

CASE STUDY

How Gerdau Saved \$3/ton

Fero helped lower costs by minimizing alloy usage in real time

\$3/ton

in savings

15%

reduced quality variation

500K lbs

reduced environmentally demanding raw material

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The Challenge

Reducing raw material costs without risking quality

Gerdau is one of the world's largest producers of long steel, specialty steel, and iron ore, with mills in 10 countries and over 30,000 employees. The company makes made-to-order special steel products for the most demanding applications in the automotive, commercial vehicle, agricultural, construction, and energy markets. After decades of running a strong process, they, like many other steel firms, faced a distinctly modern challenge: with raw material prices skyrocketing, they had to lower costs quickly in order to remain competitive, without risking the high-quality steel their customers expected.

Using traditional process improvement tools, Gerdau's engineers had already been able to optimize production as much as possible. Yet these optimizations were conservative to ensure high quality production under all circumstances. With multiple sources of variation affecting production, including scrap quality and rolling mill parameters, raw material limits had been carefully calculated to avoid even the slightest chance of failure. To further reduce costs, the team needed a tool that could adapt in real time to shifting conditions on the factory floor.

Company Stats

30,000+
employees
across 337 units

\$15 Billion
annual revenue

Steel
industry

“ We're running a lean process: we have much less room for error than ever before. We need to reduce raw material costs, while delivering the quality customers expect. By combining process knowledge with Fero's ML tool, we not only optimized our alloy usage and saved costs - we also reduced the workload on the process engineers and made huge product capability improvements.”

JENA KREUZER, PROCESS ENGINEER

The Solution

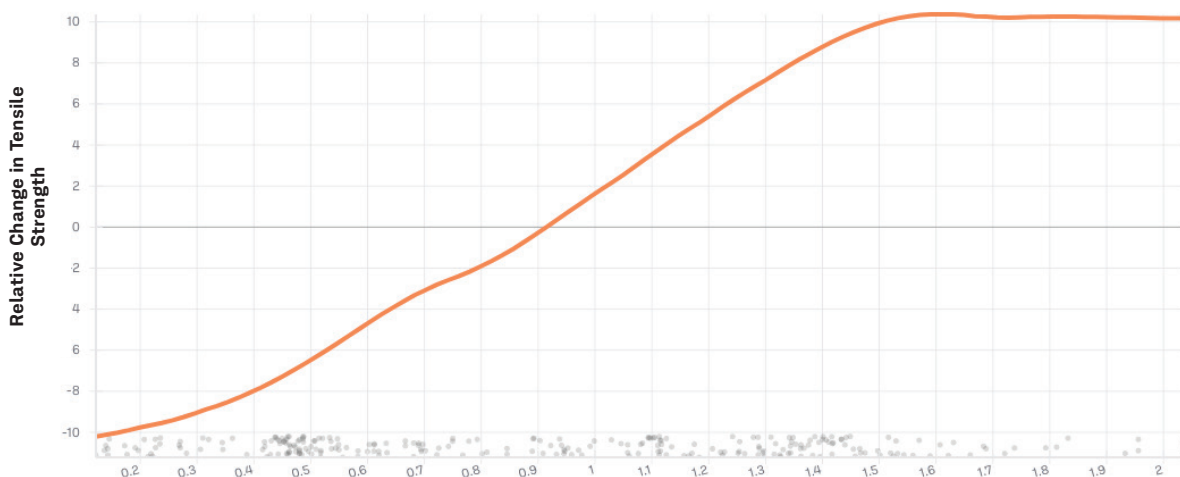
Live optimization in the melt shop

Since the team was already used to optimizing processes with Six Sigma, using Fero felt like a natural extension of those analyses. Using the Fero software, engineers at a Gerdau plant were able to create a digital twin of their unique process in minutes, without needing to write a single line of code. Fero's white-box machine learning models then determined the optimal amount of raw materials for each heat and delivered these recommendations to operators in real time. Using Fero's recommendations, the team was able to save \$3 per ton of steel in raw material costs and reduce quality variation by 15%.

