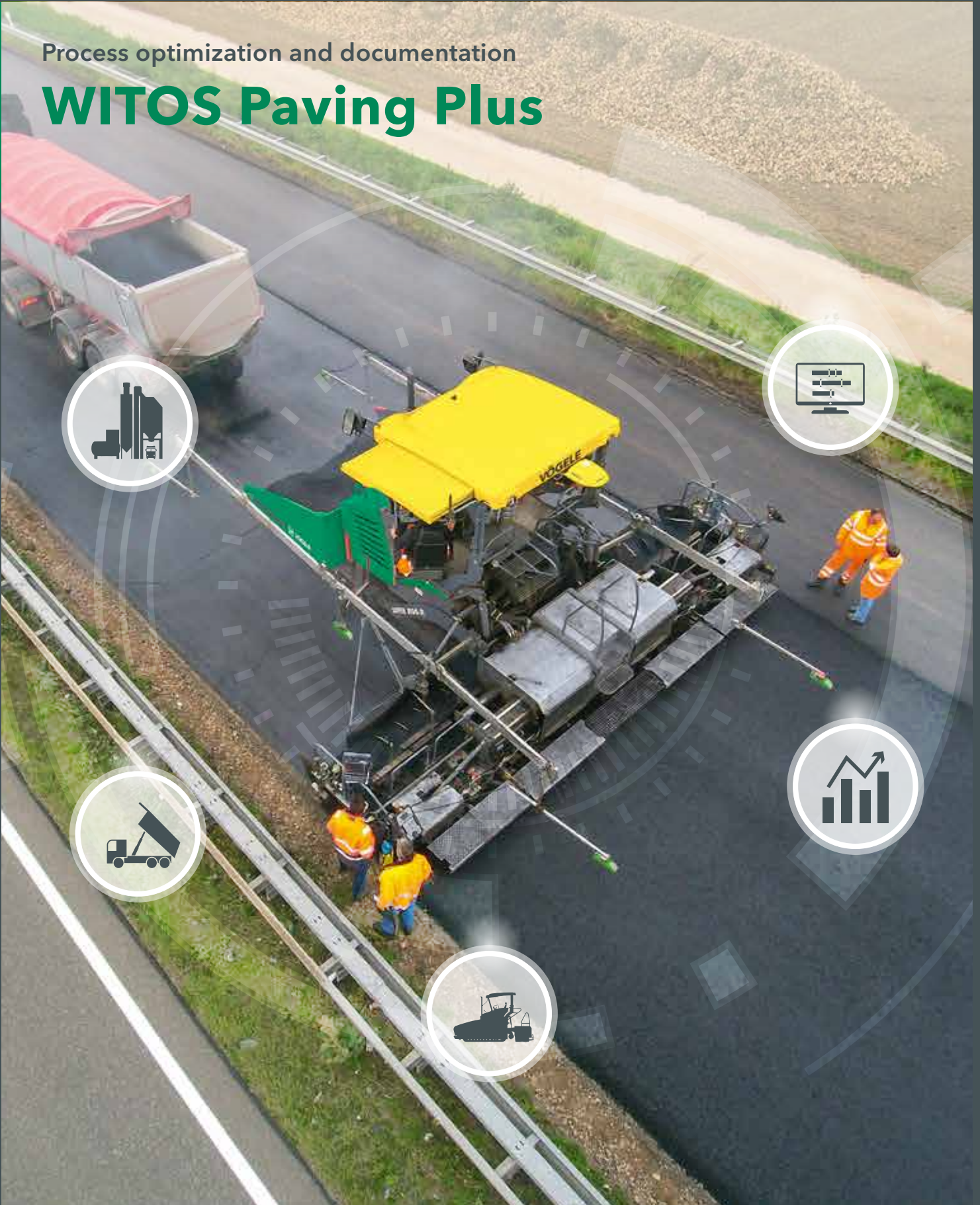


Process optimization and documentation

WITOS Paving Plus



The innovative process management solution to enhance quality and efficiency in road construction



Amid growing cost pressures and demands for better pavement quality and a longer road service life, it is becoming increasingly important to exploit untapped potential for the paving process.

And this is precisely where WITOS Paving Plus comes into play. The VÖGELE solution for process optimization and documentation lays the basis for more effective planning, greater transparency and a targeted, more rapid response to disruptions in the main processes associated with asphalt paving. WITOS Paving Plus connects the supervisors in the asphalt mixing plant, the logistics company's lorry drivers and the entire paving team on site. The system provides planning engineers and site managers with a full overview of the current construction process. Disturbances and obstructions

arising in the construction process are detected more rapidly, providing the persons in charge with a wide range of possibilities for intervening. They are put in a position where they can take immediate optimization measures and remedy deviations from the planned workflow in real time.

What is more, the projects can be analysed and documented with WITOS Paving Plus after completion of the job site. The collected data are then available to optimize future projects. In this way, working with WITOS Paving Plus will help to significantly boost the overall cost-efficiency of road construction projects in the medium and long term.

Benefits of using WITOS Paving Plus



Highlights of WITOS Paving Plus

1 **Process planning** and control, all the way from the mixing plant to paving

4 **Dynamically** cycled supply of material according to the just-in-time principle

7 **Identification of standstills and their effects**

10 **Documentation of the entire process chain**

2 **Rapid detection** of deviations in the progress of construction work

5 **A single database** for all parties involved in the process

8 **Integration of the VÖGELE RoadScan temperature-measurement system** for the recording and visual display of paving temperatures

11 **Detailed documentation of times, performance levels and consumption**

3 **Immediate notification** of all parties involved in the event of incidents or deviations

6 **Analysis and statistics tool** for optimizing process flows; HAMM HCQ roller data can also be imported for documentation

9 **Automatically detected machine data**



Fully integrated system solution from the machine manufacturer

WITOS Paving Plus is a unique solution from VÖGELE, the machine manufacturer and a long-standing, reliable partner to the road construction industry. The paver specialist's profound applications know-how and the worldwide service and consulting network of the WIRTGEN GROUP give customers maximum security and reliability - and on a long-term basis, too.

ADVANTAGES OF A FULLY INTEGRATED SYSTEM SOLUTION

- » **Full integration** of the WITOS Paving Plus system into the machine offers a high level of functional security.
- » **As the manufacturer** of the machine technology, VÖGELE ensure that all relevant machine and paving data, such as pave width, layer thickness and pave speed, are connected by means WITOS Paving Plus. As a result, key parameters are available for precise planning and as an indication of the project's progress.
- » **Since the paver's operating status** (paving, relocation on the job site, transport, neutral) is always recorded, WITOS Paving Plus is able to carry out an extensive process analysis, collecting important information for potential improvements.
- » **Integrating WITOS Paving Plus** into the paver operator's ErgoPlus console ensures that the paver operator is directly included in the system. He receives up-to-date information on the arrival of mix lorries and the progress on site.
- » **With WITOS Paving Plus**, our customers are optimally organized. They have the entire service and consulting competence of the WIRTGEN GROUP at their disposal.



WITOS Paving Plus at a glance



1
WITOS Paving Control
Planning and control module for convenient planning and monitoring of the current construction project



2
WITOS Paving Materials
Mixing plant module for supplying a job site with material just in time, on the basis of dynamically cycled delivery



3
WITOS Paving Transport
Transport module for updating the mix lorries' estimated arrival times on the basis of their current positions



4
WITOS Paving JobSite
Job site module for efficient process management throughout the construction period



5
WITOS Paving Analysis
Analysis module for documentation and analysis of the construction job

The planning and control module of **WITOS Paving Plus**

The **planning and control module** supports convenient project planning based on the job site geometry.

