Foamed-Asphalt Base Stabilization: A Review of Alaska’s Experience

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Stabilized Base Course Policy

• Bound stabilized bases, containing:
  - Asphalt cement (ATB)
  - Emulsion asphalt (EATB)
  - Lime (LTB)
  - Portland cement (CTB)
  - Mixture of RAP & base course material
  - Foamed-asphalt cement (FASB)
  using Full Depth Reclamation (FDR)

The Reclaimer
WIRTGEN (WR2500), CMI, Caterpillar Paving
The Drum

- 10-ft wide
- 20-in deep cutting rotor

Expansion Chamber

- Cold water & air are injected simultaneously into the hot asphalt
- Hot asphalt foams explosively & shoots down into the mixing chamber

Foaming process

- The asphalt expands up to 15 times its original volume
- Foaming increases the asphalt surface area:
  - reduces asphalt viscosity
  - mixes well and binds fine aggregates
- Asphalt: 2.5% - 3.5% (> 160°C = 320°F)
- Water: 2.0% - 2.5% by weight of asphalt
- 6% - 20% Fines (P200):
  - proper dispersion of the foamed asphalt
One Pass Operation
In one pass of the reclaimer, the following is achieved:

- Pulverizes the old asphalt wearing course and part of the base course (typical depth 5” to 10”)
- Injects foamed asphalt (asphalt & water) : 2% - 4%
- Lays down the product ready to be spread, shaped, graded and compacted; wearing course added
- Portland Cement spreading on the existing wearing course before starting the pulverization

Some AK Foamed-Asphalt Projects

- **East and West Hill Roads** – Homer (AK Road Builders, 2002)
- St. Paul Airport (QAP, 2002)
- Parks Hwy MP 325-351 (Wilder, 2005)
- St. George Airport (QAP, 2005)
- Kalinfornsky Beach Rd MP 4.3-11 (QAP, 2006)
- Seward Hwy MP 0-8 (QAP, 2006)
- Seward Hwy MP 37-43 (QAP, 2007)
West Hill & East Hill Roads - Homer
- Central Region, Alaska RoadBuilders, 2002
- Extensive moisture damage in the sub layers

East Hill & West Hill Roads - Homer
- Existing 2” HMA + 4” base course
- P<sub>200</sub> = 5%
- Cement = 1%
- Mix Design
  - West Hill Road: 3.0% ± 0.3% foamed asphalt
  - East Hill Road: 2.5% ± 0.3%

The Train
- Pad-foot compaction
Foamed-Asphalt Base Material

Pad-foot Compaction
Then
Grading, Shaping

Watering and
Steel Drum Compaction
FASBC covered with HMA

Before & After

FWD Evaluation

FASBC Modulus = E = 110 ksi
Red Dog Zinc Mine - Tech Cominco
Knik Construction Co., 2002

- Haul truck: 240 ton ~ 480k lbs, 11 axles
  - 33 trucks/day, 105 psi tire pressure
  - Traffic volume: 27M ESALs over a 10-year design period

Red Dog Mine – Existing Embankment

- 12" (1/2 – 2" size rock) ; 7” left
- 12" (4 – 6" size rock)
- 24” (12 – 15” size rock)
- 36” (20 – 24” size rock)
- 5-in crushed rock added
- Stabilization depth: 10"
- 3.0% ± 0.3% foamed asphalt
- AC-2.5 at 330°F
- 2.5% water
Parks Hwy MP325-351 Rehab

- Northern Region, Wilder, 2005
- FASBC (318) = 6"
- Wearing course = 4” HMA in 2 lifts
- FASBC Mix design:
  Asphalt (PG52-28) = 3%
  Water = 2.5%
  Cement = 1%
Parks Hwy MP325-351 Rehab

Finished FASBC:
- Sat for >3-days before paving
- Performed well under traffic & rain: no potholes
- Generated low dust
- Cost: ~$4.3M for 25 miles >> $170k/mile

Average Modulus = 209 psi
Design Modulus = Average E minus 1-Stdev = 144 ksi

FWD test data

Parks Hwy MP325-351 Rehab

2007 Measured IRI  
2007 Average IRI = 47
2006 Measured IRI  
2006 Average IRI = 44

Parks Hwy - MP

Parks Hwy - MP
Seward Hwy MP 37-43 Pavement Refurbishment

- Central Region, QAP, 2007
- FASBC (318) = 5"; 140k sq.yd.
- Wearing course = 3.5" HMA in 2 lifts
- FASBC Mix design:
  - 50/50 mix, existing HMA/Base course
  - Asphalt (PG52-28) = 2%
  - Water = 3%
  - Cement = 1%

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The Train

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Loose Foamed-Asphalt Base Material

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Common Features to Foamed-asphalt Projects

1- Mix Design:
WLB 10 Foamed Asphalt Plant

Indirect Tension Test

1- Mix Design:

Common Features to Foamed-asphalt Projects

2- Technical Representative

3- Test Strip: to validate the mix design, equip’t performance, compaction pattern

3- Weather Limitation: Temp. > 40F

4- Compactors:
- Vibratory Pad-foot roller
- Vibratory Steel drum roller
- Pneumatic roller
Conclusions - Lessons Learned

- Foamed-Asphalt technology is a cost-effective stabilizing method
- Increases the strength of base course and pavement
- Reduces water infiltration into subbase
- Reduces freeze-thaw cycling effects
- Cost of foaming:
  Initially ~ $10/sq.yd.
  Lately ~ $7.5/sq.yd.

Useful References & Websites

- Foamed-Asphalt related:
  https://www.wirtgenamerica.com/fa/index.html

- Recycling related:
  http://www.arra.org/content/view/40/25/
  http://www.martec.ca/

- ADOT&PF Newsletter – Summer 2002
  http://www.dot.state.ak.us/stwddes/research/assets/pdf/02v27n2.pdf

- Wirtgen Cold Recycling Manual

Questions? Comments?

Thank you!
Parks Hwy MP 325-351
After foaming - Oct.2005 Blisters

Sampling affected areas

Cross-sectional view of affected area
Parks Hwy MP 325-351
After foaming - Oct. 2005 Blisters
Field-cut samples at the office, Nov. 2005

Parks Hwy MP 325-351
Traces of Salt on the roadway surface

Parks Hwy MP 325-351
Marking the affected areas, Jun. '06