 | 27.6 | N/A | Mostly Cloudy |
| 2:56 PM | 61.0 | 21.9 | 22 | 29.82 in | 10 | North | 20.7 | 28.8 | N/A | Mostly Cloudy |
| 3:56 PM | 61.0 | 19.9 | 21 | 29.80 in | 10 | North | 19.6 | 26.5 | N/A | Mostly Cloudy |
| 4:56 PM | 59.0 | 21.9 | 24 | 29.80 in | 10 | NNW | 18.4 | 27.6 | N/A | Mostly Cloudy |
| 5:56 PM | 60.1 | 21.9 | 23 | 29.76 in | 10 | North | 18.4 | 26.5 | N/A | Mostly Cloudy |
| 6:56 PM | 57.9 | 19.9 | 23 | 29.75 in | 10 | North | 18.4 | 25.3 | N/A | Mostly Cloudy |
| 7:56 PM | 57.0 | 21.0 | 25 | 29.75 in | 10 | NNW | 18.4 | 23.0 | N/A | Mostly Cloudy |
| 8:56 PM | 55.0 | 23.0 | 29 | 29.74 in | 10 | North | 15.0 | - | N/A | Overcast |
| 9:56 PM | 54.0 | 24.1 | 31 | 29.73 in | 10 | North | 13.8 | 21.9 | N/A | Mostly Cloudy |
| 10:56 PM | 52.0 | 26.1 | 37 | 29.70 in | 10 | North | 16.1 | 23.0 | N/A | Mostly Cloudy |
| 11:56 PM | 51.1 | 27.0 | 39 | 29.69 in | 10 | North | 13.8 | - | N/A | Overcast |

| Fallon December 9, 2008 1.25 yr skid | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Time (PDT) | Temp °F | Dew Point °F | Humidity % | Pressure in | Visibility miles | Wind | | | Precip in | Conditions |
| | | | | | | Direction | Speed | Gusts | | |
| 12:56 AM | 19.0 | 10.0 | 68 | 30.20 in | 6 | Calm | Calm | - | N/A | Haze |
| 1:56 AM | 21.9 | 12.0 | 66 | 30.21 in | 6 | SW | 4.6 | - | N/A | Haze |
| 2:56 AM | 19.0 | 10.9 | 71 | 30.21 in | 6 | South | 8.1 | - | N/A | Haze |
| 3:56 AM | 19.0 | 10.9 | 71 | 30.23 in | 6 | South | 3.5 | - | N/A | Haze |
| 4:56 AM | 19.0 | 10.9 | 71 | 30.25 in | 7 | South | 3.5 | - | N/A | Clear |
| 5:56 AM | 16.0 | 10.0 | 77 | 30.27 in | 8 | South | 5.8 | - | N/A | Clear |
| 6:18 AM | 15.8 | 8.6 | 73 | 30.40 in | 8 | South | 5.8 | - | N/A | Clear |
| 6:56 AM | 17.1 | 10.0 | 74 | 30.29 in | 9 | SSE | 5.8 | - | N/A | Partly Cloudy |
| 7:56 AM | 21.9 | 12.9 | 68 | 30.32 in | 8 | South | 4.6 | - | N/A | Scattered Clouds |
| 8:56 AM | 30.0 | 16.0 | 56 | 30.35 in | 9 | SSE | 4.6 | - | N/A | Scattered Clouds |
| 9:56 AM | 35.1 | 17.1 | 48 | 30.35 in | 10 | Calm | Calm | - | N/A | Scattered Clouds |
| 10:56 AM | 39.0 | 17.1 | 41 | 30.33 in | 10 | Calm | Calm | - | N/A | Mostly Cloudy |
| 11:56 AM | 42.1 | 17.1 | 37 | 30.30 in | 10 | SE | 4.6 | - | N/A | Mostly Cloudy |
| 12:56 PM | 44.1 | 18.0 | 35 | 30.29 in | 10 | NNE | 5.8 | - | N/A | Mostly Cloudy |
| 1:56 PM | 44.1 | 18.0 | 35 | 30.28 in | 10 | NNE | 9.2 | - | N/A | Mostly Cloudy |
| 2:56 PM | 44.1 | 18.0 | 35 | 30.28 in | 10 | NNE | 4.6 | - | N/A | Mostly Cloudy |
| 3:56 PM | 43.0 | 18.0 | 37 | 30.28 in | 10 | NNE | 4.6 | - | N/A | Mostly Cloudy |
| 4:56 PM | 36.0 | 16.0 | 44 | 30.29 in | 10 | North | 3.5 | - | N/A | Scattered Clouds |
| 6:56 PM | 26.1 | 12.9 | 58 | 30.32 in | 10 | SSE | 4.6 | - | N/A | Clear |
| 7:56 PM | 26.1 | 16.0 | 66 | 30.32 in | 10 | South | 3.5 | - | N/A | Clear |
| 8:56 PM | 30.0 | 16.0 | 56 | 30.33 in | 10 | SSE | 5.8 | - | N/A | Clear |
| 9:56 PM | 25.0 | 14.0 | 63 | 30.34 in | 10 | South | 4.6 | - | N/A | Clear |
| 10:56 PM | 27.0 | 15.1 | 61 | 30.36 in | 10 | SSW | 5.8 | - | N/A | Clear |
| 11:56 PM | 25.0 | 15.1 | 66 | 30.36 in | 10 | South | 4.6 | - | N/A | Clear |

| 16-May-08 | Temp °F | Dew Point °F | Humidity % | Pressure in | Visibility miles | Wind | | | Precip in | Conditions |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Direction | Speed | Gusts | | |
| 12:56 AM | 75.9 | 32.0 | 20 | 29.97 in | 10 | SSW | 6.9 | - | N/A | Clear |
| 1:56 AM | 70.0 | 30.9 | 24 | 29.99 in | 10 | South | 5.8 | - | N/A | Clear |
| 2:56 AM | 70.0 | 32.0 | 25 | 30.01 in | 10 | SSW | 8.1 | - | N/A | Clear |
| 3:56 AM | 66.9 | 32.0 | 27 | 30.02 in | 10 | South | 4.6 | - | N/A | Clear |
| 4:56 AM | 64.9 | 33.1 | 31 | 30.04 in | 10 | WSW | 4.6 | - | N/A | Clear |
| 5:56 AM | 64.9 | 32.0 | 29 | 30.06 in | 10 | Variable | 4.6 | - | N/A | Clear |
| 6:56 AM | 68.0 | 33.1 | 27 | 30.08 in | 10 | SSW | 4.6 | - | N/A | Clear |
| 7:56 AM | 73.9 | 33.1 | 22 | 30.11 in | 10 | Calm | Calm | - | N/A | Clear |
| 8:56 AM | 81.0 | 27.0 | 14 | 30.11 in | 10 | SE | 5.8 | - | N/A | Clear |
| 9:56 AM | 82.9 | 25.0 | 12 | 30.10 in | 10 | Calm | Calm | - | N/A | Clear |
| 10:56 AM | 87.1 | 26.1 | 11 | 30.09 in | 10 | North | 5.8 | - | N/A | Clear |
| 11:56 AM | 90.0 | 25.0 | 10 | 30.08 in | 10 | NNE | 15.0 | 21.9 | N/A | Clear |
| 12:56 PM | 91.9 | 21.9 | 8 | 30.06 in | 10 | ENE | 12.7 | 24.2 | N/A | Clear |
| 1:56 PM | 93.0 | 21.0 | 7 | 30.04 in | 10 | NNE | 8.1 | - | N/A | Clear |
| 2:56 PM | 93.0 | 19.0 | 7 | 30.02 in | 10 | NE | 11.5 | 19.6 | N/A | Clear |
| 3:56 PM | 95.0 | 19.0 | 6 | 29.99 in | 10 | ESE | 9.2 | 16.1 | N/A | Clear |
| 4:56 PM | 93.9 | 19.9 | 7 | 29.98 in | 10 | SE | 9.2 | 18.4 | N/A | Clear |
| 5:56 PM | 93.0 | 21.0 | 7 | 29.97 in | 10 | ESE | 13.8 | - | N/A | Clear |
| 6:56 PM | 91.9 | 21.9 | 8 | 29.97 in | 10 | SE | 8.1 | - | N/A | Clear |
| 7:56 PM | 86.0 | 21.9 | 10 | 29.99 in | 10 | South | 6.9 | - | N/A | Clear |
| 8:56 PM | 79.0 | 21.9 | 12 | 30.01 in | 10 | South | 5.8 | - | N/A | Clear |
| 9:56 PM | 77.0 | 21.9 | 13 | 30.03 in | 10 | SSW | 9.2 | - | N/A | Partly Cloudy |
| 10:56 PM | 73.9 | 21.9 | 14 | 30.03 in | 10 | SSW | 10.4 | - | N/A | Clear |
| 11:56 PM | 73.0 | 21.9 | 15 | 30.04 in | 10 | South | 3.5 | - | N/A | Clear |
| **17-May-08** | | | | | | | | | | |
| 12:56 AM | 71.1 | 21.9 | 16 | 30.03 in | 10 | South | 6.9 | - | N/A | Clear |
| 1:56 AM | 66.9 | 23.0 | 19 | 30.03 in | 10 | WSW | 6.9 | - | N/A | Clear |
| 2:56 AM | 66.0 | 23.0 | 20 | 30.03 in | 10 | SSW | 9.2 | - | N/A | Clear |
| 3:56 AM | 64.0 | 23.0 | 21 | 30.03 in | 10 | SW | 6.9 | - | N/A | Clear |
| 4:56 AM | 59.0 | 23.0 | 25 | 30.05 in | 10 | WSW | 3.5 | - | N/A | Partly Cloudy |
| 5:56 AM | 57.0 | 21.9 | 26 | 30.06 in | 10 | Calm | Calm | - | N/A | Clear |
| 6:56 AM | 64.9 | 24.1 | 21 | 30.08 in | 10 | West | 5.8 | - | N/A | Clear |
| 7:56 AM | 71.1 | 23.0 | 16 | 30.09 in | 10 | Calm | Calm | - | N/A | Clear |
| 8:56 AM | 77.0 | 23.0 | 13 | 30.10 in | 10 | Calm | Calm | - | N/A | Clear |
| 9:56 AM | 82.9 | 23.0 | 11 | 30.09 in | 10 | Calm | Calm | - | N/A | Clear |
| 10:56 AM | 88.0 | 21.9 | 9 | 30.07 in | 10 | Calm | Calm | - | N/A | Clear |
| 11:56 AM | 93.9 | 21.9 | 7 | 30.04 in | 10 | East | 4.6 | - | N/A | Clear |
| 12:56 PM | 97.0 | 21.0 | 6 | 30.01 in | 10 | Variable | 3.5 | - | N/A | Clear |
| 1:56 PM | 99.0 | 21.0 | 6 | 29.99 in | 10 | East | 8.1 | - | N/A | Clear |
| 2:56 PM | 100.0 | 21.0 | 6 | 29.96 in | 10 | Variable | 6.9 | - | N/A | Clear |
| 3:56 PM | 102.0 | 21.0 | 6 | 29.93 in | 10 | North | 9.2 | - | N/A | Clear |
| 4:56 PM | 100.0 | 19.9 | 6 | 29.91 in | 10 | ENE | 4.6 | - | N/A | Clear |
| 5:56 PM | 100.0 | 21.0 | 6 | 29.90 in | 10 | NE | 5.8 | - | N/A | Clear |
| 6:56 PM | 97.0 | 21.0 | 6 | 29.88 in | 10 | SE | 4.6 | - | N/A | Clear |
| 7:56 PM | 93.0 | 39.0 | 15 | 29.88 in | 10 | West | 12.7 | - | N/A | Clear |
| 8:56 PM | 89.1 | 42.1 | 19 | 29.89 in | 10 | WSW | 8.1 | - | N/A | Clear |
| 9:56 PM | 84.0 | 42.1 | 23 | 29.90 in | 10 | SSE | 6.9 | - | N/A | Clear |
| 10:56 PM | 81.0 | 42.1 | 25 | 29.89 in | 10 | SE | 4.6 | - | N/A | Clear |
| 11:56 PM | 79.0 | 44.1 | 29 | 29.89 in | 10 | South | 5.8 | - | N/A | Clear |
| **18-May-08** | | | | | | | | | | |
| 12:56 AM | 78.1 | 45.0 | 31 | 29.89 in | 10 | South | 6.9 | - | N/A | Clear |
| 1:56 AM | 75.0 | 44.1 | 33 | 29.89 in | 10 | West | 4.6 | - | N/A | Clear |
| 4:56 AM | 68.0 | 42.1 | 39 | 29.91 in | 10 | SW | 4.6 | - | N/A | Clear |
| 5:56 AM | 64.9 | 41.0 | 42 | 29.93 in | 10 | Calm | Calm | - | N/A | Clear |
| 6:56 AM | 71.1 | 42.1 | 35 | 29.94 in | 10 | Calm | Calm | - | N/A | Clear |
| 7:56 AM | 77.0 | 42.1 | 29 | 29.95 in | 10 | Calm | Calm | - | N/A | Clear |
| 8:56 AM | 82.9 | 42.1 | 24 | 29.96 in | 10 | Variable | 3.5 | - | N/A | Clear |
| 9:56 AM | 90.0 | 39.9 | 17 | 29.95 in | 10 | Calm | Calm | - | N/A | Clear |
| 10:56 AM | 93.9 | 34.0 | 12 | 29.94 in | 10 | Calm | Calm | - | N/A | Clear |
| 11:56 AM | 98.1 | 32.0 | 10 | 29.91 in | 10 | SSE | 5.8 | - | N/A | Clear |
| 12:56 PM | 100.9 | 30.0 | 8 | 29.88 in | 10 | Variable | 6.9 | - | N/A | Clear |
| 1:56 PM | 104.0 | 21.9 | 5 | 29.84 in | 10 | Calm | Calm | - | N/A | Scattered Clouds |
| 2:56 PM | 104.0 | 18.0 | 5 | 29.82 in | 10 | West | 5.8 | - | N/A | Scattered Clouds |
| 3:56 PM | 105.1 | 19.0 | 5 | 29.79 in | 10 | Variable | 5.8 | - | N/A | Clear |
| 4:56 PM | 105.1 | 21.0 | 5 | 29.77 in | 10 | ESE | 8.1 | - | N/A | Clear |
| 5:56 PM | 102.9 | 32.0 | 8 | 29.76 in | 10 | West | 9.2 | - | N/A | Clear |
| 6:56 PM | 99.0 | 35.1 | 11 | 29.75 in | 10 | West | 18.4 | - | N/A | Clear |
| 7:56 PM | 93.9 | 37.9 | 14 | 29.75 in | 10 | West | 17.3 | 23.0 | N/A | Clear |
| 8:56 PM | 91.0 | 37.0 | 15 | 29.76 in | 10 | West | 13.8 | - | N/A | Clear |
| 9:56 PM | 90.0 | 37.0 | 15 | 29.78 in | 10 | Variable | 6.9 | - | N/A | Clear |
| 10:56 PM | 82.0 | 39.0 | 22 | 29.79 in | 10 | South | 4.6 | - | N/A | Clear |
| 11:56 PM | 80.1 | 39.0 | 23 | 29.79 in | 10 | South | 5.8 | - | N/A | Partly Cloudy |

| PMRF Barking Sands, HI | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 14-Dec-07 | Temp °F | Dew Point °F | Humidity % | Pressure in | Visibility miles | Wind | | | Precip in | Conditions |
| | | | | | | Direction | Speed | Gusts | | |
| 12:56 AM | 69.1 | 62.1 | 78 | 30.17 in | 10 | Calm | Calm | - | N/A | -- |
| 1:56 AM | 70.0 | 62.1 | 76 | 30.16 in | 10 | Calm | Calm | - | N/A | -- |
| 2:56 AM | 69.1 | 62.1 | 78 | 30.14 in | 10 | Calm | Calm | - | N/A | -- |
| 3:56 AM | 68.0 | 61.0 | 78 | 30.14 in | 10 | ENE | 3.5 | - | N/A | -- |
| 4:56 AM | 68.0 | 60.1 | 76 | 30.14 in | 10 | Calm | Calm | - | N/A | -- |
| 5:56 AM | 69.1 | 60.1 | 73 | 30.15 in | 10 | ESE | 4.6 | - | N/A | -- |
| 6:56 AM | 68.0 | 59.0 | 73 | 30.17 in | 10 | NE | 4.6 | - | N/A | -- |
| 7:56 AM | 68.0 | 61.0 | 78 | 30.18 in | 10 | East | 3.5 | - | N/A | -- |
| 8:56 AM | 75.9 | 64.9 | 69 | 30.20 in | 10 | East | 3.5 | - | N/A | -- |
| 9:56 AM | 78.1 | 63.0 | 60 | 30.20 in | 10 | WNW | 5.8 | - | N/A | -- |
| 10:56 AM | 79.0 | 62.1 | 56 | 30.20 in | 10 | SW | 10.4 | - | N/A | -- |
| 11:56 AM | 80.1 | 63.0 | 56 | 30.17 in | 10 | West | 8.1 | - | N/A | -- |
| 12:56 PM | 82.0 | 62.1 | 51 | 30.14 in | 10 | NW | 8.1 | - | N/A | -- |
| 1:56 PM | 82.9 | 61.0 | 47 | 30.11 in | 10 | North | 6.9 | - | N/A | -- |
| 2:56 PM | 82.9 | 62.1 | 49 | 30.10 in | 10 | North | 8.1 | - | N/A | -- |
| 3:56 PM | 80.1 | 62.1 | 54 | 30.10 in | 10 | WNW | 6.9 | - | N/A | -- |
| 4:56 PM | 79.0 | 63.0 | 58 | 30.12 in | 10 | Variable | 4.6 | - | N/A | -- |
| 5:56 PM | 78.1 | 63.0 | 60 | 30.14 in | 10 | West | 5.8 | - | N/A | -- |
| 6:56 PM | 75.9 | 61.0 | 60 | 30.15 in | 10 | Calm | Calm | - | N/A | -- |
| 7:56 PM | 73.0 | 62.1 | 68 | 30.17 in | 10 | Calm | Calm | - | N/A | -- |
| 8:56 PM | 73.9 | 61.0 | 64 | 30.18 in | 10 | Calm | Calm | - | N/A | -- |
| 9:56 PM | 71.1 | 59.0 | 66 | 30.19 in | 10 | ENE | 6.9 | - | N/A | -- |
| 10:56 PM | 71.1 | 59.0 | 66 | 30.19 in | 10 | Calm | Calm | - | N/A | -- |
| 11:56 PM | 70.0 | 59.0 | 68 | 30.19 in | 10 | Calm | Calm | - | N/A | -- |
| **15-Dec-07** | | | | | | | | | | |
| 12:56 AM | 70.0 | 59.0 | 68 | 30.18 in | 10 | East | 3.5 | - | N/A | -- |
| 1:56 AM | 70.0 | 59.0 | 68 | 30.19 in | 10 | East | 5.8 | - | N/A | -- |
| 2:56 AM | 72.0 | 57.9 | 61 | 30.17 in | 10 | Calm | Calm | - | N/A | -- |
| 3:56 AM | 69.1 | 57.9 | 68 | 30.16 in | 10 | Calm | Calm | - | N/A | -- |
| 4:56 AM | 70.0 | 57.0 | 63 | 30.17 in | 10 | Variable | 3.5 | - | N/A | -- |
| 5:56 AM | 66.0 | 55.9 | 70 | 30.18 in | 10 | East | 4.6 | - | N/A | -- |
| 6:56 AM | 71.1 | 59.0 | 66 | 30.19 in | 10 | SW | 4.6 | - | N/A | -- |
| 7:56 AM | 69.1 | 60.1 | 73 | 30.22 in | 10 | ESE | 3.5 | - | N/A | -- |
| 8:56 AM | 77.0 | 63.0 | 62 | 30.23 in | 10 | Variable | 3.5 | - | N/A | -- |
| 9:56 AM | 77.0 | 63.0 | 62 | 30.24 in | 10 | West | 3.5 | - | N/A | -- |
| 10:56 AM | 80.1 | 64.0 | 58 | 30.23 in | 10 | WNW | 6.9 | - | 0 | -- |
| 11:56 AM | 79.0 | 64.0 | 60 | 30.22 in | 10 | WNW | 6.9 | - | N/A | -- |
| 12:56 PM | 81.0 | 64.9 | 58 | 30.18 in | 10 | NW | 10.4 | - | N/A | -- |
| 1:56 PM | 80.1 | 64.0 | 58 | 30.15 in | 10 | WNW | 8.1 | - | N/A | -- |
| 2:56 PM | 81.0 | 64.0 | 56 | 30.14 in | 10 | WNW | 8.1 | - | N/A | -- |
| 3:56 PM | 81.0 | 62.1 | 52 | 30.15 in | 10 | Calm | Calm | - | N/A | -- |
| 4:56 PM | 80.1 | 63.0 | 56 | 30.16 in | 10 | WNW | 5.8 | - | N/A | -- |
| 5:56 PM | 79.0 | 61.0 | 54 | 30.18 in | 10 | Calm | Calm | - | N/A | -- |
| 6:56 PM | 78.1 | 59.0 | 52 | 30.19 in | 10 | Calm | Calm | - | N/A | -- |
| 7:56 PM | 77.0 | 52.0 | 42 | 30.21 in | 10 | ESE | 5.8 | - | N/A | -- |
| 8:56 PM | 73.0 | 55.0 | 53 | 30.22 in | 10 | SSE | 4.6 | - | N/A | -- |
| 9:56 PM | 72.0 | 57.0 | 59 | 30.23 in | 10 | ENE | 3.5 | - | N/A | -- |
| 10:56 PM | 75.0 | 59.0 | 57 | 30.23 in | 10 | Calm | Calm | - | N/A | -- |
| 11:56 PM | 73.0 | 59.0 | 61 | 30.22 in | 10 | Calm | Calm | - | N/A | -- |
| **16-Dec-07** | | | | | | | | | | |
| 12:56 AM | 73.0 | 60.1 | 64 | 30.21 in | 10 | WSW | 5.8 | - | N/A | -- |
| 4:56 AM | 69.1 | 57.9 | 68 | 30.16 in | 10 | Calm | Calm | - | N/A | -- |
| 5:56 AM | 71.1 | 55.9 | 59 | 30.18 in | 10 | Calm | Calm | - | N/A | -- |
| 6:56 AM | 68.0 | 55.0 | 63 | 30.19 in | 10 | Calm | Calm | - | N/A | -- |
| 7:56 AM | 66.9 | 55.0 | 66 | 30.21 in | 10 | East | 4.6 | - | N/A | -- |
| 8:56 AM | 73.9 | 61.0 | 64 | 30.22 in | 10 | Calm | Calm | - | N/A | -- |
| 9:56 AM | 77.0 | 60.1 | 56 | 30.23 in | 10 | WSW | 6.9 | - | N/A | -- |
| 10:56 AM | 78.1 | 60.1 | 54 | 30.22 in | 10 | WSW | 10.4 | - | N/A | -- |
| 11:56 AM | 79.0 | 61.0 | 54 | 30.20 in | 10 | West | 9.2 | - | N/A | -- |
| 12:56 PM | 79.0 | 61.0 | 54 | 30.16 in | 10 | West | 9.2 | - | N/A | -- |
| 1:56 PM | 80.1 | 61.0 | 52 | 30.13 in | 10 | West | 8.1 | - | N/A | -- |
| 2:56 PM | 80.1 | 62.1 | 54 | 30.13 in | 10 | WSW | 9.2 | - | N/A | -- |
| 3:56 PM | 81.0 | 61.0 | 50 | 30.13 in | 10 | WNW | 5.8 | - | N/A | -- |
| 4:56 PM | 80.1 | 61.0 | 52 | 30.14 in | 10 | SSW | 8.1 | - | N/A | -- |
| 5:56 PM | 78.1 | 60.1 | 54 | 30.15 in | 10 | NNW | 5.8 | - | N/A | -- |
| 6:56 PM | 73.9 | 60.1 | 62 | 30.17 in | 10 | East | 5.8 | - | N/A | -- |
| 7:56 PM | 72.0 | 60.1 | 66 | 30.18 in | 10 | Calm | Calm | - | N/A | -- |
| 8:56 PM | 72.0 | 60.1 | 66 | 30.19 in | 10 | Calm | Calm | - | N/A | -- |
| 9:56 PM | 69.1 | 57.9 | 68 | 30.19 in | 10 | Calm | Calm | - | N/A | -- |
| 10:56 PM | 71.1 | 61.0 | 70 | 30.20 in | 10 | Calm | Calm | - | N/A | -- |
| 11:56 PM | 68.0 | 57.9 | 70 | 30.19 in | 10 | Calm | Calm | - | N/A | -- |
| **17-Dec-07** | | | | | | | | | | |
| 12:56 AM | 66.9 | 57.0 | 70 | 30.19 in | 10 | East | 3.5 | - | N/A | -- |
| 1:56 AM | 68.0 | 57.0 | 68 | 30.18 in | 10 | Calm | Calm | - | N/A | -- |
| 2:56 AM | 69.1 | 55.9 | 63 | 30.16 in | 10 | East | 3.5 | - | N/A | -- |
| 3:56 AM | 66.9 | 55.9 | 68 | 30.16 in | 10 | Calm | Calm | - | N/A | -- |
| 4:56 AM | 69.1 | 55.9 | 63 | 30.16 in | 10 | Calm | Calm | - | N/A | -- |
| 5:56 AM | 66.0 | 55.9 | 70 | 30.16 in | 10 | ENE | 5.8 | - | N/A | -- |
| 6:56 AM | 66.9 | 57.0 | 70 | 30.18 in | 10 | SSE | 5.8 | - | N/A | -- |
| 7:56 AM | 69.1 | 57.0 | 65 | 30.20 in | 10 | East | 5.8 | - | N/A | -- |
| 8:56 AM | 77.0 | 55.9 | 48 | 30.21 in | 10 | Calm | Calm | - | N/A | -- |
| 9:56 AM | 79.0 | 55.0 | 44 | 30.21 in | 10 | NNE | 6.9 | - | N/A | -- |
| 10:56 AM | 79.0 | 57.0 | 47 | 30.19 in | 10 | NW | 4.6 | - | N/A | -- |
| 11:56 AM | 79.0 | 57.0 | 47 | 30.17 in | 10 | West | 8.1 | - | N/A | -- |
| 12:56 PM | 80.1 | 57.0 | 45 | 30.13 in | 10 | WNW | 9.2 | - | N/A | -- |
| 1:56 PM | 80.1 | 57.0 | 45 | 30.11 in | 10 | West | 9.2 | - | N/A | -- |
| 2:56 PM | 80.1 | 59.0 | 48 | 30.10 in | 10 | WSW | 9.2 | - | N/A | -- |
| 3:56 PM | 80.1 | 59.0 | 48 | 30.10 in | 10 | WNW | 6.9 | - | N/A | -- |
| 4:56 PM | 80.1 | 57.9 | 47 | 30.11 in | 10 | North | 5.8 | - | N/A | -- |
| 5:56 PM | 75.9 | 57.9 | 54 | 30.13 in | 10 | Calm | Calm | - | N/A | -- |
| 6:56 PM | 73.0 | 55.0 | 53 | 30.14 in | 10 | NE | 4.6 | - | N/A | -- |
| 7:56 PM | 70.0 | 55.9 | 61 | 30.15 in | 10 | Calm | Calm | - | N/A | -- |
| 8:56 PM | 69.1 | 57.0 | 65 | 30.17 in | 10 | Calm | Calm | - | N/A | -- |
| 9:56 PM | 69.1 | 57.0 | 65 | 30.18 in | 10 | Calm | Calm | - | N/A | -- |
| 10:56 PM | 71.1 | 54.0 | 55 | 30.19 in | 10 | Calm | Calm | - | N/A | -- |
| 11:56 PM | 72.0 | 51.1 | 48 | 30.19 in | 10 | Calm | Calm | - | N/A | -- |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 10:56 AM | 64.9 | 61.0 | 87 | 29.62 in | 4 | East | 5.8 | - | N/A | Mostly Cloudy |
| 11:49 AM | 64.4 | 59.0 | 83 | 29.58 in | 10 | East | 5.8 | - | N/A | Overcast |
| 11:56 AM | 64.0 | 59.0 | 84 | 29.59 in | 7 | Calm | Calm | - | N/A | Thunderstorms and Rain |
| 12:03 PM | 64.4 | 59.0 | 83 | 29.57 in | 10 | North | 3.5 | - | N/A | Thunderstorms and Rain |
| 12:25 PM | 62.6 | 59.0 | 88 | 29.57 in | 2 | WNW | 5.8 | 17.3 | N/A | Thunderstorms and Rain |
| 12:36 PM | 62.6 | 59.0 | 88 | 29.56 in | 5 | WNW | 10.4 | - | N/A | Thunderstorms and Rain |
| 12:53 PM | 60.8 | 57.2 | 88 | 29.57 in | 7 | SW | 8.1 | - | N/A | Thunderstorms and Rain |
| 12:56 PM | 60.1 | 57.9 | 93 | 29.59 in | 4 | SSW | 8.1 | - | N/A | Heavy Thunderstorms |
| 1:12 PM | 57.2 | 55.4 | 94 | 29.57 in | 10 | WNW | 9.2 | 18.4 | N/A | Heavy Rain |
| 1:19 PM | 59.0 | 57.2 | 94 | 29.56 in | 10 | WNW | 10.4 | - | N/A | Mostly Cloudy |
| 1:56 PM | 57.9 | 55.0 | 90 | 29.57 in | 10 | WNW | 11.5 | 18.4 | N/A | Overcast |
| 2:26 PM | 57.2 | 53.6 | 88 | 29.55 in | 10 | NW | 13.8 | - | N/A | Overcast |
| 2:35 PM | 57.2 | 53.6 | 88 | 29.54 in | 10 | NW | 12.7 | - | N/A | Overcast |
| 2:56 PM | 57.0 | 54.0 | 89 | 29.56 in | 10 | NW | 13.8 | 18.4 | N/A | Overcast |
| 3:24 PM | 55.4 | 53.6 | 94 | 29.54 in | 10 | WNW | 10.4 | 21.9 | N/A | Overcast |
| 3:56 PM | 55.0 | 51.1 | 86 | 29.57 in | 10 | WNW | 13.8 | - | N/A | Overcast |
| 4:05 PM | 55.4 | 50.0 | 82 | 29.55 in | 10 | NW | 10.4 | 20.7 | N/A | Overcast |
| 4:15 PM | 55.4 | 51.8 | 88 | 29.55 in | 10 | WNW | 8.1 | 17.3 | N/A | Overcast |
| 4:56 PM | 54.0 | 50.0 | 86 | 29.57 in | 10 | NW | 10.4 | 17.3 | N/A | Overcast |
| 5:56 PM | 54.0 | 48.9 | 83 | 29.56 in | 10 | NW | 10.4 | 17.3 | N/A | Mostly Cloudy |
| 6:03 PM | 53.6 | 48.2 | 82 | 29.54 in | 10 | WNW | 11.5 | 23.0 | N/A | Overcast |
| 6:23 PM | 53.6 | 48.2 | 82 | 29.54 in | 10 | WNW | 11.5 | 21.9 | N/A | Mostly Cloudy |
| 6:56 PM | 53.1 | 48.0 | 83 | 29.56 in | 10 | WNW | 8.1 | - | N/A | Overcast |
| 7:56 PM | 53.1 | 46.9 | 80 | 29.56 in | 10 | West | 10.4 | 18.4 | N/A | Mostly Cloudy |
| 8:03 PM | 53.6 | 46.4 | 77 | 29.54 in | 10 | West | 9.2 | 17.3 | N/A | Overcast |
| 8:22 PM | 53.6 | 46.4 | 77 | 29.54 in | 10 | West | 12.7 | 18.4 | N/A | Overcast |
| 8:56 PM | 53.1 | 46.9 | 80 | 29.56 in | 10 | West | 11.5 | 19.6 | N/A | Mostly Cloudy |
| 9:56 PM | 53.1 | 46.0 | 77 | 29.56 in | 10 | West | 10.4 | - | N/A | Overcast |
| 10:56 PM | 53.1 | 46.9 | 80 | 29.55 in | 10 | West | 11.5 | - | N/A | Overcast |
| 11:56 PM | 52.0 | 48.0 | 86 | 29.53 in | 9 | West | 9.2 | 18.4 | N/A | Overcast |
| **12-Oct-07** | | | | | | | | | | |
| 12:56 AM | 51.1 | 48.0 | 89 | 29.53 in | 10 | WSW | 10.4 | - | N/A | Overcast |
| 1:23 AM | 50.0 | 48.2 | 94 | 29.51 in | 10 | WSW | 9.2 | - | N/A | Overcast |
| 1:56 AM | 51.1 | 48.0 | 89 | 29.52 in | 5 | West | 9.2 | - | N/A | Overcast |
| 2:55 AM | 52.0 | 48.9 | 89 | 29.51 in | 10 | West | 10.4 | - | N/A | Overcast |
| 3:05 AM | 51.8 | 48.2 | 88 | 29.49 in | 10 | West | 9.2 | - | N/A | Overcast |
| 3:12 AM | 51.8 | 48.2 | 88 | 29.49 in | 7 | WNW | 9.2 | - | N/A | Overcast |
| 3:56 AM | 52.0 | 50.0 | 93 | 29.52 in | 9 | WNW | 10.4 | - | N/A | Overcast |
| 4:56 AM | 52.0 | 48.9 | 89 | 29.53 in | 8 | WNW | 10.4 | 19.6 | N/A | Overcast |
| 5:17 AM | 51.8 | 48.2 | 88 | 29.52 in | 10 | WNW | 11.5 | 20.7 | N/A | Overcast |
| 5:36 AM | 51.8 | 50.0 | 94 | 29.53 in | 10 | WNW | 11.5 | - | N/A | Overcast |
| 5:56 AM | 53.1 | 48.9 | 86 | 29.56 in | 10 | WNW | 10.4 | - | N/A | Overcast |
| 6:43 AM | 53.6 | 48.2 | 82 | 29.58 in | 10 | WNW | 11.5 | 18.4 | 0 | Mostly Cloudy |
| 6:56 AM | 54.0 | 48.9 | 83 | 29.60 in | 10 | NW | 15.0 | 21.9 | 0 | Overcast |
| 7:56 AM | 54.0 | 48.0 | 80 | 29.65 in | 10 | NW | 16.1 | 27.6 | N/A | Mostly Cloudy |
| 8:56 AM | 55.0 | 44.1 | 67 | 29.68 in | 10 | NW | 17.3 | 27.6 | N/A | Mostly Cloudy |
| 9:56 AM | 57.0 | 43.0 | 59 | 29.71 in | 10 | NW | 17.3 | 32.2 | N/A | Mostly Cloudy |
| 10:56 AM | 57.0 | 42.1 | 57 | 29.73 in | 10 | NW | 19.6 | 31.1 | N/A | Mostly Cloudy |
| 11:56 AM | 55.0 | 41.0 | 59 | 29.76 in | 10 | NW | 17.3 | 27.6 | N/A | Mostly Cloudy |
| 12:56 PM | 55.9 | 37.9 | 51 | 29.76 in | 10 | NW | 17.3 | 29.9 | N/A | Mostly Cloudy |
| 1:56 PM | 57.9 | 37.9 | 47 | 29.77 in | 10 | NNW | 17.3 | 27.6 | N/A | Scattered Clouds |
| 4:56 PM | 59.0 | 35.1 | 41 | 29.80 in | 10 | NW | 15.0 | 24.2 | N/A | Partly Cloudy |
| 5:56 PM | 57.0 | 33.1 | 40 | 29.83 in | 10 | NW | 13.8 | 24.2 | N/A | Partly Cloudy |
| 6:56 PM | 53.1 | 33.1 | 47 | 29.86 in | 10 | NNW | 9.2 | - | N/A | Clear |
| 7:56 PM | 51.1 | 34.0 | 52 | 29.88 in | 10 | North | 9.2 | - | N/A | Clear |
| 8:56 PM | 48.0 | 34.0 | 58 | 29.91 in | 10 | North | 6.9 | - | N/A | Clear |
| 9:56 PM | 46.0 | 34.0 | 63 | 29.93 in | 10 | NNW | 4.6 | - | N/A | Clear |
| 10:56 PM | 46.0 | 33.1 | 61 | 29.96 in | 10 | Calm | Calm | - | N/A | Clear |
| 11:56 PM | 45.0 | 34.0 | 65 | 29.96 in | 10 | WNW | 4.6 | - | N/A | Clear |

