An exchange of views
on the ideas
called "dust palliative" and
"Fines Preservation®"

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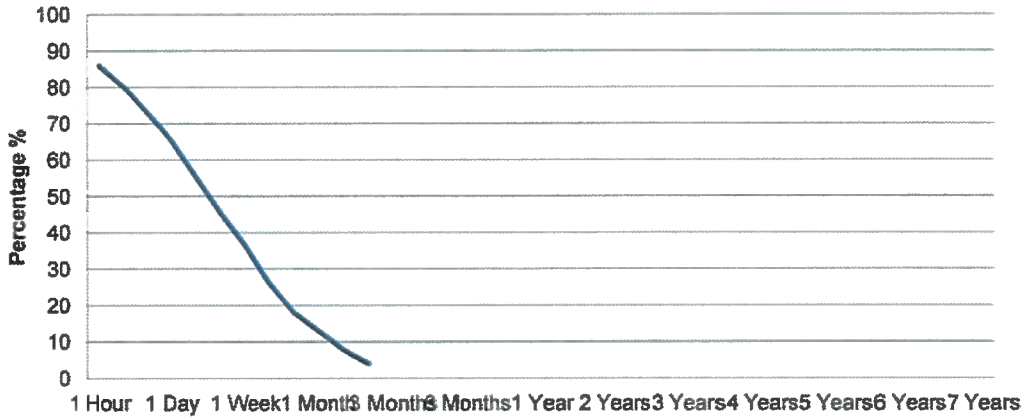
Want a dust palliative? Here are the basics . . .

- Temporary, mitigating measure; performs from 1 hour up until 3 months
- Success criterion: No visible dust
- Accomplished using water, calcium chloride, magnesium chloride, oil or other available by-products or waste products

Life Cycle Performance



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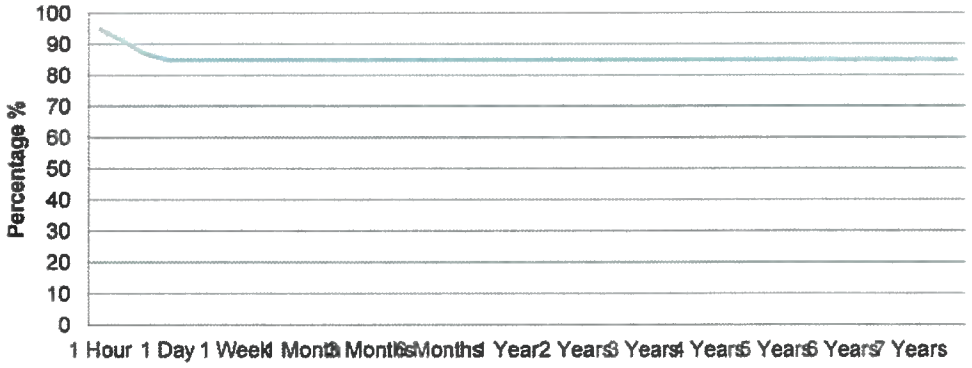
Fines Preservation® accomplishes more over the longer term

- Long-term performance ranging from 1 year to 7 years
- Criteria for success:
  - Gravel and fines are not lost; CBR strength is increased
  - "As constructed" design and profile are retained
  - Maintenance costs are reduced over runway life cycle
  - Financial return over life cycle – double the value by doubling the life of runway
  - Predictable longevity of technology
  - No visible dust
- Accomplished using components intended for this use, not by-products of other processes; will endure all conditions to which it is will be exposed and continue producing the specified performance

Life Cycle Performance with EK35® and Envirokleen®



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Midwest Approach - Fines Preservation®

- Stabilization agent with a binder (e.g., Midwest EK-35 & Envirokleen)
  - Keep the fines bound in the surface (adhesion)
  - ~ 4 times more strength
  - ~ 24 times less gravel loss
  - ~ 5 times more dust level reduction
- A chemical system positively effecting life cycle
  - Warrantied performance
    - Dust: 85% reduction over 85% of the area
    - Strength > 50% increase in CBR (aircraft min + margin)
    - 2+ years effectivity
  - Verified safe & effective by U.S. EPA ETV
  - Certified non-corrosive by Boeing
  - Life cycle cost (maintenance) reduced by ~ 50%
  - Withstands < -70°F
  - Fully documented & independently tested

- Logistically simple
  - Local borrow & crush
  - Topical application for permeable material (typical, prepared surface, loose & moist)
  - Blend application for non-permeable material (windrowed, two year cycle)
  - non-soluble in water
  - No addition of water to product to facilitate application

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Fines Preservation

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Helps preserve the road in its "as constructed" design and profile, adding years to the surface life before the significant cost of re-building or resurfacing is necessary.