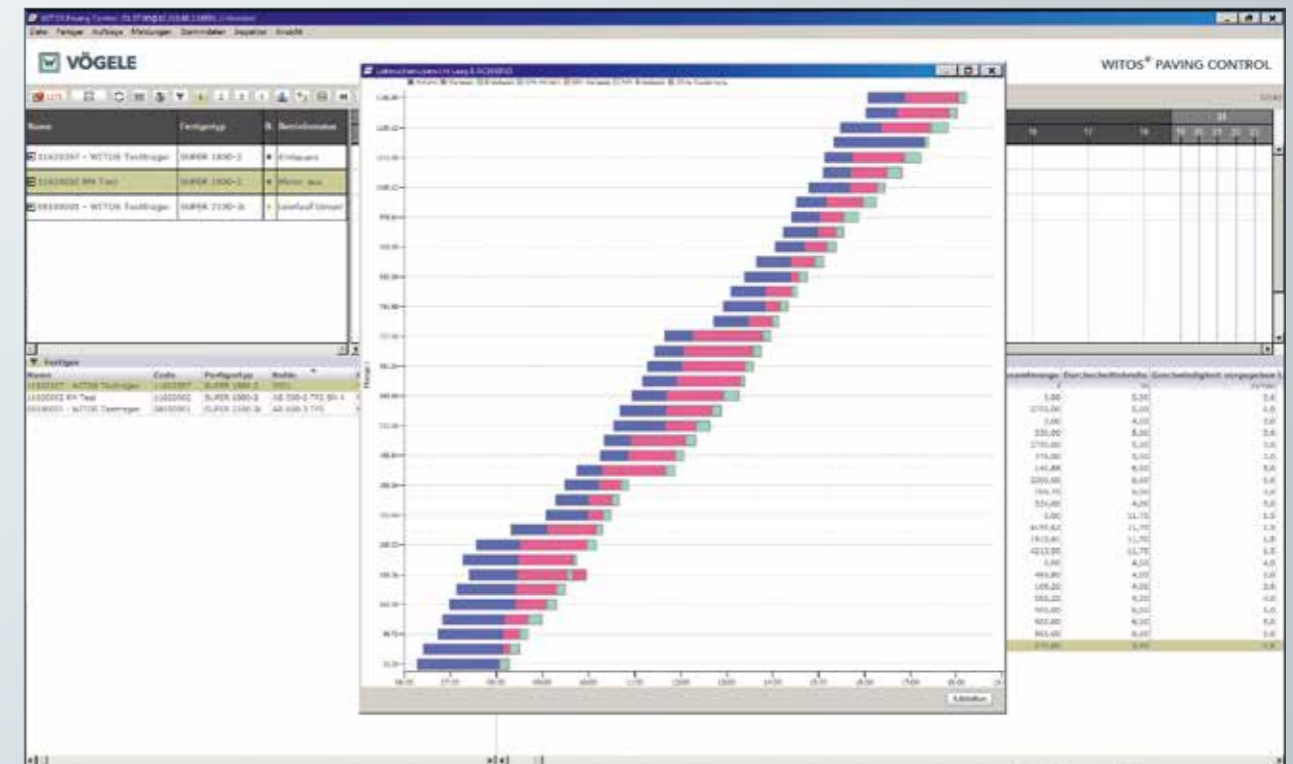
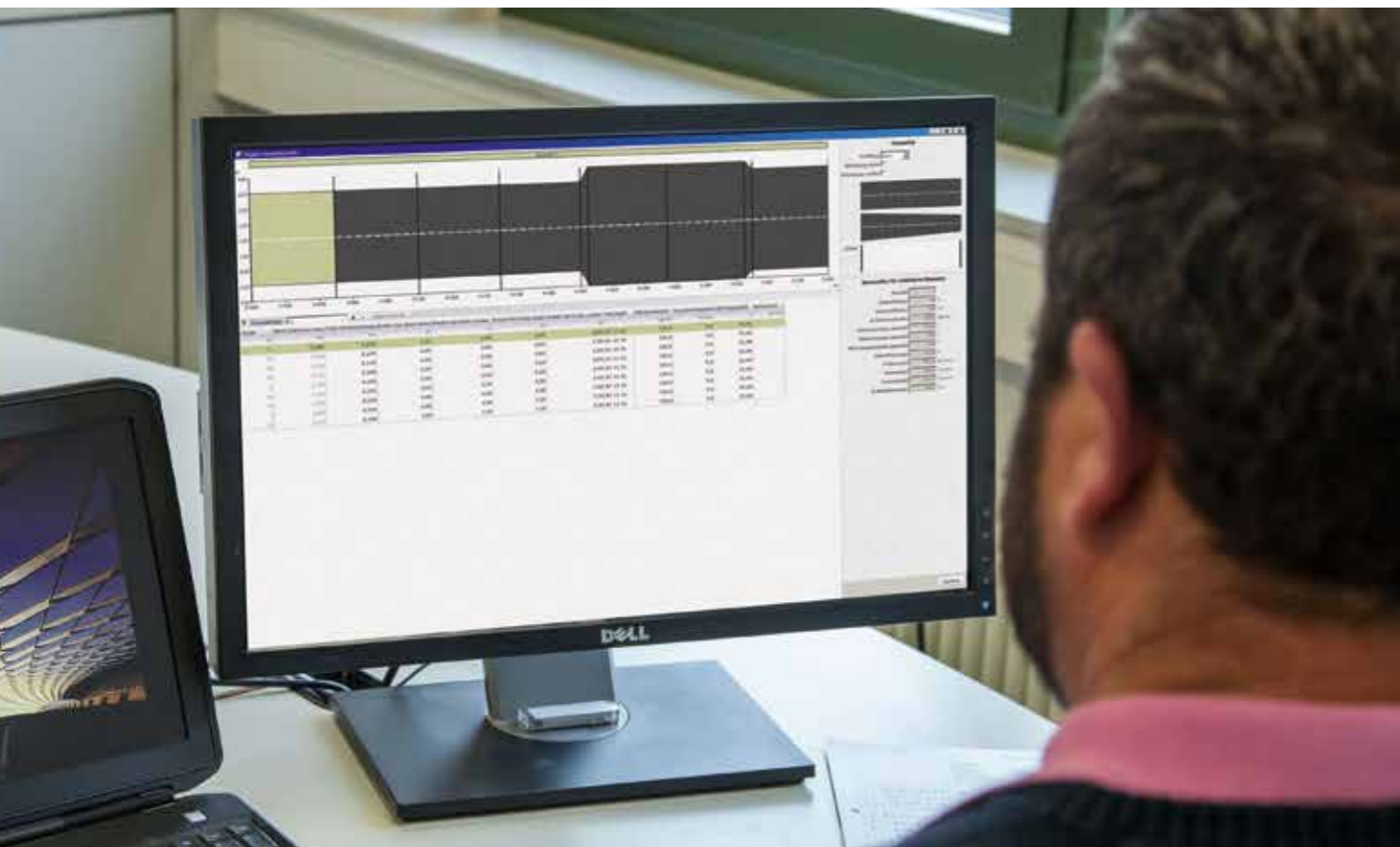
All key information is collected simply and quickly: the selected mixing plant from the master database; the recorded paving parameters, such as pave width, pave speed, etc.; the required machinery and material quantities, including their availability in terms of time.

