Asphalt Pavements for Recreational Facilities

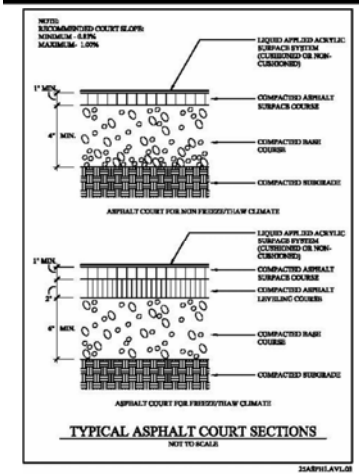
WAPA
WISCONSIN ASPHALT PAVEMENT ASSOCIATION
60TH ANNUAL CONFERENCE & BUSINESS MEETING
DEC. 3-4 / The Ingleside Hotel Pewaukee, Wisconsin

Topics

Design Considerations
- Aggregates
- Mix Types
- Thickness Considerations
- Mixture Volumetrics

Construction Considerations
- Construction / Placement
- Mat Defects / Tolerances
- Acceptance of work

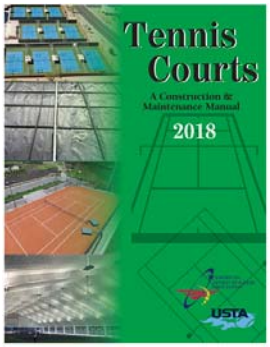
Architect's Specs

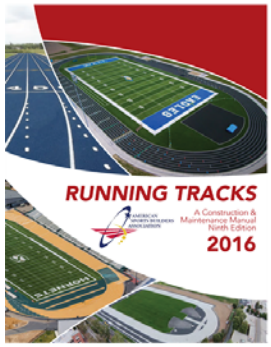


TYPICAL ASPHALT COURT SECTIONS
NOT TO SCALE

"Provide asphalt mixture according to the latest Edition of the State DOT Specifications"….

Sources





American Sports Builder's Association
sportbuilders.org

AMERICAN SPORTS BUILDERS ASSOCIATION ASPHALT GUIDELINES

This Guideline is intended to assist owners, contractors, design professionals, and hot mix asphalt suppliers in the design and installation of hot mix asphalt concrete to meet exacting sports construction standards. Because of the wide variation in climate, construction methods, site conditions and materials availability, the services of a qualified and experienced design professional should be obtained before use to ensure suitability for a specific project.

<u>The American Sports Builders Association does not represent that this Guideline is suitable for any specific project, disclaims any and all warranties with respect to this Guideline, and assumes no responsibility for the use of this Guideline with respect to any project</u>.

Aggregate Properties

The suitability of an aggregate for use in asphalt construction depends on the following:

- Maximum particle size
- Specific Gravity
- Toughness
- Absorption (affinity for asphalt binder)
- Moisture susceptibility
- Gradation (particle size distribution)
- Cleanliness or clay content
- Particle shape and surface texture

Selection Based on Economics

Thought Process in Selection of Aggregate

- Proximity to Plant and/or Job-Site and Unit Cost
- Pre-Bid Testing for Viability
- Previous Use of Aggregate
- Long Term Durability

Aggregate effects on Asphalt binder content

- Coarse graded Mixes have a lower Asphalt Binder Content -
- Fine graded mixtures have a higher Asphalt Binder Content
- Binder Costs can amount to 30 – 50% of the per ton mix cost.

