NEW TECHNOLOGY & APPROACHES TO ADDRESS PAVEMENT CONSTRUCTION ISSUES

NORTHEAST ASPHALT USER/PRODUCER GROUP
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CHUCK DEAHL
BOMAG AMERICAS, INC.
Pavement Construction Issues

- No Compaction In Embankment & Base
- Segregation
- Poor Rolling Procedures
Roller mounted compaction measurement and documentation systems
Interpretation of Omega values
Development of Omega values during compaction
GPS POSITIONING

- Two GPS Antenna
- Reference station (Trimble)
- High accuracy (5cm)
- RTK (real time)
- BCM 05 positioning software
Causes of Segregation

- Physical segregation of coarse and fine materials
- Mat temperature differentials immediately behind the paver
- Localized cooling of the mix in haul trucks and formation of crust
Key Points in Prevention of Segregation:

- Prevent Dribbling of Materials
- Keep Material Contained
- Move Material in a Smooth Uniform Uninterrupted Manner.
Segregation Prior to Placement:

- Material Production
- HMA Plant
LARGER DUMPING ANGLE ASSURES MASS DISCHARGE
Segregation During Placement

- Material feed system

Diagram labels:
- Flow Gates
- Slat Conveyors
- Hopper
- Augers
- Sensors
Cause:

- Material Segregated in Truck
- Running Conveyor Deck Dry
- Cycling Hopper Wings Too Soon
Nonstop Paving
Use of loading or transfer machine

Goals:
To stabilize a paving operation so the paver can maintain a constant unchanging paving speed, eliminating the stops and starts traditionally associated with trucks dumping directly into the paver.
A new tool for identifying Segregation
Segregation Free area
What Your eyes see
What the camera sees

Type B Mix

* > 229.8°F

* < 86.8°F
Storing the Paver
Screed Mark

* > 281.8°F

* < 113.7°F
Superpave Mix

Spot 2 273.7

Spot 3 223.6

>*>288.0°F

*<110.2°F

Stopping The paver, Cooler Mix

Spot 2 273.7

Spot 3 223.6
BASIC PRINCIPLES OF GOOD COMPACTION

KNOW THE VARIABLES
KNOW THE SPECS
ESTABLISH A PATTERN TO ACHIEVE: COVERAGE, DENSITY, SMOOTHNESS, AND BALANCED PRODUCTION
KNOW THE BASIC OPERATION OF EACH TYPE OF ROLLER
COMMUNICATION

COMPACTION GOALS

• DENSITY
• SMOOTHNESS
• BALANCED PRODUCTION
FACTORS AFFECTING COMPACTION

- MIX DESIGN
- AGGREGATE AND ASPHALT CEMENT
- LAB DENSITY & FIELD DENSITY
- CLIMATIC CONDITIONS
- PAVER TYPE AND PAVING METHOD
- TEMPERATURE: MAT, BASE AMBIENT, DIRECTION OF SUN; WIND
8.8.2 Test Strip Construction

- Simulating Actual Conditions
- Establishing Roller Pattern
- Effective Roller Speed
Compaction of Superpave Mixes

Compactive Force
Pressure Vibration
Pressure Manipulation
Pressure

TENDER ZONE

Temperature Zones
300° - 285°
240° - 200°
170 - 150°
Travel

Non-powered Drum

Powered Drum

Frictional Force turns Trailing Drum
Lift Thickness

• Recommended 3:1 to 6:1 Thickness: NMAS
• Thin lifts cool faster
  – less time available for compaction
Effect of Lift Thickness on Density

Summary of Lift Thickness Experiment

Air Void Content, %

0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0

t/NMAS Ratio

0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0
12 ft. or 14 ft. Paving Width

5 Pass Rolling Pattern
TRAVEL SPEED OF ROLLERS

DOUBLE DRUM VIBRATORY 2-4 MPH
PNEUMATIC ROLLER 2-3 MPH
STATIC STEEL WHEEL ROLLER 3-5 MPH

SPEED CAN KILL
## Spacing between impacts
(based on average rolling speed)

<table>
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<tr>
<th>Frequency</th>
<th>2mph</th>
<th>3mph</th>
<th>4mph</th>
<th>5mph</th>
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<tr>
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INTELLIGENT COMPACTION

- A SYSTEM FOR MEASURING THE STIFFNESS OF HMA ON THE ROLLER
- A RECORDING OF THAT STIFFNESS MEASUREMENT
- PROOF OF THE STIFFNESS OF THE HMA AS RELATED TO DENSITY
- PROVIDING INFORMATION FOR THE ROLLER TO MAKE DECISIONS
VARIOMATIC roller with directed vibration

Compaction principle
static pressure and dynamic energy which is automatically adjusted to type of material, compactibility, layer thickness and base layer conditions.

Applications: asphalt layers, granular bases and subbases.
Asphalt Manager with new measuring value $E_{\text{VIB}} \ [\text{MN/m}^2]$ and temperature management.
The Operator

Asphalt Manager: Easy to understand
Bomag Operational Panel

Manual - Auto
Compaction Modes

0 fixed            variable 0.08 in
0,2 mm 0 - 0.24 in
0,4 fixed 0,6 0,6
0,7 fixed 0,93
0,93 fixed 0.37 in

6 x
A2 x
Test procedure:
- Mark the track to be compacted
- „Manual operation mode“ with
- Fixed amplitude
- Fixed working speed
Printer
<table>
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<tr>
<th>EVIB - Printer</th>
<th>EVIB Max. / EVIB Min.</th>
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<tbody>
<tr>
<td>EVIB Average</td>
<td>Frequency</td>
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<tr>
<td>Average Speed</td>
<td>Track length</td>
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<tr>
<td>Temperature</td>
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**EVIB**

- EVIB Max. = 206 MN/m²
- EVIB Min. = 124 MN/m²
- EVIB Mittelwert = 168 MN/m²
- Frequenz = 44.3 Hz
- Mittlere Fahrgeschw. = 3.3 km/h
- Bahnlänge = 22.9 m
$E_{\text{VIB}}$ and Density as function of passes; BW 174 AD Asphalt Manager, Automatic mode; Asphalt Base 0/32 CS B65, Nürnberg A3

- 4 cm SMA 0/11 S
- 8 cm Binder 0/22
- > 10 cm ATS 0/32

![Graph showing $E_{\text{VIB}}$, Surface temp., Core temp., and Troxler density as functions of passes.](image)
Asphalt Manager

Benefits for Contractors:  Investment for Profit

Compaction
- Uniform and predictable results whilst rolling
- Avoids under / overcompaction
- Better evenness and roughness
- Eliminates drum bouncing

Economical and quality aspects
- More efficient roller utilisation with fewer passes
- Reduced shock loads in sensitive environment  
  e.g. buildings, bridges
- Area coverage method
$ VALUE

- I/C MEASURES THE STIFFNESS OF A LIFT OF HMA
- DENSOMETERS MEASURE DENSITY OF HMA
- THIS GIVES US TWO MEASUREMENTS OF THE STABILITY OF THE HMA
- WHY CUT SO MANY CORES THAT COST $800.00-$1000.00 A CORE
THE END

QUESTIONS ??