



Digital Productivity
A Digital Mine Solution from
Stone Three and
Wabtec's Digital Mine

WabtecCorp.com

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AI



Digital Mine Productivity Solutions

Enhancing your Bottomline





Digital Productivity enhancing your Bottomline

The operating climate for mining facilities has never been more challenging. Mine sites are faced with cost volatility, shrinking profit margins, and constantly changing buyer preferences. Operational and capital costs keep ballooning every day – not to mention the burden that lost-time injuries and unplanned downtime can place on an already strained budget. Add in the expense of equipment failure as well as maintenance and energy costs, and it becomes clear just how pressure-driven the industry is by margins and revenue alone.

Given the exorbitant costs of building new plants, the only workable solution is for mining companies to work with the assets they already have – to increase their productivity and their efficiency in order to extract as much value as possible from their existing capacity.

It's here where Wabtec Digital Mine & Stone Three come in – offering end-to-end “Rock to Dock” digital solutions that help to increase yield and optimize processes through real time analysis and instant problem-solving. In this way, our solutions can help to decrease unplanned downtime and maximize productivity, while saving millions in the process.



Digital Productivity

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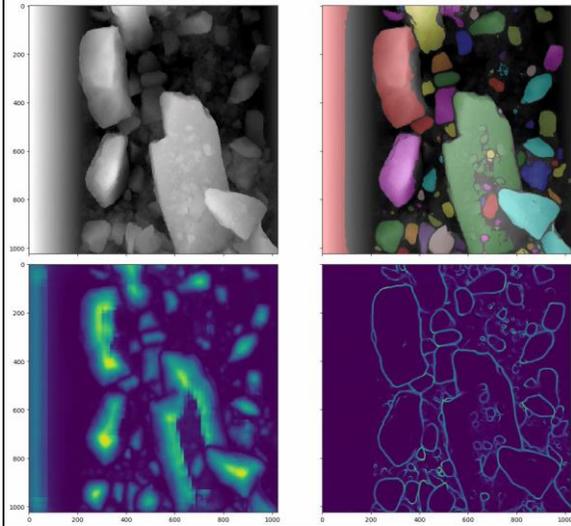
Our solutions: Offer a broad range of digital productivity solutions that have been adopted by leading Mining Operations. Our solutions leverage the power of machine vision and learning, smart sensor technology, consultative data analytics and advanced process control services to help monitor your process plant. Our Solutions include:

- AI-augmented smart sensors for Particle Size Analysis (PSA), flotation, and critical asset measurements
- Enablers for remote processing and asset monitoring and diagnostics
- Packaged crushing, grinding and flotation solutions and services
- Process stabilization and optimization
- Predictive analytics and real time intervention models

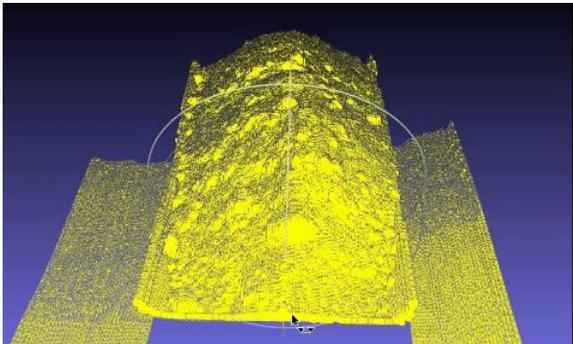
Differentiating Features

- Process Engineering Mindset
- Smart Sensor Technology
- Prepackaged Analytics with Data Science capabilities
- Continuous Improvement Monitoring & Recommendations
- Process familiarity through regular monitoring
- Site-Specific deep dives
- Actionable Advisories for improved Process Performance
- Advanced Process Control w/ Smart Sensor technology precision

Crusher Diagnostics & Analytic Solutions



Truck Particle Size



Process Health: Sensors

Crushing: A healthy mineral extraction process relies on optimal crusher performance – and complications like improper gap settings, irregular feed size and unpredictable liner wear can compromise this. Leveraging machine vision Crusher Diagnostics and Analytics Solutions, you'll be able to continuously monitor the feed and product size distribution in real time, while improving your maintenance planning, increasing your crusher uptime, and optimizing your crusher control at the same time.

