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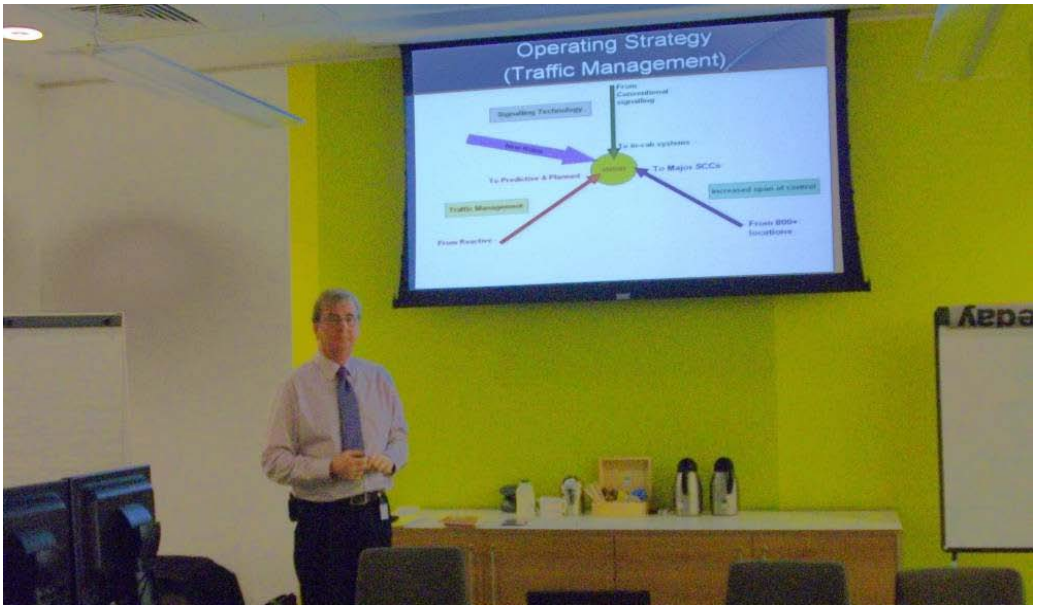
二、參訪行程紀要照片

