Construction of Quality Hot Mix Asphalt Pavements

59th Annual Asphalt Paving Conference

"Best Practices
for
Pavement Construction"

Asphalt Pavement Association of Michigan
www.apa-mi.org

Outline

Placement Best Practices

- Surface Prep
- Project planning
- Understanding the paver
- Factors affecting the screed
- Screed Adjustments
- Paving process

Surface Preparation

Pavement performance is strongly related to the condition of the surface on which it is constructed

Proof Rolling

- Tire pressure
  - 90% of maximum
- 6600 lb. per tire
- Roll full width
- Two complete passes
- Soft, yielding, unstable:
  - Remove
  - Replace with approved material
- Test roll corrected area

Construction of Quality Hot Mix Asphalt Pavements

Preparing to Overlay Existing HMA

Or it may involve one or more of the following:

- Patching
- Cleaning and filling cracks
- Placing a leveling course
- Milling the surface

Failed areas MUST be cleaned, repaired and brought into good structural condition before overlaying.

Patching

- Mark at least 1 foot into the sound pavement
- Cut with vertical faces
- Remove all loose material
- Tack base and vertical faces
- Patches must be strong enough to become part of the permanent structure

Patching

Irregular patch - getting proper compaction is going to be difficult on this one.

Straight lines, no distress visible outside the patched area

Cleaning the Surface

Thoroughly clean the surface

Construction of Quality Hot Mix Asphalt Pavements

Tack Coat

GOOD
Even uniform coverage
No puddles
No stripes

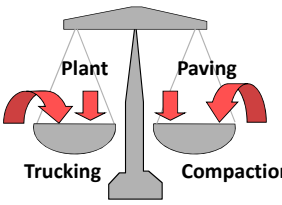
BAD
Uneven coverage
Clogged nozzles / improper orientation
Stripes are clearly visible

Project Planning

Wheeled Pavers
Maneuverable, cheaper to maintain

Tracked Pavers
Best for soft surfaces & better traction

Project Planning



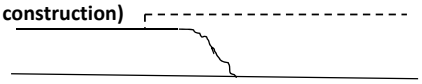
Balance:
Project Tonnage
Hot plant ***output***
Length of haul
Traffic conditions
Number of trucks

Consistency = Quality

Project Planning

Types of Longitudinal Joints

Butt Joint (paver construction)



Butt Joint (milled or cutback)

Notched Wedge Joint

Construction of Quality Hot Mix Asphalt Pavements

Project Planning

First Pass
Must Be Straight!
- String-lines
- Other reference

Understanding the Paver

Tractor Self-Leveling

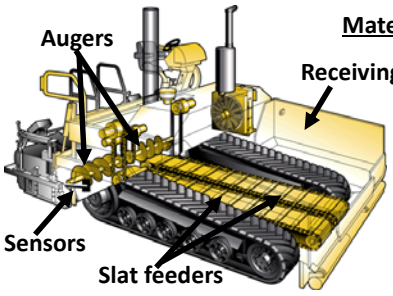
Power Unit

Screed can rise & fall
- Free Floating

Constant line of pull when set up properly

Smooth's irregular grade

Understanding the Paver



Construction of Quality Hot Mix Asphalt Pavements

Visual Inspection of HMA

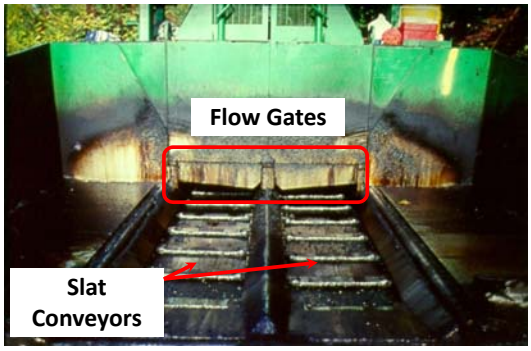
Problem Indicators

- Blue smoke
- Stiff (high peak)
- Slumped
- Dry, dull appearance
- Moisture
  - Steam
  - Condensate
- Segregation
- Contamination
  - Solid
  - Fuel or solvents

Loading the Hopper

- Avoid spilling in front of the paver
- Truck applies light brake pressure
- Remove prior to advancing
- Adhere to worker safety!

