

Track Inspection Products & Services



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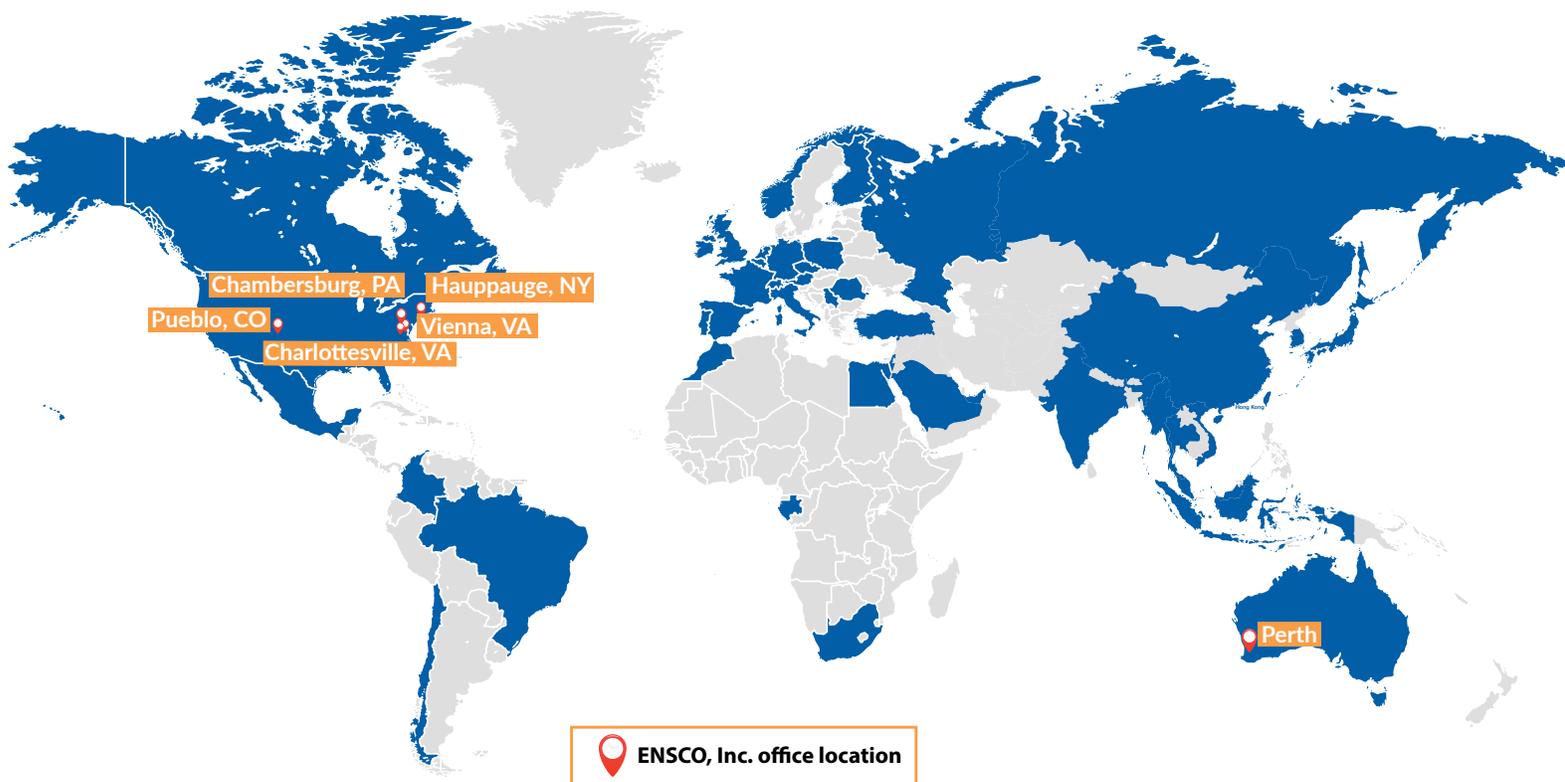
For more than 50 years, ENSCO's team of engineers has led the Rail industry in developing new, advanced technologies for transportation. ENSCO technology and services help customers improve the quality of their operations while making travel safer. With the integration of KLD Labs, Inc., a world-leading provider of automated track inspection technology and laser profiling solutions, ENSCO expands its capabilities to deliver unrivaled railway inspection technology for track and rolling stock, enhancing safety and operational efficiency worldwide.





ENSCO Delivers: Global Railway Safety and Innovation

Serving 45 Countries with Leading Automated Inspection Technologies



Global Presence: Ensuring the safety and efficiency of railway operations across 45 countries.

Innovative Technologies: Pioneering advanced inspection solutions for over 50 years.

Comprehensive Coverage: From track to rolling stock, delivering unparalleled inspection capabilities.

Commitment to Excellence: Dedicated to enhancing safety, security, and quality in rail operations.





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Track Inspection Vehicles



Through state-of-the-art engineering, ENSCO designs, builds, operates, and delivers world class, turnkey track inspection vehicles and systems that monitor comprehensive performance indicators reflecting track quality and safety. ENSCO has delivered solutions on more than 500 manned and autonomous inspection cars throughout the world to meet the needs of the railway industry.

Location Determination and Synchronization

ENSCO is the industry leader in delivering inspection cars and technology worldwide. ENSCO's automated track determination software can automatically determine the track and location (milepost, kilometer post, or chainage), a capability that is essential for both autonomous and manned operations. Additionally, ENSCO offers the unique ability to integrate multiple systems from ENSCO and other suppliers, allowing them to be synchronized precisely and viewed cohesively based on distance along the track.



Autonomous Operation

Autonomous track inspection is a growing industry practice that has surpassed manned inspection on many railways. Most of ENSCO's inspection technologies can operate autonomously, without the need for human interaction. The advantages of autonomous inspection include reduced costs, increased survey intervals, and a safer working environment. Various vehicle types can be used in autonomous inspection platforms, including locomotives, freight cars, passenger cars, and custom-fabricated vehicles.



Manned Operation

Manned operation is the traditional method used for automated track inspection. Despite the rise of autonomous systems, manned operation remains vital in today's railway industry, and ENSCO's technologies are well-equipped to meet this need. The most common manned vehicle types are shown below.



Self-propelled Vehicles

Through its relationships with track maintenance machinery manufacturers, ENSCO has designed a variety of self-propelled rail vehicles, ranging from small, 20-ton class converted work crew carriers to custom 100-ton high-speed rail cars that serve as track inspection platforms.



Hi-Rail Vehicles

ENSCO maintains long-standing relationships with hi-rail vehicle manufacturers to allow for the design and construction of specialized equipment to meet the customer's inspection and testing needs. ENSCO's solutions can be applied to light duty, medium duty, and heavy duty trucks to address a full range of inspection and operational requirements.



Towed Coaches

As railroad traffic density increases, it becomes difficult to find adequate time for both track inspection and maintenance. On high-speed rail lines, the challenge is even greater. Towed coaches provide cost-effective solutions to railroad track inspection needs. Whether implemented in revenue trains or behind dedicated locomotives, towed coaches can be configured for high-speed and long-haul track inspection operations, improving the capacity of the rail network.



Maintenance-of-Way Vehicles

KLD Labs has a tradition of serving maintenance-of-way equipment manufacturers by providing cutting edge inspection technology to aid in accurate and effective track maintenance. Technologies include the ORION Rail Profile Measurement System and machine vision technologies to aid maintenance such as rail grinding.



Track Inspection Services



In addition to supplying inspection vehicles and systems, ENSCO also offers customers the use of its own vehicles and systems as a service. This provides railways and transit systems with access to cutting-edge track inspection technology and our in-house experts.

Hi-Rail Inspection Vehicles

ENSOCO owns and operates a fleet of hi-rail inspection vehicles used for conducting automated track inspection services. The hi-rail systems are fully calibrated and staffed by experienced ENSCO personnel. The automated inspection technologies offered by the hi-rail fleet include track geometry, rail profile, third rail measurement, joint bar inspection, track component inspection, and driver-view imaging.

Portable Inspection System for Rail-Bound Vehicles

ENSOCO also owns and operates portable track geometry, rail profile, and third rail measurement systems that can be temporarily installed on rail-bound vehicles. These portable systems can be installed on passenger rail equipment, such as cab cars, coaches, and business cars.

Inspection technologies offered by ENSCO as a service include:

- Track Geometry Measurement System (TGMS)
- Rail Profile Measurement System (RPMS)
- Third-Rail (Power Rail) Measurement System (TRMS)
- Joint Bar (Fish Plate) Inspection System (JBIS)
- Track Component Imaging System (TCIS)
- Driver View Imaging System (DVIS)
- Rail Surface Imaging System (RSIS)
- Clearance Measurement System (CMS)
- Ultrasonic Rail Flaw System (URFS)

Inspection Solutions By Area

Track Geometry

Track geometry can degrade quickly, increasing the risk of derailments. Measuring and monitoring track geometry is essential for ensuring safety and directing track maintenance efficiently.

Track Geometry Measurement System (TGMS)

The TGMS is the fundamental system to directly measure all the key track geometry conditions such as gage (gauge), curvature, crosslevel, warp, twist, profile (surface, top), and alignment. Its measurements replace the manual measurements made by field personnel.



Vehicle/Track Interaction (V/TI) Monitor

Many track geometry conditions combine multiple factors to cause a derailment risk. The VTI Monitor uses the actual rail vehicle response to the track to assess the track condition. The V/TI operates autonomously and is a great addition to the TGMS to ensure complete track geometry condition assessment. Since the V/TI operates autonomously, it can identify rapidly changing conditions.



Ride Quality Measurement System (RQMS)

The RQMS has similar measurements to the V/TI Monitor, but with a key difference that it can be synchronized with other measurement systems, such as a TGMS, and measure continuously allowing for strip chart data to be plotted alongside other measurement systems data.



Inspection Solutions By Area

Rail & Joints

Rail and joints are among the most expensive assets a railway owns and maintains. ENSCO's rail inspection technologies help achieve maximum safety with optimum efficiency.

Ultrasonic Rail Flaw System (URFS)

Detecting and resolving rail flaws is an essential part of track maintenance. ENSCO's URFS provides state-of-the-art rail flaw detection while being integrated with other track inspection systems.



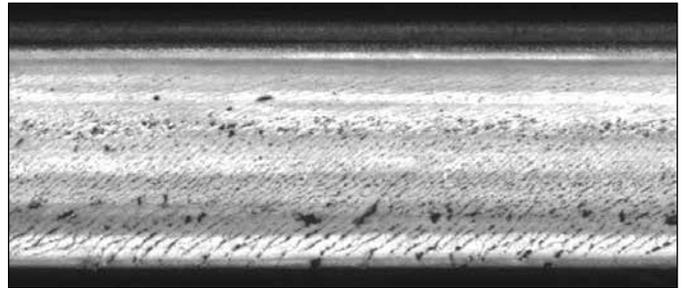
Rail Profile Measurement System (RPMS) and MiniProf Rail

ENSCO's industry leading rail profile solutions include KLD Lab's ORION RPMS intended for maintenance-of-way vehicles, ENSCO Rail's RPMS intended for track inspection vehicles, and MiniProf used for rail profile measurement by hand. All solutions support asset optimization, condition-based maintenance, and improves wheel-rail interface analysis, contributing to safer and cost-effect railway operations.



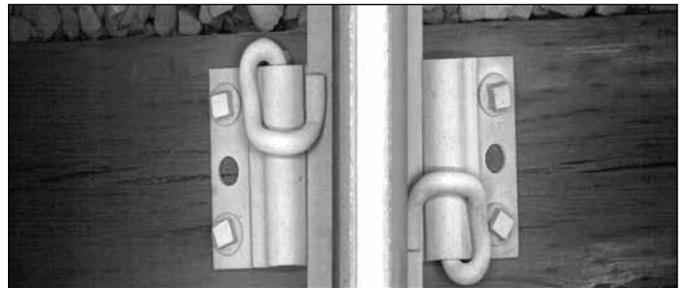
Rail Surface Imaging System (RSIS)

Assess rail surface conditions is crucial to avoid rail breaks resulting from Rolling Contact Fatigue (RCF) and other surface damage. Both ENSCO Rail's RSIS and KLD's RailScope collect high-resolution images of the rail surface. ENSCO Rail's RSIS automatically converts images to strip chart data, which can be synchronized with other datasets, such as rail wear, to facilitate optimal rail grinding planning.



Rail Component Imaging System (RCIS)

ENSCO's RCIS provides the same functionality as the RSIS and also enables combined inspection of both rail surfaces and fasteners simultaneously. This integration allows for more comprehensive data collection, improving overall track maintenance and safety.



Vehicle/Track Interaction (V/TI) Monitor

The V/TI has proven invaluable for detecting rapidly changing rail surface conditions such as battered joints, broken joints, broken frogs, broken rail, and engine burns. ENSCO's V/TI Monitor is a cost-effective, autonomous solution that continuously monitors track conditions without disrupting revenue service. Railways can proactively manage maintenance by providing real-time alerts and detailed reports via TrackIT®.



Rail Corrugation Measurement System (RCMS)

Rail corrugation can be frustrating, leading to noise, poor ride quality, and safety issues. ENSCO's RCMS identifies the corrugation condition in detail to allow for targeted rail maintenance planning.