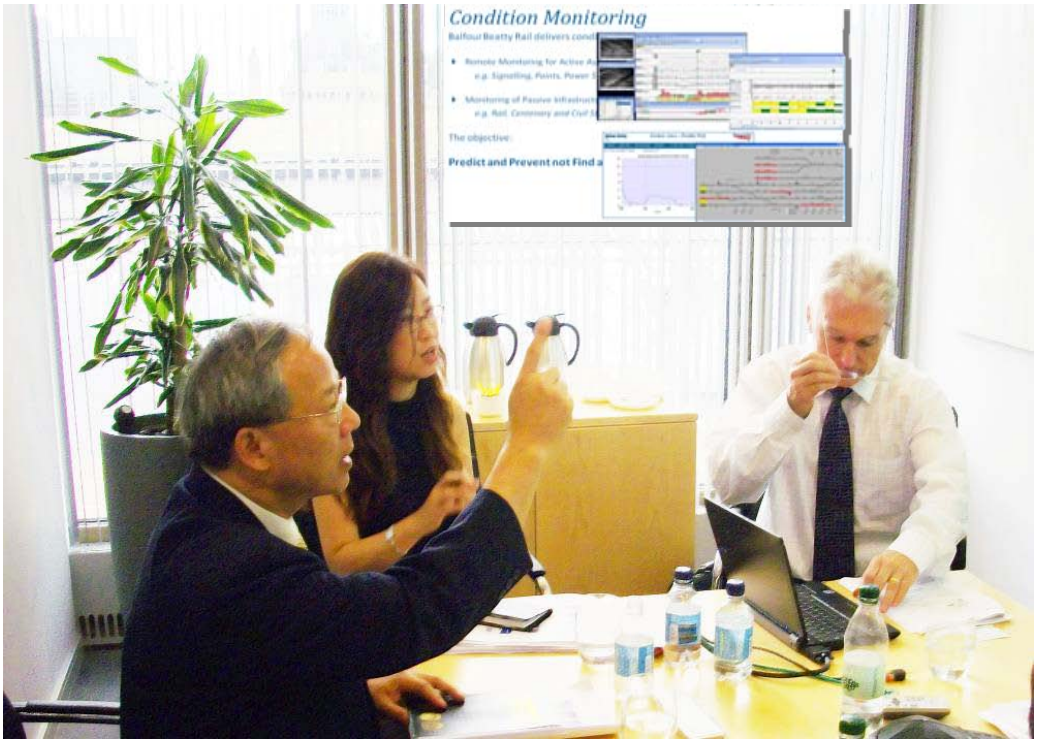
照**1.** 與英國*軌道工業協會(RIA)互贈紀念品*

照**2.** 與***Network Rail***研討*自動時刻表製作*



照3.　*Network Rail*解說*營運策略與行車管理*

照4. 與*Bombardier*研討***ERTMS Level 2***



照5. 與***Balfour Beatty***研討*狀態監視*

照6. ***BRECKNELL***介紹*高速集電弓技術*

照**7.** ***SPX Rail***介紹***轉轍器技術***

照**8.** 與***Lloyd's***研討***鐵路安全管理與驗證***

照**9.** 與***Westinghouse***研討*現代化行車控制技術*