| NASJFB Willow Grove, PA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 9-Oct-07 | Temp °F | Dew Point °F | Humidity % | Pressure in | Visibility miles | Wind | | | Precip | Conditions |
| | | | | | | Direction | Speed | Gusts | in | |
| 12:56 AM | 77.0 | 63.0 | 62 | 29.85 in | 10 | West | 6.9 | - | N/A | Clear |
| 1:56 AM | 77.0 | 63.0 | 62 | 29.85 in | 10 | West | 8.1 | - | N/A | Clear |
| 2:56 AM | 75.9 | 63.0 | 64 | 29.84 in | 10 | West | 6.9 | - | N/A | Clear |
| 3:56 AM | 75.0 | 63.0 | 66 | 29.83 in | 10 | West | 4.6 | - | N/A | Mostly Cloudy |
| 4:56 AM | 75.0 | 64.0 | 69 | 29.84 in | 10 | West | 5.8 | - | N/A | Mostly Cloudy |
| 5:56 AM | 73.9 | 64.0 | 71 | 29.85 in | 10 | West | 4.6 | - | N/A | Scattered Clouds |
| 6:56 AM | 73.0 | 64.0 | 73 | 29.85 in | 10 | West | 5.8 | - | N/A | Partly Cloudy |
| 7:56 AM | 73.0 | 64.0 | 73 | 29.86 in | 9 | Calm | Calm | - | N/A | Scattered Clouds |
| 8:56 AM | 73.9 | 64.0 | 71 | 29.86 in | 10 | WNW | 3.5 | - | N/A | Mostly Cloudy |
| 9:56 AM | 78.1 | 64.9 | 64 | 29.86 in | 10 | Variable | 3.5 | - | N/A | Mostly Cloudy |
| 10:56 AM | 79.0 | 64.9 | 62 | 29.87 in | 10 | NW | 4.6 | - | N/A | Mostly Cloudy |
| 11:56 AM | 80.1 | 64.9 | 60 | 29.86 in | 10 | Calm | Calm | - | N/A | Mostly Cloudy |
| 12:56 PM | 82.9 | 64.9 | 54 | 29.84 in | 10 | SSE | 6.9 | - | N/A | Mostly Cloudy |
| 1:56 PM | 80.1 | 64.9 | 60 | 29.81 in | 10 | SE | 15.0 | 21.9 | N/A | Mostly Cloudy |
| 2:15 PM | 75.2 | 66.2 | 73 | 29.81 in | 10 | ESE | 19.6 | 25.3 | N/A | Thunderstorms and Rain |
| 2:42 PM | 71.6 | 66.2 | 83 | 29.82 in | 5 | ESE | 15.0 | - | 0 | Light Rain |
| 2:56 PM | 70.0 | 64.9 | 84 | 29.82 in | 5 | ESE | 12.7 | - | 0 | Light Thunderstorms |
| 3:56 PM | 66.9 | 63.0 | 87 | 29.83 in | 10 | SE | 9.2 | - | 0 | Overcast |
| 4:07 PM | 66.2 | 62.6 | 88 | 29.81 in | 10 | SE | 15.0 | 21.9 | 0 | Overcast |
| 4:56 PM | 66.0 | 61.0 | 84 | 29.82 in | 10 | ESE | 16.1 | - | 0 | Overcast |
| 5:03 PM | 66.2 | 60.8 | 83 | 29.81 in | 10 | SE | 15.0 | - | N/A | Overcast |
| 5:56 PM | 64.9 | 60.1 | 84 | 29.82 in | 10 | SE | 12.7 | - | N/A | Overcast |
| 6:54 PM | 64.4 | 60.8 | 88 | 29.79 in | 10 | SE | 11.5 | - | N/A | Overcast |
| 6:56 PM | 64.0 | 60.1 | 87 | 29.81 in | 10 | SE | 10.4 | - | N/A | Overcast |
| 7:56 PM | 64.0 | 61.0 | 90 | 29.89 in | 9 | NNW | 12.7 | - | N/A | Thunderstorm |
| 8:03 PM | 64.4 | 60.8 | 88 | 29.87 in | 5 | North | 12.7 | 21.9 | 0 | Thunderstorms and Rain |
| 8:16 PM | 62.6 | 60.8 | 94 | 29.88 in | 3 | North | 15.0 | - | 0 | Thunderstorms and Rain |
| 8:56 PM | 62.1 | 60.1 | 93 | 29.86 in | 3 | NE | 10.4 | - | 0 | Thunderstorms and Rain |
| 9:03 PM | 62.6 | 60.8 | 94 | 29.86 in | 5 | ENE | 10.4 | - | 0 | Thunderstorms and Rain |
| 9:05 PM | 62.6 | 60.8 | 94 | 29.86 in | 5 | ENE | 10.4 | - | 0 | Thunderstorms and Rain |
| 9:53 PM | 62.6 | 60.8 | 94 | 29.84 in | 5 | SE | 9.2 | - | 0 | Thunderstorms and Rain |
| 9:56 PM | 62.1 | 60.1 | 93 | 29.85 in | 5 | SE | 10.4 | - | 0 | Thunderstorms and Rain |
| 10:04 PM | 62.6 | 60.8 | 94 | 29.83 in | 10 | SE | 11.5 | - | 0 | Thunderstorms and Rain |
| 10:21 PM | 62.6 | 60.8 | 94 | 29.82 in | 10 | ESE | 8.1 | - | 0 | Rain |
| 10:56 PM | 62.1 | 61.0 | 96 | 29.82 in | 3 | SE | 6.9 | - | 0 | Light Rain |
| 11:56 PM | 63.0 | 61.0 | 93 | 29.83 in | 10 | SSE | 5.8 | - | 0 | Light Rain |
| **10-Oct-07** | | | | | | | | | | |
| 12:56 AM | 63.0 | 61.0 | 93 | 29.82 in | 10 | Calm | Calm | - | 0 | Light Rain |
| 1:53 AM | 62.6 | 60.8 | 94 | 29.80 in | 10 | Calm | Calm | - | 0 | Light Rain |
| 1:56 AM | 63.0 | 61.0 | 93 | 29.81 in | 10 | Calm | Calm | - | 0 | Light Rain |
| 2:56 AM | 63.0 | 61.0 | 93 | 29.79 in | 10 | ENE | 3.5 | - | 0 | Light Rain |
| 3:36 AM | 62.6 | 60.8 | 94 | 29.77 in | 2 | Calm | Calm | - | 0 | Light Rain |
| 3:41 AM | 62.6 | 60.8 | 94 | 29.77 in | 1.5 | Calm | Calm | - | 0 | Light Rain |
| 3:53 AM | 62.6 | 60.8 | 94 | 29.77 in | 1.2 | Calm | Calm | - | 0 | Light Rain |
| 3:56 AM | 63.0 | 61.0 | 93 | 29.76 in | 1.2 | Calm | Calm | - | 0 | Light Rain |
| 4:23 AM | 62.5 | 60.8 | 94 | 29.77 in | 0.5 | Calm | Calm | - | 0 | Light Rain |
| 4:56 AM | 62.1 | 61.0 | 96 | 29.79 in | 0.5 | Calm | Calm | - | 0 | Light Rain |
| 5:46 AM | 62.5 | 60.8 | 94 | 29.77 in | 0.9 | Calm | Calm | - | 0 | Light Rain |
| 5:56 AM | 63.0 | 61.0 | 93 | 29.79 in | 0.9 | Calm | Calm | - | 0 | Light Rain |
| 6:16 AM | 62.5 | 60.8 | 94 | 29.77 in | 0.9 | Calm | Calm | - | N/A | Overcast |
| 6:21 AM | 62.5 | 60.8 | 94 | 29.77 in | 1.2 | Calm | Calm | - | N/A | Overcast |
| 6:24 AM | 62.5 | 60.8 | 94 | 29.77 in | 2 | Calm | Calm | - | N/A | Overcast |
| 6:33 AM | 62.5 | 62.6 | 100 | 29.77 in | 5 | Calm | Calm | - | N/A | Overcast |
| 6:40 AM | 62.5 | 60.8 | 94 | 29.77 in | 2 | Calm | Calm | - | N/A | Overcast |
| 6:56 AM | 63.0 | 61.0 | 93 | 29.78 in | 2 | Calm | Calm | - | N/A | Overcast |
| 7:12 AM | 62.5 | 60.8 | 94 | 29.76 in | 2 | Calm | Calm | - | N/A | Overcast |
| 7:56 AM | 62.1 | 60.1 | 93 | 29.78 in | 2 | WNW | 5.8 | - | N/A | Mostly Cloudy |
| 8:56 AM | 63.0 | 59.0 | 87 | 29.78 in | 6 | WNW | 4.6 | - | N/A | Mostly Cloudy |
| 9:01 AM | 62.5 | 59.0 | 88 | 29.76 in | 6 | WNW | 4.6 | - | N/A | Mostly Cloudy |
| 9:19 AM | 64.4 | 60.8 | 88 | 29.76 in | 6 | NW | 4.6 | - | N/A | Mostly Cloudy |
| 9:56 AM | 66.0 | 59.0 | 78 | 29.78 in | 10 | NNW | 4.6 | - | N/A | Mostly Cloudy |
| 10:56 AM | 68.0 | 57.0 | 68 | 29.79 in | 10 | Variable | 3.5 | - | N/A | Mostly Cloudy |
| 11:56 AM | 72.0 | 56.0 | 55 | 29.77 in | 10 | Variable | 4.6 | - | N/A | Scattered Clouds |
| 2:56 PM | 75.0 | 50.0 | 41 | 29.72 in | 10 | Variable | 3.5 | - | N/A | Scattered Clouds |
| 3:56 PM | 77.0 | 48.9 | 37 | 29.70 in | 10 | North | 4.6 | - | N/A | Scattered Clouds |
| 4:56 PM | 75.0 | 48.9 | 40 | 29.69 in | 10 | Calm | Calm | - | N/A | Scattered Clouds |
| 5:56 PM | 73.9 | 48.9 | 41 | 29.70 in | 10 | Calm | Calm | - | N/A | Scattered Clouds |
| 6:56 PM | 68.0 | 53.1 | 59 | 29.70 in | 10 | ESE | 6.9 | - | N/A | Partly Cloudy |
| 7:56 PM | 66.0 | 54.0 | 65 | 29.72 in | 10 | SE | 4.6 | - | N/A | Clear |
| 8:56 PM | 64.0 | 56.0 | 73 | 29.73 in | 10 | ESE | 4.6 | - | N/A | Partly Cloudy |
| 9:56 PM | 62.1 | 55.9 | 80 | 29.73 in | 10 | ESE | 5.8 | - | N/A | Clear |
| 10:56 PM | 62.1 | 55.9 | 80 | 29.72 in | 10 | ESE | 4.6 | - | N/A | Scattered Clouds |
| 11:56 PM | 60.1 | 55.9 | 86 | 29.71 in | 10 | East | 5.8 | - | N/A | Clear |
| **11-Oct-07** | | | | | | | | | | |
| 12:56 AM | 60.1 | 57.9 | 93 | 29.70 in | 9 | East | 4.6 | - | N/A | Overcast |
| 1:18 AM | 60.8 | 57.2 | 88 | 29.69 in | 8 | NE | 3.5 | - | N/A | Overcast |
| 1:56 AM | 61.0 | 59.0 | 93 | 29.70 in | 5 | North | 4.6 | - | N/A | Mist |
| 2:56 AM | 62.1 | 60.1 | 93 | 29.69 in | 3 | NNW | 3.5 | - | N/A | Mist |
| 3:12 AM | 62.5 | 60.8 | 94 | 29.68 in | 2.5 | NNW | 5.8 | - | N/A | Mist |
| 3:27 AM | 60.8 | 57.2 | 88 | 29.68 in | 4 | North | 10.4 | 16.1 | N/A | Mist |
| 3:40 AM | 57.2 | 55.4 | 94 | 29.68 in | 6 | NNW | 5.8 | - | N/A | Overcast |
| 3:46 AM | 57.2 | 55.4 | 94 | 29.68 in | 6 | NNW | 5.8 | - | N/A | Overcast |
| 3:56 AM | 57.0 | 54.0 | 89 | 29.69 in | 6 | NNW | 3.5 | - | N/A | Overcast |
| 4:03 AM | 57.2 | 53.6 | 88 | 29.68 in | 6 | Variable | 6.9 | - | N/A | Overcast |
| 4:17 AM | 55.4 | 53.6 | 94 | 29.68 in | 7 | North | 8.1 | - | N/A | Overcast |
| 4:27 AM | 55.4 | 51.8 | 88 | 29.68 in | 9 | North | 8.1 | - | N/A | Overcast |
| 4:56 AM | 55.0 | 52.0 | 89 | 29.70 in | 6 | North | 5.8 | - | N/A | Overcast |
| 5:56 AM | 55.0 | 53.1 | 93 | 29.67 in | 8 | NE | 12.7 | - | N/A | Overcast |
| 6:14 AM | 55.4 | 53.6 | 94 | 29.65 in | 10 | NNE | 9.2 | - | N/A | Overcast |
| 6:46 AM | 55.4 | 53.6 | 94 | 29.64 in | 10 | NNE | 8.1 | - | N/A | Overcast |
| 6:56 AM | 55.9 | 54.0 | 93 | 29.66 in | 5 | North | 6.9 | - | N/A | Overcast |
| 7:06 AM | 55.4 | 53.6 | 94 | 29.64 in | 5 | NNE | 5.8 | - | N/A | Overcast |
| 7:56 AM | 57.0 | 55.0 | 93 | 29.67 in | 3 | NNW | 4.6 | - | N/A | Overcast |
| 8:19 AM | 57.2 | 55.4 | 94 | 29.66 in | 2 | West | 5.8 | - | N/A | Overcast |
| 8:56 AM | 57.9 | 55.9 | 93 | 29.65 in | 2 | North | 4.6 | - | N/A | Mostly Cloudy |
| 9:30 AM | 60.8 | 57.2 | 88 | 29.62 in | 3 | NE | 4.6 | - | N/A | Overcast |
| 9:56 AM | 61.0 | 57.9 | 90 | 29.64 in | 2 | NE | 3.5 | - | N/A | Overcast |

| Fallon | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 28-Sep-07 | Temp °F | Dew Point °F | Humidity % | Pressure in | Visibility miles | Wind | | | Precip | Conditions |
| | | | | | | Direction | Speed | Gusts | in | |
| 12:56 AM | 55.9 | 30.9 | 38 | 29.79 in | 10 | Calm | Calm | - | N/A | Clear |
| 1:56 AM | 55.0 | 33.1 | 43 | 29.78 in | 10 | Calm | Calm | - | N/A | Clear |
| 2:56 AM | 55.0 | 34.0 | 45 | 29.77 in | 10 | Calm | Calm | - | N/A | Clear |
| 3:56 AM | 52.0 | 34.0 | 50 | 29.75 in | 10 | Calm | Calm | - | N/A | Clear |
| 4:56 AM | 48.0 | 34.0 | 58 | 29.75 in | 10 | Calm | Calm | - | N/A | Clear |
| 5:56 AM | 46.9 | 34.0 | 61 | 29.74 in | 10 | SW | 3.5 | - | N/A | Mostly |
| 6:56 AM | 42.1 | 33.1 | 70 | 29.73 in | 10 | South | 3.5 | - | N/A | Cloudy |
| 7:56 AM | 50.0 | 35.1 | 57 | 29.73 in | 10 | South | 3.5 | - | N/A | Scattered |
| 8:56 AM | 57.0 | 35.1 | 44 | 29.73 in | 10 | Calm | Calm | - | N/A | Cloudy |
| 9:56 AM | 63.0 | 34.0 | 34 | 29.72 in | 10 | Calm | Calm | - | N/A | Mostly |
| 10:56 AM | 64.9 | 33.1 | 31 | 29.70 in | 10 | Calm | Calm | - | N/A | Cloudy |
| 11:56 AM | 68.0 | 30.0 | 24 | 29.69 in | 10 | Variable | 4.6 | - | N/A | Overcast |
| 12:56 PM | 68.0 | 32.0 | 26 | 29.66 in | 10 | Calm | Calm | - | N/A | Overcast |
| 1:56 PM | 71.1 | 30.0 | 22 | 29.63 in | 10 | NW | 4.6 | - | N/A | Overcast |
| 2:56 PM | 73.0 | 27.0 | 19 | 29.61 in | 10 | West | 16.1 | 21.9 | N/A | Mostly |
| 3:56 PM | 73.9 | 25.0 | 16 | 29.59 in | 10 | West | 15.0 | 27.6 | N/A | Cloudy |
| 4:56 PM | 72.0 | 21.9 | 15 | 29.57 in | 10 | WSW | 21.9 | 27.6 | N/A | Mostly |
| 5:56 PM | 69.1 | 25.0 | 19 | 29.58 in | 10 | West | 19.6 | 25.3 | N/A | Cloudy |
| 6:56 PM | 63.0 | 27.0 | 26 | 29.59 in | 10 | West | 21.9 | 28.8 | N/A | Cloudy |
| 7:56 PM | 57.9 | 27.0 | 31 | 29.63 in | 4 | WNW | 34.5 | 43.7 | N/A | Haze |
| 8:56 PM | 48.0 | 32.0 | 54 | 29.73 in | 7 | North | 11.5 | 27.6 | N/A | Clear |
| 9:56 PM | 45.0 | 30.0 | 56 | 29.78 in | 10 | North | 25.3 | 34.5 | N/A | Clear |
| 10:56 PM | 43.0 | 30.0 | 60 | 29.81 in | 10 | NNW | 15.0 | - | N/A | Cloudy |
| 11:56 PM | 43.0 | 30.0 | 60 | 29.93 in | 10 | NW | 9.2 | - | N/A | Overcast |
| 29-Sep-07 | | | | | | | | | | |
| 12:56 AM | 42.1 | 32.0 | 67 | 29.84 in | 10 | North | 11.5 | 18.4 | 0 | Light Rain |
| 1:19 AM | 41.0 | 33.8 | 76 | 29.92 in | 10 | NNW | 6.9 | - | 0 | Overcast |
| 1:56 AM | 41.0 | 33.1 | 73 | 29.96 in | 10 | Calm | Calm | - | 0.00 in | Overcast |
| 2:56 AM | 39.9 | 34.0 | 79 | 29.88 in | 10 | SW | 3.5 | - | N/A | Cloudy |
| 3:56 AM | 39.0 | 30.0 | 70 | 29.30 in | 10 | West | 4.6 | - | N/A | Clear |
| 4:56 AM | 35.1 | 28.9 | 78 | 29.31 in | 10 | WNW | 4.6 | - | N/A | Clear |
| 5:56 AM | 35.1 | 28.9 | 78 | 29.33 in | 10 | West | 3.5 | - | N/A | Cloudy |
| 6:56 AM | 34.0 | 28.9 | 82 | 29.36 in | 10 | WNW | 4.6 | - | N/A | Clear |
| 7:56 AM | 39.9 | 30.9 | 70 | 29.38 in | 10 | WNW | 5.8 | - | N/A | Mostly |
| 8:56 AM | 43.0 | 32.0 | 65 | 30.00 in | 10 | Variable | 3.5 | - | N/A | Cloudy |
| 9:56 AM | 46.0 | 30.0 | 54 | 30.01 in | 10 | West | 6.9 | - | N/A | Scattered |
| 10:56 AM | 46.9 | 26.1 | 41 | 30.02 in | 10 | North | 5.8 | - | N/A | Clouds |
| 11:56 AM | 50.0 | 26.1 | 38 | 30.02 in | 10 | North | 3.5 | - | N/A | Scattered |
| 12:56 PM | 52.0 | 25.0 | 35 | 30.02 in | 10 | Calm | Calm | - | N/A | Clouds |
| 1:56 PM | 55.0 | 24.1 | 30 | 30.01 in | 10 | WNW | 6.9 | - | N/A | Clear |
| 2:56 PM | 55.0 | 21.9 | 26 | 30.01 in | 10 | Variable | 4.6 | - | N/A | Clear |
| 3:56 PM | 57.0 | 21.0 | 25 | 30.01 in | 10 | NW | 4.6 | - | N/A | Clear |
| 4:56 PM | 55.9 | 17.1 | 22 | 30.01 in | 10 | Variable | 3.5 | - | N/A | Clear |
| 5:56 PM | 55.9 | 18.0 | 23 | 30.01 in | 10 | ENE | 6.9 | - | N/A | Clear |
| 6:56 PM | 50.0 | 19.0 | 29 | 30.00 in | 10 | ENE | 5.8 | - | N/A | Clear |
| 7:56 PM | 45.0 | 19.0 | 35 | 30.02 in | 10 | ENE | 6.9 | - | N/A | Clear |
| 8:56 PM | 43.0 | 19.0 | 38 | 30.03 in | 10 | East | 6.9 | - | N/A | Clear |
| 9:56 PM | 42.1 | 17.1 | 37 | 30.04 in | 10 | SE | 8.1 | - | N/A | Clear |
| 10:56 PM | 41.0 | 16.0 | 36 | 30.04 in | 10 | SE | 5.8 | - | N/A | Clear |
| 11:56 PM | 39.0 | 14.0 | 35 | 30.04 in | 10 | SE | 8.1 | - | N/A | Clear |
| 30-Sep-07 | | | | | | | | | | |
| [illegible] | 39.9 | 15.1 | 36 | 30.03 in | 10 | SE | 6.9 | - | N/A | Clear |
| 4:56 AM | 37.0 | 15.1 | 41 | 30.01 in | 10 | SE | 5.8 | - | N/A | Clear |
| 5:56 AM | 32.0 | 18.0 | 56 | 30.01 in | 10 | Calm | Calm | - | N/A | Clear |
| 6:56 AM | 34.0 | 19.0 | 54 | 30.01 in | 10 | Calm | Calm | - | N/A | Clear |
| 7:56 AM | 42.1 | 18.0 | 38 | 30.01 in | 10 | ENE | 3.5 | - | N/A | Clear |
| 8:56 AM | 46.9 | 18.0 | 32 | 30.03 in | 10 | Calm | Calm | - | N/A | Clear |
| 9:56 AM | 54.0 | 17.1 | 23 | 30.02 in | 10 | Calm | Calm | - | N/A | Clear |
| 10:56 AM | 61.0 | 15.1 | 17 | 30.01 in | 10 | SE | 4.6 | - | N/A | Clear |
| 11:56 AM | 64.9 | 15.1 | 15 | 29.98 in | 10 | South | 9.2 | - | N/A | Partly |
| 12:56 PM | 70.0 | 15.1 | 12 | 29.96 in | 10 | South | 8.1 | - | N/A | Cloudy |
| 1:56 PM | 73.9 | 16.0 | 11 | 29.92 in | 10 | Variable | 6.9 | - | N/A | Partly |
| 2:56 PM | 77.0 | 15.1 | 10 | 29.89 in | 10 | South | 9.2 | - | N/A | Cloudy |
| 3:56 PM | 79.0 | 15.1 | 9 | 29.86 in | 10 | South | 11.5 | 19.4 | N/A | Scattered |
| 4:56 PM | 78.1 | 15.1 | 9 | 29.85 in | 10 | South | 11.5 | 21.9 | N/A | Clouds |
| 5:56 PM | 77.0 | 16.0 | 10 | 29.83 in | 10 | SSE | 9.2 | - | N/A | Scattered |
| 6:56 PM | 71.1 | 17.1 | 13 | 29.84 in | 10 | South | 10.4 | - | N/A | Clear |
| 7:56 PM | 66.9 | 15.1 | 14 | 29.86 in | 10 | Calm | Calm | - | N/A | Clear |
| 8:56 PM | 63.0 | 18.0 | 18 | 29.87 in | 10 | SW | 9.2 | - | N/A | Clear |
| 9:56 PM | 54.0 | 19.0 | 25 | 29.88 in | 10 | West | 3.5 | - | N/A | Clear |
| 10:56 PM | 54.0 | 21.0 | 28 | 29.88 in | 10 | WSW | 4.6 | - | N/A | Clear |
| 11:56 PM | 55.9 | 19.0 | 24 | 29.88 in | 10 | SE | 4.6 | - | N/A | Clear |
| 1-Oct-07 | | | | | | | | | | |
| 12:56 AM | 46.9 | 19.9 | 34 | 29.88 in | 10 | North | 3.5 | - | N/A | Clear |
| 1:56 AM | 51.1 | 18.0 | 27 | 29.88 in | 10 | Calm | Calm | - | N/A | Clear |
| 2:56 AM | 46.9 | 19.0 | 33 | 29.88 in | 10 | Calm | Calm | - | N/A | Clear |
| 3:56 AM | 43.0 | 21.0 | 42 | 29.89 in | 10 | Calm | Calm | - | N/A | Partly Cloudy |
| 4:56 AM | 46.9 | 25.0 | 42 | 29.89 in | 10 | East | 4.6 | - | N/A | Overcast |
| 5:56 AM | 46.9 | 25.0 | 39 | 29.91 in | 10 | WNW | 4.6 | - | N/A | Overcast |
| 6:56 AM | 50.0 | 27.0 | 41 | 29.93 in | 10 | North | 8.1 | - | N/A | Overcast |
| 7:56 AM | 53.1 | 30.9 | 43 | 29.96 in | 10 | NNE | 12.7 | - | N/A | Overcast |
| 8:56 AM | 53.1 | 37.9 | 57 | 29.99 in | 10 | NNE | 13.8 | 21.9 | N/A | Light Rain |
| 9:56 AM | 50.0 | 45.0 | 83 | 30.01 in | 6 | NE | 16.1 | - | 0.02 | Light Rain |
| 10:56 AM | 54.0 | 44.1 | 69 | 30.02 in | 10 | NE | 9.2 | - | 0.01 | Mostly Cloudy |
| 11:56 AM | 60.1 | 42.1 | 51 | 30.03 in | 10 | North | 13.8 | - | N/A | Mostly Cloudy |
| 12:56 PM | 61.0 | 41.0 | 48 | 30.05 in | 10 | North | 13.8 | 23.0 | N/A | Mostly Cloudy |
| 1:56 PM | 62.1 | 42.1 | 48 | 30.05 in | 10 | NNE | 12.7 | 21.9 | N/A | Mostly Cloudy |
| 2:56 PM | 63.0 | 41.0 | 45 | 30.06 in | 10 | NNE | 13.8 | 23.7 | N/A | Mostly Cloudy |
| 3:56 PM | 63.0 | 37.9 | 40 | 30.06 in | 10 | North | 16.1 | 20.7 in | N/A | Mostly Cloudy |
| 4:56 PM | 62.1 | 37.9 | 41 | 30.07 in | 10 | NNE | 13.8 | - | N/A | Scattered Clouds |
| 5:56 PM | 61.0 | 36.0 | 39 | 30.09 in | 10 | NNE | 13.8 | - | N/A | Scattered Clouds |
| 6:56 PM | 57.0 | 33.1 | 40 | 30.10 in | 10 | North | 12.7 | - | N/A | Partly Cloudy |
| 7:56 PM | 51.1 | 33.1 | 50 | 30.13 in | 10 | North | 5.8 | - | N/A | Partly Cloudy |
| 8:56 PM | 45.9 | 32.0 | 58 | 30.15 in | 10 | Calm | Calm | - | N/A | Clear |
| 9:56 PM | 45.0 | 30.0 | 54 | 30.17 in | 10 | SSE | 3.5 | - | N/A | Clear |
| 10:56 PM | 42.1 | 28.9 | 60 | 30.18 in | 10 | NW | 5.8 | - | N/A | Clear |
| 11:56 PM | 37.0 | 28.0 | 70 | 30.18 in | 10 | South | 5.8 | - | N/A | Clear |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 12:45 PM | 87.8 | 69.8 | 55 | 30.04 in | 10 | Calm | Calm | - | N/A | Clear |
| 1:05 PM | 89.6 | 68.0 | 49 | 30.04 in | 10 | SSE | 4.6 | - | N/A | Clear |
| 1:25 PM | 89.6 | 68.0 | 49 | 30.03 in | 10 | ESE | 4.6 | - | N/A | Clear |
| 1:45 PM | 89.6 | 68.0 | 49 | 30.03 in | 10 | SSE | 8.1 | - | N/A | Clear |
| 2:05 PM | 89.6 | 64.4 | 43 | 30.02 in | 10 | SSE | 8.1 | - | N/A | Clear |
| 2:25 PM | 89.6 | 64.4 | 43 | 30.01 in | 10 | SE | 5.8 | - | N/A | Clear |
| 2:45 PM | 91.4 | 64.4 | 41 | 30.01 in | 10 | SSE | 5.8 | - | N/A | Clear |
| 3:05 PM | 89.6 | 68.0 | 49 | 30.00 in | 10 | SSE | 6.9 | - | N/A | Clear |
| 3:25 PM | 89.6 | 68.0 | 49 | 30.00 in | 10 | SE | 9.2 | - | N/A | Clear |
| 3:45 PM | 91.4 | 69.8 | 49 | 29.99 in | 10 | SE | 10.4 | - | N/A | Clear |
| 4:05 PM | 91.4 | 69.8 | 49 | 29.99 in | 10 | SE | 8.1 | - | N/A | Clear |
| 4:25 PM | 91.4 | 68.0 | 46 | 29.97 in | 10 | SSE | 9.2 | - | N/A | Clear |
| 4:45 PM | 91.4 | 68.0 | 46 | 29.96 in | 10 | SSE | 9.2 | - | N/A | Clear |
| 5:05 PM | 89.6 | 68.0 | 49 | 29.95 in | 10 | SSE | 9.2 | 16.1 | N/A | Clear |
| 5:25 PM | 87.8 | 66.2 | 49 | 29.95 in | 10 | SSE | 6.9 | - | N/A | Clear |
| 5:45 PM | 87.8 | 66.2 | 49 | 29.95 in | 10 | SSE | 5.8 | - | N/A | Mostly Cloudy |
| 6:05 PM | 80.6 | 69.8 | 70 | 29.96 in | 10 | WNW | 10.4 | 19.6 | N/A | Overcast |
| 6:25 PM | 78.8 | 71.6 | 78 | 29.97 in | 10 | West | 8.1 | - | N/A | Thunderstorms |
| 7:01 PM | 75.2 | 73.4 | 94 | 29.99 in | 1.8 | SW | 8.1 | - | 0.08 | Thunderstorms |
| 7:05 PM | 75.2 | 73.4 | 94 | 29.99 in | 2.5 | SW | 12.7 | - | 0.11 | Thunderstorms |
| 7:25 PM | 77.0 | 73.4 | 89 | 29.98 in | 7 | SSE | 8.1 | - | 0.14 | Light Rain |
| 7:45 PM | 77.0 | 73.4 | 89 | 29.98 in | 7 | SE | 4.6 | - | 0.14 | Clouds |
| 8:05 PM | 77.0 | 73.4 | 89 | 29.98 in | 7 | SSE | 3.5 | - | N/A | Scattered |
| 8:25 PM | 77.0 | 75.2 | 94 | 29.99 in | 7 | South | 4.6 | - | N/A | Mostly Cloudy |
| 8:45 PM | 77.0 | 73.4 | 89 | 29.99 in | 10 | SSW | 4.6 | - | N/A | Scattered |
| 9:05 PM | 77.0 | 73.4 | 89 | 30.00 in | 10 | South | 3.5 | - | N/A | Clear |
| 9:25 PM | 77.0 | 73.4 | 89 | 30.00 in | 10 | Calm | Calm | - | N/A | Clear |
| 9:45 PM | 77.0 | 73.4 | 89 | 30.01 in | 7 | SW | 3.5 | - | N/A | Clear |
| 10:05 PM | 77.0 | 73.4 | 89 | 30.01 in | 10 | SSW | 3.5 | - | N/A | Clear |
| 10:25 PM | 77.0 | 73.4 | 89 | 30.01 in | 7 | SSW | 3.5 | - | N/A | Clear |
| 10:45 PM | 75.2 | 73.4 | 94 | 30.02 in | 7 | Calm | Calm | - | N/A | Clear |
| 11:05 PM | 75.2 | 73.4 | 94 | 30.02 in | 7 | South | 4.6 | - | N/A | Clear |
| 11:25 PM | 77.0 | 73.4 | 89 | 30.01 in | 7 | SSW | 4.6 | - | N/A | Clear |
| 11:45 PM | 75.2 | 71.6 | 89 | 30.01 in | 7 | WSW | 3.5 | - | N/A | Clear |
| **21-Jun-07** | | | | | | | | | | |
| 12:05 AM | 75.2 | 71.6 | 89 | 30.01 in | 10 | SSW | 3.5 | - | N/A | Clear |
| 12:25 AM | 75.2 | 71.6 | 89 | 30.00 in | 7 | WSW | 5.8 | - | N/A | Clear |
| 12:45 AM | 77.0 | 71.6 | 83 | 30.00 in | 10 | SW | 4.6 | - | N/A | Clear |
| 1:05 AM | 75.2 | 71.6 | 89 | 29.99 in | 7 | SSW | 4.6 | - | N/A | Clear |
| 1:25 AM | 73.4 | 71.6 | 94 | 29.99 in | 7 | SSW | 3.5 | - | N/A | Clear |
| 2:05 AM | 73.4 | 71.6 | 94 | 29.98 in | 7 | South | 4.6 | - | N/A | Clear |
| 2:25 AM | 73.4 | 71.6 | 94 | 29.97 in | 7 | SW | 3.5 | - | N/A | Clear |
| 2:45 AM | 73.4 | 71.6 | 94 | 29.97 in | 7 | WSW | 4.6 | - | N/A | Clear |
| 3:05 AM | 73.4 | 71.6 | 94 | 29.96 in | 7 | SW | 3.5 | - | N/A | Clear |
| 3:25 AM | 73.4 | 71.6 | 94 | 29.96 in | 7 | SSW | 3.5 | - | N/A | Scattered Clouds |
| 3:45 AM | 73.4 | 71.6 | 94 | 29.96 in | 7 | SSW | 3.5 | - | N/A | Mostly Cloudy |
| 4:05 AM | 75.2 | 73.4 | 94 | 29.95 in | 7 | SSW | 4.6 | - | N/A | Mostly Cloudy |
| 4:25 AM | 75.2 | 73.4 | 94 | 29.96 in | 7 | WSW | 5.8 | - | N/A | Overcast |
| 5:05 AM | 75.2 | 73.4 | 94 | 29.96 in | 7 | WSW | 5.8 | - | N/A | Overcast |
| 5:25 AM | 75.2 | 73.4 | 94 | 29.95 in | 7 | SW | 5.8 | - | N/A | Clouds |
| 5:45 AM | 73.4 | 73.4 | 100 | 29.95 in | 10 | SW | 4.6 | - | N/A | Clear |
| 6:05 AM | 73.4 | 71.6 | 94 | 29.96 in | 7 | SSW | 4.6 | - | N/A | Clear |
| 6:25 AM | 73.4 | 73.4 | 100 | 29.97 in | 5 | SW | 5.8 | - | N/A | Clear |
| 6:45 AM | 73.4 | 73.4 | 100 | 29.96 in | 3 | SW | 4.6 | - | N/A | Clear |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 8:05 AM | 77.0 | 75.2 | 94 | 29.98 in | 5 | SW | 6.9 | - | N/A | Clear |
| 8:25 AM | 78.8 | 77.0 | 94 | 29.98 in | 5 | WSW | 5.8 | - | N/A | Clear |
| 8:45 AM | 78.8 | 77.0 | 94 | 29.98 in | 7 | SW | 5.8 | - | N/A | Scattered |
| 9:05 AM | 80.6 | 77.0 | 89 | 29.98 in | 10 | SW | 6.9 | - | N/A | Clouds |
| 9:25 AM | 82.4 | 75.2 | 79 | 29.98 in | 10 | SW | 8.1 | - | N/A | Scattered |
| 9:45 AM | 82.4 | 73.4 | 74 | 29.98 in | 10 | SW | 6.9 | - | N/A | Mostly Cloudy |
| 10:05 AM | 82.4 | 73.4 | 74 | 29.98 in | 10 | WSW | 4.6 | - | N/A | Mostly Cloudy |
| 10:25 AM | 84.2 | 73.4 | 70 | 29.98 in | 10 | SW | 6.9 | - | N/A | Mostly Cloudy |
| 10:45 AM | 84.2 | 73.4 | 70 | 29.98 in | 10 | SW | 8.1 | - | N/A | Scattered |
| 11:05 AM | 86.0 | 73.4 | 66 | 29.97 in | 10 | SW | 10.4 | - | N/A | Clouds |
| 11:25 AM | 86.0 | 73.4 | 66 | 29.97 in | 10 | SW | 6.9 | - | N/A | Scattered |
| 11:45 AM | 87.8 | 73.4 | 62 | 29.97 in | 10 | South | 6.9 | - | N/A | Clouds |
| 12:05 PM | 86.0 | 73.4 | 66 | 29.96 in | 10 | SW | 10.4 | - | N/A | Mostly Cloudy |
| 12:25 PM | 87.8 | 73.4 | 62 | 29.96 in | 10 | SW | 5.8 | - | N/A | Scattered |
| 12:45 PM | 87.8 | 73.4 | 62 | 29.96 in | 10 | SW | 8.1 | - | N/A | Clouds |
| 1:05 PM | 87.8 | 73.4 | 62 | 29.95 in | 10 | SW | 5.8 | - | N/A | Mostly Cloudy |
| 1:25 PM | 80.6 | 75.2 | 84 | 29.95 in | 7 | NNE | 6.9 | - | 0.08 in | Light Rain |
| 1:45 PM | 82.4 | 77.0 | 84 | 29.95 in | 10 | NE | 3.5 | - | 0.08 in | Overcast |
| 2:05 PM | 86.0 | 77.0 | 74 | 29.94 in | 10 | East | 3.5 | - | N/A | Mostly Cloudy |
| 2:25 PM | 87.8 | 77.0 | 70 | 29.93 in | 10 | East | 6.9 | - | N/A | Mostly Cloudy |
| 2:45 PM | 86.0 | 73.4 | 66 | 29.94 in | 10 | WNW | 16.1 | 24.2 | N/A | Mostly Cloudy |
| 3:25 PM | 75.2 | 71.6 | 89 | 29.95 in | 7 | South | 8.1 | - | 0.54 | Thunderstorms |
| 3:26 PM | 75.2 | 71.6 | 89 | 29.95 in | 7 | South | 9.2 | - | 0.54 | Thunderstorms |
| 3:45 PM | 77.0 | 71.6 | 83 | 29.94 in | 10 | SSE | 4.6 | - | 0.56 | Thunderstorms |
| 4:05 PM | 77.0 | 71.6 | 83 | 29.94 in | 10 | SW | 4.6 | - | N/A | Clear |
| 4:25 PM | 78.8 | 71.6 | 78 | 29.94 in | 10 | WSW | 3.5 | - | N/A | Clear |
| 4:45 PM | 78.8 | 73.4 | 83 | 29.92 in | 10 | WSW | 4.6 | - | N/A | Clear |
| 5:05 PM | 80.6 | 73.4 | 79 | 29.92 in | 10 | WSW | 11.5 | - | N/A | Scattered Clouds |
| 5:25 PM | 80.6 | 73.4 | 79 | 29.92 in | 10 | SSW | 8.1 | - | N/A | Clear |
| 5:45 PM | 80.6 | 75.2 | 84 | 29.91 in | 10 | WSW | 9.2 | - | N/A | Clear |
| 6:05 PM | 80.6 | 73.4 | 79 | 29.91 in | 10 | WSW | 5.8 | - | N/A | Clear |
| 6:25 PM | 80.6 | 73.4 | 79 | 29.92 in | 10 | WSW | 4.6 | - | N/A | Clear |
| 6:45 PM | 80.6 | 75.2 | 84 | 29.92 in | 10 | SW | 5.8 | - | N/A | Clear |
| 7:05 PM | 80.6 | 73.4 | 79 | 29.91 in | 10 | SW | 3.5 | - | N/A | Clear |
| 7:25 PM | 80.6 | 73.4 | 79 | 29.92 in | 10 | SW | 5.8 | - | N/A | Scattered Clouds |
| 8:05 PM | 80.6 | 73.4 | 79 | 29.92 in | 10 | SW | 4.6 | - | N/A | Mostly Cloudy |
| 8:25 PM | 80.6 | 73.4 | 79 | 29.93 in | 7 | WSW | 5.8 | - | N/A | Mostly Cloudy |
| 8:45 PM | 80.6 | 75.2 | 84 | 29.94 in | 10 | WSW | 8.1 | - | N/A | Scattered Clouds |
| 9:05 PM | 80.6 | 75.2 | 84 | 29.94 in | 10 | WSW | 8.1 | - | N/A | Mostly Cloudy |
| 9:25 PM | 80.6 | 75.2 | 84 | 29.94 in | 10 | West | 10.4 | - | N/A | Scattered Clouds |
| 9:45 PM | 78.8 | 75.2 | 89 | 29.95 in | 10 | WSW | 9.2 | - | N/A | Clear |
| 10:05 PM | 78.8 | 75.2 | 89 | 29.95 in | 10 | West | 9.2 | - | N/A | Clear |
| 10:25 PM | 78.8 | 73.4 | 83 | 29.95 in | 10 | West | 9.2 | - | N/A | Clear |
| 10:45 PM | 78.8 | 73.4 | 83 | 29.97 in | 10 | West | 8.1 | - | N/A | Clear |
| 11:05 PM | 78.8 | 73.4 | 83 | 29.97 in | 10 | WSW | 6.9 | - | N/A | Clear |
| 11:25 PM | 77.0 | 73.4 | 89 | 29.98 in | 7 | WSW | 5.8 | - | N/A | Clear |
| 11:45 PM | 77.0 | 73.4 | 89 | 29.98 in | 7 | West | 4.6 | - | N/A | Clear |