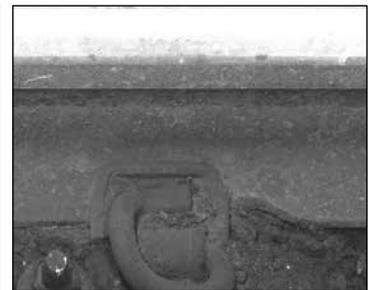
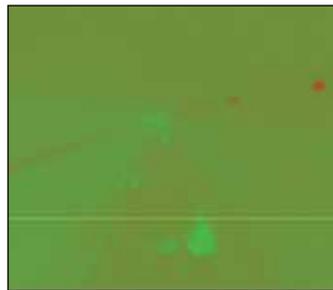
Joint Bar Imaging System (JBIS)

Failures of joint bars (fish plates) and associated bolts remain a major concern for railways. ENSCO's JBIS automatically detects rail joints and insulated joints, identifying failures such as cracked joint bars or missing bolts. The JBIS also detects broken rails.



Thermal Imaging System (THIS)

ENSCO's THIS detects cold spots caused by leaking or pooling water in tunnels. The system's detection is synchronized with our JBIS to identify rail base corrosion, which if left undetected, can lead to broken rails.



Ride Quality Measurement System (RQMS)

ENSCO's RQMS has the same functionality as V/TI, but may also synchronize with other inspection systems. When paired with the RSIS, the RQMS is able to measure of the rail surface condition along with its image.



Predictive Rail Temperature System (PRTS)

Heat inspections and slow orders for hot rail can be challenging when using only local weather data. ENSCO's PRTS utilizes proven and validated algorithms to predict peak rail temperatures in advance to better plan operations.



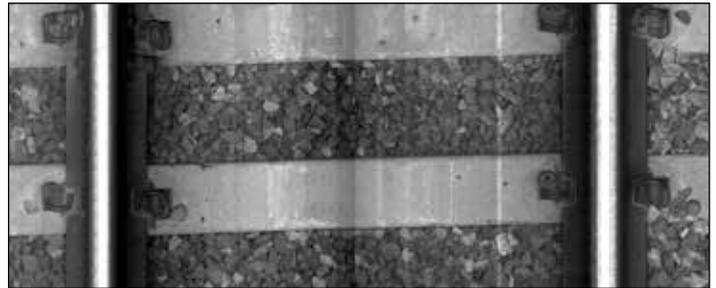
Inspection Solutions by Area

Ties (Sleepers) & Fasteners

Ties (sleepers) and their fasteners are a critical railway asset responsible for keeping the track together. Deteriorated ties or fasteners can threaten safety. ENSCO's offered technologies aid in the thorough and rapid inspection of ties and fasteners.

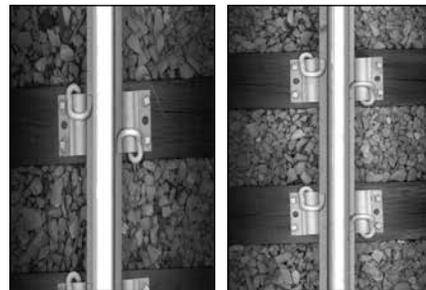
Track Component Imaging System (TCIS)

To get an overall inspection of ties and fasteners, ENSCO's TCIS is second to none. It provides high resolution machine vision imagery to identify small cracks in concrete ties. Automatic detection of tie and fastener defects enable the TCIS to be a valuable inspection system for any railway.



Rail Component Imaging System (RCIS)

Similar to the TCIS, the RCIS provides high resolution machine vision imagery of the fasteners and tie portion near the fasteners. The RCIS provides a cost-effective method to automatically inspect fasteners and the critical portion of the ties near the fasteners, while also performing a thorough inspection of the rail surface.



Track View Imaging System (TVIS)

ENSCO's TVIS operates similarly to the TCIS but uses an area scan camera to provide overview imagery of ties and fasteners in a cost-effective manner. The TVIS is synchronized with all other systems and is valuable for providing context to defective conditions detected by these systems.



Deployable Gage Restraint Measurement System (DGRMS)

Gauge (Gage) widening can be caused by several factors, including the condition of ties and fasteners, which may result in lateral rail movement or rail rotation due to rail cant. The DGRMS (Dynamic Gage Restraint Measurement System) applies known vertical and lateral loads to the rails to simulate real-life conditions, allowing gauge measurements under load. Additionally, the DGRMS measures unloaded gauge, enabling further calculations to assess the ties' and fasteners' ability to maintain gauge.



Portable Track Loading Fixture (PTLF)

Similar to the DGRMS, the PTLF is used to assess the tie's ability to hold gauge (gauge). The PTLF is a hand tool used to conduct spot checks of loaded gauge. It can be used with a TGMS mounted on a light vehicle such as a hi-rail (road rail vehicle) to measure gauge under load at suspect locations identified by the TGMS.



Inspection Solutions by Area

Special Trackwork

Special trackwork, such as turnouts (switches and crossings), diamonds, road crossings (level crossings), and derails, has unique features that require tailored technologies for accurate condition assessment. ENSCO's special trackwork inspection technologies deliver in-depth evaluations to ensure optimal safety and operation of these components.

Point Asset Inspection System (PAIS)

Point assets such as turnouts, diamonds, road crossings, and derails can deteriorate creating challenging safety risks to any railway. ENSCO's PAIS combines laser profiling and machine vision technologies to create a comprehensive assessment of the point asset's condition including key measurements, rail wear, frog and switch blade wear, and broken and missing components.



Track Geometry Measurement System (TGMS)

Track geometry in turnouts can deteriorate to create challenging derailment risk conditions. Using ENSCO's TGMS allows for pin-pointed measurement of all the key geometry measurements to ensure proper operation of a railway's turnouts.



Vehicle/Track Interaction (V/TI) Monitor

The V/TI Monitor is an invaluable tool for assessing wheel/rail impact conditions at turnout components such as frogs, switch points, and heel blocks. It has identified countless defective conditions in turnouts and helped prevent critical safety risks.



Ride Quality Measurement System (RQMS)

Similar to the V/TI, the RQMS measures wheel/rail impact conditions, which is useful for assessing turnout component conditions. An added advantage of the RQMS is its ability to synchronize measurement data with other systems, such as the PAIS.



Inspection Solutions by Area

Vehicle/Track Interaction

Monitoring and managing vehicle/track interaction is crucial for preventing derailments and maintaining optimal ride quality. ENSCO leads in vehicle/track interaction technologies, helping railways achieve peak performance.

Vehicle/Track Interaction (V/TI) Monitor

The V/TI system is the industry's leading method for monitoring passenger transit vehicle/track interaction. It is installed on various revenue vehicle types to assess vehicle/track interaction performance across all vehicles. As an autonomous system, the V/TI continuously inspects and provides a consistent safety net to ensure optimal railway operations.



Ride Quality Measurement System (RQMS)

The RQMS operates similar to the V/TI Monitor, but has the advantage that it is synchronized with other measurement systems. When the RQMS is installed on a revenue vehicle with other systems, such as a TGMS, it provides invaluable insights to understand what track geometry conditions are driving undesired vehicle/track interaction conditions.



Instrumented Wheel Sets (IWS)

IWS are the industry standard method of directly measuring wheel forces from vehicle/track interaction. ENSCO has unique features with our IWS that allow it to be synchronized with all other systems and operate autonomously. This provides a valuable ability to consistently monitor wheel/rail interaction and correlate with track geometry and rail profile conditions.



Automated VAMPIRE® Vehicle/Track Interaction Software

ENSCO's Automated VAMPIRE provides the same data as the V/TI, RQMS, and IWS but in a virtual, digital twin format. This solution, combined with an autonomous or manned TGMS, delivers crucial data for derailment prevention and offers valuable insights for track maintenance planning through the Automated Maintenance Advisor (AMA) software.



Inspection Solutions by Area

Power Infrastructure

Measuring and monitoring power infrastructure, such as overhead wire (catenary) and third rail (power rail), is as crucial as tracking the infrastructure itself to ensure safe and efficient operations. ENSCO provides a comprehensive suite of inspection technologies to support customers in monitoring the condition of their power infrastructure.

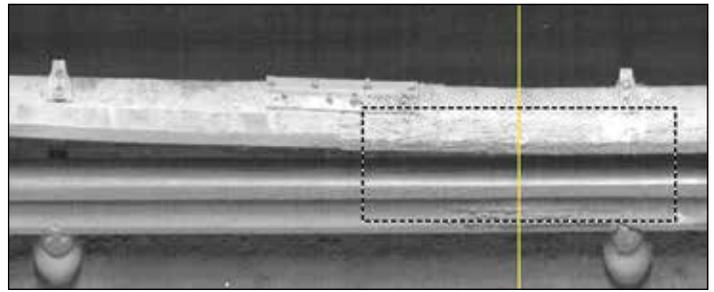
Third Rail Measurement System (TRMS)

Deteriorating conditions can affect the relative position of the third rail (power rail) to the running rails, potentially causing issues such as contact shoe breakage or clearance encroachments. ENSCO's TRMS measures the third rail's position to ensure it remains within safe tolerances.



Third Rail Imaging System (TRIS)

The third rail (power rail) comprises multiple components that can become damaged or missing, leading to safety concerns. ENSCO's TRIS captures high-resolution images of these components, including the coverboard, isolators, and goosenecks. Automated algorithms, along with human review, are employed to identify defective conditions.



Overhead Wire Measurement System (OWMS)

The position of overhead wire (catenary wire) is critical to prevent dewirements. In partnership with its collaborator, ENSCO provides measurements of height, stagger, and wire wear to ensure that the overhead wire remains within maintenance tolerances.



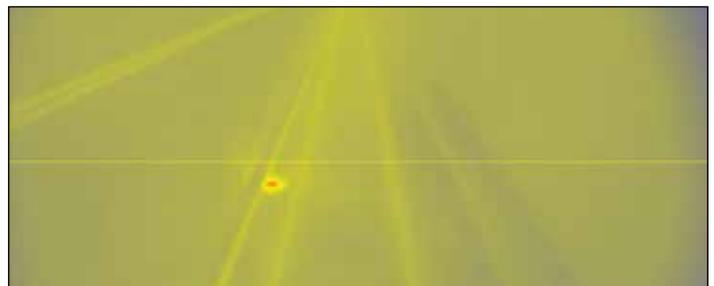
Overhead Wire Imaging System (OWIS)

ENSCO's OWIS provides overview imagery of the overhead wire and pantograph. The OWIS is synchronized with all other inspection systems so it may provide useful context images corresponding with other inspection systems, such as at a defective condition identified by the OWMS.



Thermal Imaging System (THIS)

Both third rail and overhead wire systems can suffer from hot spots that can pose potential fire hazards or component failures. ENSCO's THIS captures thermal images, which are then processed with specialized algorithms to accurately identify these hot spots.



Inspection Solutions by Area

Signal & Train Control



Signaling and train control systems operating at peak performance are crucial for maximizing safety and minimizing train delays. For this reason, ENSCO offers technology targeted for assessing the condition on train control and signaling systems.

Signal & Communication System (SCIS)

The full and proper operation of track circuits and train control systems is key to railway operations. The SCIS measures AC track circuits, associated train control systems, and wayside train control systems to ensure they are functioning as intended. It also provides an added level of protection as an independent condition monitoring tool for the train control system.



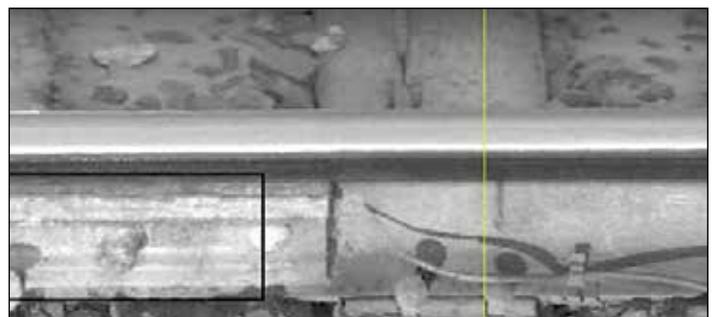
Track Component Imaging System (TCIS)

The machine vision capability of the TCIS allows for a visual inspection of train control components installed on the track, such as balises and transponders. This allows railways to identify problems of broken, missing, or incorrectly located wayside transponders which can result in incorrect train control operations.



Joint Bar Imaging System (JBIS)

The JBIS imagery allows for the visual inspection of important track circuit components such as bond wires to aid in diagnosing track circuit challenges. These wires and connections can become damaged or partially damaged, causing issues with track circuits, train control systems, and road crossing protection systems.



Track Geometry Measurement System (TGMS)



Track geometry measurement is a crucial method in the rail industry for assessing track safety and planning maintenance. Regular measurement and analysis of track geometry are proven to prevent track-related derailments, which can cause catastrophic damage. ENSCO's TGMS leads the industry in reliability and measurement reproducibility.



Derailment Prevention

Track geometry conditions are a major factor in derailments, including issues such as spreading gauge, wheel climb, and rail rollover. Additionally, poor track geometry can contribute to derailments caused by broken rails, faulty fasteners, and thermal misalignment. The TGMS plays a crucial role in ensuring track geometry remains within safe limits, thereby supporting safe and reliable railway operations.