The planning and control module is an important source of information for the site manager. With this module, he can monitor the project's progress in real time and call up status information on material

delivery. Moreover, information on the paver's operating status is available to the site manager at all times and helps him monitor and analyse the current construction job.

With the planning and control module, the temperature of freshly paved asphalt can also be displayed and monitored in real time.

All in all, the planning and control module ensures perfectly cycled, on-site operations and optimizes time and materials planning according to the just-in-time principle.



In addition to easy planning, the planning and control module also monitors operations at a current job site. For example, the supply chain can be checked at any time.

Highlights

- » **Clear** and detailed representation of the construction project in real time
- » **Easy machine scheduling** avoids double assignment
- » **Job site planning** is subjected to a plausibility check
- » **Information** is provided on the operating status of the paver
- » **Coordination and exchange of data** with the mixing plant
- » **Calculation of the number** of mix lorries required
- » **Project progress is indicated** and can also be taken into consideration when planning future jobs
- » **Display of the temperature** of the freshly paved asphalt measured by the VÖGELE RoadScan system



The mixing plant module of **WITOS Paving Plus**

The number of mix lorries calculated by the planning and control module is linked with relevant data from the mixing plant. This information serves as a basis for calculating the mix lorry cycles and arrival times of material deliveries on the job site.

In this way, paving and compacting operations can be optimally coordinated with material deliveries. The objective is to boost performance by means of precise daily planning and management.

In a move to make paper delivery notes superfluous, the mixing plant module has been given a new interface. The server of the asphalt mixing plant and the WITOS Paving Plus Server can exchange the data directly. This enables the system to reliably document how many mix lorries transport which tonnage to the job site from which mixing plant.

Highlights

- » **Indication of the actual material requirement** to prevent excess production and surplus material
- » **Just-in-time delivery** of material to the job site by the mixing plant thanks to dynamically updated cycles for mix lorry departures
- » **Easier communication** between the mixing plant and the job site, particularly in the event of deviations from the plan
- » **Mixing plant supervisor** receives information on deliveries to a job site and tonnages
- » **Continuous display of a project's progress** as well as mix lorry positions
- » **Reduced number** of mix lorries required for deliveries "free on site"
- » **Immediate notification** of the mixing plant supervisor in the event that a delivery is rejected due to poor material quality
- » **Paperless recording of delivery notes** via digital interface to the mixing plant server



Thanks to WITOS Paving Plus the paving team, site manager and mixing plant receive real-time information on the arrival of mix lorries at the job site throughout the construction period. As a result, construction projects can be handled much more reliably and in better quality than has been the case so far. This precise planning also improves the paving quality, as waiting times for mix lorries are avoided, thus reliably preventing cooling of the paving material.

In addition, the transport module guarantees economical use of the mix lorries. An Android app for the lorry drivers provides important details relating to the job, such as scheduled arrival times, and regularly transmits the GPS positions of the lorries to WITOS Paving Plus. A map visualizes the precise locations of both the job site and the mixing plant.

As a result, the system can continuously update the estimated time of arrival (ETA) and supplies reliable information to all parties involved in the project.

Highlights

- » **Supports the economical use** of mix lorries supplying asphalt to a job site
- » **The driver of the mix lorry** sees a map in the app showing the location of the mixing plant and the job site
- » **Informing all parties involved in the process** about the arrival times of mix lorries
- » **An app available for standard smartphones** (Android) provides maximum flexibility for the logistics company supplying the mix



The job site module of **WITOS Paving Plus**

The job site module is the pacemaker of WITOS Paving Plus. It gives the paving foreman and site manager full transparency on the project, ensuring efficient process management throughout the construction period.

The job site module delivers important real-time information on the project's progress on site, paving performance and number of mix lorries.

Together with indication of the planned and actual values for the paving time, paved distance and quantity of paved material, this supports the direct detection any deviations from the plan, such as higher material consumption. As a result, continuous paving is assured.

The job site module allows delivery notes to be entered at the push of a button. If QR codes are used, they can be entered into the system quickly and conveniently by means of a handheld scanner.

Highlights of the job site module



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

2 **Important information is visualized** on the paver operator's ErgoPlus 3 console

3 **Information on the current delivery volume and status**

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

5 **Simple entering of delivery notes**

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

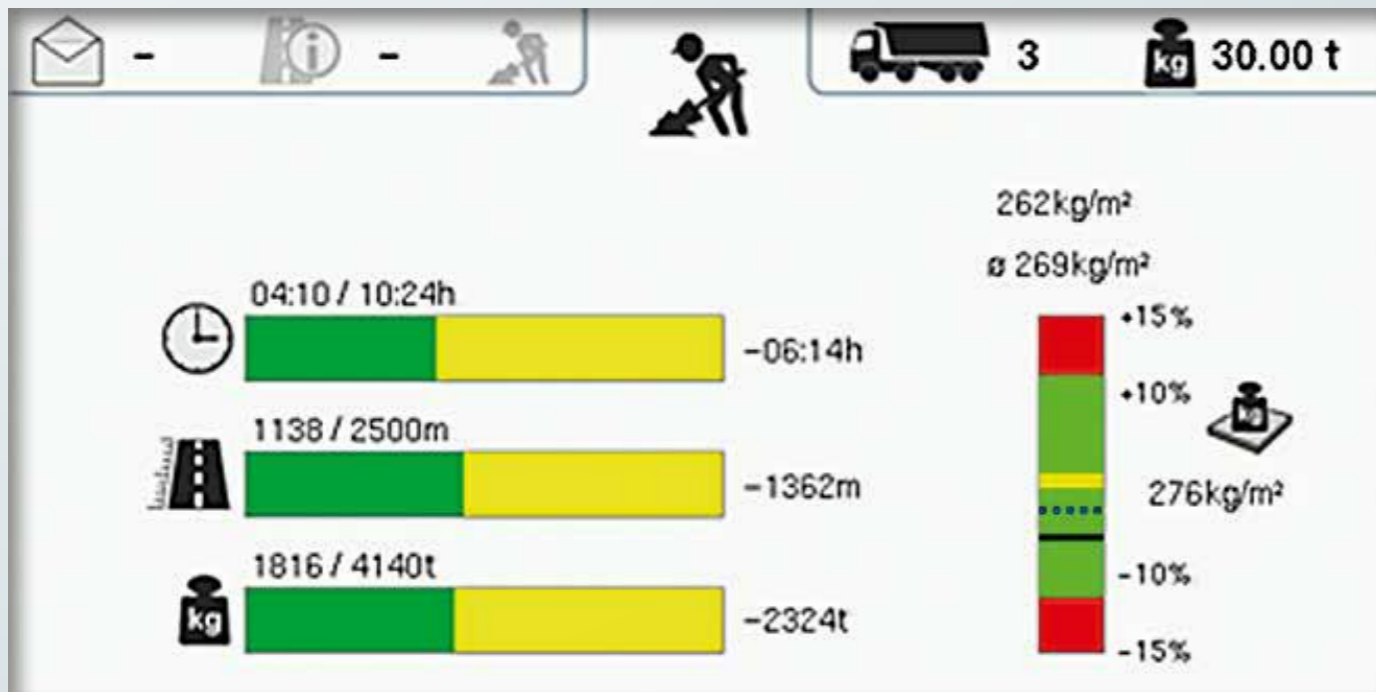
7 **Real-time updating of the project's progress** on site

8 **Early detection** of any deviations from the plan and prompt initiation of remedial measures





The practical job site module for the paving foreman



PROJECT PROGRESS

Extensive information is available to the paving foreman. For instance, he can view a real-time comparison of planned and completed paving times. The paved distance and amount of material placed can also be displayed in comparison to the planned figures.

