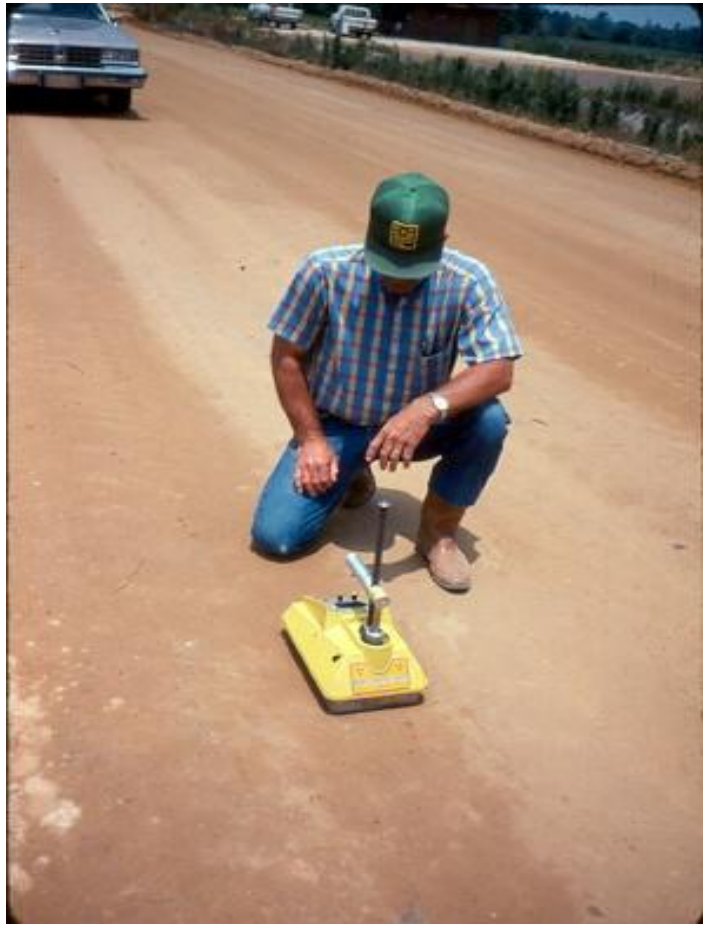
Surface Prep, Tack, Placement, & Joints

Kyle Lewis and Chuck Fuller

Subgrade Preparation

- The subgrade is the pavement foundation.
- Must support the pavement and anticipated traffic
  - Soil type considered in thickness design
- Must be properly graded to provide drainage.
  - Transverse and longitudinal grade
  - Smoothness and cross slope
- Must be uniformly compacted to required density.



Surface Preparation

- Patch defective areas
- Remove raised pavement markings
- Protect manhole covers, drains, etc.

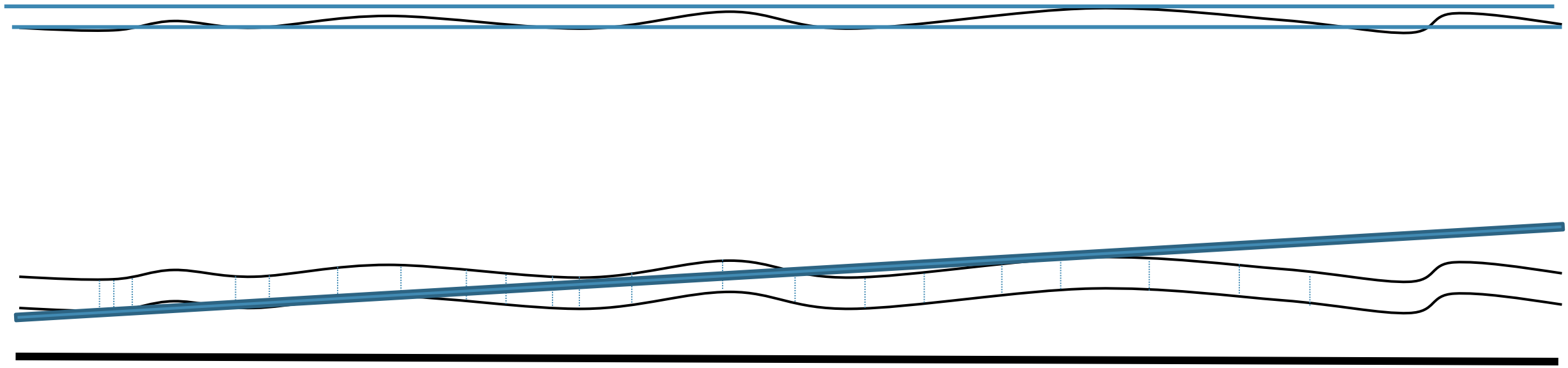
Milling/Planing: Why?

- Remove old damaged layers (cracks, raveling, seals, distress)
- Restore longitudinal grade – improve ride
- Correct cross slope issues.
- Restore curb reveal.

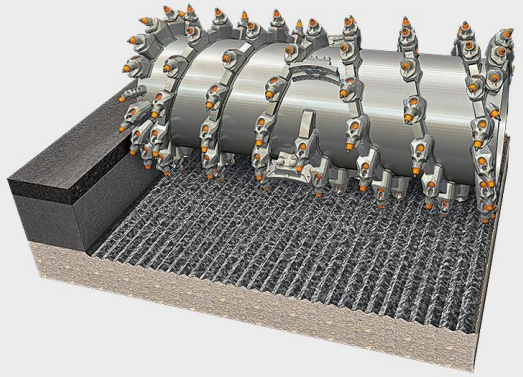

DOT 1742664

Depth – Slope – Average

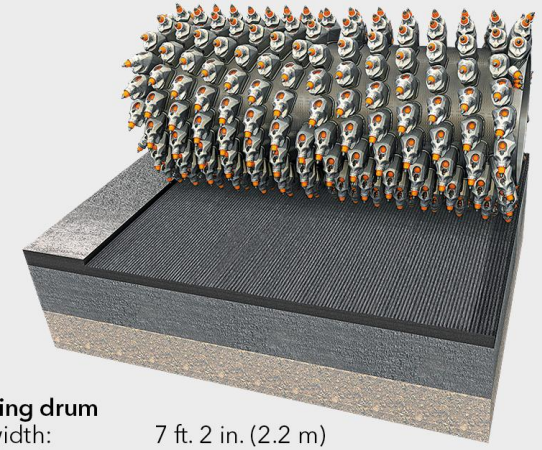
- Depth: maintains existing profile and ride.
- Slope: establishing cross slope from control point
- Averaging: depth varies, ride improves, variable removal of existing. *(you may not get all the cracks out)*
- Class Demo



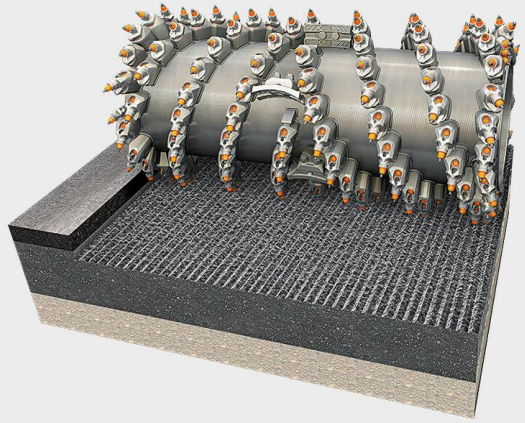
Milling & Planing



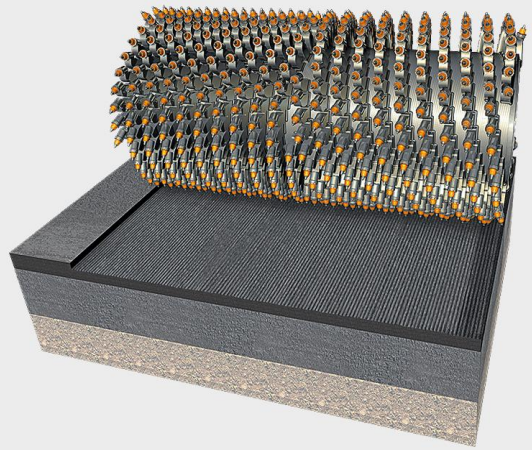
ECO cutter
Milling width: 7 ft. 2 in. (2.2 m)
Milling depth: 0 - 13.7 in. (0–350 mm)
Tool spacing: 1 in. (25 mm)



Fine milling drum
Milling width: 7 ft. 2 in. (2.2 m)
Milling depth: 0– 3.9 in. (100 mm)
Tool spacing: 0.3 in. (8 mm)

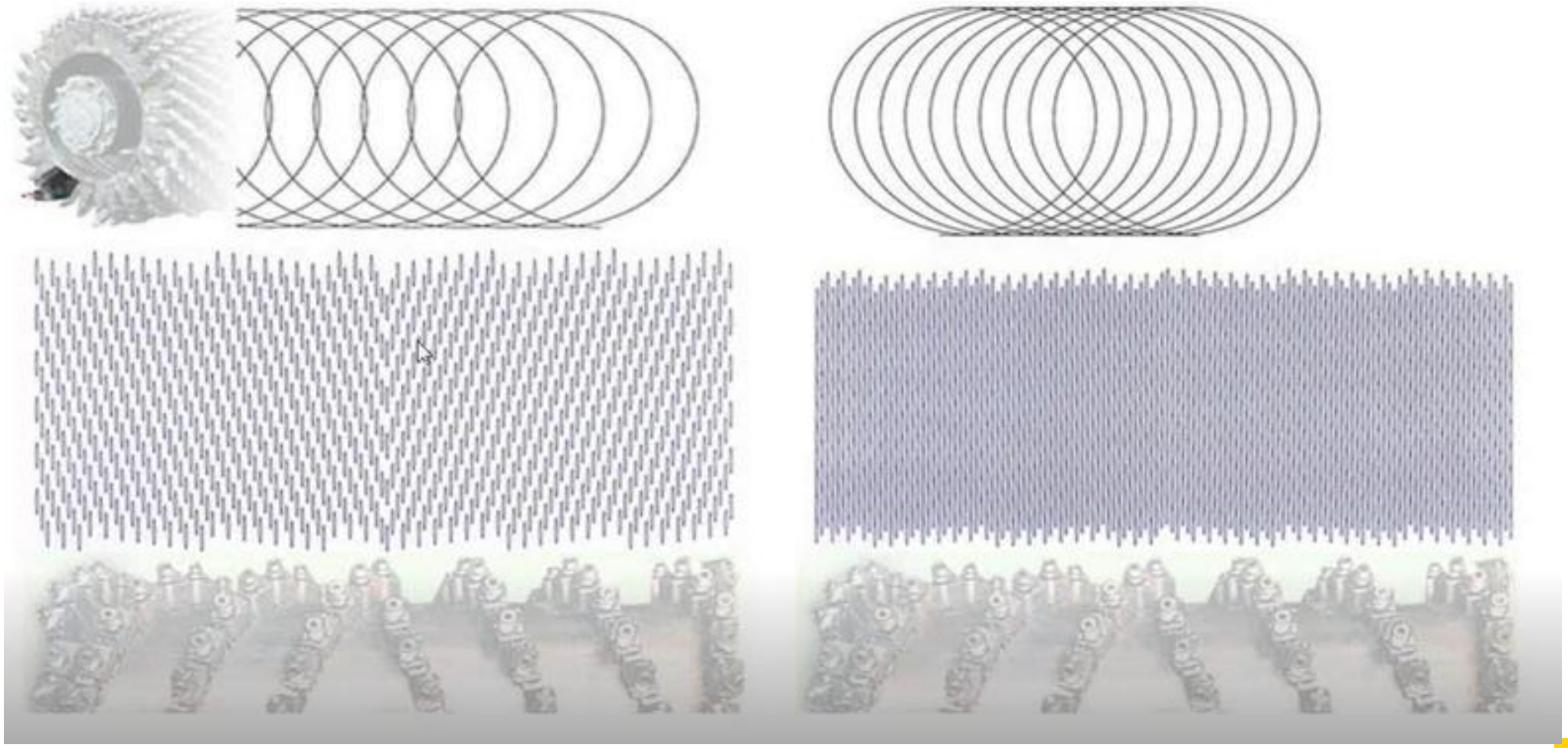


Standard milling drum
Milling width: 7 ft. 2 in. (2.2 m)
Milling depth: 0 - 13.7 in (0–350 mm)
Tool spacing: 0.6 in. (15 mm)

