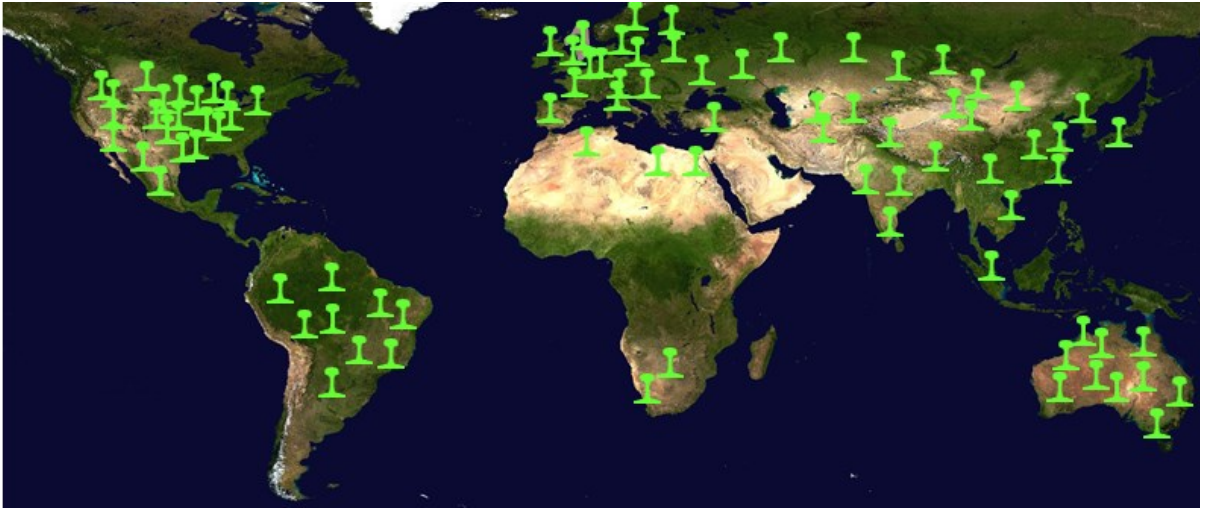


KLD LABS
MEASUREMENT TECHNOLOGIES
An ENSCO Company



BigData
Solutions



Technology with Vision

Integrity

Dedication

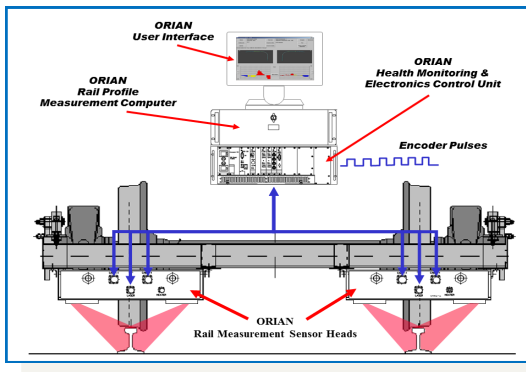
Excellence

- KLD Labs is a machine vision system provider offering Big Data Solutions to the world's railways
- Providing infrastructure, rolling stock managers, contractors and consultants accurate data to perform their work and evaluate railway assets
- Offering Big Data analytics for machine vision applications and assets railway evaluation
- Systems are deployed and supported in 32 countries
- Preferred supplier to railways, supplier and service providers
- Excellence in system performance, reliability and support
- Custom machine vision solutions for challenging railway configurations and special requirements



