

PAPA ANNUAL CONFERENCE 2019

INTELLIGENT MACHINE CONTROLS

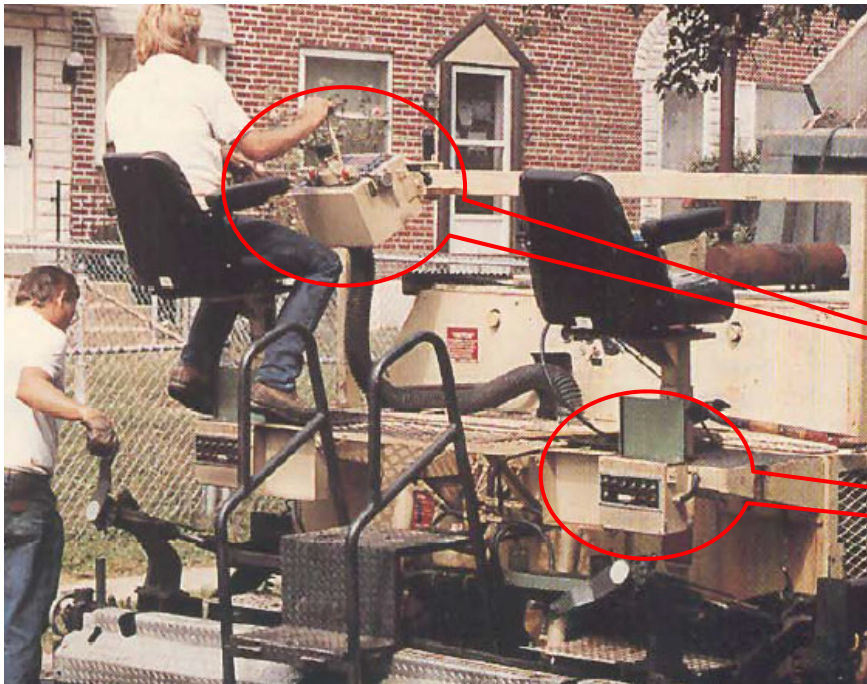
Presented by Jim Holland



Paver Controls – Past & Present

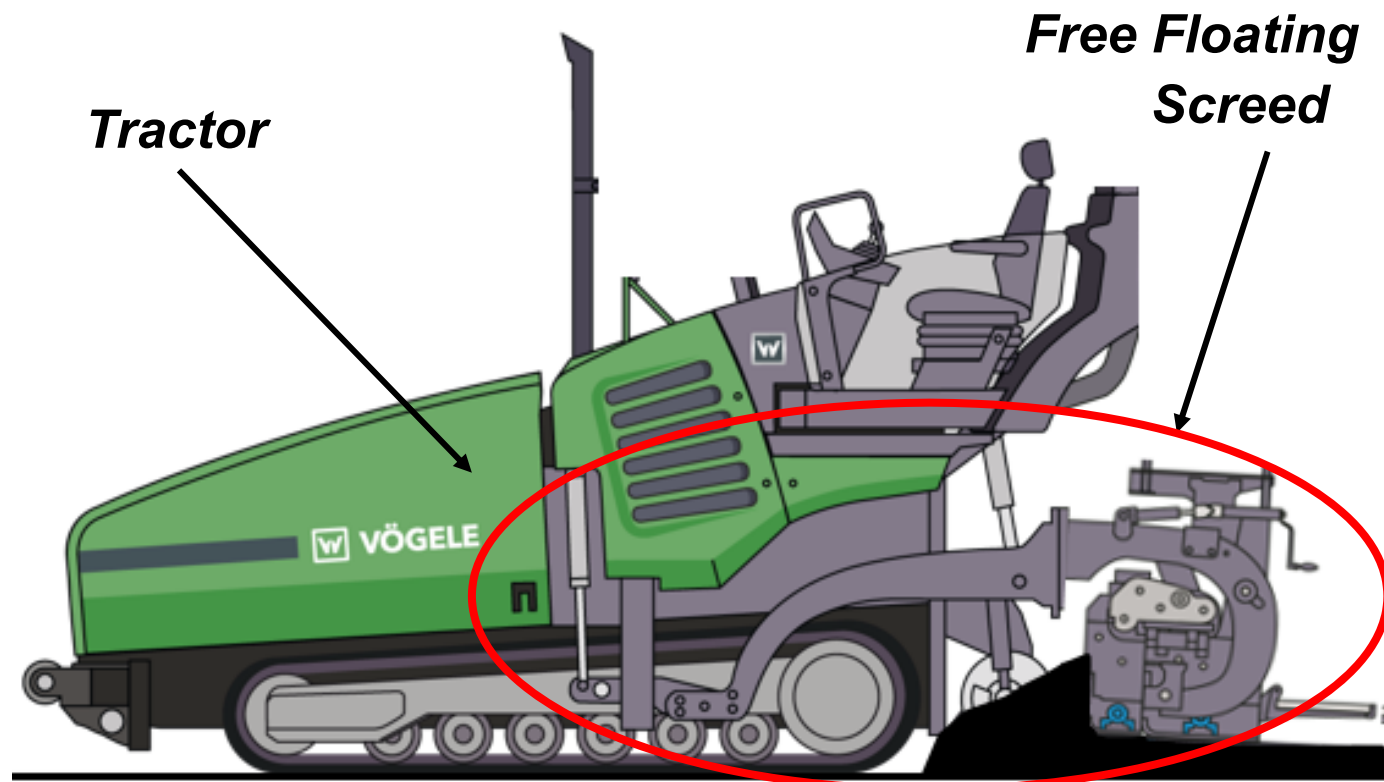
Present: Intelligent Machine Control

Past: Electric over Hydraulic



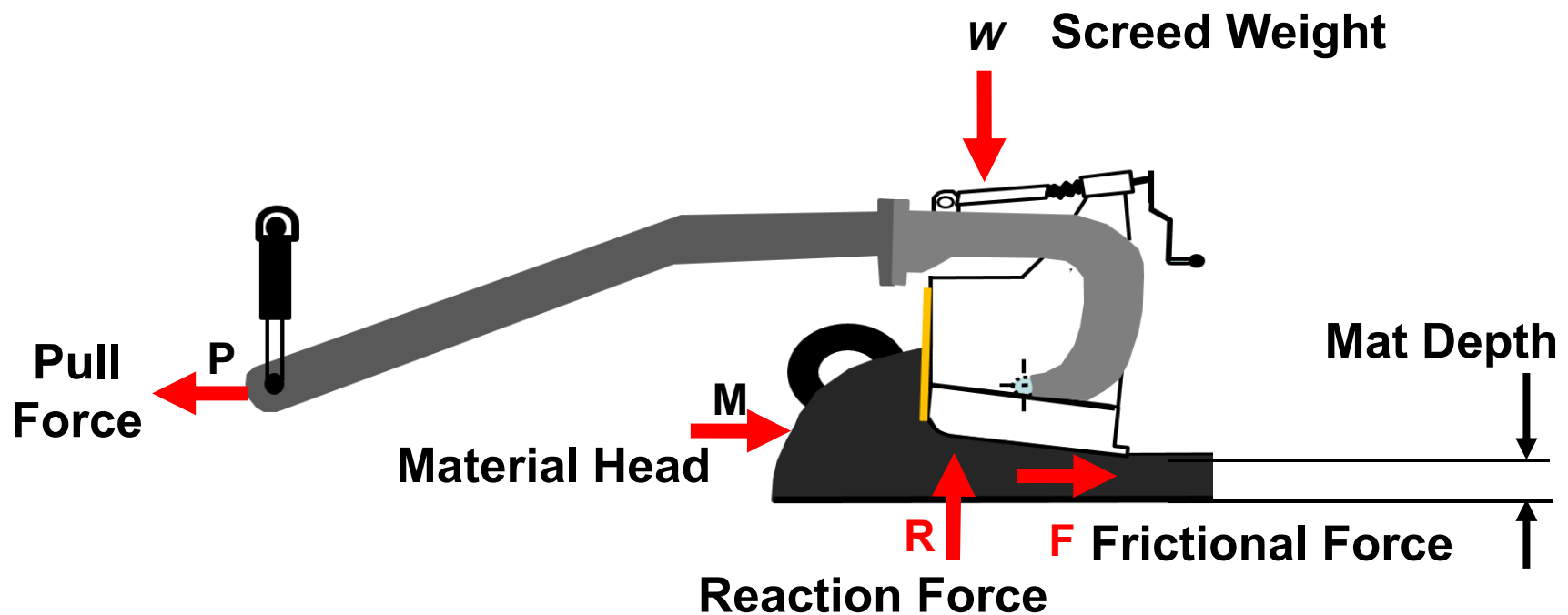
The Paver consist of 2 Independent Pieces of Equipment

- 1. The Tractor*
- 2. The screed*
 - *Float on the Asphalt like a water Skier*



Review of the Principle of the Free Floating Screed

The screed is held to grade by 5 Forces



Features to Manage Pull Force (P)