Slat Conveyors and Flow Gates



The Hopper

Newer pavers do not have flow gates; slat conveyors speed controls matl flow

Hopper Management

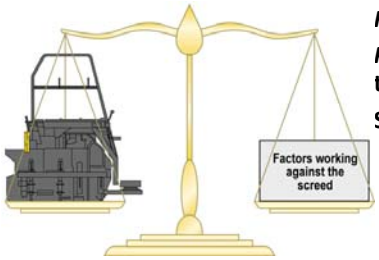
Conveyor area is exposed and augers are starved!

Basic Principle Has Not Changed

Understanding the Paver

- Keep in good condition
- Scheduled inspection
- Maintenance guidelines
- Safety Guidelines
  - Lockout/Tag out
  - Locking Pins
  - Wheel Chokes

Understanding the Paver



Free-Floating Screed

Position **determines mat thickness**

Screed *position*

- **Will remain constant**
- ***If all factors*** **remain constant**

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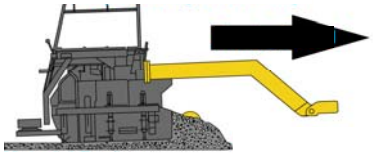
Understanding the Paver



Factors Affecting the Screed

Head of material

Paving speed

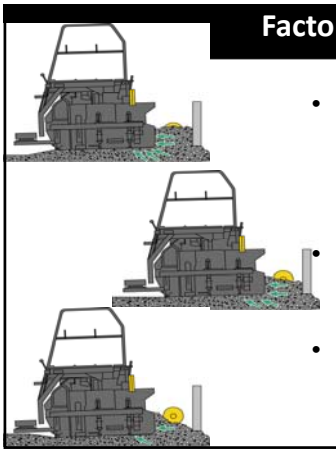
Screed adjustments

Mix design

Temperatures

- **Mix**
- **Air**
- **Grade**

Factors Affecting Screed



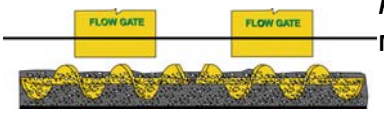
- **Too much material, screed forced to rise**
- **Correct amount of material, screed remains level**
- **Too little material, screed will dip down**

Factors Affecting Screed

Uniform Head of Material

Across Width of Auger

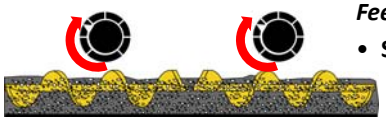
Factors Affecting Screed



Flow Gates Set Properly

Material

- **Uniform Amount**
- **Shafts half covered**



Feeder Ratio Set Properly

- **Same principle as flow**

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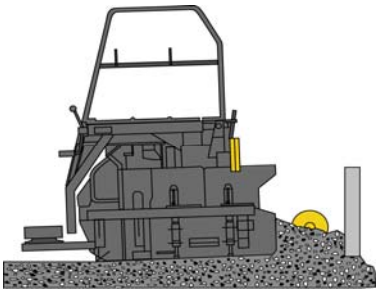
Factors Affecting Screed



Auger Speed

Auger speed uniform

20-40 rpm

Too high or too low

- Cause mat streaks

Factors Affecting Screed

Feed Sensors

- Controls head of material
  - Speed of conveyor & auger
- Situated at end of auger
- Contact or a non-contact
  - Paddle or mercury switch
  - Infrared or ultrasonic sensors