Machine Vision for Rail Grinding Assessment

Benefits/Features

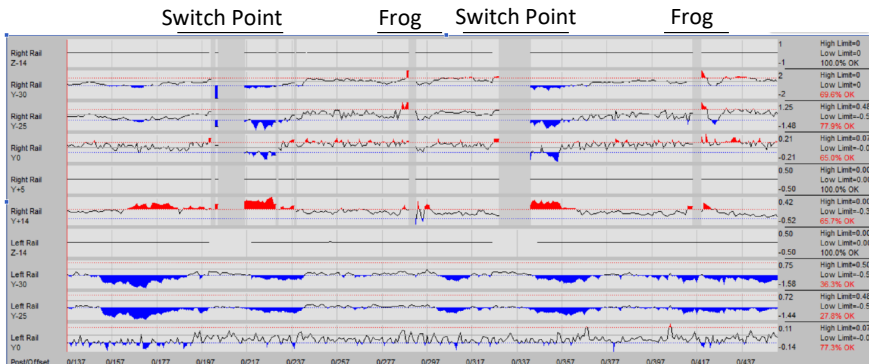
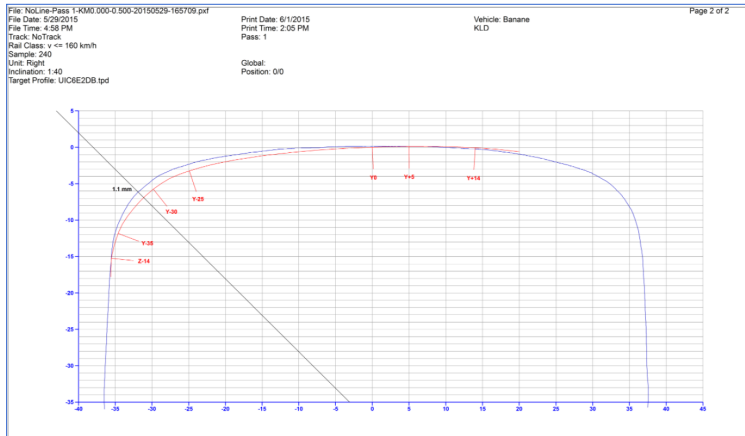
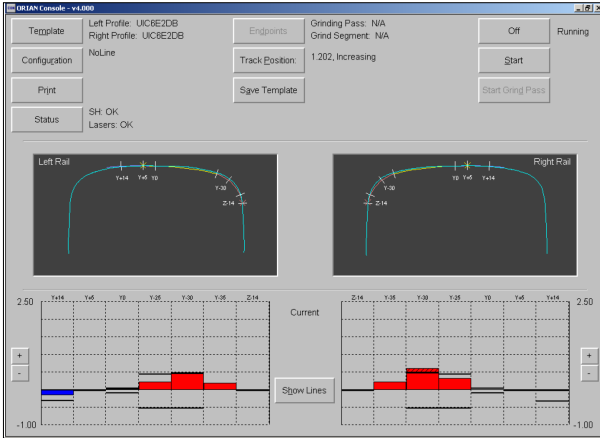


- Automatically evaluates the rail before and after grinding
- Digital record of rail profile/target rail profiles/pass number
- Track speed non-contact data collection
- Standalone or fully integrated with on-board systems
- Eliminates manual measurements/user-to-user variability
- Most widely deployed rail profile measurement on rail grinders in the world
- Rugged design for rail grinding environment
- Complete data analysis toolbox

Grinding Software

Benefits/Features

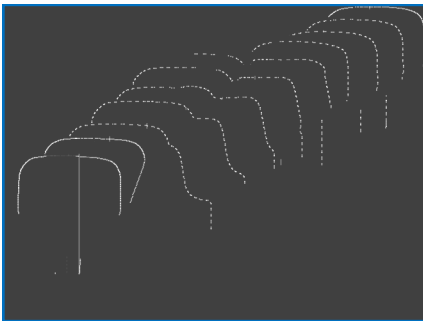
- Comprehensive Rail Grinding Analytics and Reporting
- Compliant to EN13231-3 and EN13231-4 Norms for Mainline and Switch Rail re-profiling
- Pre/post grinding rail profile analysis





Machine Vision for Special Trackwork Assessment

Benefits/Features

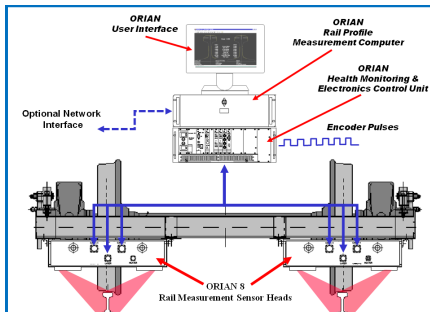


- Comprehensive cross-sectional measurements of special track work
- Performs key measurements including guard rail position, gap and wear condition
- Standalone or fully integrated with on-board systems
- Eliminates manual measurements/user-to-user variability
- Installs on track inspection, maintenance equipment, in-service and hi-rail vehicles
- Complete data analysis toolbox



