

Best Practices Paving & Innovative Technology in Equipment / Sustainability

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Innovative Technology in Equipment / Sustainability

Several Steps in Managing Sustainability

1. Do it right the first time – “Get In Get Out & Stay Out”

- ***??B\$ Spent on Rework because of Poor Quality & Performance***
- ***Todays Equipment are designed with Features to Optimize Quality & Performance***
 - ***Density & Smoothness Determine Pavement Longevity***
 - ***Understand the Principles of Paving***
 - ***Follow Recommended Practice / Procedures***
 - ***Used the features Currently on the Machines***

2. Features being Designed to allow Relevant Personnel to Monitor Performance & Quality

- ***At any Location***
- ***Fix Known Issues Once Determineddon't continue with Bad Practice***

3. Manage your EPD'S

- ***A1 to A5***
- ***Paving Construction EPD's***

Mix Design & Density

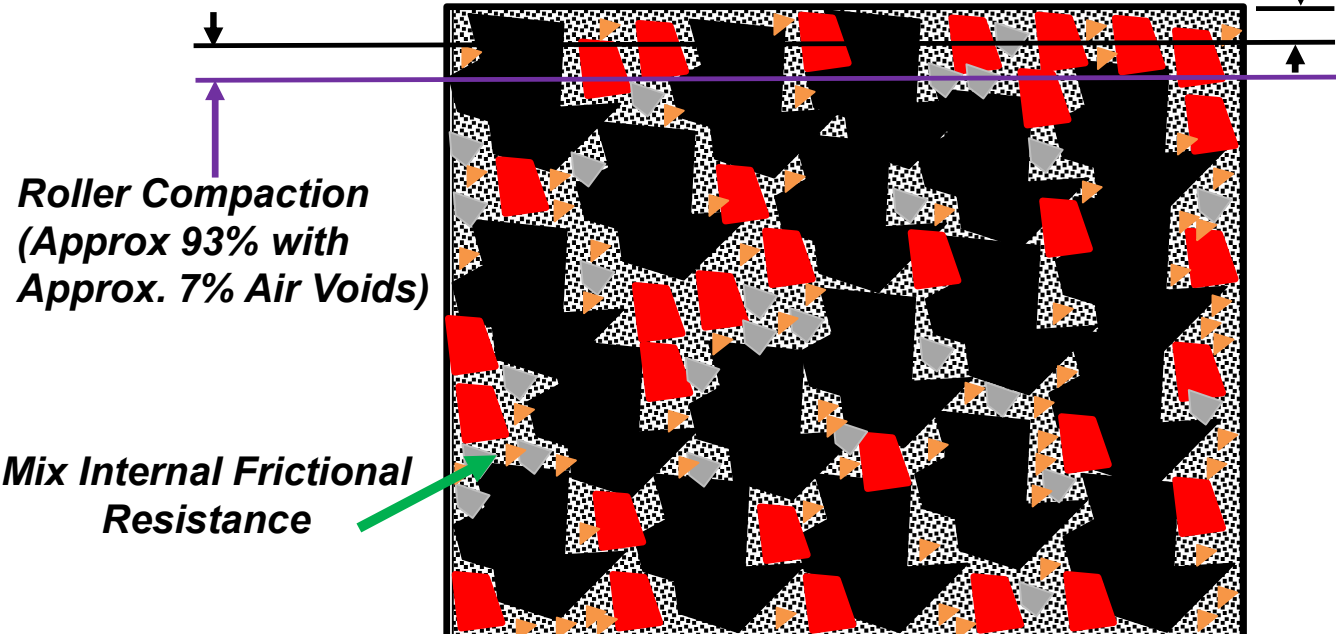
Paving – Laying a Hot Mixture of Aggregate, Sand, Asphalt Cement & Air Voids to a Width & Depth

Density – Weight / Volume, Varies during the Paving Process

- **Bulk Density: Uncompacted – 120 Lbs / Cu Ft.**
- **Screed Density: Approx. 85% (15% Air Voids)**
- **Final Roller Density: 93 to 95% (5 to 7 % Air Voids)**

**Screed Compaction Approx 85%
- Approx. 15% Air Void**

Blend		JOB MIX FORMULA
Product		
SIEVE SIZE	3/4" 19.0mm	100
	1/2" 12.5mm	98
	3/8" 9.5mm	89
	No. 4 4.75mm	67
	No. 8 2.36mm	50
	No. 16 1.18mm	39
	No. 30 600µm	31
	No. 50 300µm	24
	No. 100 150µm	12
	No. 200 75µm	5.2
Binder Content		4.9%
Mixing Temp = 300 F		



Mix Design & Density

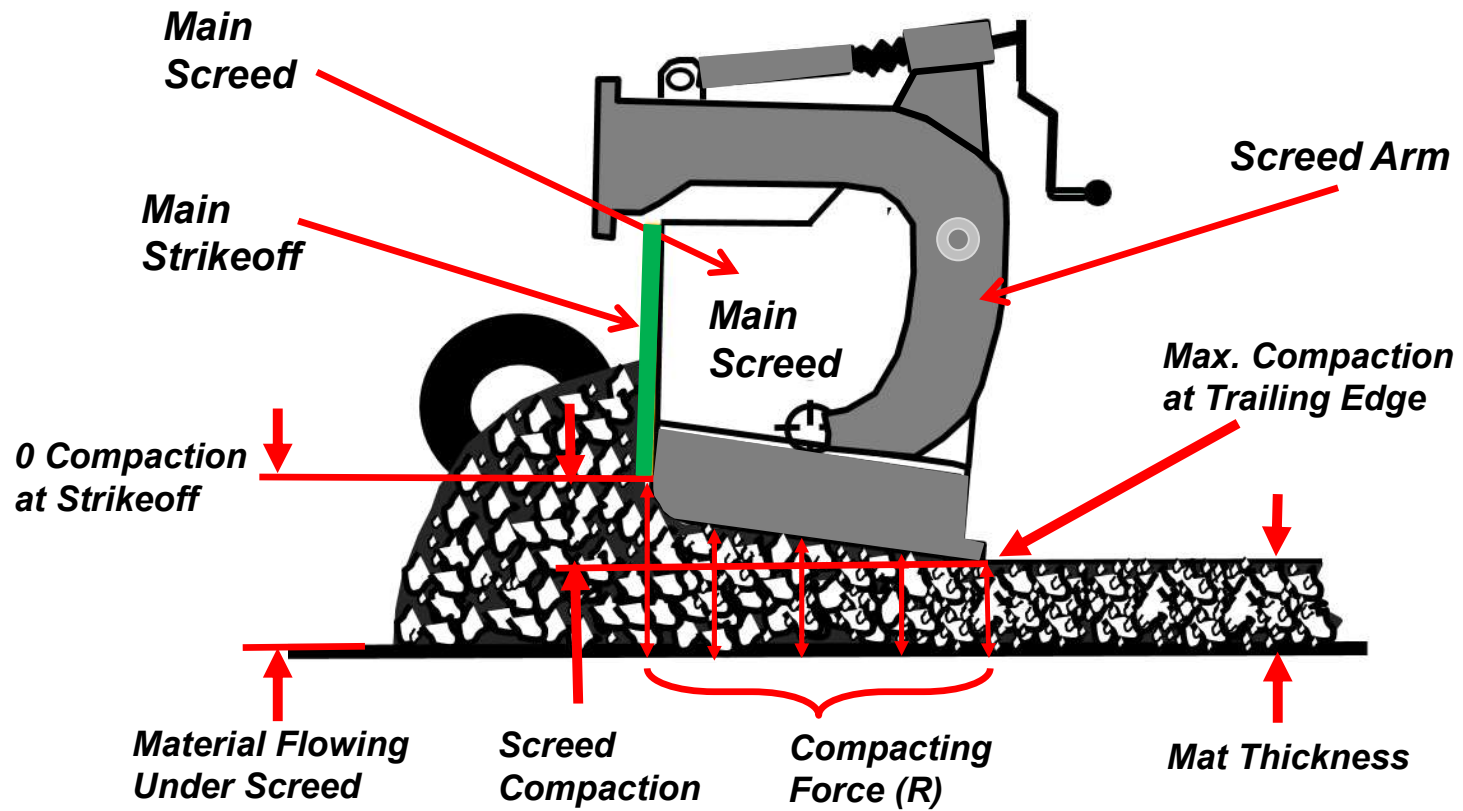
Segregation – Large Stones Separate from the Fines during Handling

- *Changes Asphalt & Heat which is usually in the fines*
- *Changes the Internal Frictional Resistance of the Mix – Impact on Compaction*



Principles of the Free Floating Screed

Vibratory Screed Compaction – Screed Float on the Asphalt:





AB 600
Flash



Inline

Principles of the Free Floating Screenshot

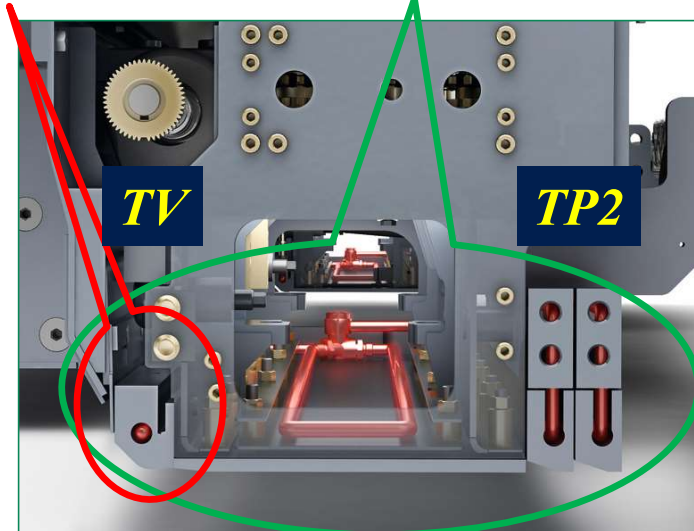
Compaction & High Compaction Screens:

1. **Vibratory – No Reciprocating Devices**
2. **Compaction Screenshot: Vibration & 1 Tamper Bar (TV)**
3. **High Compaction Screenshot: 1 Tamper Bar and 2 Pressure Bars (TP2)**

Vibratory Screenshot: 0 – 6”



Compaction Screenshot: 0 – 8”

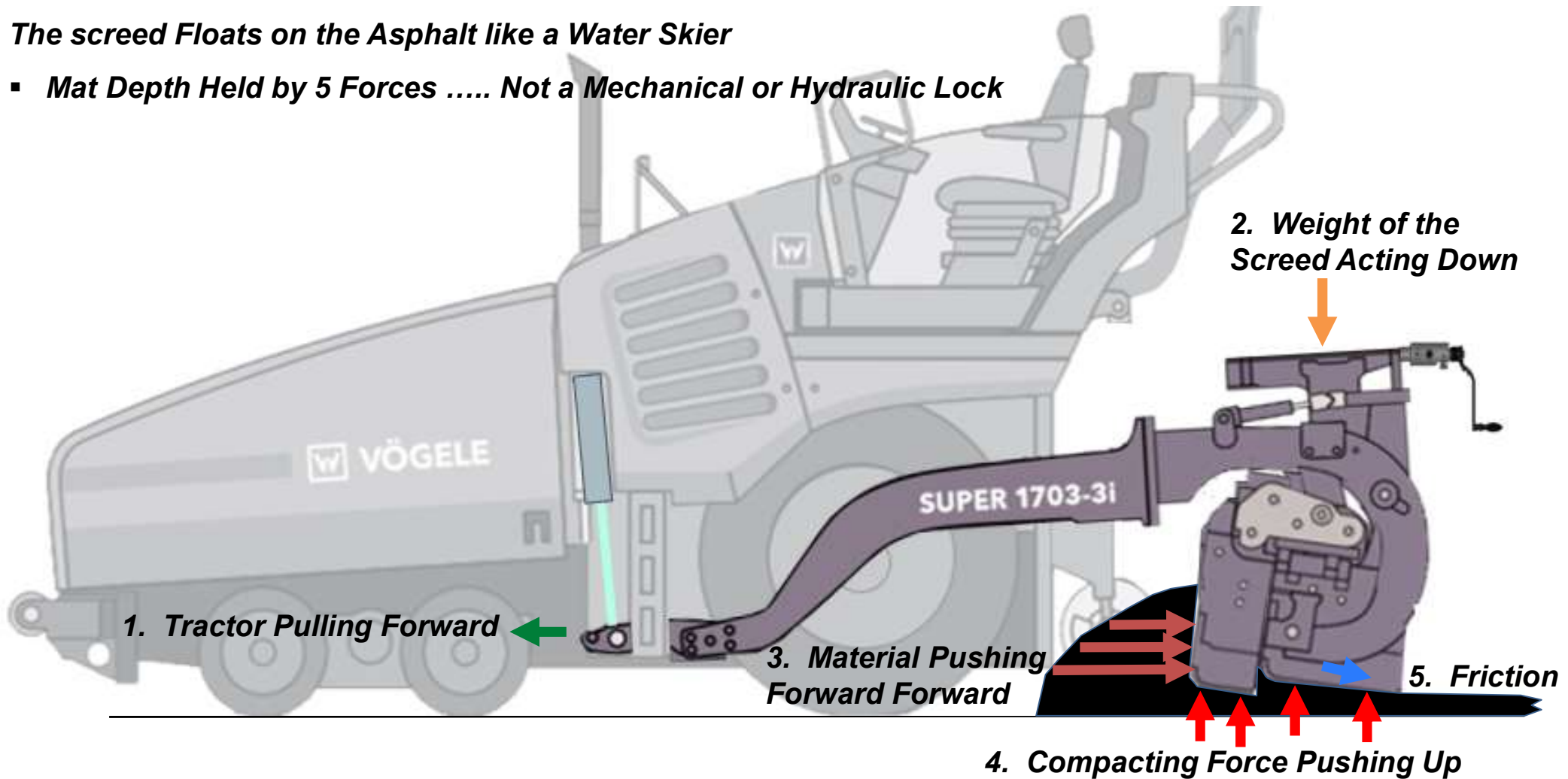


High Compaction Screenshot: 0 – 12”