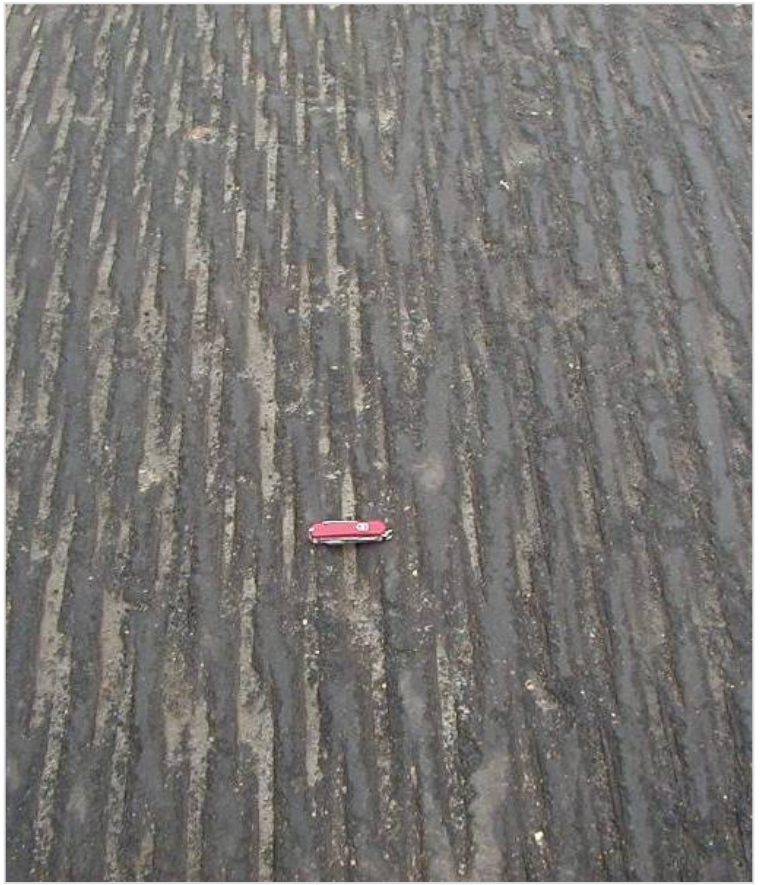


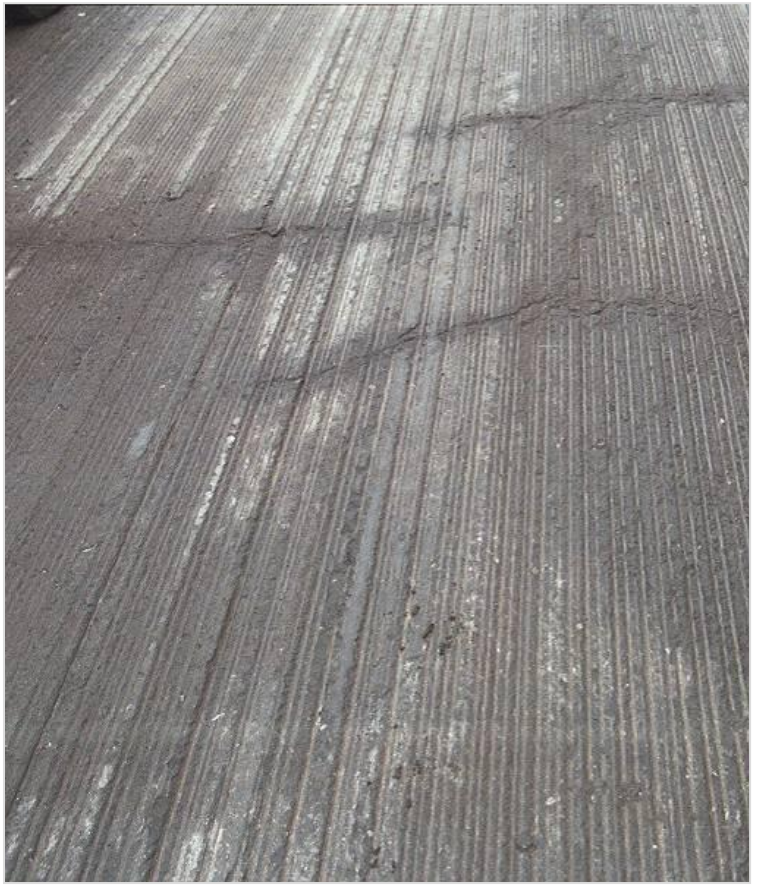
Micro-fine milling drum
Milling width: 7 ft. 2 in. (2.2 m)
Milling depth: 0–1.2 in. (30 mm)
Tool spacing: 0.2 in. x 0.08 in. (6 x 2 mm)

Milling Speed

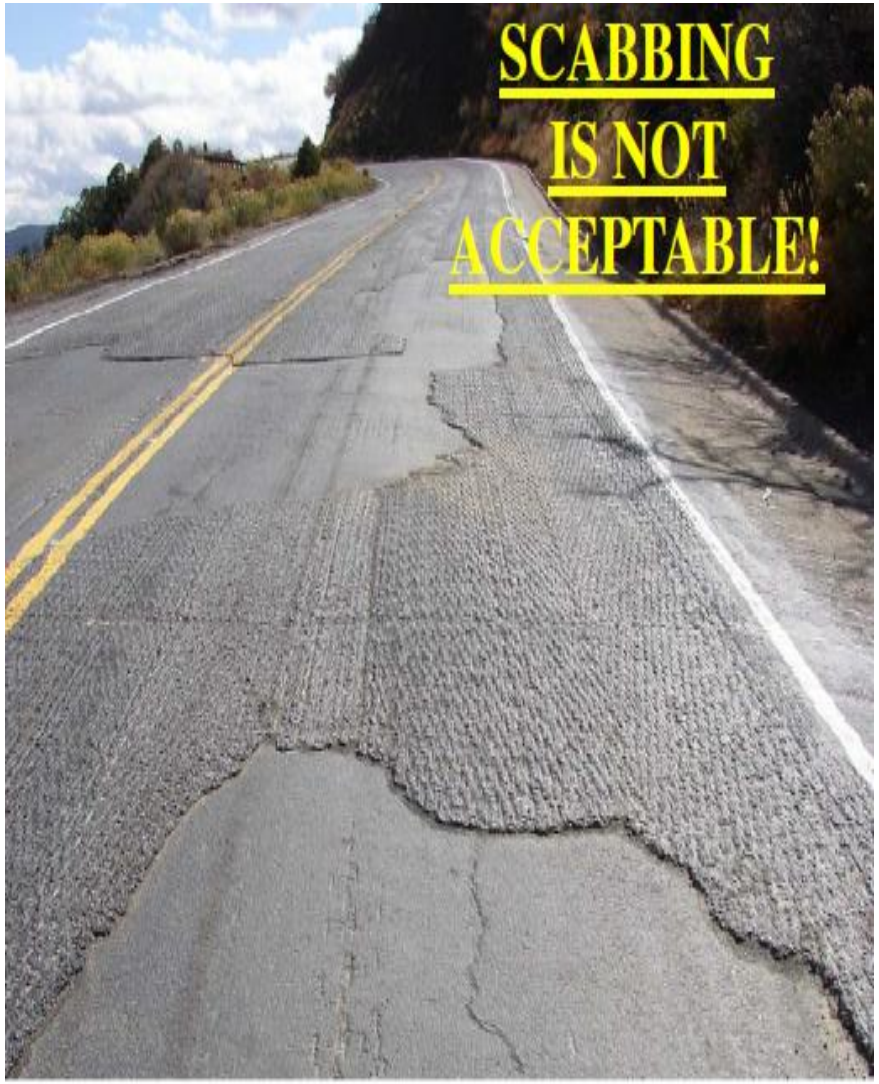


Texture vs. Speed





Milling Best Practices



Comparison of ridge to valley depth

Traditional Milling

Micro-Milling

Patching

- Mark into solid pavement.
- Excavate to solid base.
- Tack Edges
- Compact thoroughly

Resources on Asphalt Binders and Emulsions

- **Asphalt Emulsions**: https://ftp.dot.state.tx.us/pub/txdot-info/cst/AsphaltEmulsions.pdf
- **Asphalt Materials and Uses:** https://ftp.dot.state.tx.us/pub/txdot-info/cst/AsphaltMaterialsandUses.pdf

Table 18
Typical Material Use

Material Application	Typically Used Materials
Hot-mixed, hot-laid asphalt mixtures	PG binders, A-R binders Types I and II
Surface treatment	AC-5, AC-10, AC-5 w/2% SBR, AC-10 w/2% SBR, AC-15P, AC-20XP, AC-10-2TR, AC-20-5TR, HFRS-2, MS-2, CRS-2, CRS-2H, HFRS-2P,CRS-2P, CHFRS-2P, A-R binders Types II and III
Surface treatment (cool weather)	RS-1P, CRS-1P, RC-250, RC-800, RC-3000, MC-250, MC-800, MC-3000, MC-2400L
Precoating	AC-5, AC-10, PG 64-22, SS-1, SS-1H, CSS-1, CSS-1H
Tack coat	PG Binders, SS-1H, CSS-1H, EAP&T
Fog seal	SS-1, SS-1H, CSS-1, CSS-1H
Hot-mixed, cold-laid asphalt mixtures	AC-0.6, AC-1.5, AC-3, AES-300, AES-300P, CMS-2, CMS-2S
Patching mix	MC-800, SCM I, SCM II, AES-300S
Recycling	AC-0.6, AC-1.5, AC-3, AES-150P, AES-300P, recycling agent, emulsified recycling agent
Crack sealing	SS-1P, polymer mod AE crack sealant, rubber asphalt crack sealers (Class A, Class B)
Microsurfacing	CSS-1P
Prime	MC-30, AE-P, EAP&T, PCE
Curing membrane	SS-1, SS-1H, CSS-1, CSS-1H, PCE
Erosion control	SS-1, SS-1H, CSS-1, CSS-1H, PCE

Bonding Demonstration

- 11 sheets of plywood: 48”x8”x11/32”
- Span length 36”
- Weight of Person ~60 lbs
- Measured deflection over span
  - Unbounded
  - Fully bonded
- 21 times difference

Unbonded

=

2 5/8”

Fully Bonded

=

1/8”

Tack Overspray

Tacking vertical edges and joints

Copyright TXAPA 2021

Track Resistant Asphalt Interlayer (TRAIL)


Emulsion Tack Shot


Grade this tack shot.
A?
B?
C?
D?

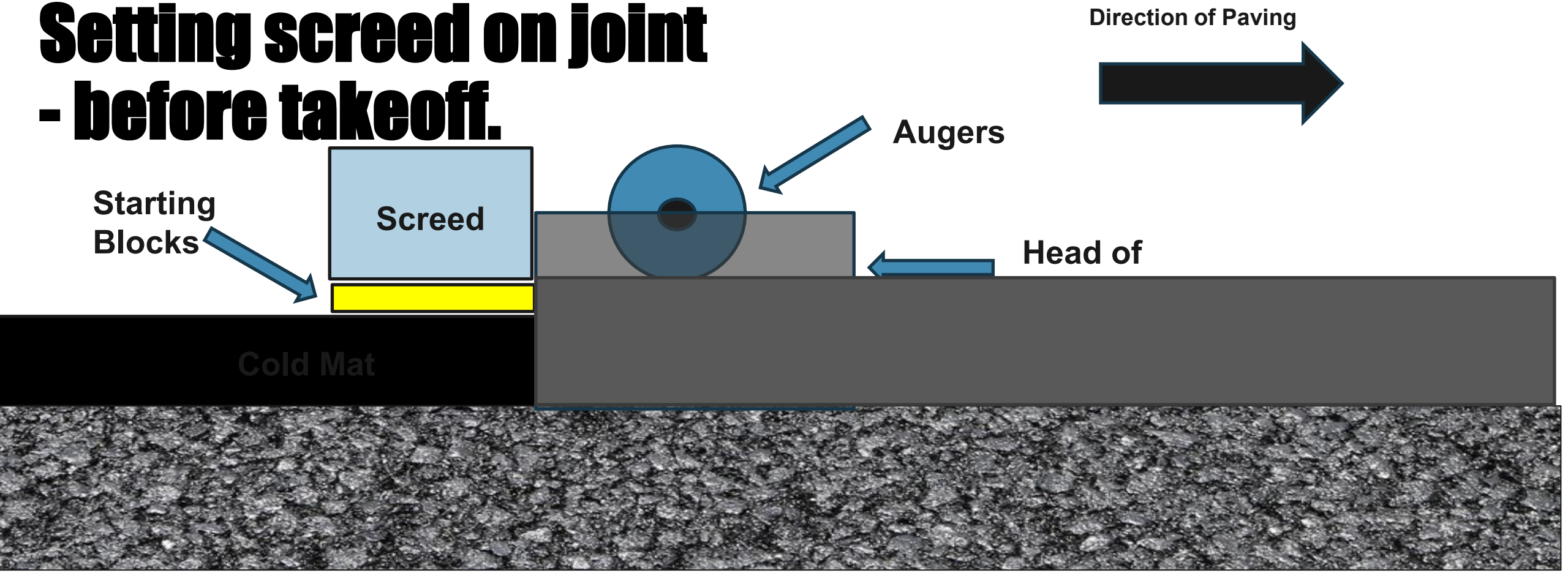
Grade this tack shot.

