IT’S NOT THE ASPHALT
IT’S YOUR FAULT

Use of Innovative Paving Practices to Achieve Excellent Pavement Density
OVERVIEW

- Project location and background
- **Successful** use of innovative technologies – and how
- Results
Asphalt Cement (~25 metric ton cubes)  Shop/Parts Cans  Truck Boxes  Asphalt Plant Pieces  18 Man Camp
PETERSBURG AIRPORT
TAXIWAY AND APRON
REHABILITATION

• Original apron construction: 1987
• Original taxiway construction: 1981
# Asphalt Crushing and Marshall Mix Design

## Mixture at Optimum

<table>
<thead>
<tr>
<th>Description</th>
<th>Marshall</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASPHALT CONTENT %</td>
<td>5.1</td>
<td><strong>5.0 MIN</strong></td>
</tr>
<tr>
<td>UNIT MASS-PCF</td>
<td>153.0</td>
<td></td>
</tr>
<tr>
<td>Voids Filled-%VFA</td>
<td>81</td>
<td></td>
</tr>
<tr>
<td>Voids Total Mix-%VTM</td>
<td>2.8</td>
<td><strong>2.8 - 4.2</strong></td>
</tr>
<tr>
<td>Voids Min Agg-%VMA</td>
<td>14.5</td>
<td><strong>13.0 MIN</strong></td>
</tr>
<tr>
<td>Stability-LBS</td>
<td>3200</td>
<td>2150</td>
</tr>
<tr>
<td>Flow-In</td>
<td>13</td>
<td><strong>10 - 14</strong></td>
</tr>
<tr>
<td>Maximum SPG Gmm</td>
<td>2.528</td>
<td></td>
</tr>
<tr>
<td>Max Unit Mass-PCF</td>
<td>157.4</td>
<td></td>
</tr>
<tr>
<td>Dust / Asphalt Ratio</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Number of Blows</td>
<td>75</td>
<td>75</td>
</tr>
</tbody>
</table>
INFRARED JOINT HEATER

Heat Design Equipment
BACKGROUND

• Project originally specified echelon paving – impractical for apron and taxiway

• Good joints most critical

• “Cold” joint spec required cutting

• Poor agency definition of cold joint for modified asphalt – 160 degrees F (71 degrees C)
EQUIPMENT AND COST TO RUN

- Heat Design Equipment: JMH 500–PA 500,000 BTU Joint Heater
- Runs off liquid propane – 1 to 2 tanks per shift in Petersburg (low setting)

Cost Comparison per meter
Cutting/Milling vs. Joint Heater

<table>
<thead>
<tr>
<th></th>
<th>Cutting</th>
<th>Cutting</th>
<th>Joint Heater</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor plus Joint</td>
<td>Waste Asphalt (Agency)</td>
<td>Propane</td>
<td></td>
</tr>
<tr>
<td>Adhesive</td>
<td>$2.79</td>
<td>$2.95</td>
<td>$0.39</td>
</tr>
</tbody>
</table>

100 lb propane tanks (91 litres)
INFRARED DATA

White = degrees F
Black = degrees C

181.6 200.2 287.5 309.4
83.1 93.4 141.9 154.4
## DENSITY DATA

### Full joint density bonus received!

<table>
<thead>
<tr>
<th>Core I.D.</th>
<th>Joint Density (% MSG)</th>
<th>Corresponding Mat Density (% MSG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMA 6</td>
<td>90.9</td>
<td>94</td>
</tr>
<tr>
<td>HMA 7</td>
<td>93.9</td>
<td>93</td>
</tr>
<tr>
<td>HMA 8</td>
<td>93.3</td>
<td>94</td>
</tr>
<tr>
<td>HMA 9</td>
<td>94.4</td>
<td>96</td>
</tr>
<tr>
<td>HMA 10</td>
<td>93.9</td>
<td>95</td>
</tr>
<tr>
<td>HMA 11</td>
<td>91.5</td>
<td>93</td>
</tr>
<tr>
<td>HMA 19</td>
<td>92.9</td>
<td>96</td>
</tr>
<tr>
<td>HMA 20</td>
<td>94.7</td>
<td>95</td>
</tr>
<tr>
<td>HMA 21</td>
<td>94.6</td>
<td>93</td>
</tr>
<tr>
<td>HMA 22</td>
<td>94.7</td>
<td>96</td>
</tr>
<tr>
<td>HMA 23</td>
<td>93.0</td>
<td>92</td>
</tr>
</tbody>
</table>