Principles of the Free Floating Screed

The screed Floats on the Asphalt like a Water Skier

- Mat Depth Held by 5 Forces Not a Mechanical or Hydraulic Lock



Principles of the Free Floating Screed

Issues Affecting Force # 1 - Pull Forces (P):

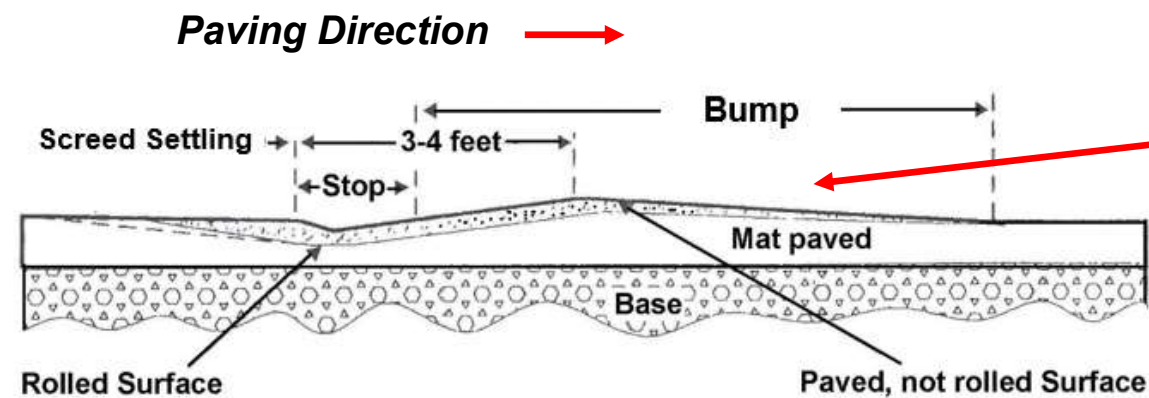
- ***Use of MTV for Non Contact Continuous Paving***
 - ***Exchange truck without Stopping***
 - ***Exchange Truck without bumping the Paver***
- ***Maintain Material Consistency***
 - ***Control Gradation & Temperature Segregation***



Principles of the Free Floating Screed

Issues Affecting Force # 1 - Pull Forces (P):

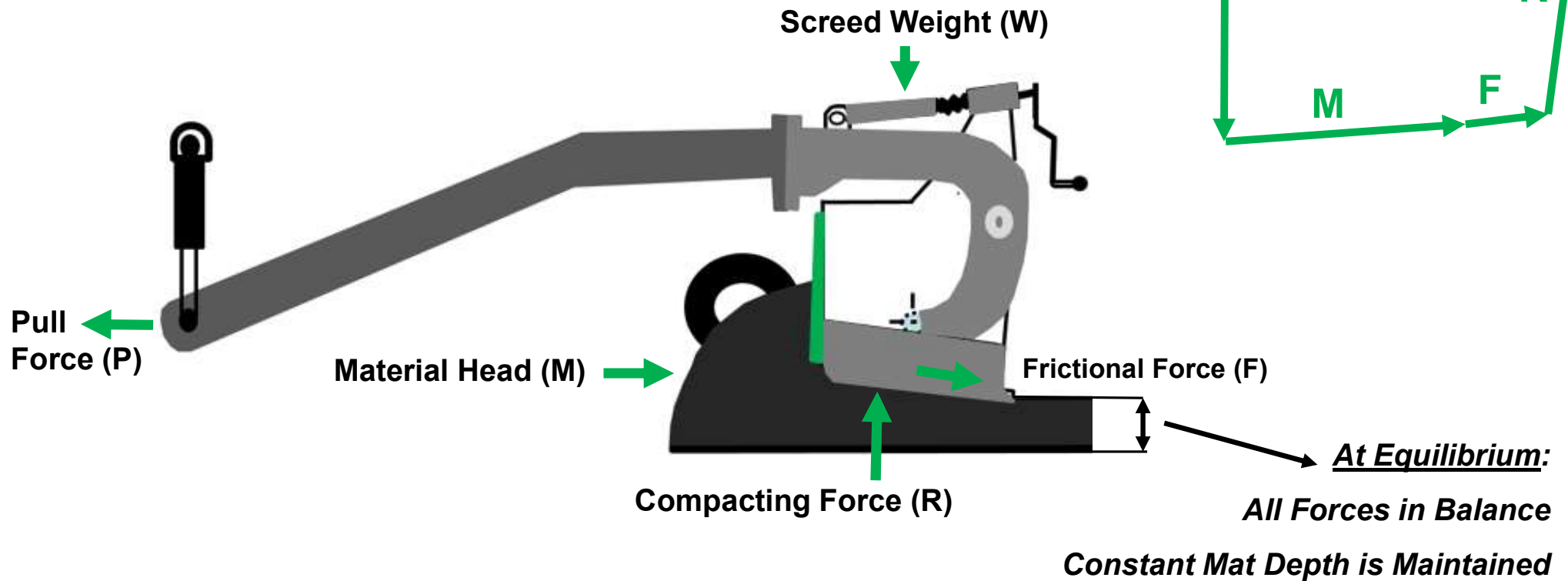
- **Stopping and Starting**
 - **Result in Settling Dips & Humps**
- **Use the Following:**
 1. **Screed Hold**
 2. **Screed Freeze**



Principles of the Free Floating Screed

Issues Affecting Force # 2 - Weight (W):

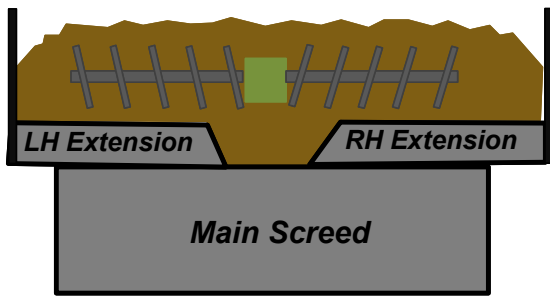
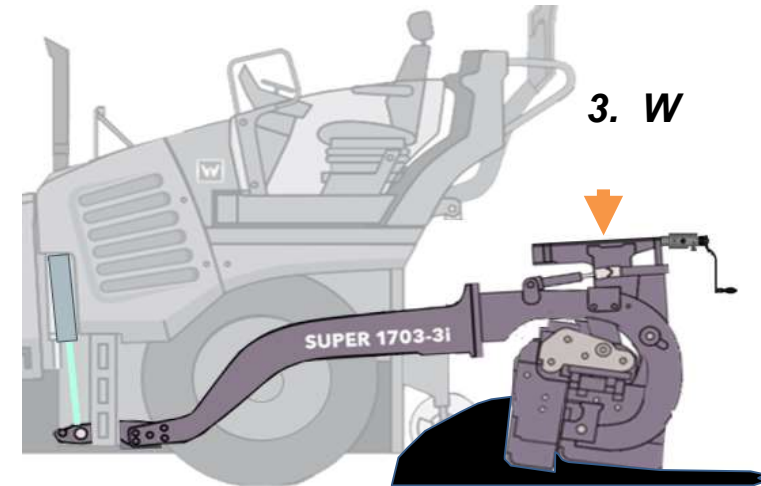
- *Weight of the Screed directly Proportional to Screed Density*
 - *Density Changes with Material Consistency*



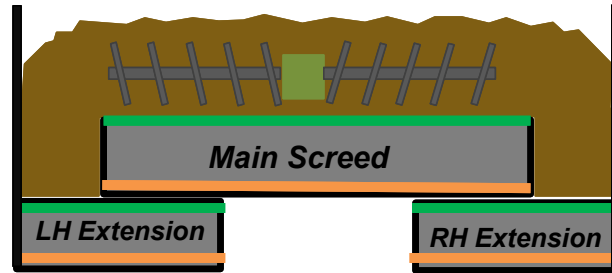
Principles of the Free Floating Screenshot

Issues Affecting Force # 3 - Weight of the Screenshot (W)

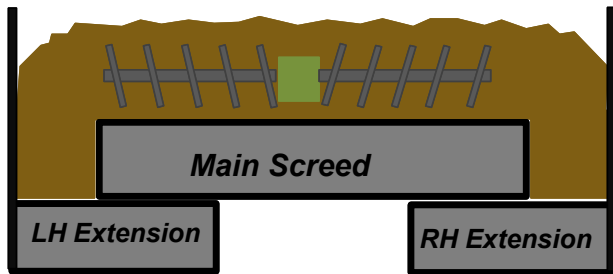
- Several Types of Floating Screens
- Application Determines the Type of Screenshot



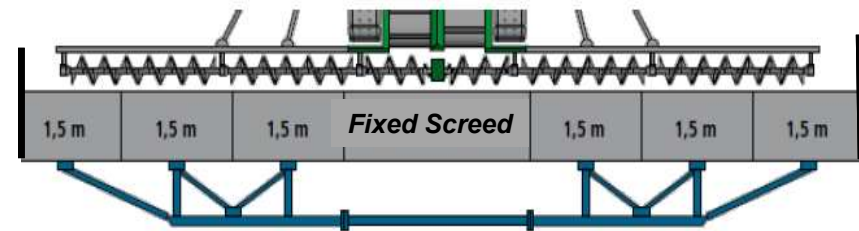
Unequal Width Front Mount Screenshot



Rear Mounted Extensions Compaction & High Compaction Screens – Max 33' Wide



Rear Mounted Extensions Vibratory Screens

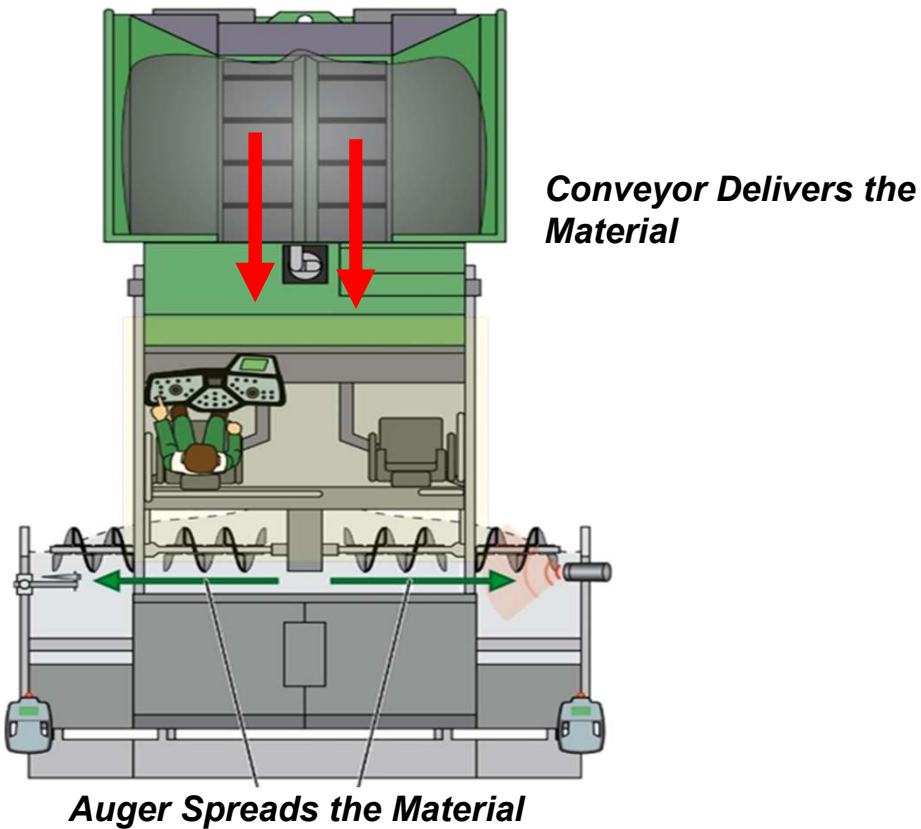


Fixed Screenshot - Compaction & High Compaction – Max 60' Wide (Hydraulic Extensions Optional)

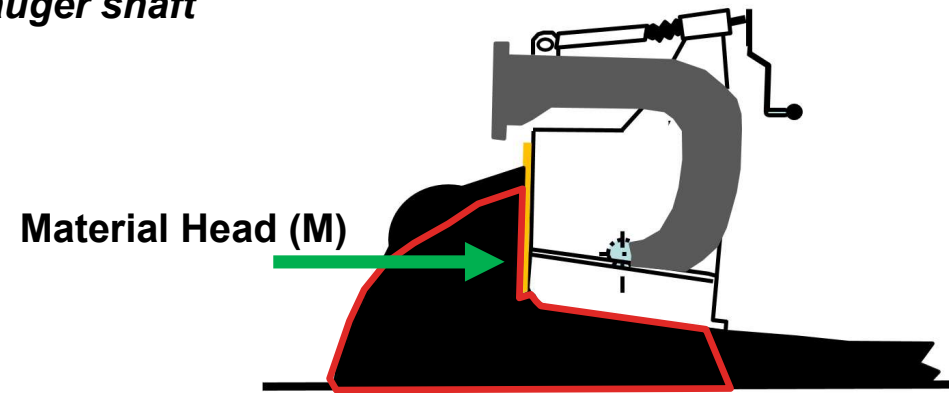
Principles of the Free Floating Screed

Issues Affecting Force # 3 - Head of Material (M):