- ❑ A?
- ❑ B?
- ❑ C?
- ❑ D?

Transverse and Longitudinal Joints

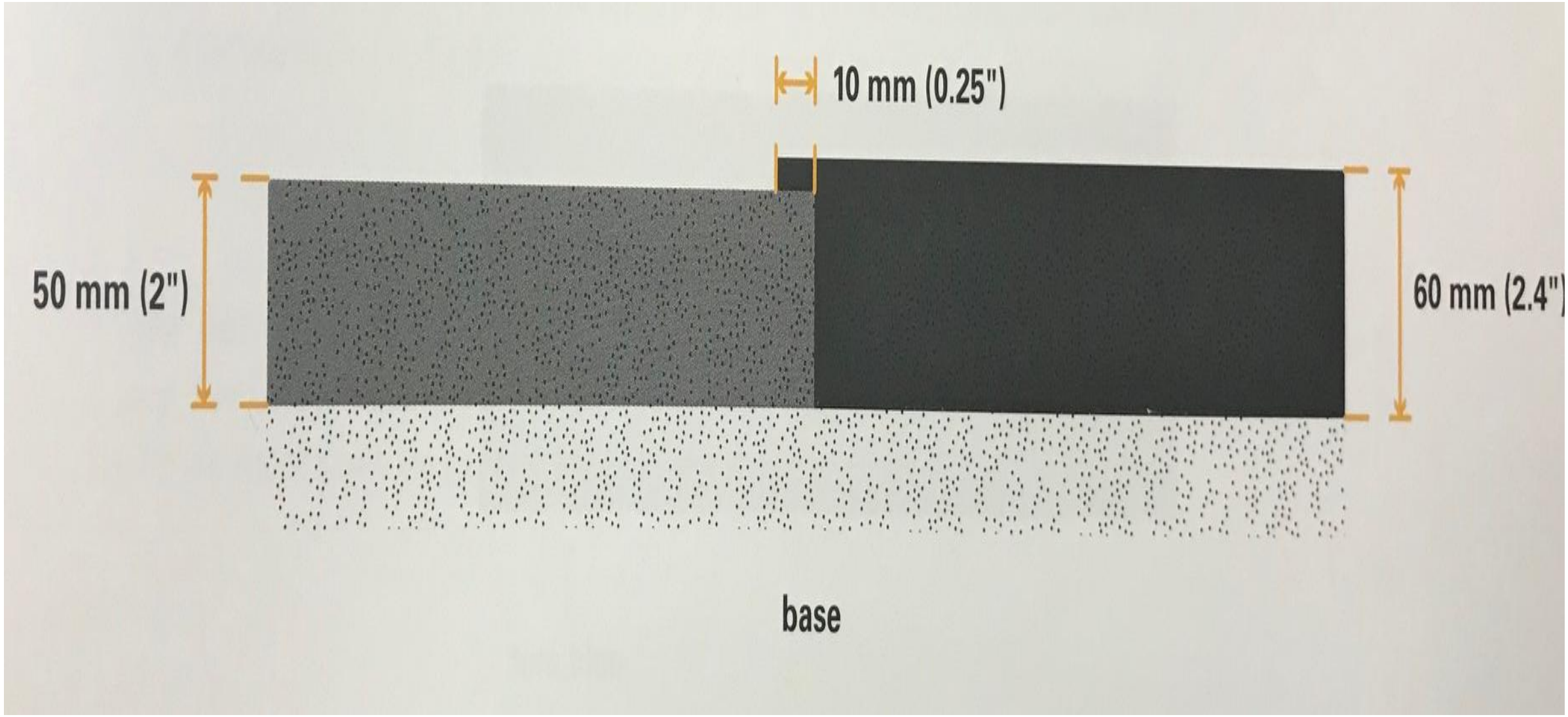
Successful Transverse Joints

Setting screed on joint - before takeoff.



- Use starting blocks on both sides of screed.
- Blocks should be thickness of expected roll down. ~1/4” per inch of compacted thickness.
- Setup of screed and paver per “Paving by the Numbers”
- Don’t “bury the augers” when filling the auger chamber.
- Pull off joint and check settings.

End Gate Down


10 mm (0.25")
50 mm (2")
60 mm (2.4")
base

Set up Correct?


IGLOO
CAT SE60


BOMAG
FAYAT GROUP


BOMAG
FAYAT GROUP

Hopper Management (Truck)

If you are using a Truck:

1. **Don’t run hopper empty between loads.**
2. **Keep the tunnels/conveyors buried.**
3. **Mix stays hotter in a mass.**
4. **Mix less likely to segregate in a mass.**


HOLT
AP0028

Always Keep a Uniform Head of Material

How many things are being done right?

Texture is important. Make it look good!

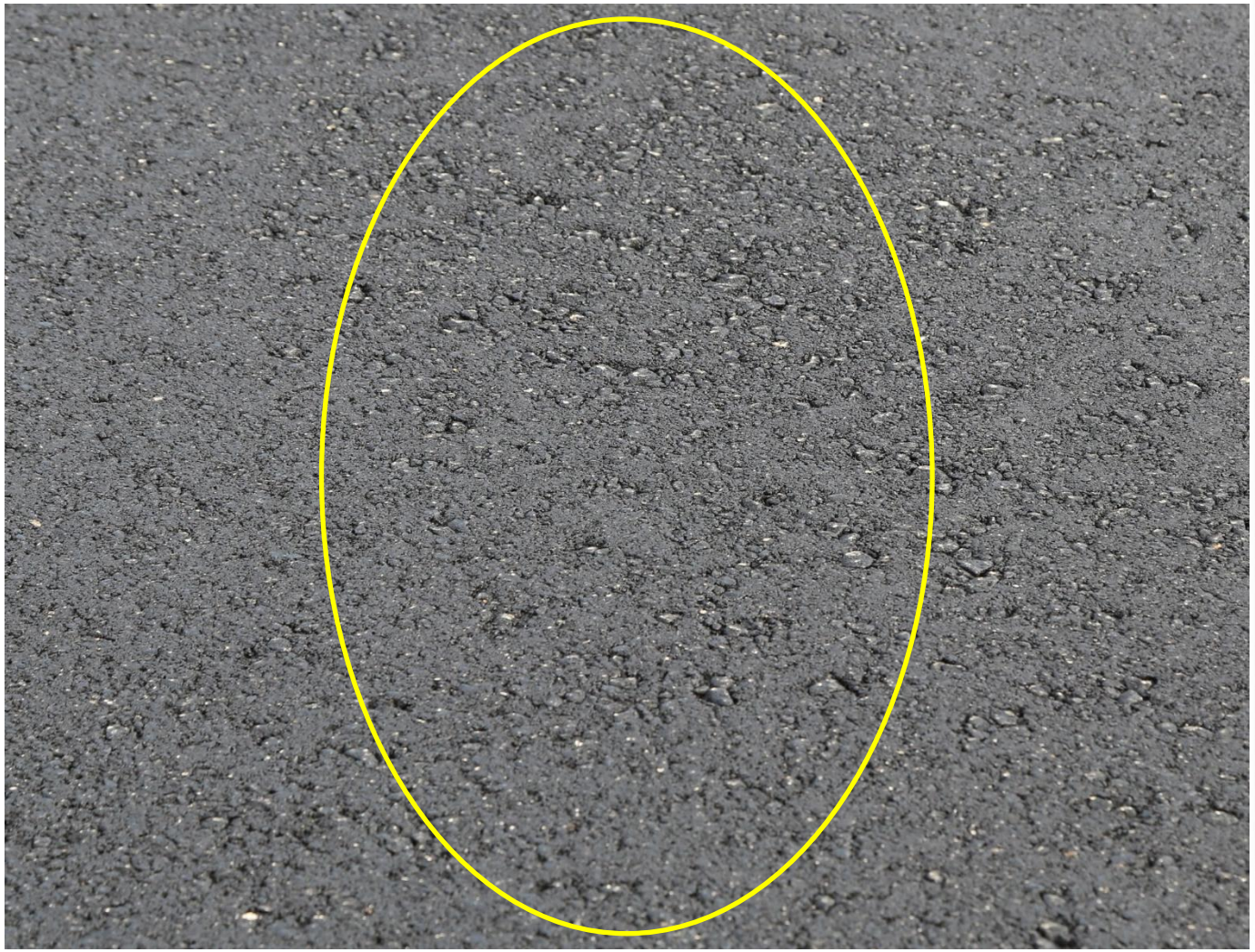
Handwork: Some is necessary. Some isn't.

Some Handwork is Necessary

XAPA 2021

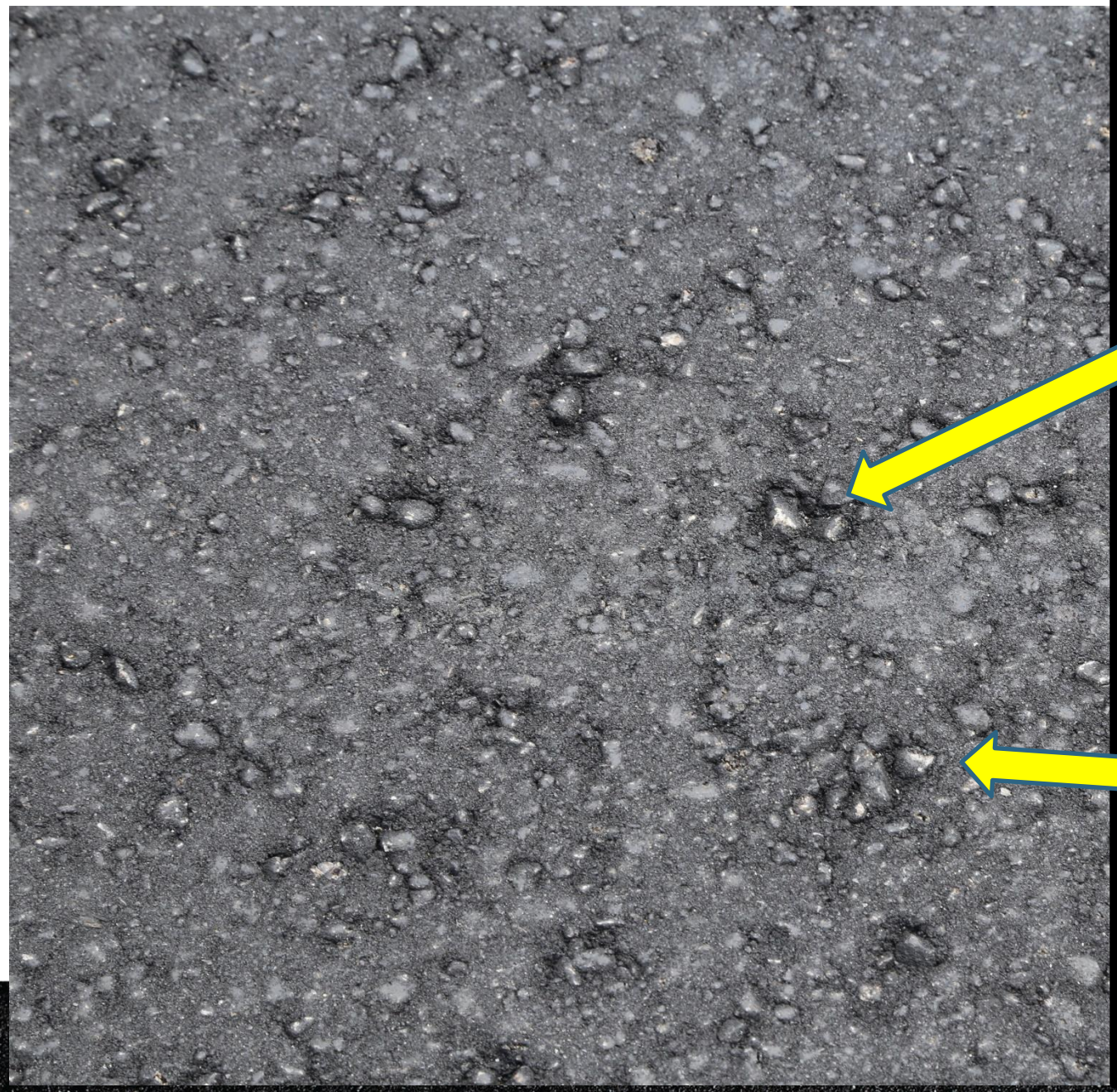
Some Handwork is not

How does this look?