照**10.** 參觀***Westinghouse ETCS****駕駛模擬機*

照11. ***Westinghouse ETCS Level 2線路模擬測試***

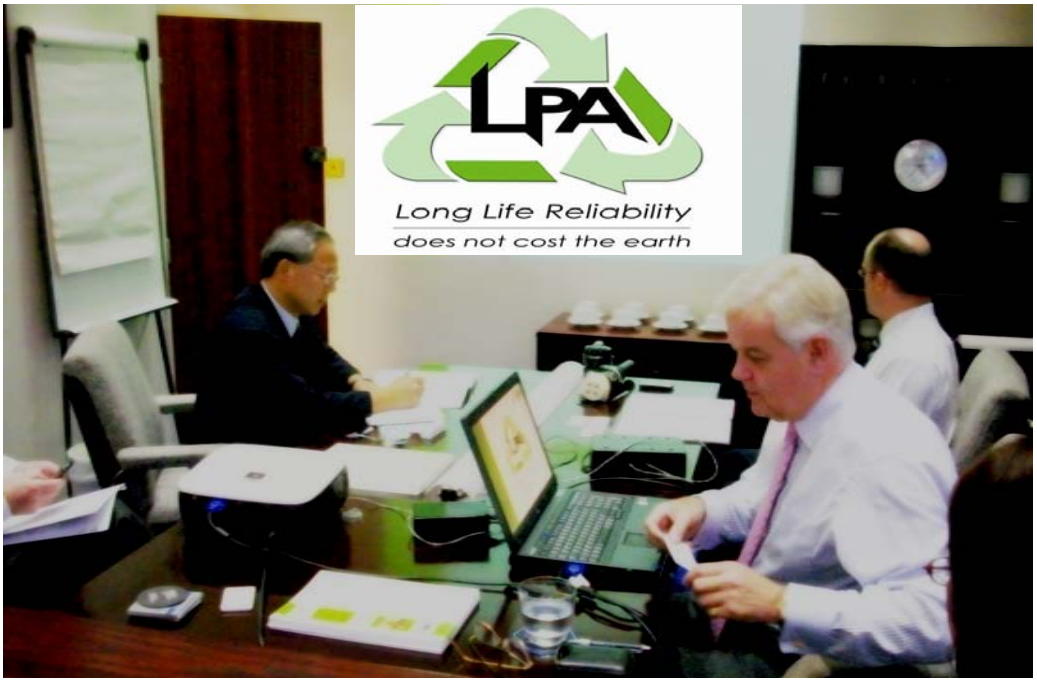
照12. 與***Westinghouse互贈紀念品***

照13. 考察成員於*Westinghouse* ***ETCS Level 1~3***前合影

照14. ***Interfleet***介紹*觀光列車更新設計及委託打造經驗*

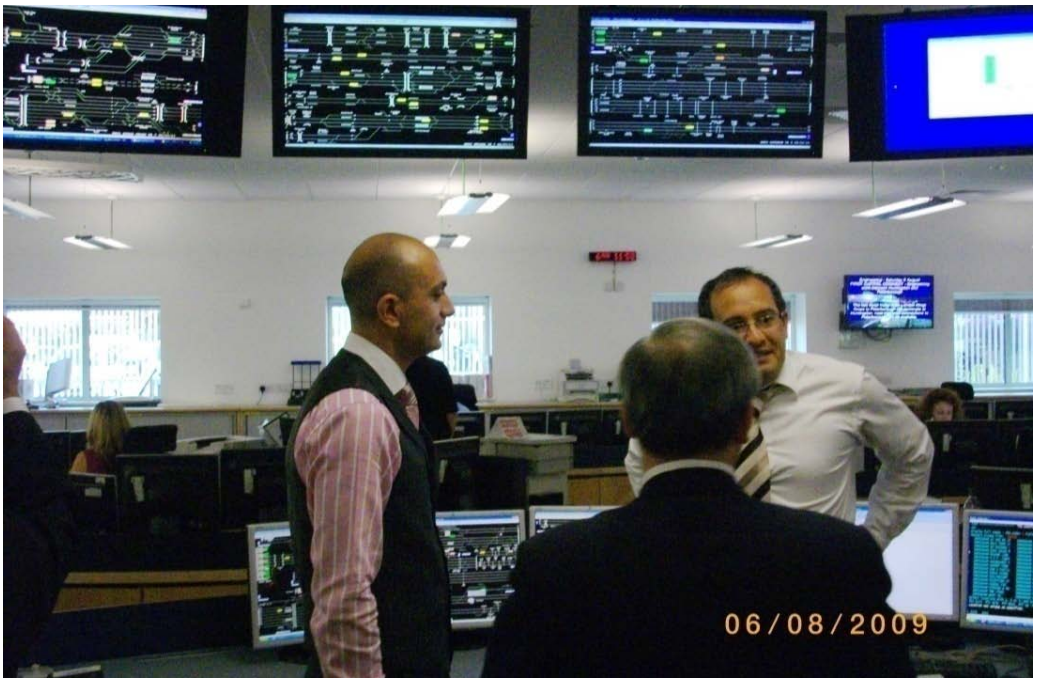
照15. ***Delta Rail***介紹*遠端狀態監視*後與業務總監**Mr. Jon Zieve**合影

