AVEVAWORLD

Enhancing Crane Maintenance Efficiency through Predictive Analytics:

A Case Study on AVEVA's Application in Non-Continuous Operations

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Plant Director
Çolakoğlu Metalurji 80 yıl

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TEB

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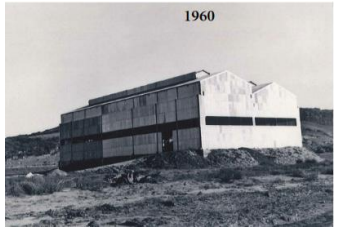
BİLTİM

Asia Minor Mining

Çolakoğlu Dış Ticaret

- Çolakoğlu is one of the diversified conglomerates in Turkey involved in steel production, shipping, energy, information systems, mining, froeing trade and finance.
- Its steel company Çolakoğlu Metalurji is ranked in the top 10 in the industrial ranking, while its bank is ranked as number 6 in the finance sector in Turkey.
- Today the group employs 12,000 people.

Çolakoğlu Metalurji



1945
Steel trade in Karaköy

1960
Investment of Rolling Mill

1969
Meltshop Investment in Diliskelesi / Gebze

1983
Start to Export Markets

1985
Start-up of Wire Rod Production

1990
Start-up of Rebar Production

2007
New Meltshop

2010
Start-up of Hot Rolled Coil Production

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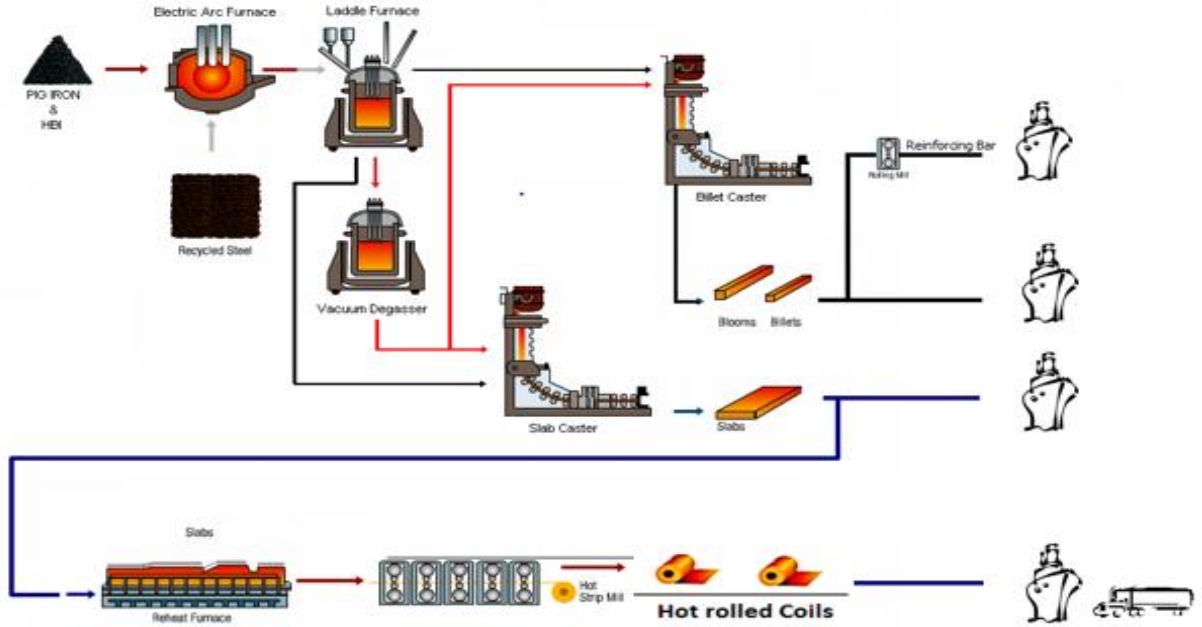
Production Flowchart



