Preventive NDT methods for railway line bolts, train axels and wheels

Discover the reliable non-destructive testing (NDT) solutions for railway applications.

With the recent reports of the train derailment, caused by a broken wheel on the Gotthard base tunnel in Switzerland, we are sharing the top preventative non-destructive testing (NDT) methods for railway axels, bolts and train wheels.

NDT is used to evaluate the properties of a material or component without causing any damage and it is essential for the safe and reliable operation of railways. Preventive NDT for railway axels, bolts and train wheels is a critical part of railway maintenance.

There are millions of train wheels, axels and bolts that need to be assessed around the globe, to prevent accidents and increase the quality and safety of railways everywhere.

Preventive NDT for railways is crucial for several reasons:

- **Increased safety:** Periodical and planned NDT inspection are the base of safety, helping to prevent accidents and minimize safety risks by identifying and repairing defects that could lead to derailments or other failures.
- **Reduced downtime:** By identifying and repairing defects early on, peridocial NDT can help to avoid costly downtime, disruptions to services and potential accidents.
- **Extended asset life:** Periodical and planned NDT inspection can help to extend the life of railway lines and train wheels by identifying and repairing defects before they cause major damage.
- **Minimized non-conformance costs:** The recent freight train derailment is a good example of why it is “better safe than sorry” to prevent failures in the first place. The non-conformance costs, also known as failure costs, of mitigating the failure afterwards is always exceedingly higher than taking steps to prevent it.
- **Compliance with regulations:** Most railway operators are required to comply with regulations that mandate regular NDT testing of railway lines, bolts, train wheels and axels.

NDT workflow for train wheels, axels and bolts.

NDT on train wheels, axels and bolts is typically carried out as part of a regular maintenance schedule. High accuracy and precision on every test are crucial to ensure the safety and quality of the railway line bolts, train axels and wheels.

Visual inspection

The first step is to conduct a visual inspection using an intelligent inspection software to identify and map any visible defects. All data is geolocated to the exact position on the map for easier follow ups at a later date. The same software can be used to manage all NDT and visual inspection data, and generate fast reports to help maintenance teams prioritize repairs.

Flaw detection

Ultrasonic testing (UT): UT is used to detect a wide range of defects in railway lines and train wheels, including cracks, voids, and delaminations that are not visible to the naked eye. Two types of ultrasonic technology can be used. The first is conventional ultrasonic testing which provides the inspector an A-scan (amplitude-time plot) that must be interpreted by an expert. The second and more advanced option is phased array testing which provides the inspector with an image of the interior of the metal. An ultrasonic flaw detector is also used to measure thickness of metal components, which is important for ensuring that railway lines and train wheels meet safety standards.

Hardness testing

Portable hardness testing can define and monitor critical material parameters, such as hardness and mechanical strength in any metal components such as wires, bolts, train wheels and axels.Hardness is a primary metal parameter, that can approximate mechanical strength, brittleness, wear, fatigue and many other characteristics that are difficult or even impossible to measure on spot and without destruction of the test object. Portable hardness testers are also used to measure the hardness of new train axels ensure sufficient and mandatory mechanical strength to withstand the heavy loads and the high traffic of trainlines. This type of NDT is also used in the maintenance of train axels, wheels and other components to help plan for preventive maintenance and avoid costly failures.

Modern Data analysis and reporting

After the non-destructive testing is complete, the collected data is analyzed and reported. Now, the process is more efficient than ever, thanks to developments in software for NDT. For example, some portable hardness testers and flaw detectors come with dedicated mobile or iPad apps for faster data management, collaboration and easy reporting. This also helps to reduce data loss and translation errors. Traceability of data is another a crucial factor for peridocial inspection. With the latest NDT instruments, it is possible to access old data which provides huge value considering that inspections are done by different people over the years.

New NDT instruments provide access to historical data and configuration. This helps railways operators can help to ensure the safety and reliability of their services, while also reducing costly downtime, increasing safety, extending asset life, and complying with regulations.

The NDT workflow outlined in this article provides an effective approach to preventive inspection. By combining visual inspection, ultrasonic testing, hardness testing, and other NDT methods, railways can identify and repair defects early on, before they cause major damage or accidents.

Introducing new technology and advanced solutions in NDT inspection helps railways to protect their passengers and employees, while saving money in the long run. Contact us today for personalized solutions to your specific project requirements.