Machine Vision for Rail Wear Assessment

Benefits/Features

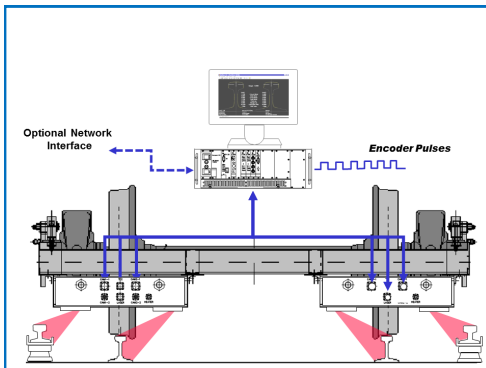


- Non-contact rail measurements/rail cant/profile at track speed
- Automatically calculates rail wear values and exception reports
- Eliminates manual measurements/user-to-user variability
- Standalone or fully integrated with on-board systems
- Installs on track inspection, maintenance equipment, in-service and hi-rail vehicles
- Supports track geometry measurement, ultrasonic probe positioning, wheel/rail data interface
- Complete data analysis toolbox



Machine Vision for 3rd Rail Analysis

Benefits/Features

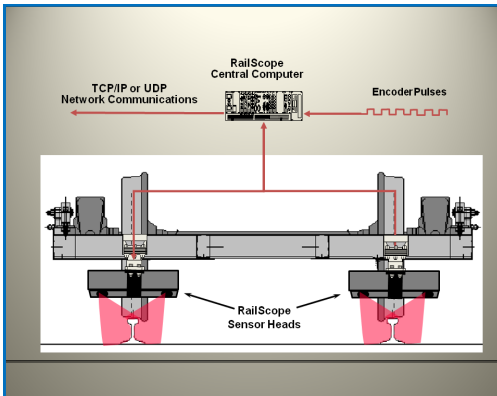


- Non-contact measurement of 3rd rail positional geometry and gauge at track speeds
- Designs for bottom and top contact shoes
- Standalone or fully integrated with on-board systems
- Eliminates manual measurements/user-to-user variability while enhancing the safety of 3rd rail inspection
- Installs on track inspection, maintenance equipment, in-service and hi-rail vehicles
- Optional 3rd rail temperature and IR imaging
- Complete data analysis toolbox



Machine Vision for Rail Surface Assessment

Benefits/Features

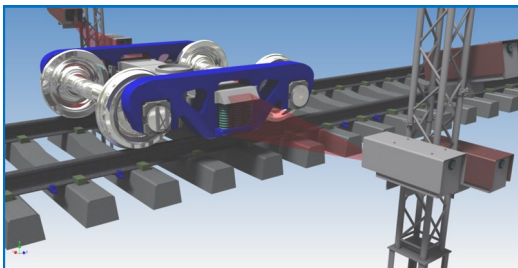


- Perform high resolution imaging of the rail surface condition at track speed
- Continuous or exception only image storage
- Standalone or fully integrated with on-board systems
- Can be integrated with automated rail profile systems
- Eliminates manual evaluations/user-to-user variability
- Rail surface image analysis
- Installs on a wide variety of railway vehicle designs



Machine Vision for Truck/Bogie Assessment

Benefits/Features

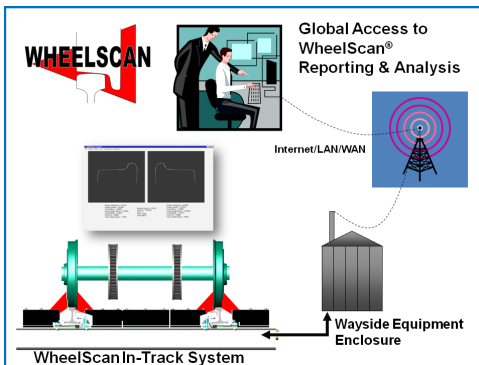


- Automatic detection and analysis of bogie components
- Suspension issues and vehicle asymmetry detection
- Web accessible database, analysis and reporting
- Fully integrated with automatic vehicle identification
- Predictive maintenance
- Eliminates manual inspections/user-to-user variability
- Yard, shop and mainline installation
- 24/7 data collection
- Speed independent