Intelligent Machine Control

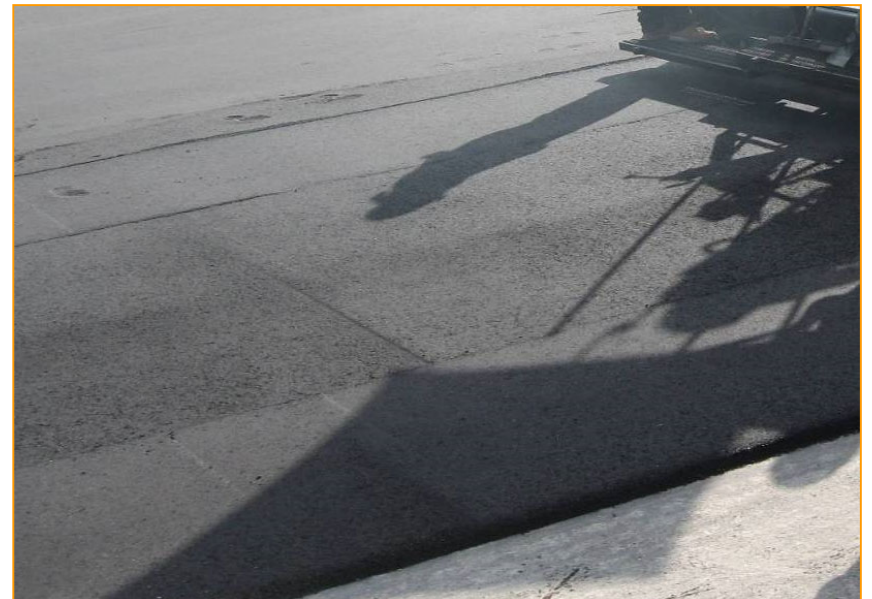
- *Precise Steering*
- *Auto Screed Hold & Freeze*



Trim Steer



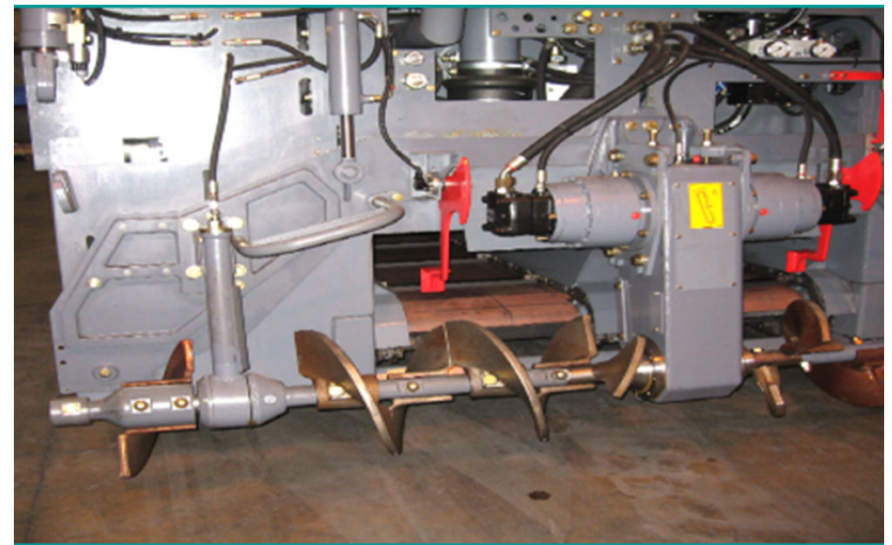
Automatic Screed Hold & Freeze



Features to Manage Material Head (M)

Independent Feeder Control & Digital Display:

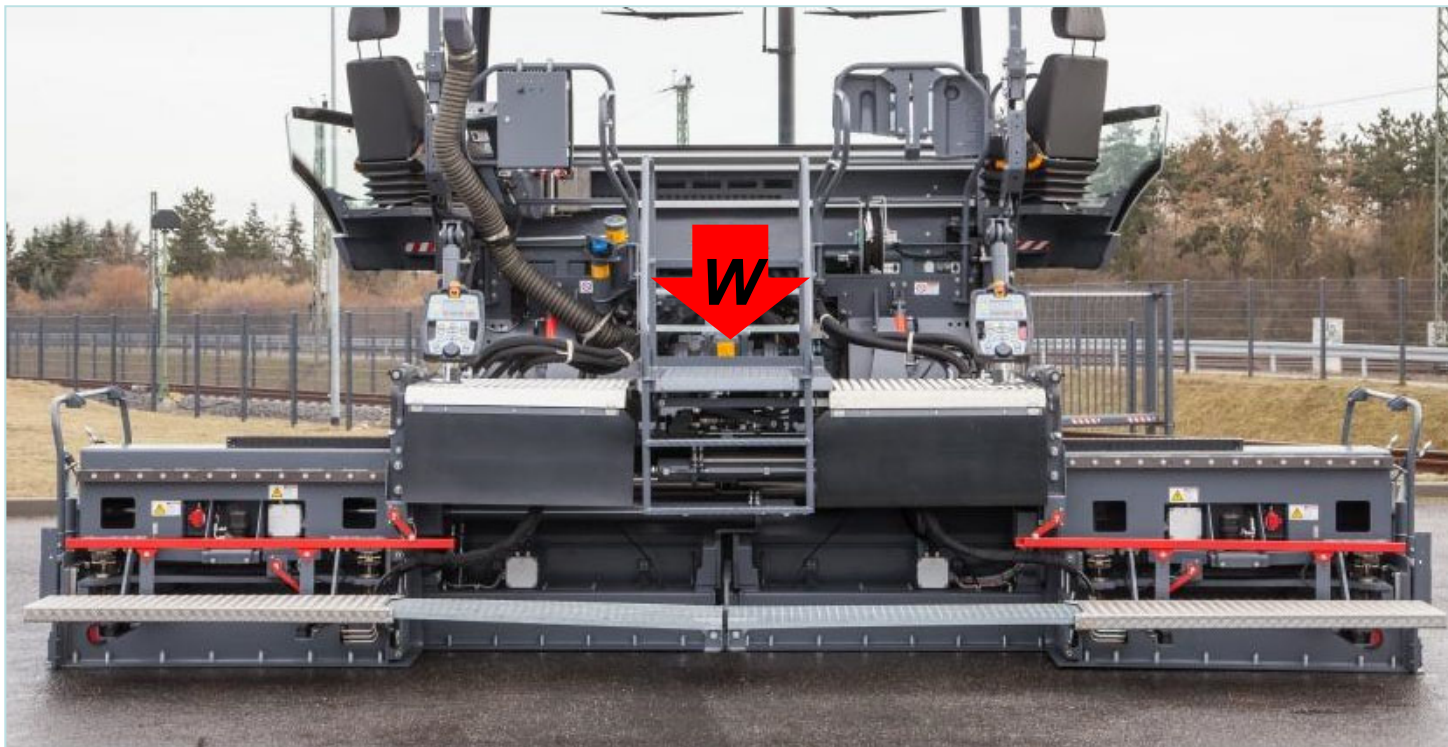
- **4 Sensors Controlling each Auger & Conveyor**
- **Digital Display to monitor Material Delivery**



Screed Weight (W) by Design

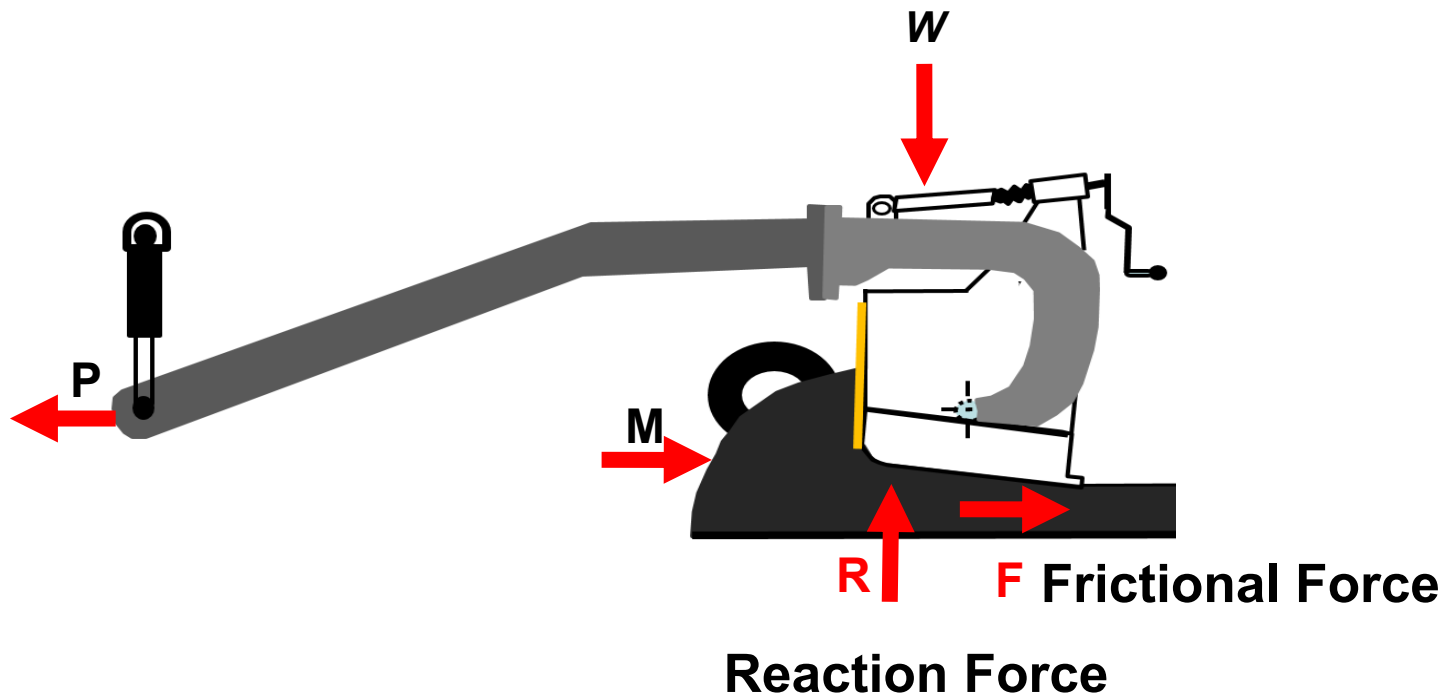
Today's Design is Usually Heavier & more Rigid

