The complete provider for Gauging Products and Measurement Systems
Effective clearance assessment is something that concerns all railways and demands for significantly increased capacity through:

- Faster, larger or longer vehicles
- Double tracking
- Gauge widening

can result in significant costs for infrastructure modification.

In recent years, work in the UK has led to new analytical approaches that have significantly reduced cost of infrastructure modification. The same approach offers significant benefits to other railways around the world.

Necessitated by a requirement to cost-effectively run larger and faster vehicles through tight infrastructure, the UK has developed the most advanced approach to clearance assessment in the world.

Over the past 15 years it has been possible to accommodate larger and faster vehicles, whilst at the same time minimising expensive infrastructure changes and managing risk. This has been done by improving the analytical methods used in clearance assessment, in conjunction with highly accurate measurement systems.

Traditionally and even today, most railways adopt a process called static gauging, which uses worst case conditions and generous allowances to provide safe clearances. To provide increased capacity involves significant civil engineering works to comply with traditional gauges, a very expensive option.

The UK approach, known as absolute gauging, analyses how the movement of a vehicle on its suspension will really affect clearance. The assessment considers how the local speed, installed cant, curvature and track quality affect the vehicle in relation to accurately measured structures.

“The UK has developed the most advanced approach to clearance assessment in the world.”
This new approach to the way in which clearance assessment is carried out is now used throughout the UK and has recently become part of the European standard. The approach is receiving growing interest as demand for increased capacity continues, given its potential for significant savings for infrastructure owners.

Balfour Beatty Rail has been central to the UK’s gauging approach, providing:

- Measurement Systems and Services
- The National Gauging Database
- Clearance Analysis Software ClearRoute™
- Gauging Consultancy Services
- Training for the Industry

"Balfour Beatty Rail provides a complete solution for infrastructure gauging. This includes the provision of LaserFlex™ and LaserSweep™ laser-based measurement systems, ClearRoute™ clearance analysis software and a range of services.”
Balfour Beatty Rail can provide the complete range of structure gauge measurement systems and services.

From manual LaserSweep™ equipment, through trolley and road-rail vehicle mounted scanners to high speed, high accuracy rail vehicle mounted LaserFlex™.

LaserSweep™ is a portable system used to measure the spatial position of railway structures for clearance assessment. The system comes with a PDA computer that controls it and captures the measurement data through a Bluetooth link.

LaserSweep™ has been designed and built to meet the UK’s statutory and safety regulations and has been awarded Product Approval by Network Rail.

The output from the LaserSweep™ is directly compatible with Balfour Beatty Rail’s ClearRoute™ software, for analysis and investigation of vehicle clearances following the survey.

Features

- Very high accuracy of +/- 1.5mm (to 2 sd)
- Day or night time use
- Excellent reflectivity ensures reliable profile measurement
- All-weather operation
- Internal battery power provides 8 hours of continuous on-site measurement, with the option of an additional external 4-hour battery
Scanners and LaserFleX™ solutions provide accuracy and configurability with high productivity. Solutions are available for a range of vehicle platforms, from trolley through road-rail vehicle to train mounted at speeds up to 120km/h.

Our highest performance solution, LaserFleX™ uses a triangulation based measurement approach using high speed cameras and lasers. There are no moving parts and this provides very high accuracy measurement at speeds up to 1KH.

Measurement includes:
- Structure profile
- ‘Six foot’ track interval
- Ballast profile
- Overhead Line
- Platform Edge

Benefits of LaserFleX™
- No moving parts
- High speed and productivity
- Ease of installation and maintenance
- Collection of a comprehensive range of data in a single measurement survey
- Elimination of labour-intensive data collection
- Streamlining of data process through intrinsic noise rejection and decimation

LaserFleX™ can be configured for all-weather use and is intended primarily for night time operation.

“LaserFleX™ combines ultimate accuracy, configurability and productivity.”
TrackRoute™ integrates closely with a number of other related Balfour Beatty Rail products for enhanced editing and clearance analysis.

TrackRoute™ provides a comprehensive storage and data management suite for the administration of structure survey data.

Benefits of TrackRoute™

- Well proven - used to manage the entire UK’s structure and gauging records
- Structure information such as description, imagery and positions are easily stored
- Structures can be defined against tracks allowing surveys to be easily referenced and managed
- Surveys can be imported directly in many formats from manual platform sheets to raw data
- Surveys can be single or two track and allow for extensive details including images
- Configurable to support customer specific infrastructure models
- Provides survey and audit trail reports
- Direct output to ClearRoute™ analysis software
- Graphical viewing of key values including cant, curvature, track fixity, measurement point density and gauge
- Links to various fields such as profile, location, speed and geometry

Where has it been used?

TrackRoute™ has been used successfully to support a wide range of projects, including:

- Toronto Metro, Canada
- PATH, New York
- Network Rail, UK

“TrackRoute™ integrates closely with a number of other related Balfour Beatty Rail products for enhanced editing and clearance analysis.”
DataMap™ is Balfour Beatty Rail’s infrastructure condition visualisation and analysis tool.

DataMap™ allows the combination of track geometry, structure gauging, video data and any other measurements, to be synchronised and accurately located, providing the user with detailed information on the track asset and surrounding infrastructure at a specific location on the network.

Allows structure gauging data to be compared against other parameters at a given location for example:

• Track Geometry
• Ride Quality
• Overhead Line
• Video
• Ballast Profile
• Rail Profile and wear
• Conductor Rail
• Ultrasonic Test Results

Features

• Supports a wide range of data inputs, from any type of vehicle or survey
• Provides spatial synchronisation of all data
• Typically delivers sub-metre run on run location consistency
• Allows comprehensive trend analysis

DataMap™ will take data collected by any type of measuring vehicle or system, including manual measurements. All data is aligned by location, so independent of source and date of collection the most recent information is always shown.

