APPENDIX 3

Practice Problems 2015
Asphalt Paving Level 2 Practice Problems

**MIX TEMPERATURE:**

Design temperature for the mix at the plant is 295ºF

A. The master range for the mix is ± ___ºF per section 320-6.3

B. What is the allowable range for the mix? ________ to ________

You sampled the first 5 trucks loads of mix and recorded the following temperatures:

285ºF, 290ºF, 270ºF, 280ºF, 290ºF

C. Do any of the individual truckloads exceed the master range?

D. The average temperature = (285 + 290 + 270 + 280 + 290) / 5 = _____ºF

Apply Table 320-2.

E. Is any single measurement greater than ± 25ºF? What action is required? __________________________

F. Is the average of five consecutive measurements greater than ± 15ºF? What action is required? __________________________

**MIX TARGET SPREAD RATE:**

1. Superpave mix: Target spread rate (lbs/yd²) = t x Gmm x 43.3. From the plans: 2 inches of SP-12.5. From the mix design: Gmm = 2.549.

Target spread rate = ________

If your actual spread rate was 200 lbs/yd², what changes would you make? __________________________

2. FC-5 mix: Target spread rate (lbs/yd²) = t x Gsb x 40.5, From the plans: 0.75 inches of FC-5. From the mix design: Gsb = 2.649.

Target spread rate = ________

If your actual spread rate was 75 lbs/yd², what changes would you make? __________________________
PRACTICE PROBLEMS - TACK SPREAD RATE

You are preparing to place the first pass of leveling on a milled surface. Use calibration chart provided.

1. (a) What tack spread rate would you select? _______ gal/yd². The tack shot is made. Using the following information, calculate the quantity, tack spread rate, and any action to be taken.

   Tack shot from Station 795+85 to Station 817+00.
   The shot width = 11 feet 6 inches
   The beginning tank measurement = 11/08
   The ending tank measurement = 16/15
   The tack temperature = 150ºF

   (b) Quantity = _______ gals.
   (c) Spread rate = _______ gal/ yd²
   (d) Action: _________________________________________________________________

PRACTICE PROBLEM - MIX SPREAD RATE

Calculate the spread rate and indicate any action you would take for the following operations.

1. Laying FC-12.5 mix. Specified spread rate is 165 lbs/ yd². Mat width is 12 feet. Placed between Station 799+00 and Station 806+50. Four truckloads net weights: 38,880 lbs, 43,740 lbs, 38,650 lbs, and 36,940 lbs.

   (a) Spread rate = _____________ lbs/ yd²
   (b) Action: _________________________________________________________________

2. Laying FC-9.5. Target spread rate is 108 lbs/ yd². Mat width is 12 feet. Placed between Station 104+15 and Station 91+39. Five truckloads net weight totals 196,680 lbs.

   (a) Spread rate = _____________ lbs/ yd²
   (b) Action: _________________________________________________________________

3. Laying FC-5. Five truckloads net weights: 39,870 lbs, 40,050 lbs, 37,970 lbs, 41,190 lbs, and 39,950 lbs. Mat width is 12.5 feet. Placed between Station 10+50 and Station 27+26. Thickness target is 0.75 inches. Gsb is 2.559.

   (a) Spread rate = _____________ lbs/ yd²
   (b) Action: _________________________________________________________________
PRACTICE PROBLEM: CROSS-SLOPE

You are the contractor and have a 6-foot manual level that you are using to check the cross-slope measurements taken with your electronic level. You set one end of the manual level on the pavement and center the bubble. You measure down with your ruler and read 1-3/4 inches.