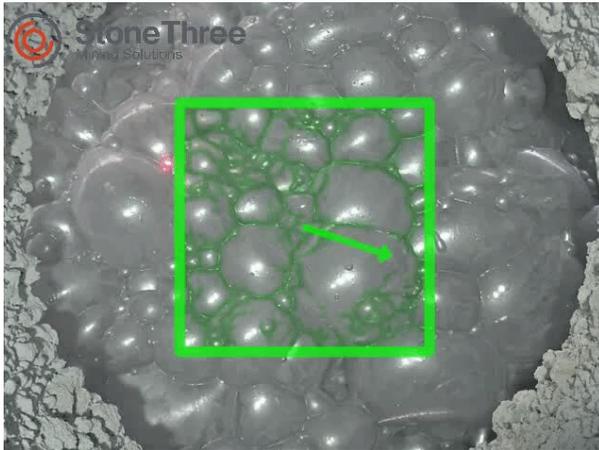
“This installation added tremendous value to the current operation. The results are better plant stability and capability.”
- Douglas Davidson (CTO Namkwa Diamonds)

Truck Particle Size Measurement Solutions: A working primary crusher is of key importance in the mining industry serving as a vital link between the mine and plant for managing ore size. If rocks or other materials are oversized when entering the crusher, they can cause significant damage, which can be costly to repair. The Truck Particle Size Measurement Solution uses machine vision laser-based sensors to measure and monitor the particle size distribution of ore as it goes into the crusher, improving uptime, increasing efficiency and providing actionable feedback.

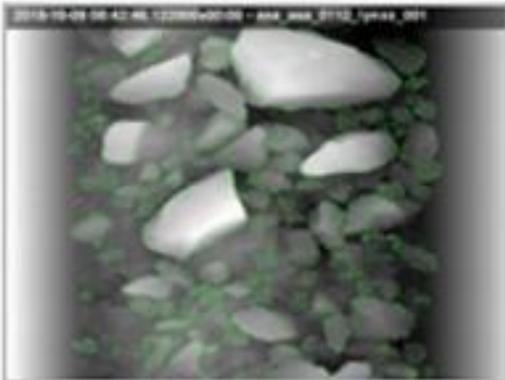
“The Truck PSD solution aided in quantifying crusher maintenance effects via customized visualization services”

-Plant Engineer

Flotation Diagnostics & Analytics Solutions



Grinding Diagnostics & Analytics Solutions



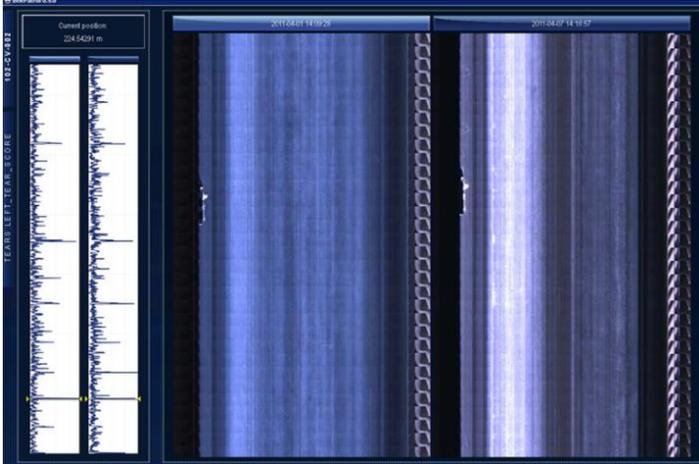
Process Health: Sensors

Flotation: Looking for increased recovery and more accurate grade control with your froth flotation process? Our Flotation Diagnostics and Analytics Solution uses a machine vision system to continuously monitor your key froth and pulp metrics, allowing for automatic detection of suboptimal froth states, measurement of mass pull per cell and estimation of grade and recovery, ultimately resulting in improved flotation circuit control overall.

The Bubble Sizer is a portable devices used to acquire information on the size and distribution of the bubbles and superficial gas velocity in flotation cells. This is then used to decide optimal frother and depressant dosage for improved froth stability and grade.

Grinding: Grinding mills are costly to run, and so ensuring their ongoing efficiency and productivity is vitally important. Irregular feed size can lead to inefficient grinding and reduced throughput, which can ultimately cause damage, delays, and unforeseen expenses. With the Milling Diagnostics and Analytics Solution, you'll be able to use the machine vision system to continuously monitor your feed size distribution and detect oversized materials in time, improving your mill's performance and your uptime as well.