Meltshop Cranes

- Capacity: 500 / 120 / 30 Tons
- Span: 27.000 mm
- Top Of Rail: 35.000 mm
- Bridge Wheels: 32
- Bridge Gearboxes: 8
- 500 Ton Hoisting Gearboxes: 3
- 500 Ton Drums: 2
- Wire Rope Assembly: 4 // 32

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Problem Description

- The 2 cranes of the meltshop are very critical for our operations
- Any disturbance of the crane operation directly affects production and meltshop sequence
- Identifying problems before they occur and resolving those issues in a planned manner is crucial to increase the operation time of meltshop

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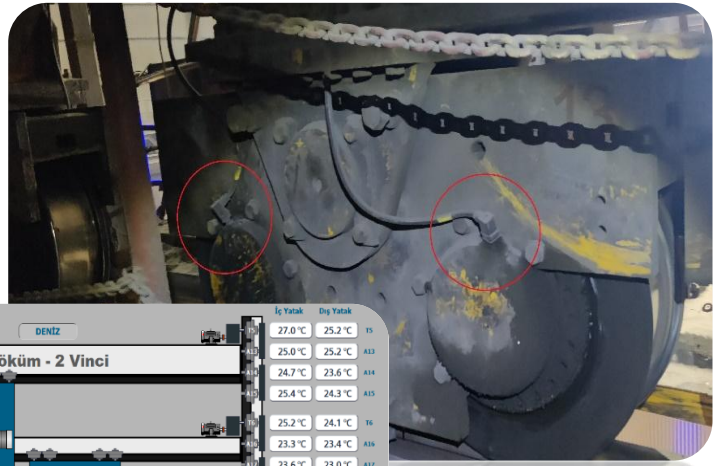
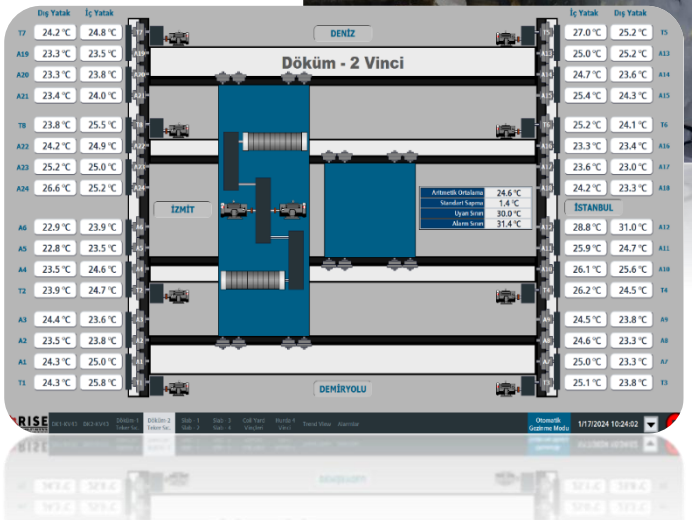
Communication Infrastructure of the Condition Monitoring System

The data from sensors installed on casting cranes and slab cranes' online condition monitoring systems are transmitted wirelessly.

When vibration and temperature levels reach predefined alarm limits, work orders are automatically generated in the CMMS (Computerized Maintenance Management System) for further action.