1. What is the cross-slope on the pavement? __________________________________________

2. If an individual cross-slope absolute deviation falls outside the acceptance tolerance, what do you do? __________________________

3. If the average cross-slope absolute deviation falls outside the acceptance tolerance, what do you do? ________________________________________________________

4. If you were the Verification Technician and the average absolute deviation or an individual absolute deviation falls outside of the acceptance tolerance as shown in Table 330-4, what would you do? ________________________________________________________
CORE LAYOUT PRACTICE PROBLEM

1. Given the following information. Locate the cores for sublot #2. Width = 12.0 feet. The station at ton 489 was 23+88. Spread rate is 153 lbs/yd². Lane R2, Lift 1 of 1.
**PRACTICE PROBLEM: SUPERPAVE FINE GRADED**

Case #2: The roadway cores from the previous LOT have been tested and you have been provided the results of the LOT. You notice the average of the LOT is pretty close to the target of 93.0% (Table 334-7), but the pay factor for the Roadway Density is 0.88 and the LOT pay factor is 0.99. What remedial action is required for the 0.88 pay factor? How do you correct the roadway density for the next LOT?

<table>
<thead>
<tr>
<th>Property</th>
<th>$P_s$</th>
<th>$P_{-200}$</th>
<th>$P_b$</th>
<th>$V_a$</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sublot 1</td>
<td>52.70</td>
<td>6.00</td>
<td>6.60</td>
<td>4.10</td>
<td>94.30</td>
</tr>
<tr>
<td>Sublot 2</td>
<td>51.00</td>
<td>6.10</td>
<td>6.40</td>
<td>4.00</td>
<td>95.40</td>
</tr>
<tr>
<td>Sublot 3</td>
<td>50.00</td>
<td>6.00</td>
<td>6.54</td>
<td>4.32</td>
<td>94.90</td>
</tr>
<tr>
<td>Sublot 4</td>
<td>52.10</td>
<td>6.10</td>
<td>6.39</td>
<td>4.01</td>
<td>94.50</td>
</tr>
<tr>
<td>Target</td>
<td>50.0</td>
<td>6.00</td>
<td>6.50</td>
<td>4.0</td>
<td>93.0</td>
</tr>
<tr>
<td>$n$</td>
<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Mean</td>
<td>51.45</td>
<td>6.05</td>
<td>6.48</td>
<td>4.11</td>
<td>94.78</td>
</tr>
<tr>
<td>SD</td>
<td>1.196</td>
<td>0.058</td>
<td>0.104</td>
<td>0.149</td>
<td>0.486</td>
</tr>
<tr>
<td>Qu</td>
<td>1.38</td>
<td>16.45</td>
<td>4.04</td>
<td>8.68</td>
<td>0.45</td>
</tr>
<tr>
<td>%U</td>
<td>95.67</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>65.00</td>
</tr>
<tr>
<td>QI</td>
<td>3.80</td>
<td>18.19</td>
<td>3.65</td>
<td>10.16</td>
<td>5.72</td>
</tr>
<tr>
<td>%L</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
</tr>
<tr>
<td>Qual</td>
<td>95.67</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>65.00</td>
</tr>
<tr>
<td>PF</td>
<td>1.03</td>
<td>1.05</td>
<td>1.05</td>
<td>1.05</td>
<td>0.88</td>
</tr>
</tbody>
</table>

Composite Pay Factor: **0.99**

Note: Sublot values that appear in RED are outside of the Master Production Range as specified in Table 334-5, refer to 334-5.4.4.

Density PF is below 0.90, see 334-5.9.2

What remedial action is required for the 0.88 pay factor?

How do you correct the roadway density for the next LOT?

What could be causing the problem (troubleshooting time) and how do you resolve?

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________
ANSWERS TO PRACTICE PROBLEMS

MIX TEMPERATURE

Answer:
A. 30ºF.
B. 265ºF — 325ºF.
C. No.
D. 283ºF.
E. Any single measurements greater than ± 25ºF? 295-270= 25ºF. Borderline on one measurement. Temperatures need to improve.
F. Average = 283ºF. 295 - 283 = 12ºF which is inside the ± 15ºF range. OK.

