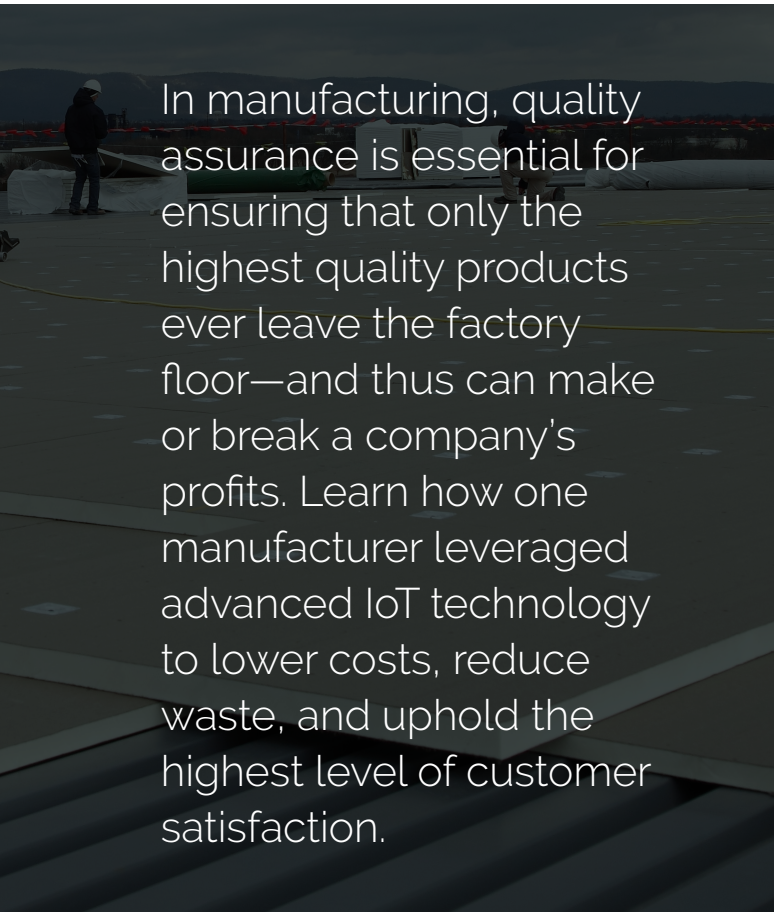
Carlisle Construction Materials Improves Quality Control with ThingWorx

The IoT Data Analysis Capabilities Help Carlisle Live Up to Its Reputation as a Customer Service Leader While Improving Processes for Frontline Workers



Carlisle Construction Materials (CCM) Knows the Roofing Business

If you've ever ducked into a nearby building to escape a passing shower or sought relief indoors after a long day in the sun, you likely felt grateful for the roof over your head—and there's a very good chance that Carlisle Construction Materials (CCM) had something to do with that.

Carlisle Construction Materials is a diversified manufacturer and supplier of premium building products and related technologies for the commercial and residential construction markets. Carlisle has been a recognized leader in the roofing industry for nearly half a century, offering high-performance single-ply roofing solutions that include EPDM, TPO, PVC, and metal roofing systems. Carlisle also offers a full line of polyisocyanurate and expanded polystyrene insulation, as well as a host of steepslope underlayments, duct sealants, adhesives, and hardware. In addition to roofing, Carlisle

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services the waterproofing, framing, and general construction industries. Every Carlisle Company offers sustainable, eco-friendly products that help reduce a building's carbon footprint and often minimize its energy consumption and costs.

Headquartered in Carlisle, Pennsylvania, the company has 50 manufacturing facilities across the U.S. in addition to several administrative office locations and international manufacturing operations.

A Clear Opportunity for Improving Operations and Emerging as Technology Leaders

In the roofing materials business, quality assurance is of the utmost importance, as faulty products can be extremely costly once they leave the factory. When this happens, the materials can lead to integrity failure of an entire roof, which can be catastrophic in both warranty fixes and customer satisfaction. This also negatively impacts productivity because time is spent making fixes rather than producing usable product, which then leads to direct financial losses.

What's more, identifying and preventing defective products during the manufacturing stage can be challenging. In Carlisle facilities, production lines are the length of a football field. Consequently, stopping and restarting production has always been a huge, costly effort, and one that impacts workers on the line. With their production lines producing more than 2 billion board feet of insulation each year, ensuring quality with mostly manual inspection systems has required an enormous amount of energy and focus from Carlisle.

In the past, Carlisle collected data from their manufacturing systems, but they sought a better method for acting on the data. There were a few known complications on the line that were investigated post-hoc, but using traditional methods, they weren't previously able to achieve immediate, real-time insight by linking the issue with the data. It was also a challenge for operators, engineers, and maintenance staff to access and leverage that data in consistent, reliable ways—much of the line work and data collection was done manually, and everyone had slightly different approaches.