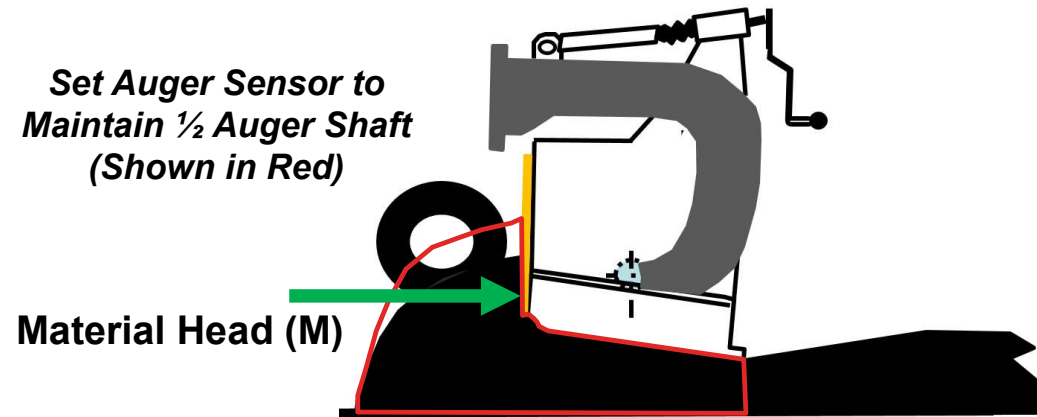
- Maintain a consistent even head of material, covering 1/2 auger shaft



Increase Head.. Screed Rises



Decrease Head.. Screed Drops



Principles of the Free Floating Screed

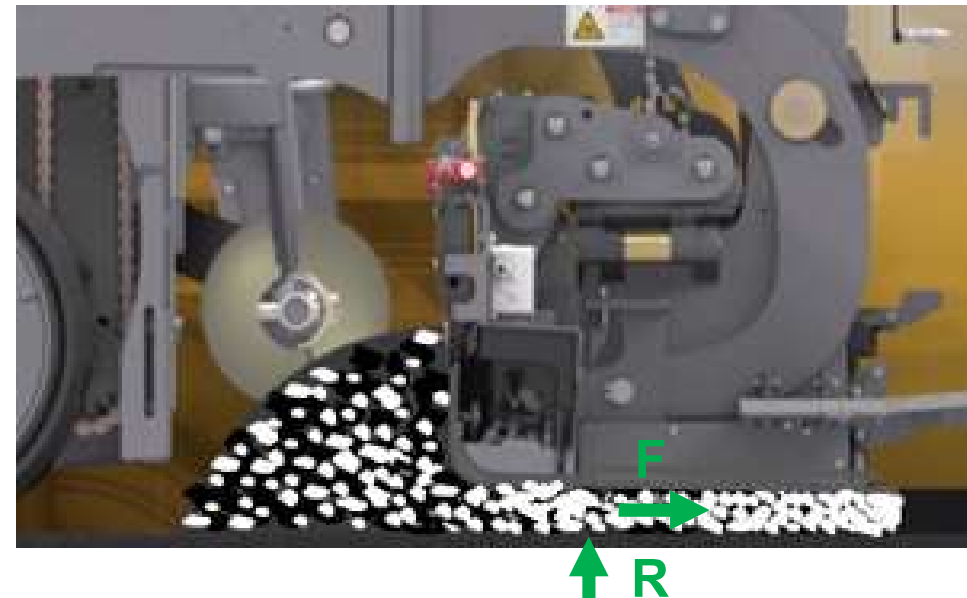
Managing Forces # 4 & 5 – Reaction (Compacting) Force & Friction Force

1. Must Manage Mix Consistence (Change with Segregation))

- a) **AC Content**
- b) **Temperature**
- c) **Gradation**
 - **Change in any of the above changes Mix Internal Frictional Resistance**
 - **Temperature could be used to Monitor**

2. Must Manage Screed Adjustments

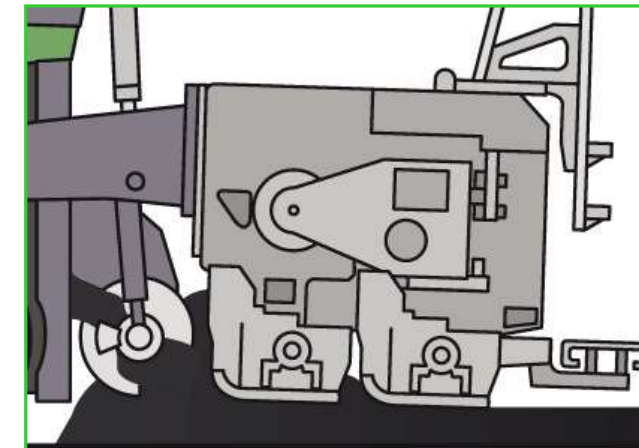
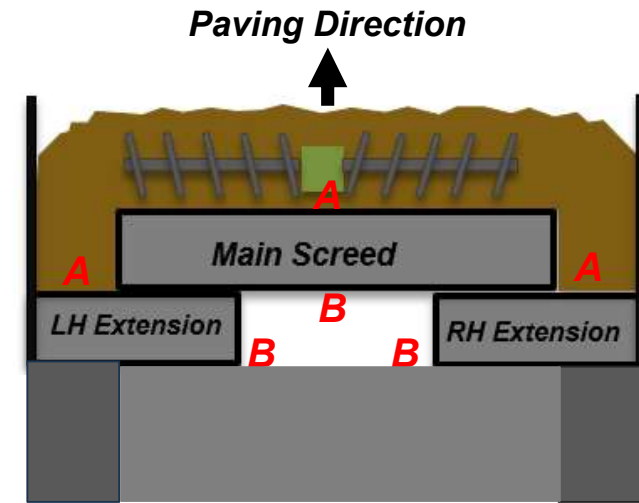
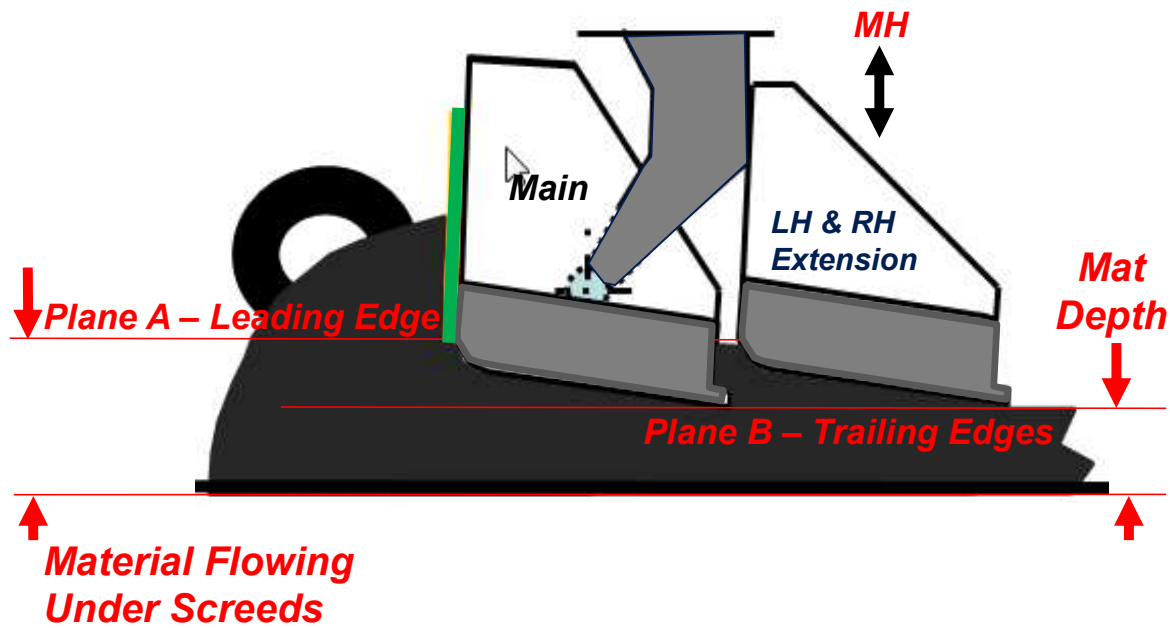
- a) **Ext. screed Angle of Attack**
- b) **Ext. screed Match Height**
- c) **Strike-off adjustment**
- d) **Screed Line of Pull**



Screed Adjustments

Rear Mount Extension Angle of Attack & Match Height

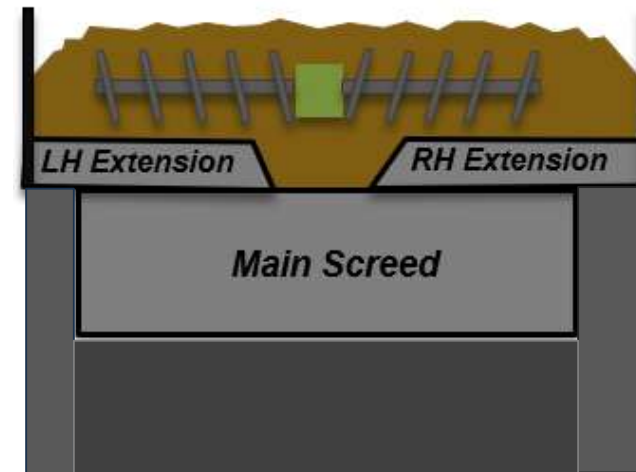
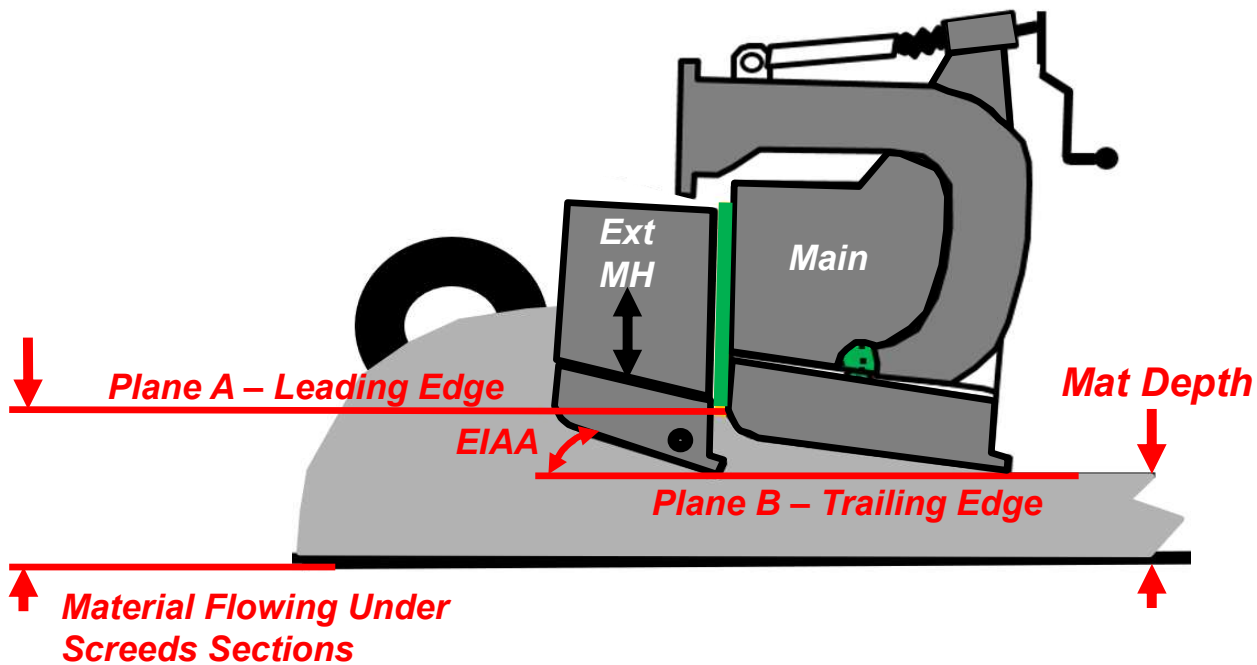
- **Material Flowing Under all Screed Sections must Be Equal**
- **Match Height (MH) - Match the Trailing Edge of Extension to Main**



Screed Adjustments

Front Mount Extension Angle of Attack & Match Height

- **EIAA** - Ext. Independent Angle of Attack, Sets Leading Edges of Ext. to Main
- **MH** – Match Height, Match the Trailing Edges of Ext. to Main
- **Parallelism** – Ensure VA is held at all paving width