Ride Quality

Various track geometry conditions drive passenger ride quality comfort. The TGMS produces Track Quality Indices (TQI) that are invaluable for identifying specific track geometry conditions resulting in rough ride conditions.

Track Geometry Measurements

The TGMS measures all the fundamental track geometry measurements such as gage (gauge), curvature, crosslevel, warp, twist, profile (surface, top), and alignment.

System Variations:

Carbody Mounting: ENSCO can directly mount the measurement beam to the carbody instead of the truck (bogie), allowing for easier installations and maintenance on the vehicle. Carbody mounting also has higher reliability of lens cleanliness and shock and vibration, both critical for autonomous operation.

Zero Speed Measurement: All standard inertial-based track geometry measurement systems have a slow speed cutoff of some measurement channels. ENSCO's Zero Speed add-on capability provides all track geometry parameters down to zero speed.

System Integration

A major advantage of ENSCO's TGMS is that it is fully integrated with all other measurement systems. This enables the correlation of track geometry measurement data with other measurements such as ride quality, and machine vision imagery, such as ballast and tie (sleeper) images from the TCIS.

Ultrasonic Rail Flaw System (URFS)



URFS for Hi-Rail (Road/Rail Vehicle)

ENSCO Rail, the leader in innovative, reliable, automated track inspection, offers the latest product in its suite of railway track inspection and maintenance planning products: the Ultrasonic Rail Flaw System (URFS). Rail flaw detection technology is the most reliable method in the rail industry for preventing broken rails, the leading cause of track-related derailments, which can result in catastrophic damage.

The URFS will help railways meet regulatory requirements, prevent derailments, and maintain safe and efficient operations. It focuses on reducing false stops, increasing productivity through automation, improving accuracy of true-positive detections, and measuring related conditions to predict and prevent rail flaws.

URFS integrates seamlessly with other ENSCO automated track inspection technologies, such as ZTG and RPM, and leverages machine vision technology. This integration ensures highly accurate defect location, data cross-correlation, and standardization of operator controls to minimize training needs. Combining URFS with ENSCO's machine vision inspection technologies, including our patented RSIS and JBIS, significantly enhances overall rail integrity assessment.



URFS for Railbound Vehicle

Rail Profile Measurement System (RPMS)

Rail wear is critical for managing rail assets efficiently. ENSCO's RPMS, now enhanced with technology from KLD Labs, integrates laser profiling with the TGMS. This combination delivers essential rail profile measurements necessary for effective rail maintenance and management.



Rail Maintenance

Rail is one of the most expensive assets for railways to maintain. ENSCO's RPMS provides critical measurements for planning maintenance activities, including rail grinding and replacement. Integrated with the Autonomous Maintenance Advisor (AMA), these measurements predict rail wear trends, pinpointing where and when rail maintenance is needed.

Rail Profile Measurements

Rail is one of the most expensive assets for railways to maintain. ENSCO's RPMS and KLD Lab's ORIAN™ (Optical Rail Inspection and Analysis) provides critical measurements for planning maintenance activities, including rail grinding and replacement. Integrated with the Autonomous Maintenance Advisor (AMA), these measurements predict rail wear trends, pinpointing where and when rail maintenance is needed.



System Variations:

Carbody Mounting: ENSCO uniquely mounts the TGMS and RPMS measurement beam to the carbody rather than the truck (bogie), simplifying installation and maintenance while ensuring higher reliability against lens cleanliness and shock and vibration, critical for autonomous operation.

Gage Side Only Measurement: In addition to the standard RPMS measuring both rail sides, ENSCO offers a Gage Side Only RPMS focused solely on the gage side. This system reduces costs and size compared to the full rail profile version while maintaining essential measurements, excluding field side wear and lip assessments.

Rail Corrugation Measurement System (RCMS)

Rail corrugation can be more than a nuisance and create safety risks if unmeasured and unresolved. The repeated worn surface patterns in the rail surface can produce not only high levels of noise, but also elevated wheel/rail contact forces that can result in further safety concerns.

ENSCO's highly accurate RCMS evaluates corrugation over multiple critical wavelength bands allowing for in-depth assessment. Measurements are key to identifying locations of needed rail maintenance to resolve corrugation to regain optimum wheel/rail behavior.

System Variations:

Laser-Based: ENSCO's laser-based system provides the highest accuracy possible for corrugation measurement. Additionally, it can measure down to zero speed. ENSCO's laser-based RCMS is an add-on system to ENSCO's RPMS.

Acceleration-Based: Through its partner, ENSCO offers an acceleration-based corrugation system that provides exceptional value and a compact installation size.



Vehicle/Track Interaction (V/TI) Monitor

ENSCO's autonomous V/TI Monitor is the most widely used, cost-effective method for autonomously inspecting track and reducing track-caused derailments

V/TI Monitors are stand-alone systems installed on revenue vehicles, such as locomotives or passenger coaches. They assess the condition of the track and vehicles through acceleration monitoring, providing real-time alerts and enabling proactive maintenance planning.

The V/TI measures ride quality, wheel/rail impacts, such as battered and broken joints, and short-chord track surface conditions, such as mud spots and pumping joints. Identified risk conditions are transmitted via cellular network, received as email alerts and viewed in TrackIT®.

With a fleet of V/TIs providing autonomous measurement, railways maintain a constant safety net to quickly identify deteriorating conditions and precursors, reporting them to field personnel for timely remediation and smooth operations. The V/TI Monitor is based on research sponsored by the Federal Railroad Administration (FRA) and ENSCO's internal R&D.



Ride Quality Measurement System (RQMS)

The ENSCO RQMS provides invaluable complementary track condition data and track geometry. Carbody, suspension and wheel acceleration data can be synchronized with track geometry data and machine vision data. Using our advanced signal processing algorithms, sensors can locate rough ride locations, battered joints, engine burns, crushed rail heads, etc.

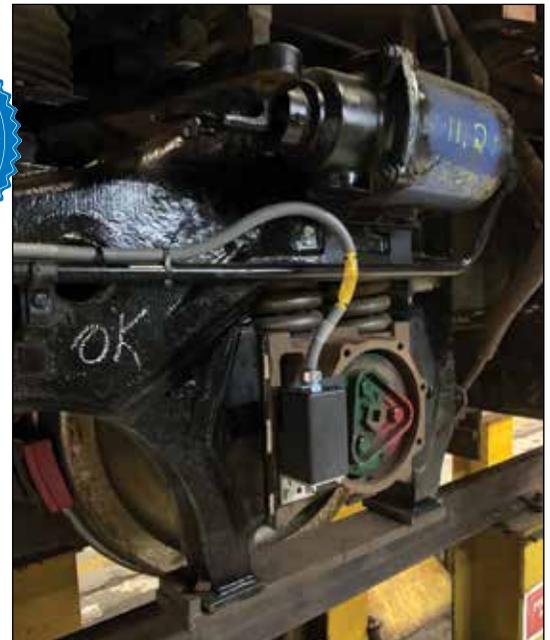
Ride Quality

The RQMS is a great way to measure passenger ride comfort directly and correlate the measurements with other systems such as the TGMS, to identify specific track geometry conditions to correct.



Derailment Prevention

The RQMS ability to measure wheel/rail impact conditions, provides a great source to identify at-risk rail conditions that can result in a broken rail or failures in turnouts such as broken frogs, or chipped switch points. Additionally the RQMS can be synchronized with other systems, including the RSIS to provide an image of the defective condition.



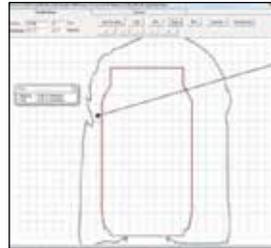
Clearance Measurement System (CMS)

ENSCO's CMS offers real-time, high-resolution Right-of-Way Clearance Assessment for railway lines, including Structure Gauge, Tunnel Clearance, Object Encroachment, Track Centerline Offset, Rolling Stock Kinematic Analysis, and Platform Track Interface Analysis ("Mind the Gap"). Measurements are taken at track speed using a LiDAR distance laser, typically mounted on the front of the vehicle, to produce a high-resolution virtual model of your railway corridor.



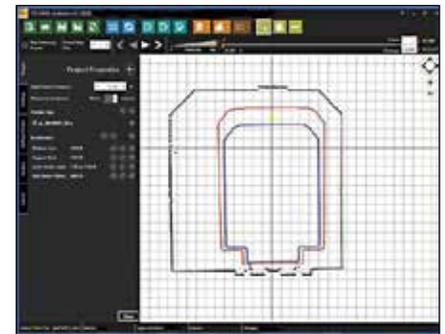
Structure Gauge

The ENSCO CMS automatically takes measurements at track speed with a LiDAR distance laser and measures the structure gauge to ensure the safe transport of rail passengers and cargo without the risk of getting too close to the infrastructure.



Vegetation Encroachment

The ENSCO detects vegetation and other objects encroaching on rails that might cause unsafe conditions. The Clearance Measurement System measures track clearance and detects vegetation and other objects encroaching on rails that might cause unsafe conditions.



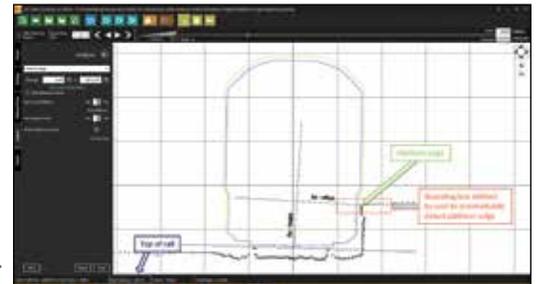
Tunnel Clearance

Uncertainty about tunnel clearances can be costly and dangerous. The ENSCO CMS measures and validates tunnel clearance and provides the clearance assessment data necessary to avoid tunnel and rail system damage.



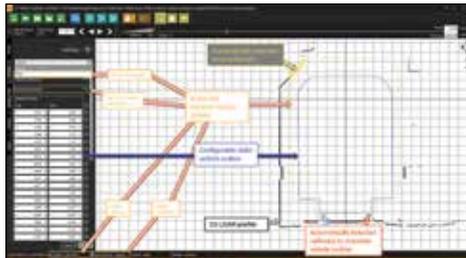
Platform/Track Interaction "Mind The Gap"

The ENSCO CMS simplifies managing the rail platform/train interface by measuring and managing the gap for safer passenger boarding and deboarding. It calculates the horizontal and vertical offset of the platform edge from the track centerline.



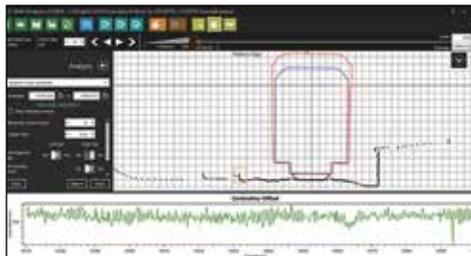
Object Encroachment

The ENSCO CMS detects vegetation and other objects encroaching on rails that might create unsafe conditions. It measures track clearance and identifies potential hazards.



Track Centerline Offset

The ENSCO CMS automatically measures at track speed using a LiDAR distance laser. The CMS software calculates the minimum distance between adjacent tracks and identifies exceptions.



Rolling Stock Kinematic Envelope

The ENSCO CMS automatically takes measurements at track speed using a LiDAR distance laser and measures the structure gauge, which varies with the curvature of the line and maximum speeds allowed. The CMS software calculates the rolling stock kinematic behavior based on measured parameters and train design features that may affect the kinematic envelope.



The CMS is available as either a purchased system or a contracted service.

Deployable Gage Restraint Measurement System (DGRMS)

The DGRMS is the rail industry's preferred method for measuring gauge restraint at high speeds from a rail-bound vehicle. It features a hydraulically actuated split axle that applies known vertical and lateral loads to the rails, allowing for measurements of loaded and unloaded gauge at high survey speeds.

Derailment Prevention

The DGRMS locations where tie and fastener support is weakened, which is crucial for preventing gauge widening derailments—the most common type of track geometry-related derailment. This tool is essential for any railway to mitigate such risks.

Measurements During Winter Conditions

The system can assess tie, fastener, and gauge conditions even when the track is covered in snow, proving invaluable for railways operating in heavy winter conditions.

Key Features:

- Measures the ability of ties (sleepers) and fasteners to maintain gauge.
- Detects areas of weak track that could cause gauge widening derailments.
- Identifies concrete tie rail base deterioration that may lead to safety risks such as rail cant (rail inclination).



Portable Track Loading Fixture (PTLF)

ENSCO's manually operated PTLF is the industry's go-to method for spot checking gage (gauge) strength. The PTLF is compliant with the American Railway Engineering Maintenance-of-way Association (AREMA) and FRA standards for gage strength.

The PTLF helps identify high derailment risk locations due to gauge widening caused by weakened ties (sleepers) or broken/missing fasteners. Track inspectors can use the PTLF for spot checks at locations of concern or to measure gauge under load after using a hi-rail mounted TGMS. When used in combination with a DGRMS, which performs similar measurements at high speed from a rail-bound vehicle, the PTLF provides a comprehensive gauge strength assessment. The PTLF is developed based on research sponsored by the FRA and ENSCO's internal R&D.



MiniProf BT Products for Track

KLD Labs is proud to be the North American Sales and Support Agent for Greenwood Engineering's MiniProf BT product line. MiniProf has long been the gold standard hand tool for measuring rail wear.