“DataMap™ provides a location based, unified view of all infrastructure measurements allowing structure measurement data to be seen in its broader context.”
Balfour Beatty Rail has developed *ClearRoute™* to provide a highly accurate assessment of clearances.

Vehicle and gauge models are held on an internal database within *ClearRoute™*. Vehicles may be selected individually or as a group to perform an assessment of clearances. Vehicle models include all of the necessary profile and behaviour data, including suspension fault modes, to calculate a dynamic swept envelope. Tools provided allow the user to populate a library of vehicles.

Once structures, vehicles and allowances have been set, a clearance run can be performed automatically - the output being a clearance report in Excel format listing the clearances around the vehicle or gauge envelope, or the go/no-go compliance to specific standards.

Clearances can be either between vehicle and structure or between vehicles (passing clearances).

*ClearRoute™* is particularly suitable for optimising platform clearances – checking the stepping ‘gap’ for stationary trains with the dynamic clearance of moving vehicles.

*ClearRoute™* is used by a number of international operators and complies with many international standards, with others easily incorporated.

“*ClearRoute™* has been a trusted product for carrying out clearance and gauging analysis for many years and has been used to support the introduction of all new trains in the UK for the last 15 years.”
Analysing Measurement Data

HyperRoute™

Increasing complexity of vehicles and the density of measured infrastructure data means that the calculation processes can be time consuming for network wide assessments.

HyperRoute™ is specifically aimed at performing large scale clearance assessments, rather than project level analyses and design. HyperRoute™ has been developed to provide processing speeds of up to 100 times that of ClearRoute™ through a variety of means, including the use of ‘clearance farm’ computing. The system has demonstrated an ability to perform whole network analyses in hours, rather than days.

HyperRoute™ is compatible with and able to perform gauging assessments using static, kinematic and dynamic vehicle models from relevant databases.

The system has been extensively validated against ClearRoute™ and further verified by independent manual calculation methods.

Examples of where HyperRoute™ would be used include:

- Analysis of freight flow traffic enquiries
- Regular production of tight clearance location schedules for the network
- Overall network capability assessments for optimisation and upgrade studies

HyperRoute™ has been used to deliver large scale clearance projects, such as supporting the UK’s recent Gauging Policy and assessing strategic network capability for passenger and freight as part of UK industry initiatives.

Structure Survey Editor

The Structure Survey Editor can be used to view and edit structure profiles which are in ClearRoute™ and LaserSweep™ formats.

Editing functions include removing points taken in error, flipping profiles which were surveyed in the wrong direction and adding attributes such as platform edges.

Groups of profiles can be viewed and edited together and photographic images of the structures can be included.

The Structure Survey Editor allows a more comprehensive check on results to be made whilst on site.
Consultancy Services

Specialist Consultancy Services on Gauging

Balfour Beatty Rail provides specialist consultancy services on gauging to a wide range of clients and are recognised as the consultant’s consultant. We offer a complete and comprehensive gauging service from feasibility study to high accuracy survey, design through to physical works.

Through effective analysis and intelligent engineering it is possible to save money, reduce risk and increase the speed of rolling stock. We have a proven track record in:

- Increasing route capability through cascade of existing vehicles on new routes
- Increasing the speed of existing lines limited by gauging issues
- Design and introduction of new and modified rolling stock on multiple routes
- Solving complex gauging issues to free up route capacity
- Reducing the risk of stepping distance incidents

Supporting New Rolling Stock Introduction

We have worked with many vehicle manufacturers to create ClearRoute/HyperRoute models representing new rolling stock for operation on both UK and International infrastructure. Through an iterative process of design and analysis, a vehicle model may be optimised to best utilise the amount of available space between the rails and the infrastructure.

To support the procurement process for new rolling stock the publication of a defined Gauge line provides a clear definition of the envelope within which a vehicle design should be constrained. The development of this gauge line, based upon the infrastructure (bridges, tunnels, platforms etc) upon the routes, enables the potential exploitation of unused space between a vehicle and the infrastructure to increase the vehicle profile and capacity. Through the use of HyperRoute we undertake accurate, large scale gauging projects in extremely short timescales. Recent examples include the highly prestigious Victoria Line, IEP (Intercity Express) and Thameslink projects.

Identifying Limiting Structures

Of significant benefit is the clear identification of structures limiting the potential for increase in vehicle size and by proposing how the issues could be resolved with the minimum of cost. Statistical analysis, site measurement and optioneering are effective means of mitigating clearance problems to achieve route clearance.
Consultancy & Training

The consultants’ consultant

Platform Stepping Analysis

We have undertaken numerous studies to assess the compliance of stepping distance triangles against current standards. Stepping distance analysis calculates the distance between the vehicle footstep and platform edge for each measured platform profile. Of particular benefit is our presentation of stepping distance results in a format that illustrates the locations where stepping distances are not compliant and hence require Mind the Gap ‘stencilling’.

“Balfour Beatty Rail provide training for the industry at our dedicated facility in Matlock, Derbyshire.”

Training courses are available for all systems, such as Lasersweep™, ClearRoute™, TrackRoute™, DataMap™ and Structure Survey Editor™.

Providing industry recognised accreditation:

- Training is carried out in small groups
- Comprehensive notes and manuals are provided
- Hands on experience is assured