| Avon Park AFR, FL | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 19-Jun-07 | Temp °F | Dew Point °F | Humidity % | Pressure in | Visibility miles | Wind Direction | Wind Speed | Wind Gusts | Precip in | Conditions |
| 12:05 AM | 71.6 | 71.6 | 100 | 30.12 in | 10 | Calm | Calm | - | N/A | Clear |
| 12:25 AM | 71.6 | 69.8 | 94 | 30.12 in | 5 | Calm | Calm | - | N/A | Clear |
| 12:45 AM | 71.6 | 71.6 | 100 | 30.12 in | 7 | Calm | Calm | - | N/A | Clear |
| 1:05 AM | 71.6 | 71.6 | 100 | 30.11 in | 7 | Calm | Calm | - | N/A | Clear |
| 1:25 AM | 71.6 | 69.8 | 94 | 30.11 in | 7 | Calm | Calm | - | N/A | Clear |
| 1:45 AM | 71.6 | 69.8 | 94 | 30.10 in | 7 | Calm | Calm | - | N/A | Clear |
| 2:05 AM | 71.6 | 69.8 | 94 | 30.10 in | 7 | Calm | Calm | - | N/A | Clear |
| 2:25 AM | 71.6 | 69.8 | 94 | 30.10 in | 7 | Calm | Calm | - | N/A | Clear |
| 2:45 AM | 69.8 | 69.8 | 100 | 30.09 in | 4 | Calm | Calm | - | N/A | Clear |
| 3:05 AM | 71.6 | 69.8 | 94 | 30.09 in | 7 | Calm | Calm | - | N/A | Clear |
| 3:25 AM | 71.6 | 69.8 | 94 | 30.09 in | 5 | Calm | Calm | - | N/A | Clear |
| 3:45 AM | 69.8 | 69.8 | 100 | 30.09 in | 5 | Calm | Calm | - | N/A | Clear |
| 4:05 AM | 69.8 | 69.8 | 100 | 30.09 in | 4 | Calm | Calm | - | N/A | Clear |
| 4:25 AM | 69.8 | 69.8 | 100 | 30.09 in | 5 | Calm | Calm | - | N/A | Clear |
| 4:45 AM | 69.8 | 69.8 | 100 | 30.09 in | 2 | Calm | Calm | - | N/A | Clear |
| 5:05 AM | 69.8 | 69.8 | 100 | 30.09 in | 3 | Calm | Calm | - | N/A | Clear |
| 5:25 AM | 69.8 | 69.8 | 100 | 30.09 in | 4 | Calm | Calm | - | 0.01 | Clear |
| 5:45 AM | 69.8 | 69.8 | 100 | 30.09 in | 4 | Calm | Calm | - | 0.01 | Clear |
| 6:05 AM | 69.8 | 69.8 | 100 | 30.09 in | 4 | Calm | Calm | - | N/A | Clear |
| 6:25 AM | 69.8 | 68.0 | 94 | 30.09 in | 1.5 | Calm | Calm | - | N/A | Mist |
| 6:45 AM | 69.8 | 68.0 | 94 | 30.10 in | 2.5 | Calm | Calm | - | N/A | Clear |
| 7:05 AM | 69.8 | 68.0 | 94 | 30.10 in | 1.8 | Calm | Calm | - | N/A | Mist |
| 7:25 AM | 71.6 | 69.8 | 94 | 30.11 in | 4 | Calm | Calm | - | N/A | Scattered |
| 7:45 AM | 71.6 | 71.6 | 100 | 30.12 in | 5 | Calm | Calm | - | N/A | Mostly Cloudy |
| 8:05 AM | 73.4 | 71.6 | 94 | 30.13 in | 7 | Calm | Calm | - | N/A | Clouds |
| 8:25 AM | 77.0 | 73.4 | 89 | 30.13 in | 7 | ENE | 3.5 | - | N/A | Clear |
| 8:45 AM | 78.8 | 75.2 | 89 | 30.13 in | 10 | Calm | Calm | - | N/A | Clear |
| 9:05 AM | 80.6 | 77.0 | 89 | 30.13 in | 10 | Calm | Calm | - | N/A | Clear |
| 9:25 AM | 82.4 | 77.0 | 84 | 30.13 in | 10 | East | 5.8 | - | N/A | Clear |
| 9:45 AM | 82.4 | 77.0 | 84 | 30.13 in | 10 | East | 5.8 | - | N/A | Clouds |
| 10:05 AM | 82.4 | 77.0 | 84 | 30.13 in | 10 | ESE | 3.5 | - | N/A | Scattered |
| 10:25 AM | 86.0 | 73.4 | 66 | 30.13 in | 10 | Calm | Calm | - | N/A | Clouds |
| 10:45 AM | 82.4 | 73.4 | 74 | 30.14 in | 10 | SE | 3.5 | - | N/A | Mostly Cloudy |
| 11:05 AM | 86.0 | 73.4 | 66 | 30.14 in | 10 | Calm | Calm | - | N/A | Mostly Cloudy |
| 11:25 AM | 86.0 | 73.4 | 66 | 30.14 in | 10 | East | 4.6 | - | N/A | Scattered Clouds |
| 11:45 AM | 86.0 | 73.4 | 66 | 30.14 in | 10 | East | 4.6 | - | N/A | Scattered |
| 12:05 PM | 87.8 | 71.6 | 58 | 30.14 in | 10 | NE | 3.5 | - | N/A | Scattered Clouds |
| 12:25 PM | 87.8 | 71.6 | 58 | 30.14 in | 10 | East | 5.8 | - | N/A | Clouds |
| 12:45 PM | 87.8 | 71.6 | 58 | 30.13 in | 10 | Calm | Calm | - | N/A | Mostly Cloudy |
| 1:05 PM | 87.8 | 71.6 | 58 | 30.13 in | 10 | ENE | 4.6 | - | N/A | Clouds |
| 1:25 PM | 87.8 | 71.6 | 58 | 30.13 in | 10 | Calm | Calm | - | N/A | Clear |
| 1:45 PM | 87.8 | 71.6 | 58 | 30.12 in | 10 | Calm | Calm | - | N/A | Scattered Clouds |
| 2:05 PM | 89.6 | 71.6 | 55 | 30.11 in | 10 | Calm | Calm | - | N/A | Scattered |
| 2:25 PM | 89.6 | 69.8 | 52 | 30.10 in | 10 | Calm | Calm | - | N/A | Scattered Clouds |
| 2:45 PM | 91.4 | 69.8 | 49 | 30.10 in | 10 | WSW | 3.5 | - | N/A | Clouds |
| 3:05 PM | 89.6 | 71.6 | 55 | 30.09 in | 10 | Calm | Calm | - | N/A | Scattered |
| 3:25 PM | 89.6 | 71.6 | 55 | 30.09 in | 10 | SE | 4.6 | - | N/A | Clouds |
| 3:45 PM | 89.6 | 71.6 | 55 | 30.08 in | 10 | South | 4.6 | - | N/A | Scattered Clouds |
| 4:45 PM | 87.8 | 71.6 | 58 | 30.05 in | 10 | SSE | 4.6 | - | N/A | Clear |
| 5:25 PM | 87.8 | 71.6 | 58 | 30.05 in | 10 | ESE | 4.6 | - | N/A | Overcast |
| 5:45 PM | 87.8 | 73.4 | 62 | 30.05 in | 10 | Calm | Calm | - | N/A | Mostly Cloudy |
| 6:05 PM | 87.8 | 71.6 | 58 | 30.05 in | 10 | Calm | Calm | - | N/A | Scattered Clouds |
| 6:25 PM | 86.0 | 73.4 | 66 | 30.05 in | 10 | Calm | Calm | - | N/A | Scattered Clouds |
| 7:05 PM | 86.0 | 71.6 | 62 | 30.05 in | 10 | East | 4.6 | - | N/A | Clear |
| 7:25 PM | 86.0 | 71.6 | 62 | 30.05 in | 10 | East | 4.6 | - | N/A | Scattered Clouds |
| 7:45 PM | 84.2 | 71.6 | 66 | 30.07 in | 10 | ESE | 4.6 | - | N/A | Scattered Clouds |
| 8:05 PM | 82.4 | 69.8 | 66 | 30.07 in | 10 | ESE | 4.6 | - | N/A | Clear |
| 8:25 PM | 80.6 | 69.8 | 70 | 30.07 in | 10 | East | 4.6 | - | N/A | Clear |
| 8:45 PM | 80.6 | 68.0 | 65 | 30.07 in | 10 | East | 4.6 | - | N/A | Scattered Clouds |
| 10:25 PM | 78.8 | 69.8 | 74 | 30.08 in | 10 | East | 4.6 | - | N/A | Overcast |
| 10:45 PM | 78.8 | 69.8 | 74 | 30.08 in | 10 | East | 4.6 | - | N/A | Overcast |
| 11:05 PM | 77.0 | 69.8 | 78 | 30.09 in | 10 | East | 3.5 | - | N/A | Scattered Clouds |
| 11:25 PM | 75.2 | 69.8 | 83 | 30.09 in | 10 | East | 3.5 | - | N/A | Clear |
| 11:45 PM | 75.2 | 69.8 | 83 | 30.09 in | 10 | East | 3.5 | - | N/A | Clear |
| 20-Jun-07 | | | | | | | | | | |
| 12:05 AM | 73.4 | 69.8 | 88 | 30.09 in | 10 | Calm | Calm | - | N/A | Clear |
| 12:25 AM | 75.2 | 69.8 | 83 | 30.08 in | 10 | Calm | Calm | - | N/A | Clear |
| 12:45 AM | 75.2 | 69.8 | 83 | 30.08 in | 10 | Calm | Calm | - | N/A | Clear |
| 1:05 AM | 73.4 | 69.8 | 88 | 30.08 in | 10 | Calm | Calm | - | N/A | Clear |
| 1:25 AM | 73.4 | 71.6 | 94 | 30.07 in | 10 | Calm | Calm | - | N/A | Clear |
| 1:45 AM | 73.4 | 71.6 | 94 | 30.07 in | 10 | Calm | Calm | - | N/A | Mostly Cloudy |
| 2:05 AM | 73.4 | 69.8 | 88 | 30.05 in | 10 | Calm | Calm | - | N/A | Scattered |
| 2:25 AM | 73.4 | 71.6 | 94 | 30.05 in | 10 | Calm | Calm | - | N/A | Clouds |
| 2:45 AM | 71.6 | 71.6 | 100 | 30.05 in | 7 | Calm | Calm | - | N/A | Scattered Clouds |
| 3:05 AM | 73.4 | 71.6 | 94 | 30.04 in | 10 | ESE | 3.5 | - | N/A | Clear |
| 3:25 AM | 73.4 | 69.8 | 88 | 30.04 in | 10 | ESE | 3.5 | - | N/A | Clear |
| 3:45 AM | 73.4 | 71.6 | 94 | 30.04 in | 10 | ESE | 3.5 | - | N/A | Clear |
| 4:05 AM | 73.4 | 69.8 | 88 | 30.03 in | 10 | SE | 4.6 | - | N/A | Clear |
| 4:25 AM | 71.6 | 69.8 | 94 | 30.02 in | 10 | SE | 3.5 | - | N/A | Clear |
| 4:45 AM | 71.6 | 69.8 | 94 | 30.02 in | 7 | Calm | Calm | - | N/A | Clear |
| 5:05 AM | 71.6 | 69.8 | 94 | 30.02 in | 10 | East | 3.5 | - | N/A | Clear |
| 5:25 AM | 71.6 | 69.8 | 94 | 30.02 in | 7 | Calm | Calm | - | N/A | Clear |
| 5:45 AM | 71.6 | 69.8 | 94 | 30.03 in | 10 | Calm | Calm | - | N/A | Clear |
| 6:05 AM | 71.6 | 69.8 | 94 | 30.03 in | 10 | Calm | Calm | - | N/A | Clear |
| 6:25 AM | 71.6 | 69.8 | 94 | 30.04 in | 10 | Calm | Calm | - | N/A | Clear |
| 6:45 AM | 71.6 | 69.8 | 94 | 30.04 in | 7 | Calm | Calm | - | N/A | Clear |
| 7:05 AM | 71.6 | 69.8 | 94 | 30.05 in | 7 | Calm | Calm | - | N/A | Clear |
| 7:25 AM | 73.4 | 71.6 | 94 | 30.05 in | 7 | Calm | Calm | - | N/A | Clear |
| 7:45 AM | 73.4 | 71.6 | 94 | 30.05 in | 7 | Calm | Calm | - | N/A | Clear |
| 8:05 AM | 77.0 | 71.6 | 83 | 30.07 in | 7 | WNW | 3.5 | - | N/A | Clear |
| 8:25 AM | 78.8 | 73.4 | 83 | 30.07 in | 10 | Calm | Calm | - | N/A | Clear |
| 8:45 AM | 78.8 | 71.6 | 78 | 30.06 in | 10 | Calm | Calm | - | N/A | Clear |
| 9:05 AM | 80.6 | 71.6 | 74 | 30.05 in | 10 | SSW | 3.5 | - | N/A | Clear |
| 9:25 AM | 82.4 | 73.4 | 74 | 30.06 in | 10 | SW | 3.5 | - | N/A | Clear |
| 10:05 AM | 82.4 | 71.6 | 70 | 30.06 in | 10 | South | 4.6 | - | N/A | Clear |
| 10:25 AM | 86.0 | 69.8 | 58 | 30.06 in | 10 | SW | 4.6 | - | N/A | Clear |
| 10:45 AM | 86.0 | 69.8 | 58 | 30.06 in | 10 | SW | 4.6 | - | N/A | Clear |
| 11:05 AM | 86.0 | 69.8 | 58 | 30.06 in | 10 | SSW | 5.8 | - | N/A | Clear |
| 11:25 AM | 87.8 | 68.0 | 52 | 30.06 in | 10 | South | 4.6 | - | N/A | Clear |

| MCAS Cherry Point, NC | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 3-Apr-07 | Temp °F | Dew Point °F | Humidity % | Pressure in | Visibility miles | Wind (mph) | | | Precip | Conditions |
| | | | | | | Direction | Speed | Gusts | in | |
| 12:54 AM | 60.1 | 57.0 | 90 | 30.06 in | 8 | Calm | Calm | - | N/A | Scattered Clouds |
| 1:44 AM | 57.2 | 55.4 | 94 | 30.06 in | 2.5 | Calm | Calm | - | N/A | Clear |
| 1:54 AM | 57.9 | 55.9 | 93 | 30.05 in | 7 | Calm | Calm | - | N/A | Shallow Fog |
| 2:54 AM | 57.9 | 55.0 | 90 | 30.05 in | 10 | Calm | Calm | - | N/A | Shallow Fog |
| 3:54 AM | 57.0 | 54.0 | 89 | 30.04 in | 9 | Calm | Calm | - | N/A | Shallow Fog |
| 4:54 AM | 60.1 | 57.0 | 90 | 30.05 in | 10 | Calm | Calm | - | N/A | Partly Cloudy |
| 5:54 AM | 61.0 | 57.0 | 87 | 30.07 in | 10 | WNW | 4.6 | - | N/A | Scattered Clouds |
| 6:54 AM | 60.1 | 55.9 | 86 | 30.08 in | 9 | WNW | 3.5 | - | 0.0" | Scattered Clouds |
| 7:54 AM | 62.1 | 57.0 | 84 | 30.10 in | 5 | West | 4.6 | - | N/A | Mostly Cloudy |
| 8:54 AM | 96.9 | 57.0 | 70 | 30.08 in | 10 | NNW | 3.5 | - | N/A | Scattered Clouds |
| 9:54 AM | 71.1 | 62.0 | 61 | 30.10 in | 10 | NNE | 3.2 | - | N/A | Mostly Cloudy |
| 10:54 AM | 75.9 | 46.0 | 35 | 30.12 in | 10 | ENE | 3.2 | - | N/A | Scattered Clouds |
| 11:54 AM | 78.1 | 43.0 | 29 | 30.11 in | 10 | NE | 10.4 | - | N/A | Scattered Clouds |
| 12:54 PM | 90.1 | 44.1 | 28 | 30.10 in | 10 | NE | 9.2 | - | N/A | Scattered Clouds |
| 1:54 PM | 80.1 | 42.1 | 26 | 30.08 in | 10 | NE | 10.4 | 16.1 | N/A | Mostly Cloudy |
| 2:54 PM | 81.0 | 39.9 | 23 | 30.06 in | 10 | ENE | 10.4 | - | N/A | Mostly Cloudy |
| 3:54 PM | 81.0 | 41.0 | 24 | 30.06 in | 10 | NE | 5.9 | 20.7 | N/A | Mostly Cloudy |
| 4:54 PM | 79.0 | 37.9 | 23 | 30.03 in | 10 | SE | 13.8 | - | N/A | Mostly Cloudy |
| 5:54 PM | 75.0 | 39.0 | 27 | 30.02 in | 10 | ESE | 13.8 | - | N/A | Mostly Cloudy |
| 6:54 PM | 71.1 | 39.9 | 32 | 30.01 in | 10 | East | 9.2 | - | N/A | Mostly Cloudy |
| 7:54 PM | 66.0 | 42.1 | 42 | 30.00 in | 10 | East | 5.8 | - | N/A | Mostly Cloudy |
| 8:54 PM | 64.0 | 45.0 | 50 | 30.01 in | 10 | SSE | 4.6 | - | N/A | Scattered Clouds |
| 9:54 PM | 62.1 | 46.9 | 58 | 30.01 in | 10 | ESE | 4.6 | - | N/A | Scattered Clouds |
| 10:54 PM | 62.1 | 52.0 | 70 | 30.00 in | 10 | ESE | 3.5 | - | N/A | Mostly Cloudy |
| 11:54 PM | 63.0 | 54.0 | 72 | 29.96 in | 10 | Calm | Calm | - | N/A | Mostly Cloudy |
| 4-Apr-07 | | | | | | | | | | |
| 12:54 AM | 64.0 | 57.9 | 80 | 29.96 in | 10 | South | 3.5 | - | N/A | Mostly Cloudy |
| 1:54 AM | 66.9 | 61.0 | 81 | 29.94 in | 10 | South | 5.9 | - | N/A | Overcast |
| 2:54 AM | 66.9 | 61.0 | 81 | 29.90 in | 10 | South | 4.6 | - | N/A | Mostly Cloudy |
| 3:54 AM | 66.9 | 63.0 | 87 | 29.90 in | 5 | South | 5.8 | - | 0.0" | Rain |
| 4:54 AM | 64.9 | 63.0 | 93 | 29.86 in | 5 | SE | 4.6 | - | 0 | Scattered Clouds |
| 6:54 AM | 64.9 | 62.1 | 90 | 29.84 in | 10 | South | 5.9 | - | 0 | Overcast |
| 7:24 AM | 64.4 | 62.6 | 94 | 29.86 in | 8 | South | 5.8 | - | N/A | Clear |
| 7:29 AM | 64.4 | 62.6 | 94 | 29.85 in | 8 | SSW | 5.9 | - | N/A | Mostly Cloudy |
| 7:54 AM | 66.0 | 62.1 | 87 | 29.83 in | 9 | SSW | 3.5 | - | N/A | Mostly Cloudy |
| 8:54 AM | 66.9 | 62.1 | 84 | 29.82 in | 10 | SSW | 8.1 | - | N/A | Mostly Cloudy |
| 9:54 AM | 68.0 | 63.0 | 84 | 29.79 in | 10 | South | 8.1 | - | N/A | Overcast |
| 10:54 AM | 73.0 | 64.0 | 73 | 29.76 in | 10 | South | 12.7 | - | N/A | Mostly Cloudy |
| 11:54 AM | 72.0 | 63.0 | 73 | 29.77 in | 10 | WSW | 11.5 | 20.7 | N/A | Mostly Cloudy |
| 12:54 PM | 79.0 | 61.0 | 54 | 29.74 in | 10 | West | 15.1 | 20.7 | N/A | Mostly Cloudy |
| 1:54 PM | 81.0 | 57.0 | 44 | 29.69 in | 10 | WSW | 12.7 | 20.7 | N/A | Mostly Cloudy |
| 2:54 PM | 84.0 | 54.0 | 36 | 29.65 in | 10 | West | 19.0 | 26.5 | N/A | Scattered Clouds |
| 5:54 PM | 77.0 | 57.0 | 50 | 29.59 in | 10 | South | 11.5 | - | N/A | Clear |
| 6:54 PM | 73.0 | 57.9 | 59 | 29.60 in | 10 | SSW | 6.9 | - | N/A | Mostly Cloudy |
| 7:54 PM | 68.0 | 57.0 | 66 | 29.62 in | 10 | SW | 5.8 | - | N/A | Scattered Clouds |
| 8:54 PM | 66.0 | 57.0 | 73 | 29.64 in | 10 | SSW | 4.6 | - | N/A | Scattered Clouds |
| 9:54 PM | 64.9 | 55.9 | 73 | 29.66 in | 10 | SSW | 6.9 | - | N/A | Scattered Clouds |
| 10:54 PM | 64.9 | 55.9 | 73 | 29.66 in | 10 | WSW | 5.8 | - | N/A | Scattered Clouds |
| 11:35 PM | 71.6 | 44.6 | 38 | 29.70 in | 10 | North | 21.9 | 28.8 | N/A | Partly Cloudy |
| 11:54 PM | 70.0 | 37.0 | 30 | 29.70 in | 10 | North | 20.7 | 28.8 | N/A | Partly Cloudy |
| 5-Apr-07 | | | | | | | | | | |
| 12:54 AM | 63.0 | 48.9 | 60 | 29.74 in | 10 | North | 16.1 | - | N/A | Partly Cloudy |
| 1:54 AM | 60.1 | 43.0 | 62 | 29.75 in | 10 | North | 11.5 | - | N/A | Partly Cloudy |
| 2:54 AM | 57.9 | 43.0 | 58 | 29.75 in | 10 | North | 11.5 | - | N/A | Scattered Clouds |
| 3:54 AM | 57.0 | 43.0 | 55 | 29.78 in | 10 | North | 6.9 | - | N/A | Scattered Clouds |
| 4:54 AM | 57.0 | 34.0 | 42 | 29.78 in | 10 | NNW | 13.8 | - | N/A | Scattered Clouds |
| 5:54 AM | 55.9 | 28.9 | 36 | 29.80 in | 10 | North | 16.1 | - | N/A | Partly Cloudy |
| 6:54 AM | 53.1 | 28.9 | 40 | 29.83 in | 10 | NNW | 10.4 | - | N/A | Scattered Clouds |
| 7:54 AM | 54.0 | 30.0 | 40 | 29.86 in | 10 | North | 12.7 | - | N/A | Partly Cloudy |
| 8:54 AM | 55.0 | 30.9 | 40 | 29.87 in | 10 | NNW | 15.0 | 20.7 | N/A | Partly Cloudy |
| 9:54 AM | 55.9 | 30.0 | 37 | 29.88 in | 10 | NNW | 15.0 | 21.9 | N/A | Partly Cloudy |
| 10:54 AM | 59.0 | 28.9 | 32 | 29.90 in | 10 | North | 13.8 | - | N/A | Scattered Clouds |
| 11:54 AM | 60.1 | 29.0 | 30 | 29.96 in | 10 | North | 15.0 | 21.9 | N/A | Partly Cloudy |
| 12:54 PM | 62.1 | 30.0 | 30 | 29.95 in | 10 | NNW | 11.5 | 18.4 | N/A | Partly Cloudy |
| 1:54 PM | 64.0 | 25.0 | 23 | 29.93 in | 10 | WNW | 9.2 | 21.9 | N/A | Scattered Clouds |
| 2:54 PM | 64.9 | 23.0 | 20 | 29.91 in | 10 | WNW | 9.2 | 18.4 | N/A | Scattered Clouds |
| 3:54 PM | 64.0 | 23.0 | 21 | 29.90 in | 10 | NW | 17.3 | 23.0 | N/A | Scattered Clouds |
| 4:54 PM | 63.0 | 21.0 | 20 | 29.90 in | 10 | WNW | 12.7 | 21.9 | N/A | Mostly Cloudy |
| 5:54 PM | 60.1 | 21.9 | 23 | 29.92 in | 10 | WNW | 16.1 | 20.7 | N/A | Mostly Cloudy |
| 6:54 PM | 57.9 | 23.0 | 25 | 29.94 in | 10 | WNW | 12.7 | - | N/A | Mostly Cloudy |
| 7:54 PM | 55.0 | 19.9 | 25 | 29.96 in | 10 | NW | 13.8 | - | N/A | Mostly Cloudy |
| 8:54 PM | 53.1 | 21.0 | 29 | 29.99 in | 10 | NW | 10.4 | - | N/A | Scattered Clouds |
| 9:54 PM | 52.0 | 24.1 | 34 | 30.01 in | 10 | North | 10.4 | - | N/A | Scattered Clouds |
| 10:54 PM | 51.1 | 23.0 | 33 | 30.02 in | 10 | North | 12.7 | - | N/A | Scattered Clouds |
| 11:54 PM | 48.9 | 23.0 | 36 | 30.02 in | 10 | NNE | 8.1 | - | N/A | Scattered Clouds |

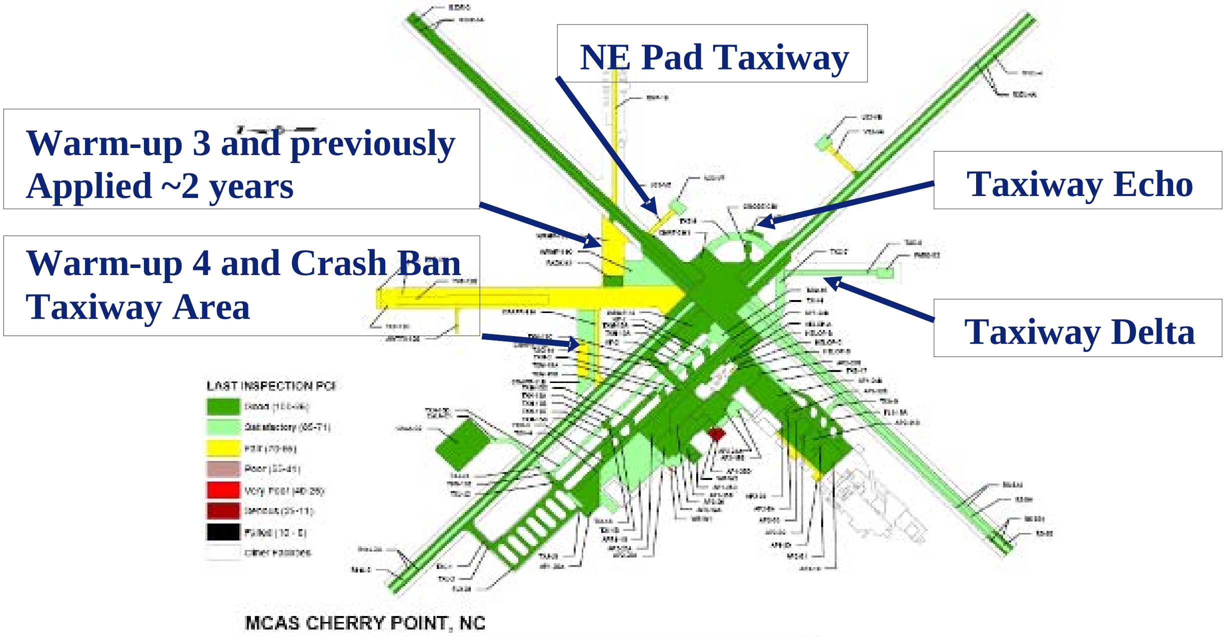
| China Lake Dec 7, 2008 6 mo skid | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Time (PDT) | Temp °F | Dew Point °F | Humidity % | Pressure in | Visibility miles | Wind | | | Precip | Conditions |
| | | | | | | Direction | Speed | Gusts | in | |
| 12:56 AM | 45.0 | 35.1 | 68 | 30.19 in | 10 | WSW | 3.5 | - | N/A | Clear |
| 1:56 AM | 45.0 | 35.1 | 68 | 30.18 in | 10 | SSW | 3.5 | - | N/A | Partly Cloudy |
| 2:56 AM | 46.0 | 35.1 | 66 | 30.17 in | 10 | Calm | Calm | - | N/A | Scattered Clouds |
| 3:56 AM | 45.0 | 36.0 | 71 | 30.14 in | 10 | West | 3.5 | - | N/A | Scattered Clouds |
| 4:56 AM | 43.0 | 35.1 | 74 | 30.13 in | 10 | WSW | 3.5 | - | N/A | Clear |
| 5:56 AM | 45.0 | 34.0 | 65 | 30.13 in | 10 | SSW | 5.8 | - | N/A | Partly Cloudy |
| 6:56 AM | 46.0 | 33.1 | 61 | 30.14 in | 10 | South | 5.8 | - | N/A | Scattered Clouds |
| 7:56 AM | 46.9 | 35.1 | 63 | 30.14 in | 10 | East | 3.5 | - - | N/A | Mostly Cloudy |
| 8:56 AM | 50.0 | 30.9 | 48 | 30.14 in | 10 | West | 8.1 | - | N/A | Mostly Cloudy |
| 9:56 AM | 53.1 | 34.0 | 48 | 30.12 in | 10 | NW | 6.9 | - - | N/A | Mostly Cloudy |
| 10:56 AM | 53.1 | 30.0 | 41 | 30.11 in | 10 | West | 8.1 | - | N/A | Partly Cloudy |
| 11:56 AM | 54.0 | 28.9 | 38 | 30.06 in | 10 | NE | 4.6 | - | N/A | Scattered Clouds |
| 12:56 PM | 55.0 | 28.9 | 37 | 30.04 in | 10 | South | 8.1 | - | N/A | Mostly Cloudy |
| 1:56 PM | 54.0 | 37.0 | 53 | 30.02 in | 10 | SSW | 5.8 | - | 0 | Light Rain |
| 2:56 PM | 54.0 | 37.9 | 55 | 30.03 in | 10 | ESE | 3.5 | - | 0 | Light Rain |
| 3:56 PM | 51.1 | 42.1 | 71 | 30.04 in | 10 | NNE | 5.8 | - | 0 | Overcast |
| 4:56 PM | 48.0 | 41.0 | 77 | 30.04 in | 10 | NNE | 5.8 | - | 0 | Light Rain |
| 5:56 PM | 46.0 | 44.1 | 93 | 30.04 in | 10 | West | 4.6 | - | 0.01 | Light Rain |
| 6:56 PM | 46.0 | 44.1 | 93 | 30.03 in | 10 | Calm | Calm | - | 0.01 | Overcast |
| 7:56 PM | 46.0 | 43.0 | 89 | 30.03 in | 10 | Calm | Calm | - | N/A | Partly Cloudy |
| 8:56 PM | 46.0 | 44.1 | 93 | 30.01 in | 10 | Calm | Calm | - | N/A | Mostly Cloudy |
| 9:56 PM | 46.0 | 43.0 | 89 | 30.00 in | 10 | Calm | Calm | - | N/A | Clear |
| 10:56 PM | 44.1 | 41.0 | 89 | 30.00 in | 10 | Calm | Calm | - | N/A | Clear |
| 11:56 PM | 41.0 | 39.9 | 96 | 30.00 in | 10 | West | 5.8 | - | N/A | Clear |