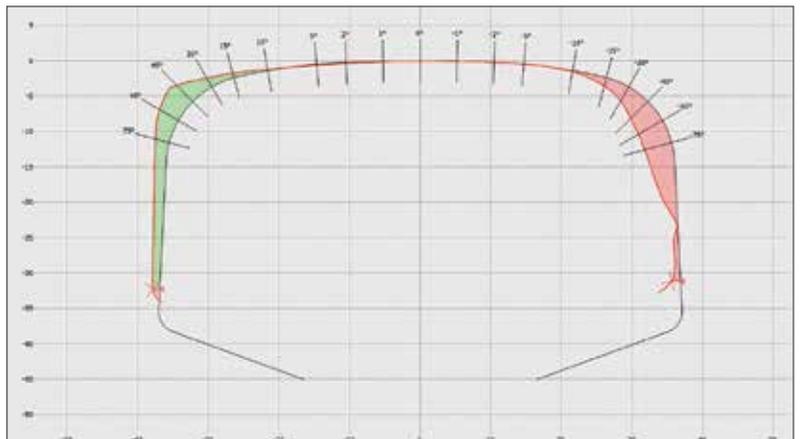
MiniProf BT Rail

The MiniProf BT Rail system is a full contact measuring system for fast and high-accuracy cross-sectional rail profile measurements. It is a lightweight hand held tool, which can be used for planned maintenance, wear prediction, trending analyses and much more. Magnetically attached to the top of the railhead using the opposite rail as reference, the rail profile and track gauge is measured in less than five seconds reducing exposure on the track. Measurements are performed easily via the free Android app MiniProf Criterion and calculations of wear parameters are provided instantly.



MiniProf BT TwinHead

The MiniProf BT TwinHead systems are designed with two measuring heads mounted on a fixed beam. These heads measure the two opposite rail profiles consecutively, storing the measurements as individual profiles and together in pairs within a common coordinate system. This setup offers high accuracy on the gauge and precise knowledge of any rotation of the profiles, which is crucial for any wheel and rail interaction study.



MiniProf BT Switch & Crossing

Text: Measuring the key parameters of a turnout is key to ensuring safe and efficient operation. The MiniProf Switch & Crossing system is a full contact turnout

measuring system with Bluetooth connectivity. It provides fast and highly accurate cross-sectional profiles of turnouts including frogs and switch points. The instrument extends to the opposite rail through a fixed rod, offering stability, gauge and track relative measurements. Precise information on the physical placement of the multiple rails is provided instantly and is stored by the accompanying software for on-site and post measurement analysis.

Third Rail Measurement System (TRMS)

ENSCO's TRMS is an add-on to the RPMS, designed to accurately measure the relative vertical and horizontal height of the third rail (power rail) in relation to the nearest running rail. Utilizing public safety lasers, the TRMS provides precise measurements. Maintaining proper third rail geometry is crucial for efficient traction power operations in transit systems. An improperly positioned third rail can damage contact shoes or disrupt contact, leading to excessive arcing. The TRMS ensures that the third rail remains within tolerance for smooth and safe transit operations.



System Variations:

Top Contact Third Rail:

This configuration is used when the contact shoe contacts on the top of the third rail.

Bottom Contact Third Rail:

This configuration is used when the contact shoe contacts on the bottom of the third rail.



Overhead Wire Measurement System (OWMS)

ENSCO, in partnership with our collaborator, offers the OWMS. This system measures the height, stagger, and wear parameters of overhead wires using advanced laser and camera technology. The OWMS can be mounted either adjacent to a pantograph or independently. It compensates for carbody movements to ensure accurate data.



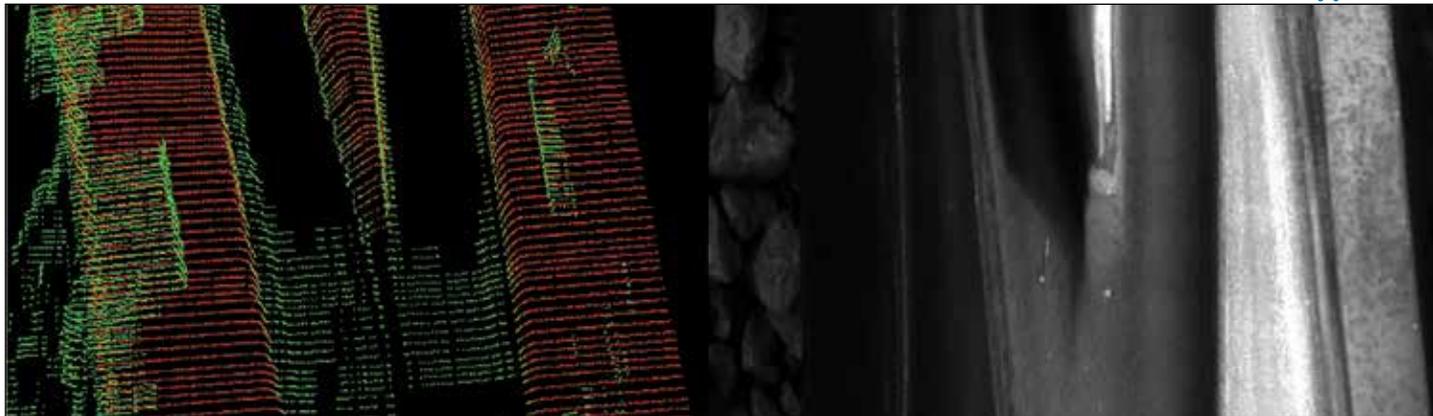
Overhead Wire (Catenary) Measurement

- Height and stagger measurements are key to ensure uninterrupted transit operations.
- When height (vertical height of the overhead wire above top of rail) or stagger (horizontal offset from the track center) exceed thresholds, they can lead to a risk of a dewirement where the overhead wire comes off the pantograph and becomes entangled.
- Additionally, the overhead wire will wear over time ultimately limiting its useful lifespan.
- The OWMS is critical to ensure the overhead wire is ready for operations.



Point Asset Inspection System (PAIS)

ENSCO's PAIS is a combination of multiple inspection systems tailored specifically for inspecting special trackwork assets such as turnouts (switch & crossing), diamonds, road crossings (level crossings), and derails. The PAIS combines the following inspection systems together to provide a comprehensive inspection system.



- **Rail Profile Measurement System (RPMS):** ENSCO's standard RPMS, now enhanced with KLD Labs technology, is tailored for use with the PAIS. Additional laser profiling capability and higher sampling rates provide detailed measurements of turnout components such as frogs and switch points. The RPMS also provides key measurements of the guard rail.
- **Track Component Imaging System (TCIS):** ENSCO's TCIS is used to obtain detailed machine vision images of turnout components such as tie bearers (sleepers), fasteners, and tie rods.
- **Joint Bar Imaging System (JBIS):** ENSCO's JBIS captures detailed images of turnout components such as switch point blades, heel blocks, frogs and guard rails.
- **Additional Inspection Systems:** ENSCO's unique ability to synchronize all inspection data allows for additional systems such as the TGMS and RQMS to be included with the above detailed inspection data at point assets.

ENSCO's PAIS utilizes data from all these systems to capture detailed information at designated point asset locations, providing an organized dataset for automated algorithms and detailed inspector review in the office using Virtual Track Walk® (VTW).

Signal and Communication Inspection System (SCIS)

ENSCO's SCIS is a comprehensive onboard system designed to monitor train control, PTC, and track circuit health. The SCIS synchronizes with the track recording vehicle's location, such as chainage, milepost, and GPS information. Real-time data is displayed on the track recording vehicle, similar to a track geometry strip chart. The SCIS identifies exceptions where measured conditions deviate from design requirements, and the data can be reviewed in the office for further evaluation.



Inspection Antenna

The SCIS measures actual track circuit conditions continuously, using custom antennas mounted on a track recording vehicle. Each antenna looks for specific carrier frequencies and signals from both DC and AC track circuits. The SCIS can pinpoint locations of degraded conditions, such as impedance bonds, insulated joints, and stray current locations.

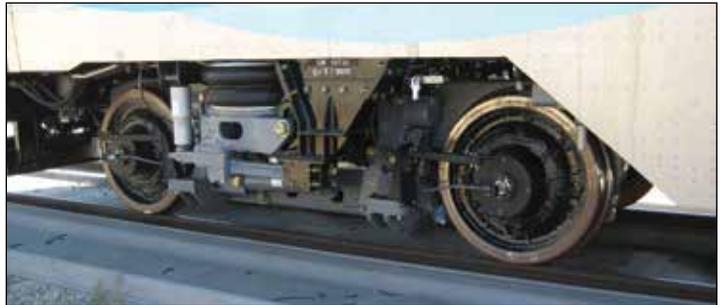
ENSCO's SCIS uses various custom and standard antennas to receive and record wayside transponder messages. The SCIS confirms wayside transponder functionality, location and signal strength. Should any transponder health condition exceed the threshold, the SCIS will create exceptions with location and GPS coordinates.

Instrumented Wheel Sets (IWS)

Since 1975, ENSCO has produced over 40 Instrumented Wheel Sets (IWS) for passenger cars, freight cars, and transit cars. ENSCO's IWS employs a fully calibrated strain gauge array to deliver real-time measurements of vertical, lateral, and longitudinal wheel/rail forces. Additionally, the IWS measures the wheel/rail contact location.



The IWS provides continuous measurement at all speeds and flags exception locations when parameters exceed set thresholds. ENSCO's system has been successfully used to qualify numerous passenger and freight cars, both at customer locations and at the Transportation Technology Center (TTC), where it is often utilized during vehicle testing. With extensive experience in vehicle qualifications and instrumented wheel set testing across the railroad and transit industries, ENSCO's internal team of vehicle/track interaction professionals supports data interpretation and conducts vehicle/track interaction simulations using programs such as VAMPIRE.



Automated VAMPIRE Vehicle/Track Interaction Software for Digital Twin

Assess your track infrastructure more thoroughly for less cost using the Digital Twin capabilities of VAMPIRE

ENSCO has acquired the source code for VAMPIRE, the world-renowned vehicle/track interaction software used for vehicle and track assessments in simulation. VAMPIRE has historically been used by engineers and consultants to manually perform simulations of rolling stock traversing tracks and predicting key items such as derailment risk, wheel/rail forces, ride quality, and wear index.

With control of the source code, ENSCO has implemented automated VAMPIRE to operate in the cloud or onboard inspection vehicles. It automatically simulates vehicles with measured track geometry and rail profile data in near real-time without human intervention.

Derailment Prevention

- Identify and address high-risk locations before they lead to derailments.
- Performance-Based Maintenance
- Establish performance-based track geometry tolerances that ensure safety and maximize effective and efficient use of maintenance resources.

Prioritize measured geometry defects using vehicle dynamics derailment risk results from simulations over each defect location. Users can also import the results of the Automated VAMPIRE into the AMA for track condition deterioration trending.



KLD Rail Grinding Systems and Software

KLD Labs offers state-of-the-art automated machine vision systems in single and dual camera configurations for monitoring the rail profile against a rail grinding template. These systems are used worldwide to evaluate the restoration of the rail crown before and after grinding, providing critical input to rail grinding planning and maintenance practices.

Rail Grinding Process: Over time, the rail profile wears due to friction at the rail and wheel interface. The grinding process restores the shape of the rail, ensuring optimal performance and safety. KLD Labs' measurement technology is integral to facilitating this process.

Advanced Machine Vision Technology: KLD Labs' system incorporates the latest machine vision technology to collect and analyze high-resolution images of the rail profile, making direct comparisons to rail grinding templates while traveling at track speeds. The video cameras capture cross-sectional rail profiles, aiding in the planning and evaluation of rail grinding.



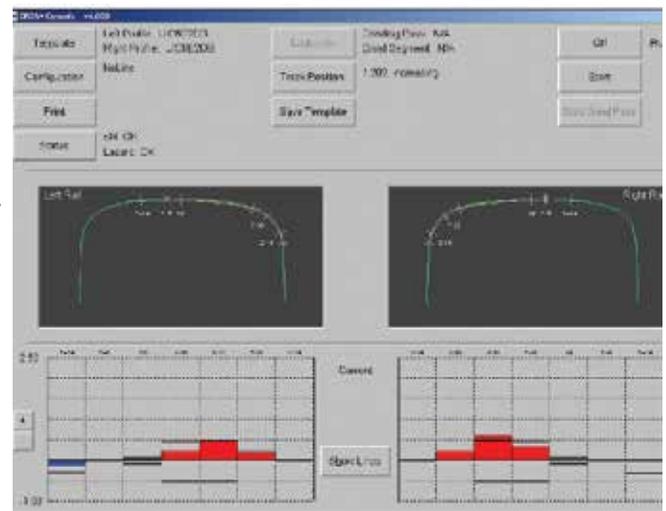
System Components:

- **Sensor Heads:** Mounted beneath a railway vehicle, designed to operate reliably in the extremes of the rail grinding environment.
- **Central Computer and Peripherals:** Housed inside the vehicle, processing high-resolution images of the running section. This information is displayed to the operator for immediate feedback and stored internally for later analysis.

Key Features:

- Automatic evaluation of the rail before and after grinding.
- Digital record of rail profile, target rail profiles, and pass number.
- Non-contact data collection at track speeds.
- Standalone operation or full integration with on-board systems.
- Elimination of manual measurements and user-to-user variability.
- Widely deployed rail profile measurement on rail grinders globally.
- Rugged design suitable for the rail grinding environment.
- Comprehensive data analysis toolbox.