Lorry on job site (3 lorries with 50.45t)		Paving duration forecast 01:05 hh:mm			Lorries approaching up to 12:11 (0 lorries) ?		
Lorry	Duration [hh:mm]	ETA	Type of mix	Number	Quantity loaded [t]	Mixing plant	
LU TT 547	00:11		AC 22 TS	2000000000	24.43	K. H. Gaul GmbH	
LU MP 123	00:00		AC 22 TS	2010000001	24.70	Mischwerk Ludwig	
LU TT 709	00:10	12:22	AC 22 TS	2010000002	27.05	K. H. Gaul GmbH	
LU MP 456	00:14	12:26	AC 22 TS	2010000003	27.00	Mischwerk Ludwig	

SUPPLY CHAIN

The job site module is a smart tool for entering material deliveries into the system at the push of a button. This information is then made available in real time to all parties involved in the project. The module also provides a convenient overview of all mix lorries, whether they are approaching a job site or have already arrived.

The job site module for the paver operator



The job site module is an integral part of the VÖGELE ErgoPlus 3 paver operating system and offers the paver operator a unique tool for control and process optimization.

External equipment and staff are no longer required to perform vital functions. These can easily be carried out by the paver operator. This includes the recording of material deliveries.

At the same time, the job site module provides the operator with important information, for example, about the project's progress in terms of paving time, paved distance, quantity of material placed or temperature of the freshly paved mix.

In addition, the module features many other functions. Locations where drill cores have been taken, for instance, can be saved via the ErgoPlus 3 display screen for later documentation and analysis.

The job site module for the paver operator



The paver operator is linked to the job site module via the ErgoPlus 3 display. For example, he can access current information on the job site and the progress of the project at any time. Thanks to clearly arranged and easily comprehensible diagrams, he can immediately recognize a deviation of the actual situation from the plan.

The paver operator can, for instance, monitor the temperature of freshly paved asphalt on the high-resolution display screen in real time. This is an important control function that contributes substantially to quality assurance in the paving process.



Indication of relevant job site data

Be it the type and quantity of material, the length of a construction job or the planned pave speed - all the important information on a current project is clearly displayed to the paver operator.



Controlling the project progress

On the ErgoPlus 3 display screen, the paver operator can constantly monitor the completed paving time, the paved distance and the project's overall progress. Moreover, he is promptly updated on the planned material quantity, the paved volume and the volume still to be placed.



Monitoring the supply chain

The number of mix lorries approaching a job site and their material loads are also displayed. The paver operator can accept the material delivery via his ErgoPlus 3 console, entering it into the WITOS Paving Plus system.



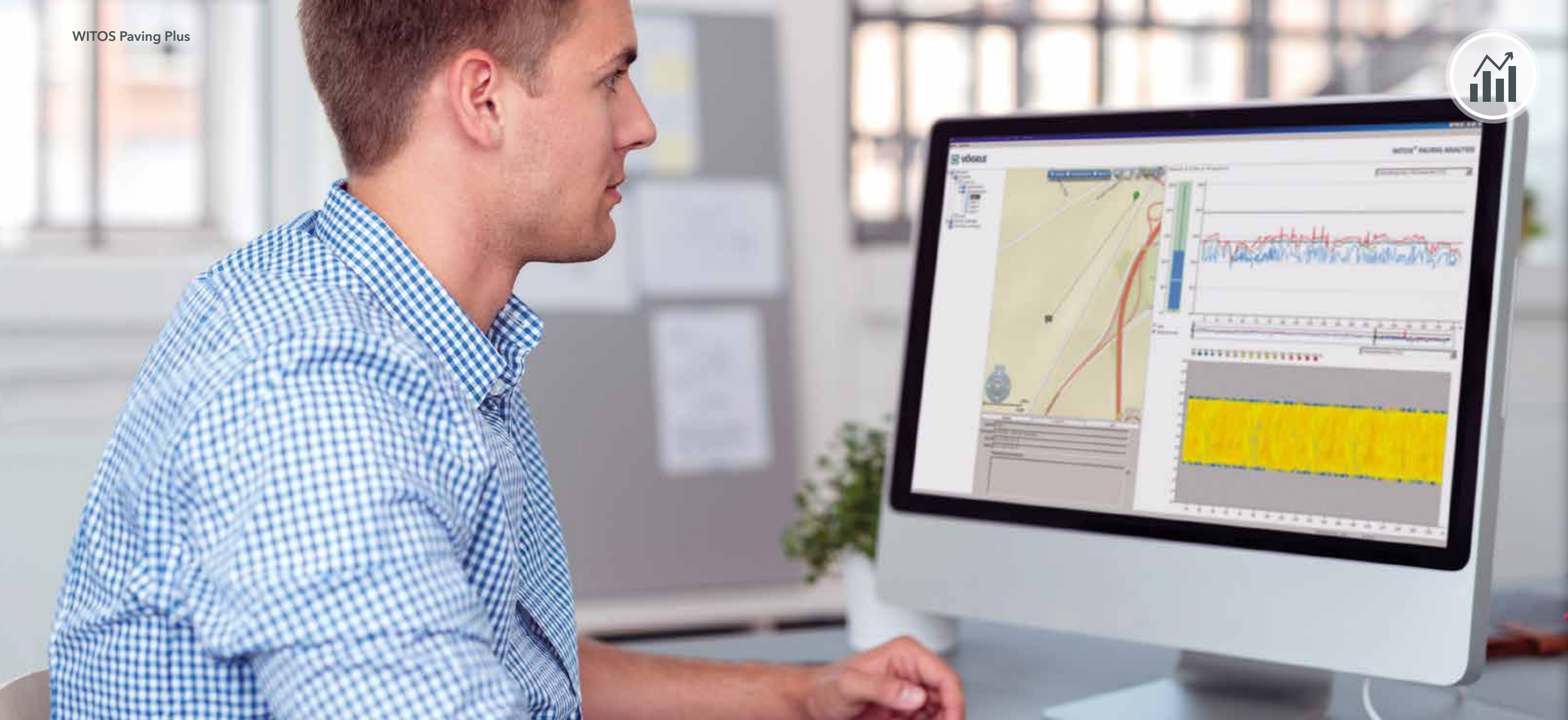
Temperature measurement with the VÖGELE RoadScan system

One of the crucial criteria for high-quality asphalt paving is the temperature at which the material is paved and compacted. Customers are therefore increasingly demanding documentation showing the temperature of the freshly paved asphalt. The

RoadScan non-contacting temperature-measurement system is an integral part of WITOS Paving and can be used on all VÖGELE pavers equipped with a paver operator's console with colour display.