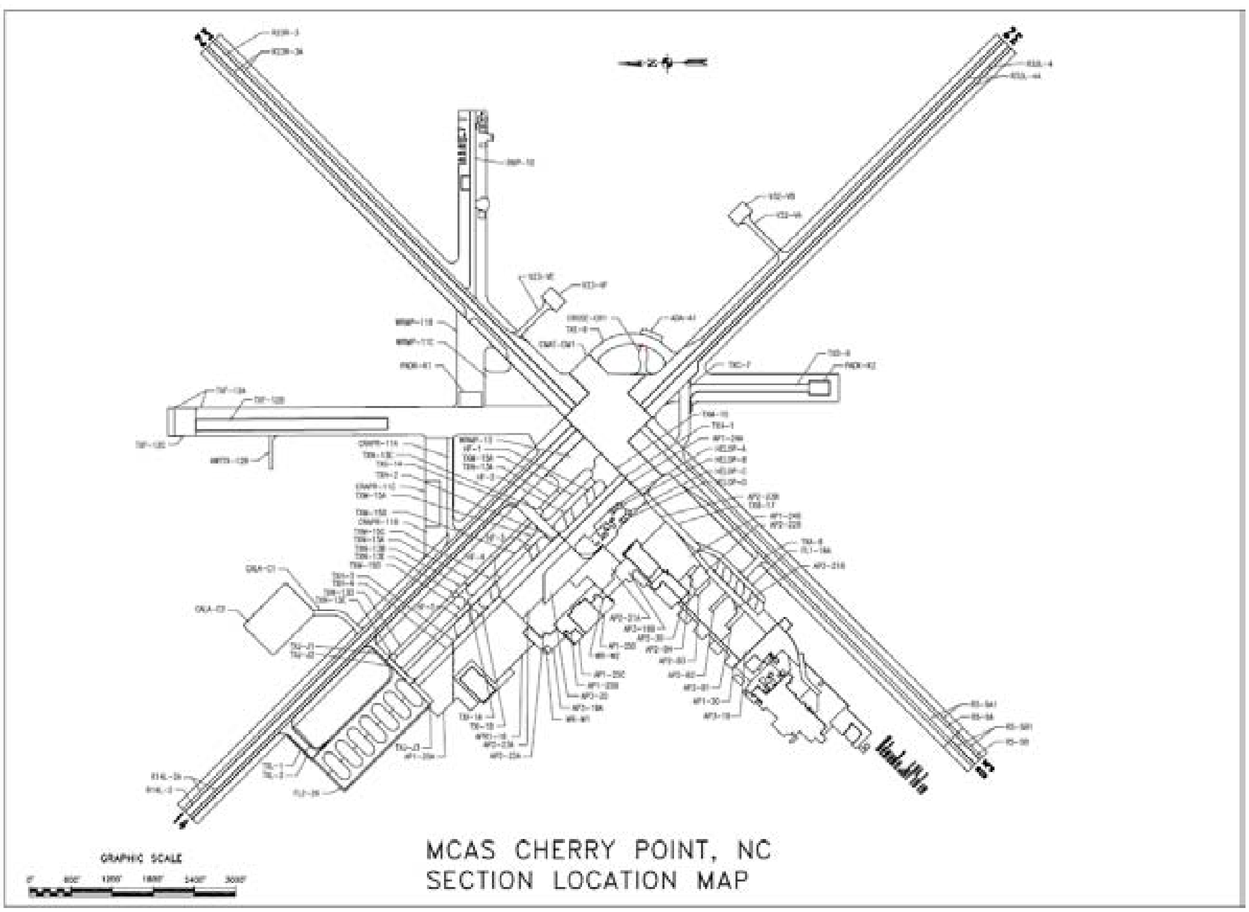
| China Lake May 16, 2009 1 yr skid | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Time (PDT) | Temp °F | Dew Point °F | Humidity % | Pressure in | Visibility miles | Wind | | | Precip | Conditions |
| | | | | | | Direction | Speed | Gusts | in | |
| 12:56 AM | 71.1 | - | N/A | 29.80 in | 10 | Calm | Calm | - | N/A | Unknown |
| 1:56 AM | 70.0 | - | N/A | 29.79 in | 10 | SSW | 6.9 | - | N/A | Unknown |
| 2:56 AM | 69.1 | - | N/A | 29.81 in | 10 | WSW | 8.1 | - | N/A | Unknown |
| 3:56 AM | 62.1 | - | N/A | 29.83 in | 10 | SE | 3.5 | - | N/A | Unknown |
| 4:56 AM | 64.9 | - | N/A | 29.83 in | 10 | West | 5.8 | - | N/A | Unknown |
| 5:56 AM | 64.0 | - | N/A | 29.85 in | 10 | Calm | Calm | - | N/A | Unknown |
| 6:56 AM | 75.0 | - | N/A | 29.87 in | 10 | WNW | 3.5 | - | N/A | Unknown |
| 7:56 AM | 82.0 | - | N/A | 29.89 in | 10 | Calm | Calm | - | N/A | Unknown |
| 8:56 AM | 87.1 | - | N/A | 29.90 in | 10 | Calm | Calm | - | N/A | Unknown |
| 9:56 AM | 91.0 | - | N/A | 29.90 in | 10 | Variable | 5.8 | - | N/A | Unknown |
| 10:56 AM | 93.0 | - | N/A | 29.90 in | 10 | Variable | 4.6 | - | N/A | Unknown |
| 11:56 AM | 95.0 | - | N/A | 29.90 in | 10 | East | 5.8 | - | N/A | Unknown |
| 12:56 PM | 99.0 | - | N/A | 29.88 in | 10 | SE | 10.4 | 19.6 | N/A | Unknown |
| 1:56 PM | 100.0 | - | N/A | 29.87 in | 10 | ESE | 13.8 | - | N/A | Unknown |
| 2:56 PM | 100.0 | - | N/A | 29.85 in | 10 | ESE | 11.5 | - | N/A | Unknown |
| 3:56 PM | 100.0 | - | N/A | 29.84 in | 10 | ENE | 11.5 | 18.4 | N/A | Unknown |
| 4:56 PM | 99.0 | - | N/A | 29.83 in | 10 | SE | 8.1 | 16.1 | N/A | Unknown |
| 5:56 PM | 99.0 | - | N/A | 29.82 in | 10 | East | 6.9 | - | N/A | Unknown |
| 6:56 PM | 97.0 | - | N/A | 29.81 in | 10 | Calm | Calm | - | N/A | Unknown |
| 7:56 PM | 93.0 | - | N/A | 29.82 in | 10 | Calm | Calm | - | N/A | Unknown |
| 8:56 PM | 84.0 | - | N/A | 29.84 in | 10 | South | 5.8 | - | N/A | Unknown |
| 9:56 PM | 80.1 | - | N/A | 29.86 in | 10 | Calm | Calm | - | N/A | Unknown |
| 10:56 PM | 78.1 | - | N/A | 29.88 in | 10 | South | 6.9 | - | N/A | Unknown |
| 11:56 PM | 75.9 | - | N/A | 29.88 in | 10 | SSW | 5.8 | - | N/A | Unknown |

# APPENDIX C

# APPLICATION LOCATIONS

## MCAS Cherry Point, NC – April 2007



## EVALUATION OF CORROSION CONTROL MATERIALS FOR ASPHALT PAVEMENT PRESERVATION OF NAVAL FACILITIES

Application of GSB-88 at MCAS Cherry Point Listed at bottom of my email is my most recent estimate of area made prior to your arrival.

Based on Base Engineer's calculations (below) and my verification, pavement actually treated with GSB-88 was:

| Location/Description where GSB-88 Surface Treatment Applied | Section ID if applicable | SY Treated |
|---|---|---|
| NE pad TX | V23-VE | 5,800 |
| Crash Barn un-named TX + Warm-up 4 | CRAPR-11B & CRAPR-11A w/control strip | 52,800 |
| TX E | TXE-9 | 20,800 |
| TX D | TXD-8 | 17,200 |
| Warm-up 3 – previously applied ~2 yrs (2nd application for "touch-up" evaluation) | WRMP-11B | 3,400 |
| **Total Square Yards Treated for Corrosion Evaluation Project** | | **100,000** |
| Warm-up 3 (Base contract) | Area within WRMP-11C & WRMP-11B | 56,400 |
| Total for MCAS Cherry Point | | 156,400 |

**Base Engineer's calculations**
NE pad TX = 5,800 SY
Crash Barn un-named TX + Warm-up 4 = 52,800 SY
TX E = 20,800 SY
TX D = 17,200 SY
Warm-up 3 – previously applied ~2 yrs = 3,400 SY
(2nd application for "touch-up" evaluation)
Subtotal of treatment area for evaluation = 100,000 SY

Warm-up 3 (Joyce contract) = 56,400 SY

TOTAL = 156,400 SY

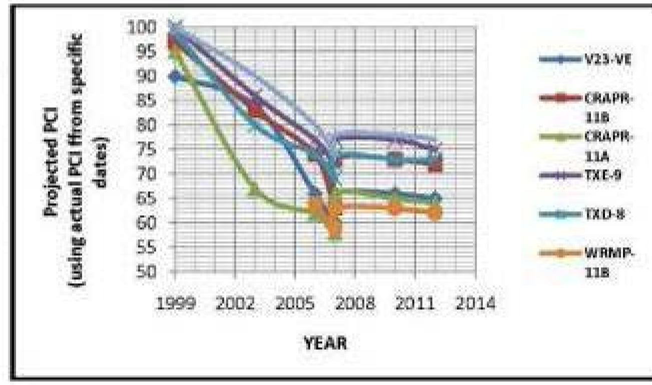
If Air Operations and Wing are satisfied with the job (I am in process of checking with them now), I do not see a need for you to return to seal the edge (control strip) of Delta. And we can wait to sometime in future years to do additional areas, such as the SE Warm-up pad TX and Delta Access Rd.

**MCAS Cherry Point, NC** Application of G58-88 week of April 2, 2007

| BRANCH I.D. | SEC. I.D. | LAST CONST. DATE | SURF ACE | USE | TRUE AREA (sq. ft.) | AGE @ INSPECT. | | | | P C I | | | | Distress Classification | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Jul. 1995 | Jun. 1999 | Feb. 2003 | Apr. 2006 | Jul. 1995 | Jun. 1999 | Feb. 2003 | Apr. 2006 | % Climate | % Load | % Other | Distress | Severity | Quantity | Distress | Severity | Quantity |
| NE pad Taxiway | V23-VE | 6/15/1985 | AC | Taxiway | 53,586 | 12 | 16 | 18 | 21 | 99 | 90 | 84 | 66 | 100 | 0 | 0 | Block Cr | L | 29580 | L&T Cr | L | 2037 |
| Crash Barn un-named TX + Warm-up 4 | CRAPR 11B | 6/15/1997 | AAC | Apron | 356,966 | - | 2 | 6 | 9 | - | 97 | 83 | 74 | 92 | 0 | 8 | L&T Cr | L | 26423 | L&T Cr | M | 5702 |
| | CRAPR 11A | 6/15/1997 | AAC | Apron | 141,234 | - | 2 | 6 | 9 | - | 95 | 67 | 62 | 75 | 25 | 0 | L&T Cr | L / M | 10017/ 1131 | W & Rav | L | 140103 |
| TX E | TXE9 | 6/15/1997 | AAC | Taxiway | 199,650 | 15 | 2 | 6 | 9 | 68 | 100 | 86 | 77 | 95 | 0 | 5 | L&T Cr | L | 12546 | L&T Cr | M | 2229 |
| TX D | TXD8 | 6/15/1997 | AAC | Taxiway | 181,187 | 15 | 2 | 6 | 9 | 54 | 99 | 80 | 74 | 83 | 0 | 17 | L&T Cr | L | 19384 | L&T Cr | M | 516 |
| Warm-up 3 (2[nd] app) | WRM P11B | 6/15/1980 | AAC | Taxiway | 414,361 | 15 | 19 | 23 | 26 | 82 | 47 | 47 | 64 | 100 | 0 | 0 | Block Cr | L | 414358 | | | |
| Warm-up 3 (Base contract) | WRM P11C | 6/15/1996 | AAC | Taxiway | 369,258 | 16 | 5 | 7 | 10 | 67 | 100 | 90 | 80 | 100 | 0 | 0 | L&T Cr | L | 18940 | L&T Cr | M | 4962 |

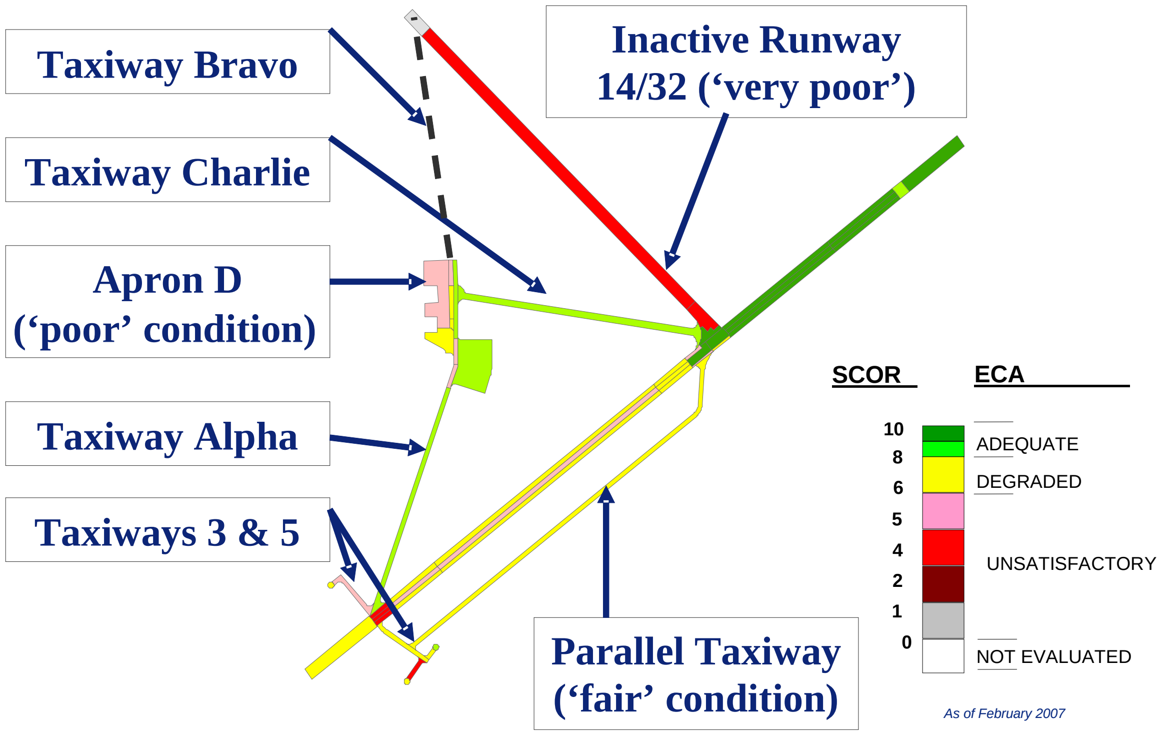
**MCAS Cherry Point, NC** Application of G58-88 week of April 2, 2007

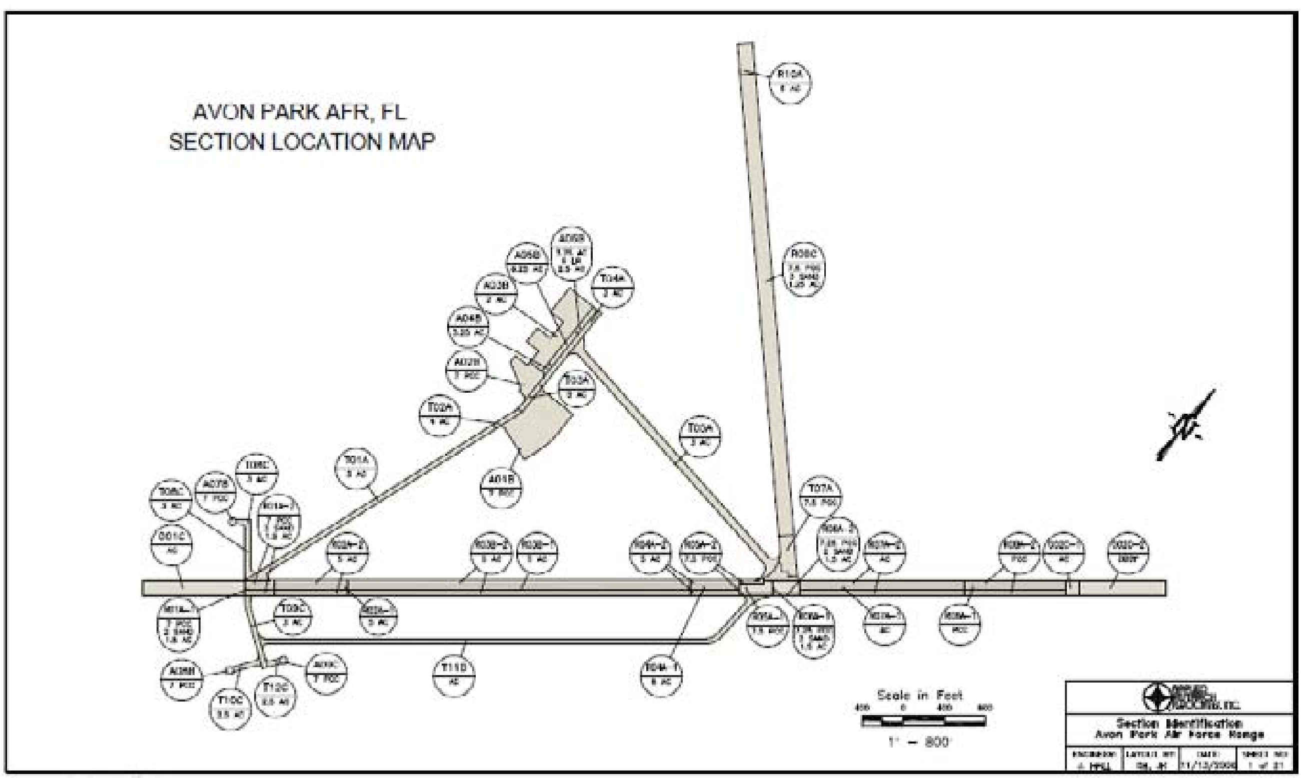
| BRANCH I.D. | SEC. I.D. | AGE @ INSPECT. | | | | | | P C I | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Jul. 1995 | Jun. 1999 | Feb. 2003 | Apr. 2006 | Apr. 2007 | Apr. 2010 | Jul. 1995 | Jun. 1999 | Feb. 2003 | Apr. 2006 | **APR 2007** | **APR 2010** | *APR 2012* |
| NE Pad Taxiway | V23-VE | 12 | 16 | 18 | 21 | 22 | 25 | 99 | 90 | 84 | 66 | **60/66** | **66** | *65* |
| Crash Barn un-named TX Warm-up 4 | CRAPR 11B | - | 2 | 6 | 9 | 10 | 13 | - | 97 | 83 | 74 | **63/73** | **73** | *72* |
| | CRAPR 11A | - | 2 | 6 | 9 | 10 | 13 | - | 95 | 67 | 62 | **58/66** | **65** | *64* |
| TX E | TXE-9 | 15 | 2 | 6 | 9 | 10 | 13 | 68 | 100 | 86 | 77 | **72/77** | **77** | *75* |
| TX D | TXD-8 | 15 | 2 | 6 | 9 | 10 | 13 | 54 | 99 | 80 | 74 | **69/74** | **73** | *73* |
| Warm-up 3 (2[nd] app) | WRMP 11B | 15 | 19 | 23 | 26 | 27 | 30 | 82 | 47 | 47 | 64 | **59/63** | **63** | *62* |
| Warm-up 3 (Base contract) | WRMP 11C | 16 | 5 | 7 | 10 | 11 | 14 | 67 | 100 | 90 | 80 | **74/78** | **78** | 77 |



# Avon Park AFR – Sep/Oct 2007

**Avon Park AFRB, FL – June 2007**



## EVALUATION OF CORROSION CONTROL MATERIALS FOR ASPHALT PAVEMENT PRESERVATION OF NAVAL/DOD FACILITIES

Application of GSB-88 at Avon Park Air Force Range during the week of June 18, 2007 was completed on several pavements, some of which were used to evaluate GSB on extensively distressed pavements; pavements considered Fair, Poor, and Very Poor relative to Pavement Condition Index (PCI). As such, rates of application were significantly adjusted at the direction of Greg Cline, hence, square areas adjusted accordingly. Specific rates and calculated adjusted rates are detailed in field notes and will be included in final evaluation reports.

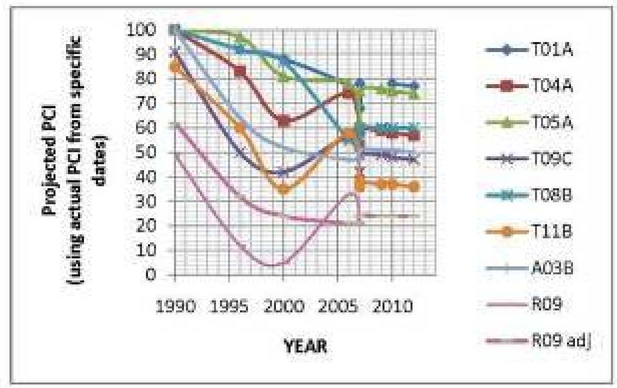
Therefore, based on Base Engineer's calculations and my verification, area adjustments as described above, and additional pavements; area of pavement treated with GSB-88 was:

| **Location/Description where GSB-88 Surface Treatment Applied** | **Section ID if applicable** | |
|---|---|---|
| Taxiway A | TW Alpha | 21,300 |
| Taxiway B | TW Bravo | 7,450 |
| Taxiway C | TW Charlie | 26,150 |
| Taxiway 3 & Taxiway 5 | TW 3 & TW 5 | 11,750 |
| Parallel Taxiway ('fair' condition) | Parallel TW | 41,500 |
| Apron D ('poor' condition) | Apron D | 36,150 |
| Inactive Runway 14/32 ('very poor') | RW 14/32 | 117,000 |
| Access Roads – FOD generating – Fire Use and Inactive 'Old' Taxiway B | Road C, B, A and Airfield Access to RW 14/32 | 38,700 |
| **Total Square Yards Treated for Corrosion Evaluation Project** | | **300,000** |
| Additional application | | 0 |
| Total for Avon Park | | 300,000 |

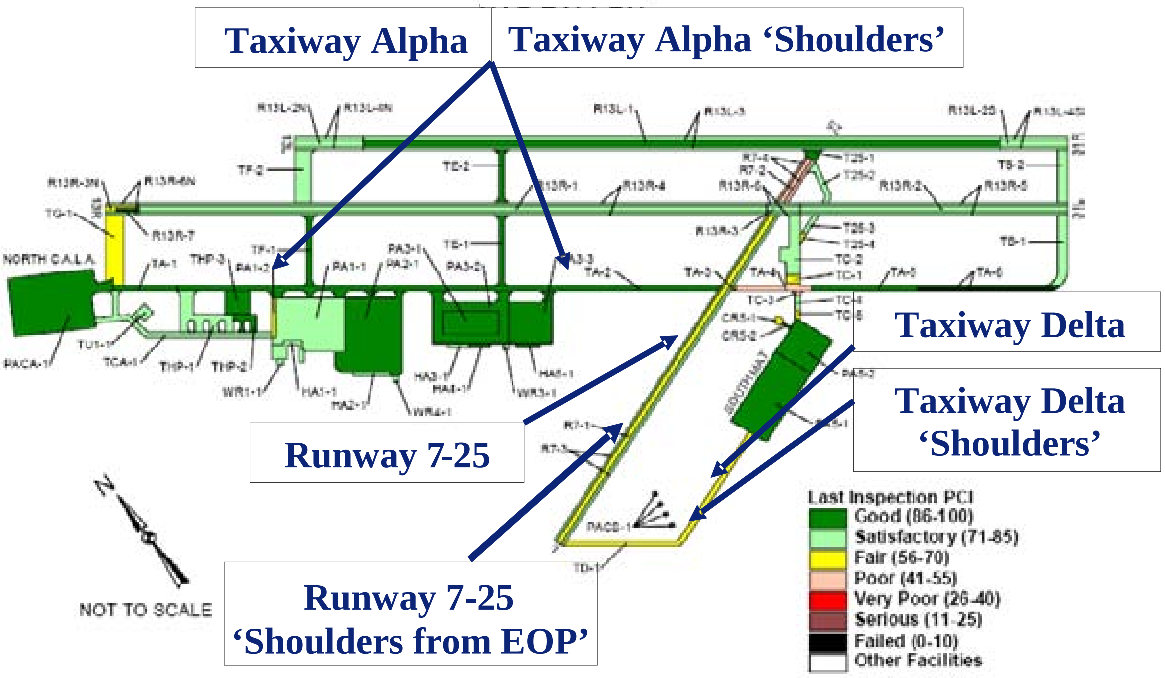
Base Engineer, Commanding Officer and Staff, and the ACC Major Command Pavement Engineer were very satisfied with the job. Total square yards indicated includes the additional area calculated for extensively distressed pavement evaluation (~70,000) and acceptable with the ACC Major Command Engineer.

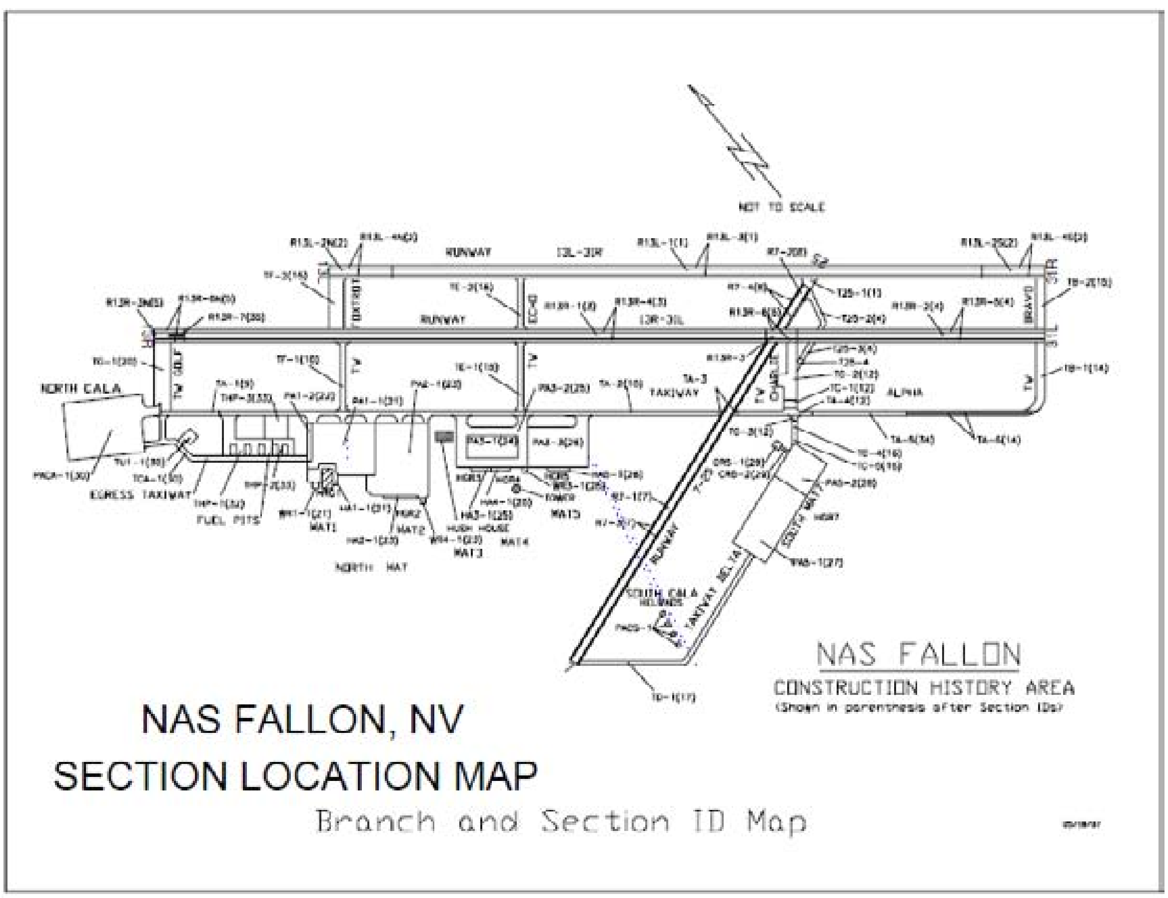
| **Avon Park AFR, FL** | | | | | | Application of GSB-88 week of June 18, 2007 | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BRANCH I.D. | SEC. I.D. | LAST CONST. DATE | SURF ACE | USE | TRUE AREA (sq. ft.) | AGE @ INSPECT. | | | | P C I | | | | Distress Classification | | | | | | | | | |
| | | | | | | Oct. 1996 | Oct. 2000 | Nov. 2006 | Jun. 2009 | Oct. 1996 | Oct. 2000 | Nov. 2006 | Jun. 2009 | % Climate | % Load | % Other | Distress | Severity | Quantit y | Distress | Severity | Quantit y |
| Taxiway Alpha | T01A<br>T02A<br>T03A | 6/30/1990 | AC | Taxiway | 181,750 | 6 | 10 | 16 | 19 | 92<br>81<br>75 | 88<br>65<br>60 | 77<br>55<br>48 | 62<br>55<br>42 | | | | | | | | | |
| Taxiway Bravo | T04A | 6/30/1990 | AC | Taxiway | 40,000 | 6 | 10 | 16 | 19 | 83 | 63 | 74 | 59 | | | | 48 | L<br>M | 900<br>200 | 43<br>Wea | L<br>L | 60%<br>100% |
| Taxiway Charlie | T05A | 6/30/1990 | AC | Taxiway | 221,250 | 6 | 10 | 16 | 19 | 97 | 81 | 78 | 66 | | | | | | | | | |
| Taxiway 3 | T09C | 10/31/1944 | AC | Taxiway | 35,000 | 9 | 13 | 19 | 22 | 50 | 42 | 56 | 49 | | | | 43 | M | 100% | Wea | L | 100% |
| Taxiway 5 | T08B | 6/30/1990 | AC | Taxiway | 32,000 | 6 | 10 | 16 | 19 | 92 | 87 | **55** | 60 | | | | | | | | | |
| Parallel Taxiway | T11B | 1/1/1942 | AC | Taxiway<br>Shoulder | 250,550<br>122,950 | 11 | 15 | 21 | 24 | | 35<br>- | 58 | 37 | | | | 43 | M<br>H | 80<br>20 | | | |
| Apron D | A03B | 6/30/1990 | AC | Apron | 188,000 | 6 | 10 | 16 | 19 | 64 | 52 | **47** | 49 | | | | | | | | | |
| RW 14/32 (inactive) | R09<br>T06B | 7/01/1944 | AC | Inactive Runway | 673,905<br>[41,250] | 23 | 27 | 33 | 36 | 12 | 5 | 33 | 24 | | | | 43 | M<br>H | 25%<br>75% | Wea | L<br>M | 75%<br>25% |
| 'Old' Taxiway B | 01 | 6/30/1988 | AC | FOD source Access Rd | 251,850 | | | | | | | | | | | | | | | | | |
| Fire Road 'C' | 01 | 6/30/1983 | AC | | 55,900 | | | | | | | | | | | | | | | | | |

| **Avon Park AFR, FL** | | Application of GSB-88 week of June 18, 2007 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BRANCH I.D. | SEC. I.D. | AGE @ INSPECT. | | | | | | P C I | | | | | | |
| | | Oct. 1996 | Oct. 2000 | Nov. 2006 | JUN 2007 | Jun. 2009 | MAR 2010 | Oct. 1996 | Oct. 2000 | Nov. 2006 | **JUN 2007** | Jun. 2009 | **MAR 2010** | ***JUN 2012*** |
| Taxiway Alpha | T01A<br>T02A<br>T03A | 6 | 10 | 16 | 17 | 19 | 20 | **92**<br>81<br>75 | **88**<br>65<br>60 | **77**<br>55<br>48 | **68/78** | 62<br>55<br>42 | **78**<br>**55**<br>**48** | *77* |
| Taxiway Bravo | T04A | 6 | 10 | 16 | 17 | 19 | 20 | 83 | 63 | 74 | **53/59** | 59 | **58** | *57* |
| Taxiway Charlie | T05A | 6 | 10 | 16 | 17 | 19 | 20 | 97 | 81 | 78 | **62/75** | 66 | **75** | *74* |
| Taxiway 3 | T09C | 9 | 13 | 19 | 20 | 22 | 23 | 50 | 42 | 56 | **42/49** | 49 | **48** | *47* |
| Taxiway 5 | T08B | 6 | 10 | 16 | 17 | 19 | 20 | 92 | 87 | **55** | **55/60** | 60 | **60** | *60* |
| Parallel Taxiway | T11B | 11 | 15 | 21 | 22 | 24 | 25 | | 35<br>- | 58 | **36/38** | 37 | **37** | *36* |
| Apron D | A03B | 6 | 10 | 16 | 17 | 19 | 20 | 64 | 52 | **47** | **47/51** | 49 | **51** | *50* |
| RW 14/32 (inactive) | R09<br>T06B | 23 | 27 | 33 | 34 | 36 | 37 | 12 | 5 | 33 | **21/24** | 24 | **24** | *24* |
| 'Old' Taxiway B | 01 | | | | | | | | | | | | | |
| Fire Road 'C' | 01 | | | | | | | | | | | | | |



## NAS Fallon, NV – Sep/Oct 2007



# EVALUATION OF CORROSION CONTROL MATERIALS FOR ASPHALT PAVEMENT PRESERVATION OF NAVAL/DOD FACILITIES

Application of GSB-88 at NAS Fallon, NV during the week of September 28 through October 2, 2007 was completed on several pavements. Rates of application were adjusted at the direction of Greg Cline, hence, square areas adjusted accordingly. Specific rates and calculated adjusted rates are detailed in field notes and will be included in final evaluation reports.