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AVEVA™ Predictive Analytics

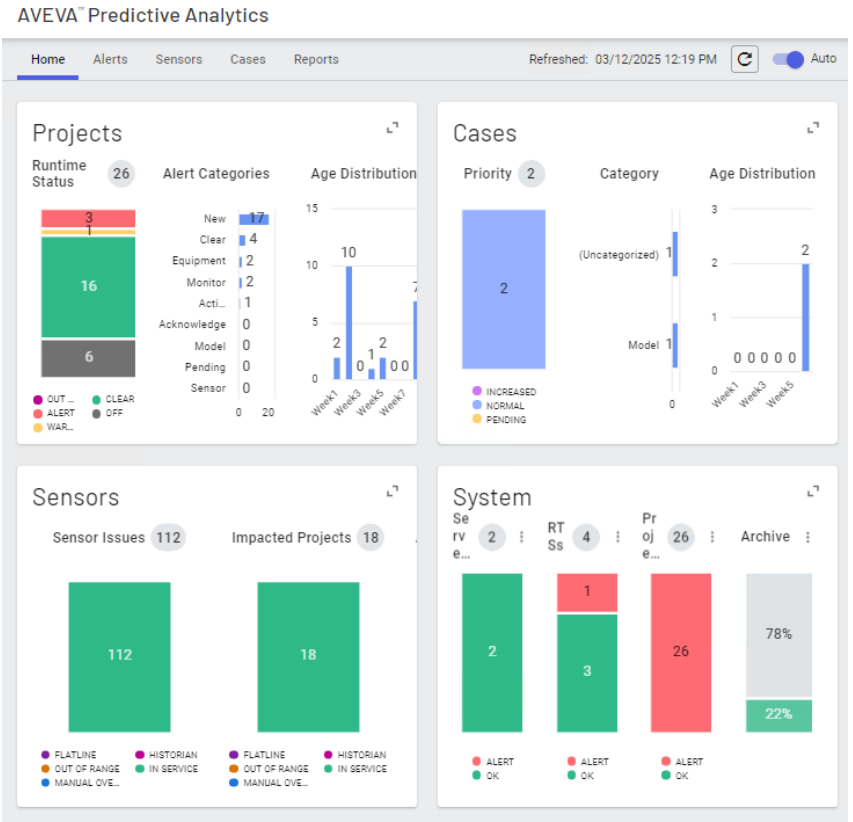
Predictive maintenance (PdM) is revolutionizing industrial maintenance practices by enabling proactive interventions based on data-driven insights.

What is unique about this project:

→ Contrary to traditionally implemented 24/7 production systems, AVEVA Predictive Analytics is implemented for cranes, where operations are non-continuous and often unscheduled.

This adaptation was a challenge for our engineering team and also AVEVA team to address non-standard operational environments and deliver impactful results.

At June of 2024, models were fully installed and operational.

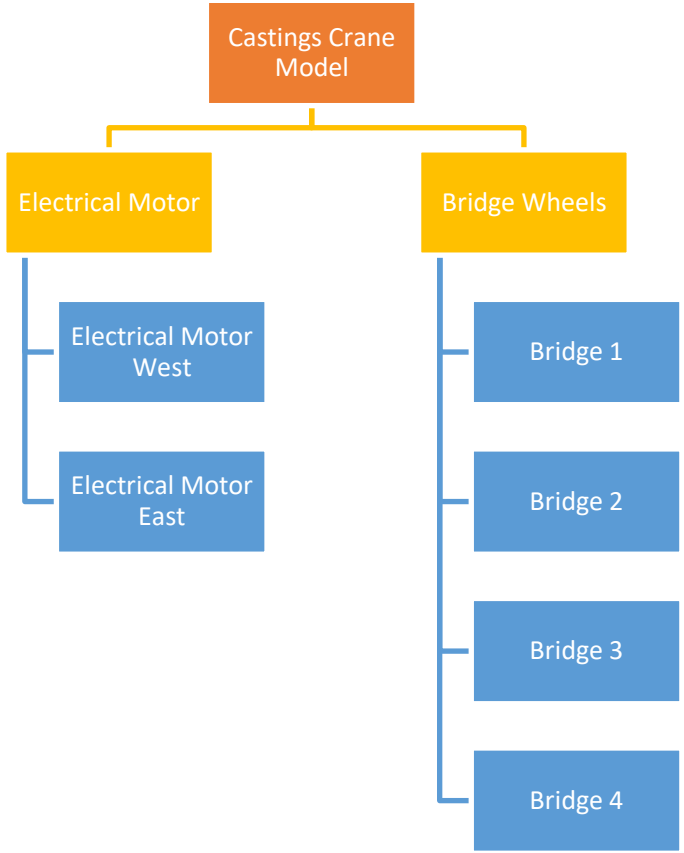


Model Design

To achieve a detailed and comprehensive analysis, the crane was divided into six primary components, each modeled separately: two electrical motors and four bridge. This modular approach enabled a targeted evaluation of each subsystem, ensuring a thorough assessment of the crane's overall performance and reliability.