- Keeps critical fines as part of the surface, where they belong
- Maintains the "as constructed" properties of the road
- Adds years to the lifecycle of the road
- Eliminates dust by 80-95% for up to 4 years
- Reduces variability of surface stiffness to double expected life of the surface
- Reduces maintenance cost and costly repairs by up to 50%
- Saves expensive aggregate used to construct the road
- Increases the structural integrity and bearing strength of the road
- Improves visibility and increase safety
- Saves money – we can help you calculate how much

Fines Preservation

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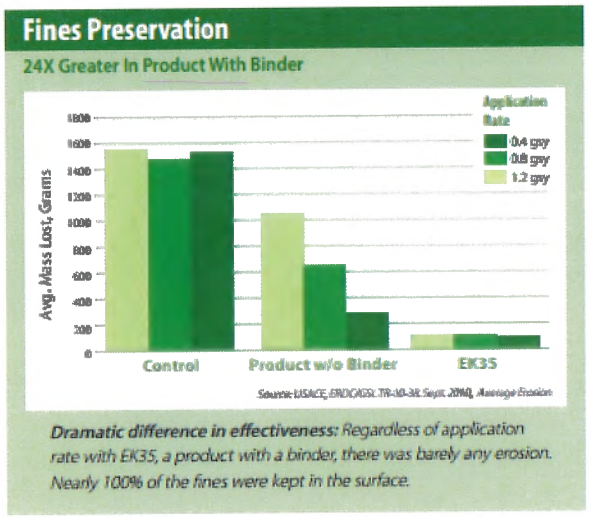
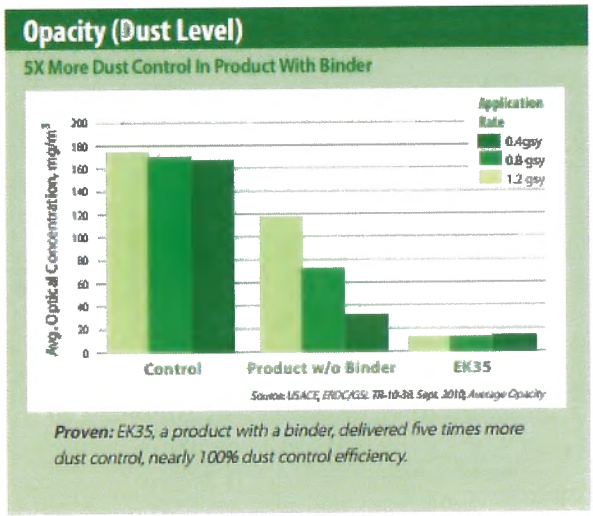
U.S Army Corps of Engineers testing of 13 helipads show that Midwest's Fines Preservation program with EK35® dramatically reduces the volume of fines removed when compared to other products as well as untreated surfaces.



Dramatic difference in effectiveness: *Regardless of application rate with EK35, a product with a binder, there was barely any erosion. Nearly 100% of the fines were kept in the surface.*



Proven: *EK35, a product with a binder, delivered five times more dust control, nearly 100% dust control efficiency.*

Fines Preservation

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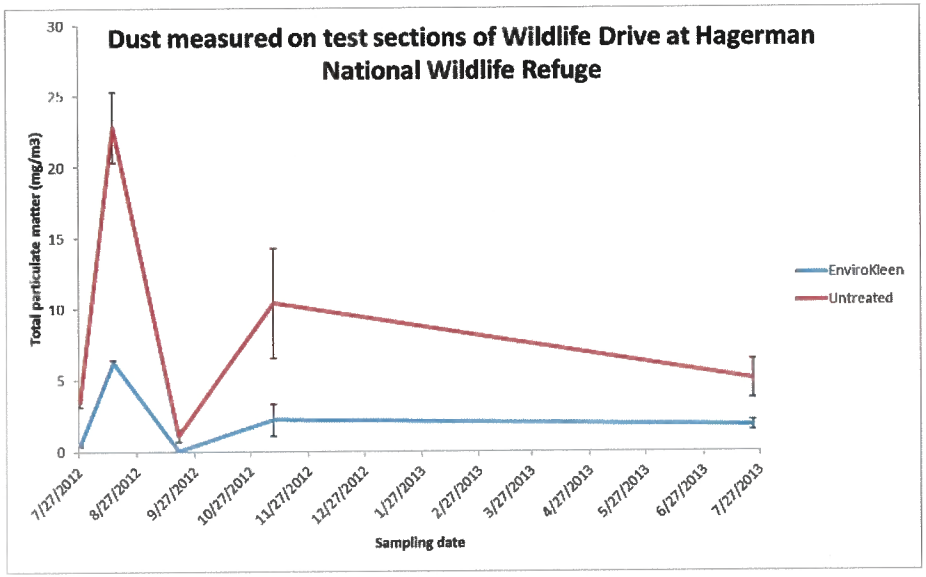
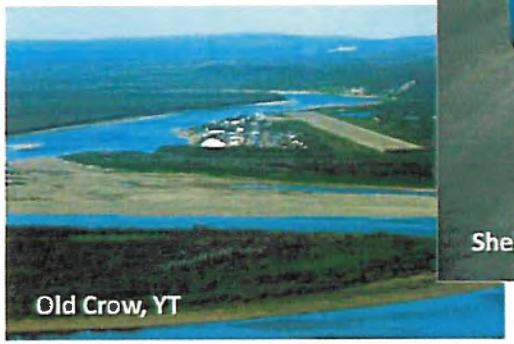
The United States Geological Survey compared dust concentrations with Midwest's EnviroKleen® vs. an untreated road section in a wildlife refuge in Hagerman, TX.



