SUPERPAVE Construction – Lessons Learned

LESSON #1

- Lesson #1
- What is this Stuff?
Lesson #1 – What is This Stuff?

- Marshall or Hveem Method for 50 years
- Comfort Zone
- Agencies developed their own mixes
  - Alphanumeric Code – AABC, Base 1, Base 2, BC, BF, BI, FABC, F-1, HDB, HDS, I-1, I-2, I-5, ID-2, ID-3, J-1, P-401, SC, SF, ST, Type 1, Type 1B, Type 1C, Wearing 1, Wearing 2
- Secret Code?
Lesson #1 – What is This Stuff?

- Marshall or Hveem Method for 50 years
- Pendulum went from fine to coarse
- After 50 years of tinkering, these mixes did not always perform well, especially in high stress areas
- Change Was Necessary
Lesson #1 – What is This Stuff?

- New Mix Names – no more secret codes
- Metric System
- Nominal Maximum Size Instead of Maximum Aggregate Size
- Typically Coarser than the Mixes of the Past
  - Potential for more production & laydown problems

19 mm SUPERPAVE Mix
Lesson #1 – What is This Stuff?

- New Asphalts – Performance Grade
  - New Secret Code to Learn
    - PG XX-XX
    - No More AC-20?
  - New to Both Suppliers and Contractors
- Is it Modified?
  - Handling
  - Temperatures
SUPERPAVE Construction – Lessons Learned

LESSON #2

- Lesson #2
- Training – Leave No One Behind
Lesson #2 – Leave No One Behind

- Information Transferred from Researchers to Material Engineers and Technicians
  - DOTs
  - Contractors
- Laydown Crews Learned by Trial & Error
- Pavement Designers – No Training?
  - Select Mix
  - Select PG Binder
  - Select Thickness
SUPERPAVE Construction – Lessons Learned

Lesson #3

SUPERPAVE is Not Forgiving
Lesson #3 – SUPERPAVE is Not Forgiving

- SUPERPAVE Mix Designs are sensitive to material changes caused by the HMA plant
  - Material Breakdown
  - Change in Aggregate Surface Texture
- Allow for Material Breakdown
- Verify the Mix Prior to Starting the Project
Lesson #3 – SUPERPAVE is Not Forgiving

- Consistent, Quality Aggregate Supply
- Proper Stockpiling and Material Handling
- Good Plant Operations
  - Calibration
  - Dust Return System
  - Maintenance
Lesson #3 – SUPERPAVE is Not Forgiving

- Comfort Zone with Fine Marshall Mixes
- Sloppy Laydown Practices Yield Lousy Results with Coarse SUPERPAVE Mixes
  - Poor Equipment
  - Poor Techniques
    - Lack of Training
    - Poor Attitude
    - Laziness
Lesson #4

How Many Bins, Tanks and Silos?
SUPERPAVE Mixes are More Sensitive to Gradation Changes - Require Tighter Control

- More Cold Feed Bins Required
- Marshall - 3 or 4 bins
- SUPERPAVE - minimum 6
Lesson #4 – How Many Bins, Tanks and Silos?

- Not Just AC-20 Anymore – Multiple Asphalt Tanks Required
  - Standard Grade – PG 64-22
  - Bump Grade – PG 70-22
  - PMA – PG 76-22
  - Recycle Mixes – PG 58-28?
Lesson #4 – How Many Bins, Tanks and Silos?

- Storage Silos – limits number of mixes
- Four Mixes - 9.5mm, 12.5mm, 19mm, 25mm
- Four ESAL levels - four asphalt contents
- PG Binders - PG 64-22, PG 70-22
- 32 Mix Designs - 3 Silos
- Try to limit number of mixes per project
SUPERPAVE Construction – Lessons Learned

Lesson #5

Back to Basics
Lesson #5 – Back to Basics

- Production & Laydown “Best Practices”
  - Developed While Using Marshall & Hveem Mixes
  - Also Worked With SUPERPAVE
  - MUST be used to Place SUPERPAVE Successfully
LESSON #6

- Lesson #6
- Don’t Stop!
Lesson #6 – Don’t Stop!