Notify the Contractor and the plant and your document results. The 3rd measurement (270ºF) is getting close to border and the average is also close to the acceptable tolerance. Should you increase your frequency of temperature measurements until the condition stabilizes?

MIX TARGET SPREAD RATE:

Question 1: 221 lbs/yd² Action: Exceeds 5% on low side. Increase and recheck.
Question 2: 80 lbs/yd² Action: Exceeds 5% on low side. Increase and recheck.

TACK SPREAD RATE

1. (a) The selected spread = 0.06 gal/ yd² is based on section 300-8.4 for milled surface.

   Station 817+00 = 81,700
   Station 795+85 = 79,585 (subtract)
   2,115 LF

   2,115 LF x 11.5 ft. (width) = 24,322.5 ft².

   \[
   \frac{24,322.5 \text{ ft}^2}{9 \text{ ft}^2/\text{sq}^2} = 2,702.5 \text{ yd}^2
   \]

   Initial Reading 11/08 = 1325 gallons
   Ending Reading 16/15 = 1193 gallons (subtract)
   132 gallons at 150ºF

   Temperature Correction Factor for 150ºF is 0.9780.

   (b) 132 gals x 0.9780 = 129.1 gals. @ 60ºF

   (c) 129.1 gals = 0.0477 or 0.05 gal/ yd²

   2,702.5 yd²

   (d) If your selected spread rate was 0.06gal/yd², this is within the 0.01 tolerance (though right on the edge). No further change is needed at this time, but it might be wise to make a change to get it closer to the target.
Answers to PRACTICE PROBLEM - MIX SPREAD RATE

1.  

\[
\begin{align*}
806 + 50 &= 856 \\
799 + 00 &= 799 \\
750 \text{ LF} &\times 12.0 \text{ ft. (width)} = 9,000 \text{ ft}^2 & 38,880 \\
9,000 \text{ ft}^2 &= 1,000.00 \text{ yd}^2 & 38,650 \\
9 \text{ ft}^2/\text{yd}^2 &= 36,940 & 158,210 \text{ lbs.}
\end{align*}
\]

(a) \(158,210 \text{ lbs.} = 158,2 \text{ lbs/} \text{yd}^2\)  

(b) Spread rate is below target of 165 lbs/\text{yd}^2, but within a 5% tolerance (157-173 lbs/\text{yd}^2). No adjustment is required. Generally though, try and hold near the target especially if the asphalt is being paid by the ton.

2.  

\[
\begin{align*}
104 + 15 &= 119 \\
91 + 39 &= 130 \\
1276 \text{ LF} &\times 12.0 \text{ ft. (width)} = 15,312 \text{ ft}^2 \\
15,312 \text{ ft}^2 &= 1,701.33 \text{ yd}^2 \\
9 \text{ ft}^2/\text{yd}^2 &= 116,680 \text{ lbs.} & 116 \text{ lbs/} \text{yd}^2
\end{align*}
\]

(a) \(116,680 \text{ lbs.} = 116 \text{ lbs/} \text{yd}^2\)  

(b) If the target is 108 lbs/\text{yd}^2, the upper target tolerance would be 5% (108 + 5 = 113 lbs/\text{yd}^2). Your actual spread rate is exceeding the tolerance and should be reduced and rechecked.

3.  

\[
\begin{align*}
27 + 26 &= 53 \\
10 + 50 &= 60 \\
1676 \text{ LF} &\times 12.5 \text{ ft. (width)} = 20,950 \text{ ft}^2 & 39,870 \\
20,950 \text{ ft}^2 &= 2,327.77 \text{ yd}^2 & 40,050 \\
9 \text{ ft}^2/\text{yd}^2 &= 37,970 \\
&= 41,190 & 39,950 \\
2,327.77 \text{ yd}^2 &= 199,030 \text{ lbs.}
\end{align*}
\]