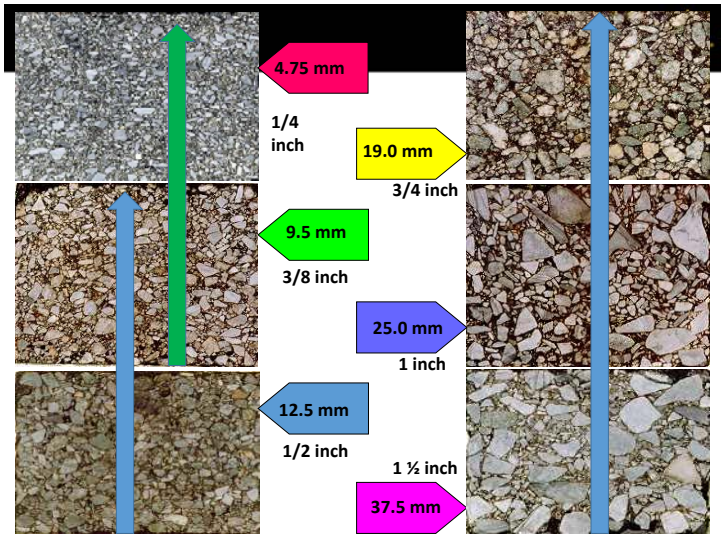
Thickness Considerations

- ***Maximum*** Aggregate Size
  - One size larger than nominal maximum size
- ***Nominal Maximum*** Aggregate Size
  - One size larger than the first sieve to retain (cumulative) more than 10%

Asphalt Mixtures

Superpave mix designations

If plant tells you: Superpave Designation	Remember: Max Size, mm
37.5 mm	50.0
25.0 mm	37.5
19.0 mm	25.0
12.5 mm	19.0
9.5 mm	12.5
4.75 mm	9.5



Asphalt Mixtures

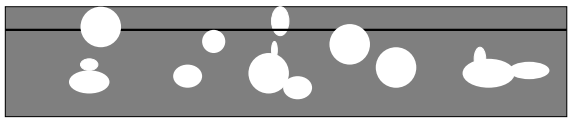
Lift thickness:

- Minimum of 4x NMAS for Coarse graded mixes
- Reduced to 3x NMAS for Fine graded mixtures.

Otherwise:

- Fracture aggregate
- Open Texture
- Water intrusion

Asphalt Mix Compaction



Air Voids ≤ 7 or 8%

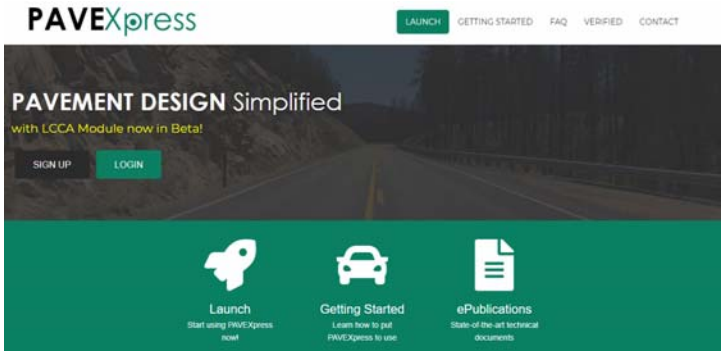
Mix generally not permeable

Asphalt Mix Compaction

Air Voids > 10%

Mix generally permeable

Thickness Considerations



Pavexpress.com

Thickness Considerations

AI recommends a min 3" of HMA for any application

Comments on pavement structures.

- **Tennis Courts – Lowest Traffic**
- **Running Tracks – Depends on Facility**
- **Golf/ bike paths – Could be a concern**
  - **Intended purpose – No Issue**
  - **Maintenance Traffic – Problem**
    - **Haul Trucks**
    - **Minimum Thickness**
    - **Minimum Width**

Thickness Considerations

Benefits of multiple lift construction

- **Smoother surface**
- **Allows different types of mixture to be placed**
- **Lower lifts are often coarser.**
  - **Have a larger NMAS (1/2")**
  - **More cost effective**
    - **Lower Binder content**
- **Surface Lifts are typically finer**
  - **Smaller NMAS (1/4" or 3/8")**
  - **Higher binder content – More durability**
  - **Lower permeability**

Aggregate Types

- **Natural**
- **Processed**
- **Synthetic**

- **Round (uncrushed)**
- **Single Crushed Face**
- **Multiple Crushed Faces**

Aggregate Types

Soundness

Before

After

Binder Content

State Highway Mixtures may not be appropriate for your facility – Why?