KLD Grinding Software: KLD's grinding software provides comprehensive rail grinding analytics and reporting, ensuring compliance with EN13231-3 and EN13231-4 norms for mainline and switch rail re-profiling. The software facilitates pre/post grinding rail profile analysis, helping rail operators maintain optimal rail conditions.



Track Imaging Systems

Joint Bar Imaging System (JBIS)

Broken joints and rails are the leading causes of track-related derailments. ENSCO's patented JBIS uses advanced vision inspection technology and high-speed cameras to conduct detailed inspections of joint bars (fish plates) and rails. This system provides a comprehensive visual assessment to ensure that cracks and defects do not lead to derailments or further failures. Developed in partnership with the Federal Railroad Administration's (FRA) Office of Research and Development, the JBIS enhances inspection efficiency by reducing labor costs associated with traditional methods.

Joint Bar Inspection

The JBIS performs automated crack detection on joint bars and rails, identifies missing bolts based on predefined criteria, measures rail gaps, and generates joint bar inventory reports. It produces real-time exception reports, including continuous line scan images of suspect areas, and maintains a permanent database of all joint bars and cracks.

Broken Rail Detection

In addition to joint bar inspection, the JBIS examines the web and base of the rail for cracks. This complements the Ultrasonic Rail Flaw System (URFS) by providing both visual and internal assessments of rail flaws.

Track Component Imaging System (TCIS)

ENSCO's TCIS is the leading method for capturing high-resolution images of entire ties (sleepers) and fasteners. Equipped with linescan cameras that sample at high frequency, the TCIS generates detailed images that ENSCO's advanced machine vision algorithms use to automatically detect defective conditions.

Tie Inspection (Sleeper Inspection)

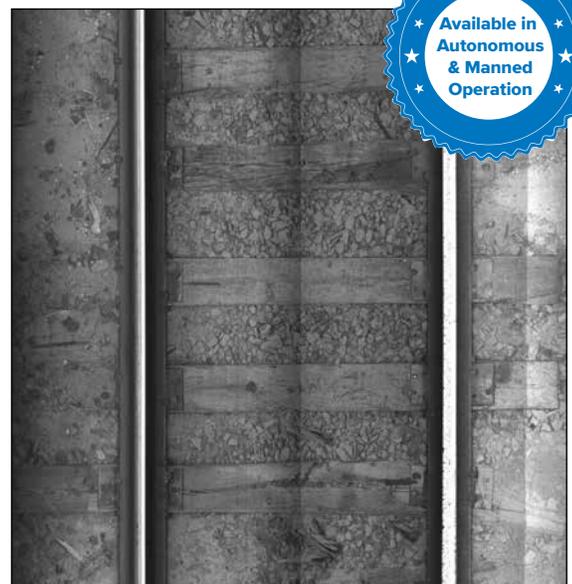
ENSCO's TCIS produces the high-resolution imagery required for inspecting concrete and wood ties (sleepers) in detail to identify small cracks in the concrete. Automated algorithms and human review using VTW enable an automated methodology to perform tie inspections from the office.

Fastener Inspection

Missing, broken, or misaligned fasteners are detected by the TCIS. More importantly, the TCIS has configurable business logic to identify groups of fastener defects associated to railway's internal standards. This fastener defect grouping logic provides an invaluable method of narrowing the railway's focus on locations of high risk.

Ballast Inspection

In addition to the tie inspection, the TCIS also automatically inspects the ballast condition to look for characteristics associated with fouling. This ballast assessment from the TCIS is paired well with other systems such as TGMS and Ground Penetrating Radar (GPR) to provide a full assessment of the ballast.

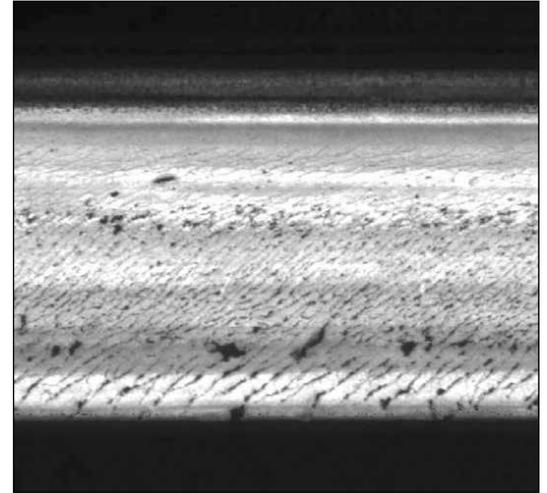


Rail Surface Imaging System (RSIS)

Rail surface condition assessment is fundamental to assuring optimum rail safety. Rolling Contact Fatigue (RCF), also known as head checking, can cause broken rails that can potentially cause a derailment. Additionally, RCF and other types of surface damage can interfere with ultrasonic rail flaw testing, leaving the rail at risk of having unknown internal rail flaws.



ENSCO's innovative RSIS employs high-speed cameras to capture detailed images of the rail surface without making contact. Concurrently, ENSCO's patented algorithms evaluate the rail surface to assess the severity of Rolling Contact Fatigue (RCF) and other surface damage. The results are presented in strip charts synchronized with the images and other inspection data.



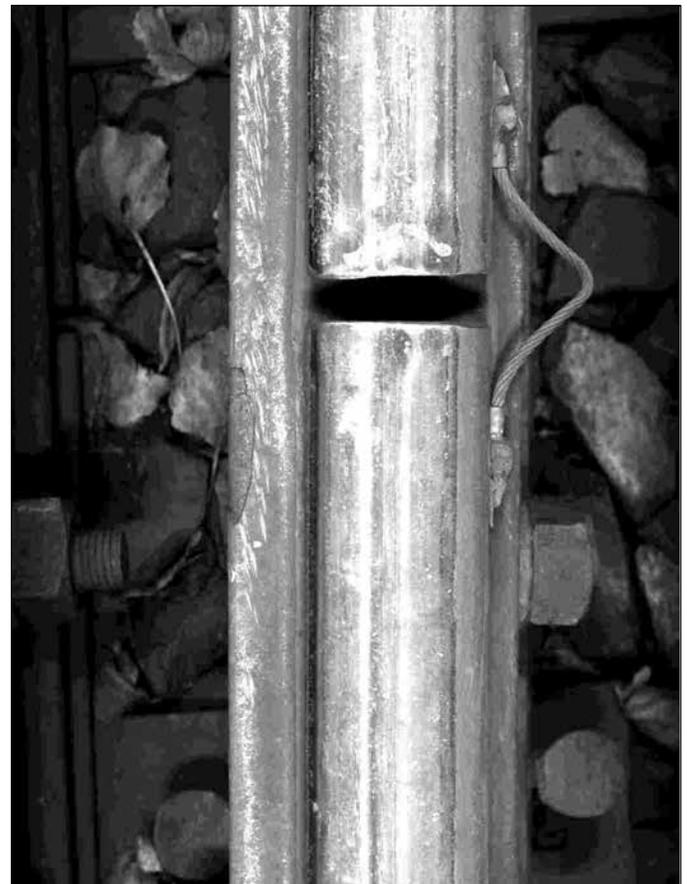
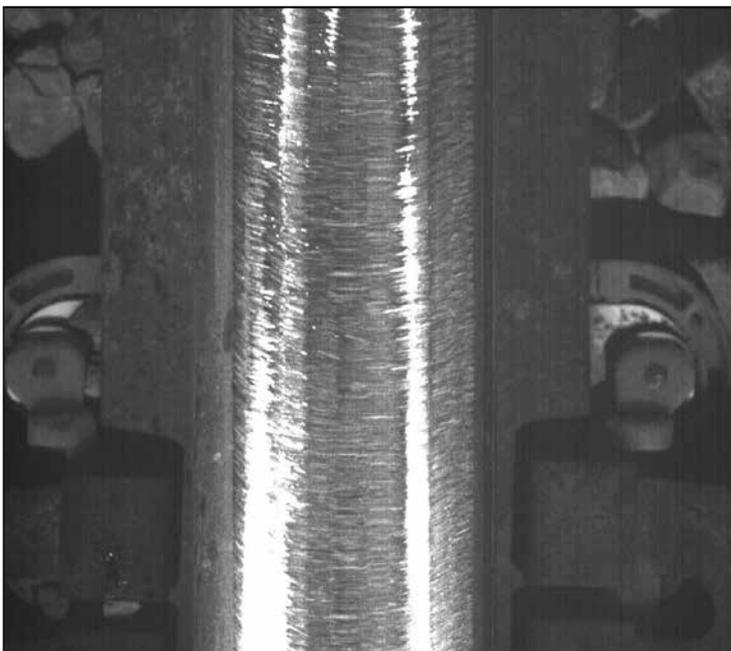
Rail Surface Imaging Advantages:

- Non-contact
- High vehicle speed
- Images processed to strip chart measurements
- Synchronized with other inspection system data
- Used to prioritize rail grinding / rail milling
- Used to proactively identify surface condition locations that interfere with ultrasonic rail flaw testing

**The RSIS can be an add-on to the JBIS or TCIS. Or alternatively it can operate on its own.*

RailScope

KLD Labs' RailScope is a high-value automated machine vision system for assessing the rail surface and web and base (foot) of the rail. RailScope utilizes either areascan or linescan cameras based on the application. RailScope makes for a perfect machine vision system for hi-rails (road/rail vehicles), and maintenance-of-way equipment.



Rail Component Imaging System (RCIS)



ENSCO's RCIS integrates the capabilities of the Rail Surface Imaging System (RSIS) and the TCIS. It captures high-resolution images of the rail surface, fasteners, and ties (sleepers) near the fasteners.

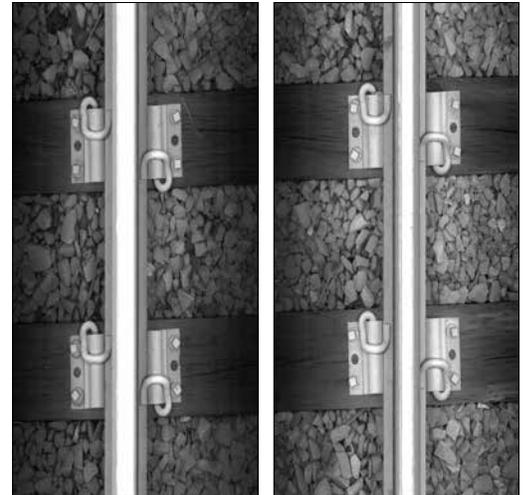
Rail surface data is automatically processed to strip charts aiding in rail maintenance planning, the same as the RSIS. Fasteners are automatically assessed to identify defective conditions, the same as the TCIS.

Fastener Inspection

Just as the TCIS does, the RCIS detects missing, broken, or misaligned fasteners. The RCIS has configurable business logic to identify groups of fastener defects associated with the railway's internal standards. This fastener defect grouping logic provides an invaluable method of narrowing the railway's focus on locations of high risk.

Tie Inspection (Sleeper Inspection)

ENSCO's RCIS produces the high-resolution imagery near the rail base of ties (sleepers). This allows for the automated inspection of concrete tie cracking near the base of the rail.



Driver View Imaging System (DVIS)



ENSCO's DVIS uses an area scan camera to provide comprehensive views of the track and surrounding right-of-way. Synchronized with all other inspection systems on the vehicle, it offers valuable contextual imagery for defective conditions identified by other systems.

Right-of-Way Video

The DVIS is particularly effective when paired with the Clearance Measurement System (CMS), allowing for detailed imagery of clearance infringements along with associated measurement data.

ENSCO offers the DVIS in the following configurations:

Infrared Lighting

Infrared lighting offers the unique advantage of not interfering with passengers or oncoming train traffic, making it particularly suitable for passenger transit applications.



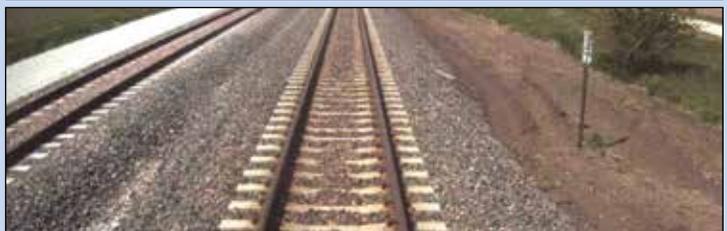
Visual Lighting

An advantage of using visual light is its ability to produce color images, which can be beneficial for detecting Right-of-Way conditions that cause discolorations.



Natural Lighting

In some instances, no additional lighting is required when surveying is conducted during the day in areas with minimal or no tunnels. This method is commonly used for freight railways.



Track View Imaging System (TVIS)



The TVIS operates similarly to the Driver View Imaging System (DVIS) but focuses on producing detailed images of the track bed. Like the DVIS, the TVIS is available with both infrared and visual light options.

Tie and Ballast Assessment

Just like the DVIS, it has the unique advantage that it is synchronized with all other inspection systems on the vehicle. This allows it to be a useful source of imagery to provide context to any defective condition identified on other systems, such as overviews of the ballast conditions associated to TGMS or GPR data.

Turnout Assessment

The TVIS also provides valuable overview images of turnouts. When synchronized with data from other systems, such as the Ride Quality Measurement System (RQMS) and PAIS, the TVIS offers excellent context regarding the condition of these assets.