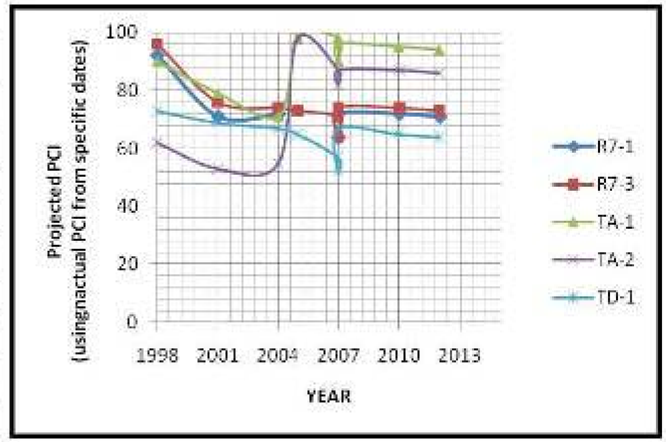
Therefore, based on Engineer's calculations and my verification, area adjustments as described above, and additional pavements; area of pavement treated with GSB-88 was:

| **Location/Description where GSB-88 Surface Treatment Applied** | **Section ID if applicable** | **SY Treated** |
|---|---|---|
| Runway 7-25 | R7-1 and R7-3 | 100,000 |
| Runway 7-25 'to EOP' | *R7-1 and R7-3* | 14,600 |
| Runway 7-25 'shoulders from EOP' | *R7-1 and R7-3* | 19,200 |
| Taxiway Alpha | TA-1 and TA-2 | 87,500 |
| Taxiway Alpha 'shoulders' | *TA-1 and TA-2* | 27,300 |
| Taxiway Delta | TD-1 | 19,600 |
| Taxiway Delta 'shoulders' | *TD-1* | 11,800 |
| **Total Square Yards Treated for Corrosion Evaluation Project** | | **280,000** |
| Additional application | | 0 |
| Total for NAS Fallon | | 280,000 |

Base Engineers and Air Ops were very satisfied with the job. Total square yards indicated includes the additional area calculated for unexpected increase of application rate for relatively new pavement on Taxiway Alpha (~15,000) and adds another condition for overall evaluation.

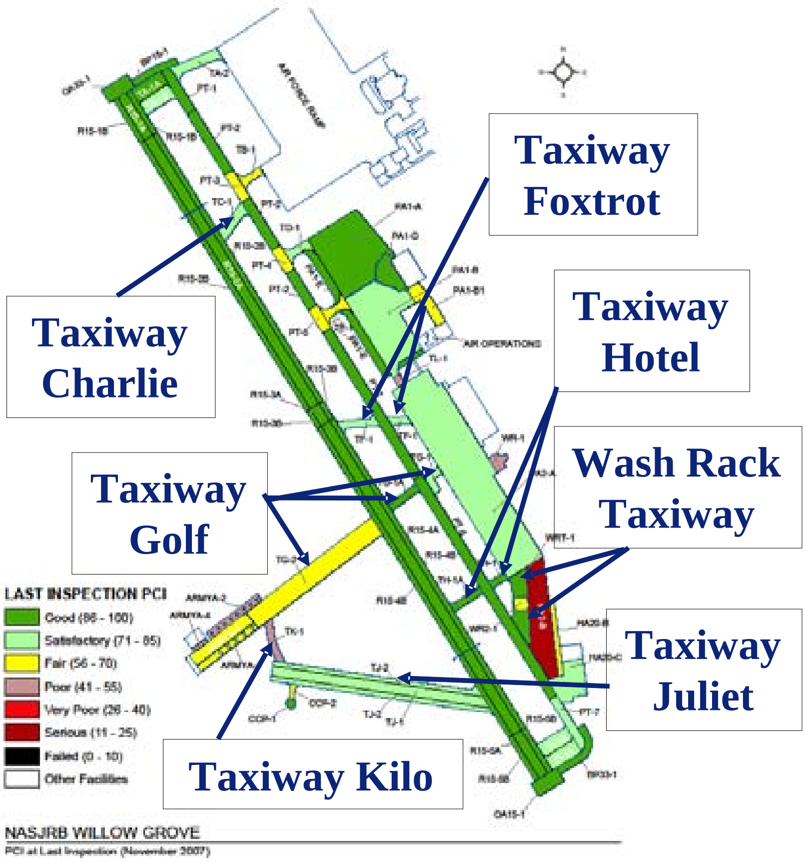
| NAS Fallon, NV | Application of GSS-88 week of September 28 through October 2, 2007 | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | AGE @ INSPECT | | | | P C I | | | | | | | | | | | | |
| BRANCH I.D. | SEC. I.D. | LAST CONST. DATE | SURFACE | USE | TRUE AREA (sq. ft.) | Oct. 1998 | Feb 2001 | Jun. 2004 | April 2007 | Oct. 1998 | Feb. 2001 | Jun. 2004 | April 2007 | % Climate | % Load | % Other | Distress | Severity | Quantity | Distress | Severity | Quantity |
| Runway 7-25 | R7-1 | 6/30/1991 | AAC | Runway | 596,000 | 7 | 10 | 13 | 16 | 92 | 71 | 72 | 64 | 88 | 12 | 0 | L&T Cr | L / M | 38308/ 12964 | W& Rav | L | 63867 |
| | R7-3 | 6/30/1991 | AAC | Runway | 298,000 | 7 | 10 | 13 | 16 | 96 | 76 | 74 | 71 | 100 | 0 | 0 | L&T Cr | L / M / H | 14519/ 5512/211 | W& Rav | L / H | 43554/ 111 |
| Runway 7-25 to EOP | - | 6/30/1991 | AAC | Shoulder | 131,400 | | | | | | | | | | | | | | | | | |
| Runway 7-25 'shoulders from EOP' | - | - | AC | Shoulder | 72800 | | | | | | | | | | | | | | | | | |
| Taxiway Alpha | TA-1 | 6/30/1996 6/30/2005 | AC | Taxiway | 61,525 | 2 | 5 | 8 | 2 | 90 | 75 | 71 | 98 | 100 | 0 | 0 | L&T Cr | L | 300 | | | |
| | TA-2 | 6/30/1984 6/30/2005 | AAC | Taxiway | 582,750 | 14 | 17 | 20 | 2 | 62 | 43 | 55 | 87 | 100 | 0 | 0 | L&T Cr | L | 24831 | | | |
| Taxiway Alpha 'shoulders' | - | 6/30/2005 | AC | Shoulder | 245,700 | | | | | | | | | | | | | | | | | |
| Taxiway Delta | TD-1 | 6/30/1983 | AAC | Taxiway | 176,250 | 15 | 18 | 21 | 24 | 63 | 59 | 67 | 57 | 72 | 28 | 0 | L&T Cr | L / M / H | 17300/ 1340/207 | W& Rav | L | 3813 |
| Taxiway Delta 'shoulders' | - | - | AC | Shoulder | 106,200 | | | | | | | | | | | | | | | | | |

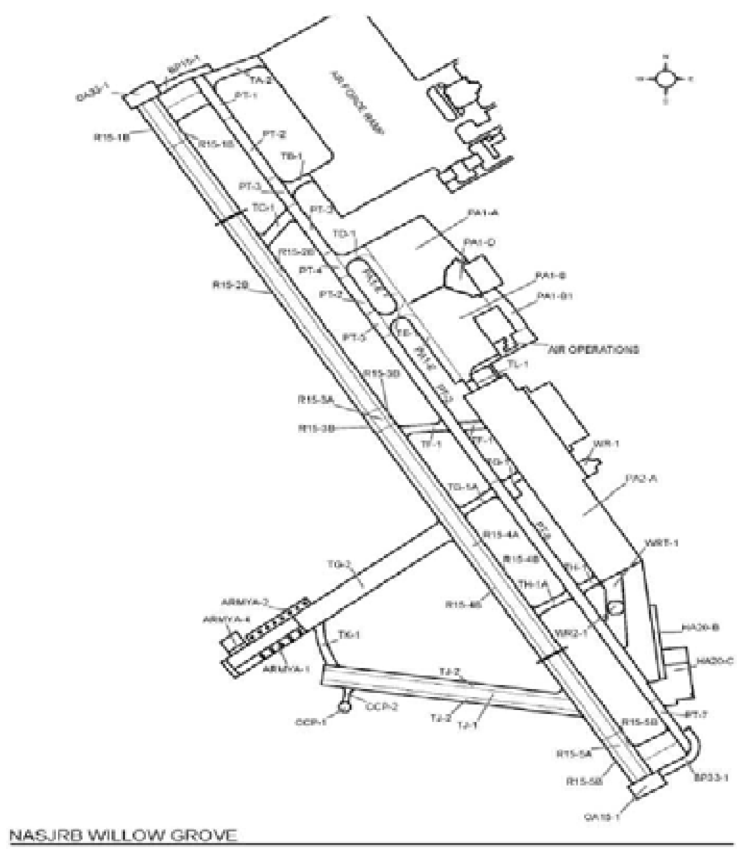
| NAS Fallon, NV | Application of GSS-88 week of September 28 through October 2, 2007 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | AGE @ INSPECT. | | | | | | P.C.I. | | | | | | |
| BRANCH I.D. | SEC. I.D. | Oct. 1998 | Feb. 2001 | Jun. 2004 | April 2007 | Sep 2007 | April 2010 | Oct. 1998 | Feb. 2001 | Jun. 2004 | April 2007 | OCT 2007 | APR 2010 | *DEC 2012* |
| Runway 7-25 | R7-1 | 7 | 10 | 13 | 16 | 16 | 19 | 92 | 71 | 72 | 64 | 64/72 | 72 | *71* |
| | R7-3 | 7 | 10 | 13 | 16 | 16 | 19 | 96 | 76 | 74 | 71 | 64/74 | 74 | *73* |
| Runway 7-25 to EOP | - | - | - | - | - | - | - | - | - | - | - | | | |
| Runway 7-25 'shoulders from EOP' | - | - | - | - | - | - | - | - | - | - | - | | | |
| Taxiway Alpha | TA-1 | 2 | 5 | 8 | 2 | 2 | 5 | 90 | 75 | 71 | 98 | 90/96 | Note 1 95 | *94* |
| | TA-2 | 14 | 17 | 20 | 2 | 2 | 5 | 62 | 43 | 55 | 87 | 82/87 | Note 1 87 | *86* |
| Taxiway Alpha 'shoulders' | - | - | - | - | - | - | - | - | - | - | - | | | |
| Taxiway Delta | TD-1 | 15 | 18 | 21 | 24 | 24 | 27 | 63 | 59 | 67 | 57 | 52/66 | 65 | *64* |
| Taxiway Delta 'shoulders' | - | - | - | - | - | - | - | - | - | - | - | | | |




Note 1: Taxiway is experiencing structural failure; an actual PCI would not be representative. Review of pavement surface only; no change from 2007

**NASJRB Willow Grove, PA – October 2007**



# EVALUATION OF CORROSION CONTROL MATERIALS FOR ASPHALT PAVEMENT PRESERVATION OF NAVAL/DOD FACILITIES

Application of GSB-88 at NASJRB Willow Grove, PA during the week of October 9th, 2007 was completed on several pavements. Rates of application were adjusted at the direction of Greg Cline, hence, square areas adjusted accordingly. Specific rates and calculated adjusted rates are detailed in field notes and will be included in final evaluation reports.

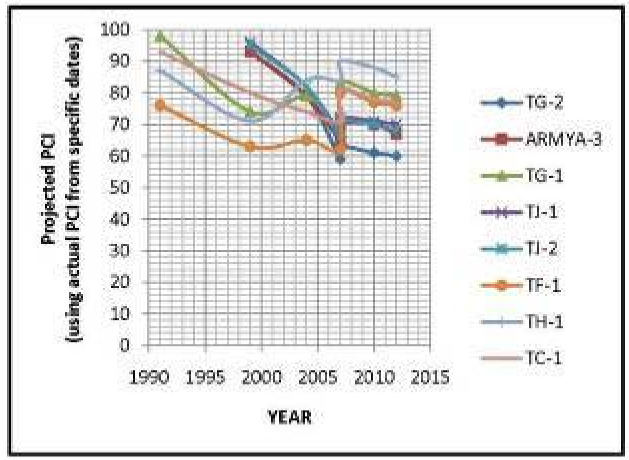
Therefore, based on Engineer's calculations and my verification, area adjustments as described above, and additional pavements; area of pavement treated with GSB-88 was:

| **Location/Description where GSB-88 Surface Treatment Applied** | **Section ID if applicable** | **SY Treated** |
|---|---|---|
| Taxiway Golf | TG-2 and ARMYA-3 | 38,870 |
| Taxiway Golf 'North of Runway' | TG-1 | 7,200 |
| Taxiway Juliet | TJ-1 and TJ-2 | 58,570 |
| Taxiway Foxtrot | TF-1 | 9,300 |
| Taxiway Hotel | TH-1 | 7,200 |
| Taxiway Charlie | TC-1 | 5,100 |
| Wash Rack Taxiway | WRT-1 | 23,760 |
| **Total Square Yards Treated for Corrosion Evaluation Project** | | **150,000** |
| Additional application | | 0 |
| Total for NASJRB Willow Grove | | 150,000 |

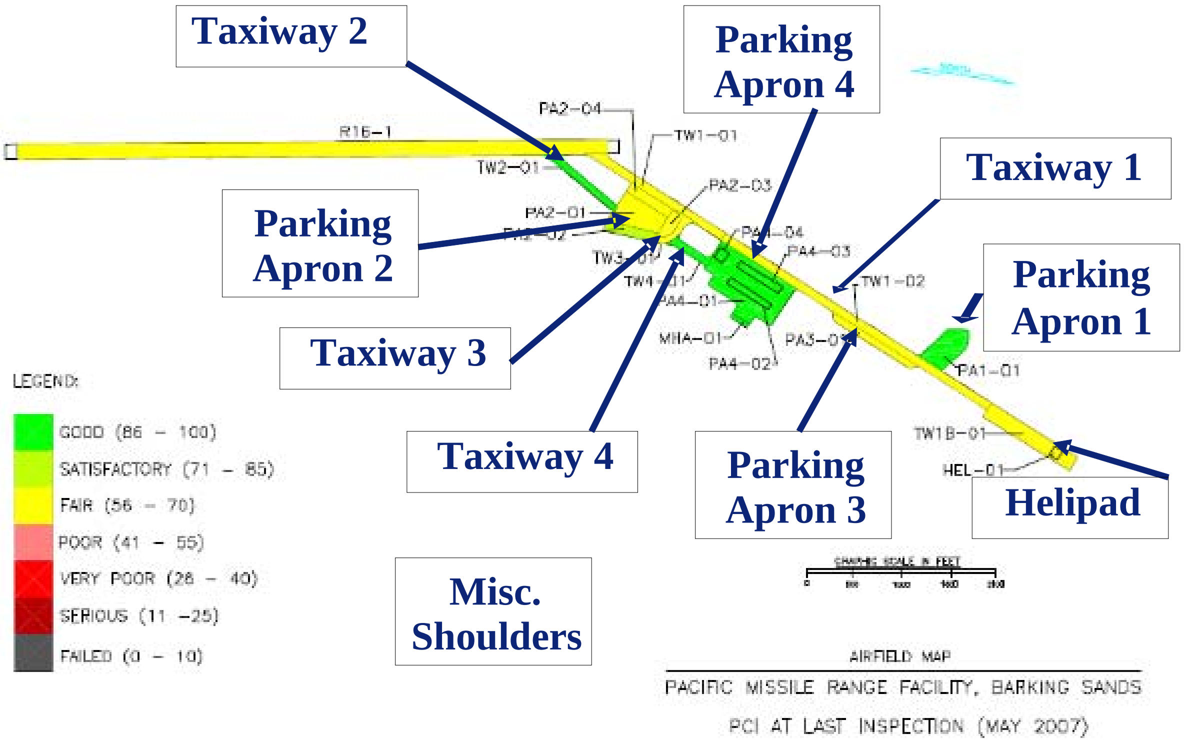
Base Engineers and Air Ops were very satisfied with the job. Total square yards indicated includes the additional equivalent area calculated for increased dilution ratio (increase in solids), which was significantly greater than originally scheduled (per direction by Greg).

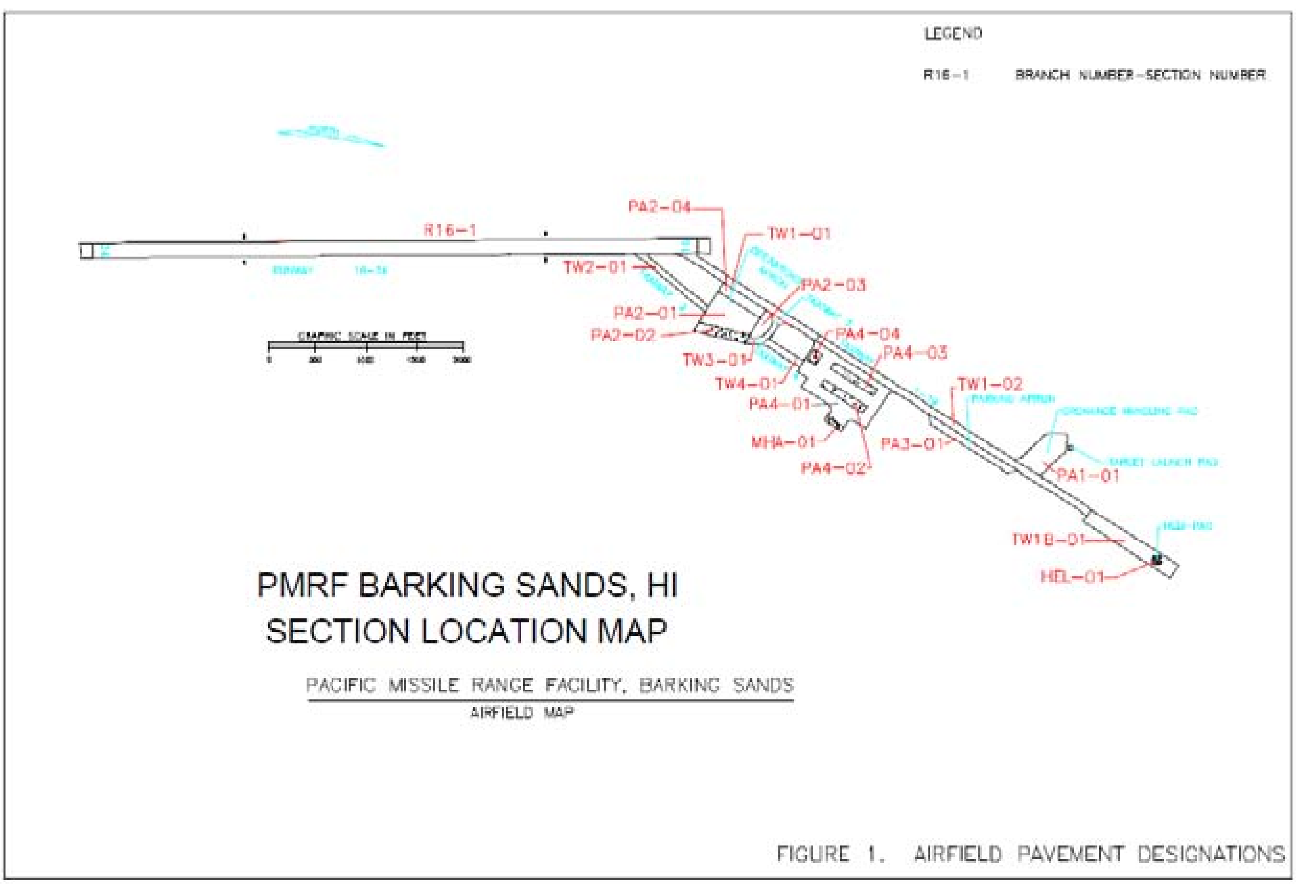
| NASJRB Willow Grove, PA | Application of GSB-88 week of October 9th, 2007 | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BRANCH I.D. | SEC. I.D. | LAST CONST. DATE | SURF ACE | USE | TRUE AREA (sq. ft.) | AGE @ INSPECT. | | | | P C I | | | | Distress Classification | | | | | | | | | |
| | | | | | | Jun. 1991 | Sep. 1999 | Oct. 2004 | Nov. 2007 | Jun. 1991 | Sep. 1999 | Oct. 2004 | Nov. 2007 | % Climate | % Load | % Other | Distress | Severity | Quantit y | Distress | Severity | 15908 /17106 |
| Taxiway Golf | TG-2<br>ARMYA3 | 11/01/199 3 | AC | Taxiway | 314,718 | 28 | 6 | 11 | 14 | 42 | 93 | 79<br>79 | 63<br>70 | 84<br>100 | 16<br>0 | 0 | Block Cr<br>Block Cr | L<br>L | 27991<br>3026 | L&T Cr<br>L&T Cr | L / M<br>L / M | 9499 / 1706 |
| | TG-1 | 6/15/1985 | AC | Taxiway | 24,327 | 6 | 14 | 19 | 22 | 98 | 74 | 79 | 83 | 100 | 0 | 0 | Block Cr | L | 854 | L&T Cr | L / M | 2049 / 247 |
| Taxiway Juliet | TJ-1 | 6/15/1993 | AC | Taxiway | 216,462 | 19 | 6 | 11 | 14 | 65 | 96 | 82 | 72 | 100 | 0 | 0 | L&T Cr | L | 6248 | L&T Cr | M / H | 6180 / 500 |
| | TJ-2 | 6/15/1993 | AC | Taxiway | 221,766 | 19 | 6 | 11 | 14 | 67 | 95 | 82 | 71 | 100 | 0 | 0 | L&T Cr | L | 8054 | L&T Cr | M | 13467 |
| Taxiway Foxtrot | TF-1 | 6/15/1985 | AC | Taxiway | 62,656 | 6 | 14 | 19 | 22 | 76 | 63 | 65 | 80 | 100 | 0 | 0 | Block Cr | L | 14967 | L&T Cr | L | 4808 |
| Taxiway Hotel | TH-1 | 6/30/1986<br>8/01/2005 | AC | Taxiway | 15,680 | 6 | 14 | 19 | 2 | 100 [87 in 1994] | 71 | 84 | 90 | 100 | 0 | 0 | L&T Cr | L | 1512 | | | |
| Taxiway Charlie | TC-1 | 6/15/1985 | AC | Taxiway | 36,953 | 6 | 14 | 19 | 22 | 93 | 80 | 74 | 81 | 100 | 0 | 0 | L&T Cr | L | 3895 | L&T Cr | M / H | 326 / 316 |
| Wash Rack Taxiway | WRT-1 | 10/01/199 6 | AAC | Taxiway | 157,740 | - | - | 8 | 11 | - | - | 100 | 86 | 100 | 0 | 0 | L&T Cr | L | 4533 | L&T Cr | M | 1157 |

| NASJRB Willow Grove, PA | Application of GSB-88 week of October 9th, 2007 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BRANCH I.D. | SEC. I.D. | AGE @ INSPECT. | | | | | | P C I | | | | | | |
| | | Jun. 1991 | Sep. 1999 | Oct. 2004 | Oct. 2007 | Nov. 2007 | MAR 2010 | Jun. 1991 | Sep. 1999 | Oct. 2004 | **Oct. 2007** | Nov. 2007 | **MAR 2010** | *DEC 2012* |
| Taxiway Golf | TG-2<br>ARMYA3 | 28 | 6 | 11 | 14 | 14 | 17 | 42 | 93 | 79<br>79 | **59**<br>**65** | 63<br>70 | **60**<br>**70** | *60*<br>*67* |
| | TG-1 | 6 | 14 | 19 | 22 | 22 | 25 | 98 | 74 | 79 | **69** | 83 | **80** | *79* |
| Taxiway Juliet | TJ-1 | 19 | 6 | 11 | 14 | 14 | 17 | 65 | 96 | 82 | **67** | 72 | **71** | *70* |
| | TJ-2 | 19 | 6 | 11 | 14 | 14 | 17 | 67 | 95 | 82 | **66** | 71 | **70** | *68* |
| Taxiway Foxtrot | TF-1 | 6 | 14 | 19 | 22 | 22 | 25 | 76 | 63 | 65 | **62** | 80 | **77** | *76* |
| Taxiway Hotel | TH-1 | 6 | 14 | 19 | 2 | 2 | 5 | 100 [87 in 1994] | 71 | 84 | **84** | 90 | **85** | *85* |
| Taxiway Charlie | TC-1 | 6 | 14 | 19 | 22 | 22 | 25 | 93 | 80 | 74 | **71** | 81 | **78** | *77* |
| Wash Rack Taxiway | WRT-1 | - | - | 8 | 11 | 11 | 14 | - | - | 100 | **81** | 86 | **82** | *80* |



## PMRF Barking Sands, HI – December 2007



## EVALUATION OF CORROSION CONTROL MATERIALS FOR ASPHALT PAVEMENT PRESERVATION OF NAVAL/DOD FACILITIES

Application of GSB-88 at PMRF Barking Sands, HI during the week of December 13th through 20th, 2007 was completed on several pavements. Rates of application were adjusted at the direction of Greg Cline, hence, square areas adjusted accordingly. In addition, material shipping required special containers as well as the applicator therefore square areas were adjusted accordingly. Specific rates and calculated adjusted rates are detailed in field notes and will be included in final evaluation reports.

Therefore, based on Engineer's calculations and my verification, area adjustments as described above, and additional pavements; area of pavement treated with GSB-88 was:

| Location/Description where GSB-88 Surface Treatment Applied | Section ID if applicable | SY Treated |
|---|---|---|
| Taxiway 1 | TW1-01 and TW1-02 | 69,443 |
| Taxiway 2 | TW2-01 | 10,947 |
| Taxiway 3 | TW3-01 | 5,370 |
| Taxiway 4 | TW4-01 | 6,316 |
| Parking Apron 1 | PA1-01 | 19,545 |
| Parking Apron 2 | PA2-01, PA2-03, and PA2-04 | 36,398 |
| Parking Apron 3 | PA3-01 | 13,659 |
| Parking Apron 4 | PA4-01 | 66,975 |
| Helipad | HEL | 4,406 |
| Misc. Shoulders | Shoulders | 2,713 |
| **Total Square Yards Treated for Corrosion Evaluation Project** | | **235,772** |
| Additional application | | 0 |
| Total for PMRF Barking Sands | | 235,772 |

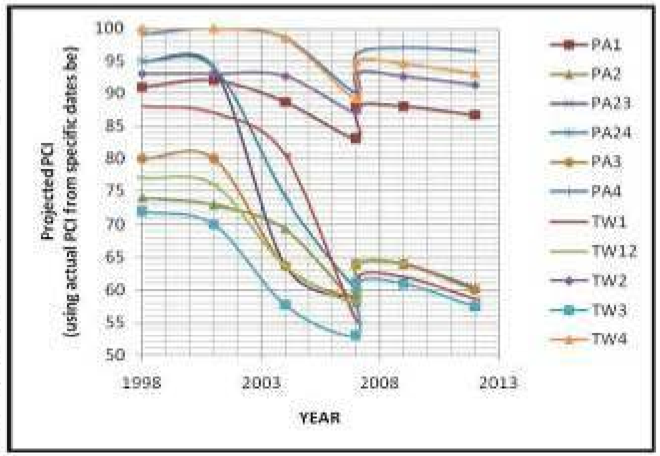
Base Engineering/Public Works, Air Ops, and the Airfield Manager were very satisfied with the job. Total square yards indicated includes the additional equivalent area calculated for premium shipping and increased dilution ratio (increase in solids), which was significantly greater than originally scheduled (per direction by Greg).

**PMRF Barking Sands, HI** Application of GSB-88 week of December 13th through 20th, 2007

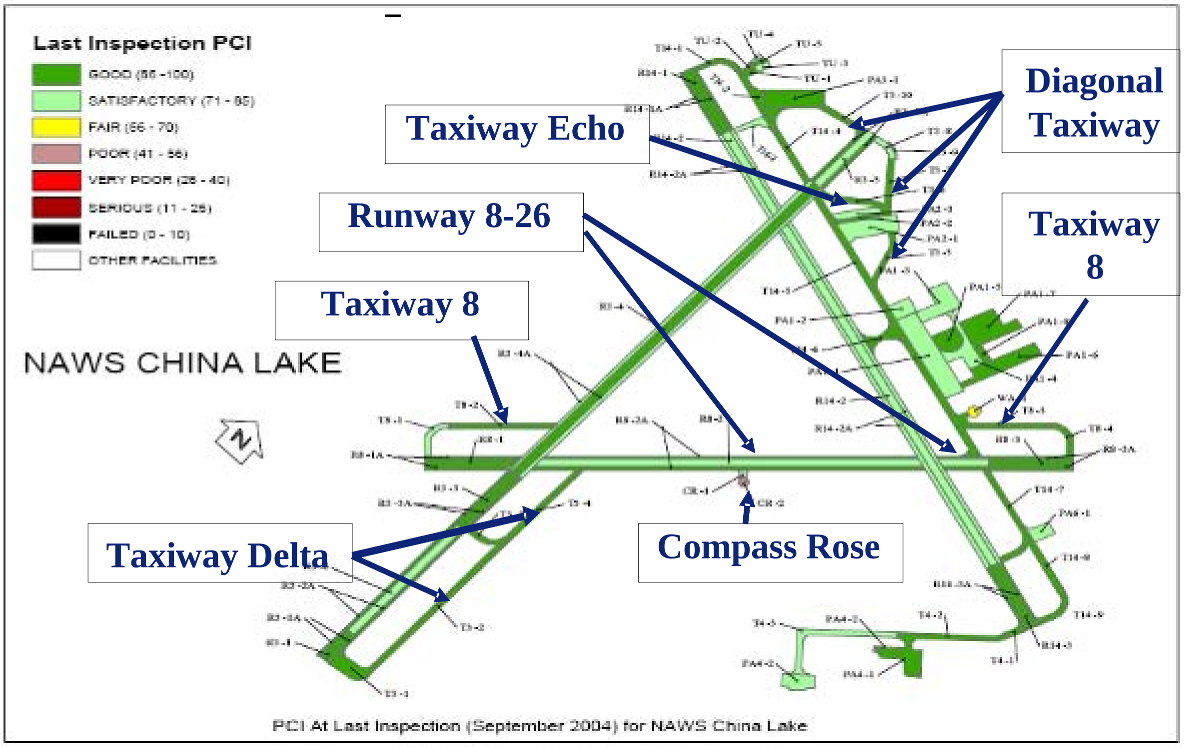
| BRANCH I.D. | SEC. I.D. | LAST CONST. DATE | SURF ACE | USE | TRUE AREA (sq. ft.) | AGE @ INSPECT. | | | | P C I | | | | Distress Classification | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Oct. 1998 | Feb. 2001 | March 2004 | May 2007 | Oct. 1998 | Feb. 2001 | March 2004 | May 2007 | % Climate | % Load | % Other | Distress | Severity | Quantity | Distress | Severity | Quantity |
| HEL (Helipad) | 01 | 6/30/1988 | AC | Helipad | 22,500 | 10 | 13 | 16 | 19 | 97 | *96* | *84* | 64 | 100 | 0 | 0 | Block Cr | L | 22500 | | | |
| PA1 (Ordnance) | 01 | 6/30/1988 | AAC | Apron | 124,758 | 10 | 13 | 16 | 19 | 91 | 92 | 89 | 88 | 71 | 0 | 29 | L&T Cr | L | 2496 | L&T Cr | M | 188 |
| PA2 (Operations) | 01 | 6/30/1986 | AC | Apron | 145,826 | 12 | 15 | 18 | 21 | 74 | 73 | 70 | 64 | 100 | 0 | 0 | Block Cr | L | 145826 | | | |
| PA2 | 03 | 6 30/1986 | AC | Apron | 37,500 | 12 | 15 | 18 | 21 | 95 | *94* | *64* | 64 | 100 | 0 | 0 | Block Cr | L | 37500 | | | |
| PA2 | 04 | 6/30/1986 | AC | Apron | 49,000 | 12 | 15 | 18 | 21 | 95 | 94 | 75 | 64 | 100 | 0 | 0 | Block Cr | L | 49000 | | | |
| PA3 | 01 | 6/30/1988 | AC | Apron | 69,750 | 10 | 13 | 16 | 19 | 80 | 80 | 64 | 64 | 100 | 0 | 0 | Block Cr | L | 69875 | | | |
| PA4 | 01 | 1/30/1994 | AC | Apron | 342,000 | 4 | 7 | 10 | 13 | 99 | 100 | 99 | 96 | 45 | 55 | 0 | L&T Cr | L | 1079 | | | |
| TW1 | 01 | 6/30/1983 | AAC | Taxiway | 102,750 | 15 | 18 | 21 | 24 | 88 | 87 | 82 | 62 | 100 | 0 | 0 | Block Cr | L | 98468 | Block Cr | M / H | 3425 / 857 |
| TW1 | 02 | 6/30/1988 | AAC | Taxiway | 251,848 | 10 | 13 | 16 | 19 | 77 | 76 | 64 | 64 | 100 | 0 | 0 | Block Cr | L | 251848 | | | |
| TW2 | 01 | 6/30/1983 | AC | Taxiway | 55,900 | 15 | 18 | 21 | 24 | 93 | 93 | 93 | 93 | 100 | 0 | 0 | L&T Cr | L | 734 | L&T Cr | M | 35 |
| TW3 | 01 | 6/30/1983 | AC | Taxiway | 27,420 | 15 | 18 | 21 | 24 | 72 | 70 | 58 | 61 | 100 | 0 | 0 | Block Cr | L | 25800 | Block Cr | M | 1620 |
| TW4 | 01 | 1/31/1994 | AC | Taxiway | 32,3505 | 4 | 7 | 10 | 13 | 100 | 100 | 99 | 95 | 100 | 0 | 0 | L&T Cr | L | 259 | | | |

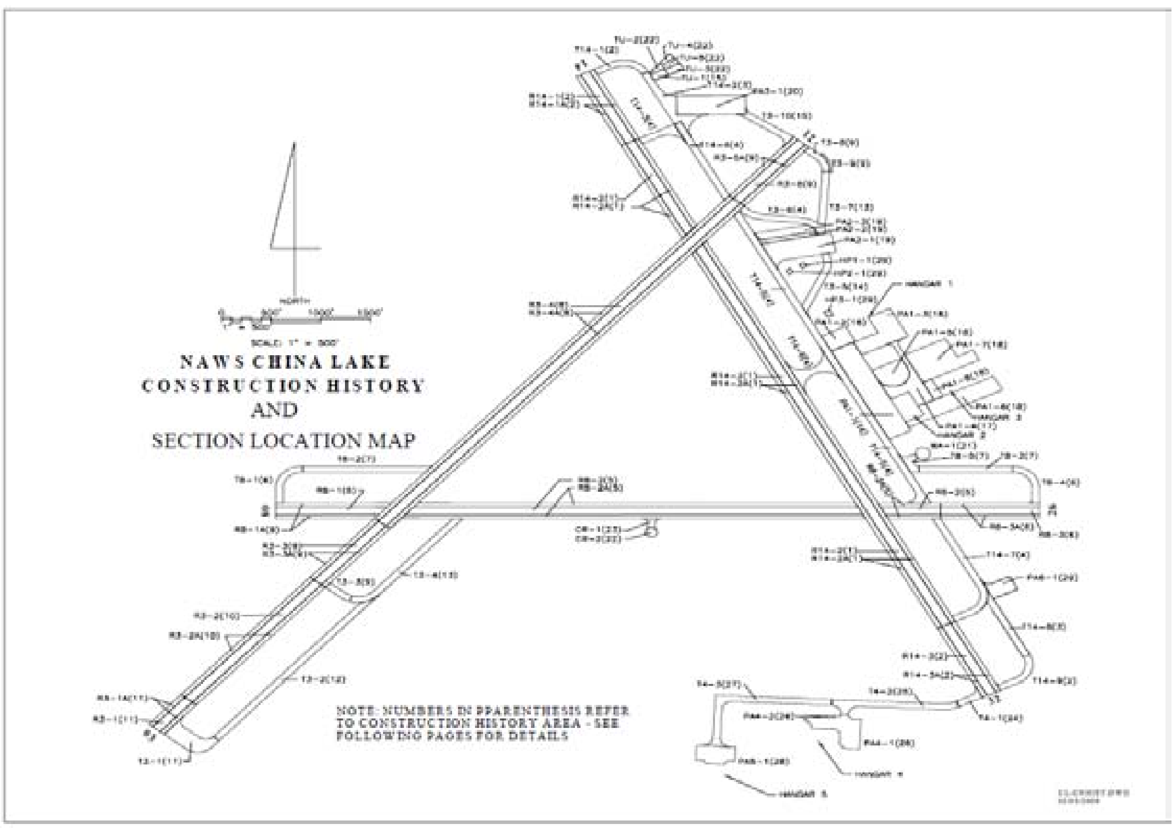
**PMRF Barking Sands, HI** Application of GSB-88 week of December 13th through 20th, 2007

| BRANCH I.D. | SEC. I.D. | AGE @ INSPECT. | | | | | | P C I | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Oct. 1998 | Feb. 2001 | March 2004 | May 2007 | DEC 2007 | DEC 2009 | Oct. 1998 | Feb. 2001 | March 2004 | May 2007 | **DEC 2007** | **DEC 2009** | *DEC 2012* |
| HEL (Helipad) | 01 | 10 | 13 | 16 | 19 | 19 | 21 | 97 | 96 | 84 | 68 | **68/78** | **78** | *78* |
| PA1 (Ordnance) | 01 | 10 | 13 | 16 | 19 | 19 | 21 | 91 | 92 | 89 | 88 | **83/88** | **88** | *87* |
| PA2 (Operations) | 01 | 12 | 15 | 18 | 21 | 21 | 23 | 74 | 73 | *69* | 64 | **58/64** | **64** | *60* |
| PA2 | 03 | 12 | 15 | 18 | 21 | 21 | 23 | 95 | *94* | *64* | 64 | **59/64** | **64** | *60* |
| PA2 | 04 | 12 | 15 | 18 | 21 | 21 | 23 | 95 | 94 | *75* | 64 | **60/64** | **64** | *60* |
| PA3 | 01 | 10 | 13 | 16 | 19 | 19 | 21 | 80 | 80 | 64 | 64 | **59/64** | **64** | *60* |
| PA4 | 01 | 4 | 7 | 10 | 13 | 13 | 15 | 99 | 100 | 99 | 96 | **90/96** | **97** | *97* |
| TW1 | 01 | 15 | 18 | 21 | 24 | 24 | 26 | 88 | 87 | 82 | 62 | **55/62** | **62** | *59* |
| TW1 | 02 | 10 | 13 | 16 | 19 | 19 | 21 | 77 | 76 | 64 | 64 | **58/64** | **64** | *60* |
| TW2 | 01 | 15 | 18 | 21 | 24 | 24 | 26 | 93 | 93 | 93 | 93 | **87/93** | **93** | *91* |
| TW3 | 01 | 15 | 18 | 21 | 24 | 24 | 26 | 72 | 70 | 58 | 61 | **61/61** | **61** | *57* |
| TW4 | 01 | 4 | 7 | 10 | 13 | 13 | 15 | 100 | 100 | 99 | 95 | **95/95** | **95** | *93* |



## NAWS China Lake, CA – May 2008



## EVALUATION OF CORROSION CONTROL MATERIALS FOR ASPHALT PAVEMENT PRESERVATION OF NAVAL/DOD FACILITIES

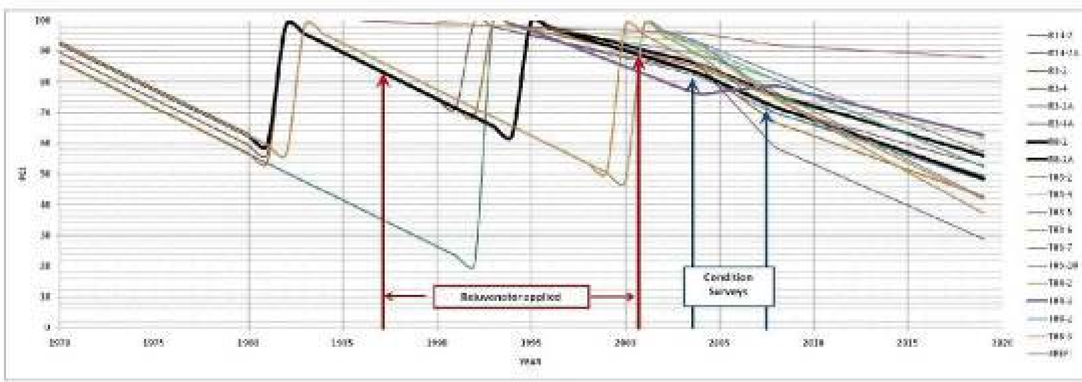
Application of GSB-88 at NAWS China Lake, CA during the weeks of May 12th and 19th, 2008 was completed on several pavements. Rates of application were adjusted at the direction of Greg Cline. Specific rates and calculations are detailed in field notes and will be included in final evaluation reports.