- ***Improved Stability and hold adjustments.....Ideal for Stiffer Mixes***
- ***Also withstand Small changes to the other 4 Forces***
 - ***Maximize Smoothness & Density***



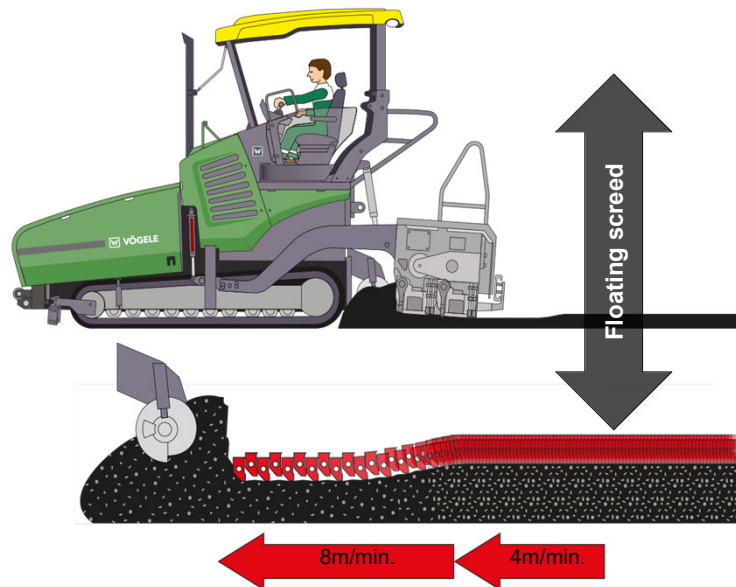
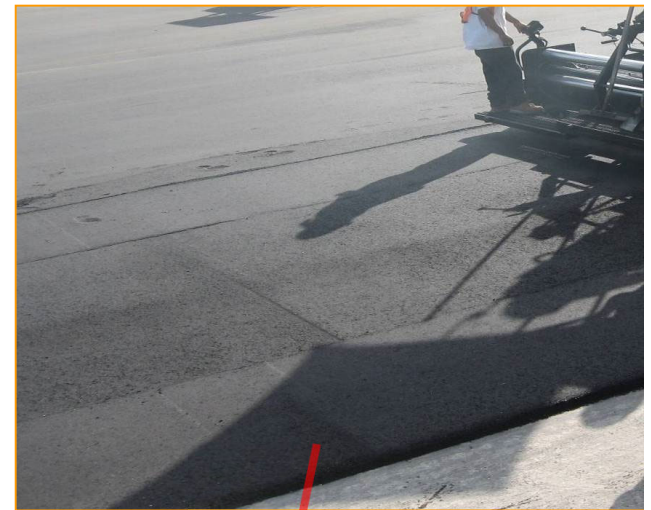
Aggregate Frictional Resistance - Influenced by:

- ***Gradation / aggregate shape***
- ***Asphalt type / content***
- ***Temperature***
- ***All of which changes with Segregation***



Maintain Consistency of the Paving Material

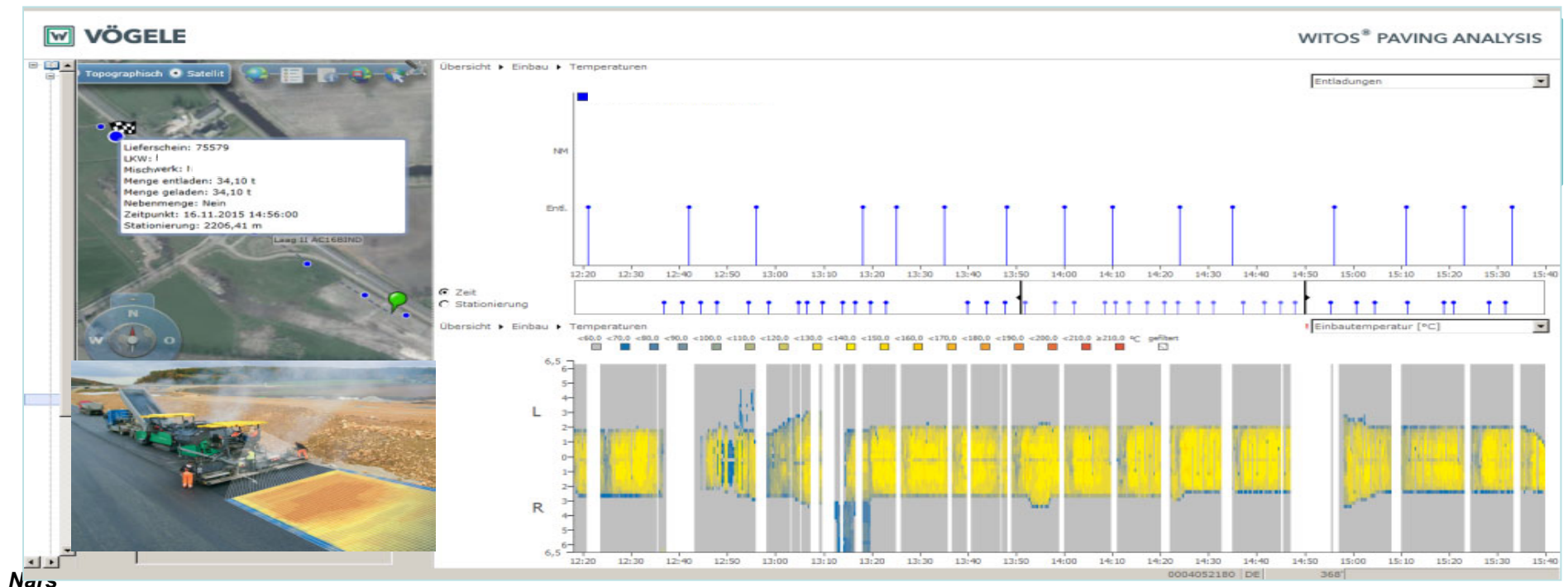
- *Temperature Varies with Mix Consistency*
- *Ideal Tool to Monitor Consistency*



OEM Objectives:

Provide a System to Manage Material Consistency

- *Pavement Surface Temperature differential*
- *Stop Time*
- *Trucking*
- *Analysis & Reports*



FHWA / Pool Fund States Objectives - ITC (Intelligent Construction Technologies)

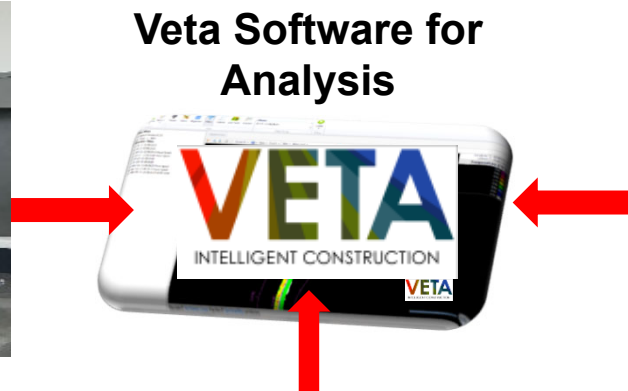


Documentation of the Paving Process....on same Coordinates

- 1. PMTP – Paver Mounted Thermal Profile (RoadScan)***
- 2. Intelligent Compaction***
- 3. Ground Penetrating Radar GPR / Density check***
- 4. IRI – Smoothness***
- 5. 3D Milling & Paving***