Highlights

- » **Temperature measurement** across the entire pave width of up to 10m
- » **Simple mounting** of the measuring unit without any adjustment (plug & play)
- » **Real-time display** on the paver operator's ErgoPlus 3 console helps the paving team achieve a high-quality asphalt pavement
- » **Reliable technology** thanks to a robust design with no moving parts



The analysis and documentation module of **WITOS Paving Plus**

This module supports objective analysis of the construction project by supplying data for various evaluations and analyses.

The job site report, which gives a summary of the day's paving work or job section and includes key information, is a very practical function.

The report consists of a PDF file containing data such as the work progress as well as a comparison of specified and actual values. The report can be sent quickly and easily to relevant recipients such as the site manager by e-mail.

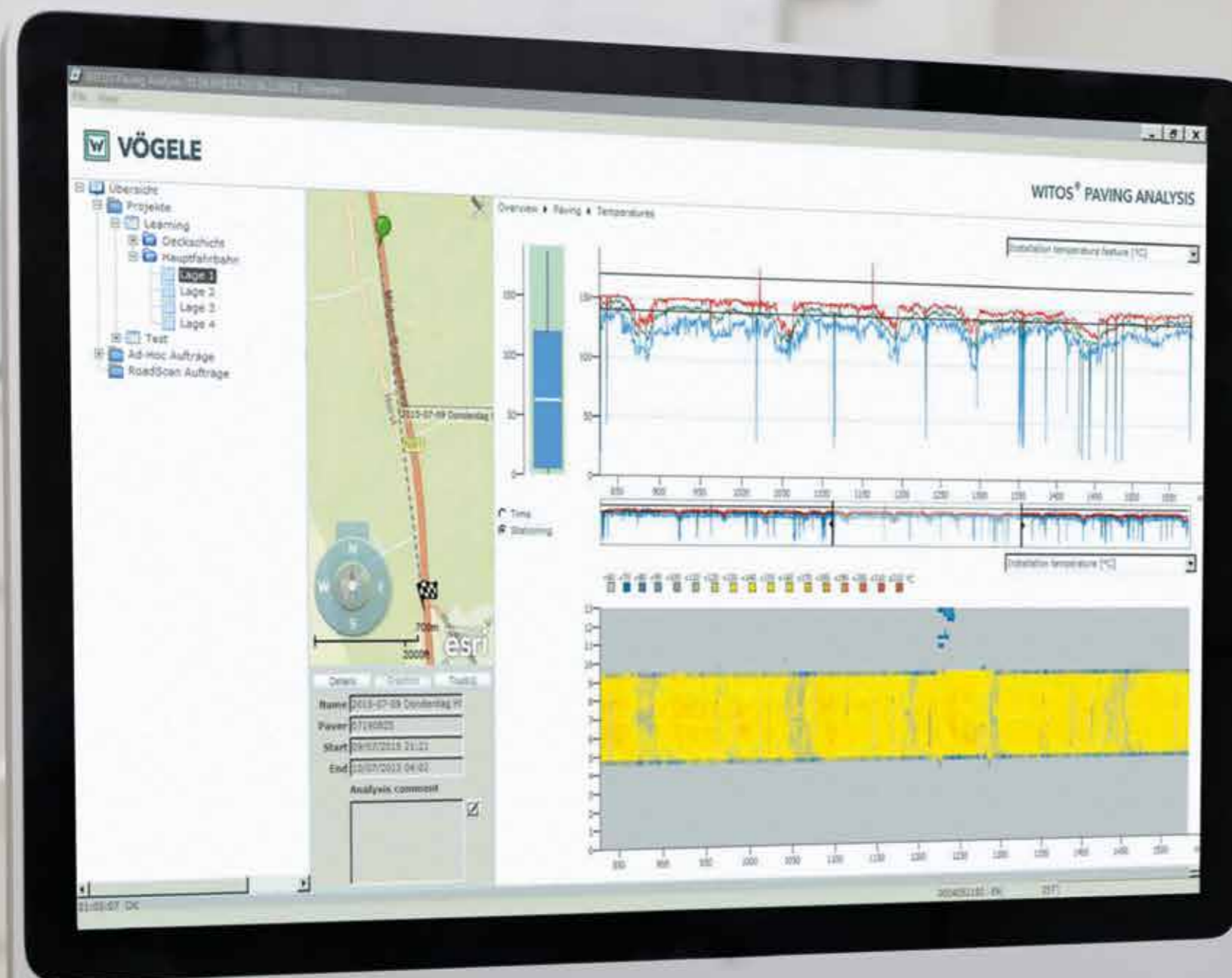
If a RoadScan system is in use, thermography data compiled from the asphalt temperatures are also transmitted immediately after paving, along with the process data. Monitoring active job sites has never been easier or more convenient. Easily understandable and clearly arranged diagrams and charts enable the site manager or planning engineer to draw important conclusions from a completed construction project. Where did which lorry unload material?

What was the pave speed? Where did the paver wait? How many mix lorries were on the job site? How long were the waiting times and can the number of mix lorries be reduced? What costs were caused by waiting times?

The analysis and documentation module provides the information required to answer all these questions.

Because the module additionally has an interface for receiving HCQ (HAMM Compaction Quality) data from HAMM rollers, the compaction process can also be analysed and optimized.

WITOS Paving Plus thus offers the option of compiling detailed documentation on the entire process chain, from asphalt production to compaction.



Highlights

- » **Objective assessment** of construction jobs based on informative diagrams and analyses
- » **Documentation of empirical values** to promote a "Best Practice" approach
- » **Examination** of interruptions in paving to identify possible optimization measures and ensure continuous improvement
- » **Assessment of the paver's operating efficiency** (standstill periods versus productive periods)
- » **Precise documentation** as proof of quality (when using the RoadScan system for asphalt temperature measurements)
- » **Daily job site report** in the form of a PDF file, which can be distributed by e-mail



Job site report

Paving parameters at a glance

At the end of a day's paving operations or some other time period entered by the user, the system automatically generates a job site report. There is no need to actively log into the system for this.