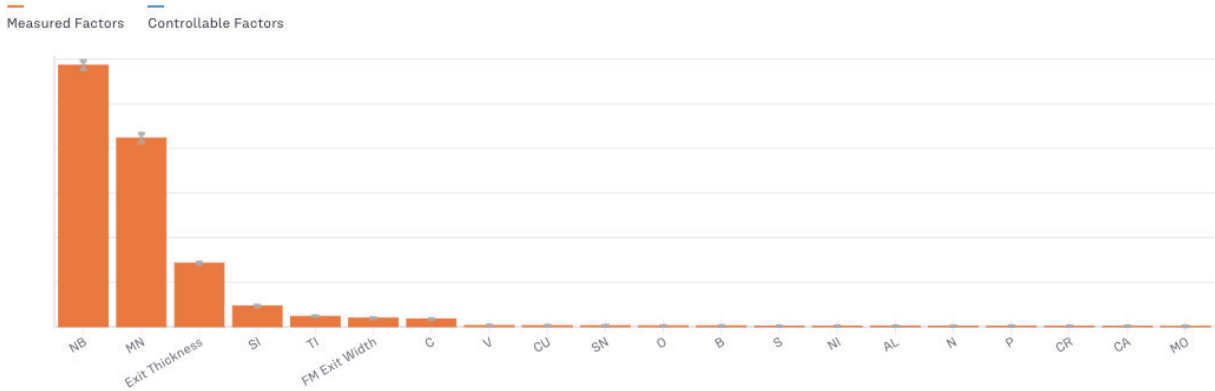
Before building this live recommendation model, the engineers wanted to start out by establishing that the model had a basic understanding of their process. In order to do this, they uploaded their historical alloy addition data into Fero and built a static model to investigate the relationships between melt shop alloy additions and end-of-line mechanical properties.

The white-box ML model reinforced their understanding of the process, as well as providing them with a new tool to investigate what was happening in the mill in a new way and assess what next steps they could take. Quantifying uncertainty around predictions and input factors allowed them to gain trust in the analysis quickly and understand where they could draw clear conclusions as opposed to general abstractions.

TARGET: Tensile Strength
FACTOR: MN



TARGET: Yield Strength

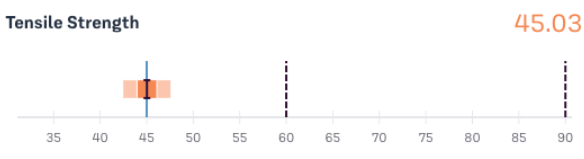


Once the Gerdau engineers had a ML model they trusted, they tested its reliability by simulating changes in rolling mill parameters. This allowed them to evaluate potential regrading scenarios and realize value from what would have otherwise been scrapped heats. With a black-box solution, they would only have been able to make simple predictions. But with Fero, they were able to see exactly what would happen in every scenario thanks to the software's underlying white-box machine learning technology.

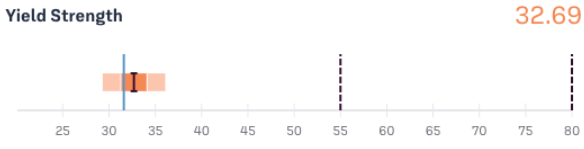
Prediction Simulator – Point Prediction Results



Predictions



Details
Measured: 45
5% Percentile: 42.43
25% Percentile: 43.96
Mean: 45.03
75% Percentile: 46.1
95% Percentile: 47.63



Details
Measured: 31.6
5% Percentile: 29.25
25% Percentile: 31.27
Mean: 32.69
75% Percentile: 34.11
95% Percentile: 36.13

Report
 No changes to display.
 All factors currently match those from the loaded source. Any changes you make below will be noted here.

Factors

<p>MN Value: 0.6458 ✎ Cost: \$2,000/unit ✎</p> <input type="range"/>	<p>NB Value: 0 ✎ Cost: \$20,000/unit ✎</p> <input type="range"/>	<p>Exit Thickness Value: 34.6 ✎ Cost: — ✎</p> <input type="range"/>
<p>SI Value: 0.2037 ✎ Cost: \$7,000/unit ✎</p> <input type="range"/>	<p>C Value: 0.1124 ✎ Cost: \$200/unit ✎</p> <input type="range"/>	<p>TI Value: 0.0013 ✎ Cost: \$13,000/unit ✎</p> <input type="range"/>

To realize the full potential of Fero, Gerdau connected it to their live data and had ladle chemistry samples sent to the software in real time. Fero was able to analyze those samples and recommend the lowest-cost alloy addition that would guarantee quality, in mere seconds. Crucially, Fero was able to give actionable insights in the short but critical time window when the operators could still alter the chemistry: all they had to do was look at a screen in the control room and they'd find the Fero recommendation for that heat.