Paver Mounted Thermal Profiler

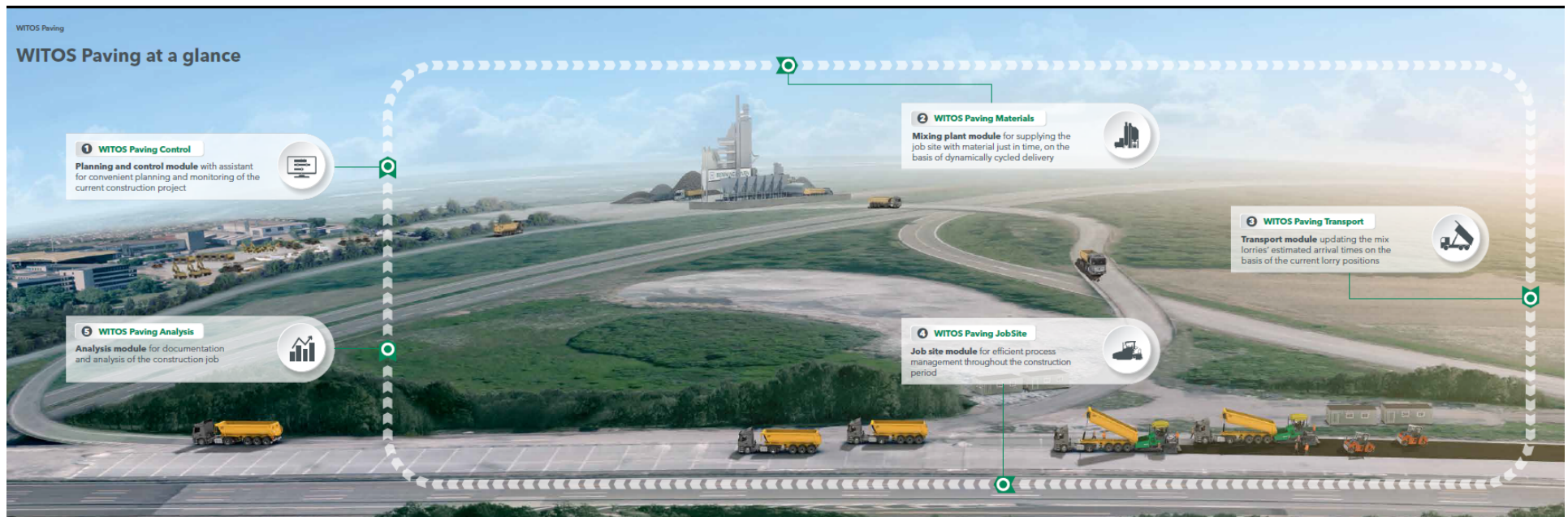


Intelligent Compaction



Future Imports: 3D, GPR, Smoothness

Vögele Solution WITOS Paving - 5 Modules to Manage the Entire Paving Process



1. Planning & Control Module

- ***Detailed Representation of the Project in Real Time***
- ***Easy Machine Scheduling***
- ***Easy exchange of Data with the mixing Plant***

2. Mixing Module

- ***Manage Material Delivery***
- ***Just In Time material Delivery***

3. Transportation Module

- ***Monitoring of Trucks from Plant to Job Site***
- ***Electronic Ticketing***

WITOS Paving – Job Site Module #4:



Several Functions including Paver Mounted Thermal Camera

01 Total transparency of the construction job for paving foreman and site manager

02 Display of vital information on the paver operator's ErgoPlus console

03 Information on currently delivered material quantity and current delivery situation

04 Display of planned and actual values for paving time, paved distance and quantity of paved material

05 Simple entering of delivery notes

06 Smart "outstanding quantity" calculator automatically determines the quantity of material still required for the job

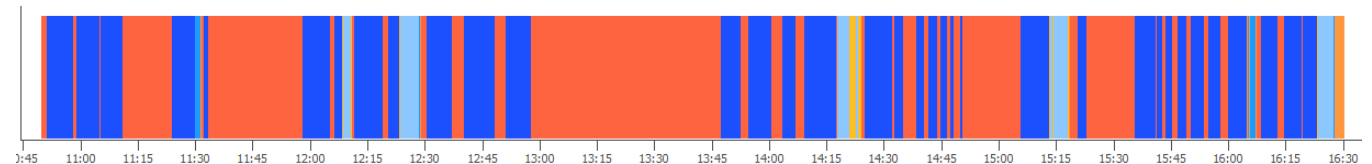
07 Noting down of ad-hoc orders directly on the job site

08 Real-time updating of the project's progress on site. If a data link is not available, the delivered material can also be conveniently recorded in offline mode.

09 Early detection of plan deviations and prompt initiation of remedial measures

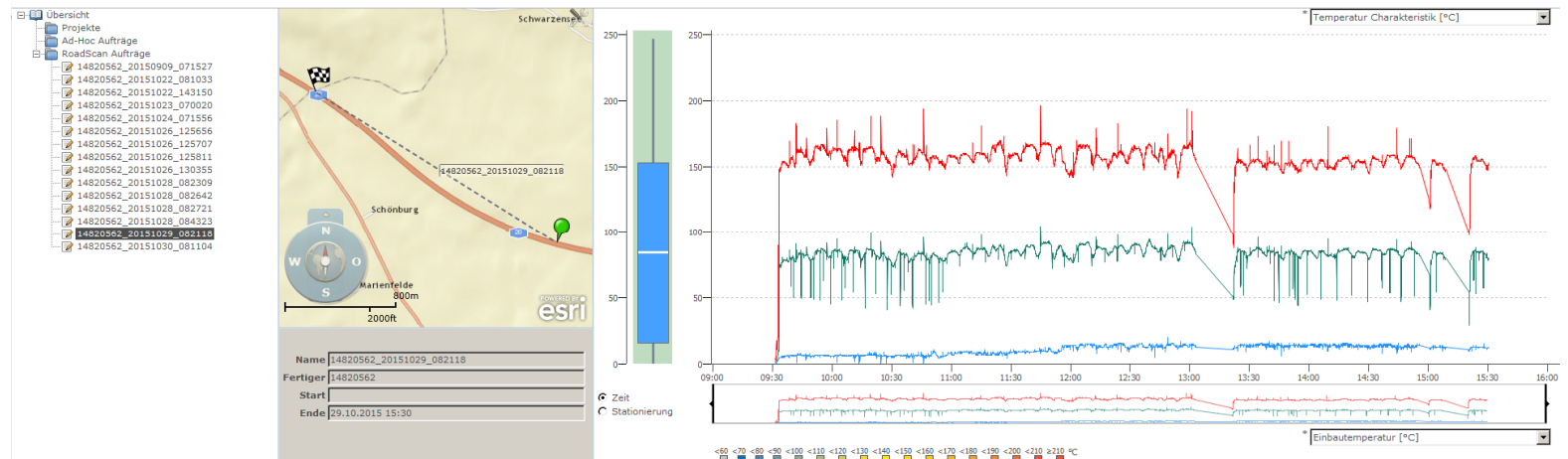
WITOS Paving – Analysis Module # 5:

Pavement Surface Temperature analyzed with RoadScan Analysis



Materials Transport Jobsite Compaction **Costs**

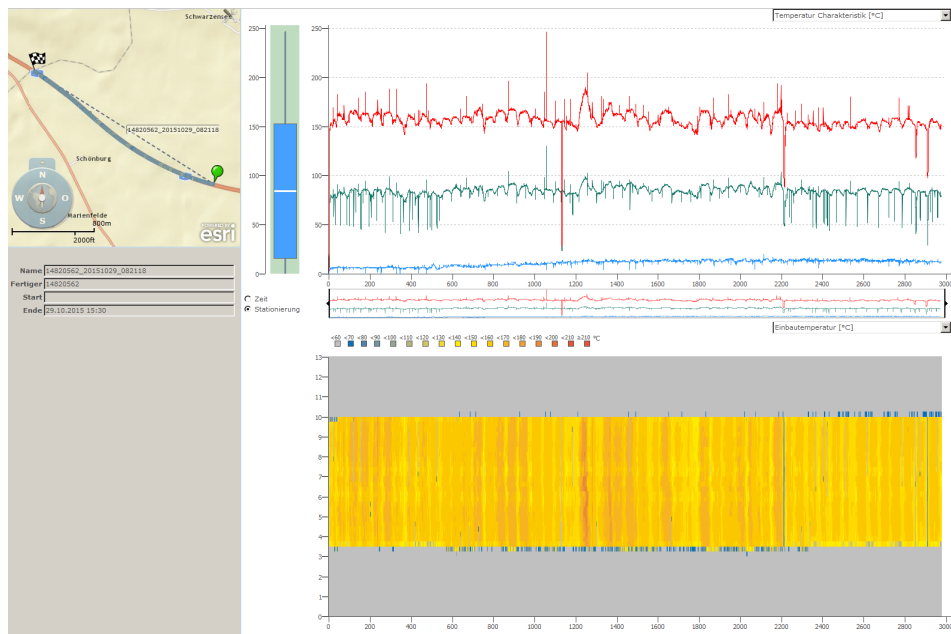
Operating mode		LL Paving		Transport/ Transpose		Eng. idle		Total		Planned	
Hours	Paving	n	02:39 hh:mm	00:32 hh:mm	00:00 hh:mm	05:42 hh:mm	03:23 hh:mm				
Idle Paving											
Machine costs/h											
Machine costs	0.00 €		0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €		0.00 €	
Staff costs/h	0.00 €/h										
Staff costs	0.00 €		0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €		0.00 €	
Costs/h	0.00 €/h										
Costs	0.00 €		0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €		0.00 €	