**Average Joint Density: 93.5% MSG**

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**DENSITY DATA**

Full joint density bonus received!
GOOD DENSITY GOOD AESTHETICS (WIN-WIN)

White = degrees F
Black = degrees C

266.4 130.2
176.1 80.1
FREQUENTLY ASKED QUESTIONS

Q: Will the joint heater overheat the pavement and prematurely oxidize the asphalt?
A: If it does it’s YOUR FAULT!

Say NO to early-oxidation!

Check with visual emissions and infrared gun temperatures
FREQUENTLY ASKED QUESTIONS

Q: Will I have to slow the paving train down to snail speed to get the temperatures I need?
A: No – Knik average paving speed with joint heater = 8 meters/min

Q: Can the joint heater be used in the rain?
A: … But should you really be paving in the rain?

Q: What prep work is required on the edge prior to using the joint heater?
A: None – not even for ugly, deformed, traffic rolled edges.
INTELLIGENT COMPACTION
BACKGROUND

• Required per contract
• No acceptance criteria
• Contractor to provide training and data to Agency
EQUIPMENT AND COST TO RUN

- Wirtgen/HAMM HD + 140 VO IC roller
- Topcon GPS (not standard)
- Knik purchased three rollers in 2013
- No cost to run after equipment is purchased
- Does “tie up” GPS receiver
- Training in less than one day
DATA – PRE PAVING MAPPING
DATA – PASS COUNTS
DATA – TEMPERATURE

<table>
<thead>
<tr>
<th>°C</th>
</tr>
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<tbody>
<tr>
<td>127</td>
</tr>
<tr>
<td>121</td>
</tr>
<tr>
<td>115</td>
</tr>
<tr>
<td>110</td>
</tr>
<tr>
<td>104</td>
</tr>
<tr>
<td>99</td>
</tr>
<tr>
<td>93</td>
</tr>
<tr>
<td>88</td>
</tr>
</tbody>
</table>
# DATA – DENSITY

<table>
<thead>
<tr>
<th>Summary</th>
<th>Mat Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average (% MSG)</td>
<td>95</td>
</tr>
<tr>
<td>Target (% MSG)</td>
<td>95</td>
</tr>
<tr>
<td>St. Deviation</td>
<td>1.55</td>
</tr>
<tr>
<td>Percent Within Limits</td>
<td>98</td>
</tr>
</tbody>
</table>

Maximum asphalt mat density bonus achieved!
"[We] noticed little deviation in both mat and joint densities and mix properties (Oil content and Gradation) once Knik’s QC team dialed in on a project. This demonstrates Knik’s QC program is proactive, has good process control and is utilizing both the IC rollers and the QC program to provide the Department with a quality, consistent product."

– Don Newell, AK DOT &PF

Note: Takes the technology AND a good QC program – if you aren’t getting the benefits of your technology it’s YOUR FAULT
Q: Does the stiffness correlate to density?
A: Not in my opinion/experience – R squared of 0.31

Q: What is the time commitment for analyzing the data?
A: Depends on what you want to see – NOT JUST ANYONE SHOULD ANALYZE THE DATA FOR ACCEPTANCE
FREQUENTLY ASKED QUESTIONS

Q: What are the benefits of intelligent compaction
A: In my (contractor’s) opinion:

1. Real time data – no guess work for operator
2. Trouble shooting – Not happy with density? What were breakdown temps, speed of roller, amplitude, frequency?
3. Guarantee of coverage and temperatures to agency
4. Pre-paving mapping – especially if another contractor built the grade
5. Training tool for less than desirable roller operators
6. Remember – you get out of it what you put into it
MATERIAL TRANSFER VEHICLE

Roadtec Shuttle Buggy SB-25000
BACKGROUND

• Required per contract (all Alaska airport contracts require MTV)

• Knik uses MTV on all significant paving projects regardless of requirement

• Proven to be best tool for anti-segregation
EQUIPMENT AND COST TO RUN

- Roadtec SB–25000
- Does require one additional crew member to operate
- One more piece of equipment to fuel and move
- Best tool for anti-segregation
- 25 ton surge capacity
- Less stopping the paver
- Mobile – not attached to paver – ideal for difficult dumping locations
DATA – TEMPERATURE

White = degrees F
Black = degrees C
# DATA – AGGREGATE

<table>
<thead>
<tr>
<th>Summary</th>
<th>3/4”</th>
<th>1/2”</th>
<th>3/8”</th>
<th>#4</th>
<th>#8</th>
<th>#16</th>
<th>#30</th>
<th>#50</th>
<th>#100</th>
<th>#200</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>19.0 mm</td>
<td>12.5 mm</td>
<td>9.5 mm</td>
<td>4.75 mm</td>
<td>2.36 mm</td>
<td>1.18 mm</td>
<td>0.60 mm</td>
<td>0.30 mm</td>
<td>0.15 mm</td>
<td>0.075 mm</td>
</tr>
<tr>
<td>Average</td>
<td>100</td>
<td>90</td>
<td>77</td>
<td>49</td>
<td>32</td>
<td>21</td>
<td>16</td>
<td>12</td>
<td>10</td>
<td>7.4</td>
</tr>
<tr>
<td>Job Mix Formula</td>
<td>100</td>
<td>89</td>
<td>76</td>
<td>49</td>
<td>33</td>
<td>23</td>
<td>17</td>
<td>13</td>
<td>10</td>
<td>7.0</td>
</tr>
<tr>
<td>St. Deviation</td>
<td>0.00</td>
<td>2.56</td>
<td>2.79</td>
<td>2.52</td>
<td>1.19</td>
<td>0.85</td>
<td>0.64</td>
<td>0.49</td>
<td>0.51</td>
<td>0.38</td>
</tr>
<tr>
<td>Percent Within Limits</td>
<td>100</td>
<td>98</td>
<td>98</td>
<td>99</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Maximum asphalt mix composition bonus achieved!
FREQUENTLY ASKED QUESTIONS

Q: Why always use a MTV?
A: Nearly eliminates segregation in the mat
WARM MIX ADDITIVE (COMPACTION AID AND ANTI-STRIP)
BACKGROUND

• Added at 0.3% per weight of asphalt as anti-strip and compaction aid
• Added at terminal
• Slight reduction in temperatures at hot plant
EQUIPMENT AND COST TO RUN

- Evotherm 3G
- Slightly higher price than typically used anti-strip
- Added at terminal – no need for additional equipment at hot plant
- Benefit in compaction aid and density related bonuses
- Benefit with difficult to compact modified binder
TYPICAL ALASKA BINDERS

Process

Lab (mix design) Temp F (C)
Mixing 325 (163)
Compaction 305 (152)
Field (construction) Temp F (C)
Mixing 300–310 (148–154)
Compaction 260–280 (127–138)

No issues with compaction (two double drum rollers)
No issues with mixing

Cost of fuel in Petersburg $6.00 per metric ton!

Mixing 325 (163)
Compaction 305 (152)

FINISHED PRODUCT TAXIWAY
FINISHED PRODUCT APRON
FINAL NUMBERS

- Contract Amount: $2,987,200
  - (originally bid to echelon pave – two crews and two sets of equipment)
- Final Project Amount: $2,855,000
- Total Bonus for quality: ~ $100,000
- Completed under budget (Agency and Contractor)
- Completed ahead of schedule
- No delays to Alaska Airlines