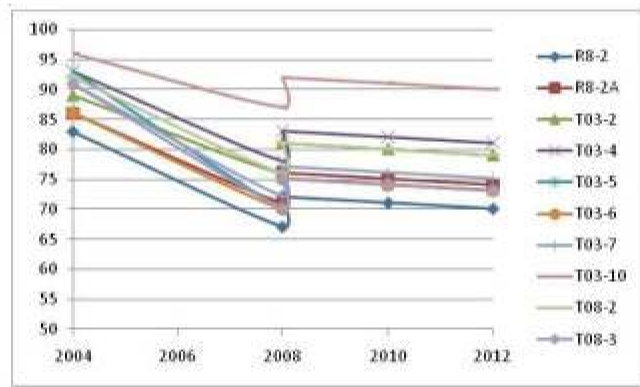
Therefore, based on Engineer's calculations and my verification, area of pavement treated with GSB-88 was:

| **Location/Description where GSB-88 Surface Treatment Applied** | **Section ID if applicable** | **SY Treated** |
|---|---|---|
| Runway 8-26 | R8-2 and R8-2A | 73,210 |
| Taxiway 8 | T8-3 | 10,600 |
| Diagonal Taxiway | T3-5 | 10,995 |
| | T3-7 | 5,950 |
| | T3-10 | 5,355 |
| Taxiway Echo | T3-6 | 7,726 |
| Taxiway Delta | T3-2 and T3-4 | 30,810 |
| Taxiway 8 | T8-2 | 10,600 |
| Compass Rose | CR-1 | 1,205 |
| | | |
| **Total Square Yards Treated for Corrosion Evaluation Project** | | **156,451** |
| Additional application | | 0 |
| Total for NAWS China Lake | | 156,451 |

Base Engineering/Public Works, Air Ops, and the Airfield Manager were very satisfied with the job.

| NAWS China Lake, CA | Application of GSB-88 weeks of May 12th and 19th, 2008 | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BRANCH I.D. | SEC. I.D. | LAST CONST. DATE | SURF ACE | USE | TRUE AREA (sq. ft.) | AGE @ INSPECT. | | | | P C I | | | | Distress Classification | | | | | | | | | | |
| | | | | | | Sep. 2004 | MAY 2008 | Oct. 2008 | MAY 2010 | Sep. 2004 | **MAY 2008** | Oct. 2008 | **MAY 2010** | % Climate | % Load | % Other | Distress | Severity | Quantity | Distress | Severity | Quantity |
| Runway 8-26 | R8-2 | 6/01/1995 | AAC | Runway | 515,600 | 9 | 13 | 13 | 15 | 83 | **67/72** | 72 | **71** | 71 | 29 | 0 | L&T Cr | L / M | 34133/ 4656 | L&T Cr W & Rav | H L | 67 59 |
| | R8-2A | 6/01/1995 | AAC | Runway | 100,000 | 9 | 13 | 13 | 15 | 86 | **71/76** | 76 | **75** | 69 | 31 | 0 | L&T Cr | L / M | 27821/ 6968 | L&T Cr | H | 207 |
| Taxiway 8 | T8-3 | 6/01/2001 | AAC | Taxiway | 95,387 | 3 | 7 | 7 | 9 | 91 | **70/75** | 75 | **75** | 47 | 53 | 0 | L&T Cr | L | 5536 | L&T Cr | L | 156 |
| Diagonal Taxiway | T3-5 | 6/01/2001 | AAC | Taxiway | 98,940 | 3 | 7 | 7 | 9 | 93 | **70/75** | 75 | **74** | 84 | 16 | 0 | L&T Cr | L / M | 8097/ 700 | L&T Cr | H | 33 |
| | T3-7 | 6/01/2001 | AAC | Taxiway | 53,550 | 3 | 7 | 7 | 9 | 91 | **72/77** | 77 | **76** | 78 | 22 | 0 | L&T Cr | L / M | 2271/ 345 | L&T Cr | H | 11 |
| | T3-10 | 6/01/2001 | AAC | Taxiway | 48,190 | 3 | 7 | 7 | 9 | 96 | **87/92** | 92 | **91** | 100 | 0 | 0 | L&T Cr | L | 1113 | | | |
| Taxiway Echo | T3-6 | 6/01/2001 | AAC | Taxiway | 69,545 | 3 | 7 | 7 | 9 | 86 | **70/75** | 75 | **74** | 85 | 15 | 0 | L&T Cr | L / M | 3965/ 861 | L&T Cr | H | 60 |
| Taxiway Delta | T3-2 | 6/01/2002 | AAC | Taxiway | 160,900 | 2 | 6 | 6 | 8 | 89 | **76/81** | 81 | **80** | 76 | 24 | 0 | L&T Cr | L | 7878 | L&T Cr | M | 583 |
| | T3-4 | 6/01/2002 | AAC | Taxiway | 116,369 | 2 | 6 | 6 | 8 | 93 | **78/83** | 83 | **82** | 74 | 26 | 0 | L&T Cr | L | 5397 | L&T Cr | M | 311 |
| Taxiway 8 | T8-2 | 6/01/2001 | AAC | Taxiway | 95,325 | 3 | 7 | 7 | 9 | 92 | **76/81** | 81 | **80** | 100 | 0 | 0 | L&T Cr | L / M | 2610/ 1013 | L&T Cr | H | 75 |
| Compass Rose | CR-1 | 7/01/1995 | AAC | Apron | 10,840 | 9 | 13 | 13 | 15 | 81 | **55/55** | 55 | **55** | 57 | 43 | 0 | L&T Cr | L / M | 292/ 295 | L&T Cr | H | 24 |



# APPENDIX D

# SKID RESISTANCE FRICTION TESTING

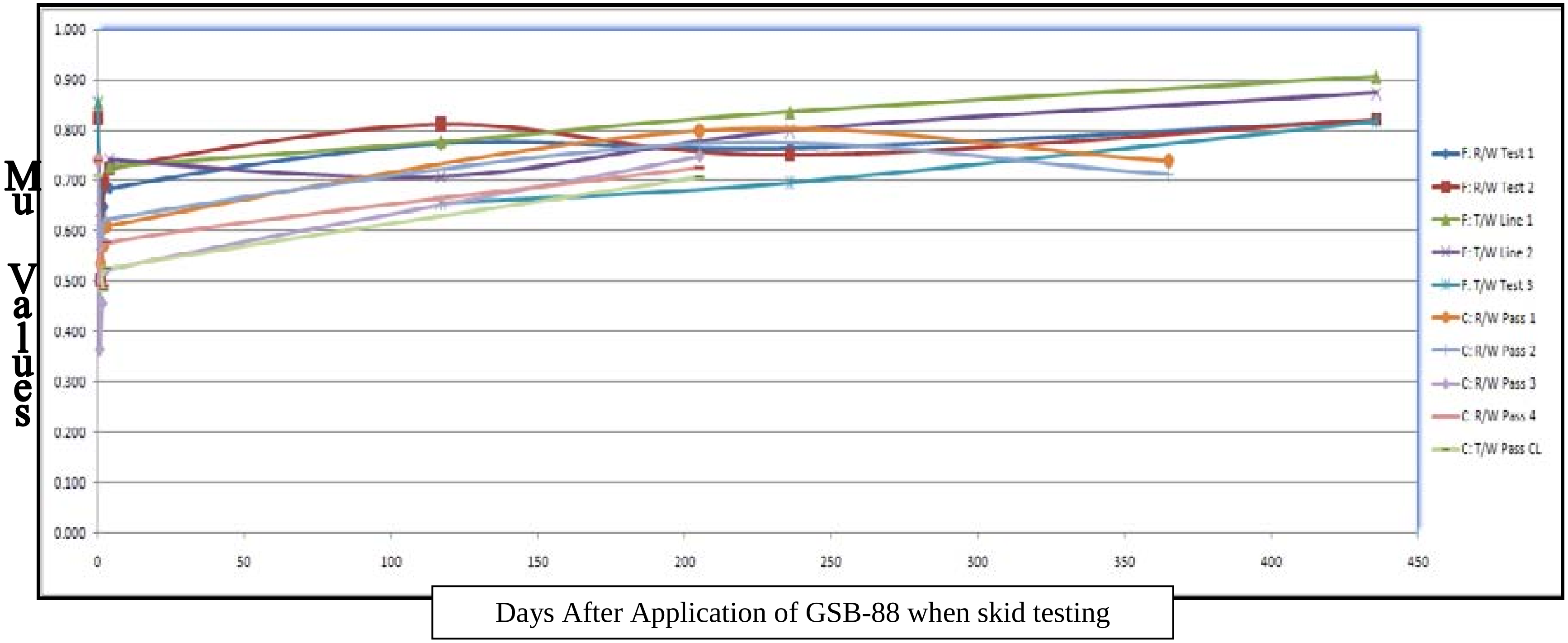



**Figure D-1. Test results of all friction testing performed.**

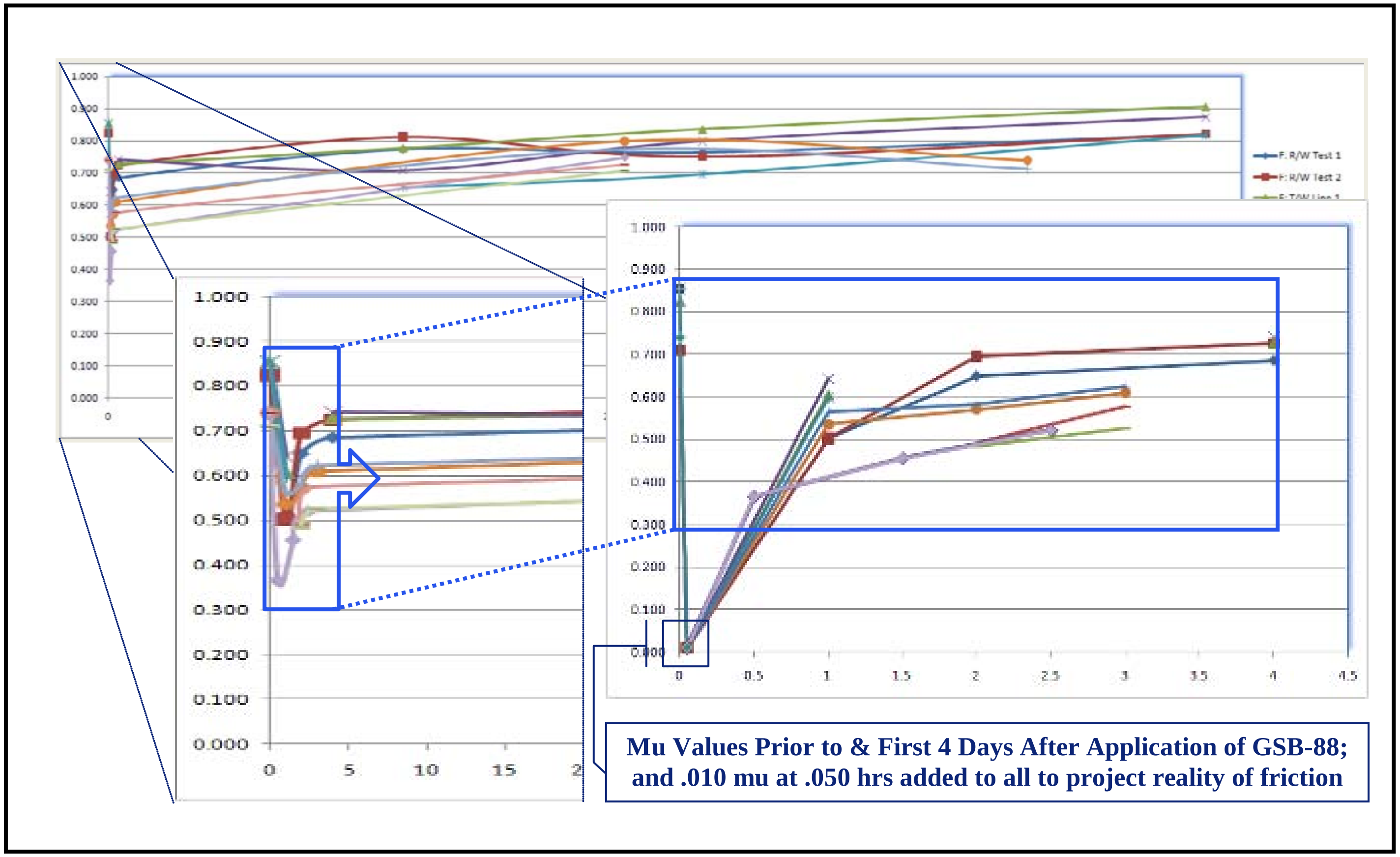



**Figure D-2. Test results of all friction testing performed.**

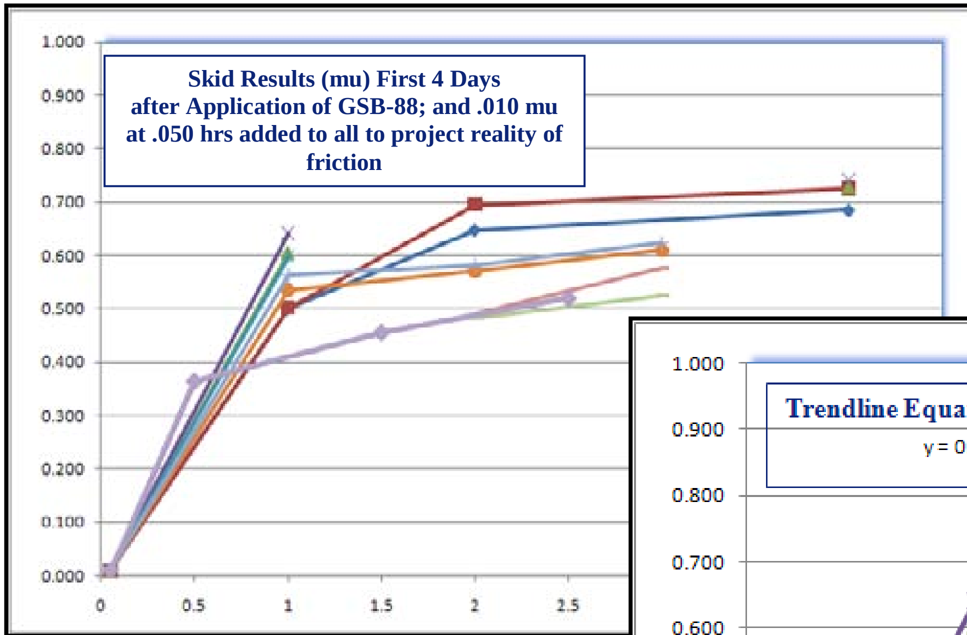



**Figure D-3. Above, shows test results of all friction testing performed the first 4 days after application of GSB-88.**