Sample L1			
KPI MN	Fero Aim 1.15	Current 1.1	↑ Increase by 0.05
KPI NB	Fero Aim 0.071	Current 0.06	↑ Increase by 0.011
KPI TI	Fero Aim 0.005	Current 0.005	No action needed

Test Time **4 months, 1 week ago**
(16 Feb 2023 17:00:00)

Sample **L1**

LOAD PREDICTION

Tensile Strength 59.07

Yield Strength 54.45

LIVE OPTIMIZATION **LOAD OPTIMUM**

Minimum COST: **3789.35 \$/unit**

This optimization is valid for factor values:

MN (COST: 2000 \$/unit) : 1.152174

NB (COST: 20000 \$/unit) : 0.071

TI (COST: 13000 \$/unit) : 0.005

Other values are shown to the right.

Tensile Strength 66.9

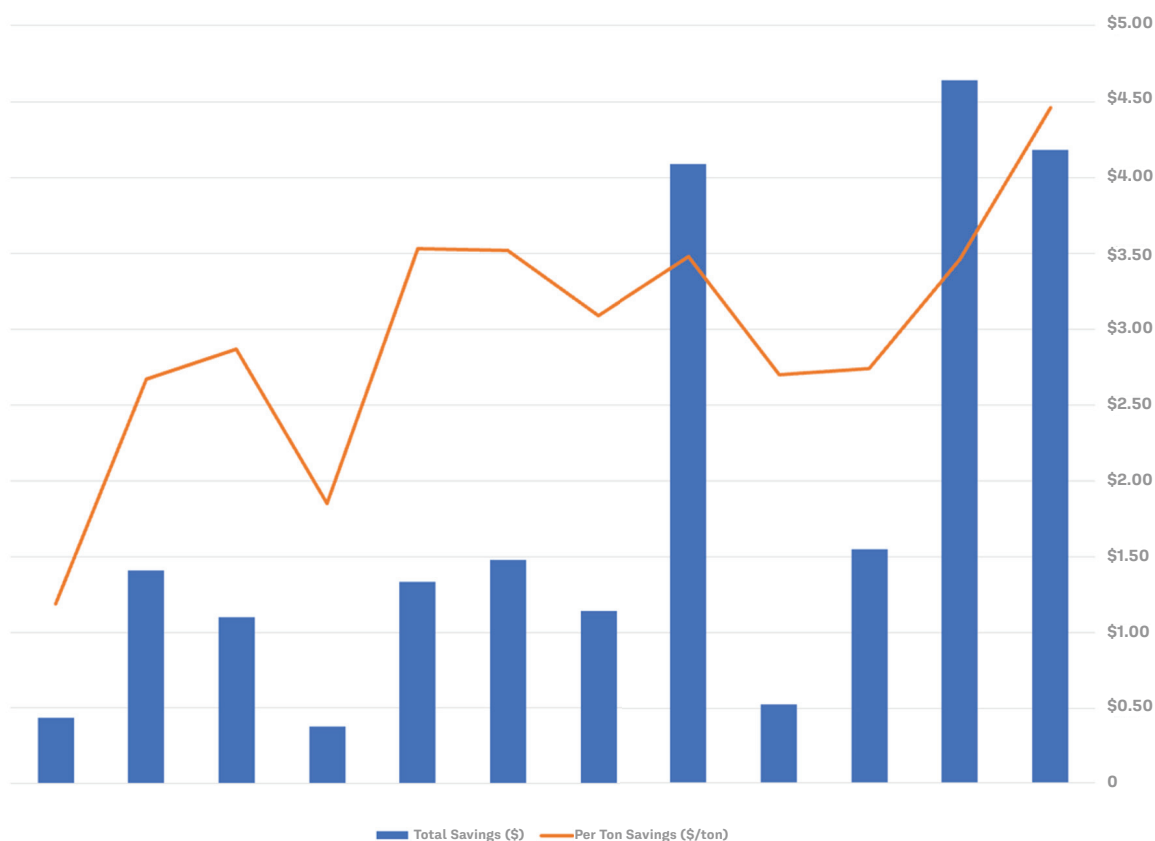
Yield Strength 64.13

Factor	Value
MN	1.1
NB	0.06
Exit Thickness	28.5
SI	0.0215
C	0.0957
TI	0.005
FM Exit Width	1052
V	0.0601
CR	0.0261
SN	0.0013
CU	0.0388