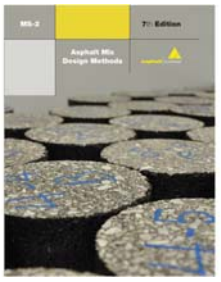
- Designed to resist rutting from heavy trucks
  - Very stiff mixtures are not needed on recreational facilities.
- Stiffer mixtures are difficult to compact and require a very stable base to achieve density
- Highway Pavements are typically designed at 4% air voids – Recreational uses should be designed at 3.5%

What to do?

Communicate with the owner/architect

- JMF should list the following
  - Gradation of the aggregate
  - Type and Amount of Asphalt Binder
  - Type and amount of Recycled materials
  - RAP – NMT 15% of the mix
  - RAS – NMT 0% of the mix
  - Volumetric Properties of the Mix
  - Laboratory Compaction
  - Type and Amount
  - Unit weight of the mix
  - Bulk Specific Gravity
  - Theoretical Maximum Specific Gravity

MS-2



Topics

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Construction Considerations
- Construction / Placement
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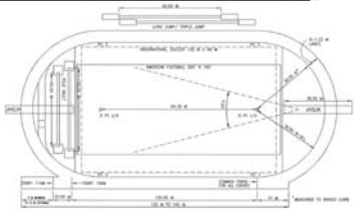
Project Planning

Goal: to eliminate as many Joints as possible



Paving Width
- Screed extensions
  - Variable
  - Fixed or rigid
- Auger extensions
- Retaining plates
  - Tunnels

Understanding the Paver

Material Handling
- Break Load
- Move in mass
- Avoid "tailgating"
  - Segregates

Understanding the Paver

Visual Inspection of material

Problem Indicators

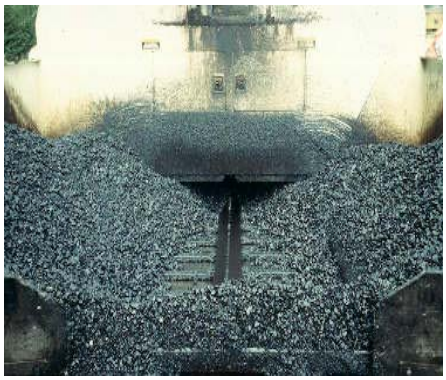
- Blue smoke
- Stiff (high peak)
- Slumped
- Dry, dull appearance
- Moisture (steam or condensate)
- Segregation
- Contamination
  - Solid
  - Fuel or solvents

Understanding the Paver

Loading Hopper

- Avoid spillage
- Driver's apply light brake pressure
- Removed prior to advancing
- Worker safety!

Understanding the Paver



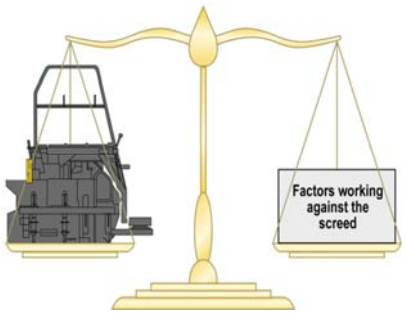
Exposing Conveyor

- Segregation
- Cold material

Understanding the Paver

Basic Principle Has Not Changed

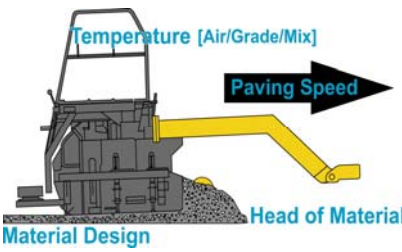
Understanding the Paver



Free-Floating Screed

- Position determines mat thickness
- Screed position is
  - constant as long
  - All factors remain constant