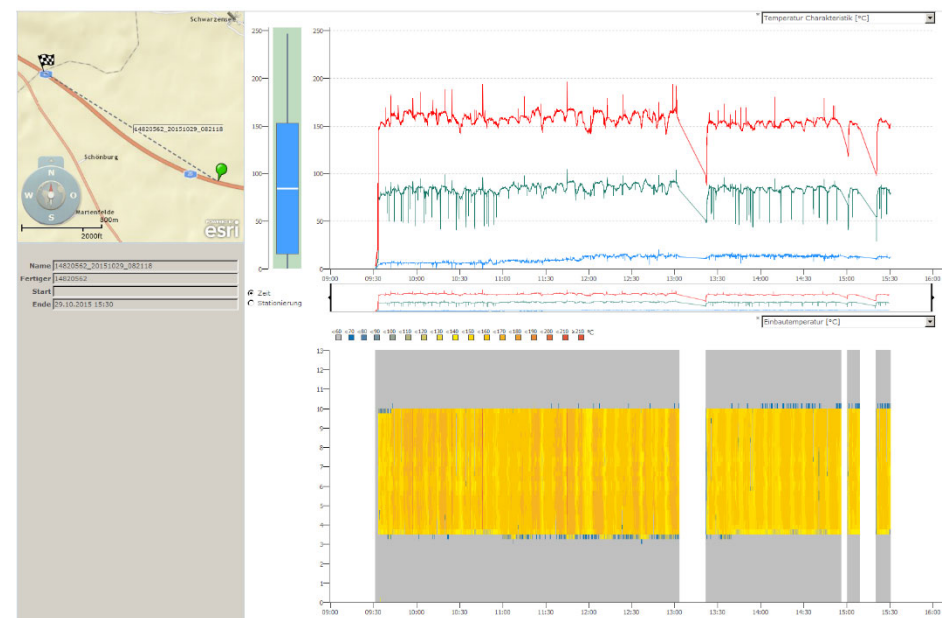
RoadScan Analysis:

Could look at the Data 2 ways

- **Position and Time**



Position

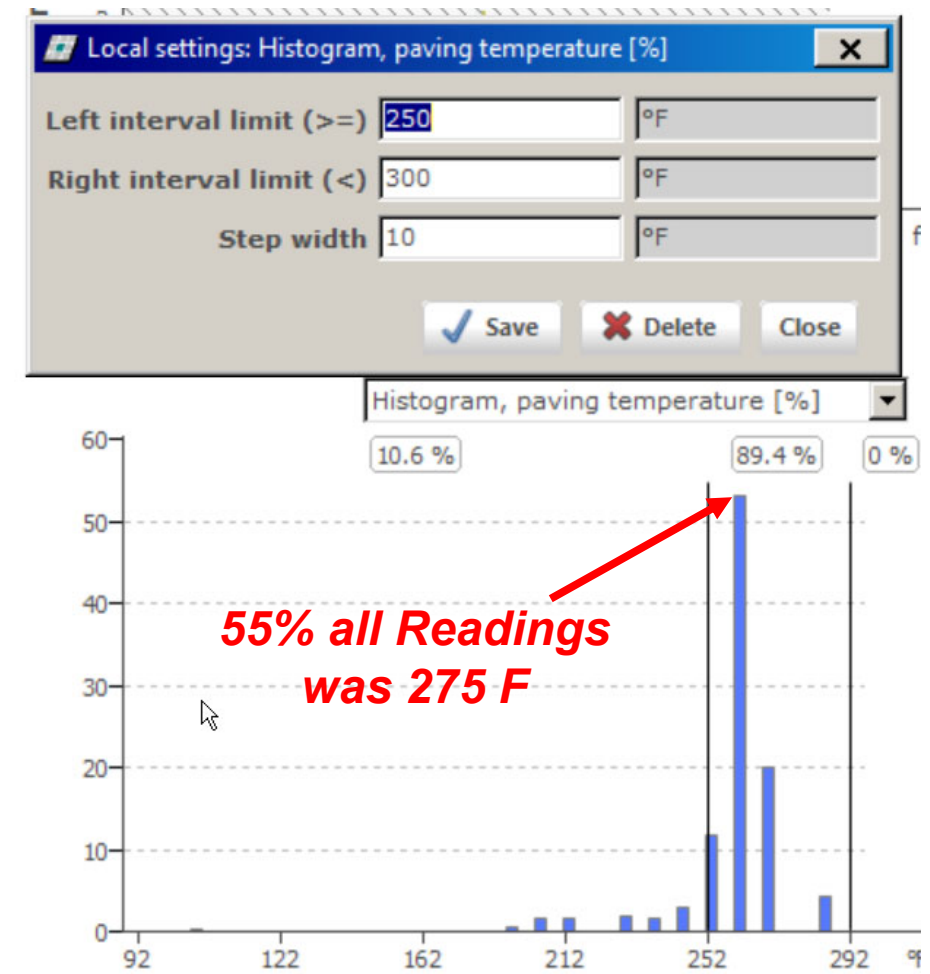
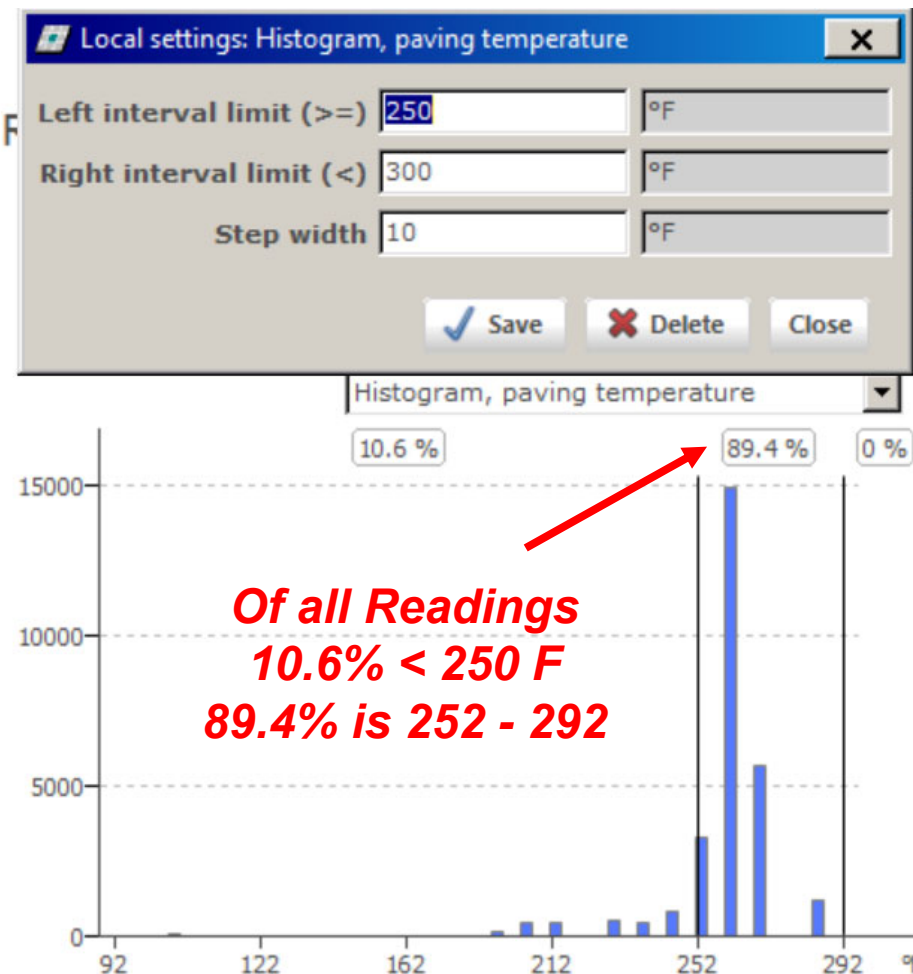


Time

RoadScan Analysis:

Could analyze the all Temperature Measurements in 2 ways

- Paving Temp Range
- % of all Temp measured placed in a Temp Range



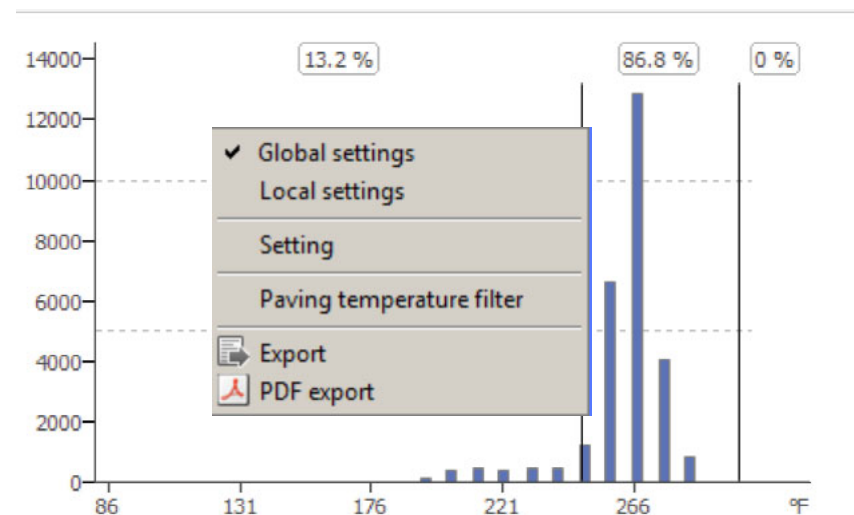
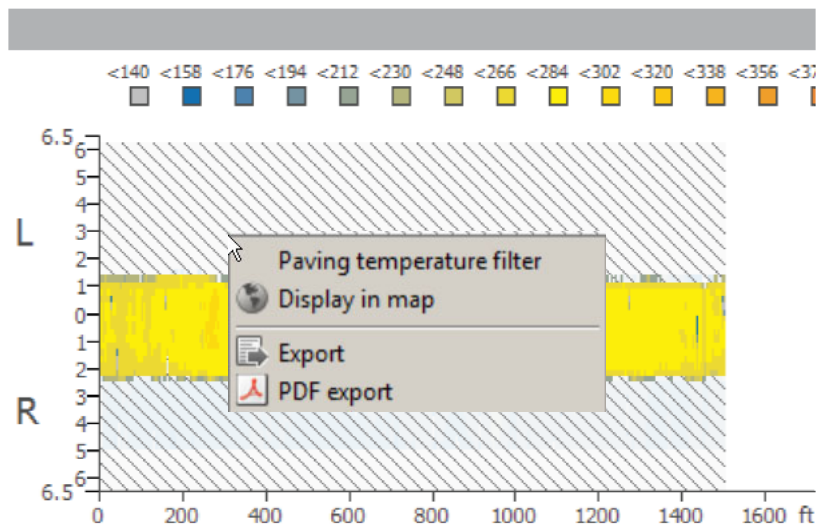
RoadScan Analysis:

Data Export

- *Data could be export on Spread Sheets or PDF Format*
- *Also Export to VETA to meet Individual State Requirements*

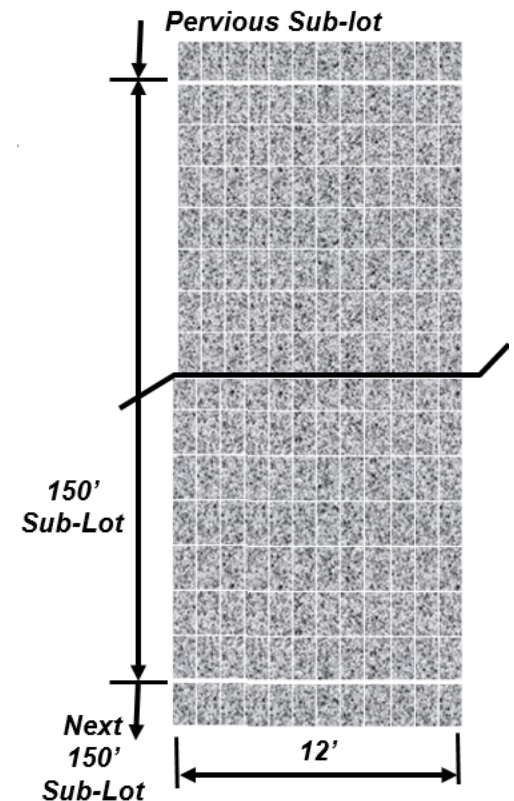
WITOS Paving Analysis

Created by usnarsinghl on 08/08/2018 09:20 pm
Order: '11740011_20170805_112046' (RS508)
Start: 08/05/2017 04:22 pm, End: 08/05/2017 05:32 pm
Graph 1: RoadScan\Paving temperature [°F]
Graph 2: \Histogram, paving temperature
Zoom excerpt: 0 ft (1600 ft)



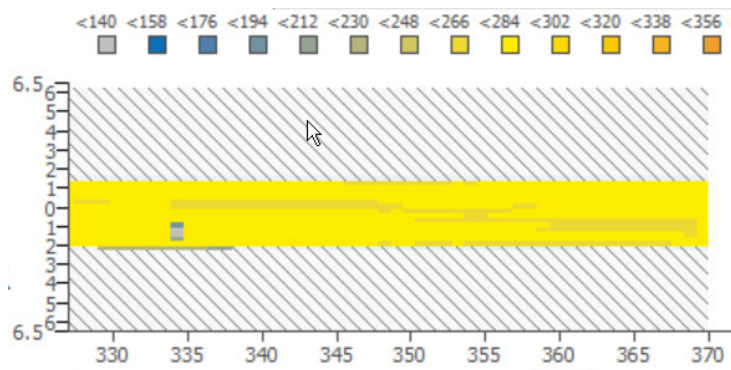
Analysis done in 150' Sub-lot

- ***Individual States drives their own Analysis Specifications***
- ***VETA Software Ideal to meet Individual States specifications***
 - ***OEM would prefer VETA for all Intelligent Construction Technology***
 - ***Intelligent Compaction***
 - ***Paver Mounted Thermal Profiler***
 - ***Ground Penetrating Radar***
 - ***3D Paving and Milling***
 - ***Smoothness (IRI)***

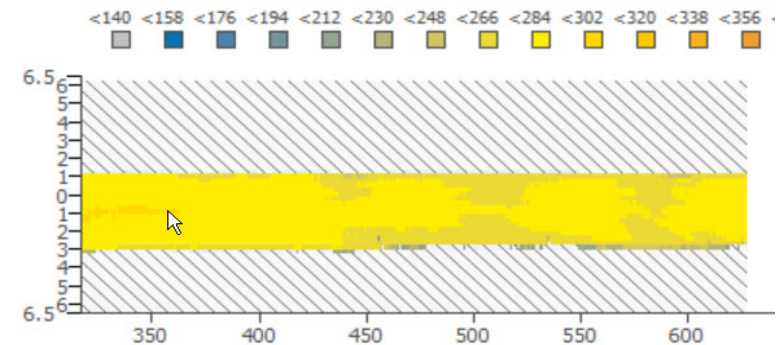


Limitations of Current AASHTO Analysis:

Thermal Streaks not detected by current AASHTO PP 80-17 Analysis



Range	Category
$\leq 13.9^{\circ}\text{C}$ [25°F]	Good
$> 13.9^{\circ}\text{C}$ [25°F] to $\leq 27.8^{\circ}\text{C}$ (50 °F)	Moderate
$> 27.8^{\circ}\text{C}$ (50 °F)	Severe



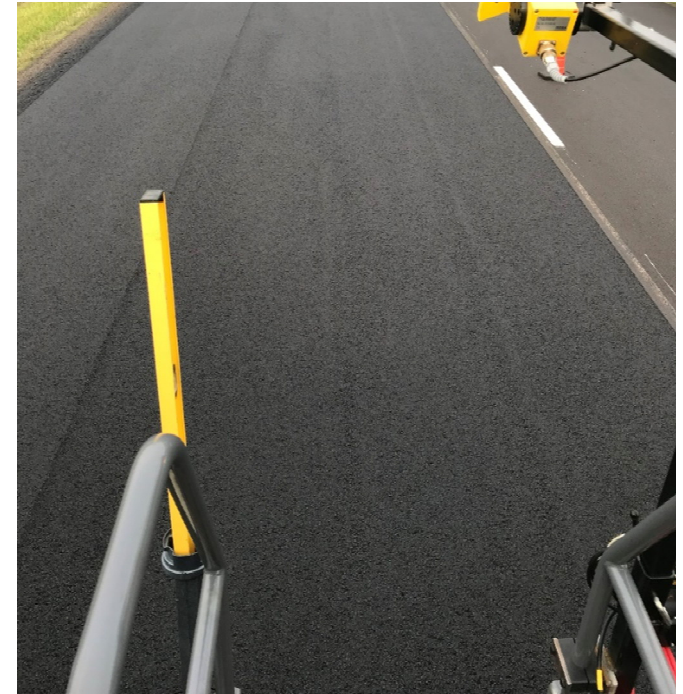
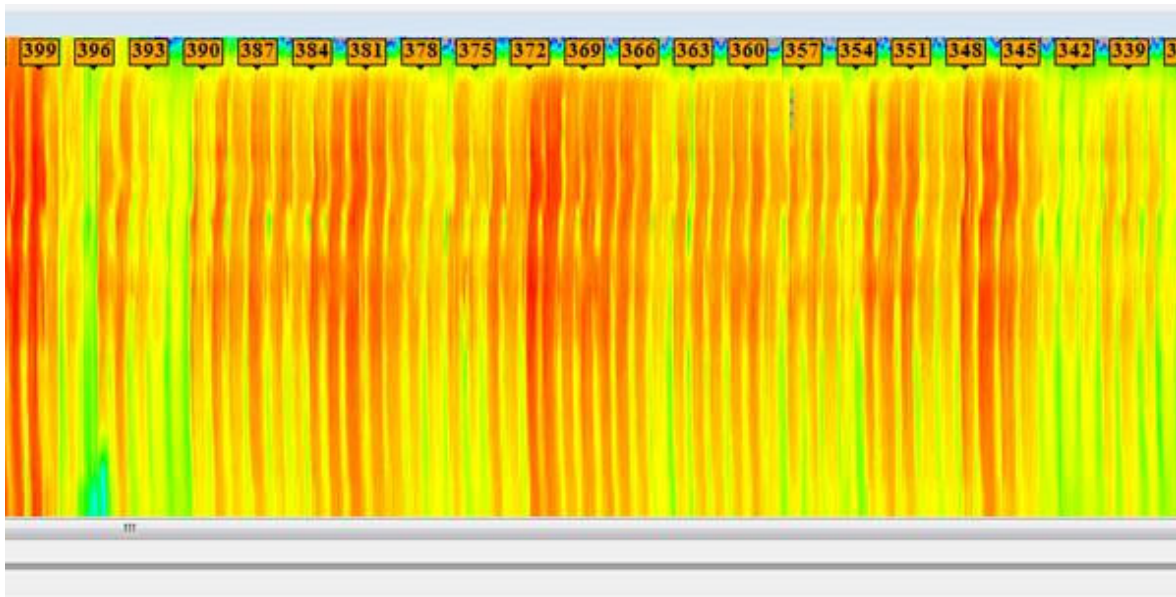
Nars