Factors Affecting Screed

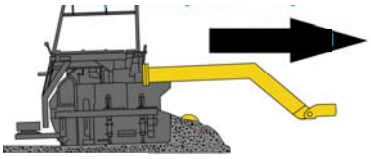
No Auger Extensions or Confinement

Auger Confinement Tunnels

- Controls Material Flow to end of the Screed

Auger Extensions & Confinement

Understanding the Paver



Factors Affecting the Screed

Head of material

Paving speed

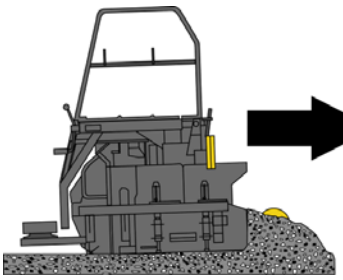
Screed adjustments

Mix design

Temperatures

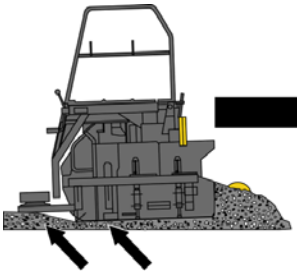
- Mix
- Air
- Grade

Factors Affecting Screed



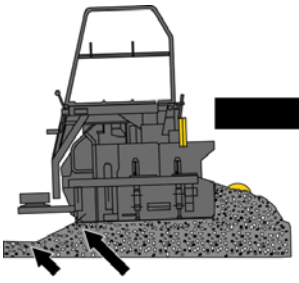
Constant Speed
Shear factor is constant
Depth remains constant

Factors Affecting Screed



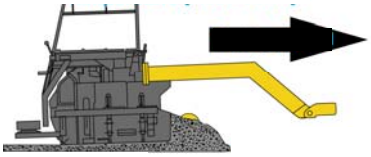
Increased Speed
Shear force decrease
Depth decreases

Factors Affecting Screed



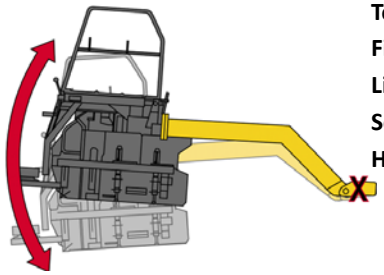
Decreased Speed
Shear force increases
Depth increases
Depth change varies wit speed change
Type of Mix affects shear force

Understanding the Paver



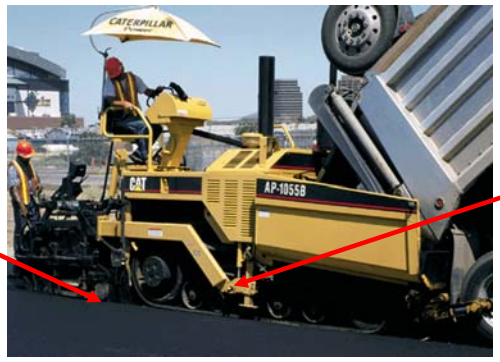
Factors Affecting the Screed
Head of material
Paving speed
Screed adjustments
Mix design
Temperatures
- Mix
- Air
- Grade

Screed Adjustments

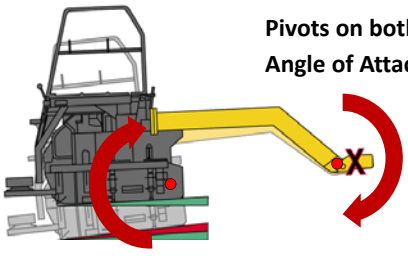


- Tow Point
- Fixed on Tractor Unit
- Line of pull
- Screed pivots
- Height tow point
  - Changes Angle of Attack

Developing the Line of Pull

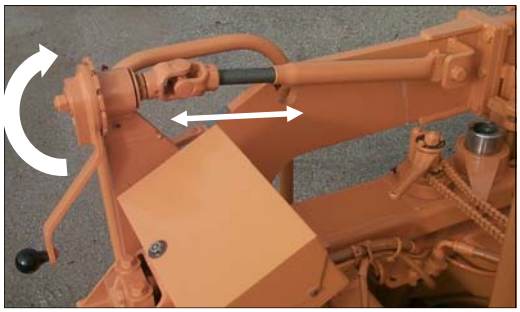


Screed Adjustments



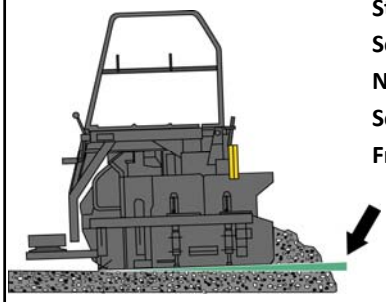
- Pivots on both ends of tow arm
- Angle of Attack

