

The Track Inspection and Maintenance Process

The **Federal Railroad Administration (FRA)** is collaborating with human factors experts at the **Volpe Center** to **understand how automation** will impact the safety and effectiveness of railroad

operations across the United States. Volpe staff focused their research on **automation-aided** and **visual** rail inspection processes to identify potential risks and safety hazards that could potentially lead to accidents.

AUTOMATED INSPECTION EXAMPLES:



Track geometry measurement system: Specially equipped train cars measure track geometry in a loaded condition.



Ground penetrating radar: Electromagnetic waves examine layers of track structure.



Machine-vision: Computers examine data and images, alerting a human to review for defects.



Vehicle-track interaction systems: Sensors on the rail car identify track areas at higher risk of deterioration.

“VISUAL” INSPECTION EXAMPLES:



Walking the track: A human inspector uses multiple senses to detect degraded conditions.



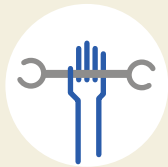
Inspection by hi-rail vehicle: A human inspector rides a hi-rail vehicle and looks for defects while also noting how the track feels (e.g., unusual bumps).

The Volpe team made **recommendations** that address potential risks at various stages of the track inspection process—detecting, assessing, and repairing defects—as well as levels of the system where both human and technological components can impact safety. The project focused on **track geometry measurement systems**; however, many of the recommendations can apply to other types of automated inspection technologies as well.

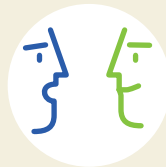
Major themes that emerged from these recommendations include:



The need for strong **user-centered design** when incorporating new technologies.



The value of **hands-on** training for railroad personnel.



The importance of **communication** and coordination among railroad staff and inspectors.



The need to manage the impact of **production and resource pressures** on inspection and maintenance activities.

Railroads can use these recommendations to **assess their practices** and **mitigate potential risks**, which will strengthen the safety of their current inspection system. Railroads may use the Volpe Center’s recommendations as a baseline when assessing future inspection technologies.