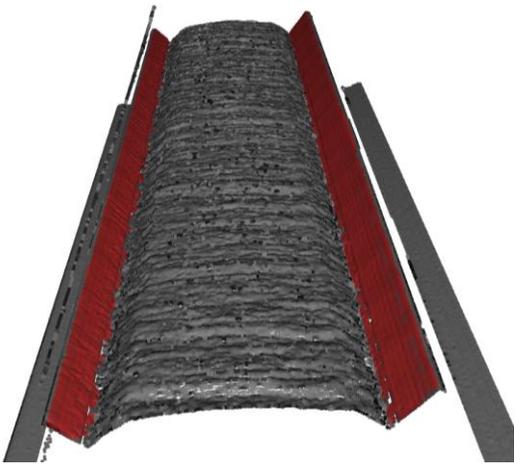
Conveyor Belt Condition Monitoring Solutions



Process Health: Conveyor Belts

Conveyor Belt: Managing your key assets is always vital to keeping costs down on site, particularly when it comes to conveyor belts. Belt failures can be dangerous, disruptive and costly – but can be prevented. Our machine vision system, the Belt Condition Monitoring Solution will identify surface features on your conveyor belts, such as splices, tears and edge deformations, while detecting belt drift at the same time. This type of enhanced early detection helps to simplify the belt inspection process, resulting in improved maintenance scheduling and helping to keep costs and downtime at a minimum.

- Reduce Damage on belt
- Reduction in safety risks
- Proactively detect potential belt failures



“Typical costs associated with standing time can run up to R1M per hour. A single belt failure can take up to 12 hours to repair.”

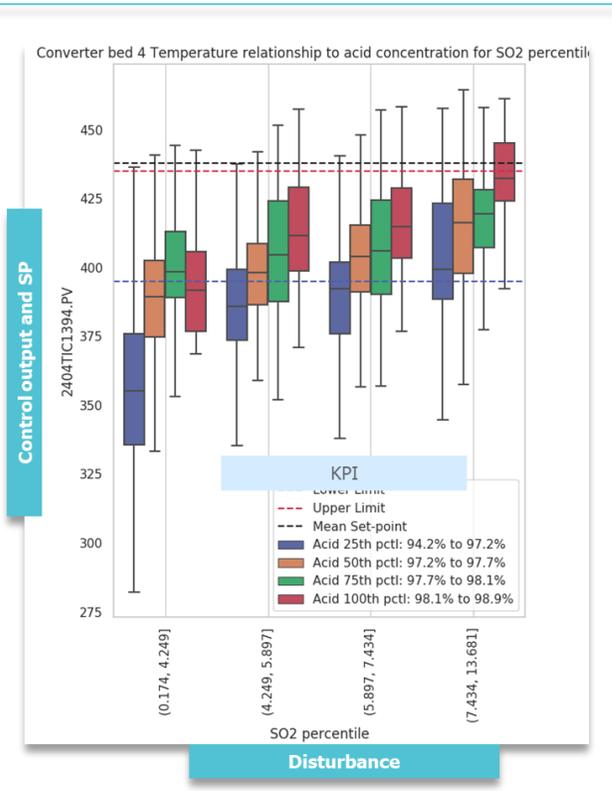
- Maintenance Engineer

Summary of Process Health Solutions

	Truck Payload	Crushing	Grinding	Flotation
Common Challenges	<ul style="list-style-type: none"> • Over/ Underloading • Uneven loading • Sub-optimal blasting • Oversized material 	<ul style="list-style-type: none"> • Crusher blockage & damage • Sub-optimal crushing • Screen panel failure • Conveyor failures 	<ul style="list-style-type: none"> • Sub-optimal milling • Poor fines-to-coarse material ratio in SAG/FAG mills 	<ul style="list-style-type: none"> • Poor recovery • Poor mass pull • Sliming • Unstable froth
Smart Sensors	<ul style="list-style-type: none"> • Truck Particle Size & Volume 	<ul style="list-style-type: none"> • Conveyor Particle Size & Volume • Conveyor Health 	<ul style="list-style-type: none"> • Conveyor Particle Size & Volume • Conveyor Health 	<ul style="list-style-type: none"> • Froth Speed, Height, Bubble Size; Pulp Bubble Size, Jg, Gas Holdup
Process Analytics	<ul style="list-style-type: none"> • Oversize alerts • Over/ under/ uneven loading alerts • Fleet efficiency • Fragmentation feedback 	<ul style="list-style-type: none"> • Oversize alert • Reduction ratio • Crusher gap monitoring 	<ul style="list-style-type: none"> • Oversize alerts • Fines to coarse ratio • Feed PSD vs throughput 	<ul style="list-style-type: none"> • Froth states • Mass pull per cell optimisation • Grade & Recovery optimisation
Expert Services	<p>Process Plant Analysis Data Science and Expert Process Monitoring & Advisories</p>			