- **Electrical Motors**: Key parameters monitored include motor speed, motor temperature, and motor bearing vibrations. Vibrations were further categorized into velocity, acceleration, and defect coefficient metrics to ensure granular analysis.

- **Bridge Wheels**: The calculations for bridge wheels focused on monitoring wheel temperatures and analyzing their condition. These parameters were essential for identifying overheating issues, and predicting potential failures.



Algorithm

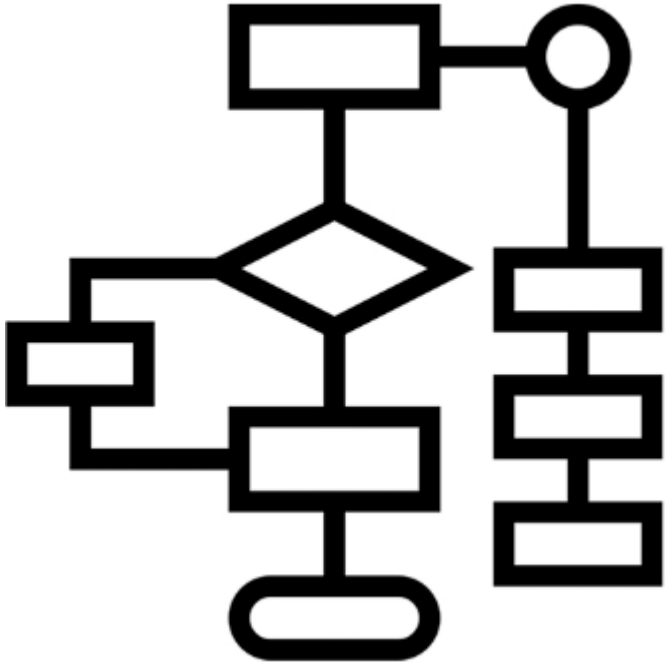
The algorithm utilized for this model is Locality Sensitive Hashing (LSH) algorithm.

This algorithm clusters the training data and identifies anomalies by determining whether real-time data falls within or outside the defined healthy cluster.

If real-time data deviates from the healthy cluster, it is marked as unhealthy, and an alarm indicator is generated. However, this alarm is not immediately displayed to the client based on a single instance of unhealthy data. Instead, the system adopts an event-based evaluation strategy.

Due to the irregular and short-duration nature of crane operations, an event-based evaluation strategy is used, where events are defined as 5 consecutive data points, triggering an alarm or warning if 3 out of 5 points are unhealthy.

This approach ensures reliable anomaly detection tailored to the crane's operational context, minimizing false positives while providing actionable insights.