The result

\$3/ton in savings... and a more efficient process

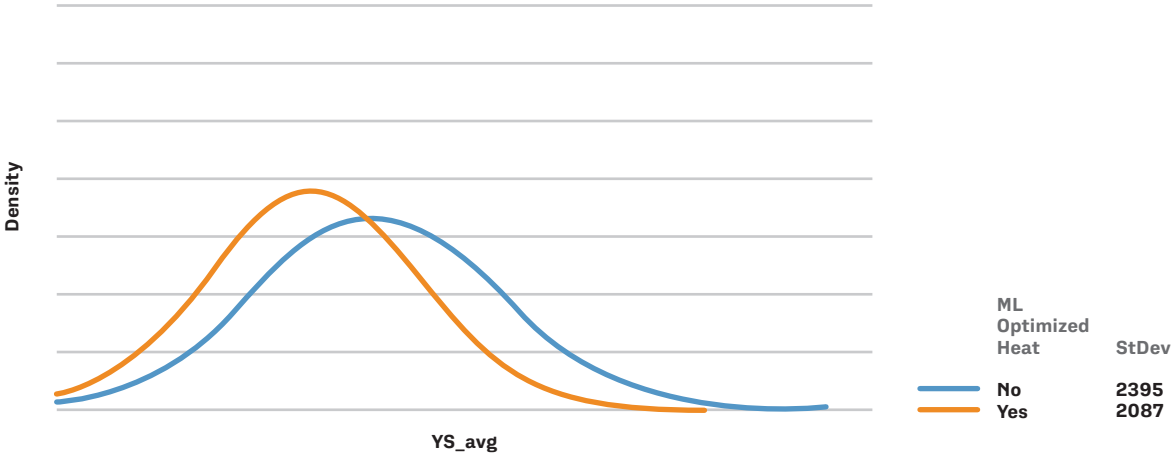
With Fero telling operators the minimum amount of alloy they needed to add to each heat in real time to meet quality specifications, the Gerdau team has been able to save \$3 per ton of steel in raw material costs. This number has only increased as a larger share of production uses the new workflow, gaining trust in the insights of white-box machine learning.



Moreover, by reducing raw material consumption, Gerdau saw the added benefit of lowering its emissions footprint. Reducing unnecessary alloy additions through Fero eliminated the need for mining and refining 500,000 pounds of raw material. If the software were employed for additional use cases, such as scrap rate reduction, furnace oxygen intake optimization, or galvanizing line energy minimization, the steel giant could see even more sustainability improvements hand in hand with increased profitability.

Not only has Fero’s machine learning solution helped save costs and emissions, it also improved quality consistency. Once operators began adjusting the chemistry on a heat-by-heat basis based on the software’s recommendations, the team observed a 15% reduction in quality variation.

Histogram of YS_avg



Comparing the distribution of yield strength in the products produced from heats that utilized ML recommendations versus those that adhered to grade book limits. There is a roughly 15% decrease in the yield strength variability in the optimized heats.

This finding attests to the increased flexibility of the operations team and their newly proactive approach to the process. The team is no longer in “firefighter mode,” but rather adapting seamlessly to raw material fluctuations and other natural sources of variability within the steel process, which has had a positive impact on many other aspects of their operations management.

Gerdaу’s success highlights that a streamlined operation, equipped with the appropriate tools, can lead to improved product quality and significant cost savings. Since 2018, Gerdaу has expanded the use of Fero to five other plants in North America and now leverages the tool as a scalable solution for other complex process challenges beyond raw material reduction, such as minimizing defects, improving energy efficiency, and enhancing production yield. This proactive approach ensures that Gerdaу remains at the forefront of innovation and drives long-term success for the company and its customers.

Fero Labs makes software that helps manufacturers find and eliminate process inefficiencies.

The human eye can't analyze all the data generated in a factory. With Fero, you can unlock new methods of cost and emissions reduction, while remaining confident that your product will stay within quality specifications.

Fero uses powerful white-box machine learning to provide context around every recommendation, empowering your team to understand the root cause of any issue and feel confident in production decisions. And with real-time optimization, you can see initial results in just a few hours.

Leading global manufacturers across the steel industry choose Fero to optimize production, including Gerdau, Tata, and Celsa Group. Solutions are also available for other industries including cement, food processing, and chemicals.

For more information, visit www.ferolabs.com.

The logo for Fero Labs, consisting of the word "fero" stacked above the word "labs", both in a lowercase, sans-serif font, enclosed within a white square.

fero
labs