Tunnel Wall Imaging System (TWIS)



The TWIS operates similarly to the Driver View Imaging System (DVIS) but is directed to produce detailed images of the tunnel walls. Just like the DVIS, it has the unique advantage that it is synchronized with all other inspection systems on the vehicle. This allows it to be a useful source of imagery to provide context to any defective condition identified on other systems, such as tunnel clearance encroachments detected by the CMS. Additionally, similar to the DVIS, the TWIS is offered with both infrared and visual light options.

Tunnel Water Leaks

Tunnel Water Inspection System (TWIS), when paired with the Thermal Imaging System (THIS), has the unique capability to identify locations of tunnel water leaks. Thermal imaging provides a clear indication of where water is present, while detailed images from the TWIS offer insight into the specific issue.

Overhead Wire Imaging System (OWIS)

The OWIS operates similarly to the Driver View Imaging System (DVIS), but focuses on producing detailed images of the pantograph, overhead wire, and supporting infrastructure. Like the DVIS, it is synchronized with all other inspection systems on the vehicle. The OWIS is also available with both infrared and visual light options.



Pantograph Monitoring

The OWIS is an effective tool for monitoring pantograph interaction with overhead wires and identifying unexpected and undesired conditions. When combined with the Overhead Wire Measurement System (OWMS), it allows transit systems to pinpoint areas of pantograph distress.

System Integration

The OWIS is synchronized with all other inspection systems, including the OWMS, to provide images correlated with height, stagger, or wire wear defects. Additionally, the OWIS is integrated with the Thermal Imaging System (THIS) to identify hot spots in the overhead wire (catenary), helping prevent undesired service interruptions from faulty power infrastructure components.



Third Rail Imaging System (TRIS)

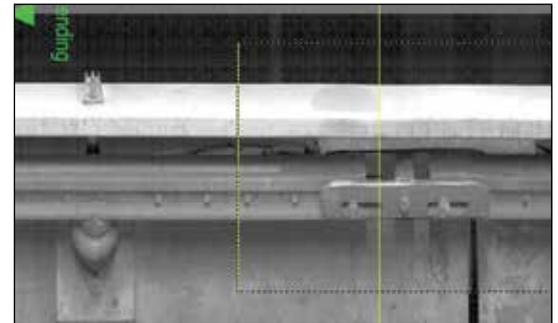


The TRIS is the premier method for capturing high-resolution imagery of the third rail and its associated components. TRIS uses high-frequency cameras to produce detailed images, allowing industry-leading machine vision algorithms to automatically identify components and detect defective conditions. **Third Rail Inspection**

The TRIS can automatically inspect the third rail and its associated components for conditions such as sagging or missing coverboards, battered end ramps, missing or broken fasteners, damaged or shorting isolators, and surface condition issues. TRIS has the unique capability of processing imagery into strip chart measurement data. Additionally, TRIS is synchronized with all other inspection systems, providing a valuable ability to view Third Rail Measurement System data—such as the position of the third rail relative to the running rail—alongside imagery and strip chart data processed from the images.

System Integration

A unique capability of the TRIS is to be synchronized with the THIS to identify the location of third rail hot spots and have a corresponding image of the location.



Thermal Imaging System (THIS)



Power infrastructure components that operate at elevated temperatures pose a risk of interrupting train operations or even causing fires. Additionally, water leaks in tunnels can lead to ongoing deterioration of concrete walls. THIS measures the temperature of all power infrastructure, right-of-way, and track components to identify both hot and cold spots.

Rail Base Corrosion

ENSCO's Thermal Imaging System detects cold spots caused by leaking or pooling water in tunnels. This detection is synchronized with the Joint Bar Imaging System to aid in identifying rail base corrosion, which, if undetected, can lead to broken rails. **Tunnel Wall Water Leakage**

THIS detects cold spots associated with leaking or pooling water. It has the unique ability to synchronize with other inspection systems, such as machine vision, to identify deteriorating infrastructure conditions. **Hot Third Rail and Hot Overhead Wire**

Both third rail and overhead wire systems can suffer from hot spots that may pose a potential fire hazard or lead to component failure. THIS captures thermal images, which are processed with specialized algorithms to accurately identify these hot spots.

Strip Chart Measurements

The ENSCO THIS has patented algorithms to process the thermal imaging data into strip charts. This allow for easy identification of hot and cold locations, correlate with other measurement and imaging systems, and overlay multiple surveys to identify changing thermal conditions.



Example hot third rail detected by ENSCO's Thermal Imaging System (THIS)



Track Data Management

ENSCO's Data Management Suite offers a fully integrated set of data management and analysis software packages. It uses common architecture, data structures, and asset databases to enable cross-communication between systems, achieving advanced capabilities. The web-based applications—DTN, Track/IT, and AMA—are seamlessly integrated into a single user interface.

Digital Track Notebook® (DTN)



Streamlined track inspections with web-based, paperless record management

GeoEdit 8



In-depth graphical analysis and reporting of track measurement data

Virtual Track Walk® (VTW)



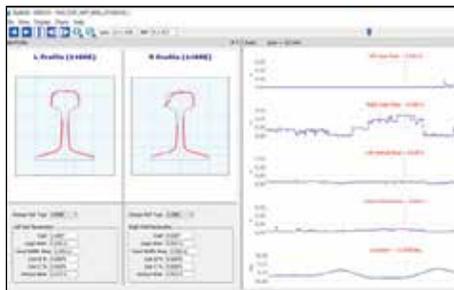
Software enables high-resolution, synchronized track images to be inspected in the office

Track/IT®



Web-based, track asset and automated inspection data management repository

RailEdit



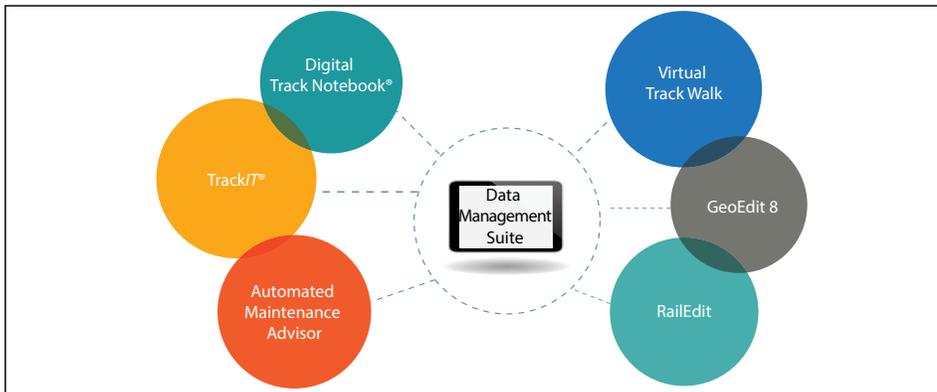
Reprocess rail profile data and identify rail size for inventory generation

Automated Maintenance Advisor (AMA)



Trend deteriorating conditions and automated identification of prescriptive maintenance tasks

Track Data Management Suite



ENSCO's Data Management Suite provides a fully integrated offering of our data management and analysis software packages. The suite is comprised of the DTN, Track/IT AMA, VTW, GeoEdit 8, and VAMPIRE. ENSCO's Data Management Suite uses common architecture, data structures, and asset databases to enable cross-communication of the systems to achieve advanced capabilities. The web-based applications, i.e., DTN, Track/IT, and AMA, are seamlessly integrated into one user interface. Customers can use ENSCO's software packages individually, or combinations of applications in the Data Management Suite.

Digital Track Notebook® (DTN)

DTN is a web-based application used by track inspectors to record regulatory and special track inspections.

Key Suite Features

- DTN defects and measurements identified by a track inspector can be used in AMA deterioration trending and maintenance planning.
- AMA recommended inspection sites can be provided to track inspectors through the DTN to investigate exceptions or deteriorating conditions, and record remedial actions.
- Allows entry of new or updated asset information, including GPS tagging of assets.

Track/IT

Track/IT serves as the data repository of the suite accepting automated measurement and asset data. It includes a table query, map, and track chart functionality.

Key Suite Features

- DTN defects and measurements identified by a track inspector can be viewed in Track/IT's map and track chart features.
- Continuous track geometry data can be queried and exported from Track/IT and viewed GeoEdit 8.

Automated Maintenance Advisor (AMA)

The AMA accepts data from the other systems to create condition-based deterioration trends and recommend maintenance tasks.

Key Suite Features

- Displays deterioration and maintenance information in Track/IT's map and track chart.
- Accepts measurement and exception data from DTN, Track/IT, & VTW.

Virtual Track Walk® (VTW)

VTW is a workstation-based Windows® software package used to conduct a comprehensive review of imagery from all of ENSCO's machine vision systems, such as the Driver View Imagery System (DVIS) and Track Component Imagery System (TCIS). Within VTW, the user can identify defects and assets.

Key Suite Features

- Within VTW, the user can automatically push exception data from VTW to Track/IT at the end of the survey review through an Internet connection.
- VTW exceptions can be queried and viewed as cropped images within Track/IT.

GeoEdit 8 & GeoEdit 8 PLUS

GeoEdit 8 is a laptop-based Windows application used to conduct comprehensive review of measurement system data including track geometry and rail profile data. GeoEdit 8 PLUS has enhanced super-user features.

Key Suite Features

- GeoEdit 8 PLUS can be used to review track geometry exceptions to remove false-positives before importing to Track/IT or AMA.
- GeoEdit 8 PLUS has synchronized viewing with VTW.

RailEdit

RailEdit is a laptop-based Windows application used for reprocessing of wear data.

Key Suite Features

- RailEdit can be used to cleanse rail wear data for template errors or data spikes before importing into Track/IT or AMA.

Digital Track Notebook® (DTN) 3.0



The DTN is designed for mobile track inspection management, leveraging extensive knowledge of railroad regulatory and operational practices. This web-based platform complies with FRA electronic record-keeping requirements. Users can perform track inspections, locate and record defects, manage inspection schedules, update remedial actions, synchronize field information from a centralized data management system, and generate reports.

Web-based Reporting

The DTN's unique, web-based platform makes it faster and easier to generate critical regulatory and performance reports using a standard Internet browser.

DTN does not require specialized computer hardware platforms. It provides transparent access to a variety of tools and reports with role-based functionality that can be tailored to meet the needs of many users—from track inspection managers to upper level executives. DTN can be used to record track inspections, generate daily inspection reports, or close the loop on track defects. The flexible design can be customized to meet the specific reporting needs of your railroad.

Paperless Inspection Record Management

The DTN facilitates paperless inspection record management, providing wide access to critical data. Inspectors can:

- Record all aspects of an inspection electronically
- Include remarks such as weather conditions
- Add defects to the inspection record
- Upload records to a centralized database
- Automate the distribution of defect records to maintenance personnel

Compliance With Automated Inspection Scheduling

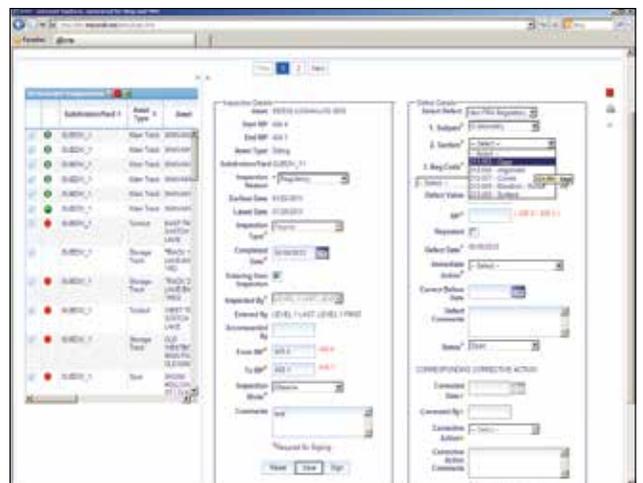
The DTN also automates compliance with regulatory inspection benchmarks by calculating the earliest and latest dates for inspections based on the 49 CFR 213 FRA Track Safety Standards. Its color-coded Inspection Priority Indicator helps prioritize inspections by their level of importance.

Streamlined Maintenance Management

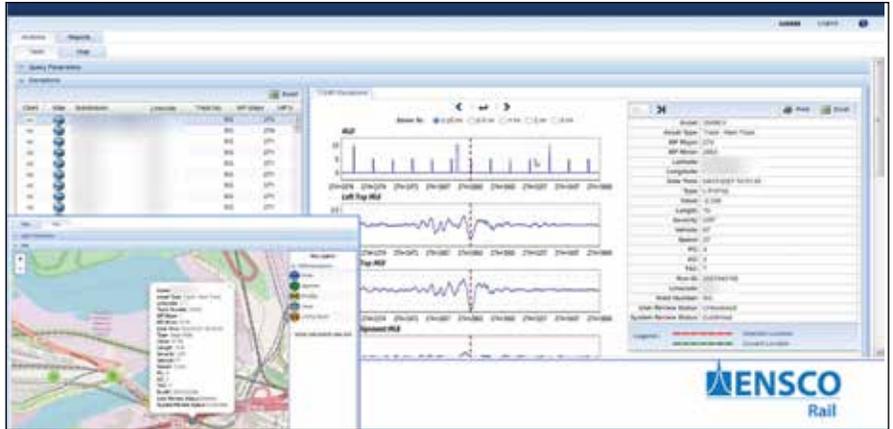
DTN simplifies managing defect status and maintenance records, and provides an organized communication path between track inspectors and maintenance crews. A DTN user can login to a central database to receive inspection and defect reports, or send maintenance reports back to the database. In addition, maintenance and defect repair status can be easily noted.

