



Rolling Stock Manufacturing & Maintenance

Virtek Vision

Driving Digital Precision in Railway Manufacturing

How laser-guided assembly, CAD-driven projection and AI-enabled process monitoring help railway manufacturers improve fit-up accuracy, reduce rework, strengthen traceability and support more consistent production across complex welded assemblies.

The Pressure to Build Better

In railway manufacturing, precision is never optional. Whether teams are building welded sub-assemblies, locating brackets or verifying fit-up across large, fabricated structures, manufacturers operate in an environment where quality, repeatability and traceability are essential.

Assemblies often involve multiple components, tight tolerances, and production steps that must align closely with engineering design.

At the same time, the industry is under increasing pressure to improve throughput, quality and maintain consistent standards while managing skilled labour shortages and rising production complexity.

These realities are pushing rail manufacturers to reconsider traditional assembly methods and adopt more automation, digital-driven, process-controlled approaches that bring clearer guidance to the shop floor.



From Manual Methods to Digital Assembly

One of the most important changes happening on the shop floor is the move away from manual measurement, physical templates and paper-based instructions toward laser-guided virtual assembly. In complex railway applications, traditional methods can introduce variability, consume setup time and increase the risk of downstream errors. A manually marked reference point, a misplaced template, or a small interpretation of a mistake can lead to disruption in the process and added expenses. By projecting digital information directly onto the workpiece, operators can create a more intuitive workflow that delivers

clear visual guidance exactly where it is needed. This helps eliminate much of the manual measuring, marking and fitting that slows production, while also reducing reliance on hard templates and the storage, maintenance and rework they often create. It also makes it easier to respond to engineering updates, because design changes can be reflected directly from CAD data in-process rather than reworked through manual setup methods.

How 3D Laser Projection Supports Railway Manufacturing

Virtek Vision's solutions bring this digital approach to assembly by

projecting CAD-based laser templates directly onto components. Operators are guided step by step through the build process without relying on manually transferred measurements or printed references. This helps improve placement accuracy, reduce setup time and support more repeatable results across complex rail assemblies. Because the system works directly from CAD data, it helps keep production aligned with engineering intent and reduces the risk of discrepancies between what was designed and what is built. Integrated 3D vision capabilities allow the system to locate parts in space and align them to CAD data, making the technology practical for real manufacturing environments where part variation, weld distortion or inconsistent positioning can affect setup. Instead of forcing operators to adapt the process around manual reference methods, the system helps bring digital intent directly to the workpiece.

Features such as FlashAlign™ help simplify setup by allowing the laser projector to align quickly to the part without time-consuming teaching steps. The platform also supports a range of applications beyond standard projection. These include ‘pick & project’ for faster workpiece selection and projection, ‘visualization’ for previewing final assemblies before production begins, ‘digitising’ for recreating CAD data from legacy or missing designs, and ‘verification’ for identifying incorrect part placement in real time. In practical terms, these capabilities help manufacturers work more efficiently across both new and existing programs while adapting more quickly to design revisions. They also help connect engineering intent with shop-floor execution by giving operators clearer guidance and reducing the manual interpretation

that can lead to fit-up issues, rework, or unnecessary production delays.

Adding Visibility with AI-Enabled Process Monitoring

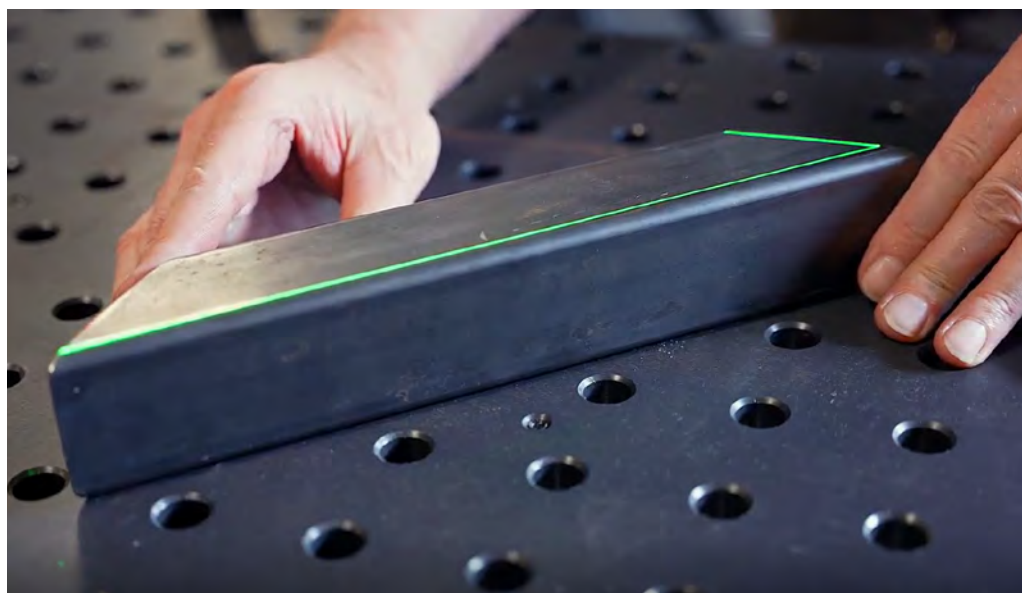
Assembly guidance is only part of the picture. Railway manufacturers also need stronger visibility into the process itself, especially in environments where quality documentation, compliance and customer assurance matter. Virtek’s AI-enabled process monitoring camera adds that layer of oversight by capturing high-definition images throughout each stage of the build process. The result is a continuous digital record that supports quality reporting, confirms process completion and helps manufacturers document what happened during production. With predefined capture points built into the workflow, image collection can be automated rather than left to manual intervention, helping create more consistent and reliable records across every assembly.

This level of monitoring offers benefits that go beyond

recordkeeping. By tracking progress in real time, teams can identify issues earlier, before they become costly defects or downstream delays. Digital verification of component placement and weld stages helps strengthen traceability and reduce the likelihood of preventable errors. Unique serial numbers can be linked to captured images and process records, giving manufacturers a more complete production history for each part or assembly. Time-stamped action logging and detailed reporting add further visibility, making it easier to review process performance, support audits, and demonstrate adherence to quality standards. Over time, the digital data captured through process monitoring can also support continuous improvement by helping manufacturers identify bottlenecks, compare results across builds, and make more informed decisions about production efficiency and quality control.

Why This Matters Now

For the railway sector, these technologies are not simply about replacing old tools with new ones. They are about creating a manufacturing environment where





instructions are clearer, workflows are more repeatable, and quality is built into the process from the first step to the final verification. That is especially important at a time when manufacturers are expected to increase throughput while maintaining strict standards for reliability and compliance.

Digital visual guidance can also help manufacturers respond to workforce challenges by making assembly steps easier to follow and reducing dependence on highly manual knowledge transfer. When best practices are projected directly onto the workpiece and paired with digital monitoring, teams

can standardise processes more effectively across shifts, facilities, or experience levels. In an industry where consistency, accountability, and efficiency are increasingly linked, that combination of precision and visibility offers a practical path forward for rail manufacturers looking to modernise operations without compromising quality.

A Smarter Path Forward

As railway manufacturing continues to evolve, the ability to combine precision, efficiency and traceability will become even more important.

Laser-guided assembly and AI-based process monitoring offer manufacturers a way to reduce rework, improve operator guidance and build greater confidence into every stage of production.

For organisations working to modernise assembly operations while maintaining the highest standards of quality, digital manufacturing tools are no longer just an advantage. They are becoming an essential part of the future of rail production.

**FOR MORE INFORMATION
VISIT OUR WEBSITE AND
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