Changing the Angle of Attack



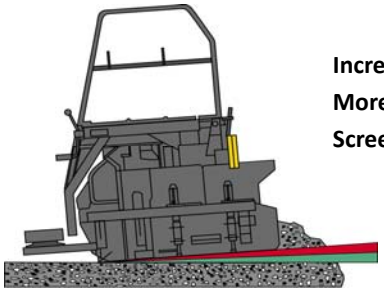
Depth Crank Increases or Decreases Attack Angle

Screed Adjustments



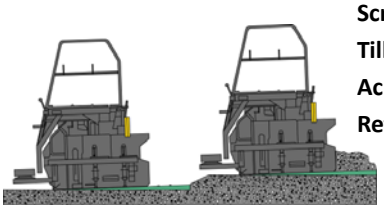
Starting Angle of Attack
Screed nose & grade
Nose up attitude
Screed in equilibrium
Free Floating

Screed Adjustments



Increase Angle of Attack
More matl under screed
Screed rises to new level

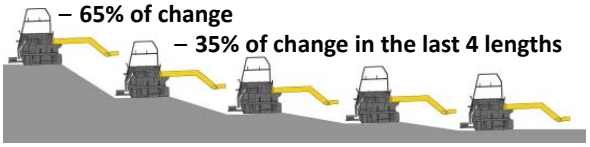
Screed Adjustments



Increased Angle of Attack:
Screed climbs
Till forces balance
Achieves equilibrium
Returns to original angle

Screed Adjustments

Reaction to Angle of Attack Changes



– 65% of change
– 35% of change in the last 4 lengths

Takes over 5 tow arm lengths

- Longer tow arm equals a longer distance
  – Improves rideability

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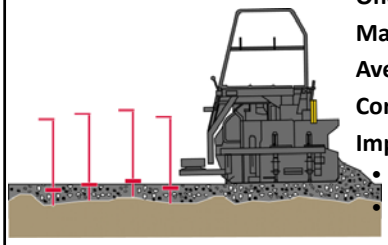
Controlling Yield



Depth Check

One check, No correction

Make series of checks

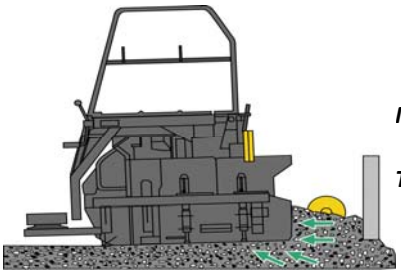
Average readings

Correct based on average

Improves

- Smoothness
- Yield

Understanding the Paver



Factors Affecting Screed

Head of material

- Paving speed
- Screed adjustments

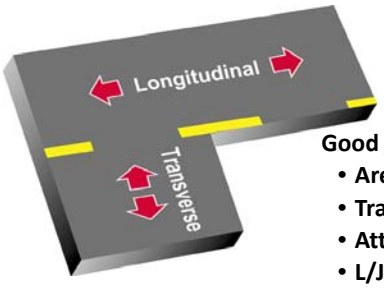
Mix design

- *Course vs fine*

Temperatures

- *Mix*
- *Air*
- *Grade*

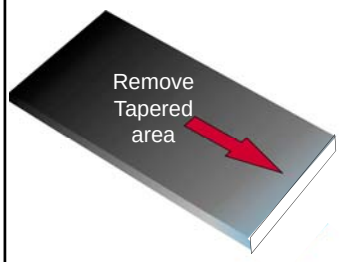
Joint Construction



Good joints

- Are no mystery
- Training & practice
- Attention to details
- L/J

Transverse Joints - Starting a Lane



- Pick starting point
  - Hand placed a starter mat
  - Previous day's mat
    - Full depth of existing
    - Saw cut & remove