To address some of these challenges in several plants, the Carlisle team implemented a standalone statistical process control (SPC) system—a method of quality control that employs statistical methods to monitor and control a process, helping to ensure that the process operates efficiently and produces more specification-conforming products with less waste.

Despite these efforts, the Carlisle team struggled with how many sensors and gauges to include and which variables to monitor. Ultimately, they didn't get the results they desired due to the lack of system integration, as well as the reality that most SPC software is based on batch manufacturing, rather than the continuous flow processing method used in Carlisle's plants. Overall, the SPC system didn't offer the flexibility needed to accurately measure process variability.

Still, Carlisle knew that within their machines was a huge amount of untapped information—data that could be leveraged to improve operations, standardize processes across plants, help floor operators do their jobs more easily, and maintain their high standards for customer satisfaction. They just needed the right platform for data analysis to get the ball rolling again.

Carlisle Turns to ThingWorx to Implement Statistical Process Control for Improved Quality Assurance

With some prior knowledge of ThingWorx—PTC's end-to-end industrial IoT platform for production and asset health analysis—the Carlisle team knew it could help not only improve quality control, but also play an important role in their overall digital transformation efforts. Starting with their Smithfield facility, Carlisle worked with PTC to pilot ThingWorx with the goal of eliminating quality issues in the field.

They began by installing ThingWorx across their single largest product line that produced polyisocyanurate rigid insulation. Working with PTC, they analyzed a large production dataset to determine which key attributes of production they needed to inspect more closely. With those findings, they leveraged ThingWorx to develop new SPC analytics to flag conditions outside the control limits that are likely to occur during the production process.

Carlisle worked closely with operators to understand what challenges they came across and how to use data to proactively identify them—seeking operator input here was critical for understanding the nuances, since they were the people closest to the process and their experience could be best utilized to build a solution.

They prototyped dashboards to give operators a view of production with real-time data, as well as up-to-the-minute predictions and alerts of imminent quality issues and contributing risk factors. Operators could quickly digest this information and use their expertise to adjust parameters such as line speed, temperature, thickness, and pressure.

The impact was immediately evident. "The SPC solution allowed us to analyze the data in a more significant way," says Tim Wickard, Director of Quality Services at Carlisle. "We started by looking at hundreds of parameters, then narrowed down to a couple dozen, and eventually down to just a few key parameters. We kept narrowing down the data to make an association to the actual complication," he explains. "Without that, the contributing factors would have continued to go unnoticed for a long time."

A Powerful Combination of Operator Wisdom and Production Analytics

If there's one thing that has helped solidify Carlisle's success with digitally transforming their production lines, it's the well-honed instincts of the floor operators who work them. Carlisle's frontline workers have always been closest to the action.

In the days before ThingWorx and SPC, operators relied on years of knowledge and experience to detect production issues. While that wisdom will never go unused, the addition of digital technology gives operators the tools needed to make their jobs a little easier, explains Wickard. "It's crucial that we listen to the operators because they're closest to the source," he says. "We can take their knowledge and link it back to the models, the analysis, and the data crunching. In my experience, observational skills are extremely powerful, and our operators excel in that regard."

Wickard explains that it's all about leveraging those skills and applying them to the analytics to find the optimal solution. "What we're really asking is 'how do we make their day better, tomorrow?' These workers are helping to drive incredible progress, so it's a very important consideration."

Carlisle Dramatically Reduces Variable Production Conditions and Looks to Future Expansion

Using data from ThingWorx, Carlisle identified production challenges with far more accuracy than before; previously, they could only rely on small sample sizes taken manually, offering only lagging indicators. SPC analytics helped identify the process parameters that were contributing to manufacturing variances, which improved their ability to make immediate adjustments on the factory floor.

Identifying and reducing the production challenges has also helped them realize extra savings. "Reducing production costs, even if just pennies, has been crucial for our ability to deliver high-integrity products to our customers," says Wickard. "We've proven that with the right technology, we can increase margins while ensuring the highest quality product standards."

While Carlisle is currently only using ThingWorx and its SPC analytics in one factory, they plan to scale ThingWorx across multiple sites and eventually replace their legacy SPC system. Scaling technology across facilities has the additional benefit of knowledge transfer: more operators getting trained on more new types of technologies will help increase overall productivity and labor efficiency across the entire organization.

With process data from manufacturing systems contextualized, enriched by statistics and validated by operators in production, Carlisle is able to ask more advanced questions of their data, opening up opportunities for prediction and optimization.

As Carlisle continues to digitally transform operations across their facilities, the partnership with PTC holds great value—and with new interest in Vuforia AR technology for employee training and safety awareness, Carlisle is excited to continue exploring new technology solutions with PTC.