An investigation into the spray pattern of bitumen products

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Introduction

End jet

Standard jet

100

Effective width
Introduction

• Traditional sprayer calibration practice relies on calibrating oils
• PMBs and emulsions are not adequately represented

• Single jet laboratory spraying simulator used in experiments
• Investigating
  – performance and repeatability of the nozzles
  – the properties of sprays with alternative materials
Equipment – field sprayer simulator

- Simulates single nozzle spray
- 15 litre storage tank
  - temperature and pressure controls
  - stirrer
- Discharge collected by 25 20 mm wide troughs
- Nozzle height 260 mm above troughs
Method

• Repeatability of Copley AN18 spray distribution
• Alternative nozzles
  – Copley A3
  – Copley AN18W (end)
  – VeeJet H1/2U.
Method (2)

- Testing with products
  - C170
  - C320
  - S20E
  - S25E
  - S35E
  - S15RF
  - CRS Emulsion

- Simulation program
Results – Calibration oil testing
Results – Between nozzle variation
Results – Quantifying variation

![Graph showing variation](image)
Results – Effect of pressure

![Graph showing the effect of pressure on troughs. The graph compares two pressures: 82 kPa (blue line) and 110 kPa (red line). The x-axis represents the number of troughs, while the y-axis shows the percentage of the total. The graph illustrates how the pressure affects the distribution of troughs.]
Results
Results – Alternative nozzles
Results – ‘Hot’ product testing
Results – Bitumen products
Results – PMBs

![Graph showing PMBs results with different lines for S25E, S20E, and S35E. The x-axis represents Trough number, and the y-axis represents % of total. The graph illustrates the distribution of PMBs across different trough numbers.]
Results – Crumb rubber & emulsion
Results – spray width & viscosity
Results - Viscosity

![Graph showing the relationship between spray width and Brookfield viscosity. The graph plots spray width (mm) against Brookfield viscosity (Pa.s). There are data points for CRS, C170, S35E, S20E (hot), S20E, S25E, and S25E (cold). The linear equation is given as y = -783.86x + 589.69 with R² = 0.95796.]
Ongoing work – simulation program

- Conducts full spraybar simulations
- Variables
  - binder type
  - nozzle spacing
  - nozzle angle
  - number of nozzles.
Ongoing work – simulation program (2)
Conclusion

• Testing undertaken with calibration oil and bitumen products
• The Copley AN18 nozzle showed good repeatability
• Conventional bitumen & PMBs tested
  – bitumens conformed to expected shape well
  – PMBs showing more variation
  – crumb rubber retained a very uniform fan shape.
• Spraybar simulation under development
Thankyou

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