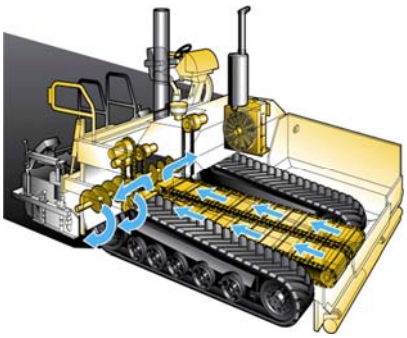
Understanding the Paver



Factors Affecting the Screed:

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

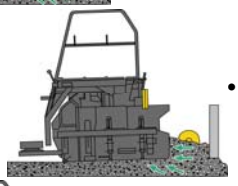
Understanding the Paver



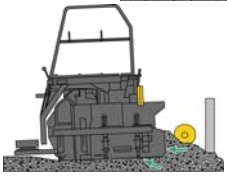
Head of Material

- Uniform flow
- Uniform force against face of screed

- Too much material, screed will rise up

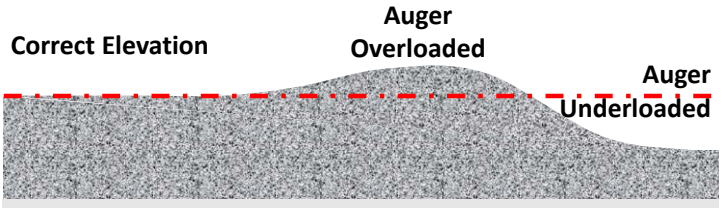


- Correct amount of material, screed remains level

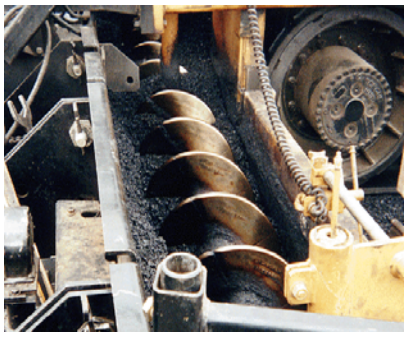


- Too little material, screed will dip down

Understanding the Paver



Understanding the Paver



Correct Amount of Material

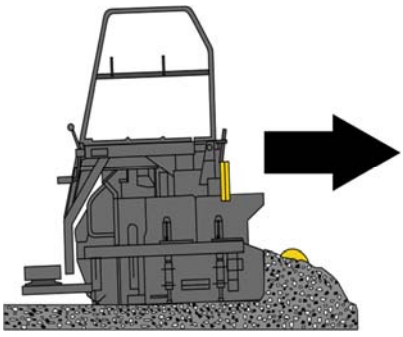
- Auger extensions
- Bulkhead extensions