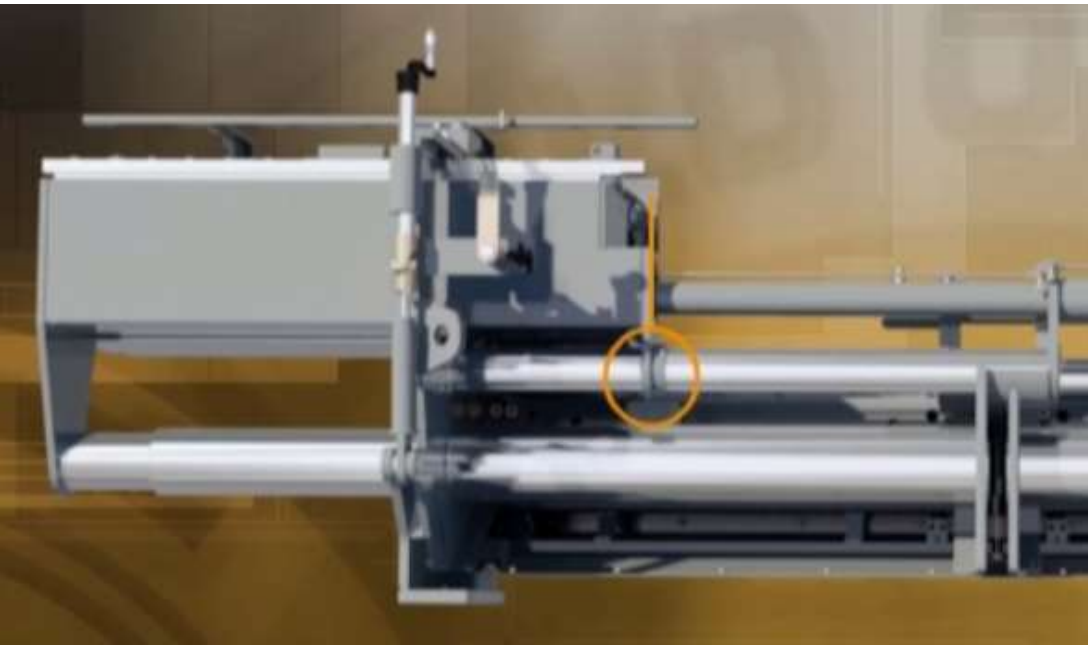


Screed Adjustments

Extension Screed Angle of Attack, VA (Match Height) & Parallelism

- *Screed Rigidity is important for Consistency under all paving conditions*
- *Sloppy Bushings etc. hinders screed performance*

Rear Mount Extension - VR 600



Front Mount Extension - VF 600



Screed Adjustments

Extension Screed Angle of Attack & Vertical Adjust

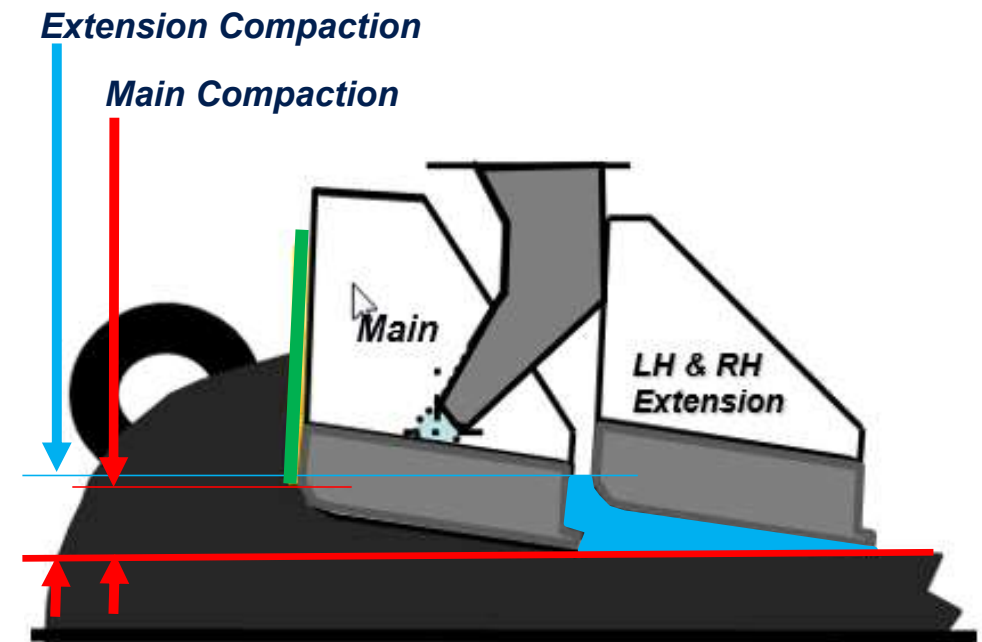
- **Correct Angle of Attack & Vertical Adjust = Stable Screed & Quality Mat**



Screed Adjustments

Rear Mount Extension: Extension Angle Greater than Main Screed Angle

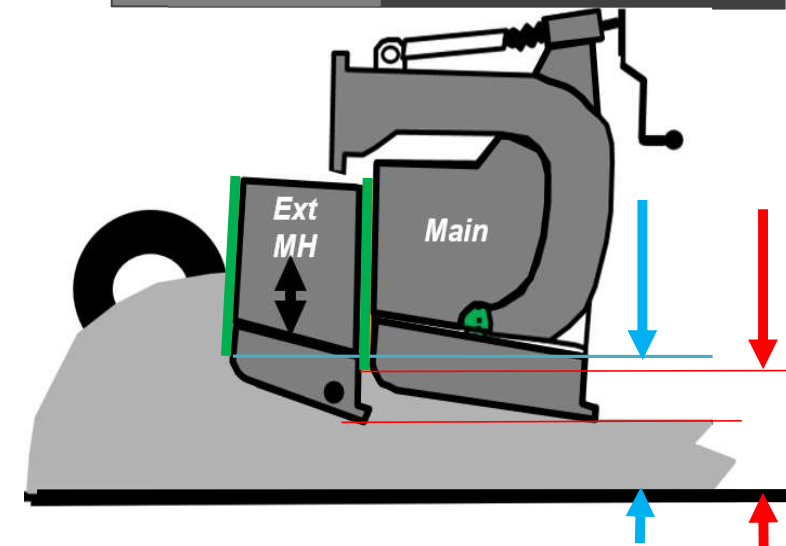
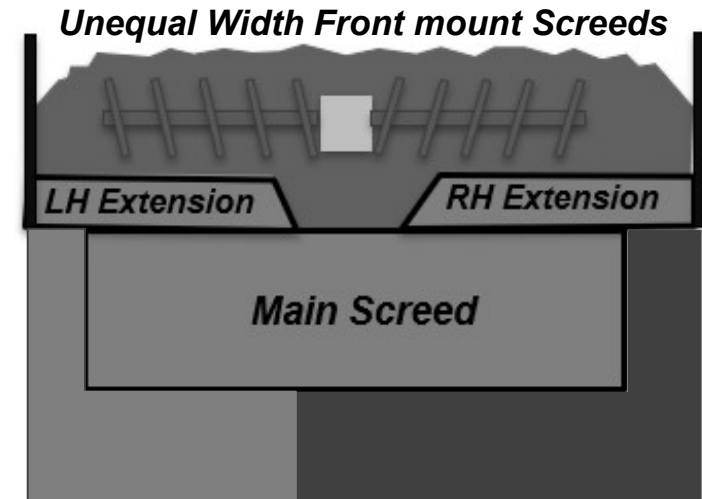
- *The Result Is More compaction under the Extension & shadow at the Center*
- *Inconsistent Screed Compaction*



Screed Adjustments

Front Mount Extension: Extension Angle Greater than Main Screed

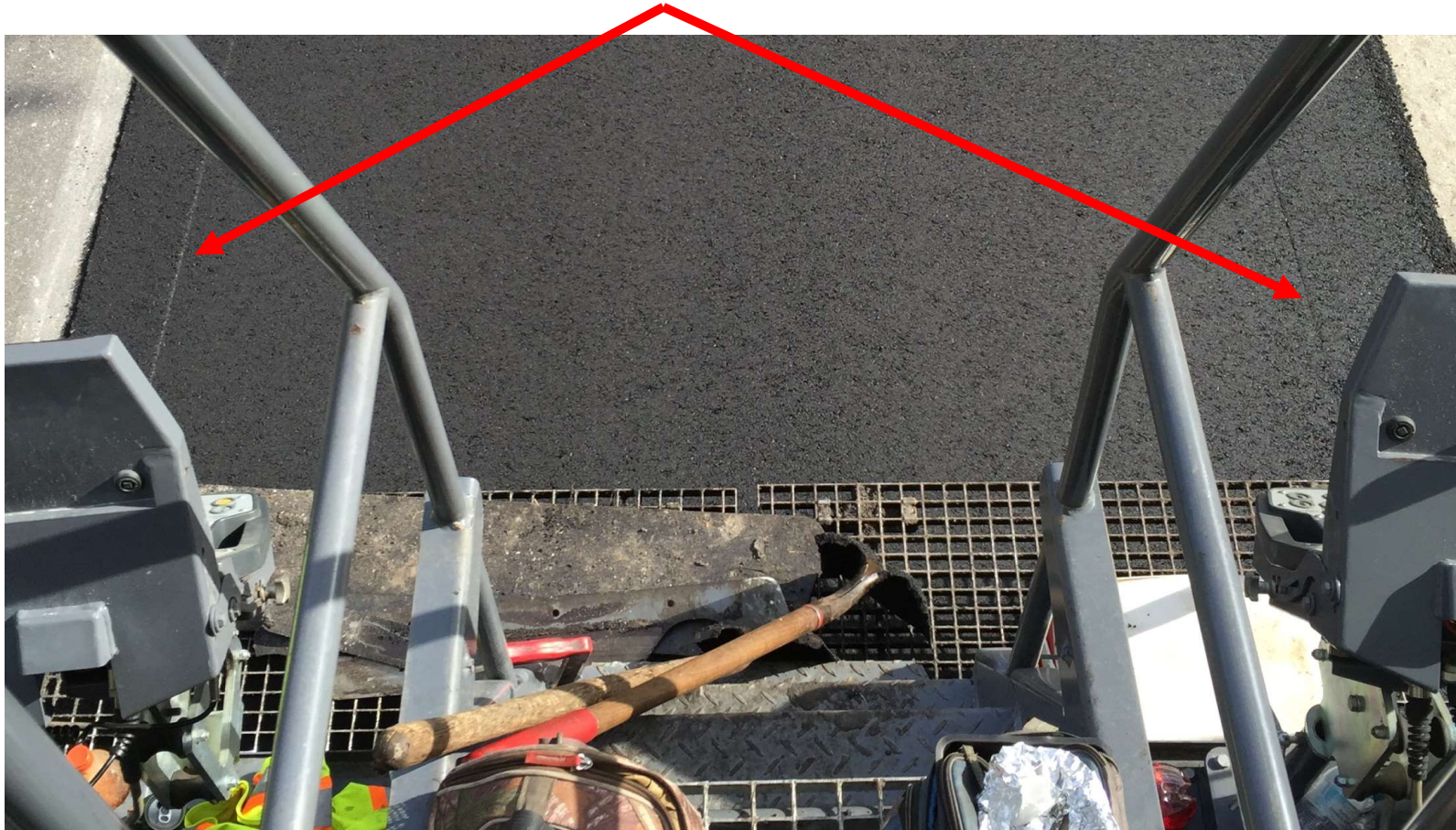
- *The Result Is Lines & Thicker Mat Under the Ext.*
- *Inconsistent Screed Compaction*
- *Adjust on the fly with Un-equal width screeds*



Screed Adjustments

Ideal Vertical Adjust (VA)..... for Unequal Width Front Mount Screed

- *Extension Slightly Higher than Main Screed to ensure Main is dominant*



Screed Adjustments

EIAA, VA & Parallelism Could Be Out of Alignment in Several Areas

- ***Rigidity & Ability to make Easy Adjustment is Critical***



Screed Adjustments

Combination of Segregation & Screed Adjustment Issues



Screed Adjustment

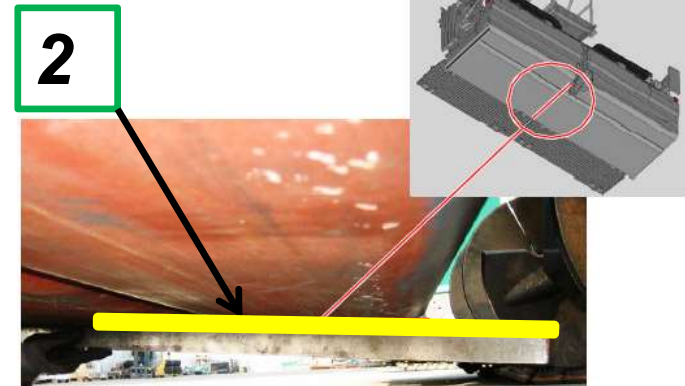
Segregation

Screed Adjustments

Verifying Extension Screed Adjustment: - Unequal Width Front Mount

1. Start with Screed Flat on flat ground, Towpoint at 0, Screws Nulled and 0 Crown / Invert on Trailing Edge
2. Position a Straight Edge flat with the outside of the Main Screed Plate
 - Use Vertical Adjust Switch, move Extension to Touch Straight Edge
 - Use Angle of attack Screw to flat Extension Screed on Straight Edge
3. Move Straight to Inside of Ext Screed
 - Extension Should be $1/16''$ to $1/8''$ above straight edge (Inside Slope)
 - Match Height Scale Reading 0