(a) \(199,030 \text{ lbs.} = 86 \text{ lbs/} \text{yd}^2\)  

(b) First calculate the spread rate as you have above. Now you need to know what the target spread rate is. Remember the formula for FC-5? Target spread rate = t x G sb x 40.5. Calculating that out gives you 78 lbs/\text{yd}^2 target. Add 5% to that (78 + 4 = 82 lbs/\text{yd}^2). Your actual rate is still above the upper limit. Reduce the spread rate and recheck.
Answer to CROSS SLOPE problem

1. 1.75 divided by (6 x 12 = 72 inches) x 100 = 2.43%. Rounded = 2.4%

2. If an individual cross slope deviation falls outside the acceptance tolerance as shown in Table 330-4, make corrections at no cost to the Department in accordance with 330-9.5 to address the deficient area of the structural course. Complete all corrections before placement of the final pavement surface layer, unless stated otherwise in the Plans, or as determined by the Engineer. For pavement with multiple layers, the deficient areas for the structural course may be left in place, upon the approval of the Engineer. For friction course layers, make corrections in accordance with 330-9.5.

3. Immediately make a comparison check at the QC test locations to verify the QC measurements in the section. If the comparisons are beyond the acceptable comparison tolerance in accordance with 330-9.3.1, stop the paving operations until the issue is resolved to the satisfaction of the Engineer. Correct any cross slope not meeting the individual deviation acceptance tolerance in accordance with 330-9.5 at no cost to the Department.

Answer to CORE LAYOUT PRACTICE PROBLEM

Answer: Ton number 489 becomes our base. The first core in sublot 3, core 3-2-1 is at ton 576. 576 - 489 = 87 tons. For 3-2-2, 673 - 489 = 184 tons. For 3-2-3, 748 - 489 = 259 tons. For core 3-2-4, 800 - 489 = 311 tons. For 3-2-5, 981 - 489 = 492.

Remember we developed a single factor based on the common factors in the conversion. 2000 lbs/ton divided by the target spread rate (153 lbs/yd$^2$) divided by the lane width (12 feet) times 9 ft$^2$/yd$^2$ = 9.803

87 x 9.803 = 853 feet. Adding that to 23+88 gives you 32+41

184 x 9.803 = 1804 feet. Adding that to 23+88 gives you 41+92

259 x 9.803 = 2539 feet. Adding that to 23+88 gives you 49+27

311 x 9.803 = 3049 feet. Adding that to 23+88 gives you 54+37

492 x 9.803 = 4823 feet. Adding that to 23+88 gives you 72+11

Make sure you write on the Random Number Sheet the lane and lift next to the station you calculated.

ANSWER TO PRACTICE PROBLEM: SUPERPAVE MIX

What remedial action is required for the 0.88 pay factor?

From the specs., 334-5.9.1 Pay Factors Below 0.90: In the event that an individual pay factor for any quality characteristic of a LOT falls below 0.90, take steps to correct the situation and report the actions to the Engineer. It obviously would be in the contractor's best interests to correct the situation immediately. If the composite pay factor dropped below 0.90, you would be facing a shut down unless you already corrected the situation.
How to correct the roadway density for the next LOT?

In this case the mean of the sublots is significantly higher than the target of 93.0 (per Table 334-7). The variability is quite low (which is great), but the problem is too much density. Since the P200 (dust), Asphalt Content (Pb), and Air Voids (Va) are all pretty close to what they need to be for this mix, the first step would be to look at the compaction operation. In the field, recheck the QC technician’s gauge calibration to make sure it is properly calibrated and being run correctly. Check the mix temperature. Is it running on high side? Consider adjusting the rolling pattern to either reduce coverages or eliminate equipment. Monitor the rolling pattern and resulting density values to bring them closer to the target. What other issues could contribute to this problem? Develop a plan of action including a series of steps to help improve this situation. Start with the step that has the highest probability of success and work through the list until the situation is resolved.