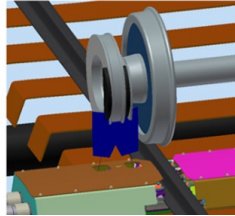
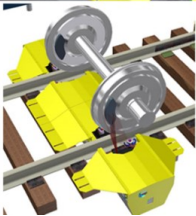
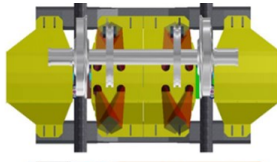
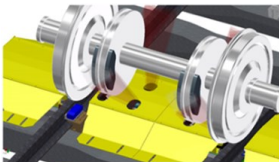
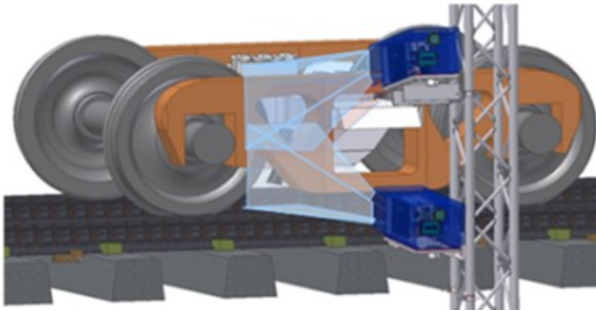


Machine Vision for Wheel Wear Assessment

Benefits/Features

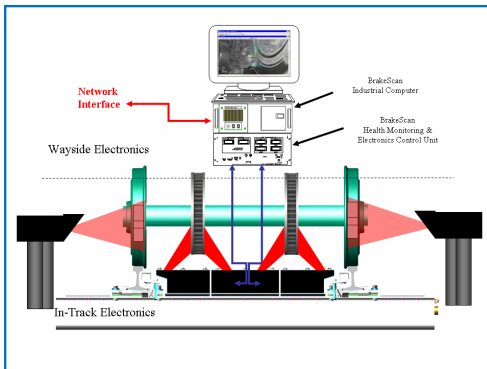


- Track speed wheel profile measurement for analysis, alerting, and trending
- Eliminates human error and increases data timeliness
- Web accessible asset management tools
- Exports to all asset management systems
- Operates 24/7 at track speed
- Yard, shop and mainline installation
- Supports wheel/rail interface analysis

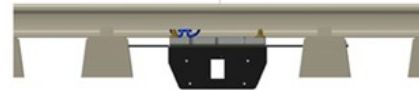
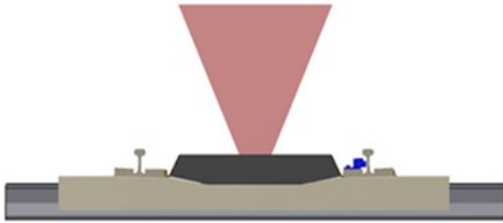
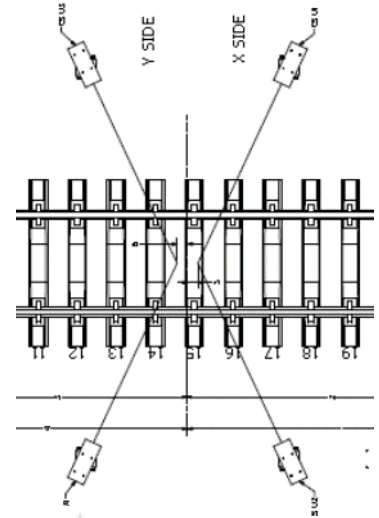