Understanding the Paver

Paving Speed

- Constant
- Feeders match
  - Paving speed
  - Speed changes

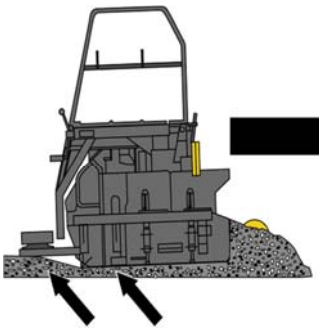
Understanding the Paver



Constant Speed

- Shear force is constant
- Depth remains constant

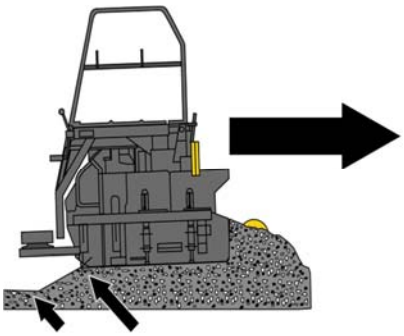
Understanding the Paver



Increased Speed

- Shear force decrease
- Depth decreases

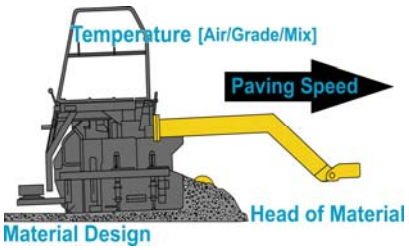
Understanding the Paver



Decreased Speed

- **Shear force increases**
- **Depth increases**

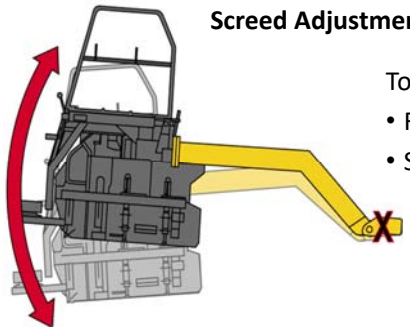
Understanding the Paver



Material

- **Mix design**
- **Temperatures**
  - **Mix**
  - **Air**
  - **Grade**

Understanding the Paver

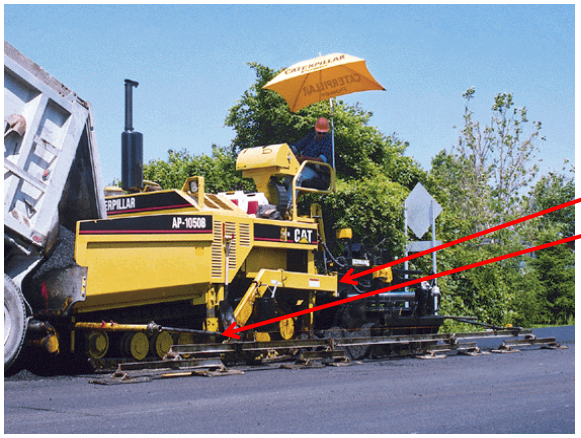


Screed Adjustments

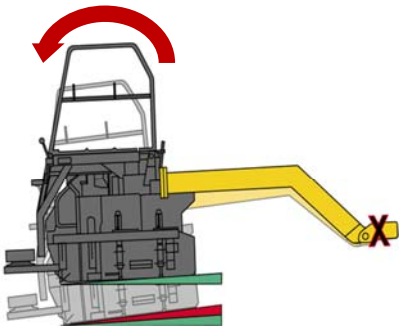
Tow Point

- Fixed on Tractor Unit
- Screed pivots

Understanding the Paver



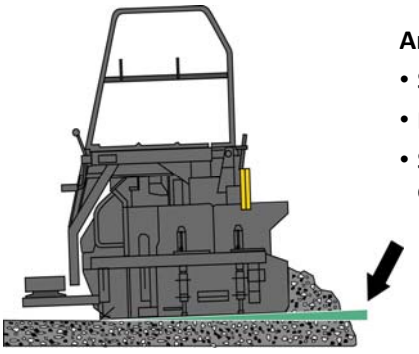
Understanding the Paver



Angle of attack

- **Changes amount of material flow under screed**

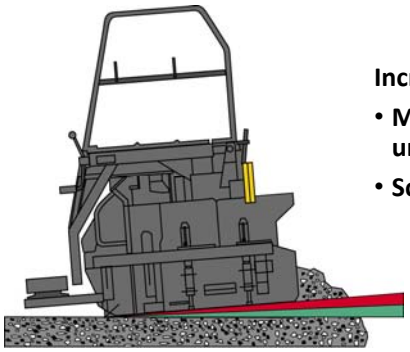
Understanding the Paver



Angle of Attack

- **Screed nose & grade**
- **Nose up attitude**
- **Screed reaches equilibrium**

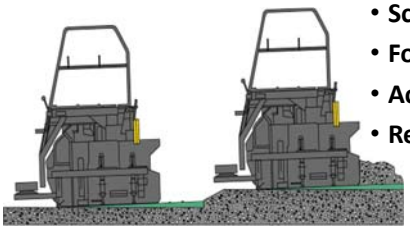
Understanding the Paver



Increase Angle of Attack

- More material passes under screed
- Screed rises to new level

Understanding the Paver

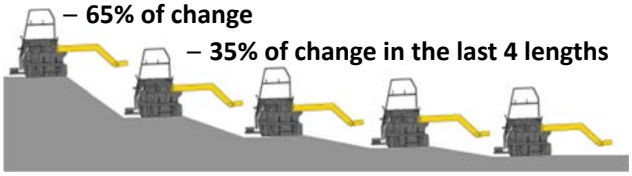


Increased Angle of Attack:

- Screed climbs
- Forces balanced
- Achieves equilibrium
- Returns to original angle

Understanding the Paver

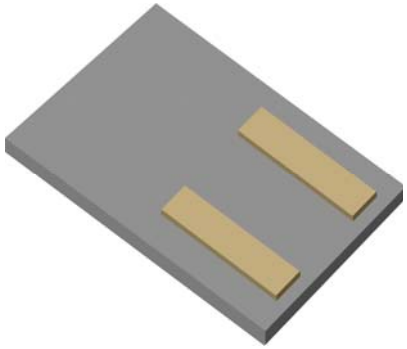
Reaction to Angle of Attack Changes



Takes over 5 tow arm lengths

- 8 foot tow arm vs 78 ft court length
  - One change = ½ court length

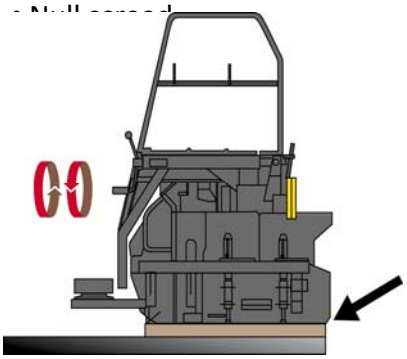
Joint Construction



- Center tow point
- Set width
- Set crown
- Set extender slope & height
- Use boards that allow for compaction rate

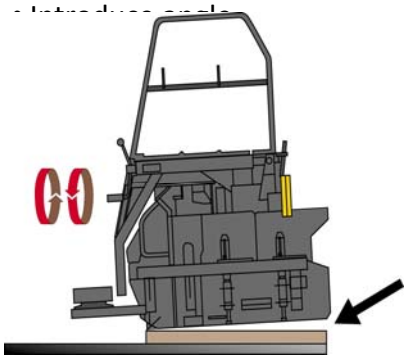
Joint Construction

- Null screed

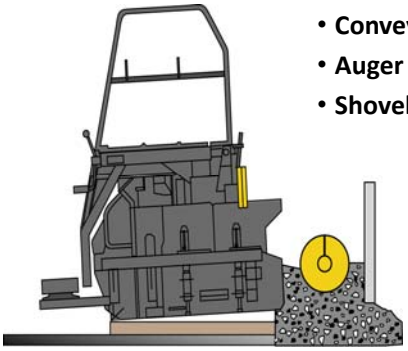


Joint Construction

- Introduce angle

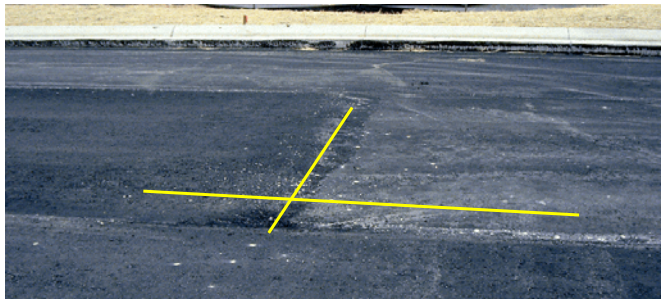


Joint Construction

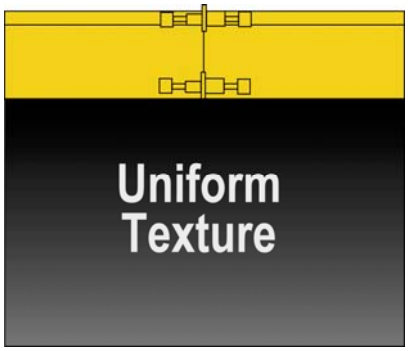


- Fill auger chamber half full
- Conveyor manually
- Auger manually
- Shovel if needed

