Balfour Beatty Rail
Engineering and Technology Solutions

‘Delivering the benefits of technology to infrastructure asset management’
 Agenda

- Welcome and introductions
- Overview of Balfour Beatty Rail Engineering and Technology Solutions
  - Company information
  - Measuring and visualising infrastructure condition
  - Cost-effective capacity improvement
  - Signalling monitoring
  - Innovative track solutions
- Questions
Balfour Beatty

- Quoted on the London Stock Exchange
- An international infrastructure business:
  - UK plc but with around half the business now overseas
  - Significant operations in the US, Middle East, Far East and Australia
- Four business areas:
  - Professional services
  - Construction services
  - Support services
  - Infrastructure investments
- Lifecycle approach: deliver services essential to the development, creation and care of infrastructure assets
- 50,000 employees worldwide
- Acquired Parsons Brinckerhoff in October 2009

2011 Revenue £11,035m – EUR 13,210m

Construction services
2011 Revenue
£7,050m – EUR 8,440m

Infrastructure Investments
2011 Investments Results
£71m – EUR 84m

Support services
2011 Revenue
£1,584m – EUR 1,896m

Professional services
2011 Revenue
£1,645m – EUR 1,969m

NB – Revenues including shares of joint ventures and associates / Exchange rate 31 Dec 2011
**Balfour Beatty Rail Technologies**

- Part of the Balfour Beatty Rail UK
- 130 professional engineering staff
- Core business is the application of technology to improve infrastructure asset management
**Asset Management Focus**

- Innovative solutions that help deliver more reliable, safer rail infrastructure at reduced lifecycle cost
- Management systems for condition visualisation, decision support and planning
- Systems developed from knowledge of being a maintainer of the UK’s 150 year old rail infrastructure
- Service proven measurement and data acquisition systems
- Applications include track, overhead line, conductor rail, switches and signalling systems
The Business Case for Rail Infrastructure Asset Management

- The results show that some of the better performers achieve this through having better information with which to drive the maintenance process
- Asset management typically costs about 2% to 3% of the cost of maintenance
- Properly implemented it can deliver a 10% to 20% maintenance cost reduction.............a significant return on investment
Measuring and Visualising Infrastructure Condition
Attended Measurement Systems

London Underground – Tubelines Asset Inspection Train

Key Systems
- Inertial Track Geometry*
- Running Rail Profile*
- Check Rail Geometry*
- Conductor Rail Profile/Geometry*
- Corrugation*
- Tunnel Profile(*)

- RFID/GPS based location
- Multi Channel Video (Digital)
- Thermal Imaging
- Ride Quality
- Noise
- Synchronised data display
* = Triangulation measurement systems

Queensland Rail – Road/Rail Vehicle

Key Systems
- Instrumented Pantograph
- Non-contact OHL
- Mast Detection
- GPS based location
- Inertial Track Geometry

- Versine Track Geometry
- Ballast Profile
- Platform Clearance
- Corrugation
- Contact patch
**Rail Infrastructure Measurement**

- A very large part of the UK Network is now measured with Balfour Beatty Rail systems

- **Track Geometry Measurement**
  - TRC
  - PLPR 1 & 2

- **Overhead Line Measurement**
  - Mentor upgrade

- **Structure Gauge Measurement**
  - LaserFlex on SGT1
  - and soon on SGT2
Unattended Track Geometry Measurement

- New track geometry measurement equipment compact and automated for fitment to normal service trains:
  - Dramatically reduced cost
  - Much more frequent measurement
  - Mandated for all new fleets by DfT

- Frequent measurement provides an early indication of developing faults and a clearer understanding of deterioration rates and causes

- This allows the right maintenance to be carried out at the optimum time
  - At an early stage where it can be seen to be cost effective
  - Where safe, as late as possible to minimise intervention costs
Ultrasonic Rail Testing

- Balfour Beatty Rail is working in exclusive partnership with RTI, one of the leading ultrasonic testing organisations, to deliver the 8000SX™ testing system.