XAPA 2021

What do you see?



Keep a Straight Joint

Texture is important, stay off the mat.

Check your settings - frequently

- Thickness
- Spreadrate/Yield
- Slope
- Texture
- Width
- Ride

Paving Sequence: Dumping Load.

Paving Sequence: Paving in between islands.

Compaction Training

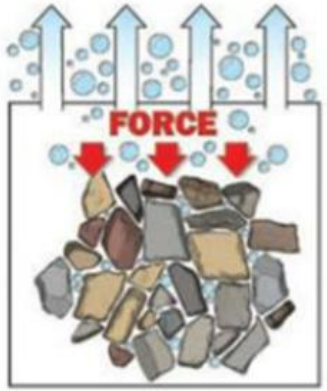
Safety Share - Compaction

- Wear seat belt
- Focus on operating
- Mindful of Folding ROPS
- Caution around articulation joint

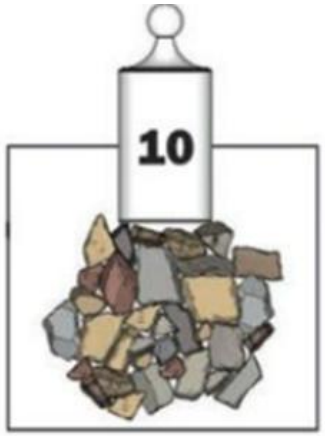
What's the purpose of compaction

Compaction is the process of reducing the volume of air voids to develop more stone-on-stone contact in order to increase density & strength

BEFORE COMPACTION
Loose soil with air voids between the particles



DURING COMPACTION
Soil air voids diminshing with aplied energy



AFTER COMPACTION
Compacted soil with reduced air voids between particles

1%

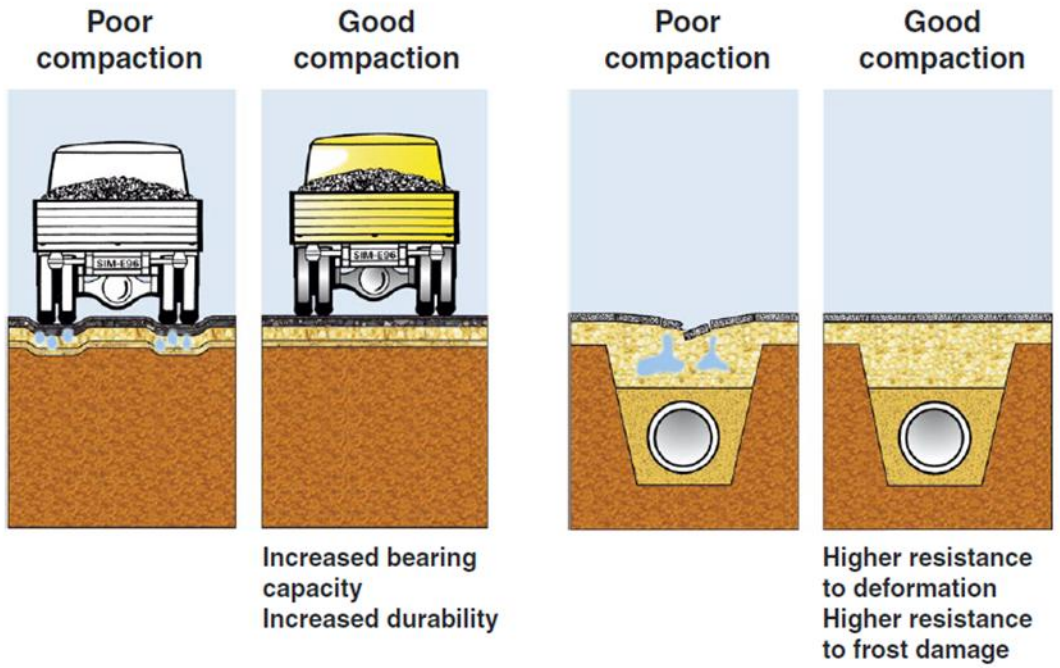
Increase in density can extend the asphalt pavement ***service life*** by at least

10%

Why compaction

Compaction helps create a more durable pavement

- Improve load-bearing properties to keep from rutting
- Increased asphalt density to keep out water
- Increased stability to keep edges from breaking



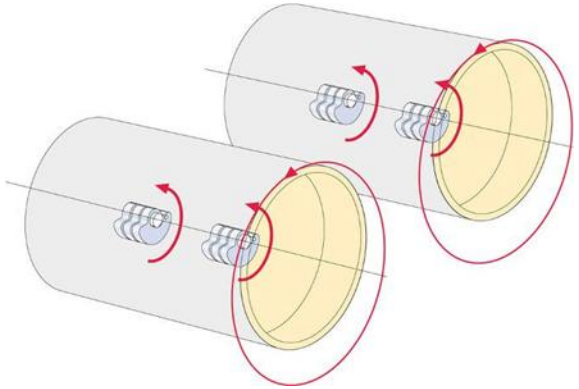
Verifying Density – Get Your %#s

93%

95-96%

~~**100%**~~

Forces of Compaction

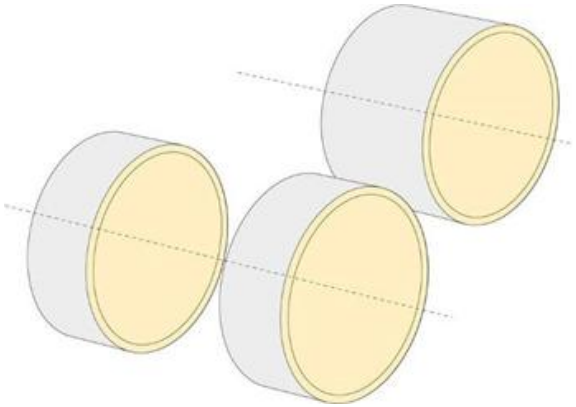


Vibration

Eccentric weights cause vibration, releasing pressure waves into the asphalt

Manipulation

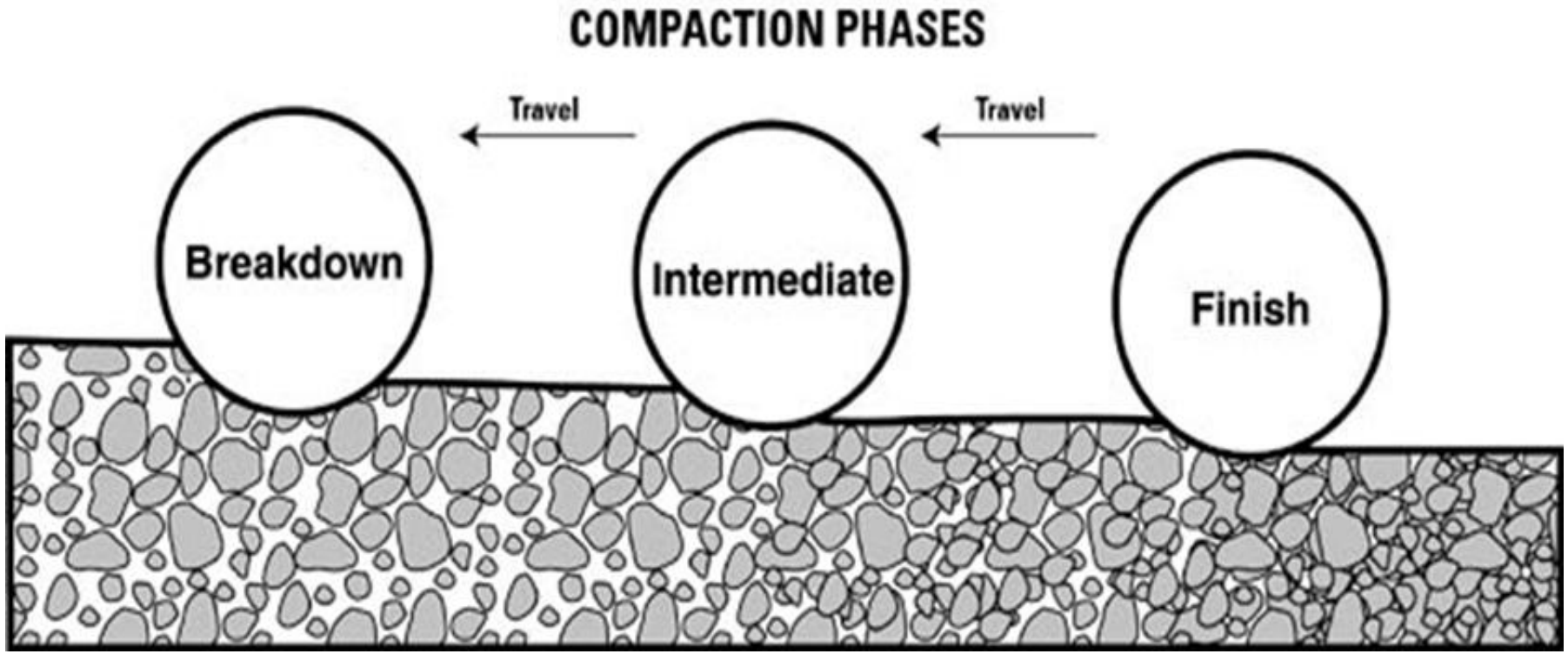
Forces are not all vertical, but many directions and creates a tighter surface



Static

Weight, static linear load exerts vertical force

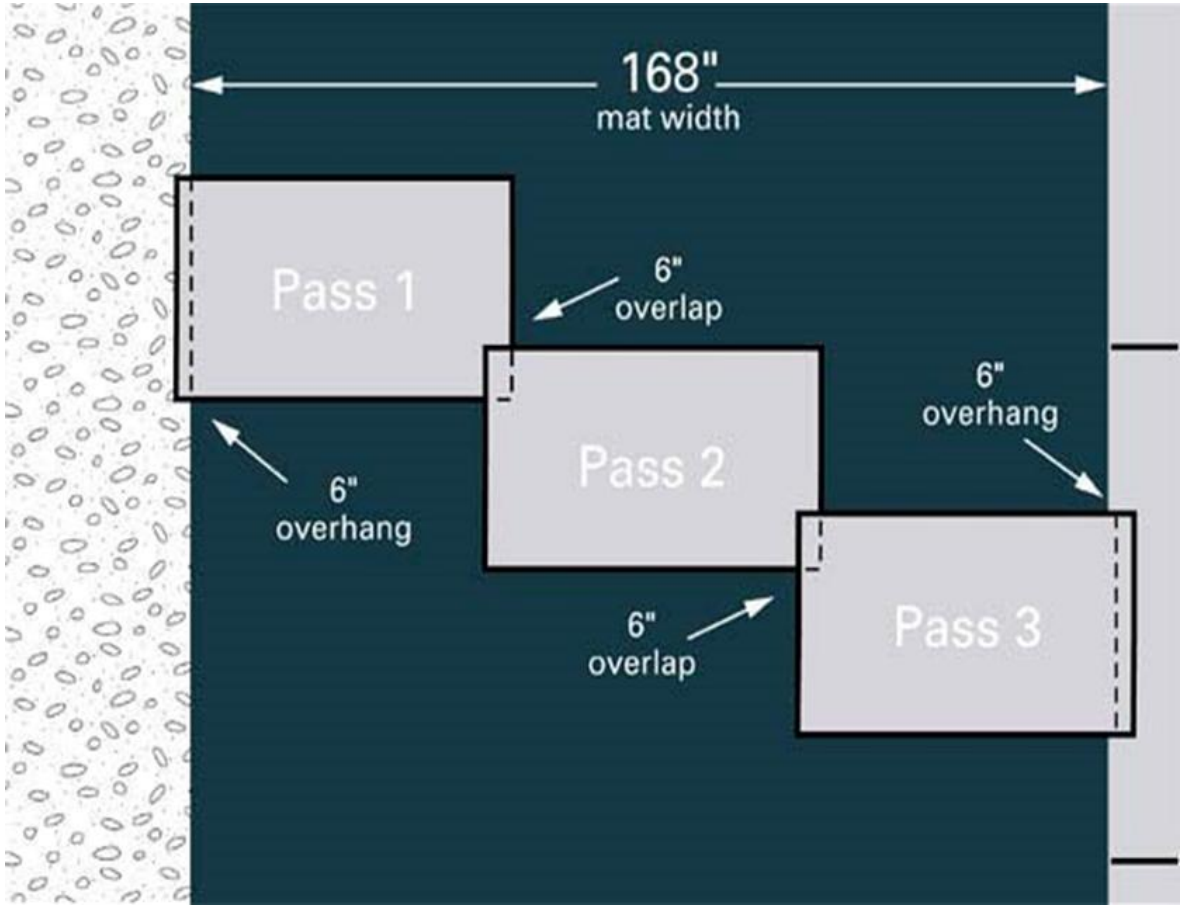
Compaction Phases



Establish a Rolling Pattern

- Know The Target Paver Speed
- Understand Roller Width Coverage
- Most of our compaction with Break-Down Roller
- Perform Test Strip / Pave Non-Critical area