照16. 與***East Midland Trains***研討*營運計畫與管理*



照17.　*LPA*介紹*LED與節能減碳現況*

照18. *Funkwerk*介紹*電腦化排點作業*



照19. 參訪*Network Rail* ***Integrated Control Centre***

照20. *Network Rail* ***Integrated Control Centre監控畫面***

照21. 參觀*National Railway Museum*<u>*展覽品*</u>近20,000件

照22. *National Railway Museum*<u>*歷代骨董機車頭*</u>近300輛

照23. ***National Railway Museum***仍使用中的***機件維修場***

照24. ***National Railway Museum***典藏***舊路牌&機械閘柄***

照25. ***National Railway Museum****軌道電路與臂型號誌模型*

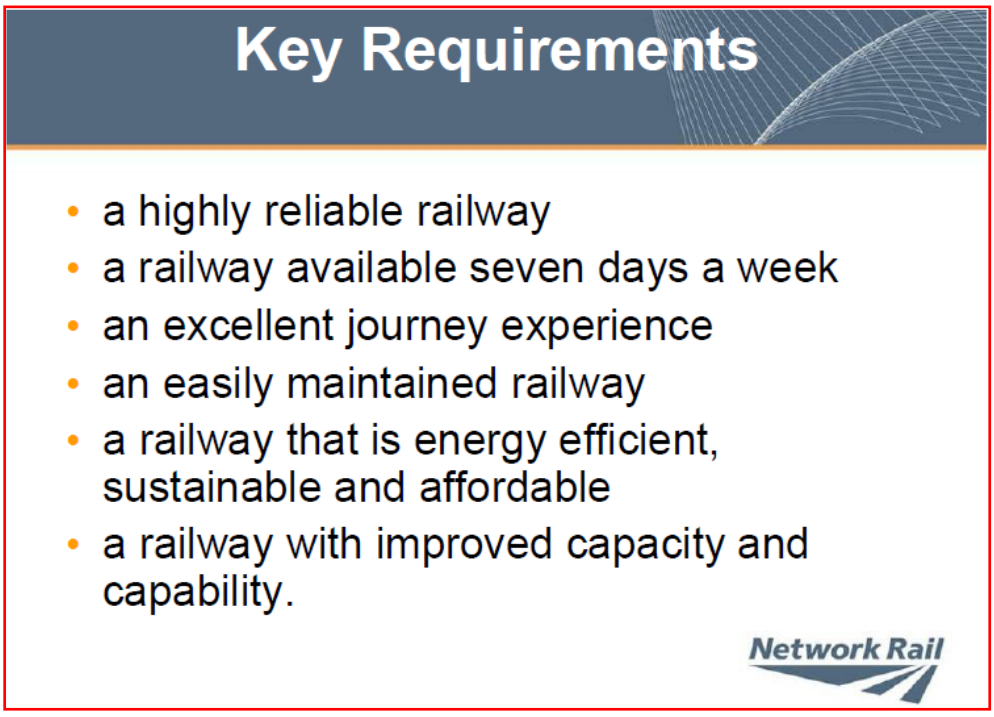
照26. ***National Railway Museum***典雅貴氣的*皇家火車*

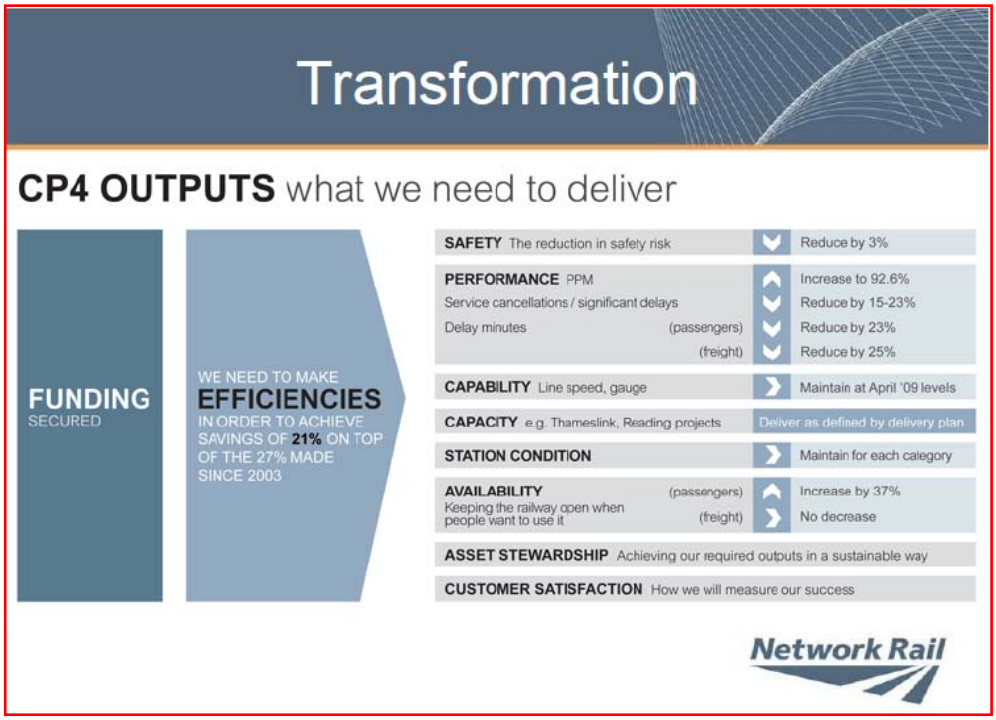
照27. Network Rail人員陪同搭乘駕駛室(York~Kings Cross Station)