Outcomes of Midwest Fines Preservation® Program

- Villages worldwide
  - 70 airport runways
- Tight, bound and uniform gravel surfaces
- 1 to 5+ years life cycle demonstrated
- > 50% reduced maintenance
  - ~ $300,000 savings over a 7 year gravel runway life cycle
- Practical and manageable application
- Over 80% dust reduction for up to 4 years
- US EPA safeguards for dust palliatives met
- Aviation corrosion standards met
- Performance specifications in use
- Easily repaired



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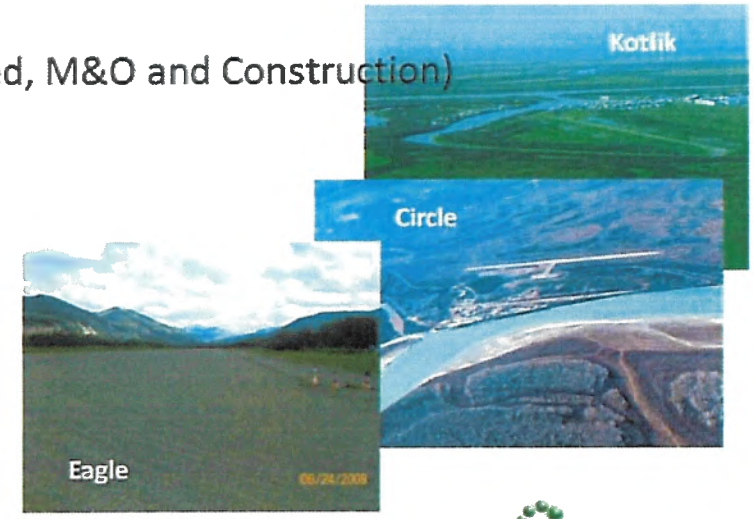
AKDOT&PF Northern Region
Largest Subscriber to Fines Preservation®

- 38 airports utilizing EK35 (applied & scheduled, M&O and Construction)
  - 28 Fines Preservation® (rate of 1/40 or more)
  - 10 Dust Palliative (rate of less than 1/40)
  - Initial EK35 application has generally extended service life from ~ 10 to 15 years
  - Maintenance applications will add 4 to 5 more years of service life
  - Gravel loss reduced by ~ 50%
- 28 airports utilizing Durasoil (applied & scheduled, M&O and Construction)
  - All Dust Palliative
  - Trending to in 2008 & trending away in 2012
  - Why: competition, cost, …?



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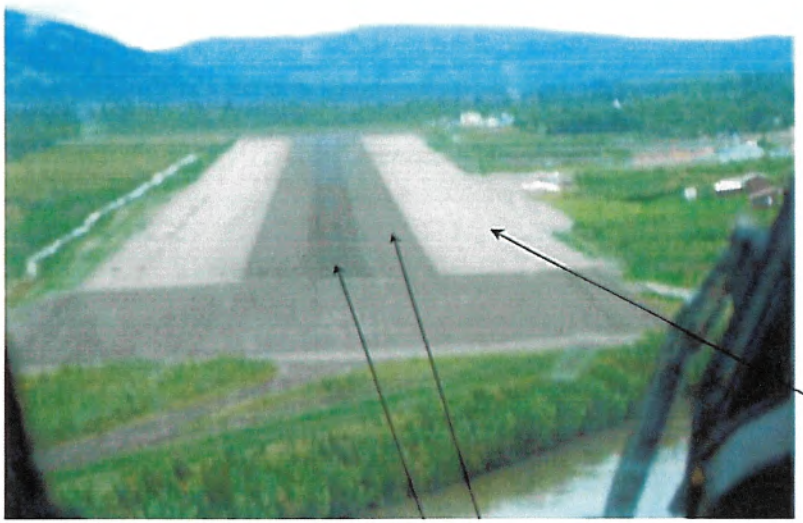
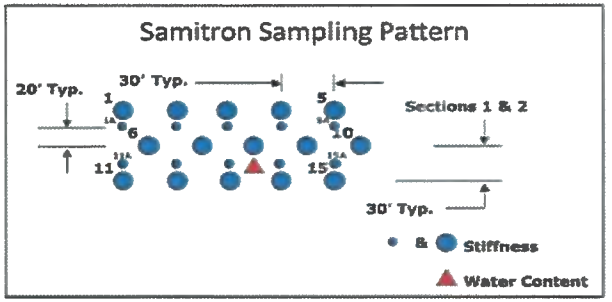
AK DOT and Public Facilities
Strength Increase and Uniformity