Calculating Required Drum Width



- Coverage in 3 passes or less
- 6” overlap & overhang
- 168” (14’) wide mat plus 4 x 6” overlaps equals 192” total width
- Total width divided by 3 passes equals 64”
- Minimum drum width is 64” this example

Breakdown Roller 3 Key Factors

1) Temperature
2) Amplitude
3) Frequency

Temperature

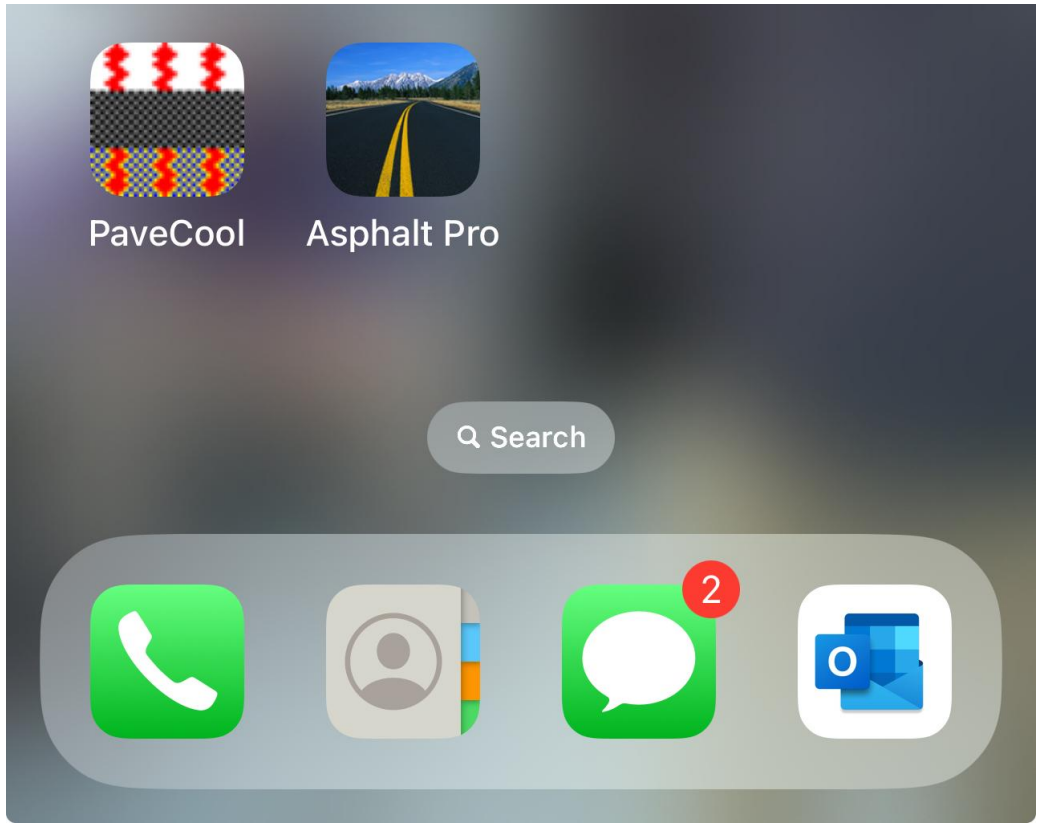
Asphalt Binder

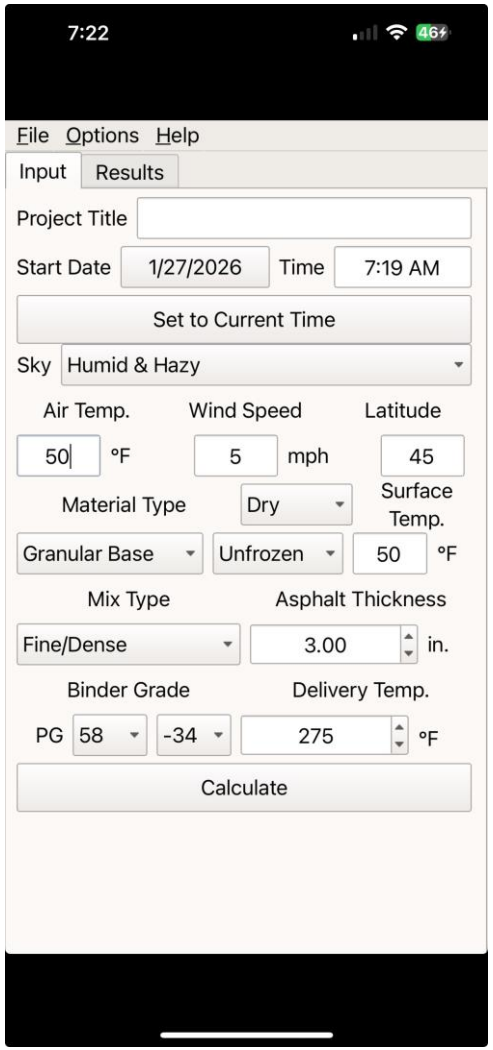
- **Acting first as a lubricant while the asphalt is hot**
- **Second as a glue/binder as the asphalt cools**

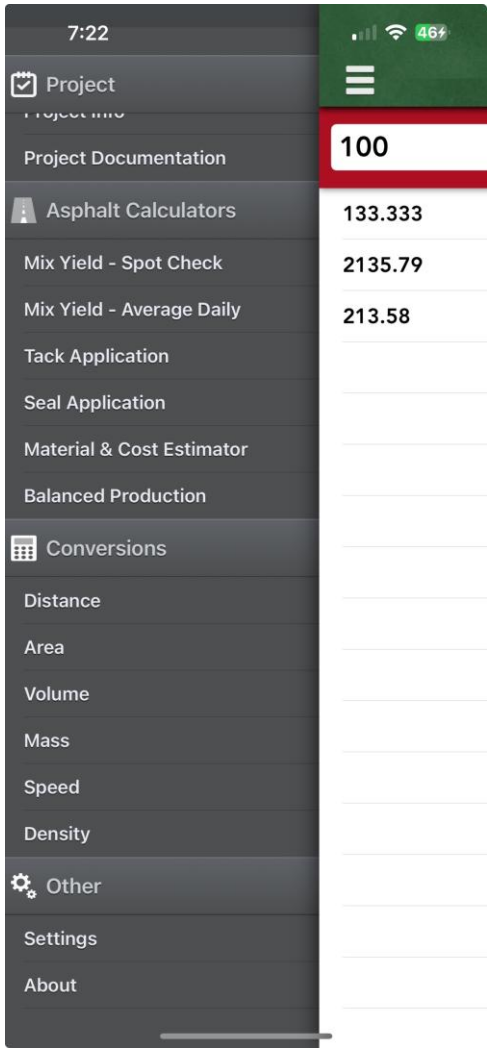
Temperature Considerations

- Mix Temperature from the plant
- Haul Time
- Truck and dump practices (truck vs. Ground/skid steer)
- Ground temperature
- Air temperature
- Wind speed
- Type of Mix
- Sunny vs. Cloudy vs. Night