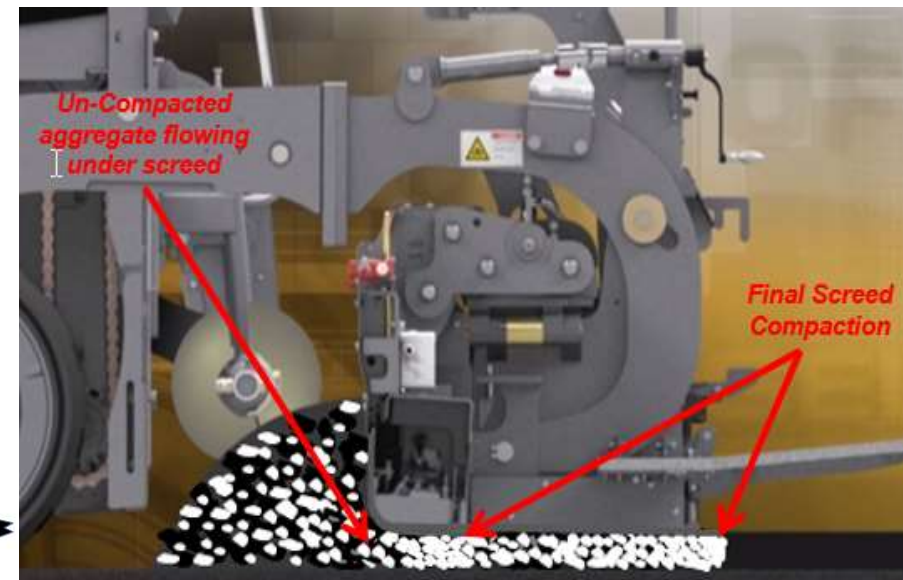
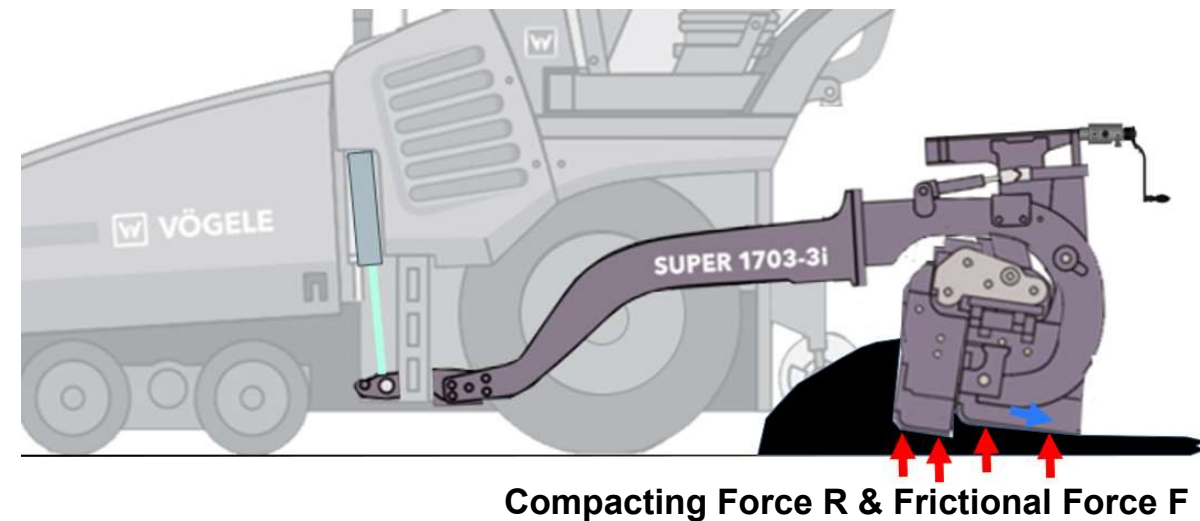
If not See Manufacturers Adjustment Procedure



Segregation

Segregation Impact on Force R & F (Force 4 & 5):

- Change in AC Content
- Change in Temperature
- Change in Gradation



2 Types of Segregation

1. Gradation Segregation – Chevron / Blotches and Streaks:

- **Large Stones Separating from smaller stones and Fines:**
 - **Usually occurs on sloped surface of piles..... during Handling**

2. Thermal Segregation

a) **Cold Material from Crust, End of load or Insert, Cold Mix in Auger**

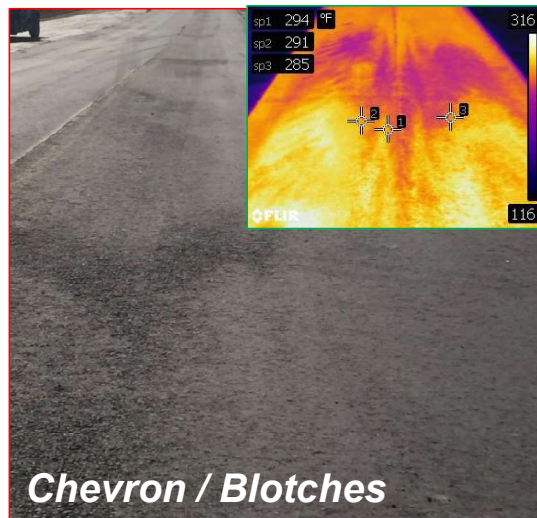
b) **From Gradation Segregation due to Heat separating with Fines**



Continuous
Segregation



Polymer Mod Mix



Gradation Segregation

Chevron / Blotch Type Segregation - Impact on Screed Performance

- **Fines acts as ball bearings.....asphalt acts as Lubricant**



End of load raveling

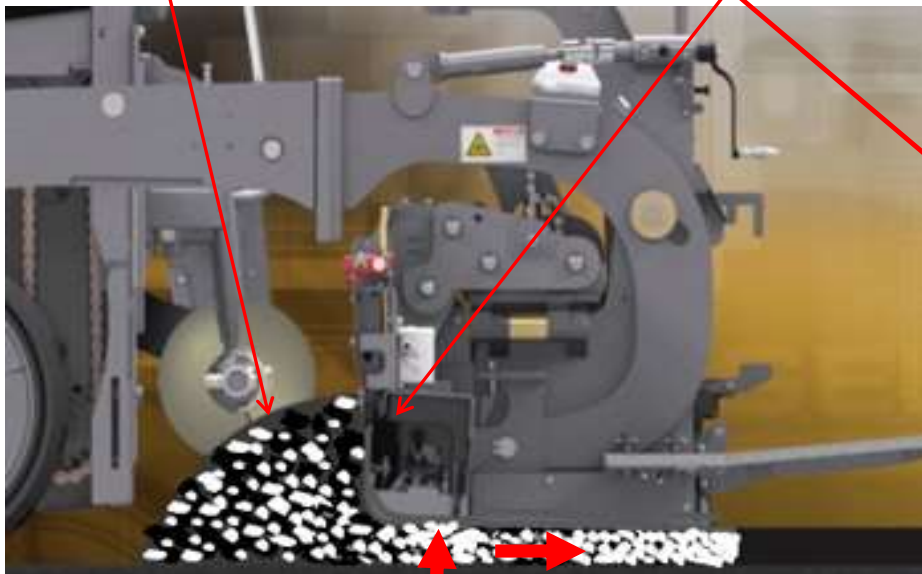


End of load raveling 2

Segregated material flowing under screed Changes R & F

Change internal frictional resistance

Screed seeks new Depth - Little asphalt / No fines - Dynamic loading starts raveling



R ↑
F →



Gradation Segregation

Chevron / Blotchy Type Segregation - Potential Locations & Typical Failure



Low Insert

Running the insert low



End / Start of Load



Running Augers too low



Side of Truck
Bed Paver

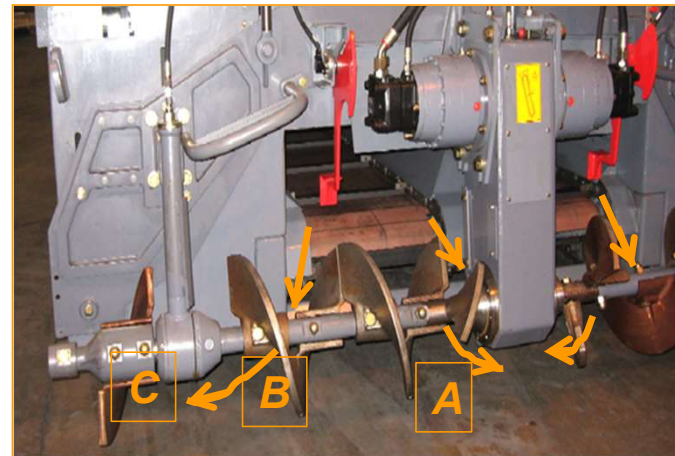


Center Line & wheel path

Gradation Segregation

Streaks / Continuous Gradation Segregation

- Not adequate to disturb the screed but will Cause Premature Failure



Location On Paver



Thermal Profile



Pavement Blemish

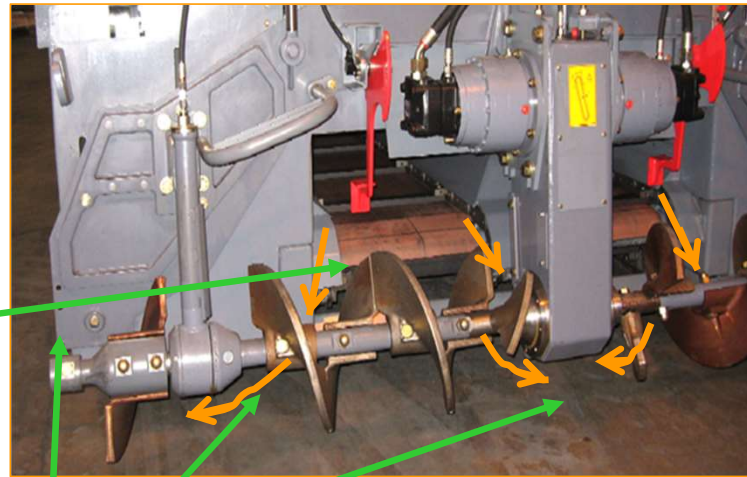
Managing the Forces to Enhance Smoothness & Density

Streaks / Continuous Segregation – Potential Locations & Typical Failure

Along the Insert Side Wall during Filling



Under the auger box & Edge of Conveyor to Edge of Mainframe

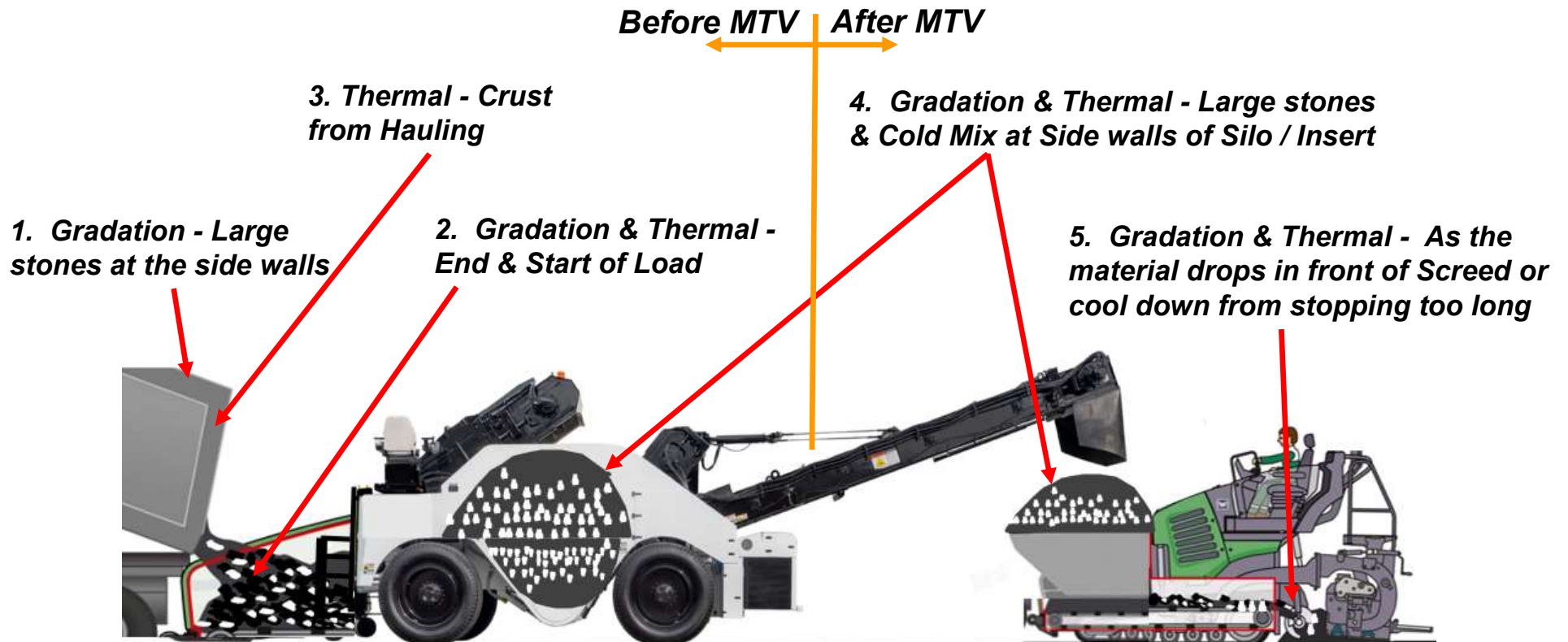


Potential Failure

Potential Location for Segregation in Paving Train

5 Potential Location for Segregation to be created During Handling

- 3 Before the MTV and 2 After the MTV





Side of truck bed

1. Remix Stones that rolled to Side Wall of Truck beds

Solution: Variable Pitch / Re-mixing Augers in MTV Receiving Hopper

- Auger Re-blend Large stones from the side walls
 - As it moves to the center



2. Remix Segregation from End & Start of Load

Solution: Re-mixing Augers & Front Tilting Hopper

- **Hopper Dumps on top of Augers**
- **Auger Re-blend End & Start of Load Segregation**