Midwest Runway Survey, '08: Tanana, Alaska - EK35 Application





Untreated: CBR ~15

Blackish runway 40' wide center EK35A at 1 gallon per 80 ft² applied in Summer 2008 to center of the runway

Maintenance Application: CBR ~52

Brown Runway 40' Wide South Edge EK35A at 1 gallon per 40 ft² applied in Summer 2007 to full width of the runway

Initial Application: CBR~27

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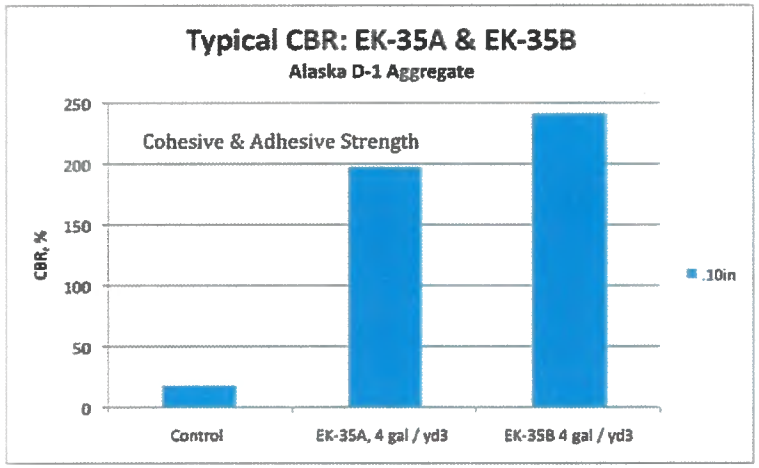
Fines Preservation®

What are the Benefits of Fines Preservation®?

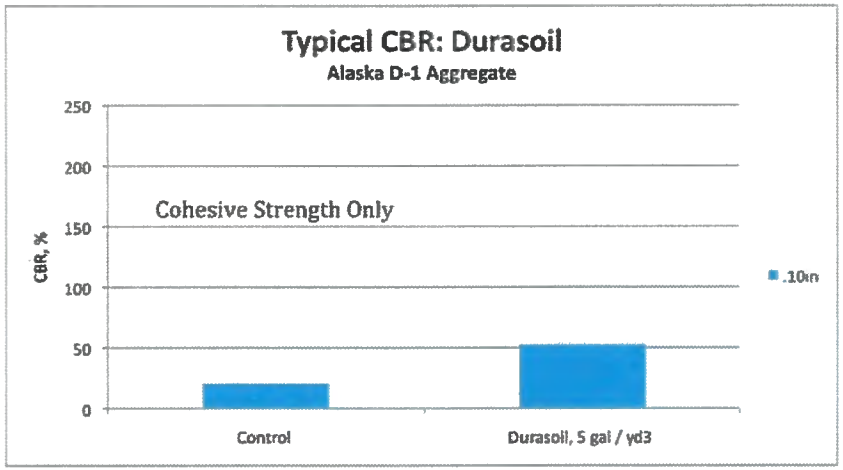
- A chemical system positively effecting life cycle - ~ 50% reduction in cost
  - > 35% Strength Gain At application
  - > 70% dust reduction for years
  - Verified environmentally sound & effective by U.S. EPA ETV
  - Verified Effective for PM10 Attainment
  - Certified non-corrosive by Boeing (D6-17487)
  - Won't Wash Out – No Storm Water or Groundwater Contamination
  - Renders surface reworkable
  - Surface loss reduced by > 80%
  - Sustaining structural integrity
  - Withstands < -50° F
- Application rate & method determined by site conditions

The Value of a Binder - Strength Gain (Lab)