Apps to Help Manage Temperature





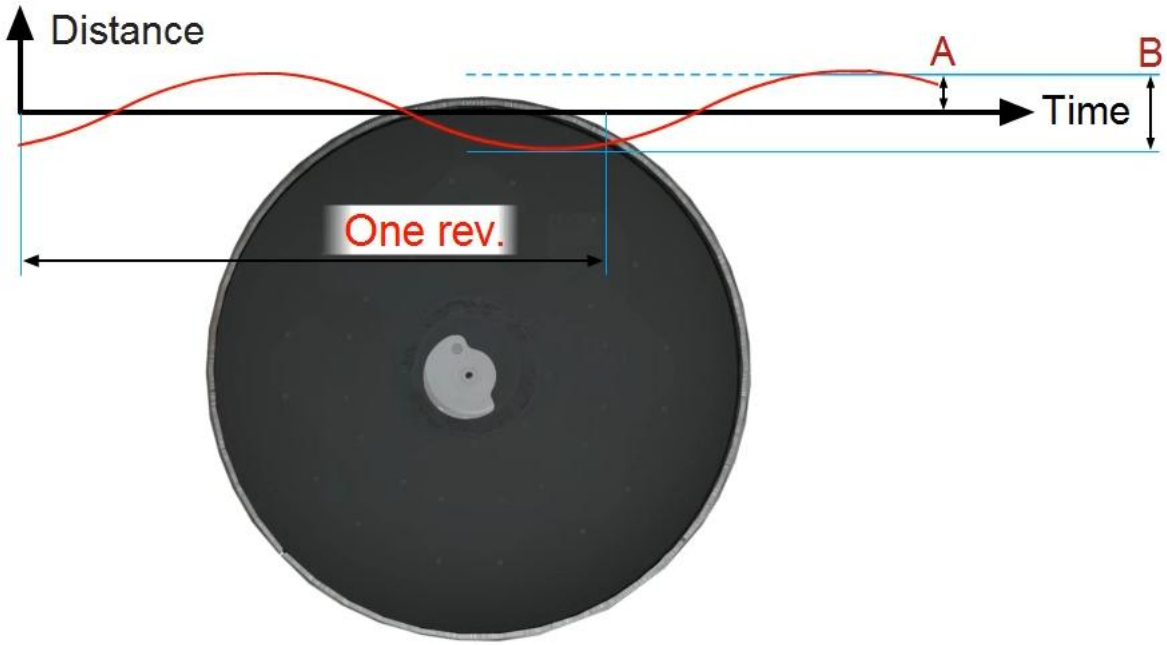


Temperature

https://theasphaltpro.com/articles/maintain-quality-in-cooler-temperatures/

Courtesy of Asphalt Pro Magazine

Amplitude *aka Altitude*



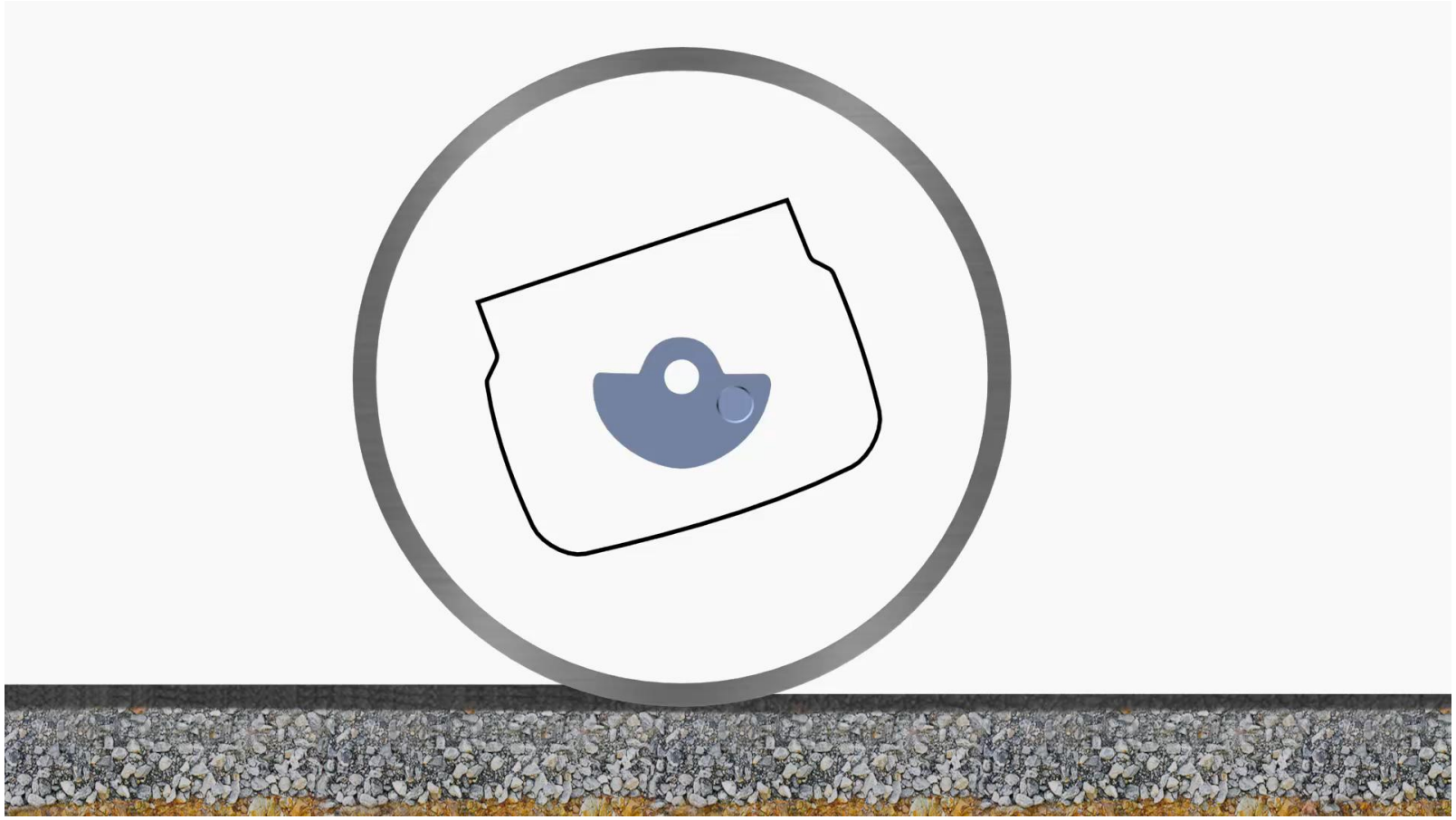
Note!

Animation shows exaggerated movement to illustrate the distance better.

-Vertical movement of the drum up and down

- Low Amplitude 1” – 3”
- High Amplitude 3” +

Amplitude – High & Low



Frequency

How fast we move the eccentric weight to move drum up & down

- **Number of vibrations (hits) per minute (vpm) or second (Hz)**

Hi Amp = *Low Frequency* ~ 3,000 vibrations per minute
~ 50 Hz – impacts per second

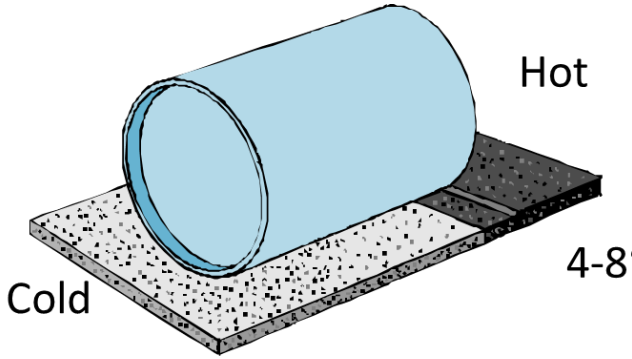
Low Amp = *Hi Frequency* ~ 4,000 vibrations per minute
~ 67 Hz – impacts per second

Impact Spacing vs Rolling Speed

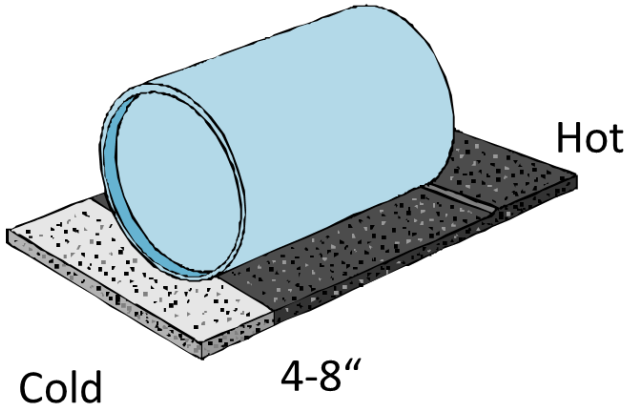
Frequency of Vibration (vpm)	Speed (mph)		
	2.8	3.4	4.5
	Impacts Per Foot		
2,500	10.0	8.3	6.3
3,000	12.0	10.0	7.5
4,000	16.0	13.3	10.0

Rule of Thumb – 10-12 Impacts /ft is good.

Rolling the Transverse Joint

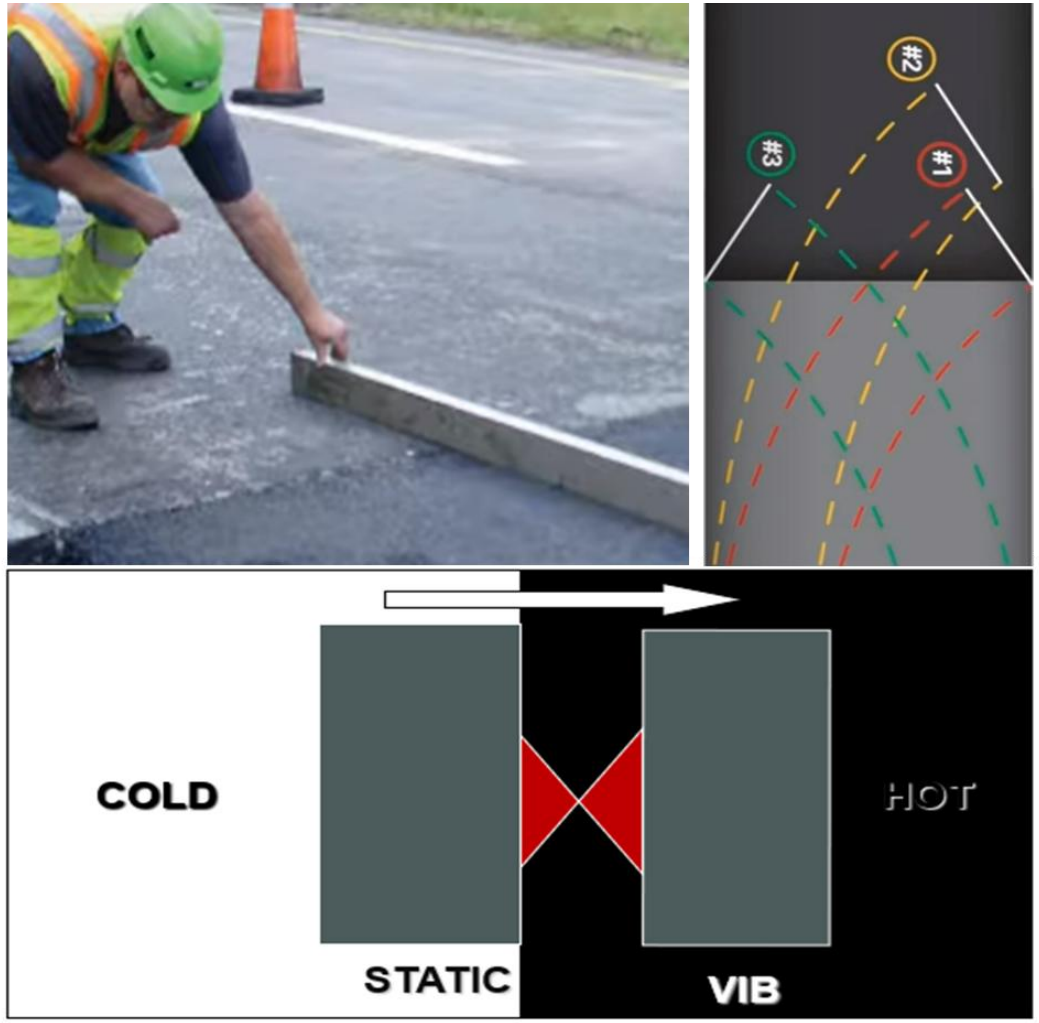


Start of the joint compaction



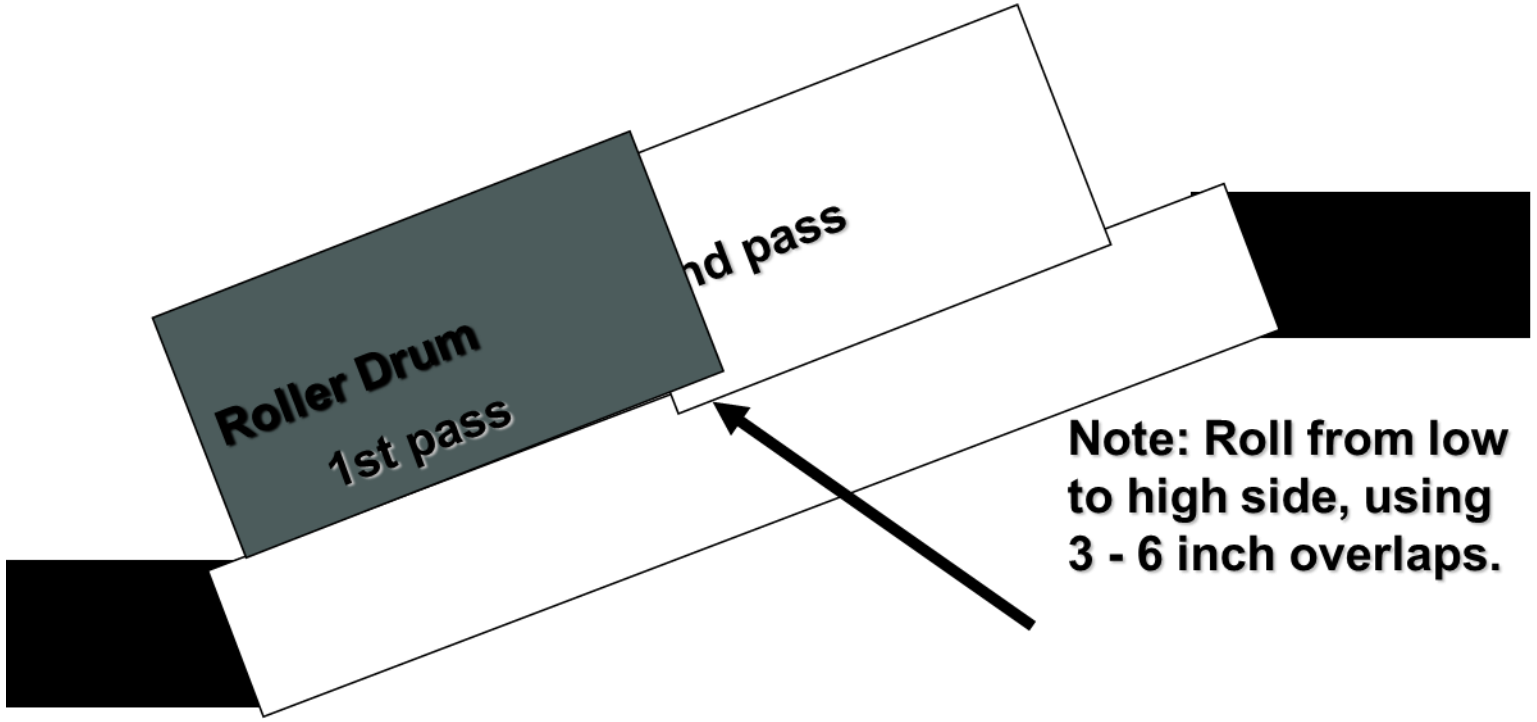
End of the joint compaction

Rolling the Transverse Joint

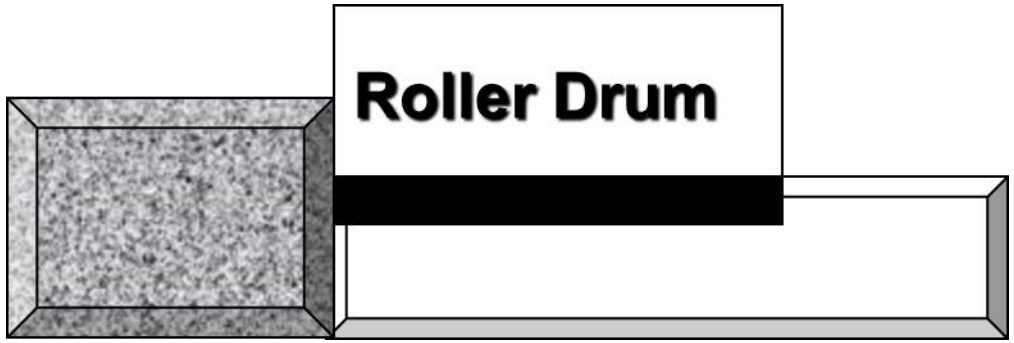


Note - Rolling “head on” GO SLOW, turn vibration on after roller passes onto hot side.