照28. York ~ Kings Cross途中拍攝*車外路況 (4條路線)*

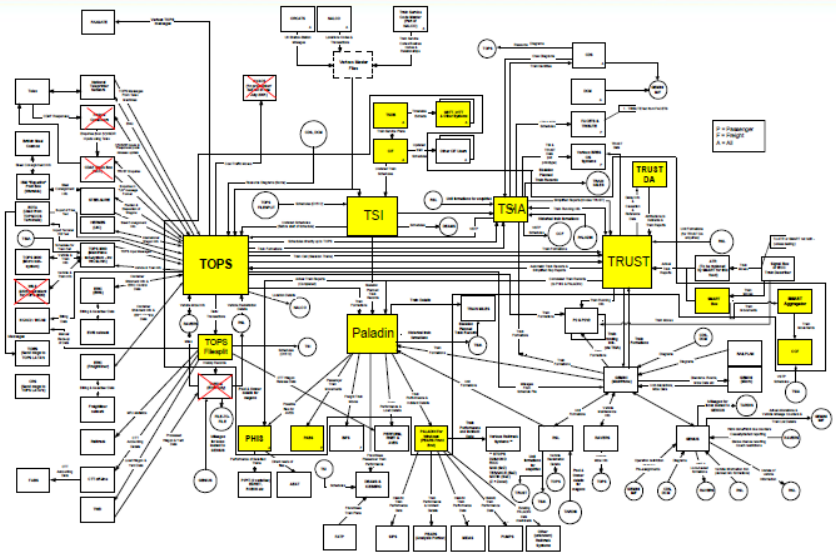
三、英國簡報資料摘錄

(一)Network Rail Presentations：Pam Fellows & Michael Purcell

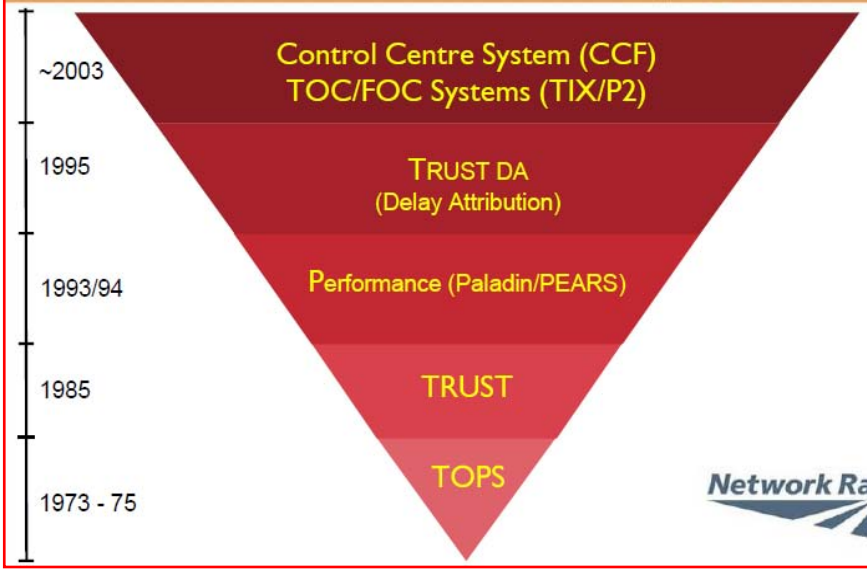


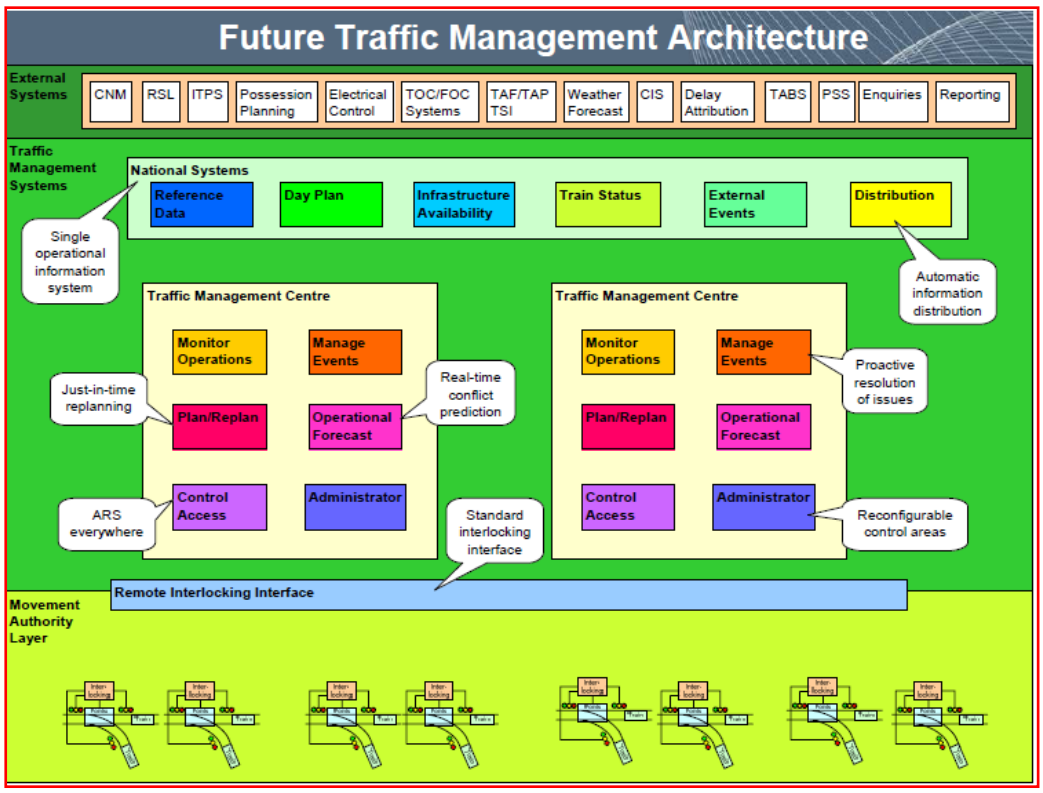


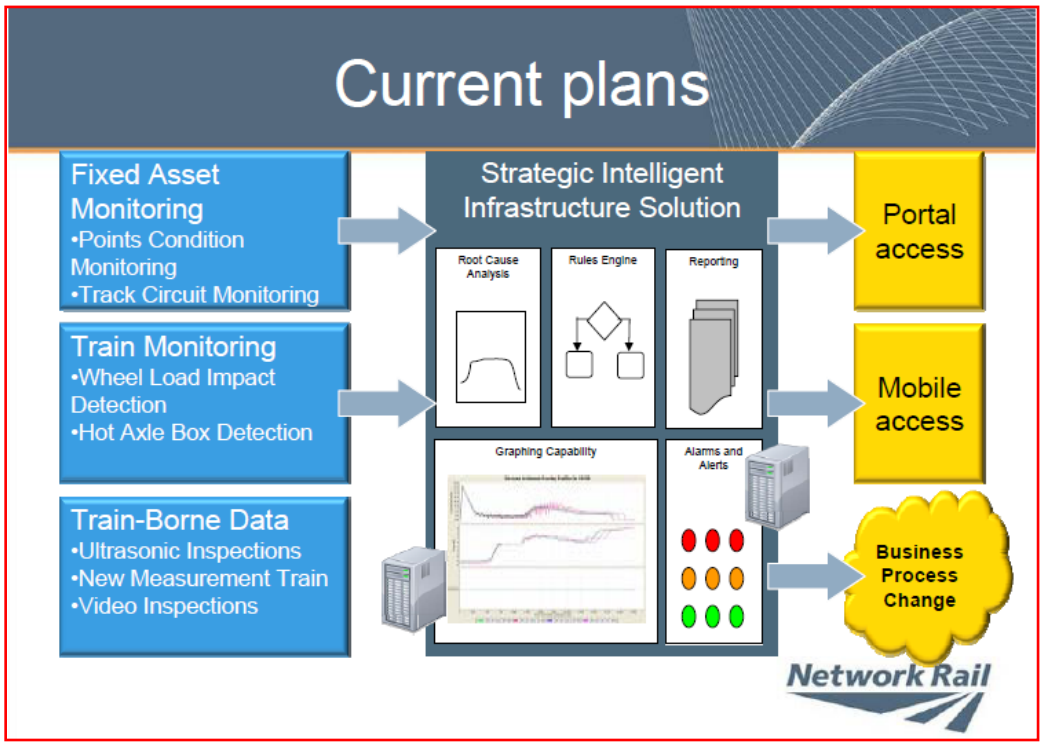
Current Train Management Systems



Evolution of TMS




Future Traffic Management Architecture
External Systems
CNM
RSL
ITPS
Possession Planning
Electrical Control
TOC/FOC Systems
TAF/TAP TSI
Weather Forecast
CIS
Delay Attribution
TABS
PSS
Enquiries
Reporting
Traffic Management Systems
National Systems
Reference Data
Day Plan
Infrastructure Availability
Train Status
External Events
Distribution
Single operational information system
Automatic information distribution