Control & Process Health Monitoring

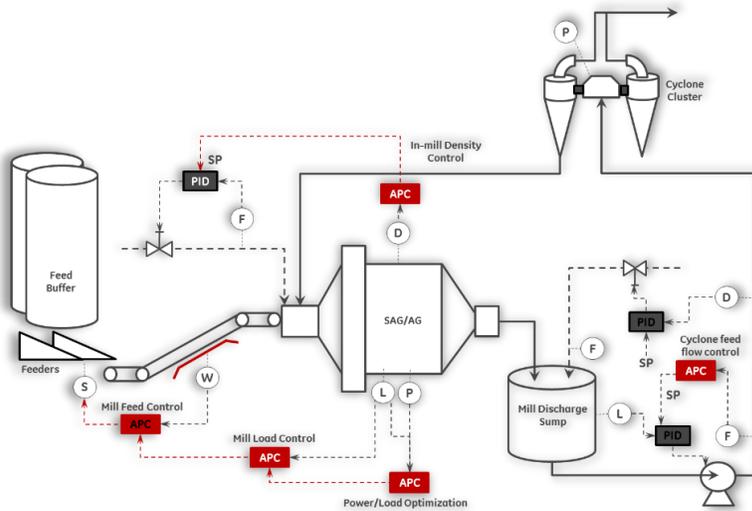
Control Loop Performance Monitoring



Control Loop Performance Monitoring: Monitor and ensure health and performance of base-layer PID control loops to avoid variation & increase capacity. Deploy analytics to monitor the health & performance of the process, PID control loops, and process equipment health and sensors/data quality.

- 14% of loops had excessive valve wear
- 15% of valves showed problems with stiction and hysteresis
- 16% of loops were in manual mode
- 16% of loops had severe tuning problems
- 24% of loop's controller outputs were saturated most of the time
- 41% of loops oscillated due to tuning problems, coupling, disturbances and actuator problems

Advanced Process Control



Control & Process Health Monitoring

Advanced Process Control: Leverage advanced process control across mining processes and business systems to bring substantial energy savings, increase ore recovery and optimize product mix based on real-time data on pricing and ore feed properties.

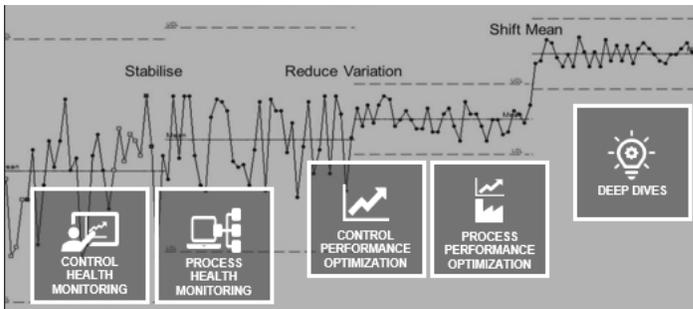
How to achieve a higher level of automation and optimization:

Grinding circuit

A milling circuit is a complex, multi-variable interacting system. Dynamically changing ore conditions and wear parameters pose particular problems for grinding controllers. By integrating data, the automation system optimizes grinding controls, avoiding the need for constant manual tuning. Feed-forward data on ore quality and quantity, rock face production rates or market demand rates can be used to optimize the grinding stage.

Flotation circuit

Automatic control can lead to significant flotation performance improvement. The controller needs to stabilize the process and to maximize the concentrate production, while guaranteeing a minimum concentrate quality. This pushes the process to an upper limit operating point. To achieve this, optimal set points are automatically chosen by the controller. Online analyzers and blending algorithms reconcile actual feed with quality specifications for better predictability. APC manages blending, grinding and flotation in real-time.



Rapid deployment for Monitoring Critical Systems & Assets

WABTEC SOLUTIONS



REMOTE TOOLS

- Leveraging the power of the ecosystem to accelerate access to remote service tools and digital solutions across many areas of the mining flowsheet
- Equipping customers with the means to continue operating



OPERATIONAL SUPPORT

- Working with Mining Operators to ensure access to field operators and service engineers
- Delivering control room livestreams, operational insights, process data and plant KPI's remotely

IMMEDIATE IMPLEMENTATION AT SITE



PROCESS & CONTROL LOOPS

- Identify and focus on poor performing control loops, stabilize base control layer, recommend control optimization
- Add intelligent insights with data analysis & deep dive unit operations using analytics to detect process upsets



ASSET PREDICTIVE ANALYTICS

- Using extensive mining blueprint library we can quickly implement support for critical mining equipment w/ our Asset Starter Kit.
- Real-time performance data is combined with external data to predict failures assets.