Limitations of Current AASHTO Analysis:

Visual Streaks but Pass AASHTO Requirements

- **Not > 25 Deg F**



Thermal Profile Results Summary

Number of Profiles	Moderate 25.0°F < differential <= 50.0°F		Severe differential > 50.0°F	
	Number	Percent	Number	Percent
90	57	63	5	6

Thermal Camera Specification

- *Scan grid: 10" x 10" (40 readings at the Same Time over 10 m Wide)*



RoadScan Components:



**Ground
temperature
measurement**



Odometer

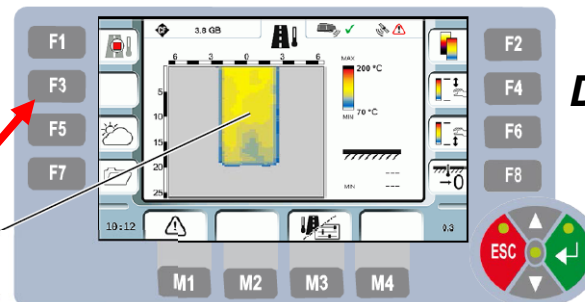
**Weather station
(optional)**



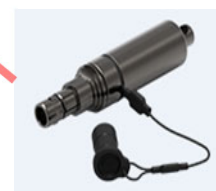
**ThermoScan & GPS
Receiver**



vars



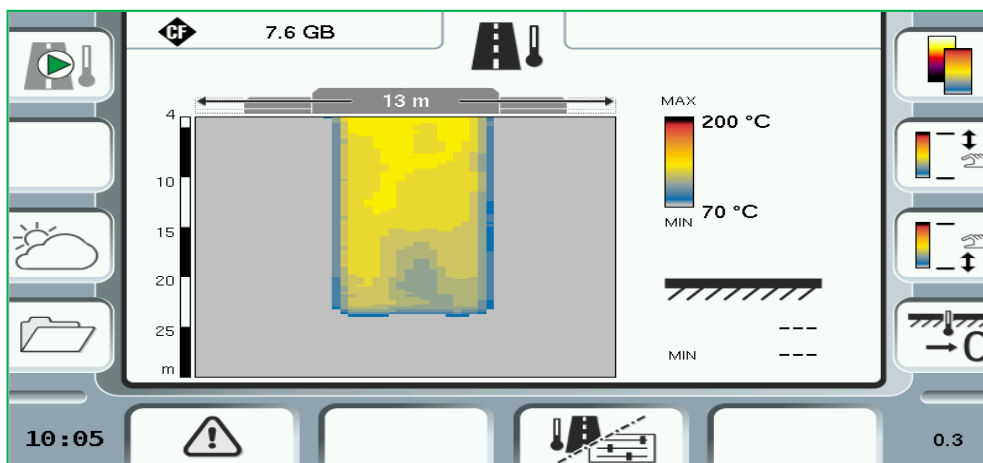
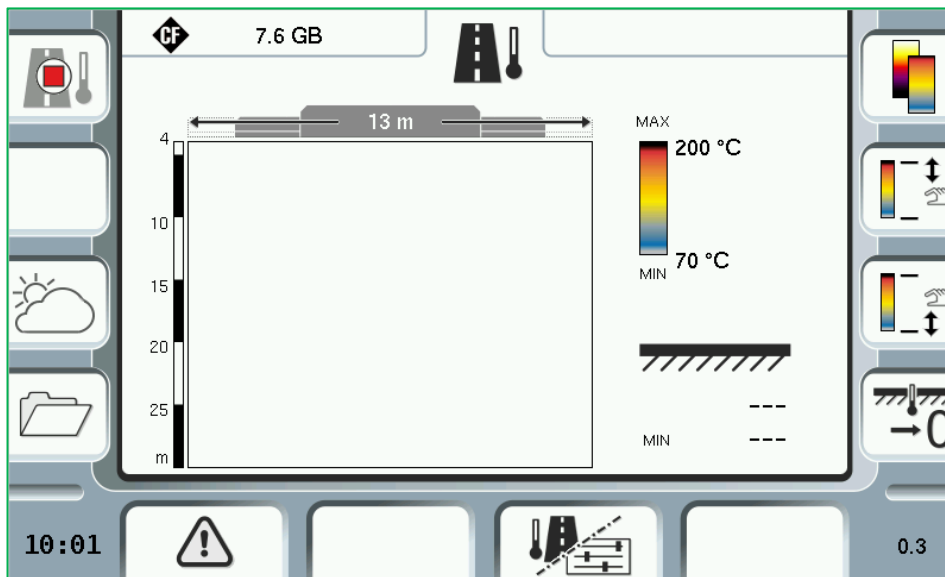
**Thermal Profile
Displayed on Tractor
console**



**Data transfer via special
USB to Computer then to
Veta**

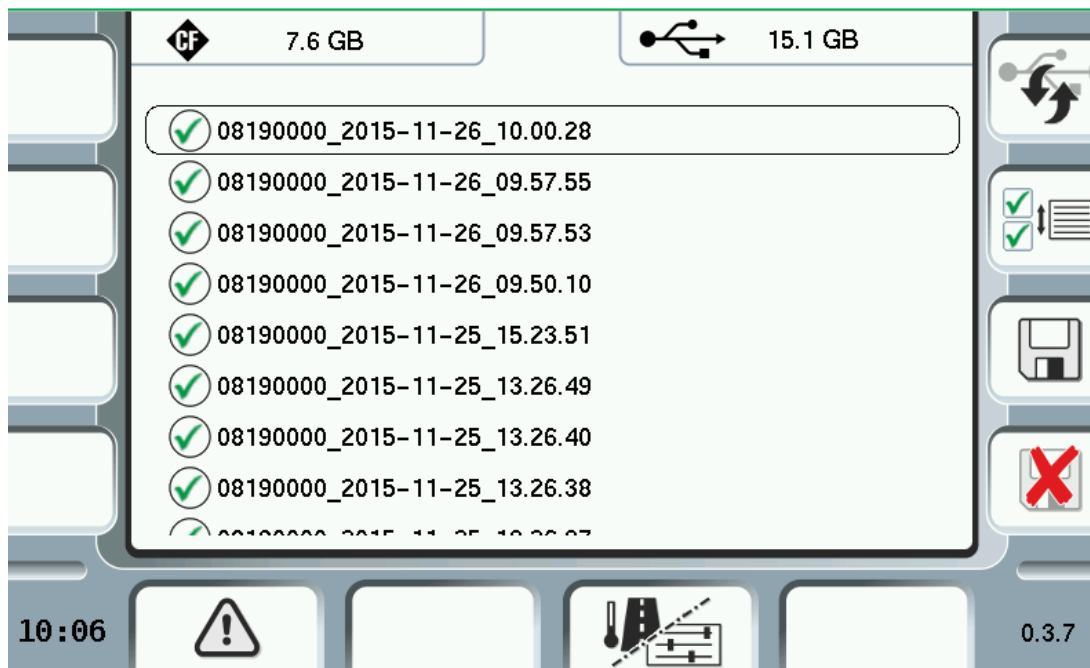
RoadScan Operation

Recording start and Stop on the paver

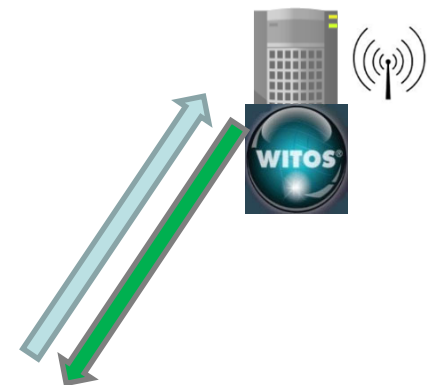


Data are copied to a USB stick

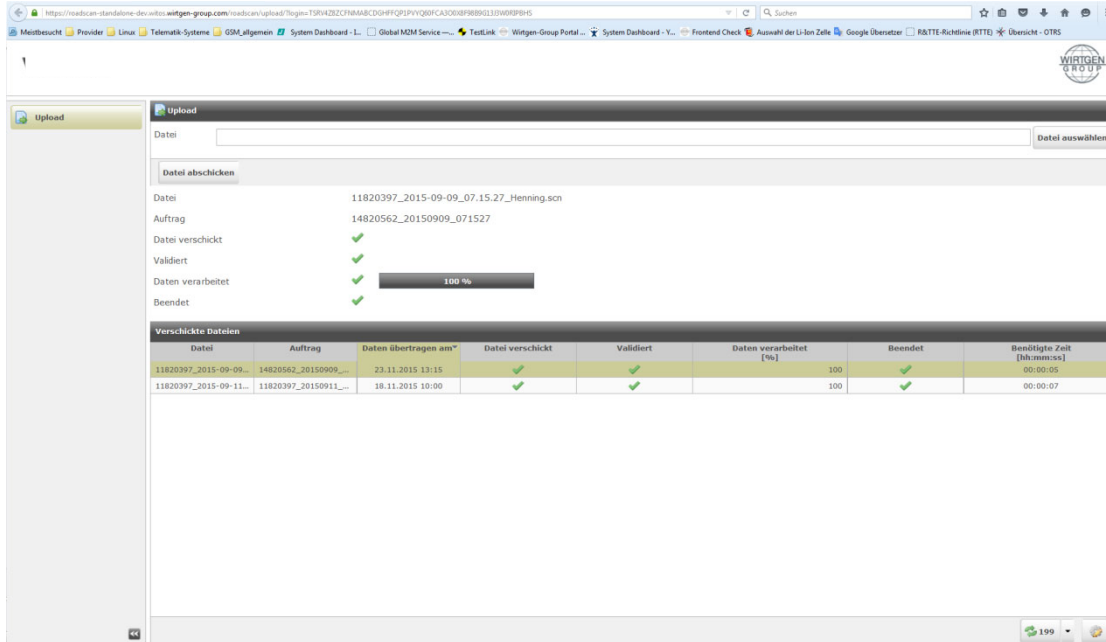
- Data is uploaded to Wirtgen server using RoadScan Upload tool