Machine Vision for Brake Shoe/Disc Assessment

Benefits/Features

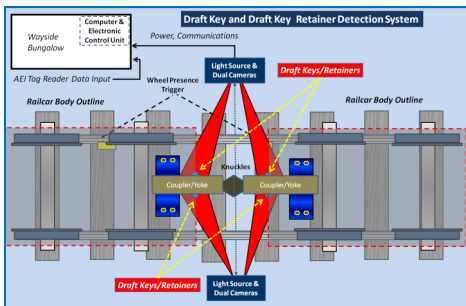


- Continuous brake wear measurement and analysis for brake shoes, pads and rotors
- Eliminates manual measurement
- Web accessible database, analysis and reporting tools
- Exports to all asset management systems
- Operates 24/7 at track speed
- Yard, shop and mainline installation
- Optional measurements for pilot and door height

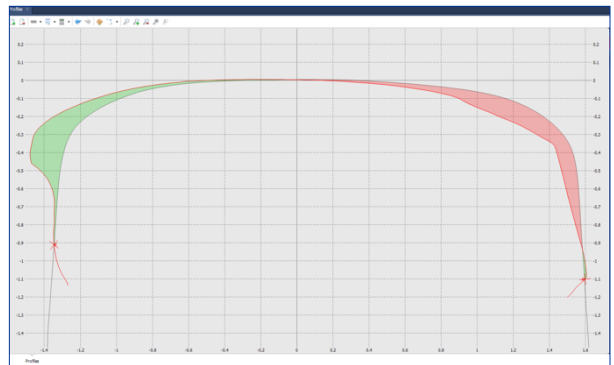
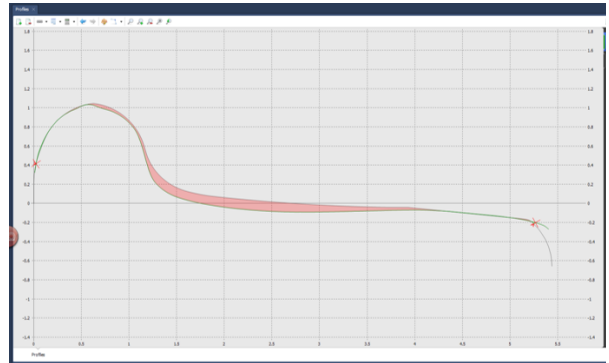


Machine Vision for Coupler Assessment

Benefits/Features



- Continuous capture of key coupler components at track speed
- Automatic detection of coupler issues
- Fully integrated with automatic vehicle identification
- Comprehensive database, analysis and reporting tools
- Data exchange with maintenance management systems
- Eliminates manual inspections/user-to-user variability
- Yard, shop and mainline installation