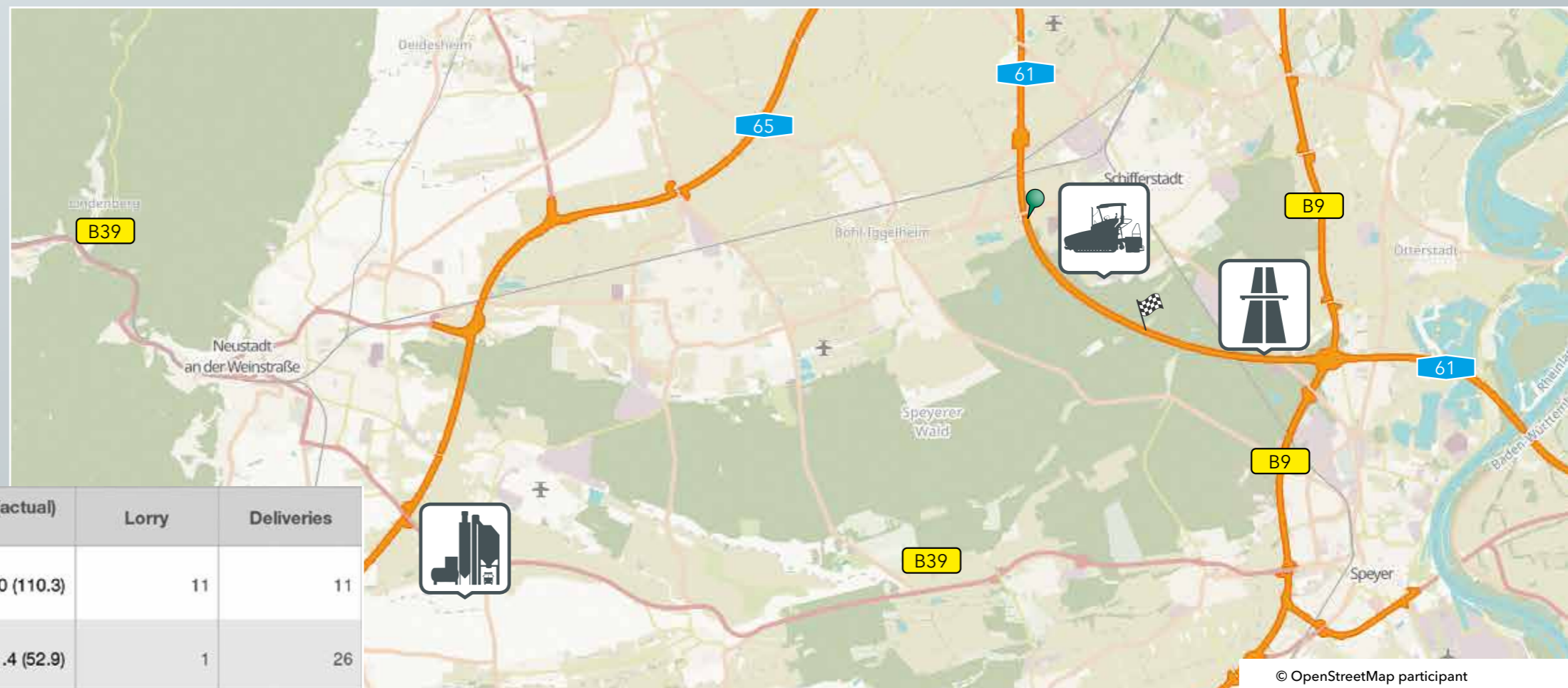
The first page of the report shows a summary of all paving parameters: job site, duration, paving performance data, mixing plant deliveries, etc. Details on logistics, paving efficiency and paving temperature are shown on the subsequent pages.

The map shows the geographical location and the section of the construction project worked by the paver. The start and end points of the paver assignment are marked.

Duration:	15.03.2019 07:54 to 18:54
Paving length specified (actual):	2211 (2198) m
Paving surface area specified (actual):	9134 (8971) m ²
Layer thickness:	4.0 cm
Lorries/number of delivery notes specified (actual):	10 (12) Lorries with (37) delivery notes
Quantity specified (actual):	868.11 (952.98) t
Ø Screed width specified (actual):	4.13 (4.08) m
Ø Pave speed specified (actual):	4.7 (4.0) m/min
Ø Laydown rate specified (actual):	97.6 (103.0) t/h
Ø Areal density specified (actual):	95.0 (106.2) kg/m ²
CO2:	- kg

Users can see the most important information on mix delivery in a clearly structured table

Type of mix	Target quantity (actual) [t]	Target output (actual) [t/h]	Lorry	Deliveries
AC 11 DS	282.54 (282.54)	107.0 (110.3)	11	11
AC 11 DS	585.57 (670.44)	111.4 (52.9)	1	26





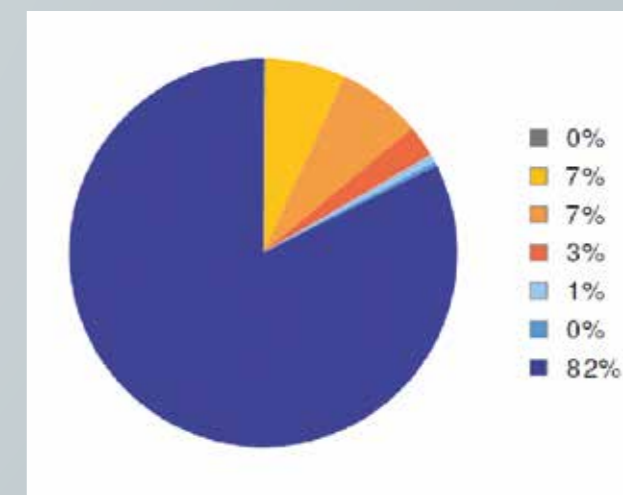
Job site report

Paving efficiency

The starting point for optimizing a job site operation is to analyse paving efficiency. Users need to be able to see how many hours of a job were taken up by standstills and non-paving times in order to identify potentials for improvement in the value chain and take the necessary steps.

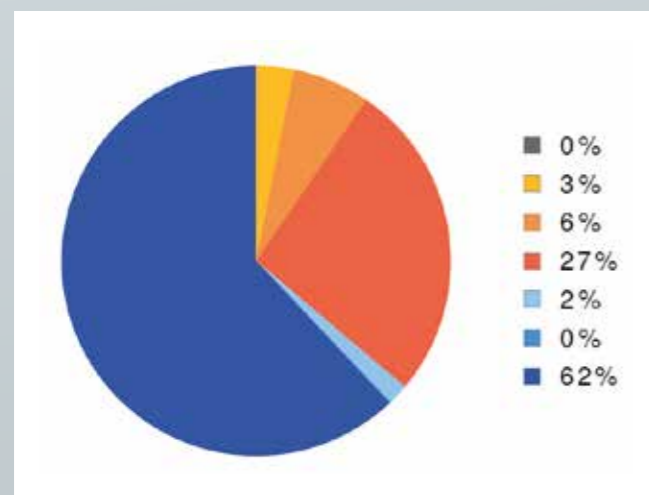
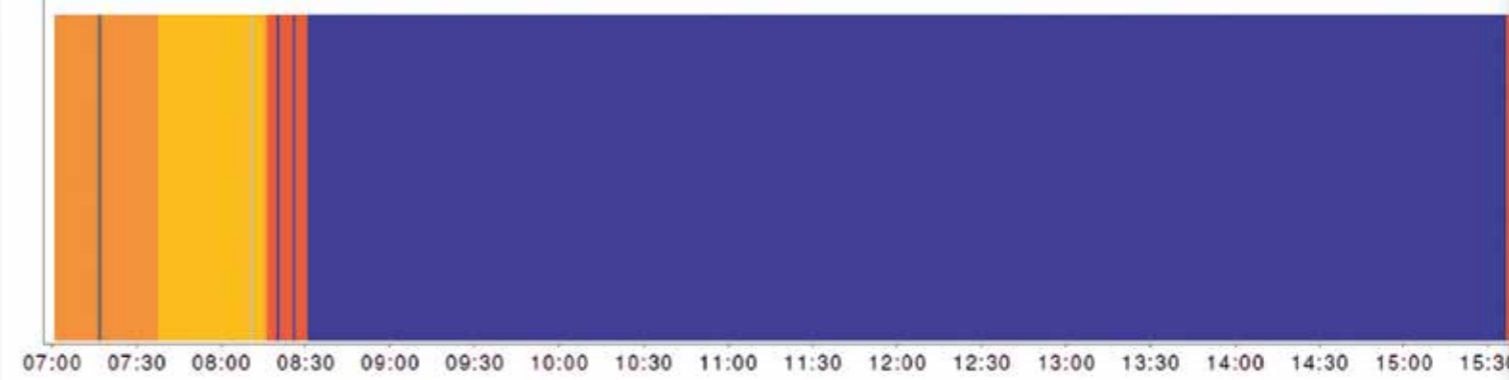
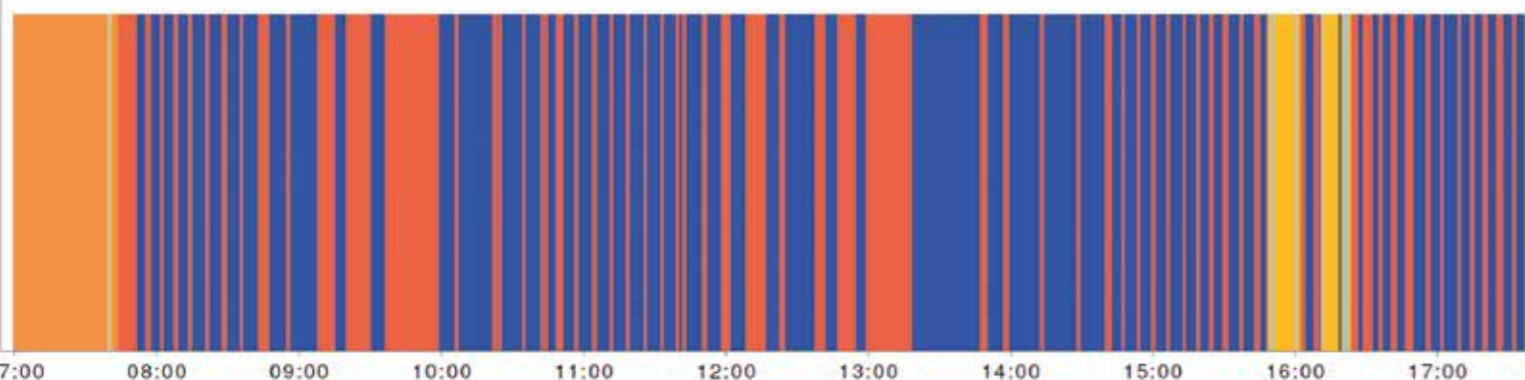
WITOS Paving Plus is a product developed by VÖGELE. As the machine manufacturer and technology leader, we can supply you with all the most important machine data, such as idling, repositioning or paving times, for analysis with WITOS Paving Docu. Status data are calculated automatically via the operating mode switch on the paver and visualized in informative, intuitive diagrams.