- Total Flexibility – service or product offering

- Train borne, RRV or trailer mounted

- Very accurate detection and discrimination of rail faults - ensuring the highest Probability of Detection (POD) with the lowest False Call Rate (FCR)

- Survey to survey comparison to assess defect growth

- Proven with some of the most demanding railways in the world
Data Management Challenge

- More frequent measurement and earlier identification of faults places greater demands on data management systems

- Systems must be more automated and ensure excellent positional repeatability to give confidence in early fault detection and allow right first time intervention
  - Is that a series of defects, or just one inaccurately located?

- This led us to develop **DataMap™**, an asset condition visualisation system, built on a location based model of the network with automated tools to ‘fit’ data streams with an accuracy of 0.5m even underground
DataMap™ supports the visualisation of a complete range of asset condition information

- Track geometry
- Ride quality
- Overhead line
- Lineside structures
- Structure gauging
- Rail profile & wear
- Conductor rail
- Noise
- Corrugation
- Rail flaw
- Traction supply
- Video
- Ground Penetrating Radar
- Thermal imaging
- Ballast profile

Key Benefits of DataMap™

- Reduces maintenance costs
- Enables life extension rather than renewal
- Improves safety management
- Scalable solution from individual line to national network
- Information access from full corporate to individual trackside PDA
- Cost effective audit record of asset condition
- Identify operational train performance improvement
- Enables virtual track walking
- Supports more effective maintenance
- Better utilisation of costly plant
- Reduces unplanned maintenance activity
- Helps the user make sense of measurement information
- Reduce levels of analysis and management
- More pro-active maintenance monitoring
- Improved planning (tamping, grinding ballast)
- Helps contractor management
- Supports acceptance warranty management for new lines
A Synchronised View
Cost Effective Capacity Improvement
The need to cost-effectively run larger and faster vehicles through tight infrastructure, has led the UK to develop 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.

**UK Structure Gauging**
Traditional and Absolute Gauging

- Traditionally, most railways adopt a process called static gauging which is simple but uses worst case conditions and generous allowances.

- Static gauging over-predicts and can ‘waste’ up to 300mm of usable space.

- Increasing capacity (larger or faster trains) involves significant civil engineering works so this conservative approach is a very expensive option.

- The UK now uses accurate measurement and enhanced analysis to understand the true clearances required, an approach known as absolute gauging.

- The actual space required to run each type of vehicle along a route is compared with the actual size of structures and the position of adjacent tracks.
**Structure Gauge Measurement**

- Any required platform
- High accuracy integration with track geometry data

- Output information compatible with industry standard CAD packages and in-house databases and clearance analysis
- Supporting the UK’s leading approach to clearance gauging, giving more space for vehicle operation than any other method

**References**

- LaserFlex - high speed train based measurement for Network Rail, TTC, PATH
- LGV - RRV based measurement services for Network Rail
- LaserSweep - manual measurement equipment sales, hire and services
**TrackRoute™**
3D Infrastructure Database

- Used to manage all Network Rail gauging measurements
- Developed and hosted by BBR
- Links various fields such as profile, location, speed & track geometry
- Direct output to ClearRoute for clearance analysis
- Supported by BBR for over 15 years
ClearRoute™
Clearance Assessment

- Clearances between infrastructure and vehicle and between vehicles
- Static gauging and dynamic gauging with vehicle models
- UIC kinematic gauging
- Platform stepping calculations
- Allows complete route assessment
- Compliant with all relevant standards
Gauging Services
Specialist Gauging Consultancy

- The consultants’ consultant
- Advanced toolbox
  - ClearRoute+ and HyperRoute
- Specialist knowledge
- Proactive project involvement
- Full service – measurement through to certification
- Involved in all new trains for the UK since privatisation
If it all seems to be much more complicated you would be right

It’s a significant exercise in infrastructure data collection and management.