Approximately 4 Times More Strength with Binder



Binder



No Binder

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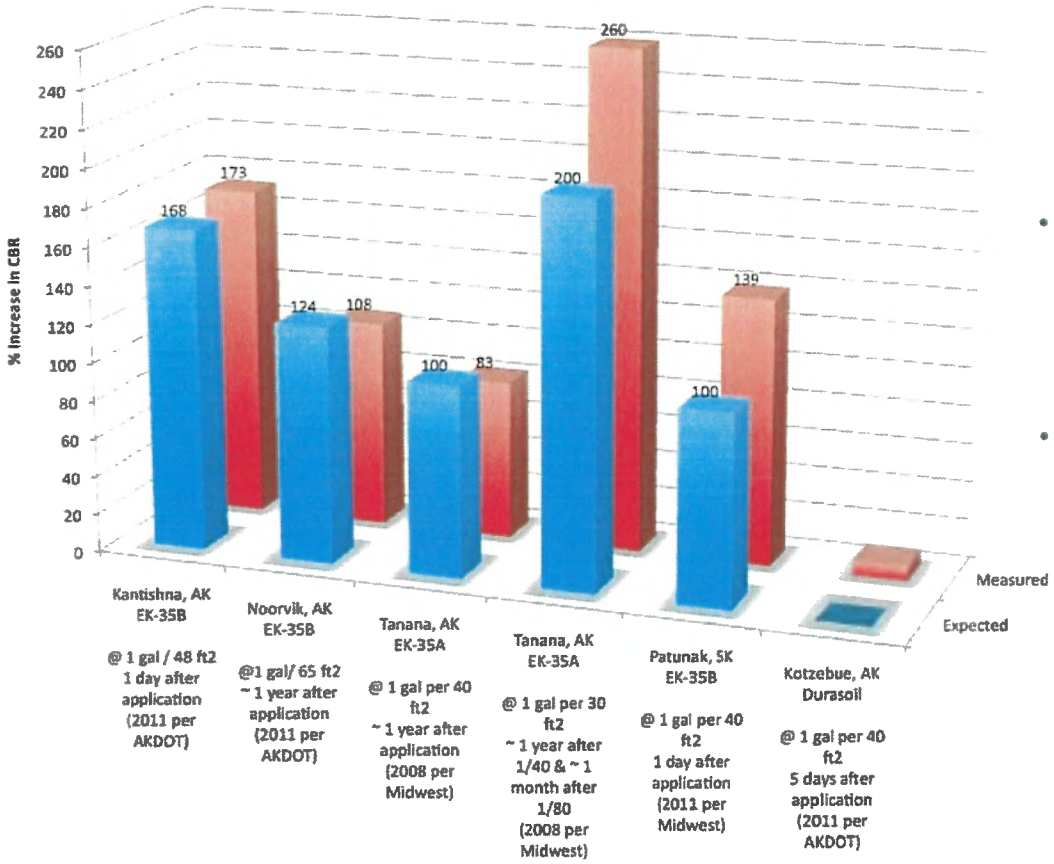
The Value of a Binder - Strength Gain (In-Place)

In-Place Trends



- As surface strength increases, so does fines preservation and the level of dust reduction.
  - This represents the general trends in the data gathered to date.
  - There are exceptions.
- Expected gain is a linear extrapolation based on lab CBR tests at a rate of 1 gal per 40 ft² and the application rate used for a given runway.
  - This assumes some degree of compaction

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The Value of a Binder - Fines (Gravel) Loss