COLLABORATION AND EXPERTISE



MONITORING CENTERS

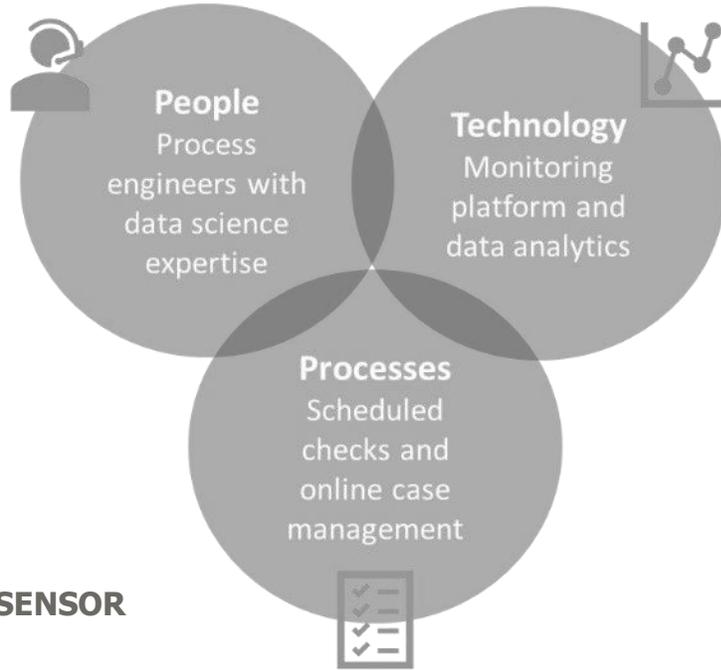
- Wabtec has remote monitoring centers dedicated to the mining industry to connect people, process and technology
- Providing experts in mining processes and automation for Asset Operations Performance Management.



CUSTOMER COLLABORATION

- With 24/7 access, Wabtec domain experts and data scientists use digital technologies to help customers monitor assets, processes and risks
- Derive insights from data & suggest mitigating actions

Digital Productivity: Remote Monitoring & Diagnostics



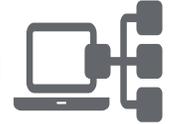
SMART SENSOR HEALTH

STABILIZE CONTROL



- ✓ Prioritize worst performing loops
- ✓ Regular SME interaction and diagnosis

DATA AND INSTRUMENTATION HEALTH



- ✓ Foundation for control and process health
- ✓ Regular data integrity checks
- ✓ Prioritize instrumentation maintenance

OPTIMIZE CONTROL LOOPS

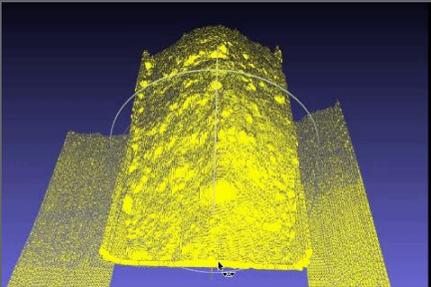


- ✓ Recommend control set points for measured disturbances
- ✓ Remote tuning

PROCESS HEALTH



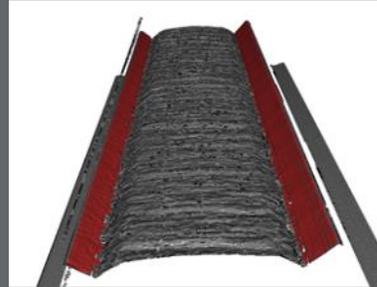
- ✓ Identify and prioritize process upsets
- ✓ Automated notification of undesirable process states



