

Enhanced Visual Inspection

Image analysis software

The core intelligence for converting raw image data into information is embedded within our “Enhanced Visual Inspection” software suite which consists of a library of software modules. These modules are used for intelligent image interpretation, with each module focussed on a different track inspection and measurement task. Some software modules are designed to work near real-time on-board the vehicle whereas others work offline. The online analysis is used to provide near-real-time alerts on critical defects to vehicle operator, whereas off-line automated data analysis is carried out within an office environment to find and report on other defects. The software provides a range of defect and run by run exception reports for maintenance planning. The following description illustrates EVI software’s technical capability.

Track Inspection Image Analysis

Input	Track images captured using line-scan camera with high resolution of up to 1 mm. The line-scan jpeg data is processed using modular image analysis software on a cluster of high speed processors.
Capability	<p>Automated image analysis solution is available for on-board and offline data processing to detect following features:</p> <ul style="list-style-type: none"> ▪ Rail joints: Cracked or broken fishplates, missing nuts and bolts, incorrectly fitted fishplates, gaps and damaged joints, weld defects ▪ Switch areas: Surface defects, cracks, breaks, running band deviation, and lubricators ▪ Rails: Wheelburns, squats, shelling, cracks, running band deviation, broken rail, and rolling contact fatigue cracks ▪ Jointed track: Enlarged gaps between rail ends particularly during hot weather, absence of gaps at rail ends during cold weather, classification of fishplates and differentiation from IBJs, broken T piece, and temporary welds ▪ Track fastenings: Classification on clip type, detection of broken, loose or missing clips ▪ Ballast: Detect areas of excess ballast ▪ Level crossings: Detection and obstructions in flangeways ▪ Sleepers (ties): Sleeper classification, cracked or broken sleepers and incorrect sleeper spacing (for wood sleepers analyses anchor patterns, spike patterns, and plate cutting) ▪ Track clearances: Unidentified objects causing obstruction ▪ Signalling assets: Detection of TPWS, AWS magnets, and red bonds

3rd Rail measurements

Input	High speed linescan images and laser data
Capability	<ul style="list-style-type: none"> ▪ Detection of broken insulator pots ▪ Detection of defective joints and breakages

Rail Wheel Interface Analysis

Input	A high speed area scan image captured at up to 250 frames per second
Capability	<ul style="list-style-type: none"> ▪ Profile of wheel deviation from rail flange ▪ Estimates of potential corrugation

Forward Facing Image Analysis

Input	A high definition area scan image with a wide angled lens. An overhead imaging system can be similarly used to image overhead wires and pantograph.
Capability	<ul style="list-style-type: none"> ▪ Vegetation profiling ▪ Overhead line obstructions ▪ Signal sighting distance measurement ▪ Detection of level crossings and threats

Data Processing Task Manager

Task manager	The data processing manager is responsible for processing large volume image data using a distributed processing system.
Capability	<ul style="list-style-type: none"> ▪ Distributing image processing across multiple processors for quick analysis ▪ Selected track features can be processed ▪ Compiles results seamlessly into a database for upload into EVI reporting software or TrackPad

System Output

Database	<p>Image analysis results are archived in a SQL database which is used by EVI reporting software for providing analysis results to end-user</p> <p>The system can also export defect images with defect areas marked</p>
Capability	<ul style="list-style-type: none"> ▪ Each data entry shows defects with their location, and size measurements ▪ The database can be queried for generating a range of reports based on user requirements ▪ The database can be exported and integrated with external systems

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