End of Load



Proper truck exchange

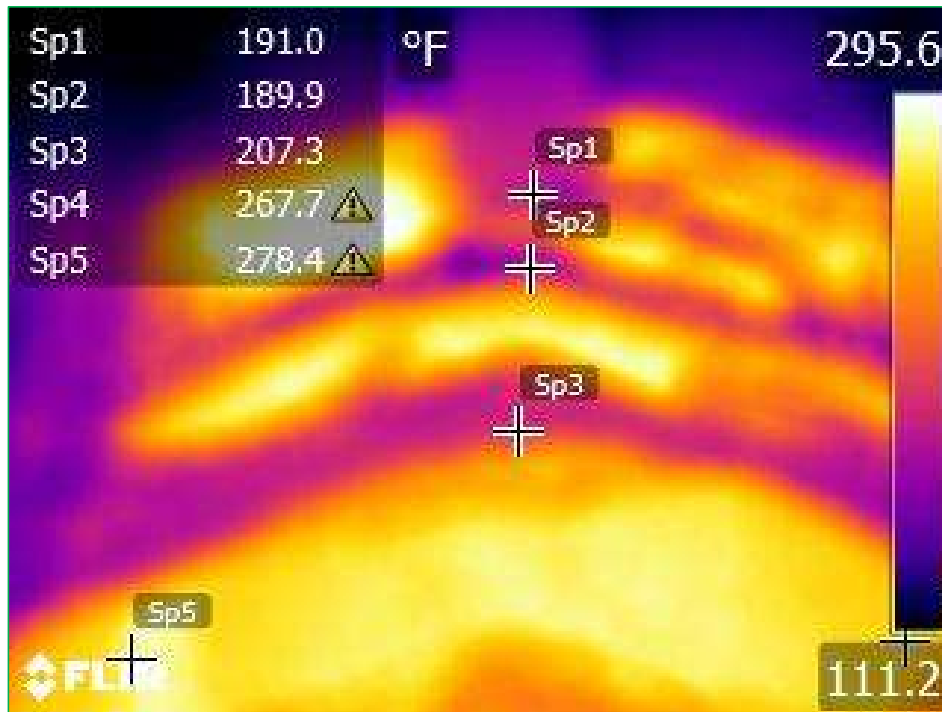


3. Remix Cold Mix / Crust on surface & Truck Bed side walls

Cold Mix / Crust from Transportation – Could Occur anytime

- **Could also Have cold in the Auger, Hopper Insert and MTV**

Thermal Image



Crust in Truck Bed



3. Remix Cold Mix / Crust on surface & Truck Bed side walls

Solution: Combination of Re-blending Augers / Grate Insert and Flight Chains

- **Augers re-blend cold Mix / Grate brake up the clumps**
- **Flight Chains brakes up the crust as it moves to the next conveyor**



4. Remix Segregated stones & Cold Mix at Insert Side walls

Larger stones from the pile..... rolled Until stopped by the insert walls

- **Occurs after the MTV**
- **Flight chains remix Segregation along front & Rear Walls**
- **Segregation along the side walls flows to Edge of Conveyors**
 - **Placed from edge of conveyor to Outer Bearing Hanger**
 - **Not Severe with All Mix Design**



*Sb & Std
Insert*



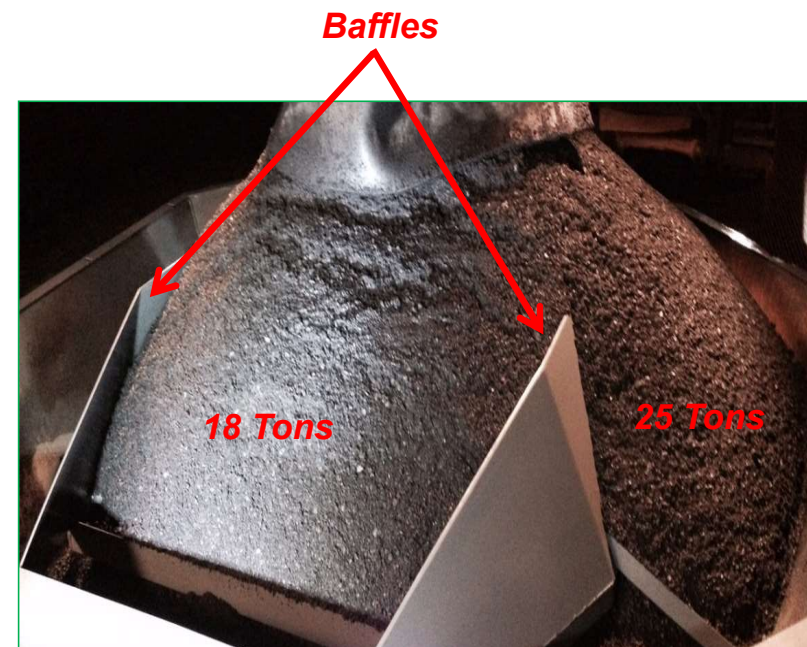
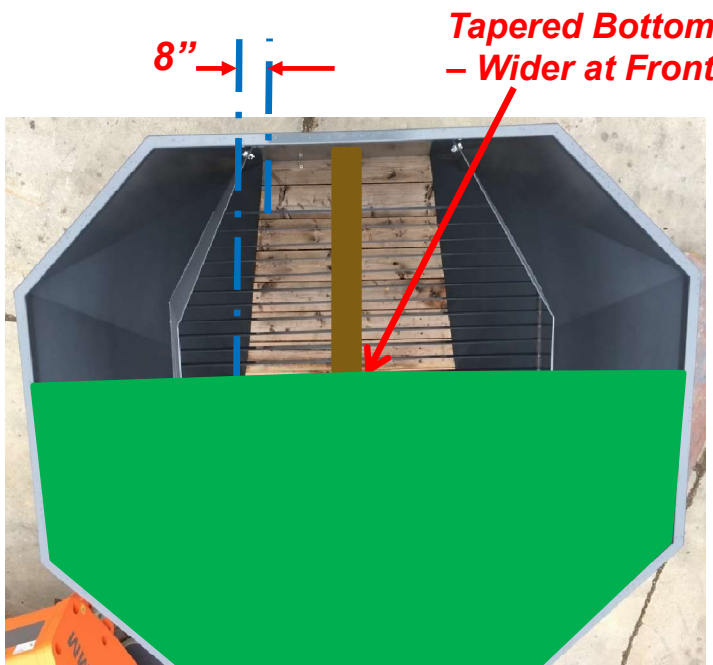
*Edge of
tunnel*



4. Remix Segregated stones & Cold Mix at Insert Side walls

Solutions: Passive Re-mixing Insert with Baffles & Tapered Bottom Opening

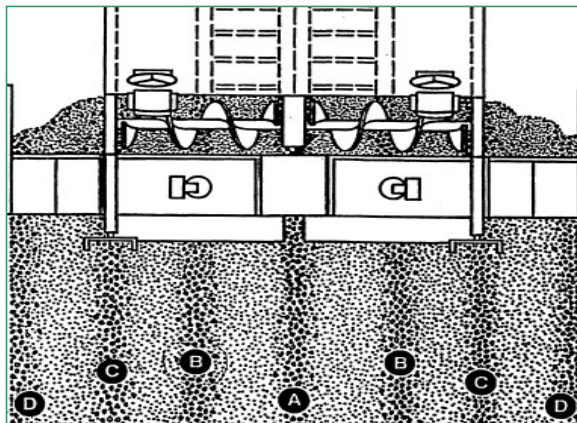
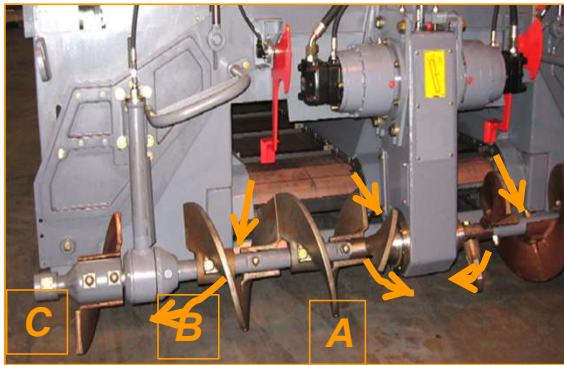
- The Baffles Reduce length Pile sloping face
 - Also Provides Dual Capacities
- Tapered Bottom Spreads segregated stones along side walls
- Wider front allow more material movement from Front to Rear



5. Remixing Segregation as Tractor delivers to Screed

Tractor Related Segregation After MTV)

- **Several Location along width of mat**
 - **Temperature Differential not as Severe**



B, C, D



**Center Line
& wheel path**

5. Remixing Segregation as Tractor delivers to Screed

Solution for Centerline Segregation (A)

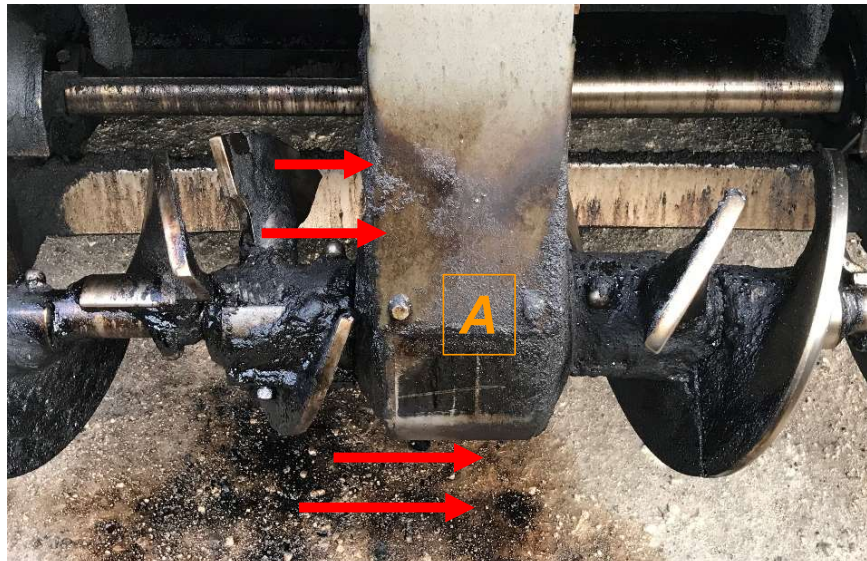
1. Proper Auger Height

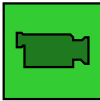
2. Adequate Reverse flights next to auger box

- *Push and Pull Concept*
- *LH & RH Reverse Kickers tuck segregated material to center)*
- *Augers must Rotate Continuously to be Effective*



¼ flight





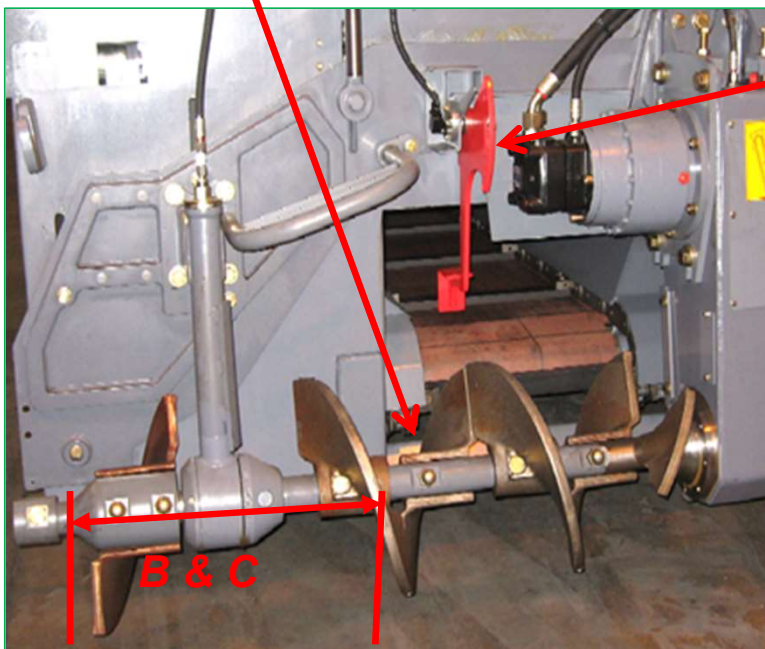
Constant
Feeding

5. Remixing Segregation as Tractor delivers to Screed

Solutions: From Edge of conveyor to Edge of Mainframe (B, C)

1. **Hardware to maximize Remixing: Material Chutes, Auger & Tunnel Extension**
2. **Set Up for Continuous Delivery: Proper Auger & Conveyor sensors setting**
3. **Adjustment: Adequate Auger height and Auger to Screed Distance**

Material Chute (Delta Plate)