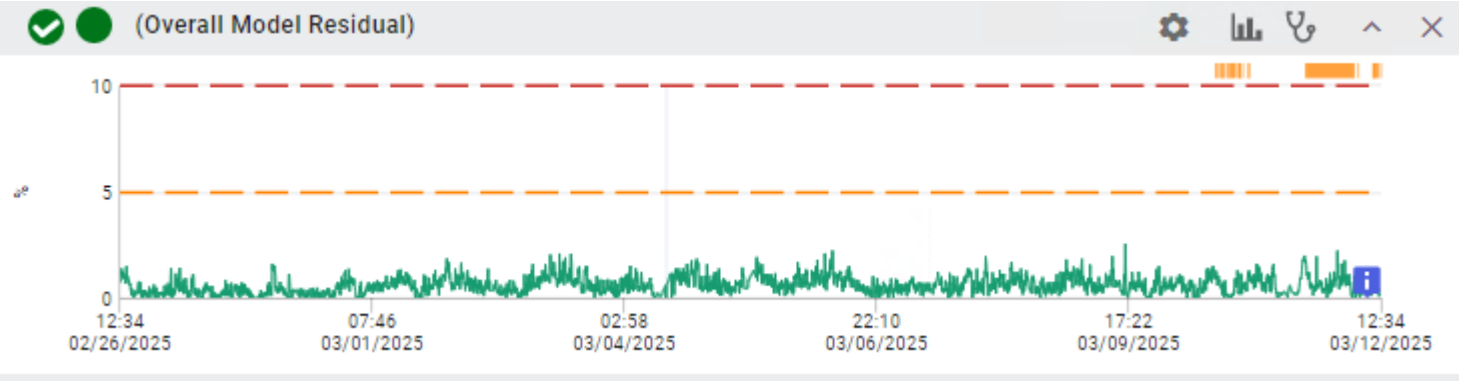


OMR – Overall Model Residual

In AVEVA Predictive Analytics, the Overall Model Residual (OMR) is a core metric used to evaluate the health of an asset and detect anomalies.

The OMR represents the difference between the predicted values of a model and the actual sensor data collected from the asset.

Essentially, it quantifies how well the model's predictions align with the real-world operation of the equipment.



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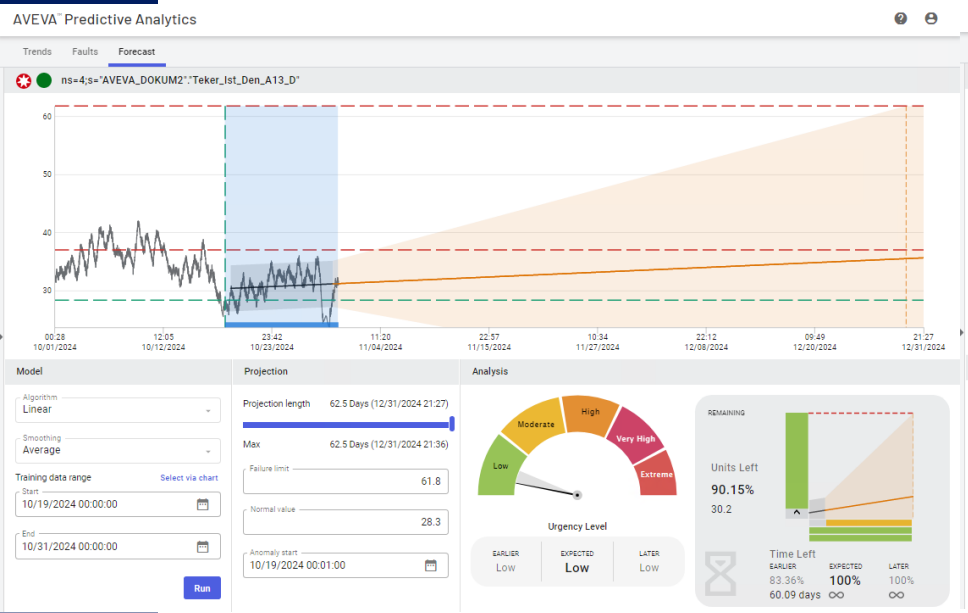
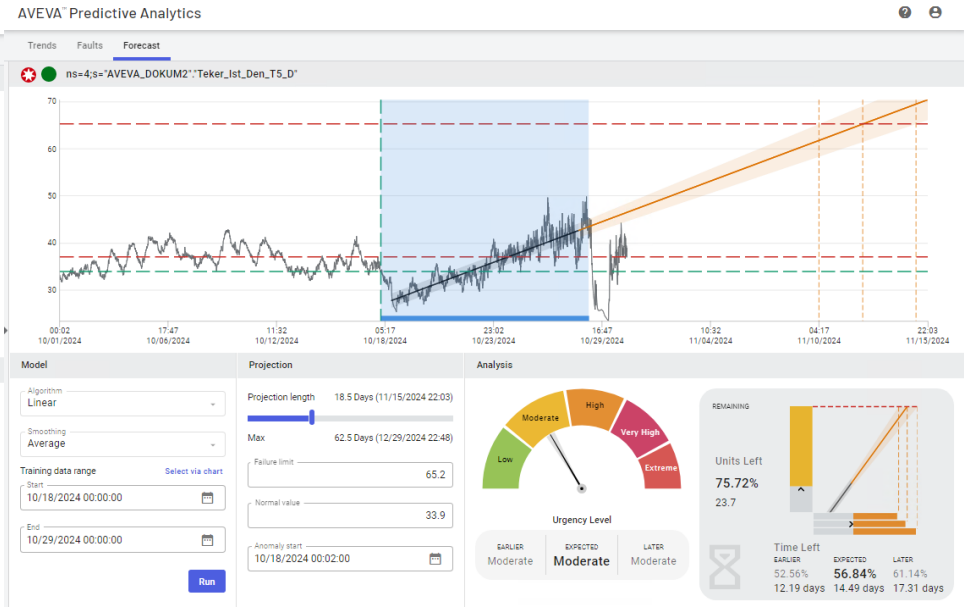
Case Study