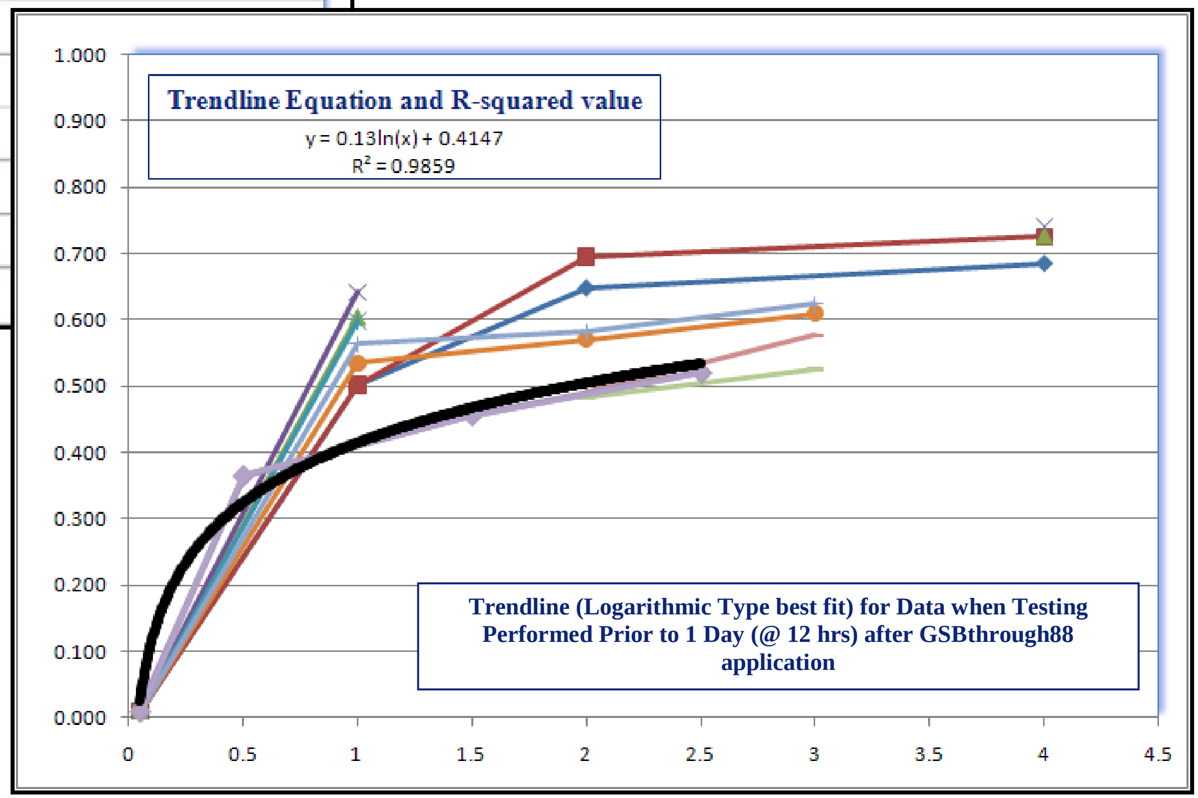



**Figure D-4. Right, shows same as Figure D-3 with a Trendline for data when testing performed prior to 1 day.**

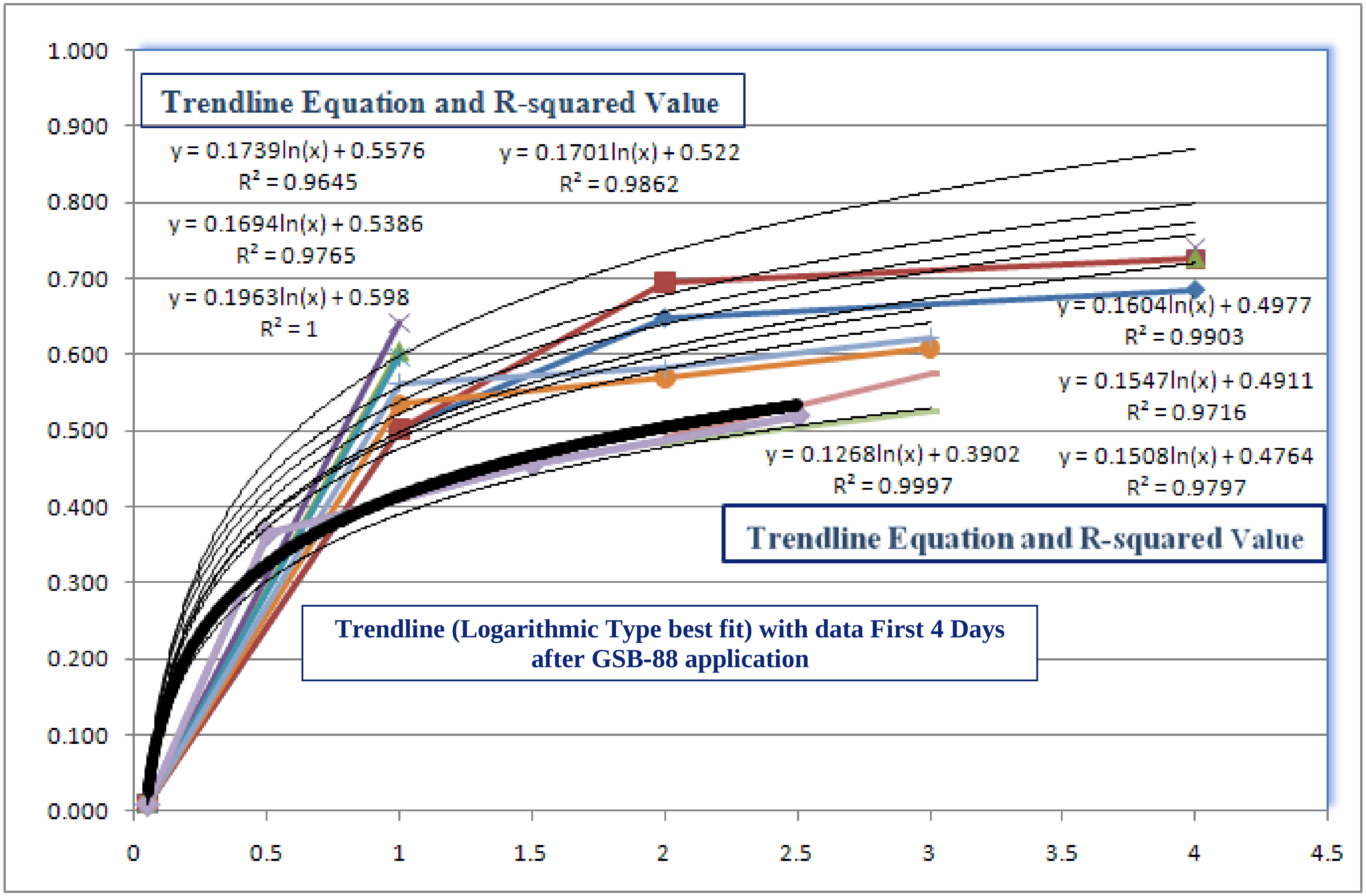



**Figure D-5. Trendlines developed for each set of tests representing first 4 days after application.**

# APPENDIX E

# REVIEW
# OF MICROPAVER DATABASES TO
# EVALUATE PERFORMANCE OF GSB-88
# ON AIRFIELD PAVEMENTS

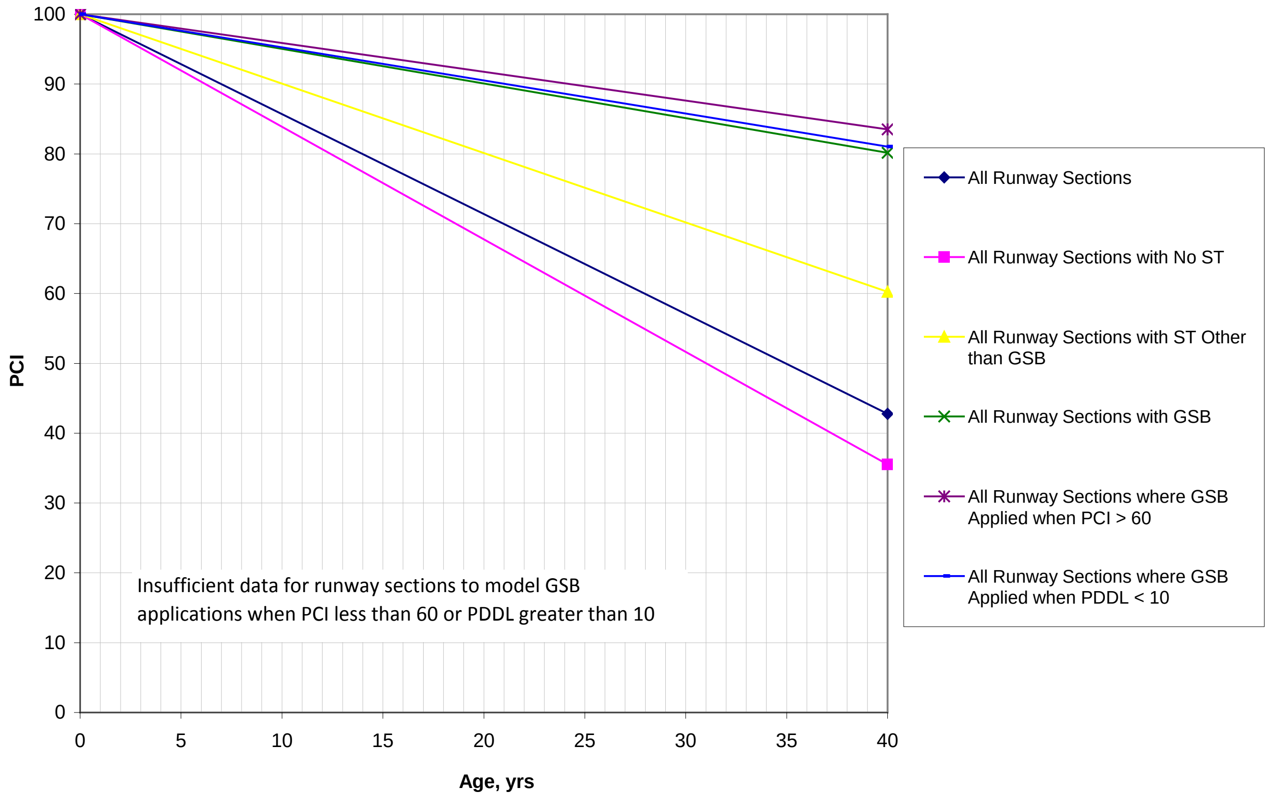



**Figure E-1. Oregon runway sections.**

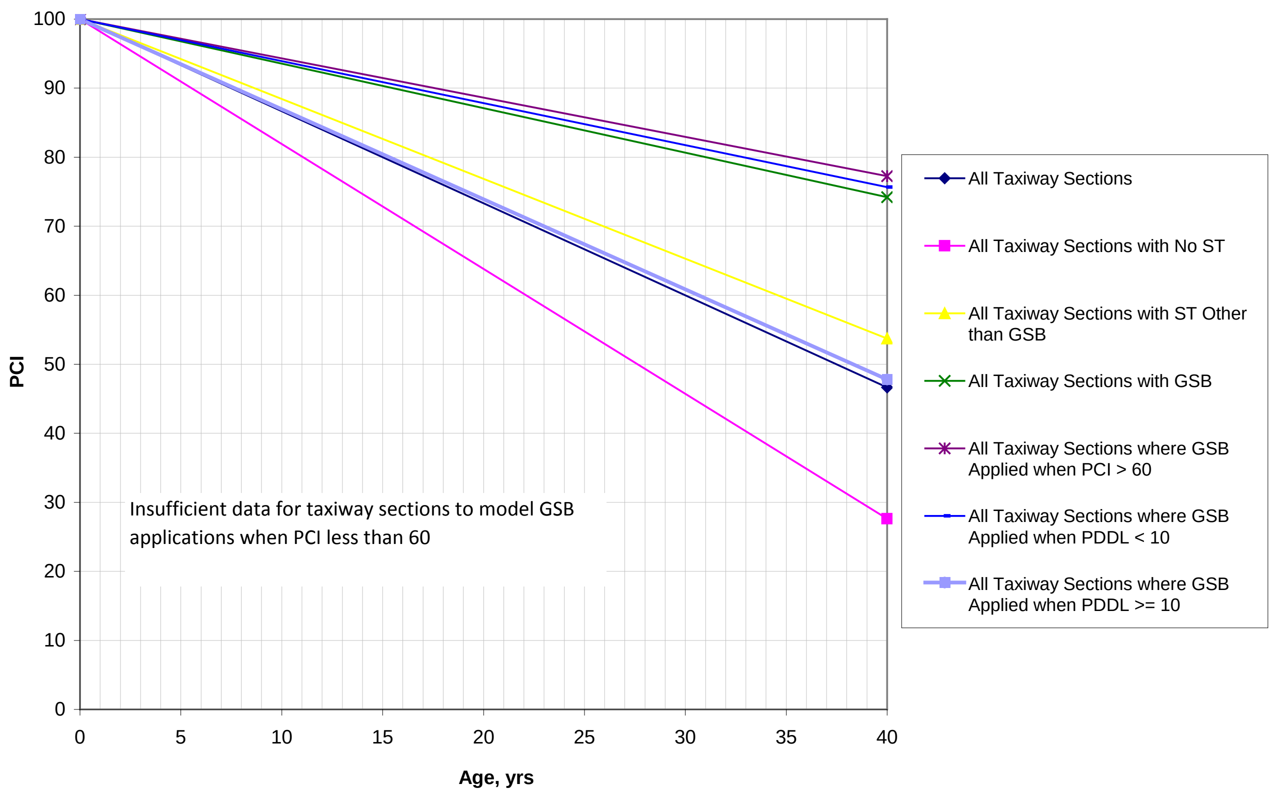



**Figure E-2. Oregon taxiway sections.**

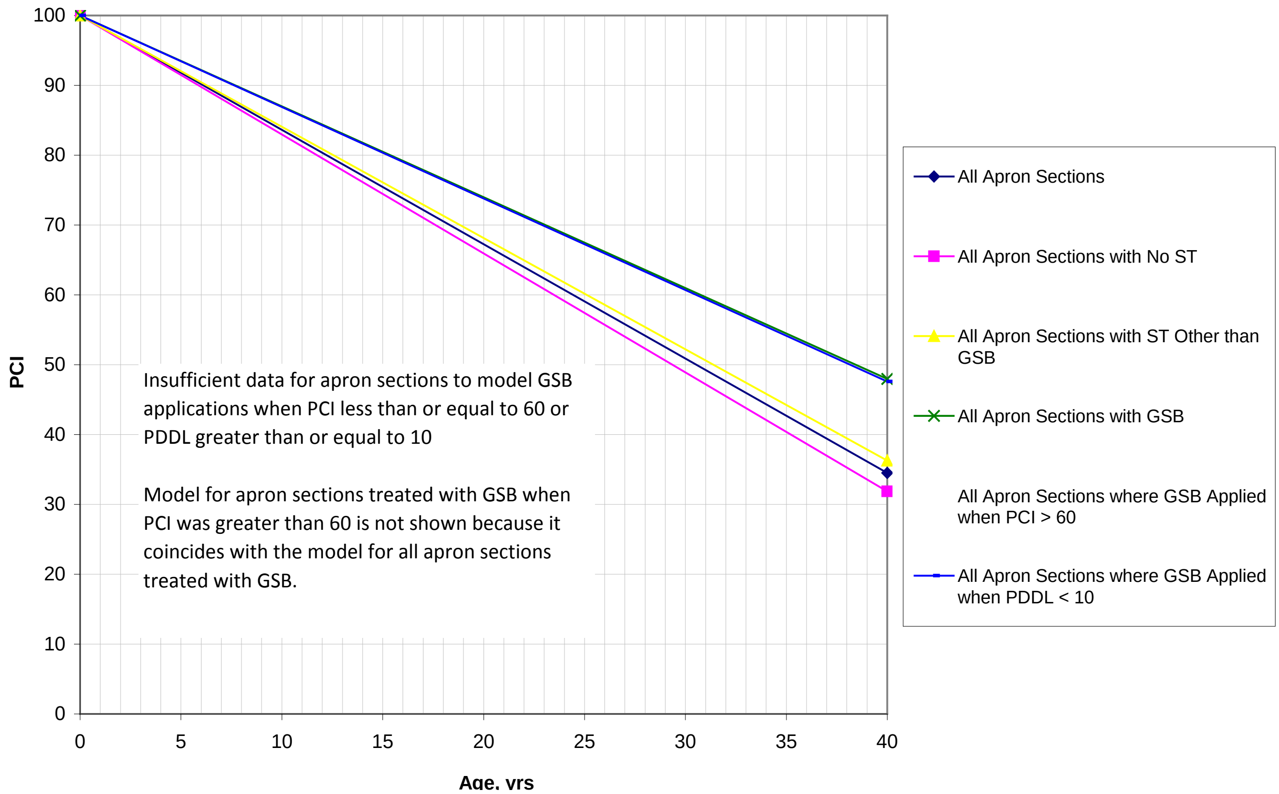



**Figure E-3. Oregon apron sections.**

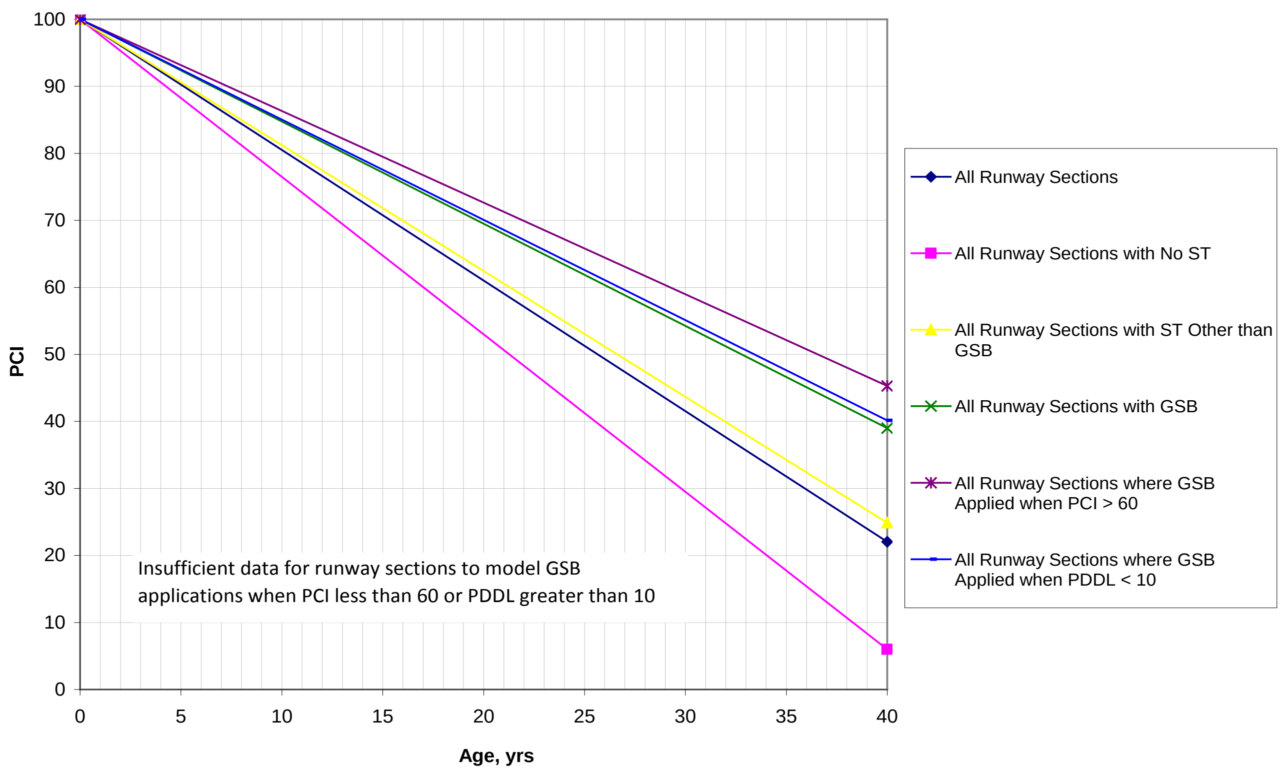



**Figure E-4. Colorado runway sections.**

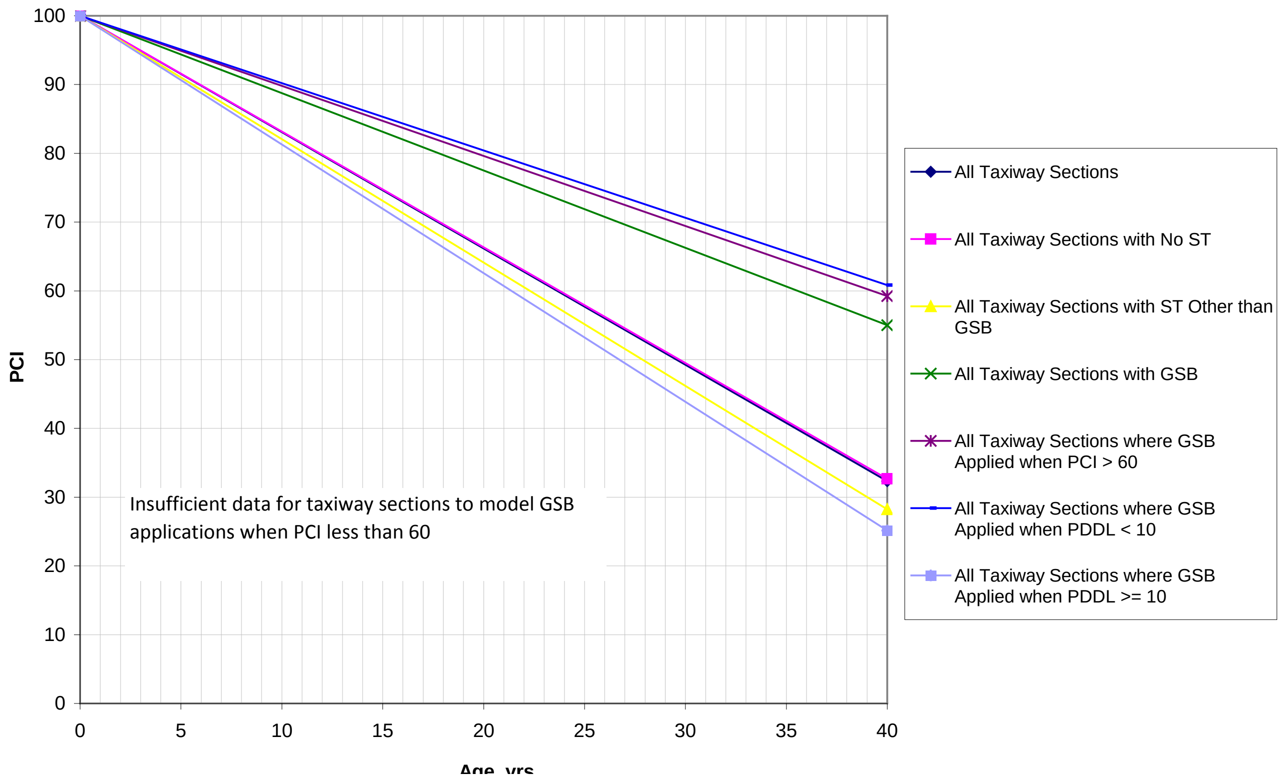



**Figure E-5. Colorado taxiway sections.**

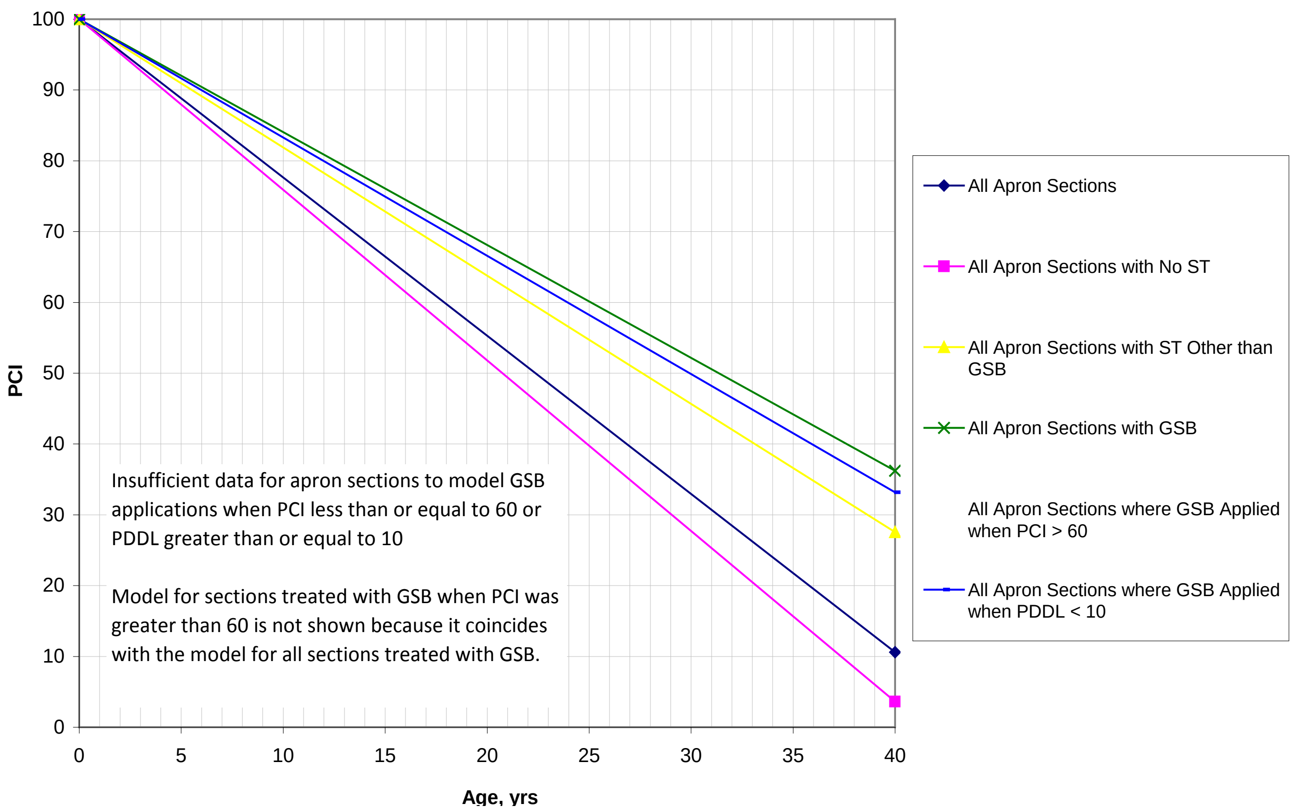



**Figure E-6. Colorado apron sections.**

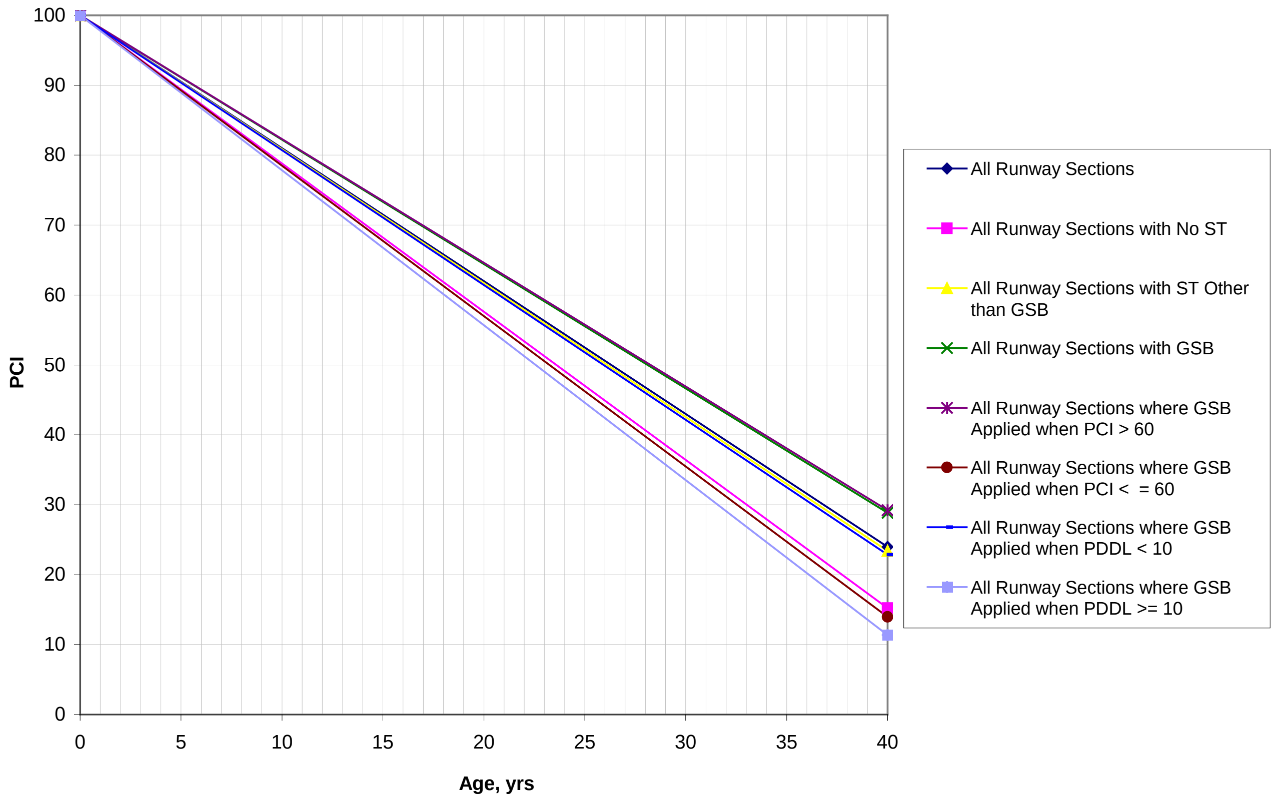



**Figure E-7. Utah runway sections.**

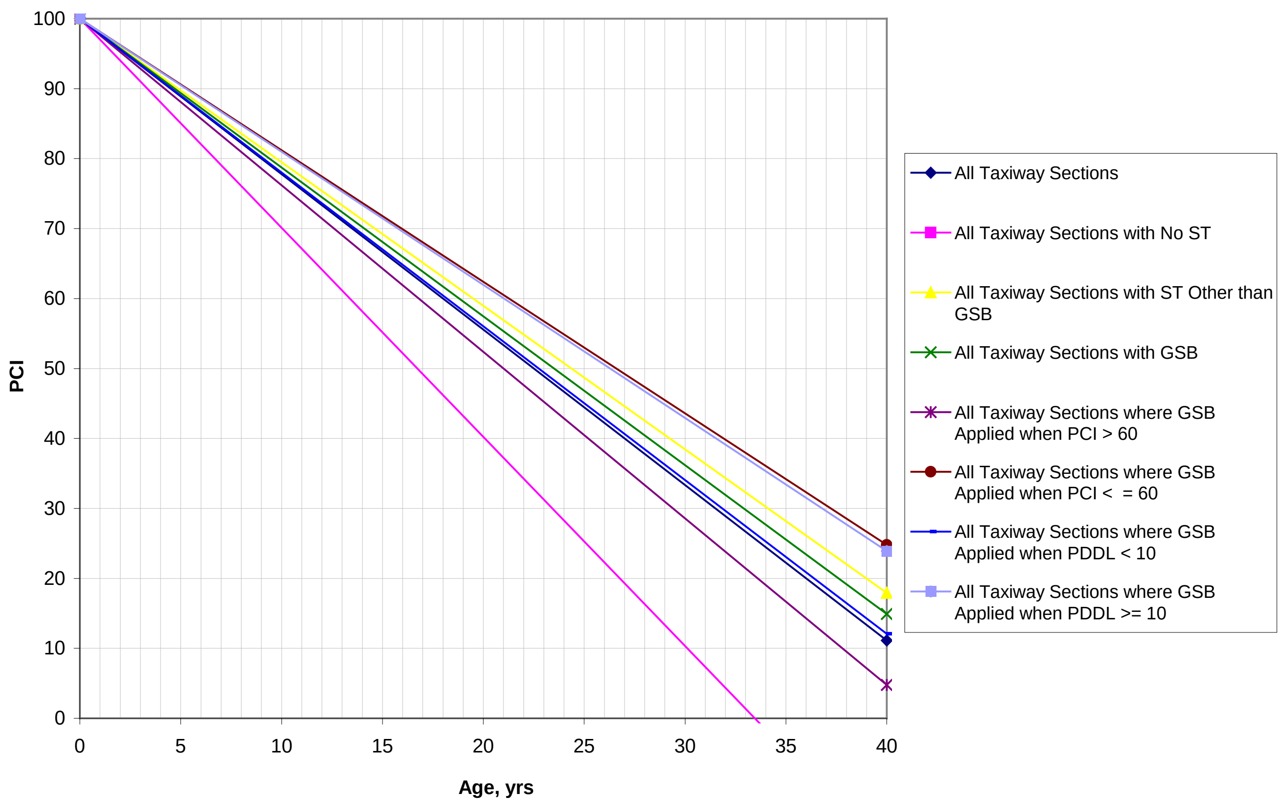



**Figure E-8. Utah taxiway sections.**

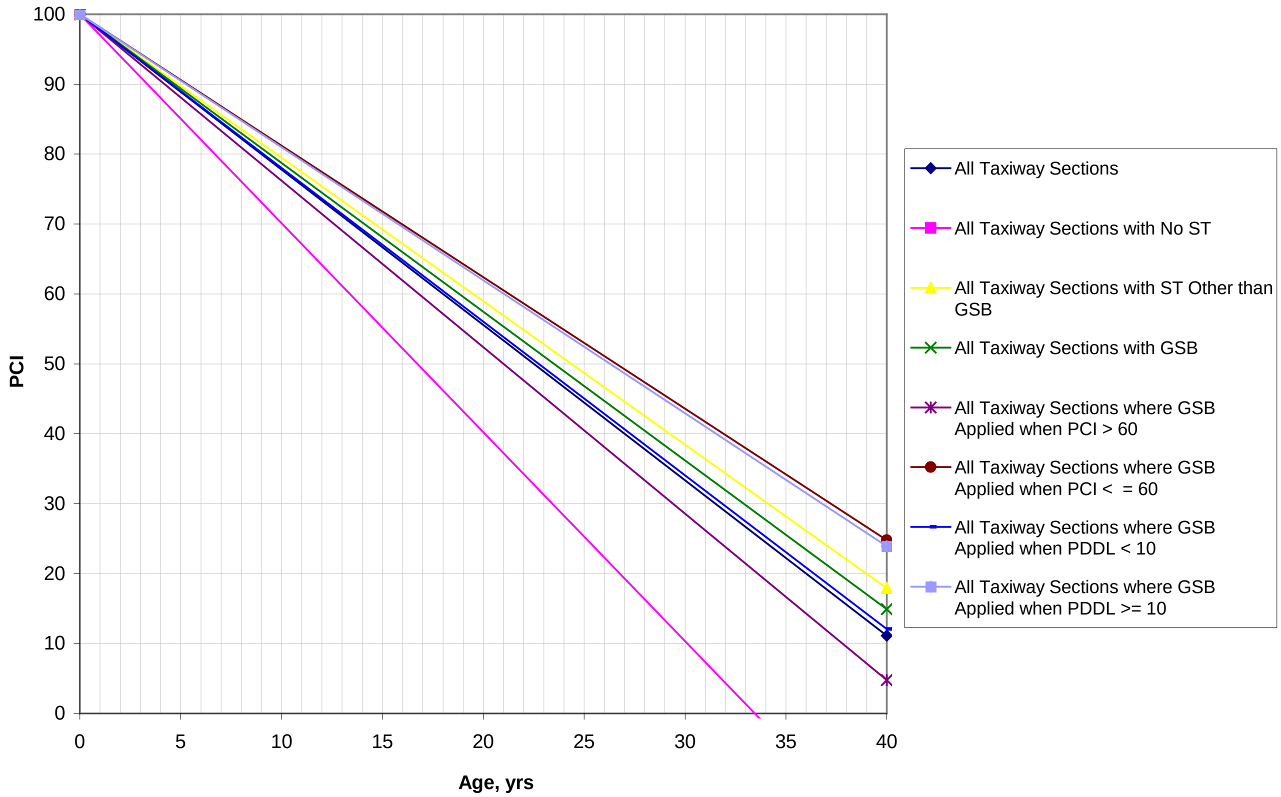
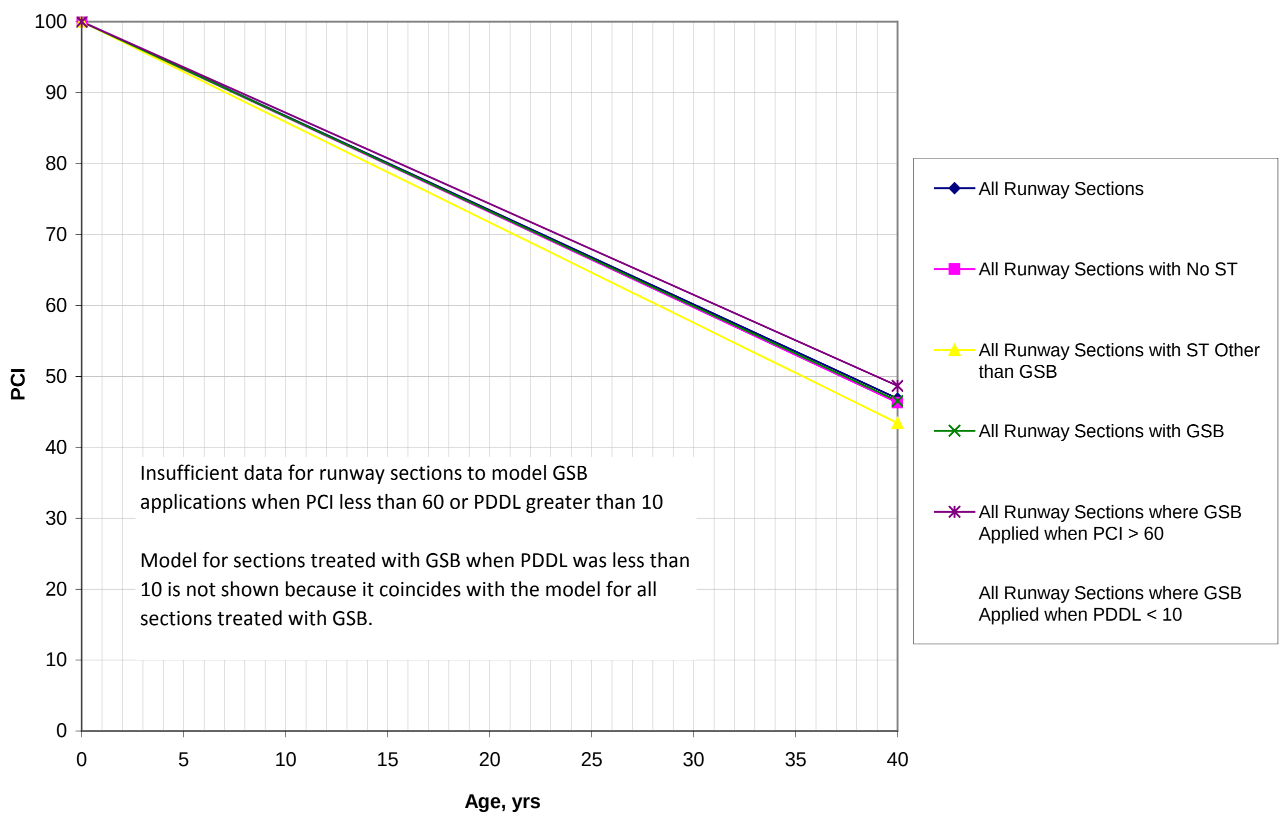



**Figure E-9. Utah apron sections.**

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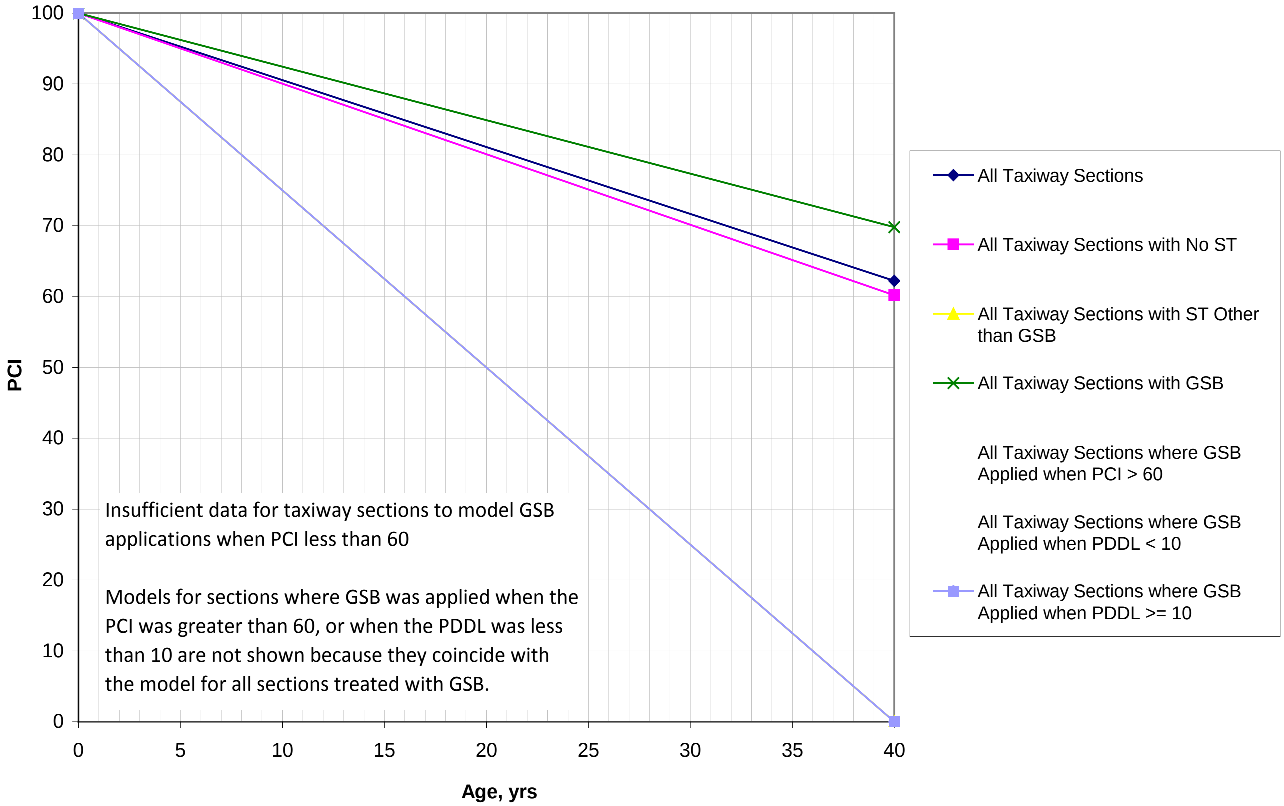
**igure E-10. Portland International Airport runway sections.**

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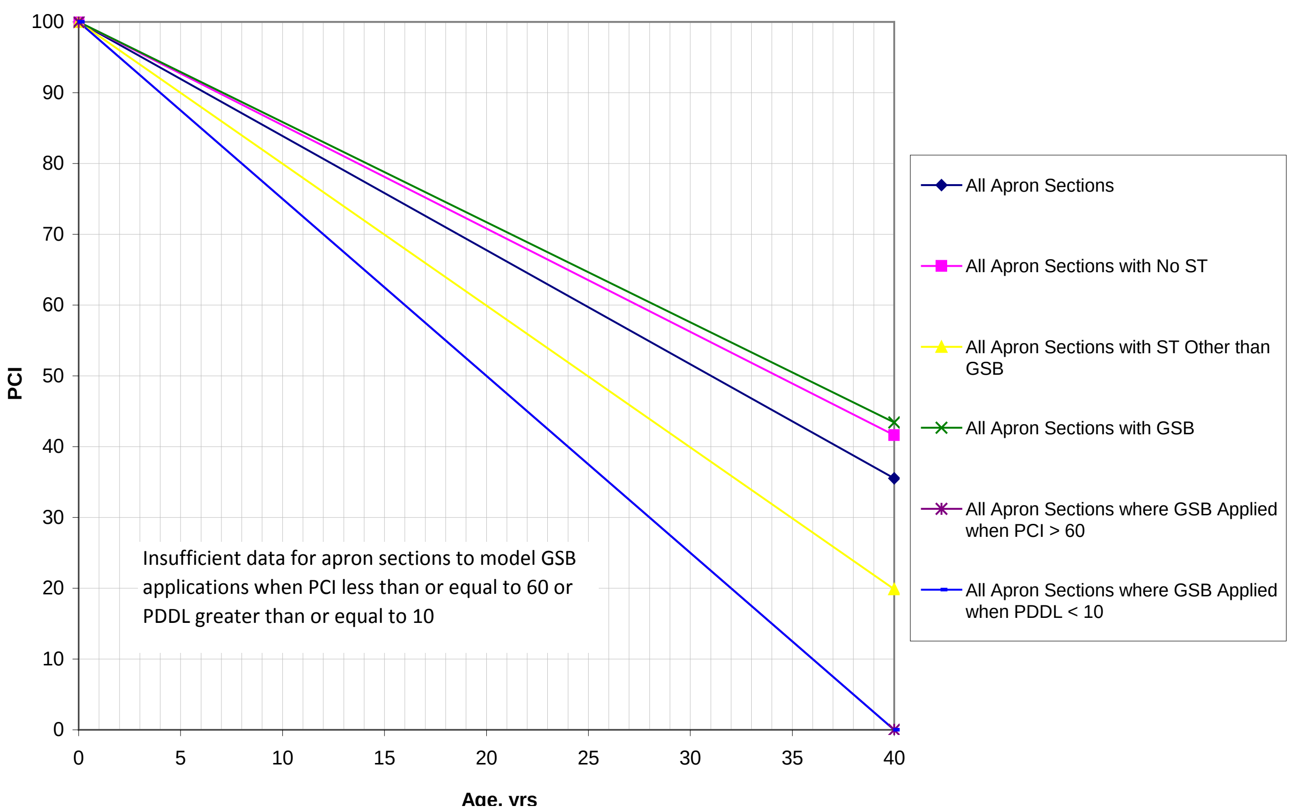
**igure E-11. Portland International Airport taxiway sections.**

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**igure E-12. Portland International Airport apron sections.**

## Table E-1. Oregon Pavement Performance Models

| Family Description | Deterioration Equation (X = age in years) |
|---|---|
| | |
| All Runway Sections | 100 - 1.43113X |
| All Runway Sections with No ST | 100 - 1.61183X |
| All Runway Sections with ST Other than GSB | 100 - 0.99366X |
| All Runway Sections with GSB | 100 - 0.49612X |
| All Runway Sections where GSB Applied when PCI > 60 | 100 - 0.41262X |
| All Runway Sections where GSB Applied when PCI <  = 60 | Insufficient Data |
| All Runway Sections where GSB Applied when PDDL < 10 | 100 - 0.47432X |
| All Runway Sections where GSB Applied when PDDL >= 10 | Insufficient Data |
| | |
| All Taxiway Sections | 100 - 1.33351X |
| All Taxiway Sections with No ST | 100 - 1.80924X |
| All Taxiway Sections with ST Other than GSB | 100 - 1.15652X |
| All Taxiway Sections with GSB | 100 - 0.64452X |
| All Taxiway Sections where GSB Applied when PCI > 60 | 100 - 0.56890X |
| All Taxiway Sections where GSB Applied when PCI <  = 60 | Insufficient Data |
| All Taxiway Sections where GSB Applied when PDDL < 10 | 100 - 0.60837X |
| All Taxiway Sections where GSB Applied when PDDL >= 10 | 100 - 1.30474X |
| | |
| All Apron Sections | 100 - 1.63757X |
| All Apron Sections with No ST | 100 - 1.70362X |
| All Apron Sections with ST Other than GSB | 100 - 1.59306X |
| All Apron Sections with GSB | 100 - 1.30108X |
| All Apron Sections where GSB Applied when PCI > 60 | 100 - 1.30108X |
| All Apron Sections where GSB Applied when PCI <= 60 | Insufficient Data |
| All Apron Sections where GSB Applied when PDDL < 10 | 100 - 1.30983X |
| All Apron Sections where GSB Applied when PDDL >=10 | Insufficient Data |

## Table E-2. Colorado Pavement Performance Models

| Family Description | Deterioration Equation (X = age in years) |
|---|---|
| | |
| All Runway Sections | 100 – 1.94885X |
| All Runway Sections with No ST | 100 – 2.34999X |
| All Runway Sections with ST Other than GSB | 100 – 1.87833X |
| All Runway Sections with GSB | 100 – 1.52542X |
| All Runway Sections where GSB Applied when PCI > 60 | 100 – 1.36801X |
| All Runway Sections where GSB Applied when PCI < = 60 | Insufficient Data |
| All Runway Sections where GSB Applied when PDDL < 10 | 100 – 1.49622X |
| All Runway Sections where GSB Applied when PDDL >= 10 | Insufficient Data |
| | |
| All Taxiway Sections | 100 – 1.69167X |
| All Taxiway Sections with No ST | 100 – 1.68362X |
| All Taxiway Sections with ST Other than GSB | 100 – 1.7942X |
| All Taxiway Sections with GSB | 100 – 1.12466X |
| All Taxiway Sections where GSB Applied when PCI > 60 | 100 – 1.01928X |
| All Taxiway Sections where GSB Applied when PCI < = 60 | Insufficient Data |
| All Taxiway Sections where GSB Applied when PDDL < 10 | 100 – 0.97915X |
| All Taxiway Sections where GSB Applied when PDDL >= 10 | 100 – 1.87100X |
| | |
| All Apron Sections | 100 – 2.23504X |
| All Apron Sections with No ST | 100 – 2.40910X |
| All Apron Sections with ST Other than GSB | 100 – 1.81100X |
| All Apron Sections with GSB | 100 – 1.59460X |
| All Apron Sections where GSB Applied when PCI > 60 | 100 – 1.59460X |
| All Apron Sections where GSB Applied when PCI <= 60 | Insufficient Data |
| All Apron Sections where GSB Applied when PDDL < 10 | 100 – 1.67033X |
| All Apron Sections where GSB Applied when PDDL >=10 | Insufficient Data |

**Table E-3. Utah Pavement Performance Models**

| Family Description | Deterioration Equation (X = age in years) |
|---|---|
| | |
| All Runway Sections | 100 – 1.90022X |
| All Runway Sections with No ST | 100 – 2.11948X |
| All Runway Sections with ST Other than GSB | 100 – 1.91488X |
| All Runway Sections with GSB | 100 – 1.77884X |
| All Runway Sections where GSB Applied when PCI > 60 | 100 – 1.65093X |
| All Runway Sections where GSB Applied when PCI < = 60 | 100 – 2.28958X |
| All Runway Sections where GSB Applied when PDDL < 10 | 100 – 1.79980X |
| All Runway Sections where GSB Applied when PDDL >= 10 | Insufficient Data |
| | |
| All Taxiway Sections | 100 – 2.22161X |
| All Taxiway Sections with No ST | 100 – 2.98868X |
| All Taxiway Sections with ST Other than GSB | 100 – 2.05181X |
| All Taxiway Sections with GSB | 100 – 2.12675X |
| All Taxiway Sections where GSB Applied when PCI > 60 | 100 – 2.38079X |
| All Taxiway Sections where GSB Applied when PCI < = 60 | 100 – 1.88014X |
| All Taxiway Sections where GSB Applied when PDDL < 10 | 100 – 2.19800X |
| All Taxiway Sections where GSB Applied when PDDL >= 10 | 100 – 1.90217X |
| | |
| All Apron Sections | 100 – 2.56873X |
| All Apron Sections with No ST | 100 – 3.44062X |
| All Apron Sections with ST Other than GSB | 100 – 2.46639X |
| All Apron Sections with GSB | 100 – 2.20663X |
| All Apron Sections where GSB Applied when PCI > 60 | 100 – 1.52243X |
| All Apron Sections where GSB Applied when PCI <= 60 | 100 – 2.35100X |
| All Apron Sections where GSB Applied when PDDL < 10 | 100 – 1.90795X |
| All Apron Sections where GSB Applied when PDDL >=10 | 100 – 2.46959X |

## Table E-4. Portland International Airport Pavement Performance Models

| Family Description | Deterioration Equation (X = age in years) |
|---|---|
| | |
| All Runway Sections | 100 - 1.32833X |
| All Runway Sections with No ST | 100 - 1.34283X |
| All Runway Sections with ST Other than GSB | 100 – 1.41469X |
| All Runway Sections with GSB | 100 - 1.33625X |
| All Runway Sections where GSB Applied when PCI > 60 | 100 - 1.28343X |
| All Runway Sections where GSB Applied when PCI <  = 60 | Insufficient Data |
| All Runway Sections where GSB Applied when PDDL < 10 | 100 - 1.33625X |
| All Runway Sections where GSB Applied when PDDL >= 10 | Insufficient Data |
| | |
| All Taxiway Sections | 100 - 0.94483X |
| All Taxiway Sections with No ST | 100 - 0.99486X |
| All Taxiway Sections with ST Other than GSB | Insufficient Data |
| All Taxiway Sections with GSB | 100 - 0.75451X |
| All Taxiway Sections where GSB Applied when PCI > 60 | 100 - 0.75450X |
| All Taxiway Sections where GSB Applied when PCI <  = 60 | 100 - 0.94697X |
| All Taxiway Sections where GSB Applied when PDDL < 10 | 100 - 0.75647X |
| All Taxiway Sections where GSB Applied when PDDL >= 10 | Insufficient Data |
| | |
| All Apron Sections | 100 - 1.61176X |
| All Apron Sections with No ST | 100 - 1.45947X |
| All Apron Sections with ST Other than GSB | 100 - 2.00330X |
| All Apron Sections with GSB | 100 - 1.41415X |
| All Apron Sections where GSB Applied when PCI > 60 | Insufficient Data |
| All Apron Sections where GSB Applied when PCI <= 60 | Insufficient Data |
| All Apron Sections where GSB Applied when PDDL < 10 | Insufficient Data |
| All Apron Sections where GSB Applied when PDDL >=10 | Insufficient Data |

**Table E-5. Summary of Basic Deterioration Rates**

| | | Deterioration Rate (PCI Points per Year) | | |
|---|---|---|---|---|
| **Database** | **Use** | **No Surface Treatment** | **Non-GSB Surface Treatment** | **GSB** |
| Oregon | Runway | 1.6 | 1.0 | 0.5 |
| | Taxiway | 1.8 | 1.1 | 0.6 |
| | Apron | 1.7 | 1.6 | 1.3 |
| Utah | Runway | 2.1 | 1.9 | 1.8 |
| | Taxiway | 3.0 | 2.1 | 2.1 |
| | Apron | 3.4 | 2.5 | 2.2 |
| Colorado | Runway | 2.3 | 1.9 | 1.5 |
| | Taxiway | 1.7 | 1.8 | 1.1 |
| | Apron | 2.4 | 1.8 | 1.6 |
| PDX | Runway | 1.3 | 1.4 | 1.3 |
| | Taxiway | 1.0 | Insufficient Data | 0.8 |
| | Apron | 1.5 | 2.0 | 1.4 |

# APPENDIX F

# ECONOMIC ANALYSIS
# AND
# LIFE CYCLE COST

# ECONOMIC ANALYSIS OF GSB-88 AS AN ALTERNATIVE


BACKGROUND

An economic analysis is needed to determine whether a savings will be generated, how long it will take to receive a payback, and what the return on investment will be.