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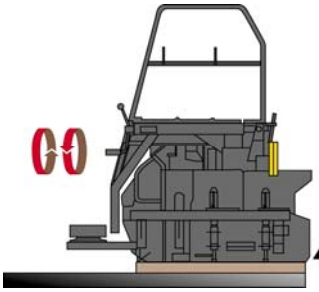
Transverse Joints

At start-up

All vertical edges

- Clean
- Tack

Transverse Joints

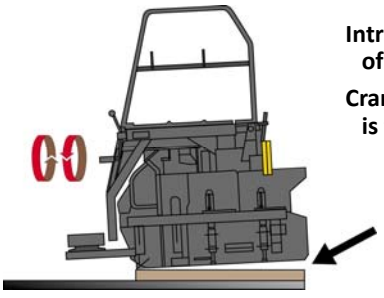


Null screed

- Zero out angle of Attack

Boards allow for rolldown thickness

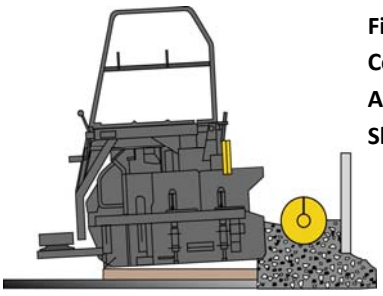
Transverse Joints



Introduce angle of attack

Crank until resistance is felt

Transverse Joints



Fill auger half full

Conveyor manually

Auger manually

Shovel if needed

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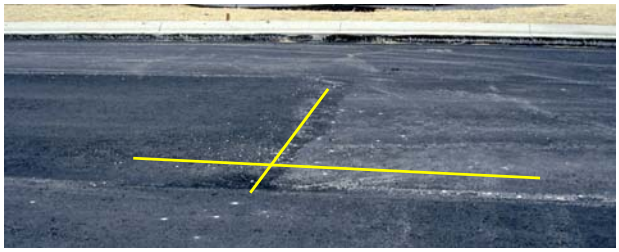
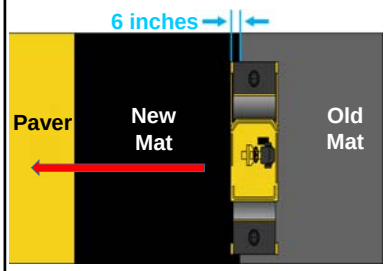
Transverse Joints



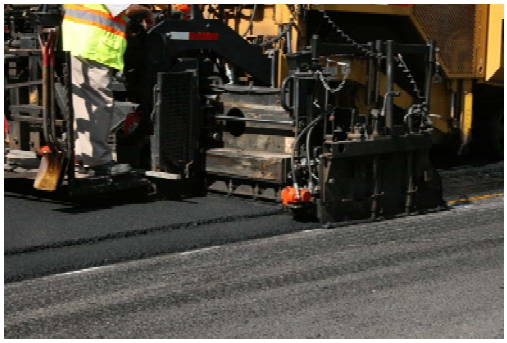
Transverse Joints



- Roll transverse
- Roll static
- Start on cold side
- Move over in 6” - 8” until on hot side

Transverse Joints

Vibratory Screed Should Always Be On



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Joint Matchers

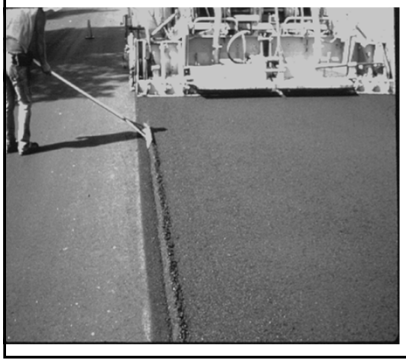
Contact Grade Sensor

Ultrasonic Grade Sensor

Longitudinal Joints

- Proper Overlap:
  - 1.0 ± 0.5 inches
  - Exception: Milled or sawed joint should be 0.5 inches

Longitudinal Joints



Longitudinal Joints

This lute person is doing a great job

Asphalt Paver & Placement

Questions?