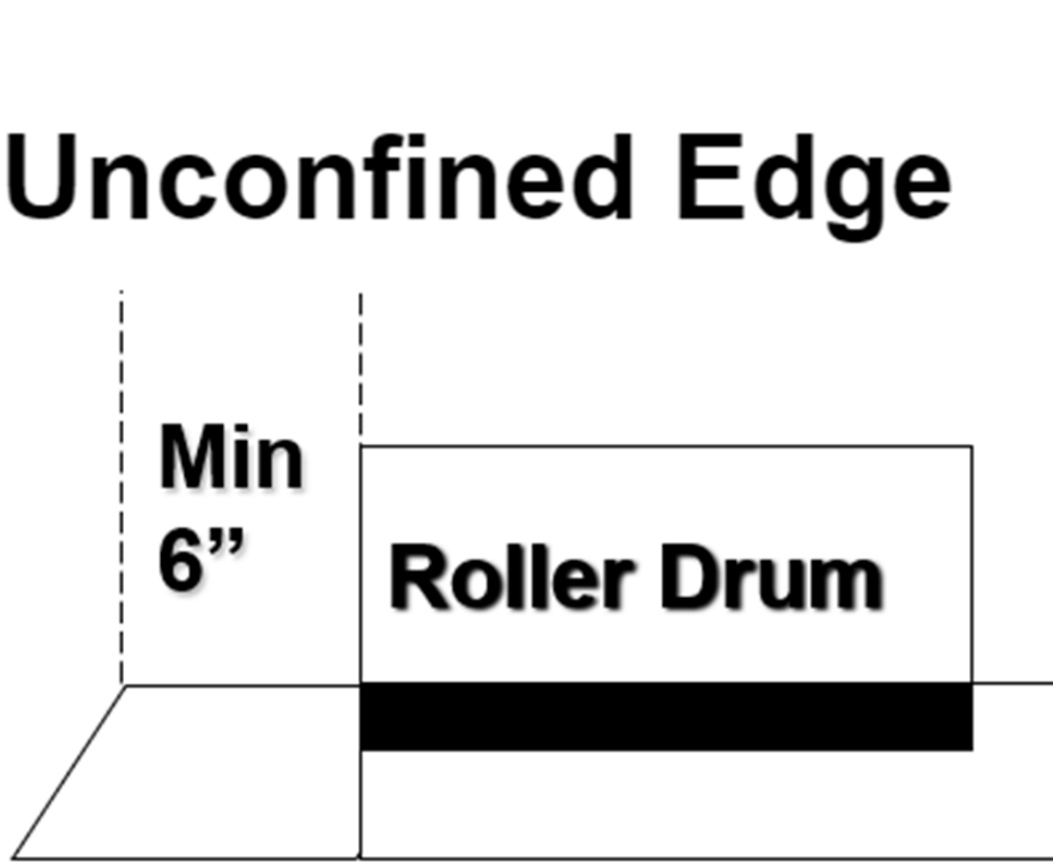
Start Rolling Low to High



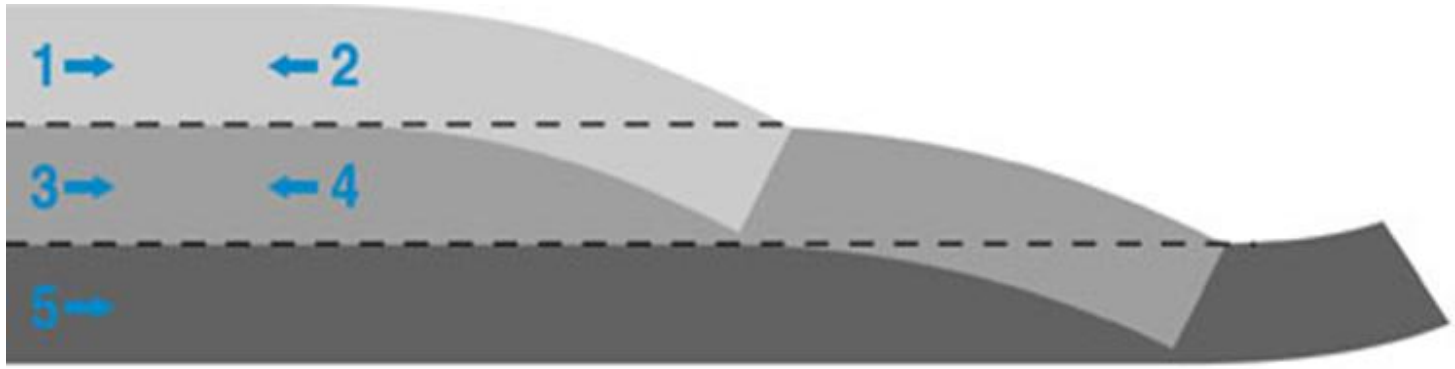
Confined Edges (Curbs)



Unconfined (Open) Edge



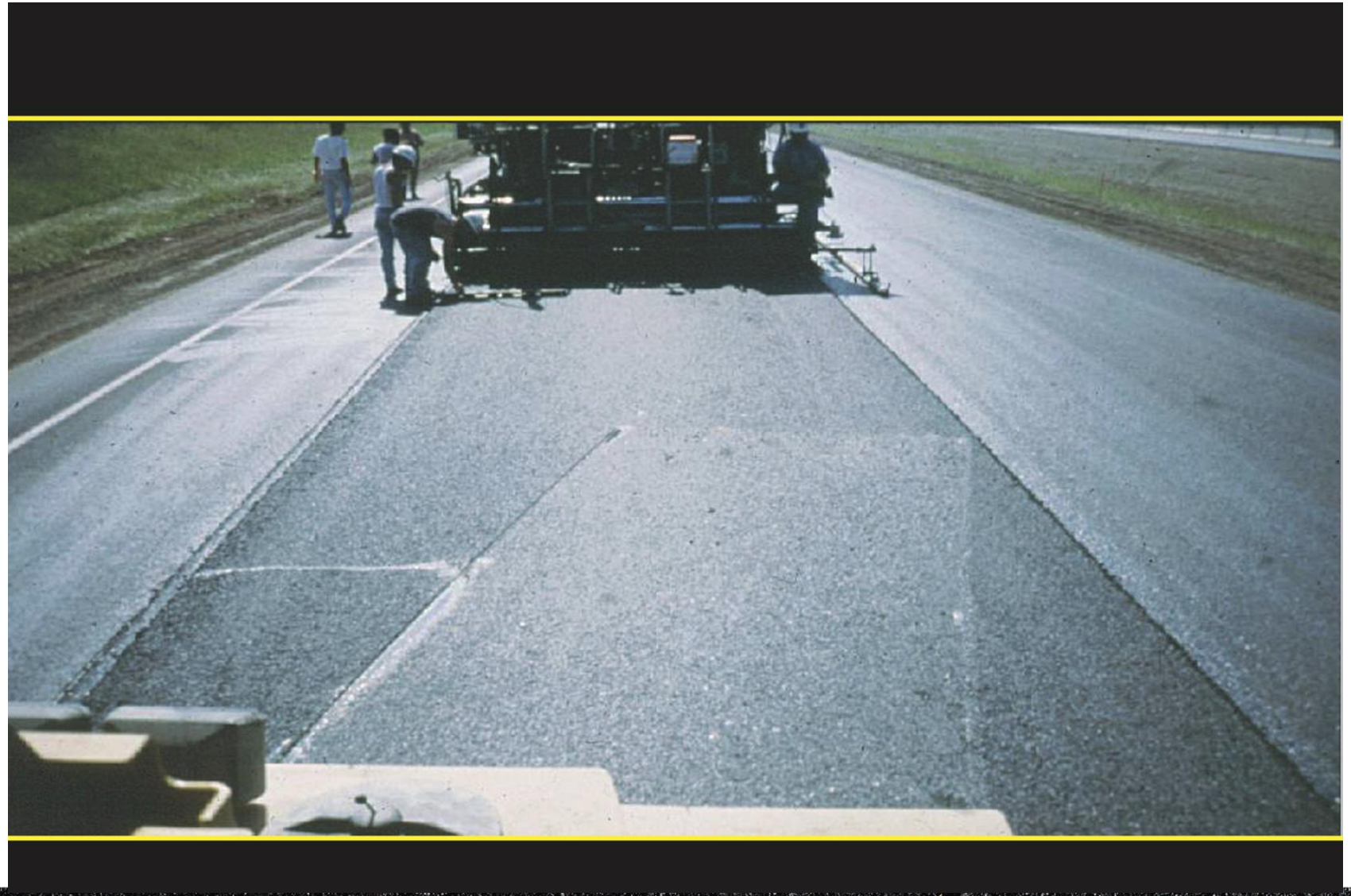
Reversing Direction



Reversing

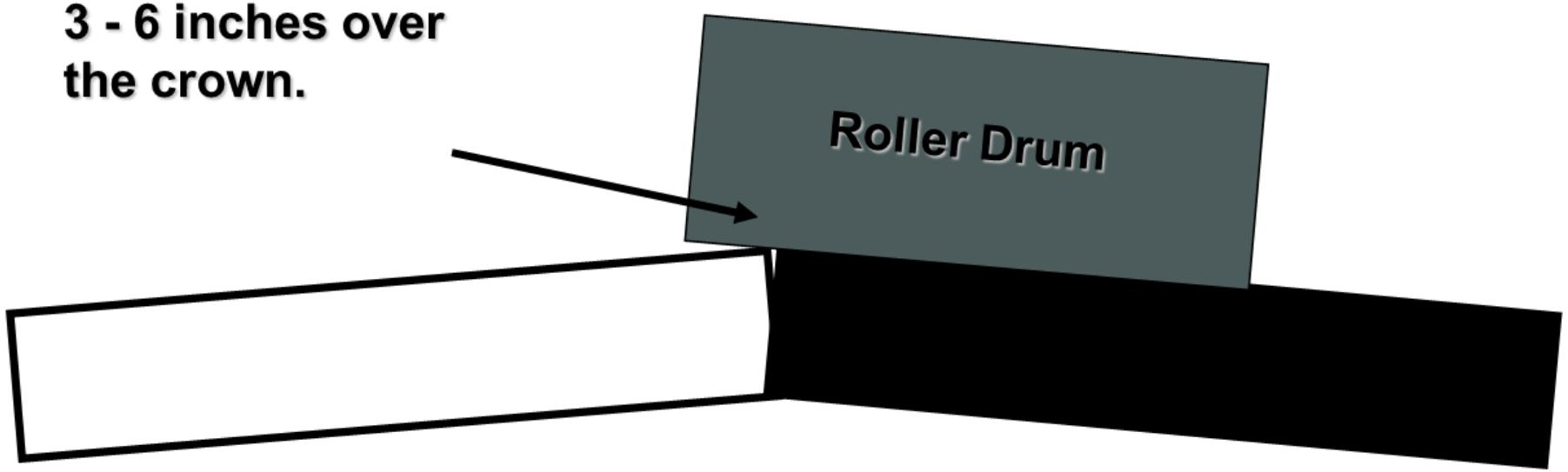
- Avoid straight stops
- Turn toward center of mat
- Don’t turn drum while stopped
- Next pass should be able to roll out any marks created by reversing