ALTERNATIVES

**Status Quo**:

Reviewing the history of the five Navy airfields for this project, the status quo is to maintain pavement to a Design Life when funding is available for proper maintenance. One airfield in the mildest climate has averaged 22 years life since the 1940’s with virtually no maintenance (the threshold being when the condition goes below a PCI of 70 for Runways, 60 for Taxiways and Aprons); but remains below the 25 year Mission Life. The remaining airfields data were used to determine actual life or status quo, which is 15 years for Runways, 18 years for Taxiways, and Aprons appear to be consistent with Taxiways, hence 18 years. The rate of deterioration was found to be around 2.0 and 2.25 PCI points per year for Runways and all other pavement respectively. However, Runway data will be used for this analysis with an understanding that all pavements are similar, and analyses would conclude the same.

**Pavement Maintenance**:

For simplification of unlimited possible scenarios, a constant deterioration rate for a straight line approach was found to be around 1.5 PCI points per year for Runways. This is using a design life of 20 years and assuming all maintenance is funded at appropriate levels.

**Pavement Preservation with GSB-88**

To be consistent, the Pavement Maintenance model will be used as the basis of this alternative. The new Weathering distress in ASTM will also be incorporated with the understanding that weathering will only have a maximum of 5 PCI points attributed (100 % of pavement surface with low severity weathering) and the assumption the pavement is structurally adequate for actual aircraft use. Based on review of the history as indicated in Status Quo, and review of numerous data from both the internet and other sources previously obtained anonymously, GSB-88 will be assigned a 4 year effective life and an application interval of 5 years. Other maintenance will be assumed completed and is built into the base line of the Pavement maintenance model.

**Pavement Preservation with Fog seal or Rejuvenator**

To be consistent, the Pavement Maintenance model will be used as the basis of this alternative. The new Weathering distress in ASTM will also be incorporated with the understanding that weathering will only have a maximum of 5 PCI points attributed (100 % of pavement surface with low severity weathering) and the assumption the pavement is structurally adequate for actual aircraft use. Based on review of the history as indicated in Status Quo, and review of numerous data from both the internet and other sources previously obtained anonymously, Fog seal/Rejuvenator will be assigned a 1 year effective life and an application interval of 5 years. Other maintenance will be assumed completed and is built into the base line of the Pavement maintenance model. It should be noted that all data available on the airfields for this project shows a lower pavement life increase in every case where a rejuvenator was applied. However, in all cases, the fog/rejuvenator was only applied once; and that one application was at 3, 4, or 12 years after the new pavement surface was constructed. Another point of interest is that where pavement life decreased with one application of rejuvenators, at each location this occurred, there was also pavement with extended life (longer than average but still well below the design or mission life) when a series of at least two applications of surface treatments were used; but in all cases, the first surface treatment was a seal coat product applied within the first two years and either one or two applications of either slurry seal or chip seal products averaging about 3 ½ years of effective life for each application.

ASSUMPTIONS

**1.** Per OMB Circular Number A-94, Appendix C, dated December 2008, a discount rate of 2.8% is used.

**2.** The period of analysis is 51 years (50 year mission year plus 1); and due to preservation as being the purpose of this project, life extended needs to be realized for the theoretical possibility (information gathered and results observed indicate probability), which for GSB-88, could be the Physical Life indicated in P-442, which is 50 years).

**3.** All costs/benefits occur throughout the year and will be discounted using a "middle-of-year" discounting convention.

**4**. Start of this analysis is assuming the pavement is new.

**5.** There will be no residual for project.

**6.** Costs for new overlays will be lump sum and assume a 3 month down time. Surface treatments can be coordinated with re-striping and rubber removal time periods and may or may not require down time attributed to this work. In addition, down time, when required, can be as short as 48 to 96 hours but would typically indicate 30 days to accommodate re-striping.

**7.** 2009 general inflation is applied to all recurring.

MAINTENANCE AND REPAIR SOURCE/DERIVATION

**1.** Includes day-to-day maintenance, exclusive of engineering services (major repair is included in maintenance and repair cost from 2011 and beyond).

**2.** Pavement Age Multiplier Table was developed for each alternative.

Source: MicroPAVER, Navy Cost Tables

| O & M Costs (PCI Vs Cost for Pavements) Pavement Age Multipliers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Status Quo (AC) | | Maintenance | | Preservation GSB | | Preservation Fog | |
| YEAR | PCI | $/SY | PCI | $/SY | PCI | $/SY | PCI | $/SY |
| 2010 | 100 | 0.00 | 100 | 0.00 | 100 | 0.00 | 100 | 0.00 |
| 2011 | 98 | 0.01 | 99 | 0.01 | 100 | 0.00 | 100 | 0.00 |
| 2012 | 96 | 0.03 | 97 | 0.02 | 100 | 0.00 | 99 | 0.01 |
| 2013 | 94 | 0.05 | 96 | 0.03 | 100 | 0.00 | 97 | 0.02 |
| 2014 | 92 | 0.07 | 94 | 0.05 | 97.5 | 0.02 | 96 | 0.03 |
| 2015 | 90 | 0.09 | 93 | 0.06 | 97.5 | 0.02 | 96 | 0.03 |
| 2016 | 88 | 0.11 | 91 | 0.08 | 97.5 | 0.02 | 94 | 0.05 |
| 2017 | 86 | 0.15 | 90 | 0.09 | 97.5 | 0.02 | 93 | 0.06 |
| 2018 | 84 | 0.19 | 88 | 0.11 | 97.5 | 0.02 | 91 | 0.08 |
| 2019 | 82 | 0.23 | 87 | 0.13 | 95 | 0.04 | 90 | 0.09 |
| 2020 | 80 | 0.27 | 85 | 0.17 | 95 | 0.04 | 90 | 0.09 |
| 2021 | 78 | 0.28 | 84 | 0.19 | 95 | 0.04 | 88 | 0.11 |
| 2022 | 76 | 0.30 | 82 | 0.23 | 95 | 0.04 | 87 | 0.13 |
| 2023 | 74 | 0.32 | 81 | 0.25 | 95 | 0.04 | 85 | 0.17 |
| 2024 | 72 | 0.34 | 79 | 0.27 | 92.5 | 0.06 | 84 | 0.19 |
| 2025 | 70 | 0.36 | 78 | 0.28 | 92.5 | 0.06 | 84 | 0.19 |
| 2026 | 100/98 | 0.00 | 76 | 0.30 | 92.5 | 0.06 | 82 | 0.21 |
| 2027 | 98 | 0.01 | 75 | 0.31 | 92.5 | 0.06 | 81 | 0.23 |
| 2028 | 96 | 0.03 | 73 | 0.33 | 92.5 | 0.06 | 79 | 0.27 |
| 2029 | 94 | 0.05 | 72 | 0.34 | 90 | 0.09 | 78 | 0.29 |
| 2030 | 92 | 0.07 | 70 | 0.36 | 90 | 0.09 | 78 | 0.29 |
| 2031 | 90 | 0.09 | 100/99 | 0.00 | 90 | 0.09 | 76 | 0.30 |
| 2032 | 88 | 0.11 | 97 | 0.01 | 90 | 0.09 | 75 | 0.31 |
| 2033 | 86 | 0.15 | 96 | 0.02 | 90 | 0.09 | 73 | 0.33 |
| 2034 | 84 | 0.19 | 94 | 0.03 | 87.5 | 0.11 | 72 | 0.34 |
| 2035 | 82 | 0.23 | 93 | 0.05 | 87.5 | 0.11 | 72 | 0.34 |
| 2036 | 80 | 0.27 | 91 | 0.06 | 87.5 | 0.11 | 70 | 0.36 |
| 2037 | 78 | 0.28 | 90 | 0.08 | 87.5 | 0.11 | 100/100 | 0.00 |
| 2038 | 76 | 0.30 | 88 | 0.09 | 87.5 | 0.11 | 100 | 0.00 |
| 2039 | 74 | 0.32 | 87 | 0.11 | 85 | 0.17 | 99 | 0.01 |
| 2040 | 72 | 0.34 | 85 | 0.13 | 85 | 0.17 | 97 | 0.02 |
| 2041 | 70 | 0.36 | 84 | 0.17 | 85 | 0.17 | 96 | 0.03 |
| 2042 | 100/98 | 0.00 | 82 | 0.19 | 85 | 0.17 | 96 | 0.03 |
| 2043 | 98 | 0.01 | 81 | 0.23 | 85 | 0.17 | 94 | 0.05 |
| 2044 | 96 | 0.03 | 79 | 0.25 | 82.5 | 0.21 | 93 | 0.06 |
| 2045 | 94 | 0.05 | 78 | 0.27 | 82.5 | 0.21 | 91 | 0.08 |
| 2046 | 92 | 0.07 | 76 | 0.28 | 82.5 | 0.21 | 90 | 0.09 |
| 2047 | 90 | 0.09 | 75 | 0.30 | 82.5 | 0.21 | 90 | 0.09 |
| 2048 | 88 | 0.11 | 73 | 0.31 | 82.5 | 0.21 | 88 | 0.11 |
| 2049 | 86 | 0.15 | 72 | 0.33 | 80 | 0.27 | 87 | 0.13 |
| 2050 | 84 | 0.19 | 70 | 0.34 | 80 | 0.27 | 85 | 0.17 |
| 2051 | 82 | 0.23 | 100/99 | 0.36 | 80 | 0.27 | 84 | 0.19 |
| 2052 | 80 | 0.27 | 97 | 0.00 | 80 | 0.27 | 84 | 0.19 |
| 2053 | 78 | 0.28 | 96 | 0.01 | 80 | 0.27 | 82 | 0.21 |
| 2054 | 76 | 0.30 | 94 | 0.02 | 77.5 | 0.28 | 81 | 0.23 |
| 2055 | 74 | 0.32 | 93 | 0.03 | 77.5 | 0.28 | 79 | 0.27 |
| 2056 | 72 | 0.34 | 91 | 0.05 | 77.5 | 0.28 | 78 | 0.29 |
| 2057 | 70 | 0.36 | 90 | 0.06 | 77.5 | 0.28 | 78 | 0.29 |
| 2058 | 100/98 | 0.00 | 88 | 0.08 | 77.5 | 0.28 | 76 | 0.30 |
| 2059 | 98 | 0.01 | 87 | 0.09 | 75 | 0.31 | 75 | 0.31 |
| 2060 | 96 | 0.03 | 85 | 0.11 | 75 | 0.31 | 73 | 0.33 |

NON-MONETARY CONSIDERATIONS

An estimate was made of the times the runway would not be available for operational use because of construction or application of surface treatments associated with each alternative. The intent was to develop time estimates for information only and was not used as part of this analysis. Estimates could not be derived with data from typical construction sources therefore it must be emphasized that these potential “down times” were estimates based on collective experience, knowledge of the processes involved and history of these types of actions. These times were developed with the intent to only provide another parameter for use by the activity and major claimant to assist in understanding the potential impact on the operational mission.

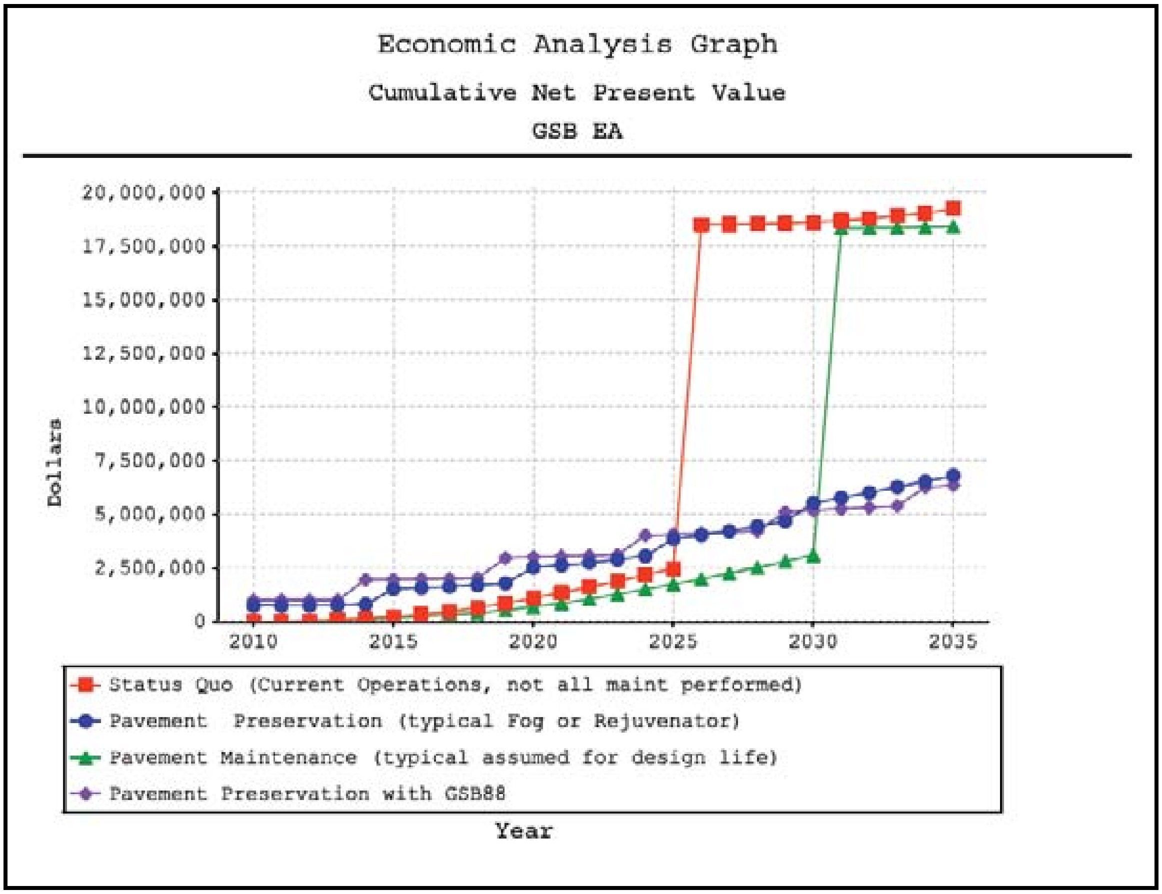
It is not possible to determine the time precisely for the purpose of this study. The actual times will depend on numerous factors associated with the site, including availability and capability of contractors, weather, mission requirements and numerous other factors. This information is presented only as a general guide to the decision maker for use in conjunction with the life cycle cost figures and anticipated performance of these alternatives.

| Interruptions To Airfield Operations | | | | |
|---|---|---|---|---|
| Alternative | Economic Life | Number Of Occurrences | | |
| | | Initial Construction | Overlay | Surface Treatment |
| **Status Quo (Current Ops, not all maintenance performed)** | 25 Years | **0** | **2** | **0** |
| | 50 Years | **0** | **3** | **0** |
| **Pavement Maintenance (typical assumed for design life)** | 25 Years | **0** | **1** | **0** |
| | 50 Years | **0** | **2** | **0** |
| **Pavement Preservation with GSB-88** | 25 Years | **0** | **0** | **5** |
| | 50 Years | **0** | **0** | **10** |
| **Pavement Preservation (typical Fog or Rejuvenator)** | 25 Years | **0** | **0** | **5** |
| | 50 Years | **0** | **1** | **10** |

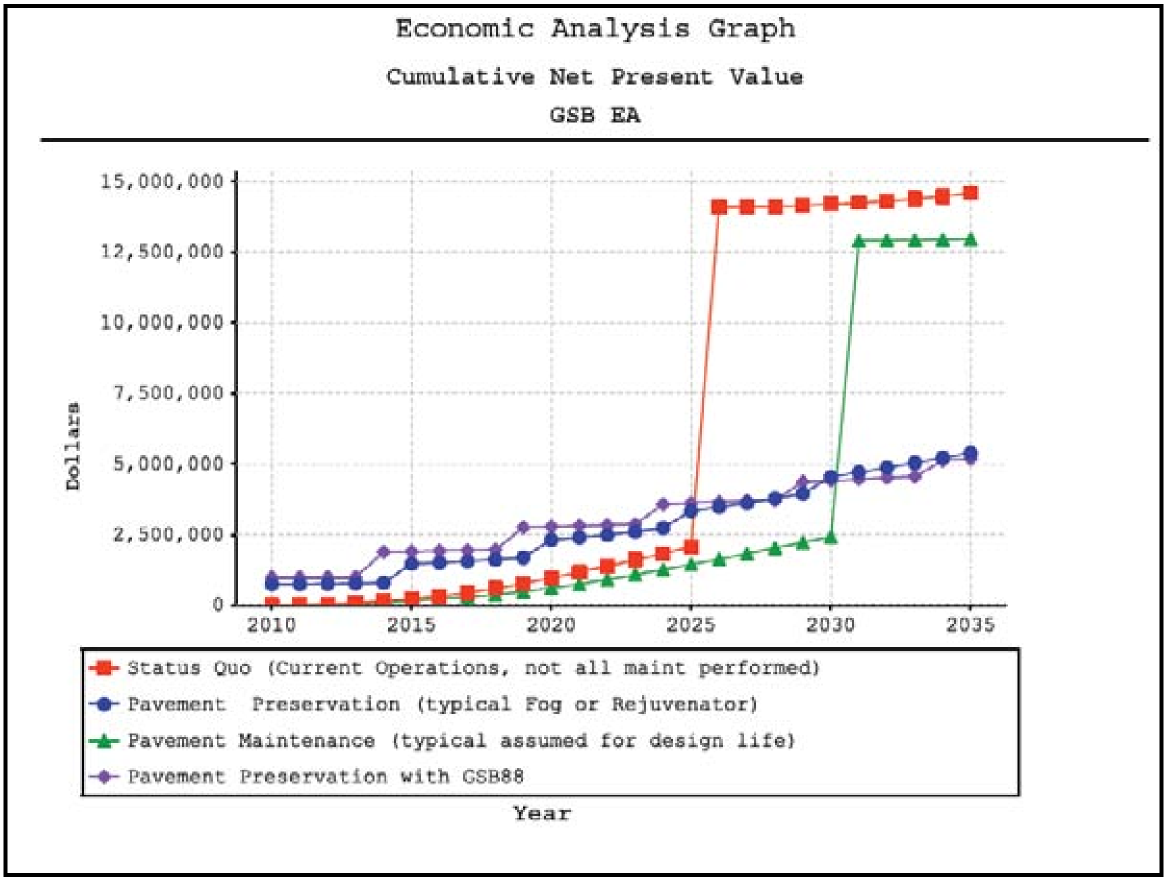
This table indicates the number of occurrences of each type of action that will interrupt airfield operations for each alternative. Multiplying an estimated amount of time (i.e. 3 ½ months for an asphalt concrete overlay or 1 month for application of a surface treatment) with number of occurrences will provide a general guide for interruptions to airfield operations to be used in conjunction with the life cycle cost from the economic analysis. However, proper planning can minimize overall downtime in the life cycle if, for instance, GSB-88 is applied in conjunction with re-striping. In addition, if Operations/NAVAIR would allow or consider different procedures for striping, similar to what roads and highways have adapted since lead was removed from paint (i.e. preliminary critical striping immediately after cure of surface treatment with a ‘light’ application of the coating, followed by completing the full amount of coating and all other markings one month later), down time would be minimized to one week or less.

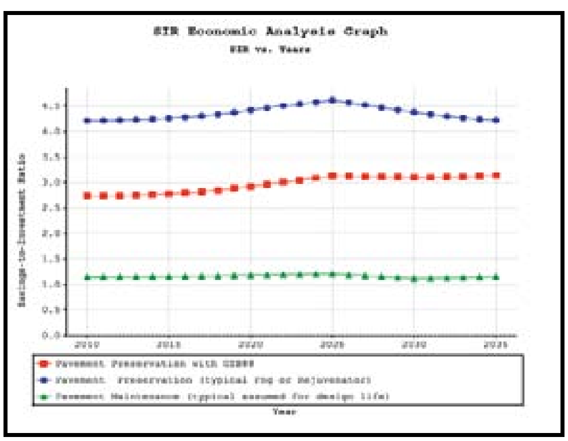
**ECONOMIC ANALYSIS: NPV, SIR, DISCOUNT RATE SENSITIVITY GRAPHS**

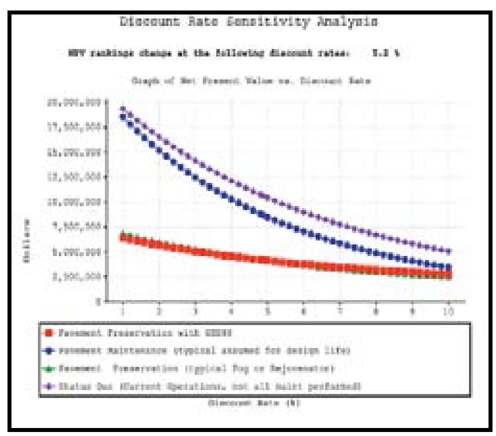
25 YR WITH INFLATION



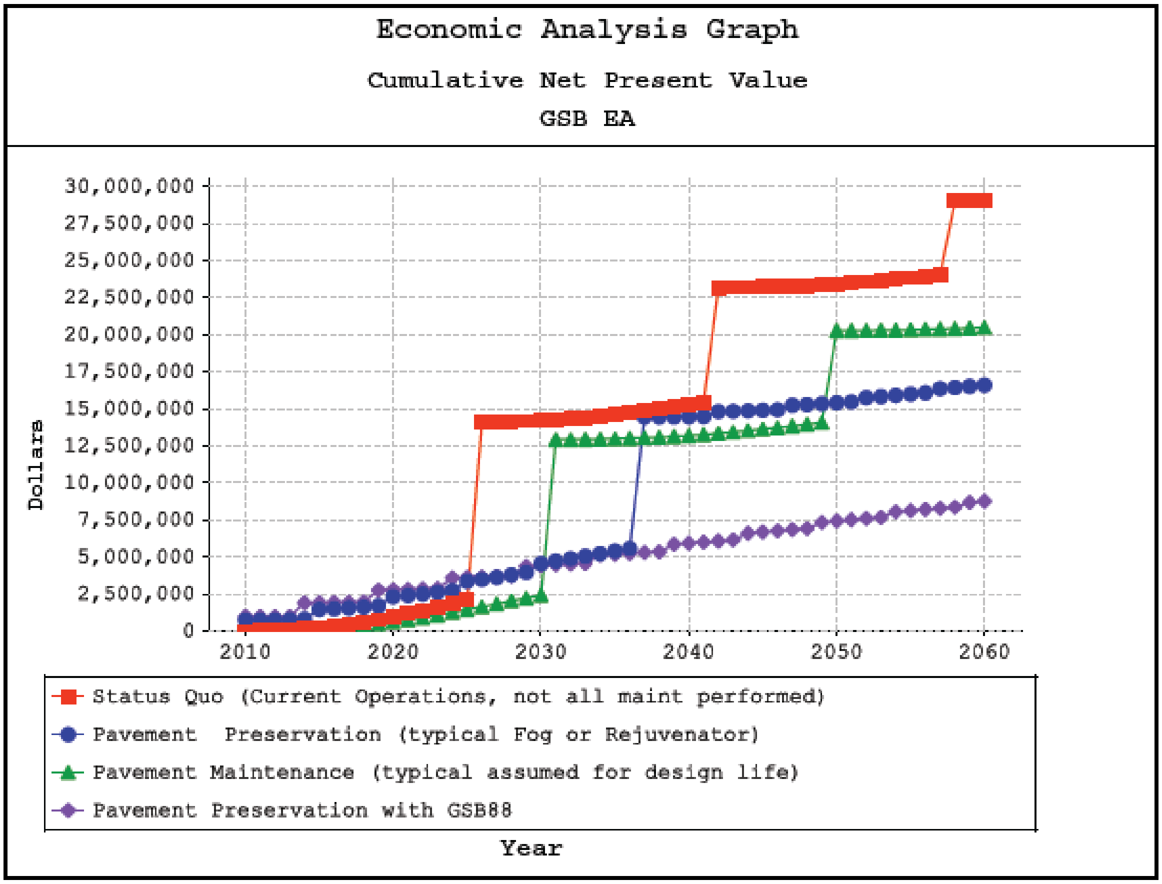
25 YR W/O INFLATION

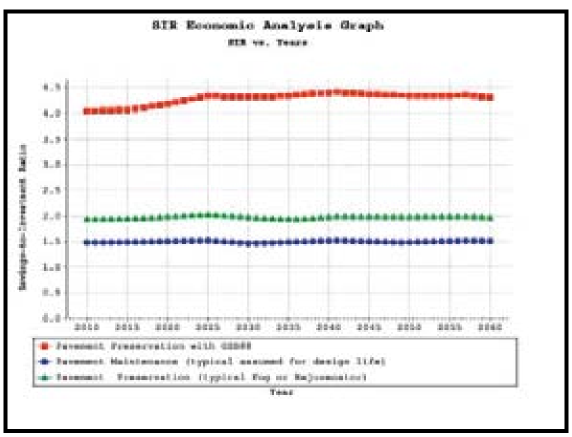


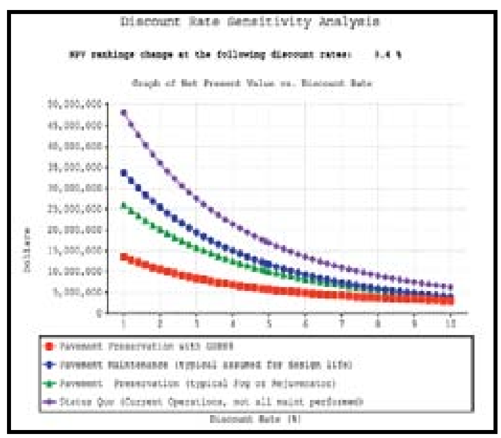



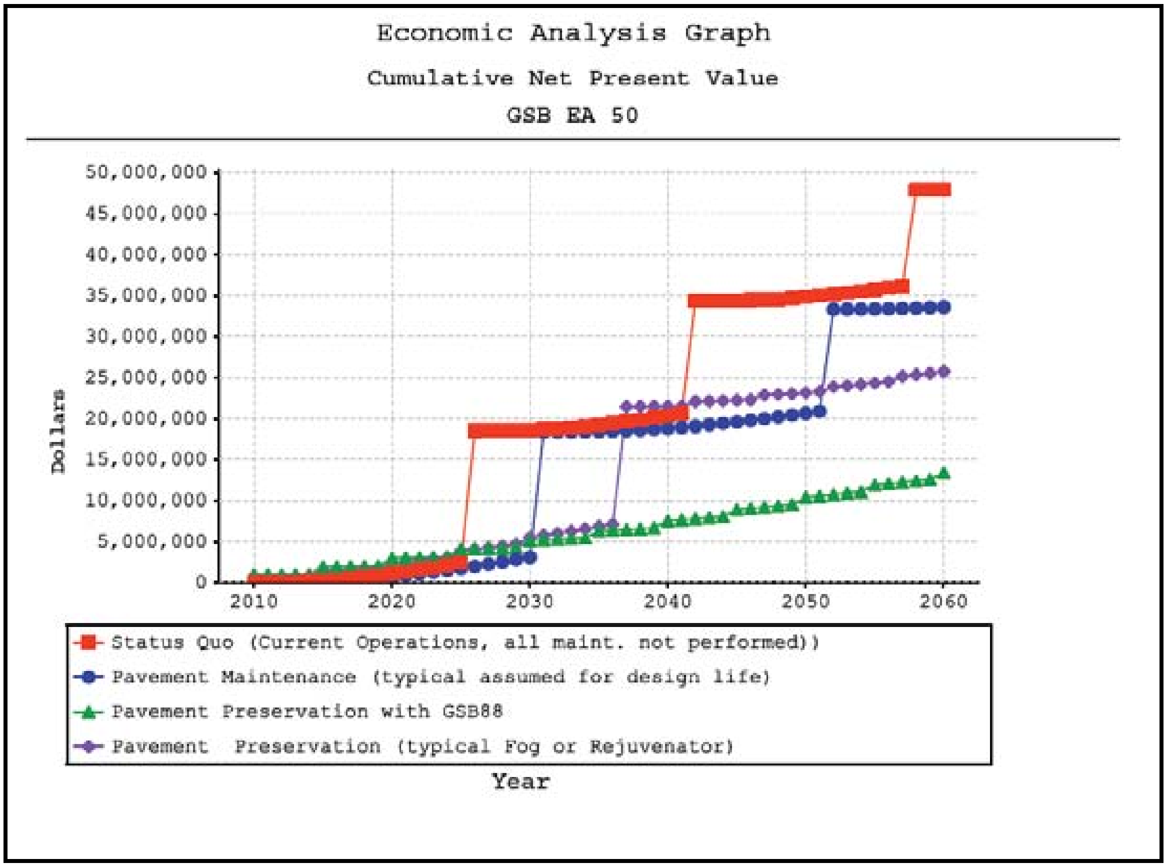
50 YR W/O INFLATION





50 YR WITH INFLATION



## ECONOMIC ANALYSIS: NPV TABLES

| LIFE CYCLE COST (50 Years) | | | | | | |
|---|---|---|---|---|---|---|
| Results represent costs per million square yards; analysis, or life cycle begins immediately after new asphalt pavement overlay or construction; and GSB-88, Fog, or Rejuvenator applied within the first year after new pavement completed.<br>**Alternative** | **Economic Life** | **Costs ($1,000) NPV** | | | **Life Cycle Cost NPV ($1,000)** | **Life Cycle Cost [w/o inflation] NPV ($1,000)** |
| | | **Initial Const.** | **M & R** | **O & M** | | |
| **Status Quo (Current Ops, not all maintenance performed)** | **50 Years** | **0** | **6,462** | **41,455** | **47,917** | **29,024** |
| **Pavement Maintenance (typical assumed for design life)** | **50 Years** | **0** | **5,907** | **27,692** | **33,599** | **20,480** |
| **Pavement Preservation with GSB-88** | **50 Years** | **0** | **4,803** | **8,604** | **13,407** | **8,759** |
| **Pavement Preservation (typical Fog or Rejuvenator)** | **50 Years** | **0** | **5,964** | **19,774** | **25,738** | **16,594** |

| LIFE CYCLE COST (25 Years) | | | | | | |
|---|---|---|---|---|---|---|
| Results represent costs per million square yards; analysis, or life cycle begins immediately after new asphalt pavement overlay or construction; and GSB-88, Fog, or Rejuvenator applied within the first year after new pavement completed.<br>**Alternative** | **Economic Life** | **Costs ($1,000) NPV** | | | **Life Cycle Cost NPV ($1,000)** | **Life Cycle Cost [w/o inflation] NPV ($1,000)** |
| | | **Initial Const.** | **M & R** | **O & M** | | |
| **Status Quo (Current Ops, not all maintenance performed)** | **25 Years** | **0** | **3,224** | **16,027** | **19,251** | **14,601** |
| **Pavement Maintenance (typical assumed for design life)** | **25 Years** | **0** | **3,188** | **15,262** | **18,450** | **12,973** |
| **Pavement Preservation with GSB-88** | **25 Years** | **0** | **1,056** | **5,301** | **6,357** | **5,179** |
| **Pavement Preservation (typical Fog or Rejuvenator)** | **25 Years** | **0** | **3,447** | **3,366** | **6,813** | **5,387** |

## ECONOMIC ANALYSIS: ECONOMIC INDICATORS

25 yr with inflation

**Economic Indicators:**

| Alternative | NPV | SIR | DPP | ROI |
|---|---|---|---|---|
| Status Quo (Current Operations, not all maint performed) | $19,250,660 | N/A | N/A | N/A |
| Pavement Preservation (typical Fog or Rejuvenator) | $6,813,201 | 4.7 | -1294.6 YEARS | 370.0% |
| Pavement Maintenance (typical assumed for design life) | $18,450,478 | 1.1 | N/A | 10.0% |
| Pavement Preservation with GSB88 | $6,357,963 | 3.4 | -1096.5 YEARS | 240.0% |

25 yr w/o inflation

**Economic Indicators:**

| Alternative | NPV | SIR | DPP | ROI |
|---|---|---|---|---|
| Status Quo (Current Operations, not all maint performed) | $14,601,596 | N/A | N/A | N/A |
| Pavement Preservation (typical Fog or Rejuvenator) | $5,386,951 | 4.2 | -956.6 YEARS | 320.0% |
| Pavement Maintenance (typical assumed for design life) | $12,973,250 | 1.2 | N/A | 20.0% |
| Pavement Preservation with GSB88 | $5,179,404 | 3.1 | -796.0 YEARS | 210.0% |

50 yr with inflation

**Economic Indicators:**

| Alternative | NPV | SIR | DPP | ROI |
|---|---|---|---|---|
| Status Quo (Current Operations, all maint. not performed)) | $47,917,569 | N/A | N/A | N/A |
| Pavement Maintenance (typical assumed for design life) | $33,599,430 | 1.5 | N/A | 50.0% |
| Pavement Preservation with GSB88 | $13,407,158 | 5.0 | -3360.8 YEARS | 400.0% |
| Pavement Preservation (typical Fog or Rejuvenator) | $25,738,010 | 2.1 | -2217.8 YEARS | 110.0% |

50 yr w/o inflation

**Economic Indicators:**

| Alternative | NPV | SIR | DPP | ROI |
|---|---|---|---|---|
| Status Quo (Current Operations, not all maint performed) | $29,023,713 | N/A | N/A | N/A |
| Pavement Preservation (typical Fog or Rejuvenator) | $16,594,106 | 2.0 | -1251.1 YEARS | 100.0% |
| Pavement Maintenance (typical assumed for design life) | $20,479,618 | 1.5 | N/A | 50.0% |
| Pavement Preservation with GSB88 | $8,759,046 | 4.3 | -1943.6 YEARS | 330.0% |

SIR = Savings-to-Investment Ratio     DPP = Discounted Payback Period     ROI = Return on Investment