24 Times Less Fines (Gravel) Loss As A Result Of Impinging Air (Wind) With A Binder Than Without

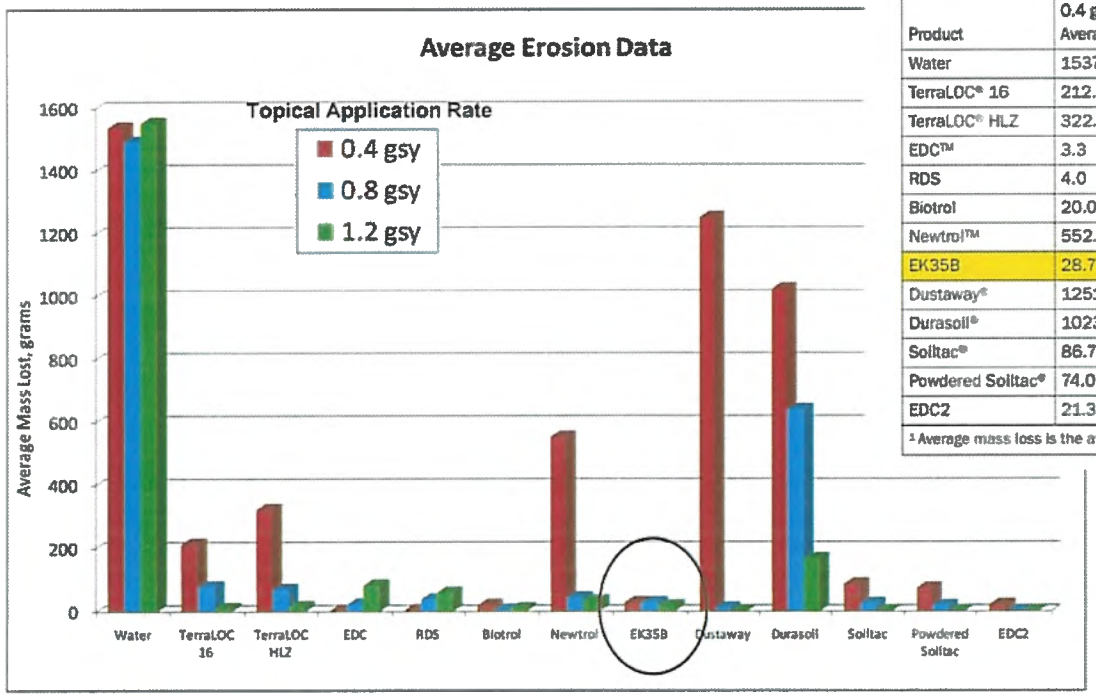

Figure 7. Air impingement results in terms of mass lost during testing.

Table 1. Results of air impingement testing in terms of erosion potential, or mass loss.

Product	Erosion Potential, Average Mass Loss (grams) [1]					
	0.4 gsy Average	0.4 gsy Standard Deviation	0.8 gsy Average	0.8 gsy Standard Deviation	1.2 gsy Average	1.2 gsy Standard Deviation
Water	1537.3	42.7	1492.7	15.0	1514.3	93.4
TerraLOC® 16	212.7	34.2	78.7	44.0	5.0	5.0
TerraLOC® HLZ	322.0	82.7	69.3	20.0	24.0	28.8
EDC™	3.3	5.8	22.7	37.5	78.7	29.1
RDS	4.0	5.3	38.0	36.4	124.0	57.2
Biotrol	20.0	2.0	5.3	7.6	16.7	8.3
Newtrol™	552.7	410.6	44.7	5.0	32.7	6.1
EK35B	28.7	8.1	28.7	3.1	22.0	4.0
Dustaway®	1251.3	170.2	12.0	5.3	16.7	27.2
Durasoil®	1023.0	193.7	639.3	135.4	264.7	111.7
Soiltac®	86.7	4.6	24.7	15.1	0.7	1.2
Powdered Soiltac®	74.0	112.6	18.7	12.2	0.0	0.0
EDC2	21.3	18.6	0.0	0.0	16.0	21.2

[1] Average mass loss is the average of the three specimens tested per concentration.

Simulated Aircraft: 150 mph @ 20° for 30 sec.

Source: U.S. Army Corp of Engineers
ERDC/GSL TR-10-38
September, 2010

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The Value of a Binder - Opacity (Dust Level)