So is it worth it? ……UK experience says yes, very much so

The analysis of true clearances reduces expensive modification work, resulting in very significant savings for infrastructure owners

An analysis looked at the need for structure modification to accommodate the W10 gauge on a 150 mile route with 2187 structures

- Using a static gauging approach, 66 structures would need to be modified
- Using an absolute gauging assessment only 48 structures need be modified

The saving from not having to modify 18 structures was estimated to be £25m

With further savings from reducing the extent of the modification that still needs to occur
Signalling Monitoring

- AssetView is an event monitoring and analysis system that automatically analyses the results from analogue and digital event recorders, including data driven systems such as Solid State Interlocking
- Embedded signalling engineer ‘know-how’
- Diagnostic and prognostic
- Now covers around 40% of the UK network
- Business case driven, primarily by delay minute reduction
Intelligent Analysis

- AssetView processes data from a range of sources to provide meaningful information on the performance of the asset.
  - Point machine operating statistics
  - Signal lamp / LED burn times and operations
  - Graphical replay for incident replay and route cause identification
  - Operational performance statistics – e.g: aspect shown to approaching trains, direction of trains over switches
  - Predictive and reactive failure alerts – e.g: SPAD, Change of Aspect and asset failure alerts
Delay Reduction Focus

- Benefits provided in a range of areas including maintenance optimisation and operational planning

- The main focus however is on delay minute reduction, speeding up access to data, aiding diagnosis and demonstrating what really happened to help with driver ‘management’
**Delivering Benefits**

- At a key London station the system provided circa 10,000 minutes (£600,000) delay savings over 18 months by:
  - Identifying the root cause of a Change of Aspect fault without testing
  - Early detection of slowing points at a key Junction
  - Identifying point detection flicking under passing train – preventing a potential Change of Aspect fault
  - Diagnosing the root cause of a Signal Passed at Danger at a key location
XiTRACK®

Eliminating the Cost of Ballast Maintenance

- Polyurethane provides a strengthening ‘cage’
- Free draining matrix
- Ballast degradation eliminated
- Ballast movement eliminated
- Track stiffness consistent and sustained
XiTRACK Examples of Use

Heavy Haul / High Speed / Light Rail / Metro
No Ballast Maintenance Required
No Tamping of S&C

Track Support at Transitions

Maintaining Structure Clearance / Track Geometry

Lateral End Restraint for S&C/Curves
Ideal for High Speed with Crossing Traffic

Control of ballast on embankments and reducing dynamic loads on embankments
Track Solutions

- Rail alignment and geometric design
- Clearance checking and reporting
- Stage designs for complex build schemes
- Management of manufacturing interface
- Specification for topographical survey
- Work with complex multidisciplinary interfaces
- Detailed track form design/formation specification
- Track drainage
- Track related civil engineering (retaining walls, foundations, walkways, platforms, UTX’s)
- LRT, Mainline, Metro and Heavy Haul
- Predominantly UK – Network Rail, LUL, TfL
- Have worked internationally (Brazil/Argentina/Far East)
Example Projects

- KO2 Thameslink London Bridge Track
- KO2 London Bridge Equipment Room
- Crossrail West Outer Track Improvements
- South East Section
- Track Partnership
- ECML WCML Gauge Enhancement
Summary

- Secure and financially stable international company
- A unique combination of rail infrastructure domain knowledge and technology capability
- Proven measurement systems
- State-of-the-art condition visualisation software
- Innovative track solutions
- Proven delivery of significant client benefit
Balfour Beatty Rail
Engineering and Technology Solutions
‘Delivering the benefits of technology to infrastructure asset management’
The creation and care of tomorrow’s railways

- Balfour Beatty Rail is an international rail infrastructure contractor offering single-discipline and multi-discipline solutions
- Design, supply, install and maintain rail assets to meet customers’ needs through:
  - New technologies
  - Engineering capability
  - Own manufacturing facilities
  - Multi-disciplinary project management
  - High-speed expertise
  - Transfer of methods and solutions
  - Safety

References in Manila:

- Manila LRTA Line 1 Capacity Expansion 50% (1997-1999)
  - OCS upgrade depot switchgear
- Manila MRTC Line 3 (1999-2000) - OCS material
  - DC switchgear replacement in all substations
- Manila LRTA Line 2 (2001-2005) - OCS system
- Manila LRTA Line 1 Capacity Exp. (2006) - OCS material depot
- Manila LRTA Line 1 North Extension (2009-2012) - OCS system & DC Traction power supply