Transverse Joints - Starting a Lane



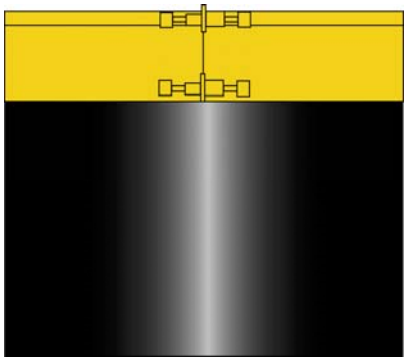
Understanding the Paver



Crown Correct

- Zero out all crown
- Even texture full width
- 1/4 to 3/8 turn lead crown

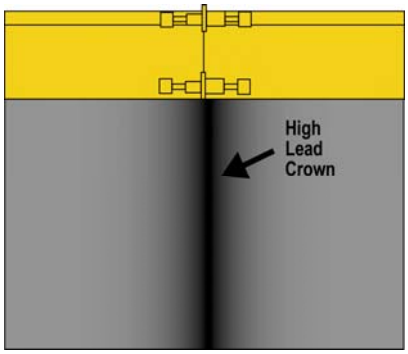
Understanding the Paver



Lead Crown Low

- Open texture in center
- Tight on sides
- Add 3 mm (1/8") crown

Understanding the Paver



Lead Crown High

- Tight, shiny strip in center
- Open texture on sides
- Reduce lead crown

Mat Defects

Longitudinal Joints;

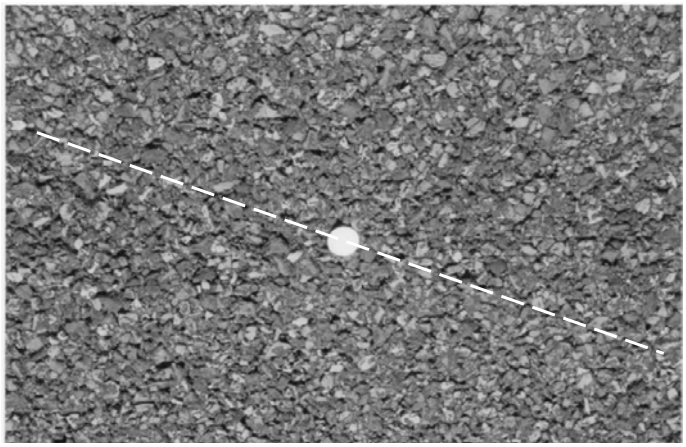
- Avoid overlap

Mat Defects

B. Prowell photos

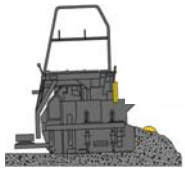
Cutting Back the Joint
- Eliminates low density area
- When HMA still warm
- Straight is critical

Mat Defects



Mat Defects

Screed Alignment
- Main Screed
- Gates
- Full Extensions.



Mat Defects

Surface Patching
- Partial depth
- Infrared heater
- Heat existing pavement
- Add material
- "Weld" to surrounding material
- Straight edge
- Compact
- Do not overheat

Mat Defects

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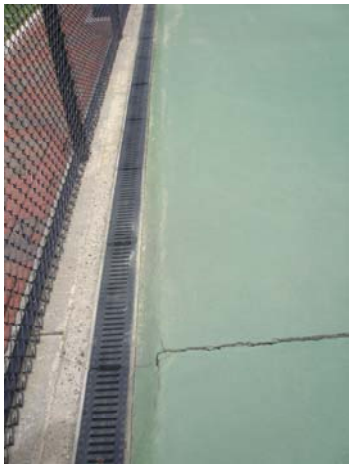

Mat Defects

Questions?

www.asphaltinstitute.org

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