Paperless Record Management

DTN tracks defects electronically, and the data can be reviewed in Track/IT, an ENSCO web-based track infrastructure, maintenance and exception data viewer. Track/IT brings multiple data sources to a central location where the total track health can be comprehensively assessed. ENSCO is a comprehensive service provider offering a full range of solutions for the rail industry.



Track/IT



Track/IT is a comprehensive, enterprise-level web-based system for track asset management developed by ENSCO Rail. It features a suite of viewing and analytical tools for efficient review and analysis of track infrastructure, maintenance, and inspection data, assembling information from various data sources into a centralized management system that streamlines the storage, analysis, and dissemination of critical information.

Maximum Flexibility

The system is offered in two configurations to meet customers' information technology needs: as a hosted web service or as a site license installed on a corporate network. It is compatible with various data communication protocols, facilitating automated data loading and integration with existing information management systems. Users access the platform through a secure login, utilizing a range of viewing and analytical tools that present information in multiple formats, including maps, tables, and track charts. The system also enables data downloads in standard file formats, offering users the flexibility to perform custom analyses.

Track Chart Management

This flexible tool is ideal for track chart management, capable of generating production-quality track charts for a subdivision or an entire railroad on demand. Users can customize chart content and export it to a PDF track chart book, ensuring that charts are up-to-date at the time of request.

Derailment Investigations

In the event of a derailment, users can quickly generate reports of track data for the derailment site. Exportable data include track charts, track geometry, rail wear test results, video images, ultrasonic rail flaw data, and more.

Maintenance Planning

The system offers consolidated track chart views that display track maintenance and inspection results over time, enabling planning departments to assess track degradation and the effectiveness of maintenance programs. This information is valuable in the maintenance planning process, and the latest track charts, inspection results, strip charts, and GPS waypoint files can be downloaded for field verification.

Ease of Use

Designed to be intuitive, this web-based tool facilitates the secure transmission of information to authorized users while maintaining secure data storage. It is scalable to meet the needs of various organizations, with data loading engines that centralize common industry data types from multiple suppliers. Reports and graphical outputs are configurable, and end-user training can be completed in less than two hours.

ENSCO's Suite of Products

The system complements other ENSCO products, including the V/TI Monitor, the Autonomous Track Geometry Measurement System, and the Digital Track Notebook. Each of these products interfaces directly with the system to enhance reporting capabilities for users.

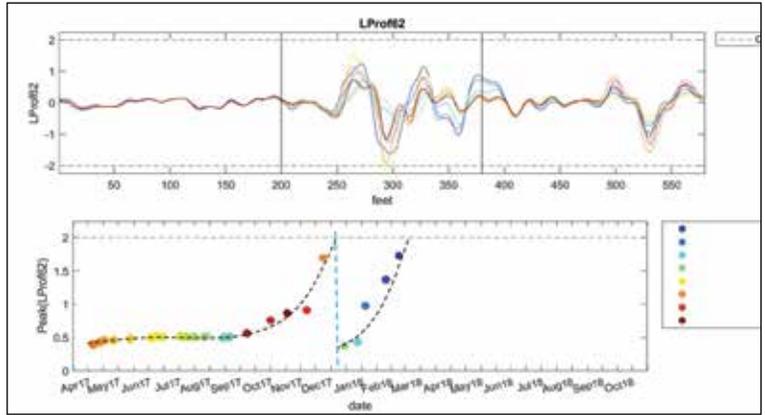
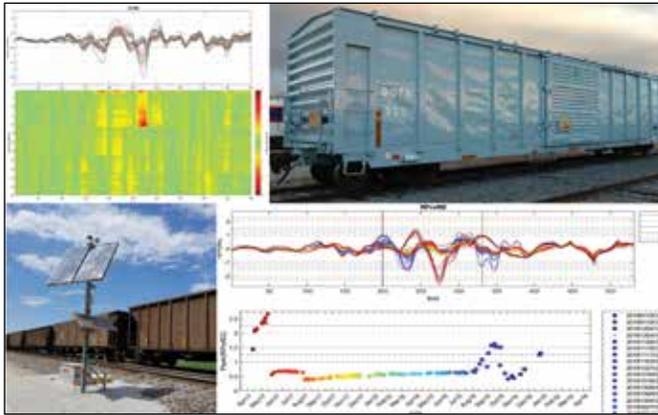
Simplifies enterprise-wide storage, analysis, and dissemination of track infrastructure, maintenance, and inspection data.

Key Features

Use Track/IT for data management

- Track geometry measurements
- Rail wear
- Rail corrugation
- Overhead wire anomalies
- Third rail derivation
- Autonomous V/TI and track geometry
- Track charts
- Right of way video recording
- Track bed video recording
- Ultrasonic rail inspection

Automated Maintenance Advisor (AMA)



ENSCO's AMA transforms track measurement data into actionable maintenance tasks. Leveraging ENSCO's expertise in track condition monitoring and deterioration, the AMA trends deteriorating conditions and recommends proactive, scientifically-informed maintenance tasks.

Automated and Integrated

The AMA is a web-based application that is fully integrated with ENSCO's DTN and TrackIT web products. It accepts measurement data from all ENSCO manned and autonomous track measurement systems and can be configured to accept data that is not generated by ENSCO. The AMA recommends maintenance tasks based on the measured track condition. The AMA can also be integrated with Enterprise Resource Planning (ERP) systems, such as SAP or Maximo to execute those maintenance tasks as work orders. The AMA is intended to operate automatically, routinely assessing condition data, and recommending maintenance tasks when applicable.

Deterioration Trending

The AMA is designed to be fully flexible and configurable by the end user to define deterioration trending settings. The AMA can handle both linear and point assets. For linear assets, the AMA performs dynamic segmentation based on asset characteristics. The user can create user-defined trending parameters, such as custom TQI or TCI. The AMA can also be integrated with VAMPIRE to create vehicle/track interaction data to be used in the track deterioration trending.

Maintenance Identification

Users can define custom rules logic to determine when and where maintenance tasks need to be completed. Alternately, users can use ENSCO's recommended settings defined by our track experts. The AMA can also recommend both repair maintenance, such as tamping, and replacement maintenance, such as undercutting. Rules logic can include cumulative tonnage and component information, such as manufacturer or component type. The final output recommends maintenance tasks with earliest and latest dates, and start and stop mileposts (kilometer posts). If the AMA is integrated with an ERP, the AMA includes a human approval process of maintenance tasks before they are sent to the ERP.

Data Viewing

The AMA can be configured to operate automatically on the server. The resulting data is viewed in ENSCO's web-based TrackIT map and track chart. Additionally, the user can select specific segments, or point assets to see trend lines over time.

Examples of AMA recommended maintenance tasks;

Rail grinding

- Rail replacement
- Tie replacement
- Tie pad replacement
- Tamping
- Ballast renewal (undercutting)
- Turnout maintenance
- Diamond maintenance

Key Features

- Both Web-based and workstation-based
- Fully automated operation
- Separate "sand-box" instance used for settings optimization
- Recommends maintenance tasks with earliest/latest dates and start/stop mileposts (kilometer posts)
- User customized settings and rules logic
- Flexible to various asset and measurement types
- Integrates with all strip chart and exception data produced by measurement and imaging systems, including automated VAMPIRE.
- Optional application hosting by ENSCO as a service

Benefits

- Increases maintenance efficiency
- Decreases unneeded maintenance work
- Condition-based maintenance
- Uses actual measured data to recommend maintenance
- Reduces manual data analysis

GeoEdit 8 and GeoEdit 8 PLUS

Manage your track measurement data effectively



GeoEdit 8 is a Track Measurement Data Management program in a Windows environment. It can be used to view data, generate reports, assist in maintenance management planning, and export data for a range of efforts. It provides quick access to exception, curve, and graphical data in a concise and user-friendly format.

Benefits

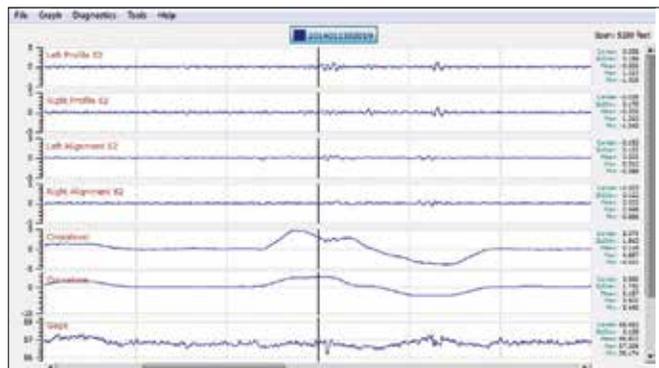
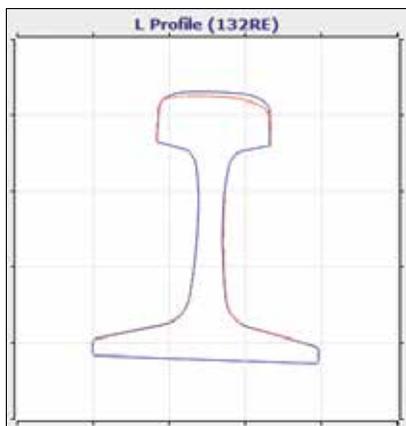
This program supports a range of functions, including track geometry, rail profile, ride quality, DGRMS, third rail, and corrugation assessments. It allows users to overlay multiple track measurement survey files and plot differences between channels from different files. The program facilitates the generation and printing of detailed reports and plots, and it can reverse the direction of data to compare separate surveys. Additionally, it prepares continuous track geometry and rail profile data for vehicle/track interaction modeling and supports exporting data in various formats, such as CSV, VAMPIRE, and MiniProf. This enhances insight and understanding of the data with accurate annotation while offering the cost efficiency of a paperless environment.

Users

- Track supervisors
- Division engineers
- Track engineers
- Maintenance managers
- Track analysts
- Vehicle dynamics

Requirements

Microsoft Windows 7, 8, or 10; 8 GB RAM, 60 MB hard drive space



Features

Exception List

- Scrollable listings of recorded events and calculated exceptions.
- Click-on defect list to display on strip chart.

Strip Chart Viewing

- Customizable display of multiple track measurement channels.
- Click to view rail profile at associated track geometry location.
- Synchronized with exceptions and curve lists
- Strip chart measuring tool.

Rail Profile Viewing

- Display of absolute and relative parameters including cant and wear parameters.
- Pan and zoom utilities on rail profile plots.
- Slider bar and play button to rapidly view rail profiles throughout survey.

Exports

- PDF reports for exceptions, curve analysis, strip charts, and rail profiles.
- Export continuous track geometry to CSV and VAMPIRE formats over selectable ranges.
- Export rail profiles to MiniProf format.

Virtual Track Walk[®] (VTW)



ENSCO's VTW software allows high-resolution track images to be inspected in the office. A key feature is the ability to view synchronized images from multiple inspection cameras, along with milepost and GPS data. VTW provides tools for marking defects and identifying track assets, which are then automatically tagged with milepost numbers and GPS coordinates. Identified defects and assets can be exported to CSV reports.

Automated and Manual Exception Review

VTW is the key software package for reviewing exceptions identified by automated algorithms. It can also be used to manually identify exceptions as is done in a walking track inspection.

Optimized Concrete Tie Grading

A key feature of the VTW is its application in concrete tie grading. It can be used to verify automated tie grading algorithms or to perform manual grading. Users can view multiple perspectives of the ties, including zoomed-in images to inspect hairline cracks. The program allows for manual scrolling through ties or systematic display of each tie and specific areas of interest. Additionally, it enables identification of assets such as mileposts and markings on the rail web to ensure locational accuracy. Tie grading reports can be exported, facilitating rapid and accurate grading.

Asset Location Verification

VTW can also be used for verification of asset locations, such as signs, signal masts, insulated joints, road crossings, switches,

and diamonds. The user can click on any of the multiple views to identify an asset and VTW will automatically determine the milepost and GPS coordinates of the asset. The user can define the type of asset and the name in the details on the asset. Identified assets can be exported to CSV format with milepost, GPS, and asset details.