MiniProf Portable Measurement Instruments

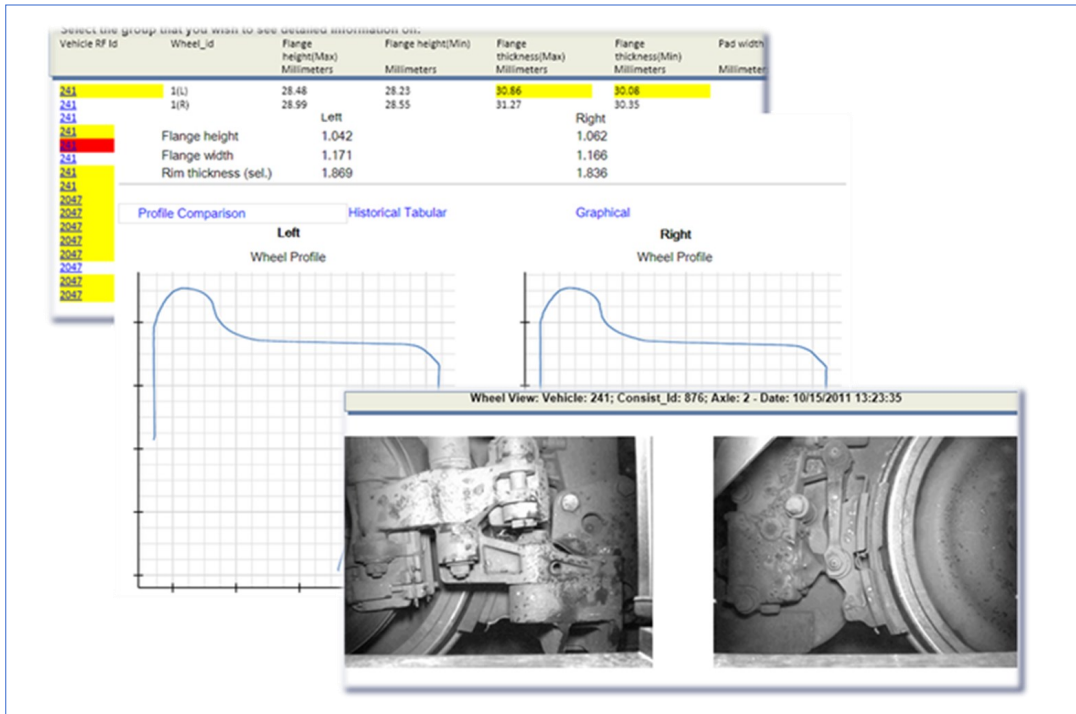
Benefits/Features



**MiniProf
Envision**

Complete data analysis toolbox

- Full digital profile record of key railway assets
- Lightweight and wireless
- Works with PDA, Tablet or Notebook PC
- Easily enables wheel/rail interface studies
- Envision Software—complete data analysis toolbox

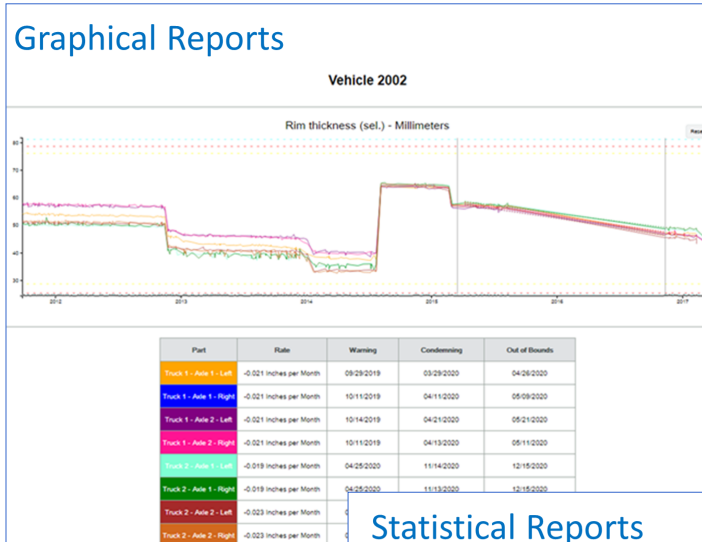


Cloud Based Big Data Management and Analysis

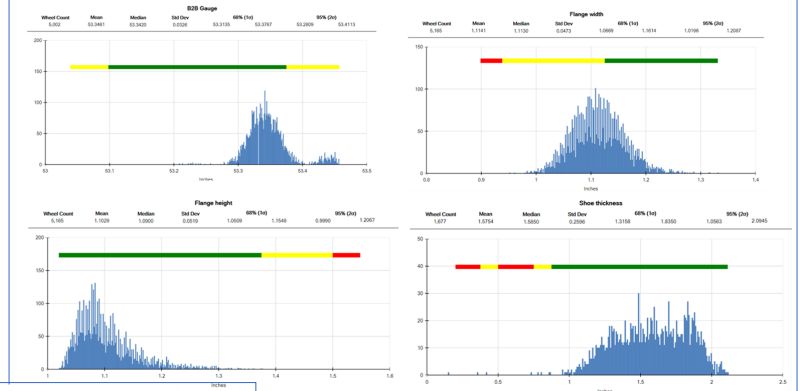
Benefits/Features

- Cloud or locally Hosted database, analysis, reporting and alerting tools
- MS SQL scalable backend
- Fleet and individual vehicle condition
- Tabular, statistical, graphical, trending and predictive maintenance reporting
- Exports data to rail Industry's EAM/CMMS software and other 3rd Party applications