USB stick



Data uploaded to Wirtgen server using RoadScan Upload tool



The screenshot shows the 'Upload' section of the RoadScan Upload tool. It displays the file name '11820397_2015-09-09_07.15.27_Henning.scn' and the order number '14820562_20150909_071527'. The status of the upload is shown as 'Beendet' (Completed) with a progress bar at 100%. Below this, a table titled 'Verschickte Dateien' (Sent Files) lists the upload details.

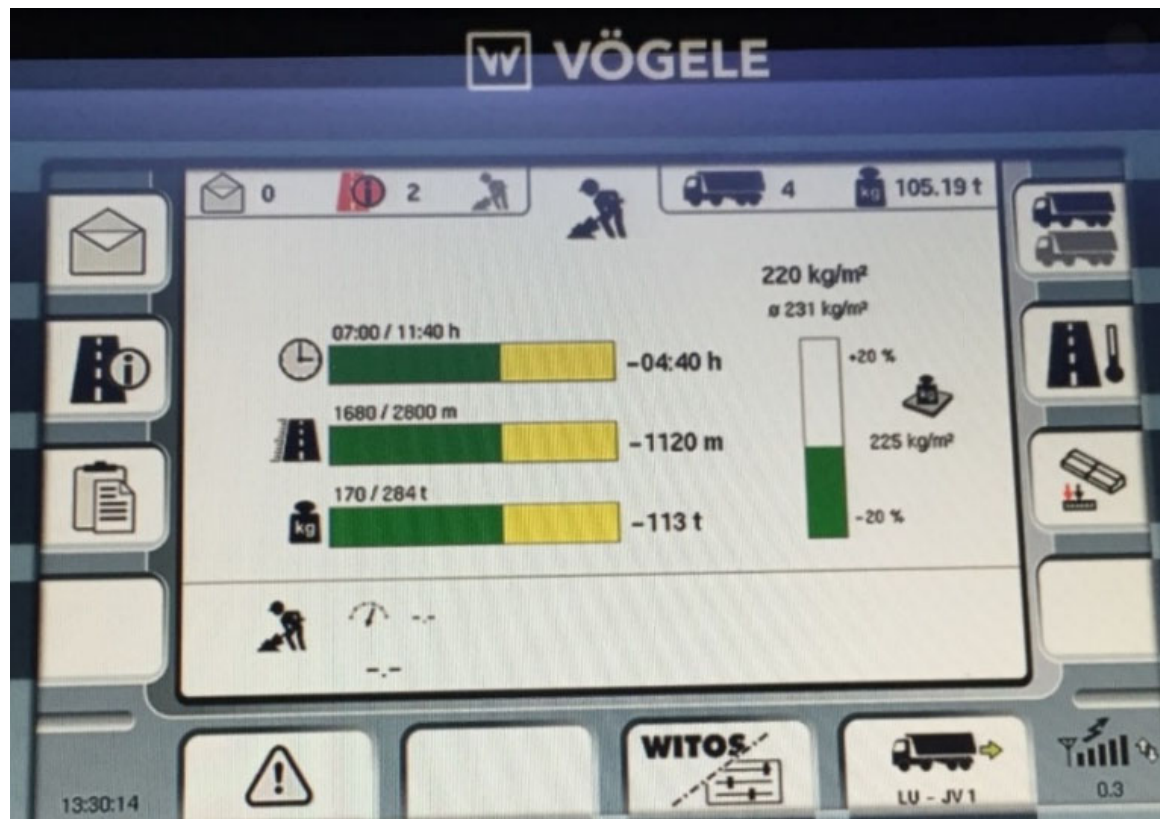
Daten	Auftrag	Daten übertragen am	Daten verschickt	Validiert	Daten verarbeitet [%]	Beendet	Benötigte Zeit [hh:mm:ss]
11820397_2015-09-09...	14820562_20150909...	23.11.2015 13:15	✓	✓	100	✓	00:00:05
11820397_2015-09-11...	11820397_20150911...	18.11.2015 10:00	✓	✓	100	✓	00:00:07



WITOS Trucking Module:

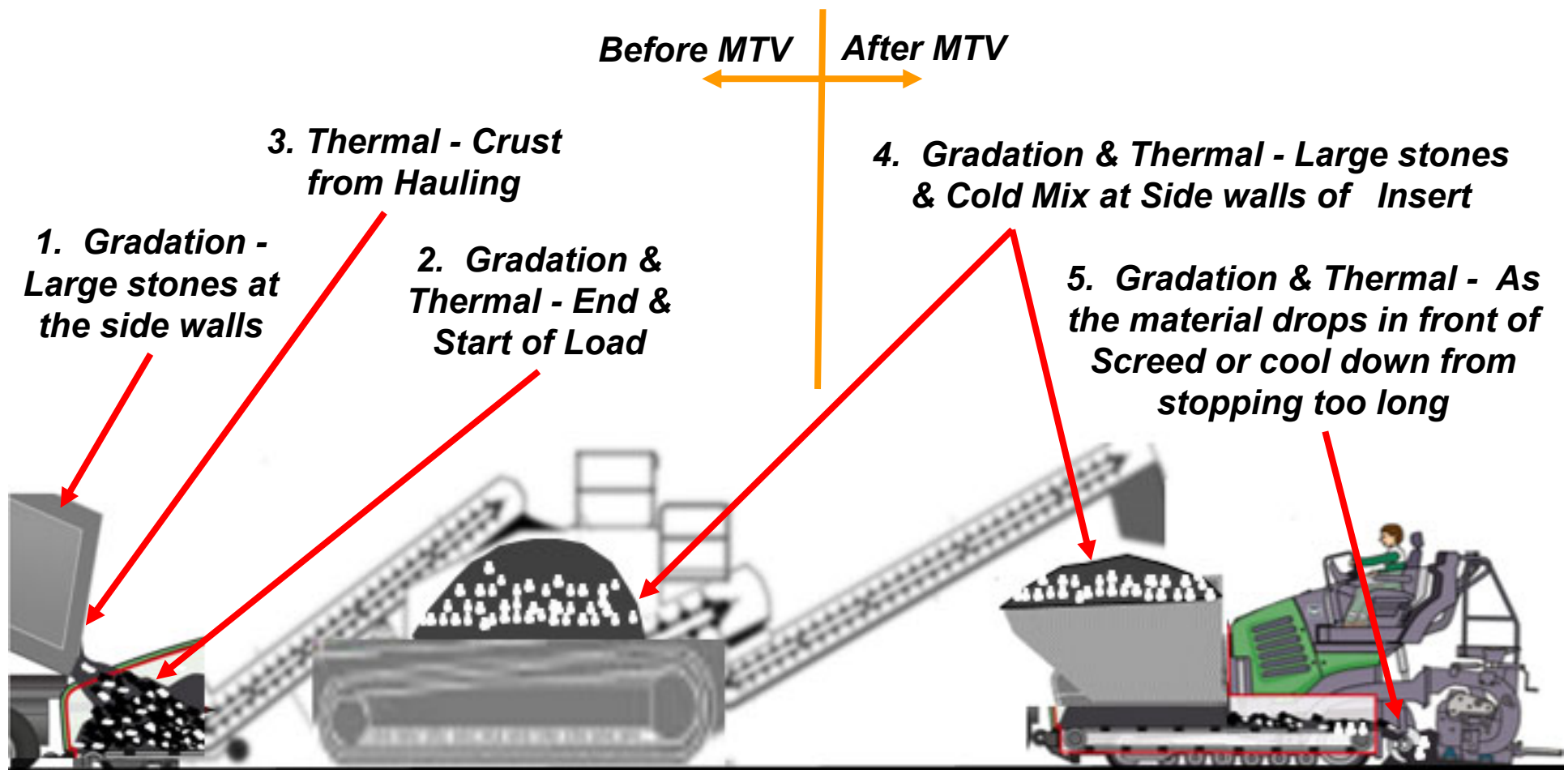
Trucking & Messaging Information – Used in Europe:

- *Number of trucks / Tonnage on the road*
- *Tons Laid / Tons to be laid*
- *Messages from the Plant*



Manage the 5 Forces

- *3 of the 5 Forces Using Control Features*
- *2 of the 5 Forces by managing Segregation at 5 typical locations*



QUESTIONS

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For More Info On Paving

<https://tinyurl.com/paving-academy-FIU>