Turn Gradually



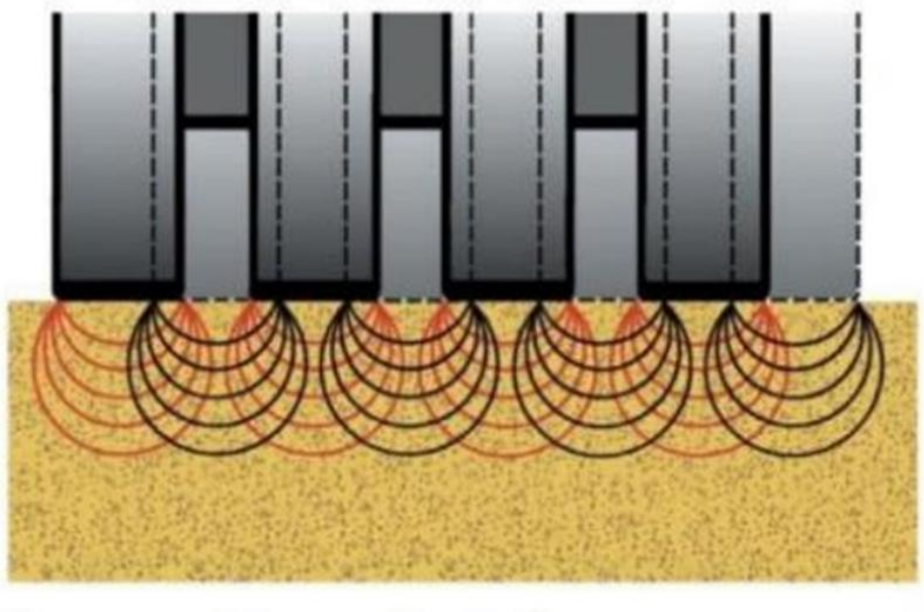
Rolling a Crown

Overlap drum
3 - 6 inches over
the crown.



Note: Roll from the low to high side of the crown
Never roll directly on top of the crown

Pneumatic Tire Rollers – Manipulation



Compaction Principle

Ground Pressure and Kneading Effect

Key Parameters

Wheel Load

Tire Pressure

Pneumatic Tire Rollers – Ground Pressure

- Weight of the machine
- + Ballast Weight = Wheel Load
- Tire Inflation Pressure

	Tire pressure (psi)		
	50	70	90
Wheel load (lb)	Ground pressure (psi)		
2500	58	62	67
3000	62	67	70
3500	65	68	74

Tips for Using a Pneumatic Roller

- Use Temp Gun 210-250 Degrees
- Approved Release agent
- Warm up before rolling
- Keep tires hot, within 40°F of mat
- Do not turn
- Stop slowly
- Finish roller cleans up the marks

RECAP – IMPORTANT STUFF

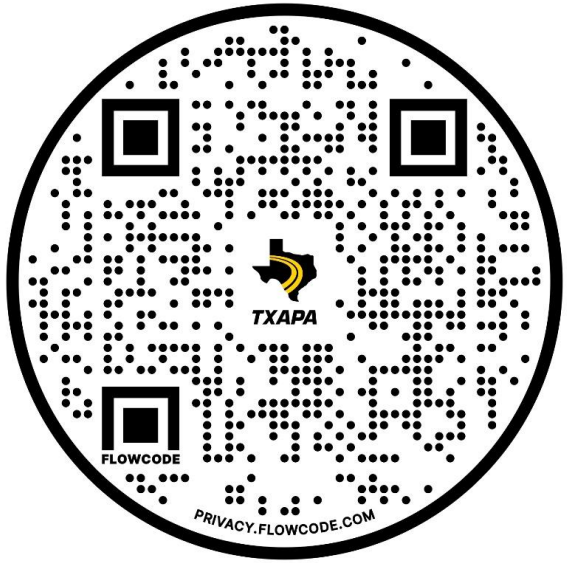
- Partner up to to find your % #s
- Paver/Roller Speed
- Roller Width Coverage
- Work Low to High
- Gentle curves with Break-down

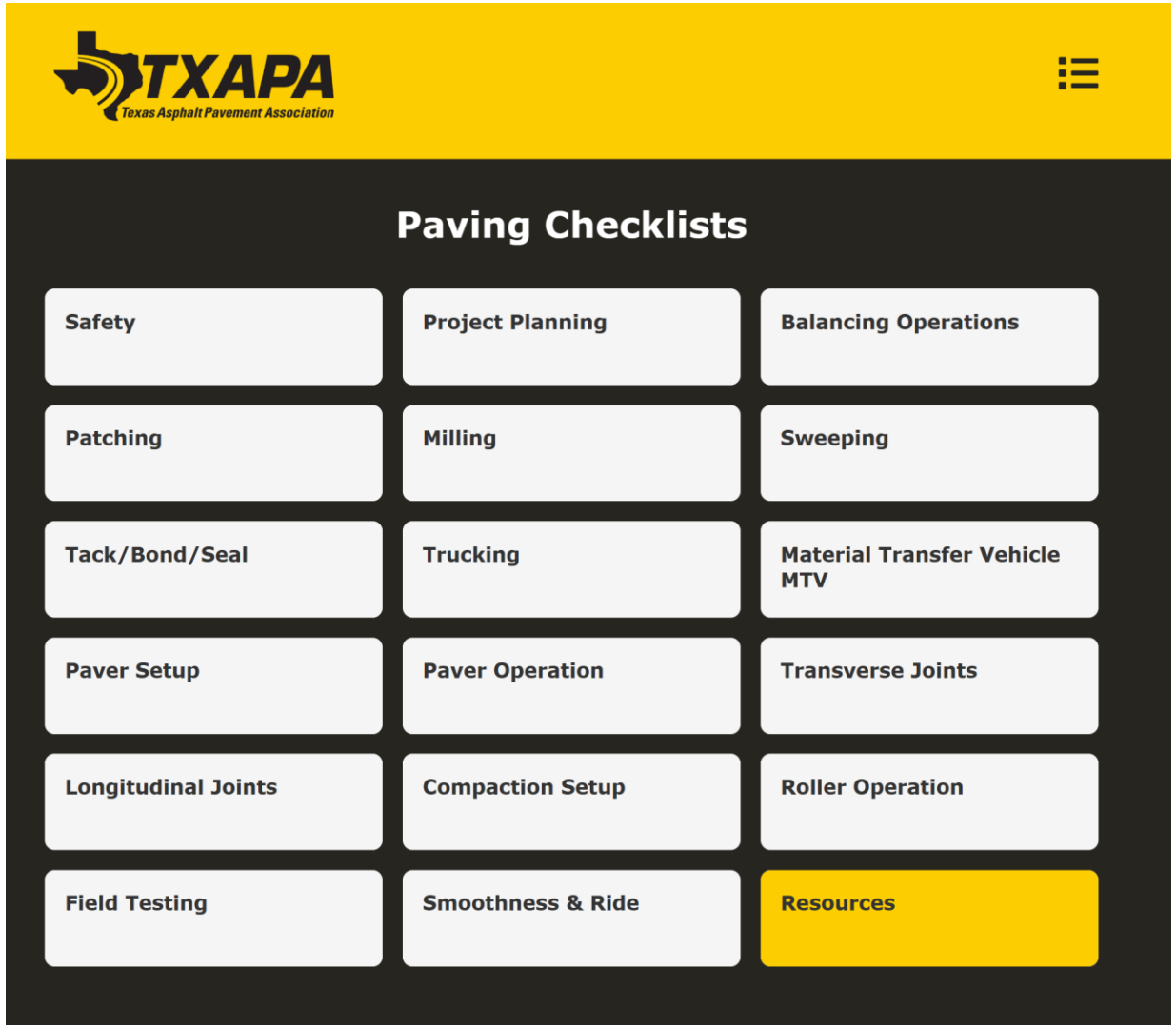
Daily Debrief

- ***What was the plan today****?*
- ***Did we achieve it?*** *Why or why not?*
- ***Safety****/Traffic Control Issues*
- ***Test Results*** *– Plant mix properties, Temperatures, In-Place Air Voids, Segregation Profile, Density Profile, Longitudinal Joint Profiles* ***all ok? Any trends?***
- ***Results shared*** *with plant?*
- *All* ***reports and documents*** *turned in timely?*
- *What is the* ***plan tomorrow****? Anticipate any issues?*

Paving Checklist

- ✓ Free
- ✓ Web-Based
- ✓ Save link to your home screen





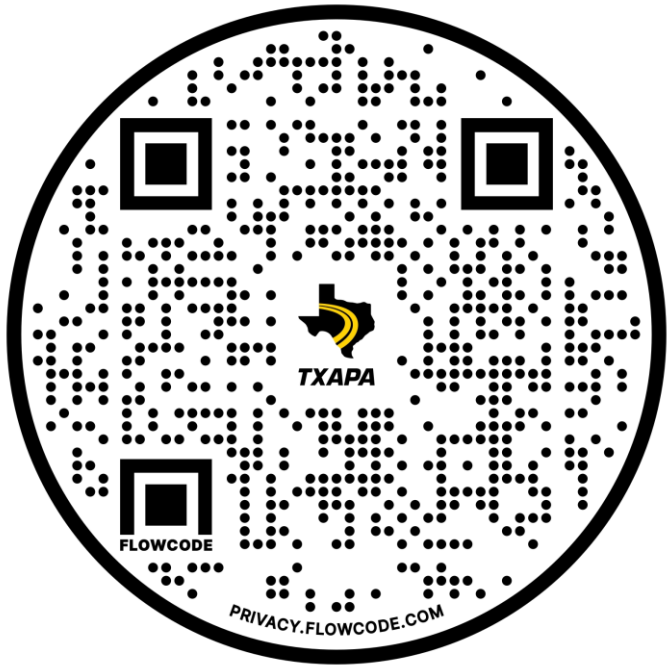
Example

Paver Setup

Paving Checklist

- Verify paver tractor and screed are properly maintained, greased, fueled, and fully operational.
- Verify all equipment is ready including electronics, skis, and cables.
- Perform safety walk around check, check fluids, and condition of screed plate, augers, chains, extensions, attachments.
- Use stringline, paint, or fixed structure to establish steering guide.
- When using joint matcher, position sensor at leading edge of screed.
- Verify mat width to avoid longitudinal joint in wheel paths.
- Block screed up and use stringline to check for crown or verify flatness of screed and extensions.
- Use starting blocks or asphalt pad under screed to establish thickness of roll-down. (~1/4 inch per inch of compacted thickness)
- Use CAT Paving-By-The-Numbers as generic guideline for paver setup. See your specific manufacturer's manual for specifics.
    - YouTube: Cat® At Home Series – Paving by the Numbers with Ron Wilson
    - YouTube: Paving by the Numbers for Cat® F-Series Pavers with Vibratory Screeds
- Paver/Screed Startup Checklist – recheck each start.
    - Heat the screed.
    - Set the tow points.
    - Set paving width.
    - Set crown height.
    - Set extender height.
    - Set extension slope
    - Set screed and pull forward to remove slack
    - Null the screed.
    - Position end gates – add slack (loose washer).

Resources



- TXAPA Texas Asphalt Pavement Association
- TXAPA YouTube channel
- TXHMAC HMAC Training and Certification Center
- HMAC (QF) Quick Facts – Quick summaries and explanation of test procedures.
- Specifications
  - TXDOT Specifications
    - 300 series 300, 320, 341, 342, 344, 346, 347, 348
  - Texas 341M Municipal Asphalt Specification
- NAPA National Asphalt Pavement Association
- Hey NAPA AI assisted Q&A
- Asphalt Institute – Asphalt Binders/Emulsions.
- TXDOT Guidance on materials
- Asphalt Pavement Alliance (Asphalt pavement info and resources)
- State Asphalt Pavement Associations
- PaveCool (cooling rate calculator)
- MultiCool V2.0 (cooling rate calculator) Google App
- Cat Paving Products – Paving App. (IOS and Google apps)
- TXAPA Balancing Production Rates Online Class.
- Asphalt Pro Paving App (IOS only).

MATERIALS & ASPHALT PAVEMENT SOLUTIONS

QUESTIONS?

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