Graphical Reports



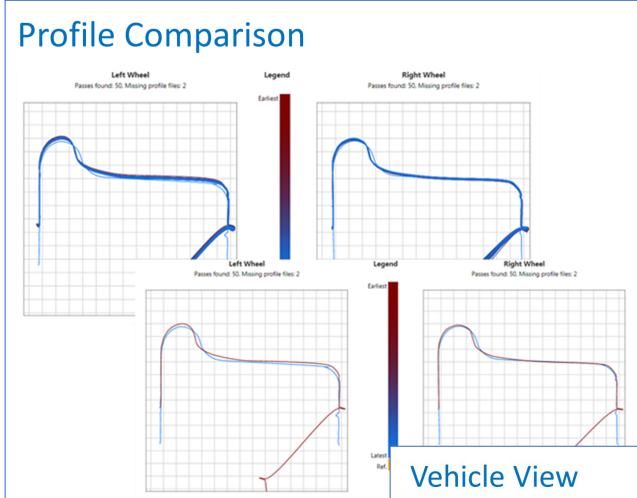
Statistical Reports



Predictive Reports

Predictive Report: Prediction Count 9

| Vehicle ID | Wheel ID | Measurement Type | Exception Date |
|------------|----------|----------------------|----------------|
| 2838 | 1-L | Rim thickness (sel.) | 04/08/2018 |
| 2838 | 1-R | Rim thickness (sel.) | 04/16/2018 |
| 2857 | 4-L | Rim thickness (sel.) | 07/27/2018 |
| 2558 | 4-R | Rim thickness (sel.) | 08/02/2018 |
| 2501 | 1-R | Rim thickness (sel.) | 08/26/2018 |
| 2558 | 4-L | Rim thickness (sel.) | 09/20/2018 |
| 2836 | 2-L | Rim thickness (sel.) | 09/21/2018 |
| 2501 | 1-L | Rim thickness (sel.) | 10/01/2018 |
| 2554 | 1-R | Rim thickness (sel.) | 11/02/2018 |



Vehicle View

The vehicle view diagram shows a top-down perspective of a vehicle chassis with two axles. Red highlights indicate the wheel and axle locations. To the right of the diagram are several data tables for 'Wheel', 'Axle', 'Door', 'Brake', 'Check Brake Assembly', 'Check Brake Split Ratio', and 'Check Brake Pad'.

| Measurement | Left | Right |
|--|--------|--------|
| Depth (X) rate - inches per Month | -0.003 | -0.006 |
| Diameter (X) - inches | 32.900 | 32.747 |
| Flange height - inches | 1.183 | 1.200 |
| B29 Gauge - inches | 53.309 | 53.309 |
| R1 Face 2 R1 Face - inches | 55.006 | 55.006 |
| Flange angle - Degrees | 73.52 | 66.63 |
| Hollow tread - inches | 0 | 0.013 |
| Truck taper (R) - Degrees | 2.41 | 1.79 |
| Tread width - inches | 3.672 | 3.671 |
| F height rate - inches per Month | 0.001 | 0.002 |
| B29 rate - inches per Month | 0.001 | 0.001 |
| FF2FF rate - inches per Month | -0.023 | -0.023 |
| F angle rate - Degrees per Month | 0.012 | -0.060 |
| Hollow tread rate - inches per Month | 0 | 0.000 |
| T taper (L) rate - Degrees per Month | 0 | -0.012 |
| T width rate - inches per Month | 0.000 | 0.000 |
| Flange width - inches | 1.117 | 1.000 |
| F width rate - inches per Month | -0.001 | 0.000 |
| Rim thickness (std.) - inches | 2.475 | 2.374 |
| Rim thickness (std.) rate - inches per Month | -0.002 | -0.003 |

| Measurement | Value |
|-------------------------|-------|
| Diam (Y) delta - inches | 0.154 |

| Measurement | Value |
|----------------------|--------|
| Sill height - inches | 17.540 |

| Measurement | Left | Right |
|--|-------|-------|
| Shoe increase - inches | 0.002 | 1.000 |
| Shoe present - Yes/No | Yes | Yes |
| Shoe thickness rate - inches per Month | 0.000 | 0.000 |

| Measurement | Left | Right |
|-----------------------------|-------|-------|
| Rotor width (std.) - inches | 0.905 | 0.900 |

| Measurement | L.Fault | L.Gauge | R.Gauge | R.Fault |
|--------------------------|---------|---------|---------|---------|
| Std. dev. value - inches | 0.012 | 0.001 | 0.002 | 0.016 |

| Measurement | L.Fault | L.Gauge | R.Gauge | R.Fault |
|--------------------------------|---------|---------|---------|---------|
| Clearance pad present - Yes/No | Yes | Yes | Yes | Yes |
| Pad thickness - inches | 0.900 | 0.700 | 0.610 | 0.930 |