Conveyor Sensor

Auger Sonic Sensor

Auger & Tunnel Extensions



Mat Flaws due to Incorrect Screed Adjustment

EIAA, VA & Parallelism Could Be Out of Alignment in Several Areas

- ***Rigidity & Ability to make Easy Adjustment is Critical***

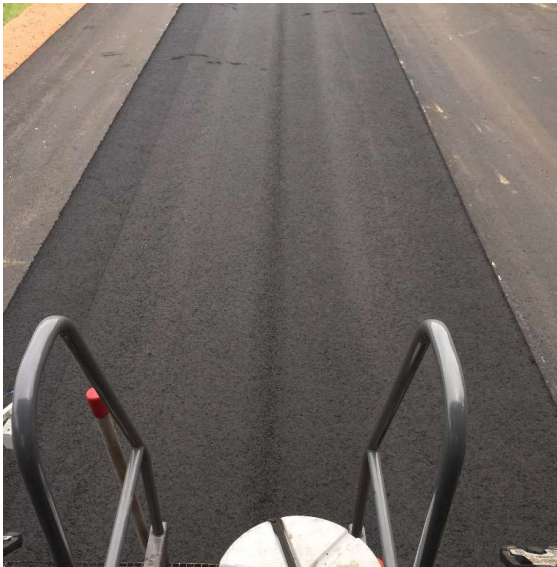
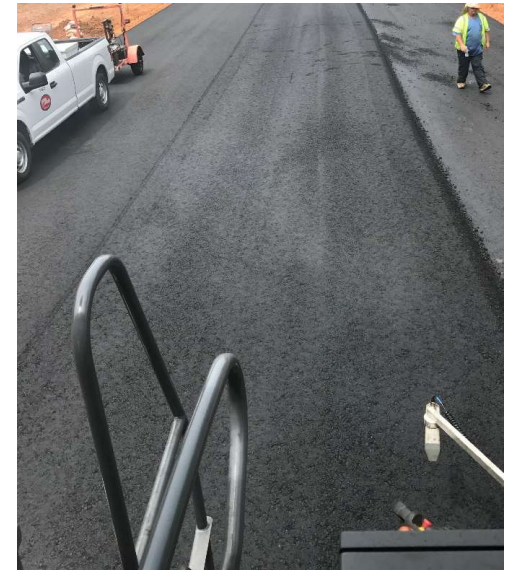


Mat Flaws created by Gradation Segregation

Continuous or Sporadic Open surface (Blemish)

- 1. Under the Auger Box**
- 2. From Edge of Conveyor Tunnel to outside of Mainframe**
- 3. Chevron Shape**

- Low Temperature Common with all ... Could Detect with Thermal Image**

1**2****3**

Mat Flaws created by Gradation Segregation & Screed Adjustment

Combination of Segregation & Screed Adjustment Issues



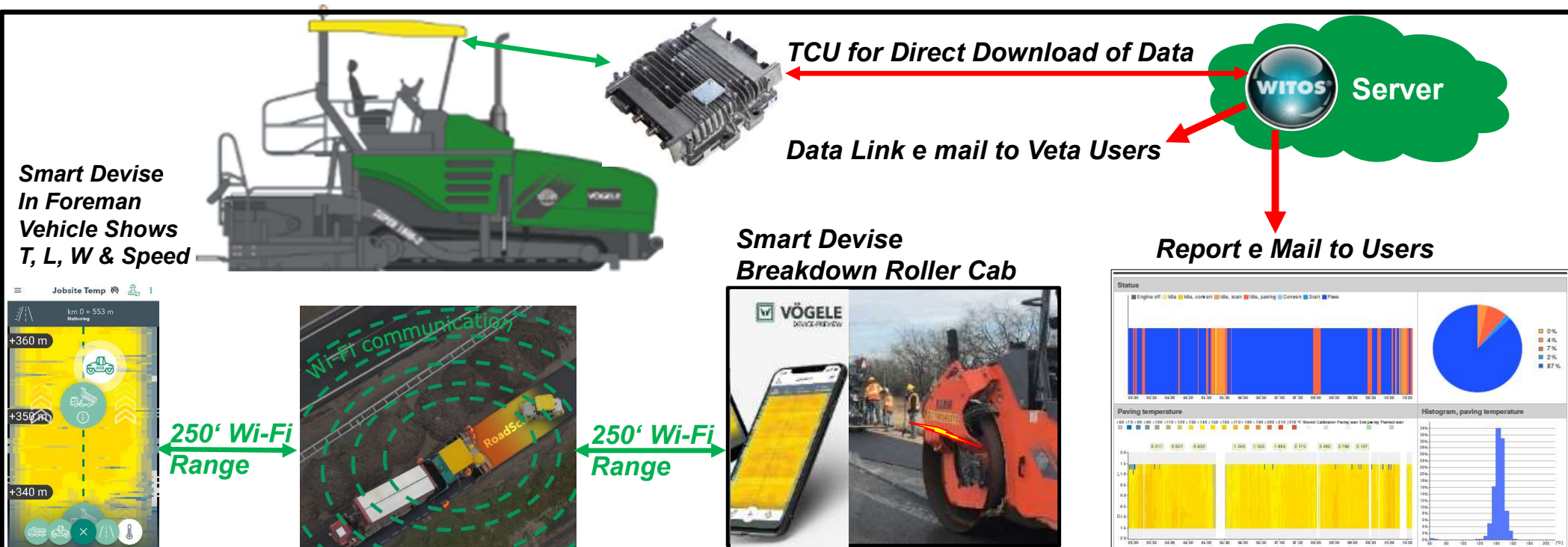
Screed Adjustment

Segregation

Monitor Performance & Quality Remotely

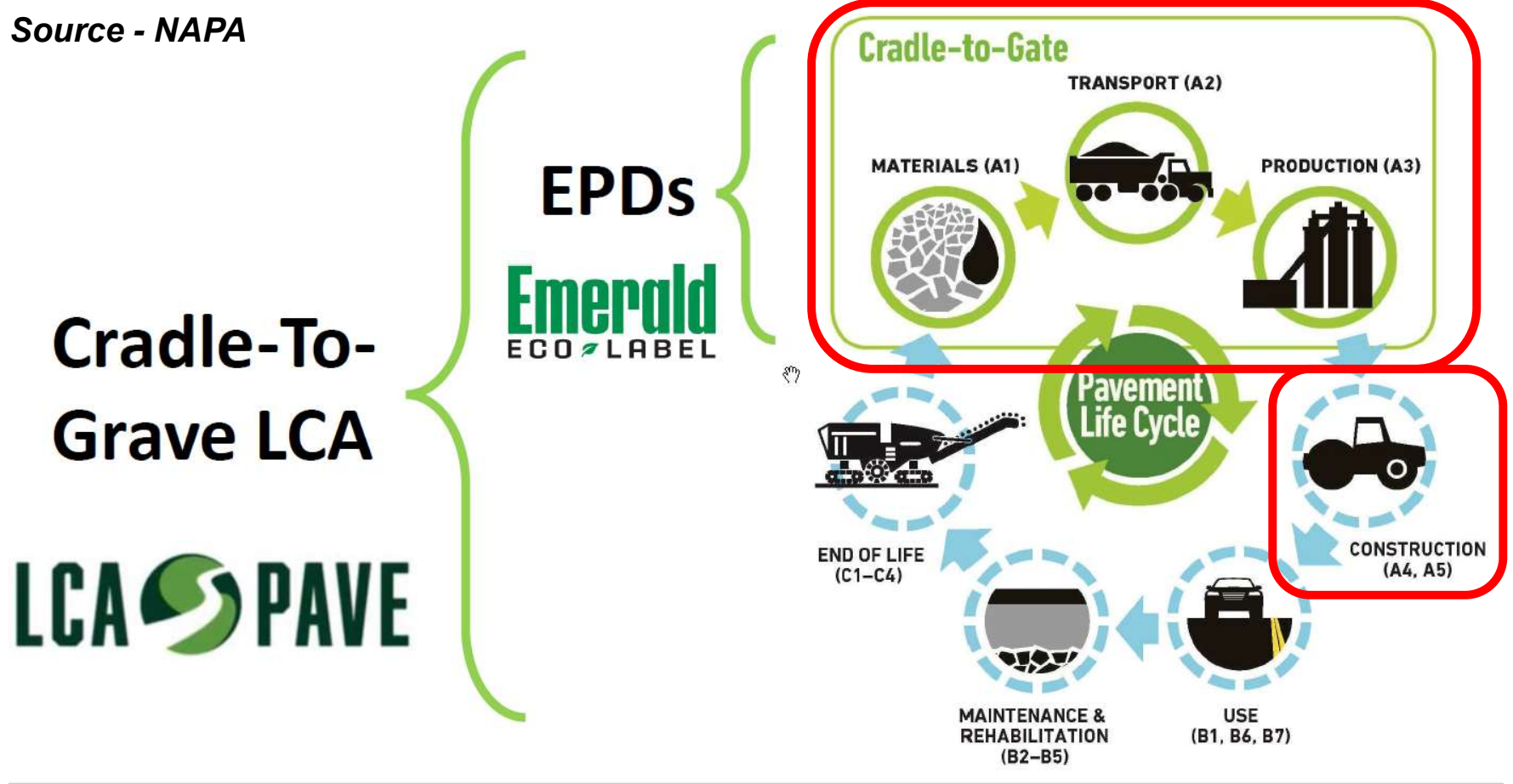
MTG on Paver

- Builds WIFI network around paver & Communicate with Wirtgen Server
- Smart Phone With Android App Communicate with MTG
- WITOS Server Generates E Mail with Data Link and Report



Life Cycle Framework – LCA and EPDs

Source - NAPA



NAPA Focus on EPD's / Sustainability

Source - NAPA

Simple Mix from a Typical Plant

- **Materials (A1)**

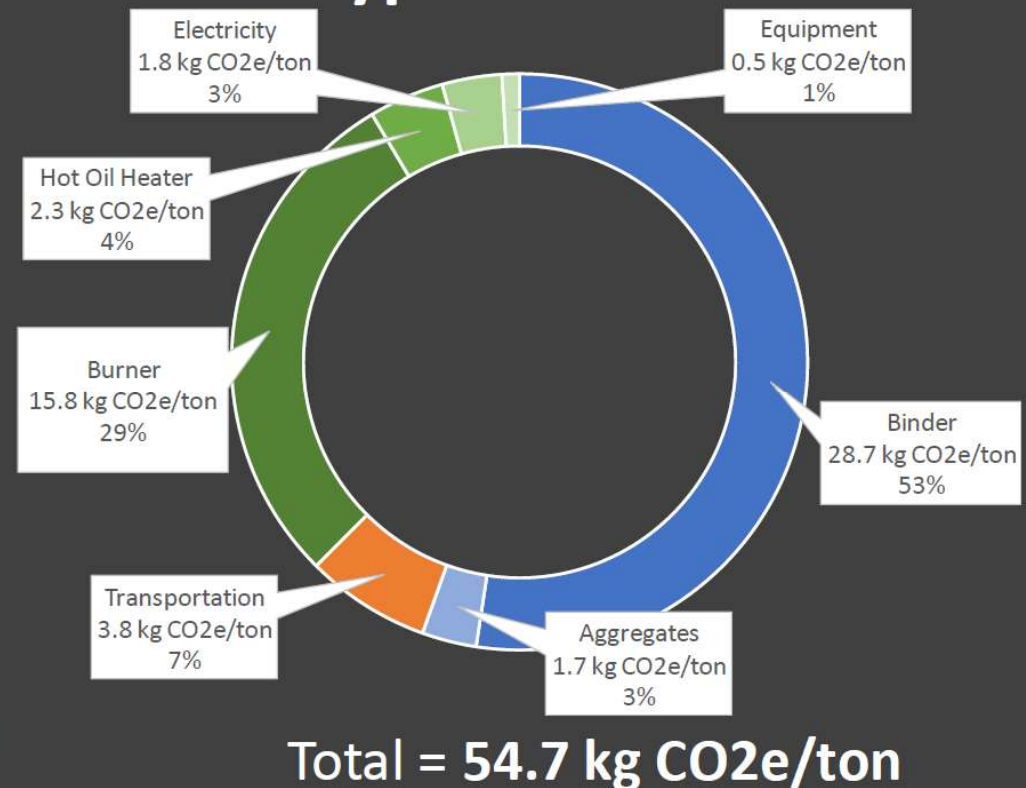
- 95% aggregates
- 5% asphalt binder

- **Transport (A2)**

- 22 miles by truck

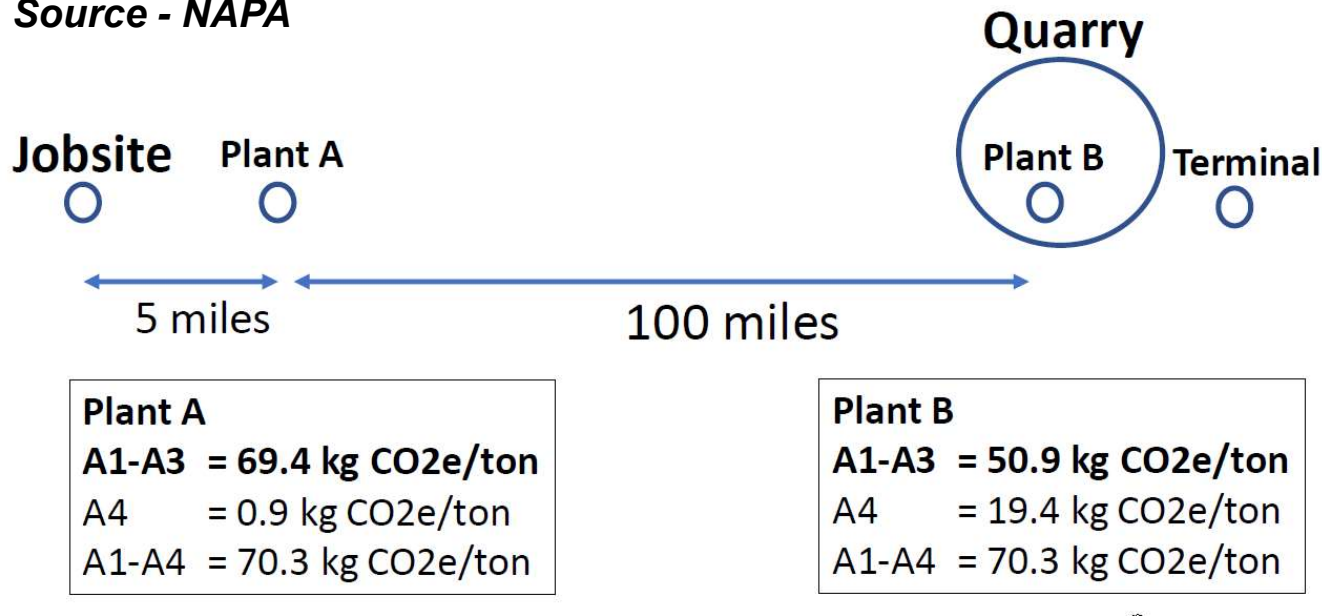
- **Plant Energy (A3)**

- Burner fuel – Natural Gas
- 289,000 Btu/ton
- 3.3 kWh/ton – Average grid



NAPA Focus on EPD's / Sustainability

Source - NAPA



A5 Equipment EPD's

- *Miniscule, not on the Radar Currently*
- *However, the Wirtgen Group have been Developing Features to reduce Equipment EPD's (A5)*