5 Times Less Dust Opacity (Observed Dust) As A Result Of Impinging Air (Wind) With A Binder Than Without

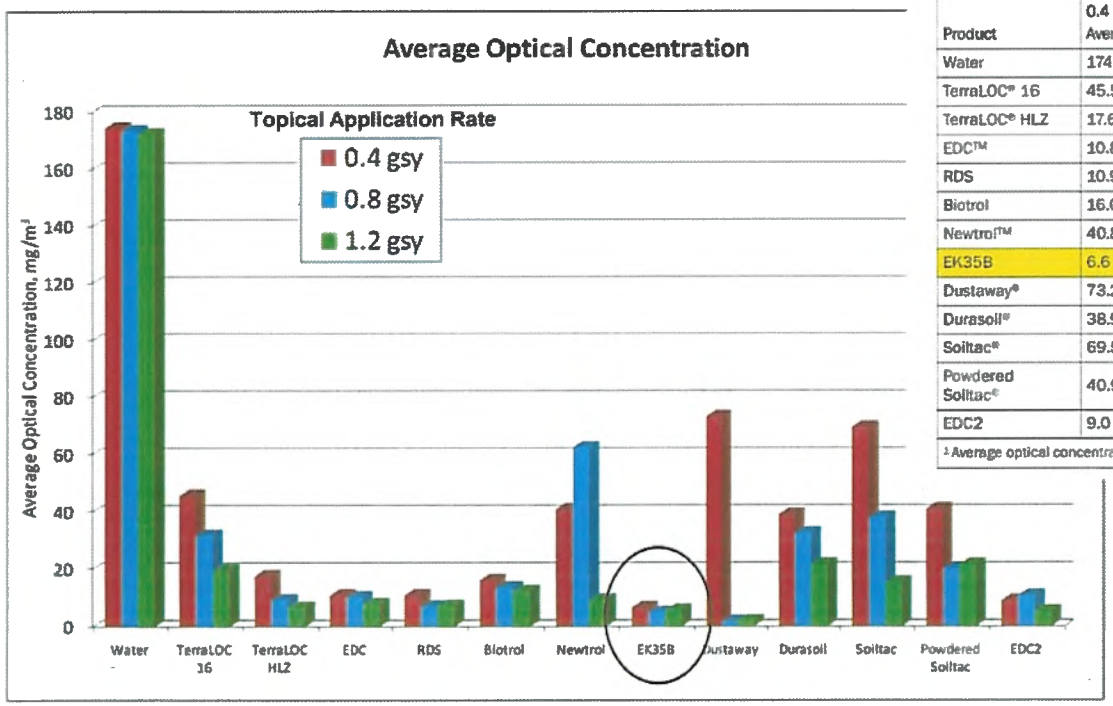

Figure 8. Air impingement results in terms of optical concentration during testing.

Table 2. Results of air impingement testing in terms of optical concentration.

Product	Average Optical Concentration (mg/m³) [1]					
	0.4 gsy Average	0.4 gsy Standard Deviation	0.8 gsy Average	0.8 gsy Standard Deviation	1.2 gsy Average	1.2 gsy Standard Deviation
Water	174.4	3.5	173.4	1.8	172.2	1.7
TerraLOC® 16	45.5	4.6	31.7	8.9	19.6	3.0
TerraLOC® HLZ	17.6	2.0	9.2	1.3	6.6	2.9
EDC™	10.8	3.5	10.3	4.8	7.9	1.0
RDS	10.9	7.8	7.1	2.2	7.3	0.8
Biotrol	16.0	3.5	13.6	2.9	12.4	4.0
Newtrol™	40.8	28.1	62.4	77.2	9.3	8.6
EK35B	6.6	2.3	5.0	4.1	5.7	6.8
Dustaway®	73.2	3.1	1.9	1.1	2.0	2.7
Durasoil®	38.9	21.8	32.6	7.1	21.7	3.5
Soiltac®	69.5	21.4	38.0	6.7	15.5	3.7
Powdered Soiltac®	40.9	31.7	20.1	4.0	21.6	5.0
EDC2	9.0	6.4	10.8	0.6	5.3	4.0

[1] Average optical concentration is the average of the three specimens tested per concentration.

Simulated Aircraft: 150 mph @ 20° for 30 sec.

Source: U.S. Army Corp of Engineers
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September, 2010

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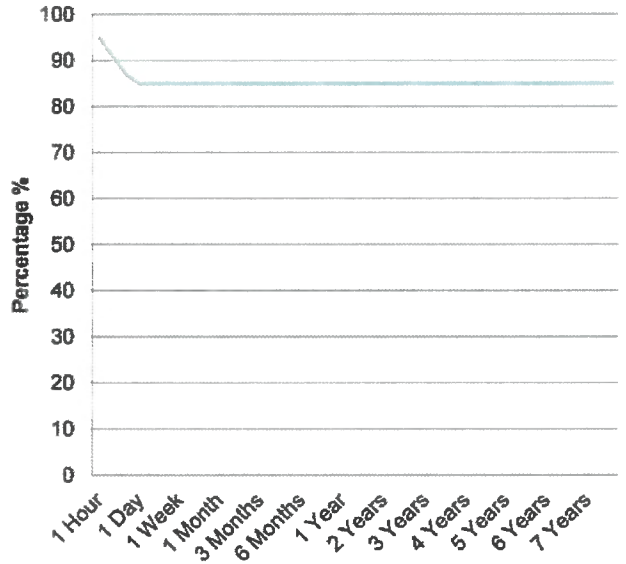
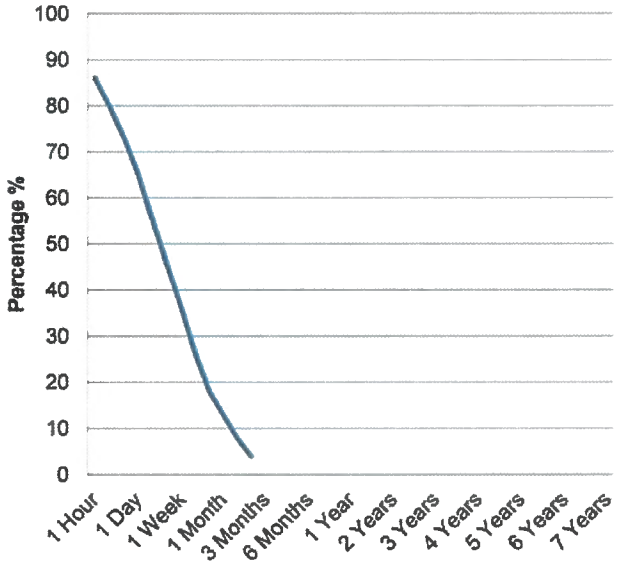
A Fundamental Choice