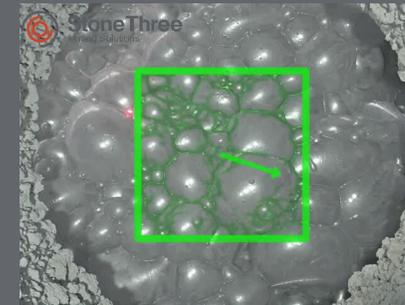
Volume



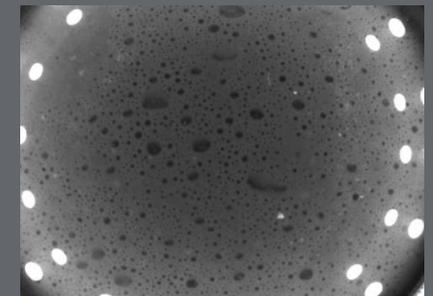
Particle Size



Conveyor Health



Froth Metrics



Pulp Metrics

Customer Corner

Overview & Challenge: A plant was seeking support from a digital technology supplier to help stabilize and optimize their process. The plant was experiencing challenges with process instability, unpredictability and unplanned shutdowns.

In the past, automation issues raised were by operators and followed up by ad-hoc analysis in Historian trends. Also, there was little confidence in their PID control as the process operated manually.

Solution: Wabtec Digital Mine was called to solve the challenge. The Wabtec Services team implemented a 3 Month tuning campaign for Process Stabilization and then a 6 Month monitoring campaign for remote monitoring of control loops for continuous improvement

Outcome: Estimated \$1MM in benefits resulting in

- Tuning campaign \$250k
- 21 Catches leading to corrective action with measurable catches \$750k
- 7% decrease in excessive controller error & 0.8% increase in production
- Weekly rhythm using software tools to prioritize actions
- Data driven process improvement projects from Big Data studies
- Cultural change: Buy-in into benefits of automation





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With a highly skilled team of specialists in place, Stone Three & Wabtec Digital Mine are able to support the global mining industry with end-to-end services that include process diagnostics and integration with advanced process control platforms, in order to deliver actionable insights and outcomes-based solutions. Or to put it more simply, we're dedicated to developing technology that not only increases your productivity significantly, it saves you valuable time and money as well.

Advantages

- High Reliability Smart Sensors
- Proven in use 25 years
- Extensive remote control & process health monitoring
- Data ingestion and analytic capabilities
- SME Domain Expertise

Outcomes

- 1-3% recovery increase when integrated with mass pull APC
- 2% increase in crusher availability via monitoring & diagnostics
- An annual savings of \$5M in conveyor belt stops
- 200 Systems installed to date with a 95% renewal

Get Started with Us Today!

Rapid Remote Implementation for **Process Health Starter Kit**

Remote Monitoring

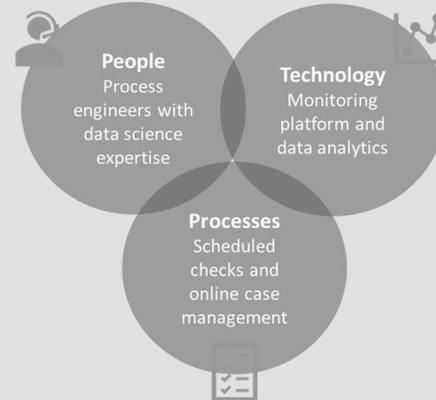
+

Data Ingestion & Analysis

+ Domain & SME Expertise

=

Complete Benefits



- **Scheduled checks of process operation to identify upsets**
- **Weekly process health summary reports**
- **Operational states and drivers in month 2**
- **Case Management**
- **Weekly meetings**

Extend your process team, we can monitor and report on process health and notify you on changes to operational states



Identify pain points



Notification on changes



Improve Staff Productivity

About Wabtec

Wabtec Corporation (NYSE: WAB) is a leading global provider of equipment, systems, digital solutions and value-added services for freight and transit rail. Drawing on nearly four centuries of collective experience across Wabtec, GE Transportation and Falvey Transport, the company has unmatched digital expertise, technological innovation, and world-class manufacturing and services, enabling the digital-rail-and-transit ecosystems.

Wabtec is focused on performance that drives progress, creating transportation solutions that move and improve the world. The freight portfolio features a comprehensive line of locomotives, software applications and a broad selection of mission-critical controls systems, including Positive

Train Control (PTC). The transit portfolio provides highly-engineered systems and services to virtually every major rail transit system around the world, supplying an integrated series of components for buses and all train-related market segments that deliver safety, efficiency and passenger comfort.

Along with its industry-leading portfolio of products and solutions for the rail and transit industries, Wabtec is a leader in mining, marine and industrial solutions. Wabtec has approximately 27,000 employees in facilities throughout the world.

Visit the company's new website at:
WabtecCorp.com

For more information

Please call 1-888-264-0011
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