The AVEVA system detected an increase in OMR values for the bridge starting from 10/23/2024 and triggered an alarm. Upon examining the wheel temperatures, the crane maintenance engineer identified two anomaly sources causing the increase in OMR values: Wheel-West-South-Idle13-Outer (Teker_Ist_Den_13_D - 33.6%) and Wheel-West-South-Driven5-Outer (Teker_Ist_Den_T5_D - 17.1%).

Case Study

Then, the engineer conducted a forecast study for these two anomalous wheels, a low risk level was determined for Wheel-West-North-Idle13-Outer, while a moderate risk level was identified for Wheel-West-North-Driven5-Outer.

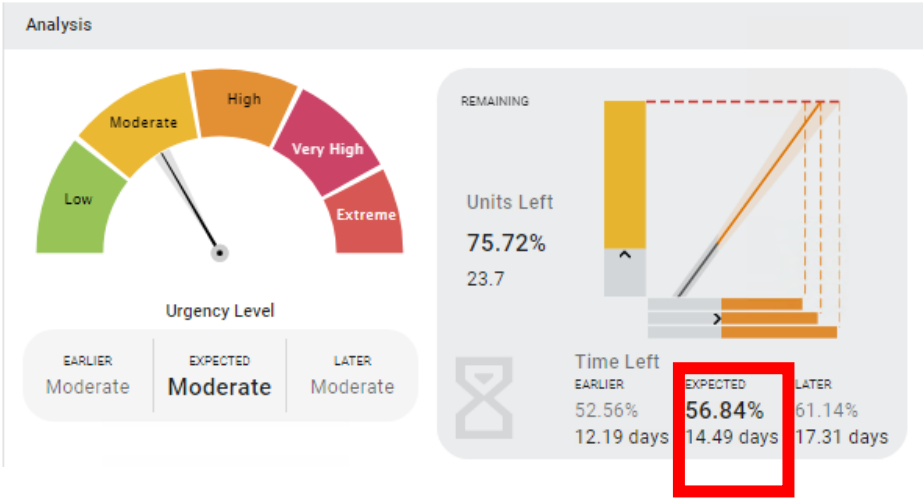




Case Study

The forecast study also provided expected lifespan information. It was predicted that a failure related to this wheel would occur within approximately 15 days.

The engineer urgently added the wheel replacement to the next maintenance schedule, and on 11/04/2024, the crane was taken into maintenance.