- Consistent, Non-Stop Movement of HMA Material and the Paver is the Goal
  - Mat Texture
  - Prevent Segregation
  - Smoothness
Lesson #6 – Don’t Stop!

- **Match Paver Speed to Delivery Rate of HMA to the Job**
  - 250 tph delivery - 12’ lane, 2.00” lift
    - $250 \text{ tph} \times 9 \text{ sy/ton} = 2250 \text{ sy/hr}$
    - $2250 \text{ sf/hr} \times 9 \text{ sf/sy} = 20,250 \text{ sf/hr}$
    - $20,250 \text{ sf/hr} / 12’ \text{ width} = 1688 \text{ ft/hr}$
    - $1688 \text{ ft/hr} / 60 \text{ min/hr} = 28 \text{ ft/min}$
  - 400 tph requires 45 ft/min
Lesson #6 – Don’t Stop!

- Plan for Easy, Quick Entry and Exit from Paver for Delivery Trucks
- Train Truck Drivers in Proper Procedures
  - Trucks Lined Up in Front of Paver With Beds Raised
  - Paver Bumps Truck
  - No Cleanout in Front of Paver
    - Designate a location on the project site
- Traffic Control
LESSON #7

- No Jail Breaks!
Lesson #7 – No Jail Breaks!

- Keep HMA Confined in a Mass From the Plant to the Pavement
- Larger Aggregate Particles Will “Break & Run” At Any Time Prior to Passing Under The Screed If You Allow It – SEGREGATION
Lesson #7 – No Jail Breaks!

- Segregation in HMA Plant
- No Obstructions in Drum
- Drag Conveyor Operation
- Storage - Batcher and Silo Gates
Lesson #7 – No Jail Breaks!

- **Truck Loading Procedure**
  - Prevent “Break & Run” From Silo Into Truck Bed
  - **3 Drops**
    - Use Tailgate, Front of Dump Body, and First Two Drops as Confinement
Lesson #7 – No Jail Breaks!

- Truck Unloading Procedure
  - Raise Dump Bed & Place Mix Against Tailgate Before Opening It
  - Dump HMA into Paver as a Mass
    - Don’t Dribble – Prevent “Break & Run” From Truck into Paver
- Train Truck Drivers in Proper Procedures
Lesson #7 – No Jail Breaks!

- Paver Hopper Operation
  - Keep Hopper Deck Covered With HMA At All Times
  - Hopper Wings Dumped Only Into Half-Full Hopper Deck
- Prevent End-of-Load Segregation
Lesson #7 – No Jail Breaks!

- **Paver Feeder Operation**
  - Prevent “Break & Run” of Coarse Aggregate Under Feeder Gear Box
    - Diverter Plates
    - Reverse Augers
Lesson #7 – No Jail Breaks!

- Paver Feeder Operation
- Flow Gates Set for Consistent Feeder Operation
- Maintain Constant Head of Material
Lesson #7 – No Jail Breaks!

- Paver Feeder Operation
- Move Mix as a Confined Mass to End Gate
  - Auger Extensions
  - Auger Tunnel Extensions
Lesson #7 – No Jail Breaks!