Exports to Multiple Formats

The screenshot shows the TrainBase software interface. At the top, there are navigation and tool icons. A dropdown menu is open, showing export options: Acrobat (PDF) file, CSV, Excel 97-2003, TIFF file, and XPS Document. Below the menu, the text 'ular report - 9/5/2018 10:41 AM' is visible. The main area contains a table with the following data:

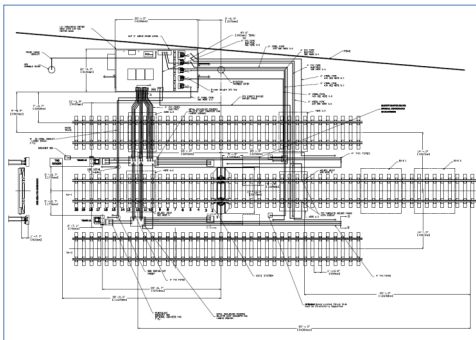
| Consist ID | Vehicle ID | Part Location | B29 Gauge Inches | Flange height Inches | Flange width Inches | Hollow tread Inches | Rim thickness (std.) Inches | Shoe thickness Inches |
|---------------------------------|------------|--------------------------|---------------------|-------------------------|------------------------|------------------------|--------------------------------|--------------------------|
| Willowbrook:08/24/2018 17:54:20 | 2002 | Truck 1 - Axle 2 - Left | 53.174 | 1.203 | 1.348 | 0.000 | 2.457 | |
| Willowbrook:08/29/2018 06:55:39 | 2002 | Truck 2 - Axle 1 - Left | 53.254 | 1.316 | 1.380 | 0.071 | 2.334 | |
| Willowbrook:08/29/2018 06:55:39 | 2002 | Truck 2 - Axle 1 - Right | 53.254 | 1.179 | 1.317 | 0.000 | 2.490 | 1.793 |
| Willowbrook:08/29/2018 06:55:39 | 2002 | Truck 2 - Axle 2 - Left | 53.222 | 1.215 | 1.328 | 0.000 | 2.457 | |
| Willowbrook:08/29/2018 06:55:39 | 2002 | Truck 2 - Axle 2 - Right | 53.222 | 1.283 | 1.445 | 0.056 | 2.367 | |
| Willowbrook:08/29/2018 17:54:22 | 2002 | Truck 1 - Axle 1 - Right | | | | | | 1.896 |
| Willowbrook:08/29/2018 17:54:22 | 2002 | Truck 2 - Axle 1 - Right | | | | | | 1.828 |
| Willowbrook:08/29/2018 17:54:22 | 2002 | Truck 2 - Axle 2 - Right | | | | | | 1.747 |
| Willowbrook:09/04/2018 09:28:31 | 2002 | Truck 1 - Axle 1 - Left | 53.211 | 1.184 | 1.337 | 0.000 | 2.504 | |
| Willowbrook:09/04/2018 09:28:31 | 2002 | Truck 2 - Axle 1 - Right | 53.224 | 1.175 | 1.332 | 0.000 | 2.491 | |



Engineering Support Services

Benefits/Features

- In-track and trackside systems specification development
- Main line, in-shop and depot yard engineering technical support
- Design services and consulting
- Civil works management
- Global onsite technical support
- IT/Data Hosting Services
- Remote Monitoring
- Turnkey services





- 500 Systems deployed in 32 Countries
- Railway customers include passenger, freight, and light rail systems
 - Design/construction companies
 - Railway manufacturers
 - Railway contractors
 - Research institutions
- Supplier/Partner to the world's leading railways and service providers
- Supporting systems for over 30 years

Deployments



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