Supported ENSCO Imagery Systems

- Driver View Imaging System (DVIS)
- Track Component Imaging System (TCIS)
- Joint Bar Inspection System (JBIS)
- Rail Surface Imaging System (RSIS)
- Overhead Wired Imaging System (OWIS)
- Third Rail Imaging System (TRIS)
- Thermal Imaging System (THIS)
- Track View Imaging System (TVIS)
- Tunnel Wall Imaging System (TWIS)
- Rail Component Imaging System (RCIS)

Key Features

- Simultaneous viewing of images from multiple cameras
- Support for multiple computer monitors
- Customizable viewing and settings for user preferences
- Ability to move and adjust windows as needed
- Synchronization of all images with milepost (kilometer post or chainage) and GPS coordinates
- Scrolling, zooming, and video playback capabilities
- Functionality to mark defects and identify assets
- Tie grading capabilities
- Automatic calculation of location and GPS coordinates for defect and asset locations
- Export of defect and asset data to CSV format
- Synchronized measurement data viewing with GeoEdit 8 PLUS
- Ability to compare exceptions and assets from previous surveys

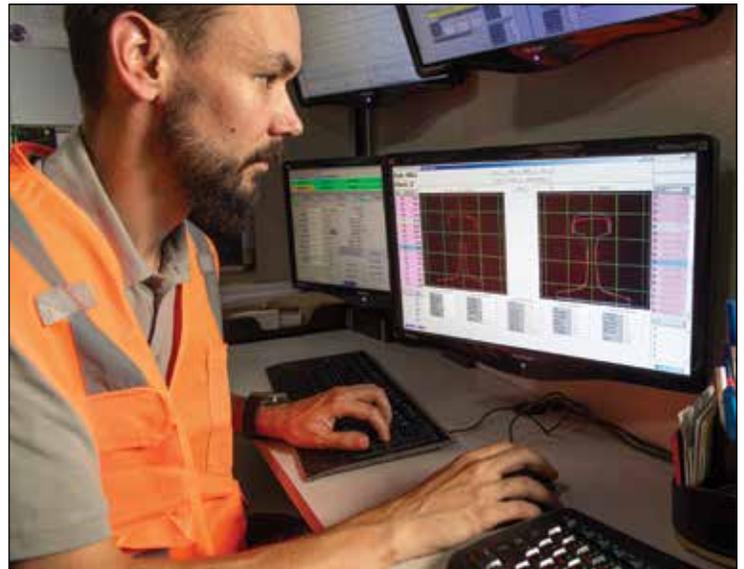
Track Engineering Services

In addition to ENSCO's industry leading products, we also serve our customers providing critical engineering services. These services aid railways that need to supplement their staff, grow and train in-house staff, and accelerate utilizing data from automated track inspection technologies to aid in decision making and improved railway operations. ENSCO's engineering services include:

- Expert Staff to Plan and Operate Inspection Technology
- Track Inspection Technology Operations Program and Processes Implementation
- Asset Mapping and Register Construction Using Inspection Data
- Track Maintenance Planning.

Expert Staff to Plan and Operate Inspection Technology

ENSCO has operated and maintained track inspection vehicles for over 50 years. Our team has extensive experience supporting railroads in establishing operational procedures for successful track geometry testing, ultrasonic rail testing, track mapping programs, and more. This expertise covers all aspects of testing, including safety procedures, operational protocols, data distribution, threshold establishment, and test frequency determination. Additionally, ENSCO can support the operation and maintenance of all testing and measurement equipment on a turnkey basis or through a knowledge transfer partnership to effectively train railroad staff.



ENSCO staff can operate and maintain your track inspection technology on your behalf.

Track Inspection Technology Operations Program and Processes Implementation

ENSCO is a global leader in developing comprehensive track inspection programs, from optimizing inspection technology to establishing internal processes and creating documentation.

ENSCO's expertise in this area can be applied to:

- Developing internal staffing requirements and training plans to establish a skilled in-house team for the life of the asset, aligned with the railway's practices.
- Creating operation plans for integrating track inspection vehicles into railway operations, including track control interaction, surveying, and storage.
- Developing maintenance plans that incorporate the railway's existing maintenance resources.
- Establishing or updating internal track inspection standards to incorporate advanced inspection technology, including recommended exception thresholds and corresponding maintenance responses.
- Providing financial analysis and budget planning support.



ENSCO can provide expertise in building your internal track inspection program.

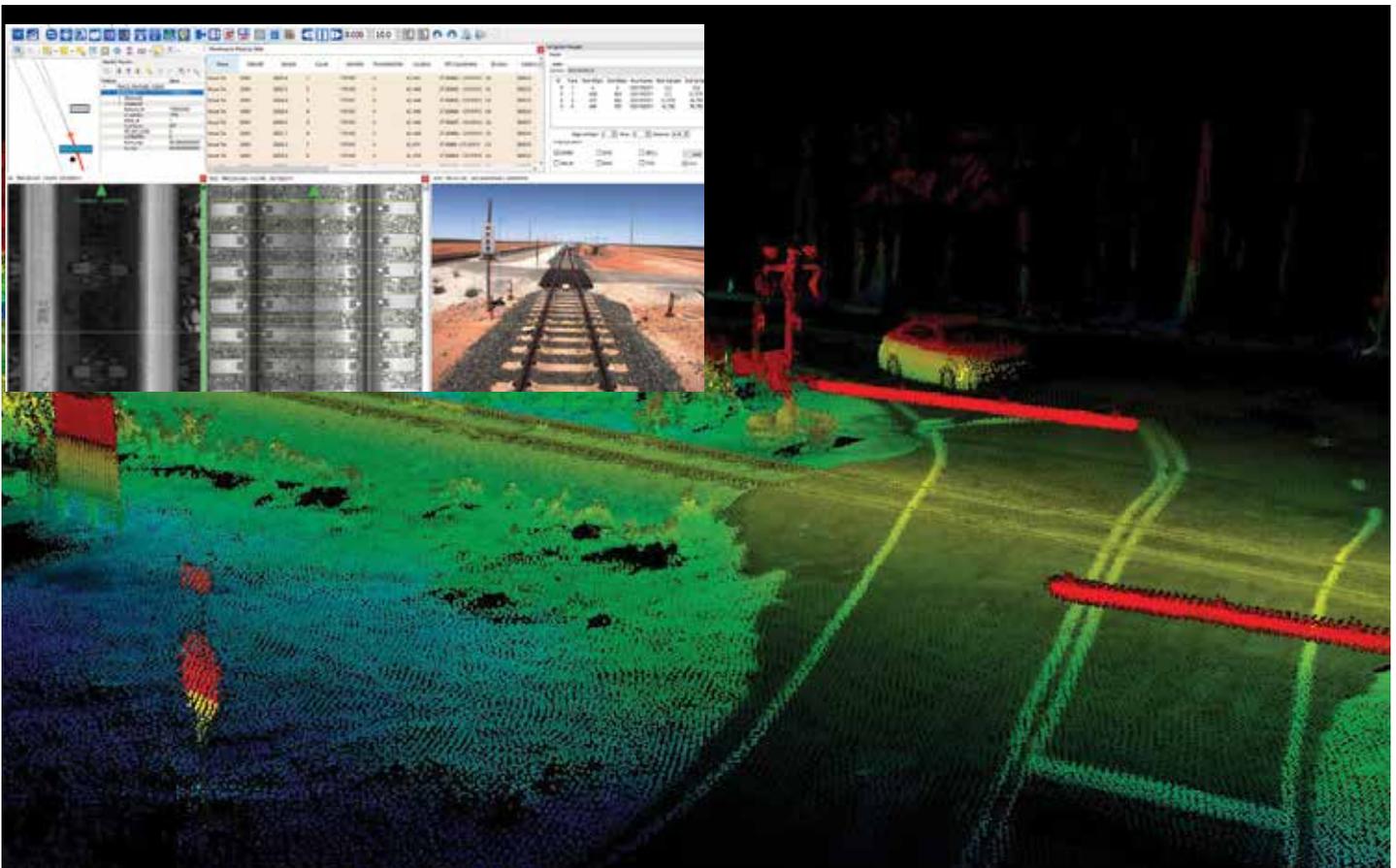
Asset Mapping and Register Construction Using Inspection Data

Track infrastructure asset management and planning services use advanced track inspection technology to capture and assess fixed infrastructure-related assets, determining and recording asset inventory and geographical locations. This results in a comprehensive asset register that forms the foundation for an asset management program, linking condition data, exceptions, defects, and inspections.

As infrastructure evolves, a digital “track chart” and Geographic Information System (GIS) are created for record-keeping, safety analysis, and maintenance data analysis. This system allows senior managers to visually monitor the effectiveness of inspection and maintenance activities. Additionally, existing asset hierarchy and componentization templates can be customized to meet specific needs for rail infrastructure assets.

Asset Mapping and Register Construction Services

- Operational planning and confirming the total length of track to be surveyed matches predefined sections
- Assets and location identification
- Asset classification
- Quality assurance of all data before importing into your asset register system
- Importing assets into your asset management system (SAP, Maximo, or other enterprise asset management systems) is streamlined with the Automated Maintenance Advisor software, which is available as a condition-based asset register system.

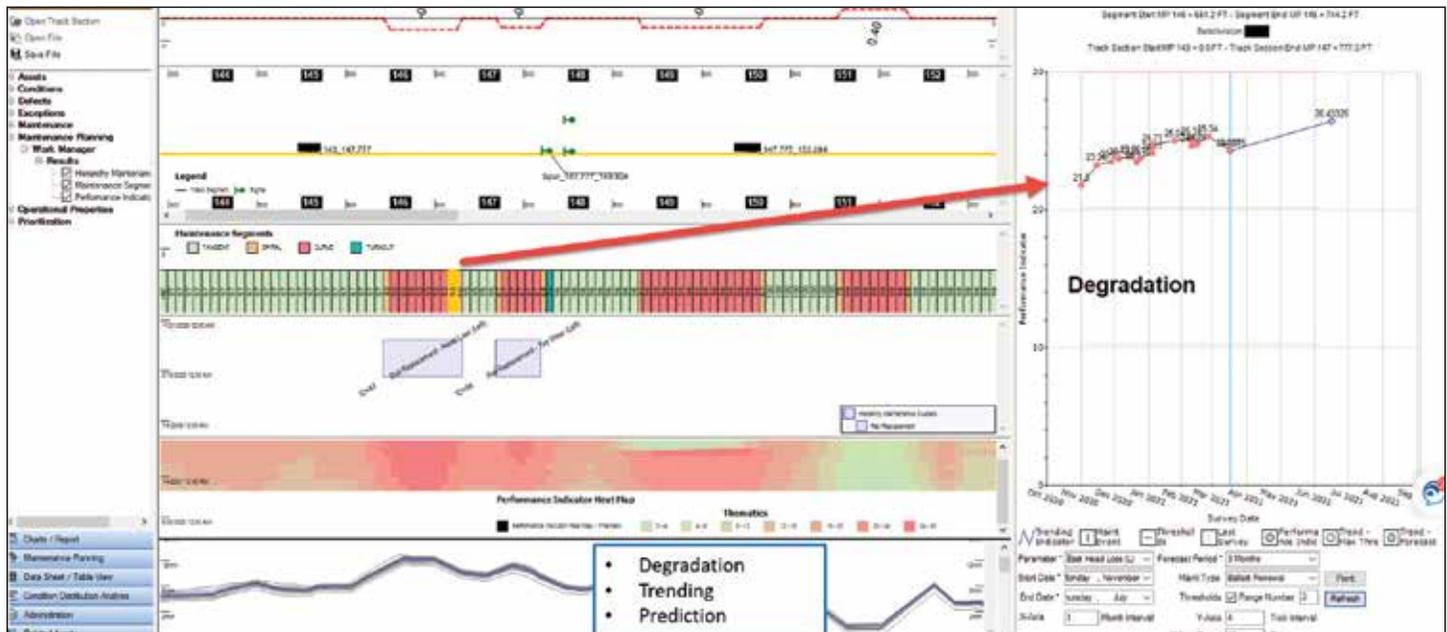


ENSCO is able to use LiDAR, machine vision, and GNSS to build your asset register.

Track Maintenance Planning

Combining track maintenance planning experts with cutting-edge software, the company provides both services and software products for science-driven track maintenance and capital improvement plans. The track maintenance planning tools aggregate data from multiple inspection tests to establish degradation rates and trends, and to identify problematic areas. These tools seamlessly generate maintenance orders and establish optimal maintenance routines.

Proposed maintenance tasks are data-driven, identifying specific locations and time frames for maintenance to achieve maximum optimization at the lowest cost.



ENSCO's track maintenance planning experts are equipped with advanced software tools and data scientists to achieve data-driven results.

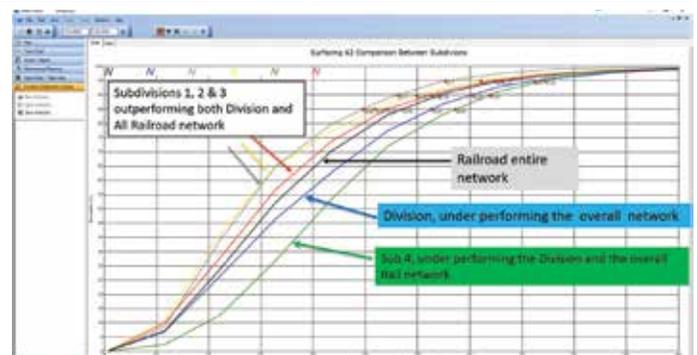
Case Study: Track Maintenance Planning

Project: Condition-Based Maintenance Planning and Advising

The Challenge: Optimize maintenance needs over large, extensive networks.

The ENSCO Approach: Utilize autonomous and manned track inspection systems to consistently collect a range of measurements, including track geometry. Analyze the data with ENSCO's AMA software to evaluate performance across the entire network, divisions, and subdivisions, focusing attention on specific areas requiring further analysis.

Result: Achieved more objective, data-driven maintenance decisions.



Track Maintenance Planning Capabilities

- Designing track quality indices and health scores.
- Utilizing asset condition data and trends to identify necessary track maintenance.
- Proposing maintenance actions, including tamping, ballast renewal, rail grinding, and rail replacement.







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