- Fines Preservation® preserves the investment of the runway reconstruction
- A dust palliative expects the likelihood of the major investment to be made a second time, sooner rather than later
- If reconstruction costs $25,000,000, the choice to use dust palliative will likely cost $25,000,000 again, sooner rather than later

Preservation – as-built condition, preventing loss



Palliative – temporary, stopgap, mitigate



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How to get what you want
Tight Specifications for each intended outcome

Preservation – as-built condition, preventing loss

- Has a Binder
  - > 70% Dust Reduction 2+ Years After Application
  - Verified Effective for PM10 Attainment
  - > 35% Strength Gain At application
  - Won't Wash Out
- U.S. EPA Verified Minimum Impact
- Noncorrosive - Boeing D6-17487
- Application Rate Based on Material & Site
- Non Water-Soluble
- No Petroleum Distillates
- Render Surface Reworkable
- Won't Freeze (e.g., -50° F)
- Topically Applied
- Independent, Documented Verification

Palliative – temporary, stopgap, mitigate

- Keeping Dust Down is Enough
  - Coating and lubricating soil particles
  - Ballasting agent
- Topical application
- Safe for people & environment
- No adhesion
- ~ 1 year of effectiveness
- No life cycle cost impact
- Minimum initial cost

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Application Guidelines
Topical

When the Surface Is Permeable

Two Days With One E-Sprayer

- When to apply: > ~ *4.5° C (40° F), not in rain & min. traffic*
- Surface preparation: *shape, moisten, loosely compact & drainage*
- Sprayer set up: *flow rate, overlap & pressure*
- Application rate: *typ. 1 L per 1 m² (1 gal per 40 ft²) accumulative*
- Initial application: *typ. five 7.2 kph (4.5 mph) passes at 1 L per 9.8 m² (1 gal per 400 ft²)*
- Dwell: *allow penetration (overnight)*
- Final application: *typ. Five more 7.2 kph (4.5 mph) passes at 1 L per 9.8 m² (1 gal per 400 ft²)*
- Dwell: ~ *24 to 48 hr. (open to traffic in < 1 hr. or continuously for emergencies)*
- Compaction: *assure max density*
- Inspection: *visual, surface strength or dust level*

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Application Guidelines
Incorporation

When the Surface Is Relatively Impermeable
> 12% fines, both silt and clay

- When to apply: > ~ *4.5° C (40° F), not in rain & min. traffic*
- Application sequence: *half of the runway (centerline to ~ the lights) at a time*
- Sprayer set up: *flow rate, overlap & pressure*
- Application rate: *typ. 1 L per 1.4 m² (1 gal per 55 ft²) accumulative*
- Surface preparation: *Scarify surface ~ 3.8 cm (1-½ inches), optimum moisture*
- 1st application: *typ. 4 passes at ~ 1 L/21.6 m² (1 gal/880 ft²) & ~ 9.7 kph (6 mph) & windrow to outside*
- 2nd application: *typ. 4 passes at ~ 1 L/21.6 m² (1 gal/880 ft²) & ~ 9.7 kph (6 mph) & grade & spread*
- 3rd application: *typ. 4 passes at ~ 1 L/21.6 m² (1 gal/880 ft²) & ~ 9.7 kph (6 mph) & compact*
- 4th application: *typ. 4 passes at ~ 1 L/21.6 m² (1 gal/880 ft²) & ~ 9.7 kph (6 mph)*
- 2nd half of runway: *as above*
- Inspection: *visual, surface strength or dust level*
- Repeat above in 1 year with ½ product volume

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Maintenance

- Incorporation
  - Grade & repair as required (surface reworkable)
  - Reapplication triggers
    - Excessive surface wear
    - Annual to biannual surface evaluation (Samitron or DUSTM)
      - An in-place decrease in CBR of 40%
      - A dust reduction of 50% or less
  - Repeat 2 year application cycle in 4 to 5 years
- Topical
  - Grade & repair as required (surface reworkable)
  - Reapplication triggers (as above)
  - Mean time between reapplications
    - Sandy or silty fines: 4+ years
    - Clayey fines: 12 to 18 months
  - Reapplication rate: .33/1 (liters/m^2) or 1/120 (gal/ft^2)

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