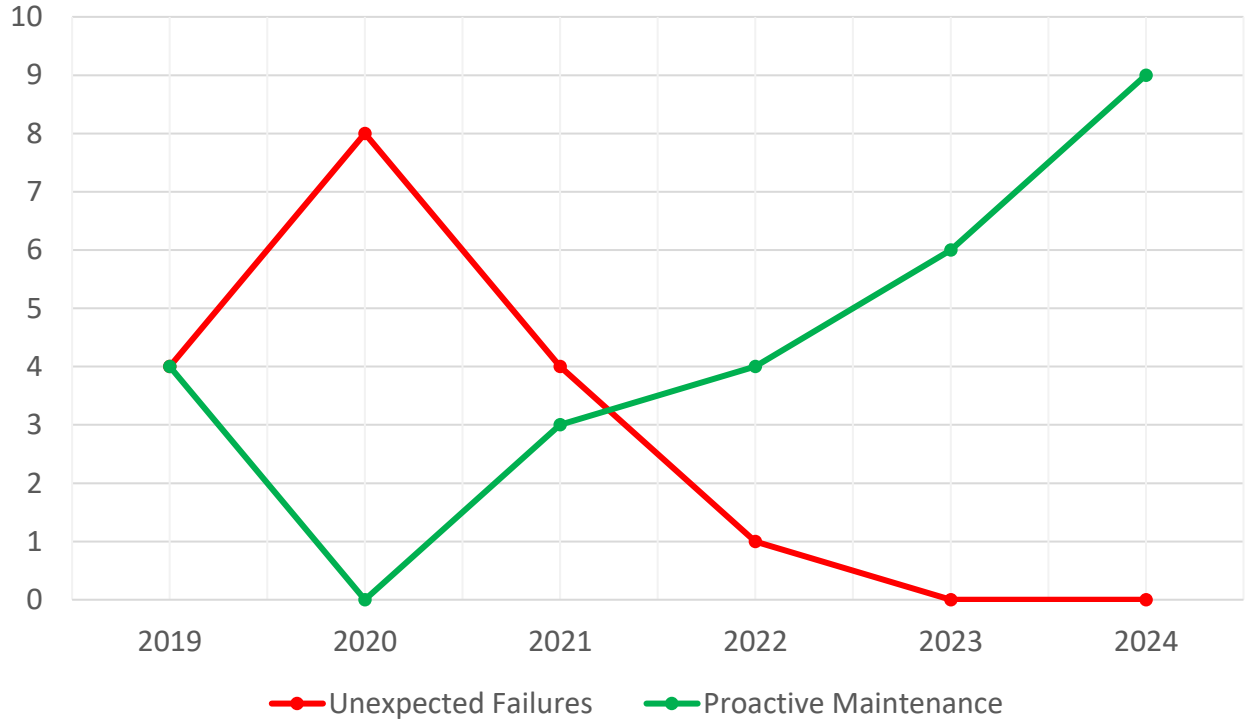


Case Study

Indeed, after the replacement of the Wheel-West-North-Driven5-Outer wheel, when the removed wheel was disassembled, flaking damage was found on the inner ring of the bearing.

AVEVA Predictive Analytics System predicted the incoming failure **successfully**.

Wheel Failure Records Of Casting 2 Crane Over the Years



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MINING, MINERALS & METALS | TURKEY

Çolakoğlu Metallurgy drives efficiency and sustainability in steel manufacturing

Challenge

- Lack of visibility into crane parameters and prediction of future anomalies
- Without real-time monitoring and predictive insights, minor issues escalate into major failures, increasing operational risks and downtime

Solution

- Ensuring seamless integration of SCADA and AVEVA™ Predictive Analytics while maintaining accurate and high-quality data for reliable predictions

Results

- **Eliminated unexpected failures of crane wheels due to implementations of SCADA and AVEVA Predictive Analytics**
- **Overcame resistance to change, ensuring that maintenance teams effectively utilize predictive insights for proactive decision-making**
- **Through timely and actionable insights from AVEVA Predictive Analytics, 348.1 tons of steel production loss was prevented**

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Thank you

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