Regular analysis of the logistics processes and paving measures improves our customers' paving efficiency and hence also their cost-efficiency.



■ Engine off ■ Idling ■ Idling "Job Site" mode ■ Idling "Positioning" mode ■ Idling "Pave" mode ■ "Job Site" mode
■ "Positioning" mode ■ "Pave" mode

■ Engine off ■ Idling ■ Idling "Job Site" mode ■ Idling "Positioning" mode ■ Idling "Pave" mode ■ "Job Site" mode
■ "Positioning" mode ■ "Pave" mode



Visualization of typical daily paving operations: paving work only accounts for 62% of the working day. The paver spends about one-third of its time idling and waiting, for instance for mix.

WITOS Paving Plus supports the analysis of the construction project and helps site managers to better coordinate and optimize logistics processes.



Job site report

Paving temperature

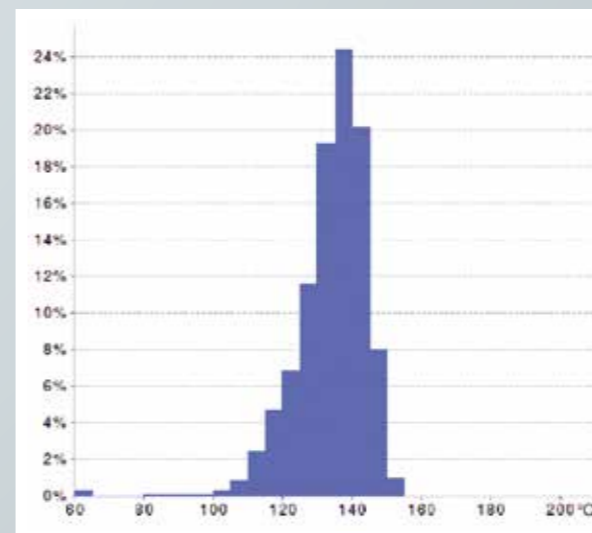
Making quality measurable is one of the major challenges for contractors and clients worldwide. In road construction, it is particularly important to verify that a constant temperature of the freshly paved asphalt has been maintained, as this is a key criterion for ensuring the quality and durability of roads.

Visualizing paving temperature in a diagram helps to answer the following questions:

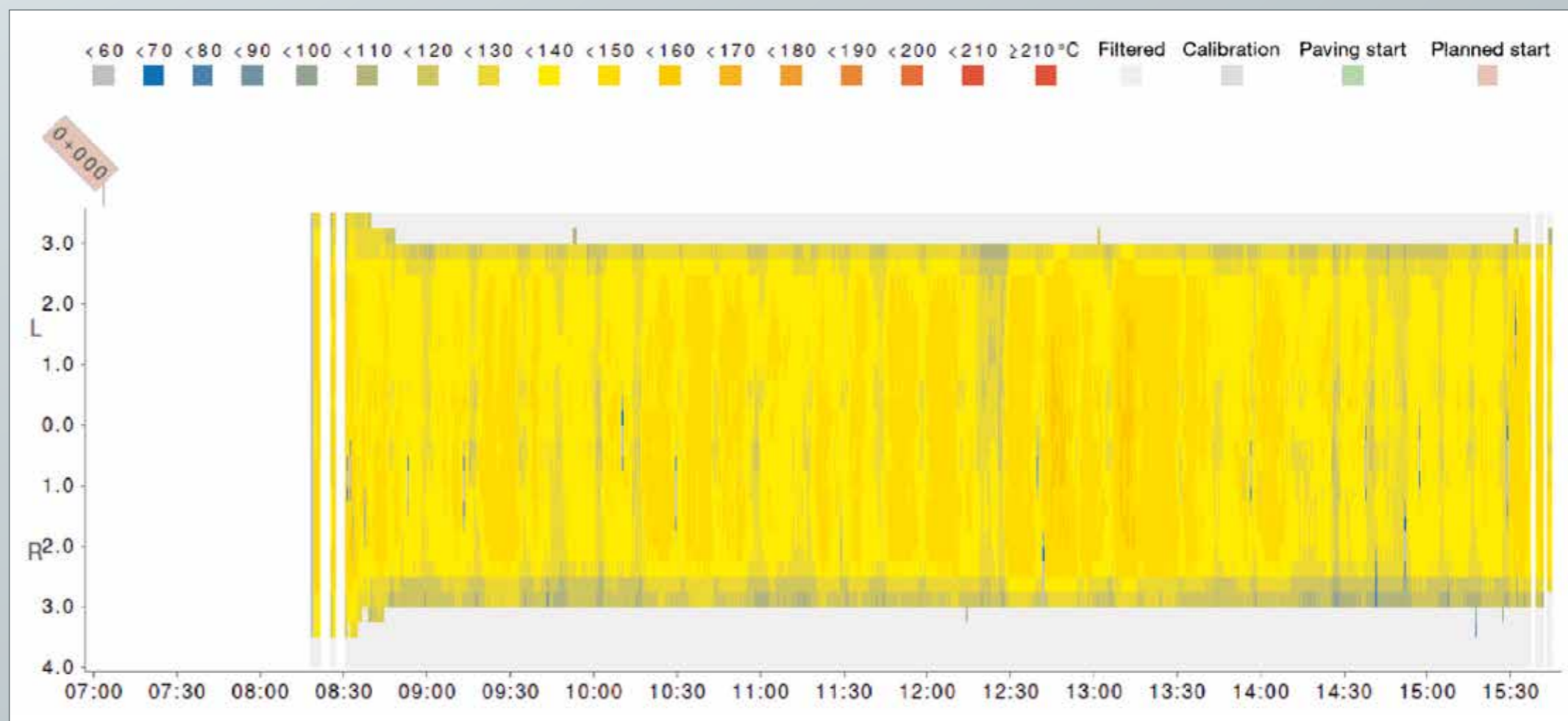
- » Was the paved material hot enough at all times?
- » Was material that was too cold (or even too hot) paved in some spots?
- » What could have caused the paving material to cool?
- » How much of the mix was paved in the specified temperature range?