Innovative Technology in Equipment / Sustainability

Vögele Tier IV Engine Installation

- ***Diesel Exhaust Fluid (DEF) to control NOx***
- ***Diesel Oxidization Catalyst (DOC) to Control Particulate Matter***
- ***No Diesel Particulate Filter (DPF)***
 - ***No Regen.....Lower Fuel Consumption***



Innovative Technology in Equipment / Sustainability

Vögele 10' Pavers Engine Performance:

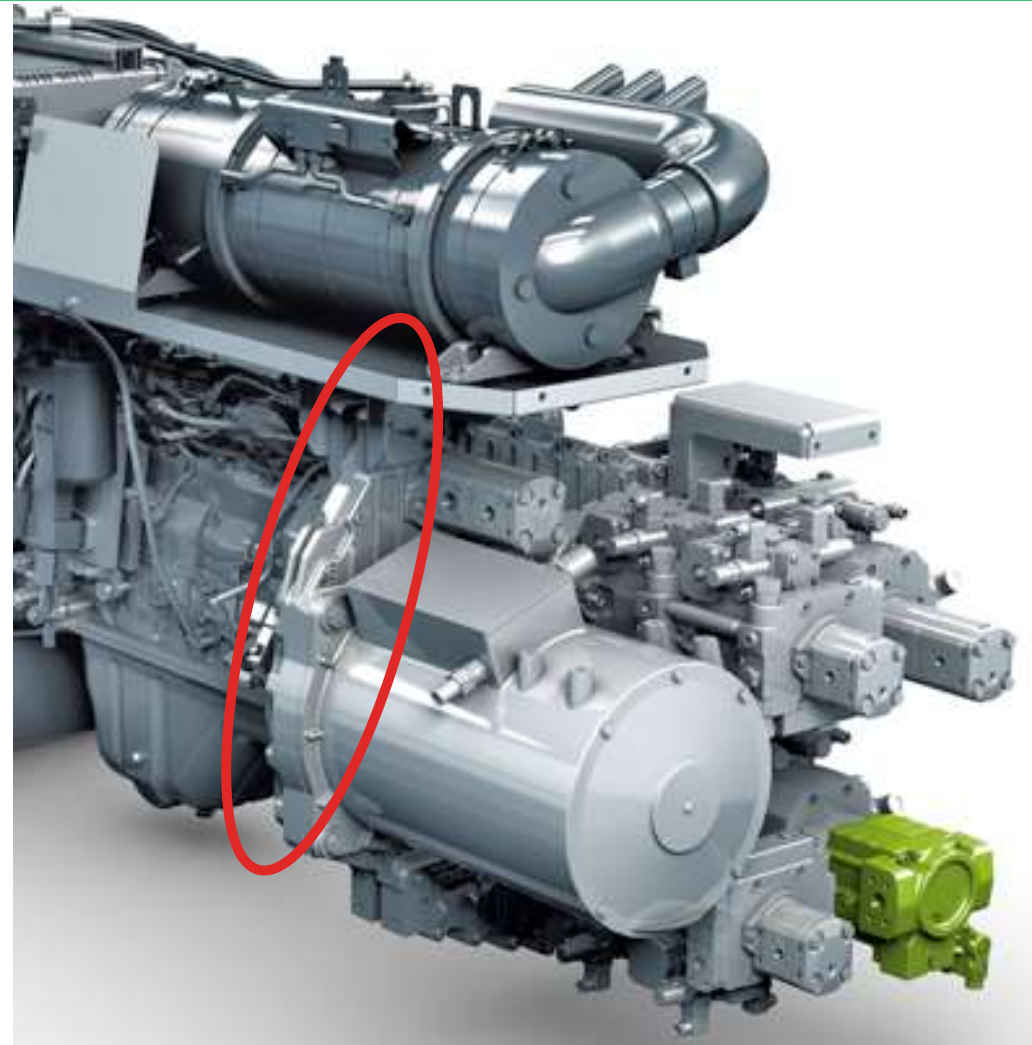
- **Max. 250 HP @ 2000 RPM**
- **Eco. 235 HP @ 1700 RPM**
- **Power On Demand – Engine Revs Up automatically to HP Demand**
- **Auto Engine RPM – Engine Automatically returns to Idle when F&R Lever brought to Neutral**



Innovative Technology in Equipment / Sustainability

Clutch Driven Pump Drive

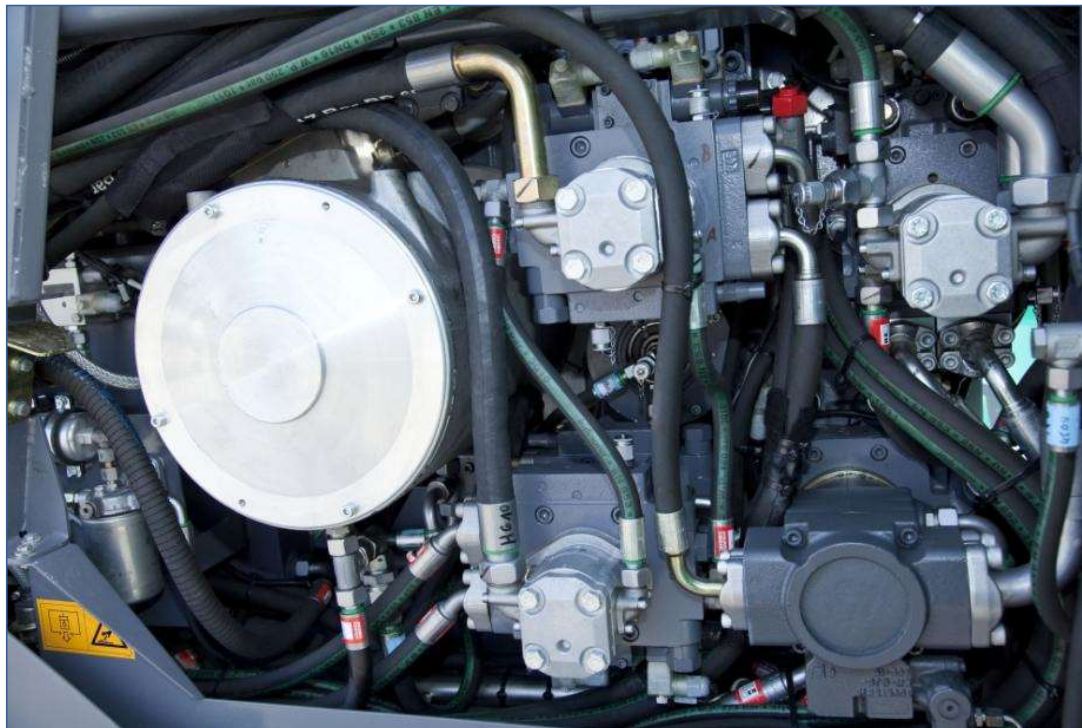
- ***Dis-engage with no function***
- ***Save on Fuel & Wear & Tear***



Innovative Technology in Equipment / Sustainability

Direct Drive Generator

- ***Generator plugged into Gearbox***
- ***Belt eliminated***
 - ***More Efficient Drive Chain***



Innovative Technology in Equipment / Sustainability

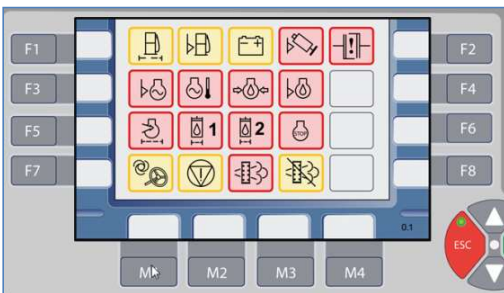
Engine Cooling Fan

- ***Clutch Driven***
 - ***More Efficient than Belt Drive***
- ***Controlled by Coolant & Hydraulic Oil and Air Intake Temp***



Innovative Technology in Equipment / Sustainability

3 Levels of On-Board Diagnostic & a back up System – Minimize Down Time of All Equipment on Site



1. Warning Light & Symbol for Functions monitored by sensors:



**2. Description / Error Codes for certain Problems
Check Fault Message Screen**



**3. Detailed Circuit Troubleshooting.
- LED light on Solenoids, Switch screen, Input / out put screen**

Back up Controls to prevent Down time

- 1. Ability cleanout paver**
- 2. Conveyor Sensor and cable Override**
- 3. Auger sensors and cable override**

Innovative Technology in Equipment / Sustainability

Equipment Software that Monitors Fuel Consumption / EPD's

Welcome Laikram

Equipment

Search

Make **Large Milling Machine** Model

Inactive Equipment (28)

- 21200408 - Spears & Hopkins 509 mi
- 13220057 - Vulcan Materials 541 mi
- 23200503 - Rogers Group, Inc 542 mi
- 23200737 - PECO 545 mi
- 21200452 - Tinsley 545 mi
- 11220062 - Nashville Metro 547 mi
- 23200726 - Volunteer Paving 567 mi
- 06221122 - Volunteer Paving 567 mi

09750180 - Rogers Gro...
WGV00975PJVA00180
3 hours ago
1,760 70% 100%

Manage Tags

Directions Share/Export

Feb 11, 2024

Summary Alerts Maintenance

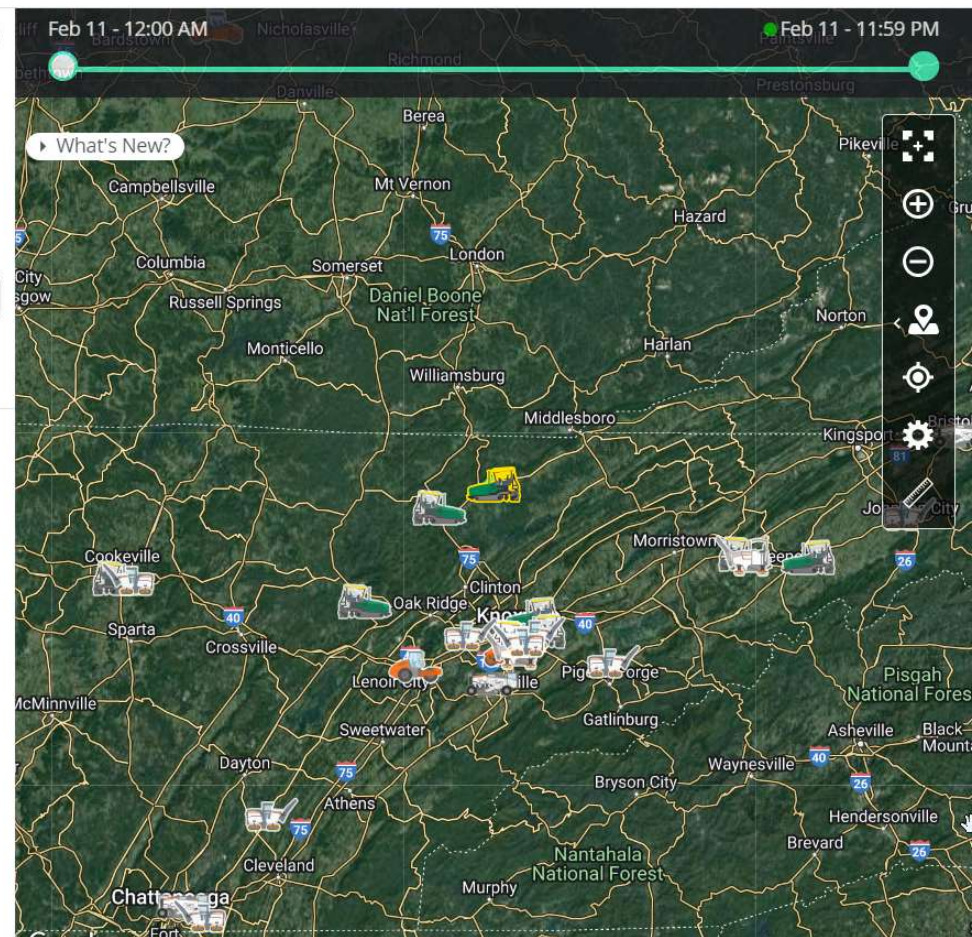
Utilization
No utilization data available. Try a different time period.

Hours of Operation 0 hrs
12AM 12PM 12AM
Feb 11

On Off Unavailable

Performance
No performance data available. Try a different time period.

View all data



QUESTION

INNOVATIVE SOLUTIONS

Our passion.

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