- **Material Transfer Vehicle**
  - Reduces Truck-Dumping Issues
  - Remixing Reduces Silo And Truck-Loading Segregation
  - If Paver Hopper Insert Is Kept Full – Reduces Segregation Caused By Hopper Operation
  - Does NOT Correct Poor Practices Behind the Hopper
LESSON #8

It’s Not Easy to Be Dense
Lesson #8 - It’s Not Easy to be Dense

- Coarse-Graded SUPERPAVE Mixes Typically Harder to Compact than Marshall Mixes
- Major Adjustment for Agencies and Contractors Using Poor Marshall Density Specifications
  - 10% - 12% in-place air voids typical
  - Worked for fine-graded Marshall mixes
  - Permeability problems for SP mixes
Lesson #8 - It’s Not Easy to be Dense

- Factors Affecting Compaction
  - Lift Thickness (Design)
  - Mix Temperature (Contractor)
  - Compactive Effort (Contractor)
  - Strength of Underlying Material (Design)
    - Cannot achieve density when paving over structurally unsound material
  - Weak Subgrade
  - Roadway Shoulders
Compaction of Superpave Mixes

<table>
<thead>
<tr>
<th>Approximate Density Measurement</th>
<th>91% - 92% of M.T.D.</th>
<th>92% of M.T.D.</th>
<th>94% - 97% of M.T.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Zones</td>
<td>320° - 240°</td>
<td>240° - 170°</td>
<td>170° - 150°</td>
</tr>
<tr>
<td>Distance</td>
<td>200 feet</td>
<td>200 feet</td>
<td>150 feet</td>
</tr>
</tbody>
</table>

TENDER ZONE
Lesson #8 - It’s Not Easy to be Dense

- **All SUPERPAVE Coarse Mixes DO NOT HAVE A Tender Zone!!!**
- Tender Mix VS. Tender Zone
- Only 1/3 of SUPERPAVE coarse mixes have shown a Tender Zone
- Build a Test Strip
Lesson #8 - It’s Not Easy to be Dense

- Use Enough Rollers to Achieve Density
  - Three or Four?
  - Width
  - High Frequency
  - Rubber tired?
- Keep Front Roller Close to Paver - *If Mix Temperature is Appropriate*
- Use an Infrared Temperature Gun
SUPERPAVE Construction – Lessons Learned

Lesson #9

Good Equipment is a Must!
Lesson #9 – Good Equipment is a Must!

- HMA Plant Must be in Good Condition and Calibrated to Produce Quality SUPERPAVE Mixes Consistently
- Calibrate Quarterly
  - Truck Scales
  - Belt Scales
  - Asphalt Pump Meter
  - Thermocouples
Lesson #9 – Good Equipment is a Must!

- Paver in Poor Condition Cannot Place a Quality Pavement
- A Paver in Perfect Mechanical Condition May Still Place a Lousy HMA Pavement
  - Paver Adjustments
    - Feeder Gates
    - Feeder Controls
      - Head of Material
      - Feeder Speed
  - Screed & Extensions
  - Electronic Grade Control
Lesson #9 – Good Equipment is a Must!

- Compaction Equipment Must be in Good Condition and Well-Maintained
  - Engine RPM
  - Hydrostatic System
    - Smooth travel movement
    - Vibratory system
  - Drums
    - Smooth
    - Round
  - Water Spray
Lesson #10

Quality Starts at The Top
Lesson #10 – Quality Starts at the Top

- Commitment to Quality Must Start With Upper Level Management
- Management Must Clearly Communicate Expectation of Quality to All Employees
Lesson #10 – Quality Starts at the Top

- Management Must Provide Necessary Resources to Perform Quality Work
  - People
    - Motivated
    - Celebrate Success
  - Training
  - Equipment
  - Materials
SUPERPAVE Construction – Lessons Learned (Summary)

- 1) What is This Stuff?
- 2) Training – Leave No One Behind
- 3) SUPERPAVE is Not Forgiving
- 4) How Many Bins, Tanks and Silos?
- 5) Back to Basics
- 6) Don’t Stop!
- 7) No Jail Breaks!
- 8) It’s Not Easy to Be Dense
- 9) Good Equipment is a Must
- 10) Quality Starts at the Top
SUPERPAVE Construction – Lessons Learned (Summary)

- Pressures to Meet Production Targets Should Not Make Us Forget or Set Aside the Lessons Learned