The temperature strip in the diagram on the right shows that the temperature was very homogeneous overall. There are very few deviations into colder areas (blue) and these are visible more at the edges of the paved section. Hotter material was delivered at 12.50 and 1.15 pm. Data from the delivery notes can be used to check which lorry delivered this material.

Depending on the mix, there is a specific temperature range that is particularly suitable for paving and subsequent compaction. Thanks to the visualization of temperatures, a comparison can be made with the specified values.



The bar chart on the left shows that 98% of the paved material was within the target temperature range.





Job site report

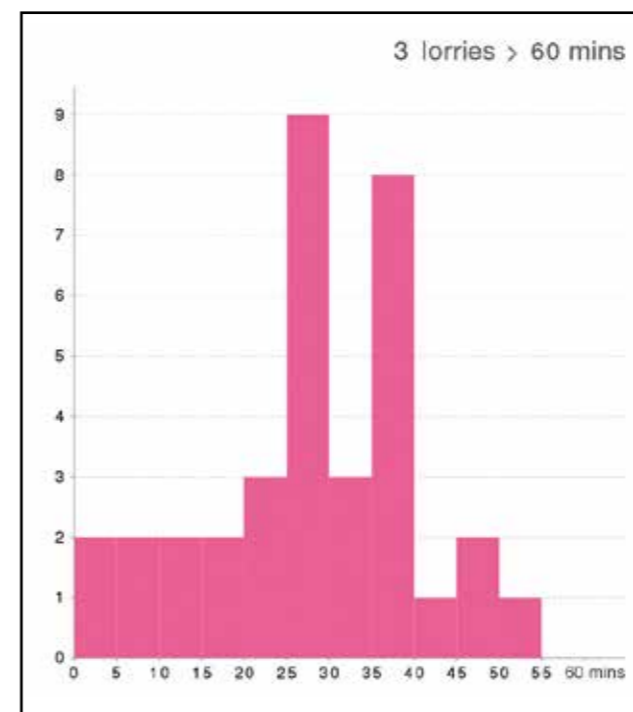
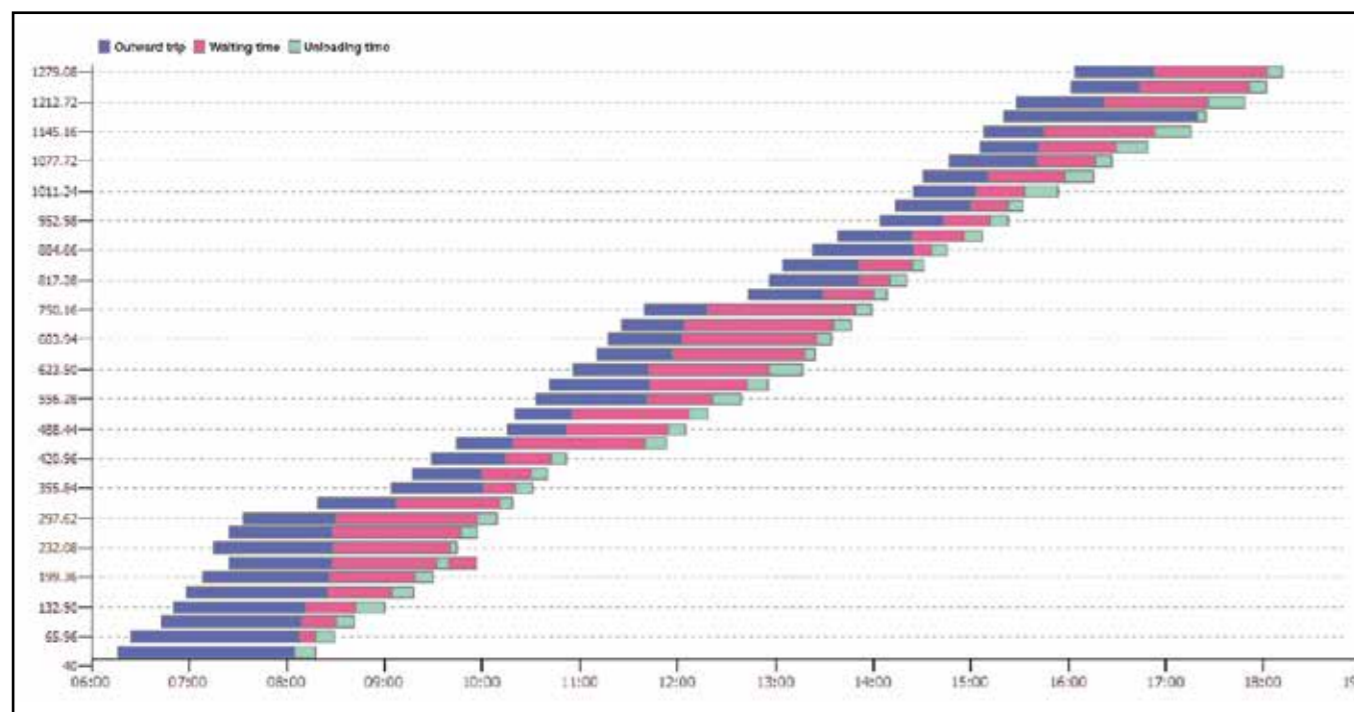
Feed lorry delivery chain

Delivery logistics is a decisive factor in job site organization. If the delivery chain is well-timed, the paver always has a sufficient supply of mix. The continuous flow of material avoids waiting times caused by standstills, idling, positioning again, etc. A non-stop paving process is the best prerequisite for maintaining a homogeneous mix. In this way, the paved surface can be optimally prepared for the subsequent roller passes. The result is a durable carriageway with high load-bearing capacity.

The progression chart on the right documents how many lorries were at the job site at what time.

The bar chart below shows the number of lorries on the Y-axis as a function of the respective waiting times at a job site on the X-axis.

Example: two lorries each waited over 5, 10, 15, 20 minutes. Nine lorries waited over 25 minutes.



Comparing the arrival, waiting and unloading times of the lorries with the data on paving temperatures reveals weak points in the delivery chain. Why was the paving material too cold? Did a lorry arrive at the job site too late? Or was it waiting too long? This provides a basis for optimizing logistics.

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