Traffic Management Centre
Monitor Operations
Manage Events
Plan/Replan
Operational Forecast
Control Access
Administrator
Traffic Management Centre
Monitor Operations
Manage Events
Plan/Replan
Operational Forecast
Control Access
Administrator
Just-in-time replanning
Real-time conflict prediction
Proactive resolution of issues
ARS everywhere
Standard interlocking interface
Reconfigurable control areas
Remote Interlocking Interface
Movement Authority Layer


Current plans
Fixed Asset Monitoring
•Points Condition Monitoring
•Track Circuit Monitoring
Train Monitoring
•Wheel Load Impact Detection
•Hot Axle Box Detection
Train-Borne Data
•Ultrasonic Inspections
•New Measurement Train
•Video Inspections
Strategic Intelligent Infrastructure Solution
Root Cause Analysis
Rules Engine
Reporting
Graphing Capability
Alarms and Alerts
Portal access
Mobile access
Business Process Change
Network Rail

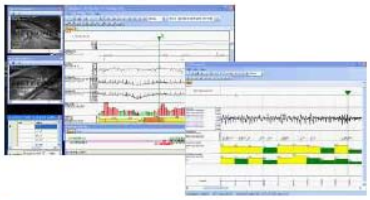
(二)Balfour Bertty **Presentations：Manfred Leger & Paul Stubbings**

Balfour Beatty Rail

Condition Monitoring

Balfour Beatty Rail delivers condition monitoring solutions for:

- Remote Monitoring for Active Assets
  e.g. Signalling, Points, Power Supply
- Monitoring of Passive Infrastructure Assets
  e.g. Rail, Centenary and Civil Structures



The objective:

Predict and Prevent not Find and Fix

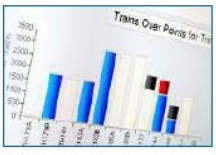
Balfour Beatty Rail

Remote Monitoring of Active Assets

Condition monitoring for a growing range of applications including:

- Relay and SSI Interlockings
- Track circuit monitoring
- Earth leakage detection
- Points condition monitoring
- Power supply monitoring

- Event Monitoring – *range of data loggers*
  - Record & store information relating to all aspects of a rail interlocking – signals, points, track, level crossings etc.
  - Record time stamped information to assist investigations
  - Typically used to analyse historic data
  - Similar to an aircraft 'black box'



- Intelligent Asset Monitoring – '*Asset View™*' *software*
  - Turns data from loggers into useful information
  - In line with UK's 'Intelligent Infrastructure Initiative' and move from 'Find and Fix' to 'Predict and Prevent' culture
  - Uses data in a predictive manner to identify trends and predict performance of assets
  - Universal system compatible with all data loggers
  - User friendly Web based functionality

Balfour Beatty Rail

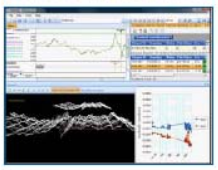
Monitoring of Passive Infrastructure Assets

Solutions for measuring condition of track and surrounding infrastructure:

- Measurement Systems

  e.g. Track Geometry and Overhead Line Measurement

  - Attended (manned on dedicated measurement trains) and unattended measurement systems (unmanned on regular service trains
  - Range of measurements – e.g. track geometry, overhead line and pantograph interaction, ride quality, rail profile, corrugation, conductor rail profile, tunnel profile, ballast profile, platform clearance, noise



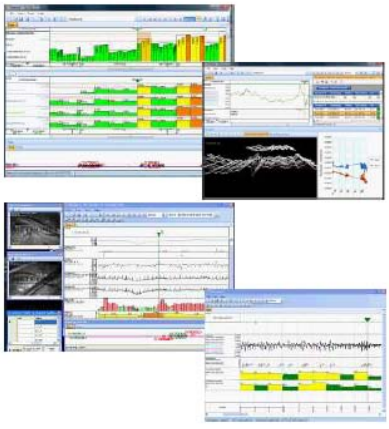
- Rail Infrastructure Asset analysis and evaluation

  DataMap™ Software

  - Helps mange and analyse large volumes of infrastructure measurement data from disparate sources
  - Turns large volumes of data into useful information
  - In line with move from 'Find and Fix' to 'Predict and Prevent' culture
  - Uses data in a predictive manner to identify trends and predict performance of assets

Balfour Beatty Rail

DataMap™ Software– Infrastructure Asset Condition Analysis



Features

- Takes and displays data from disparate sources, inc. video
- All cata is synchronised
- Graphical/chart data visualisation
- Geographically aligned data
- Statistical and exceedence analysis
- Link node model based
- Accurate run-on-run alignment
- Trending of discrete features
- Identification of repeat faults

Benefits

- Turns data into useful information
- Target maintenance where needed
- Monitor effectiveness of maintenance
- Monitor quality of maintenance
- Enables change of culture from 'Find & Fix' to 'Predict & Prevent'
- Benefits Asset Engineers, Maintenance Engineers and Incident Investigators
- Helps reduce maintenance and renewal costs

(一) Bombardier Presentations：Allan Morgan & Heikki Vikka

Bombardier has also secured key successes in CBTC

CBTC Successes

- Offering one of the most advanced mass transit solutions on the market with capability for moving block and driverless operations
- Metro Madrid (Spain): System in operation where we demonstrated the capability to migrate to CBTC on an existing line with no disruption to traffic (two major lines with more than 300 mio. passengers p.a.)
- Neihu Line (Taiwan): Installation of a fully automated, driverless system on a 15 km line
- Shenzhen Metro (China): Major contract won to supply a CITYFLO solution for a 40 km line with 30 stations
- Tianjin L2&3 (China): Contract for a total of 56 km and 44 stations

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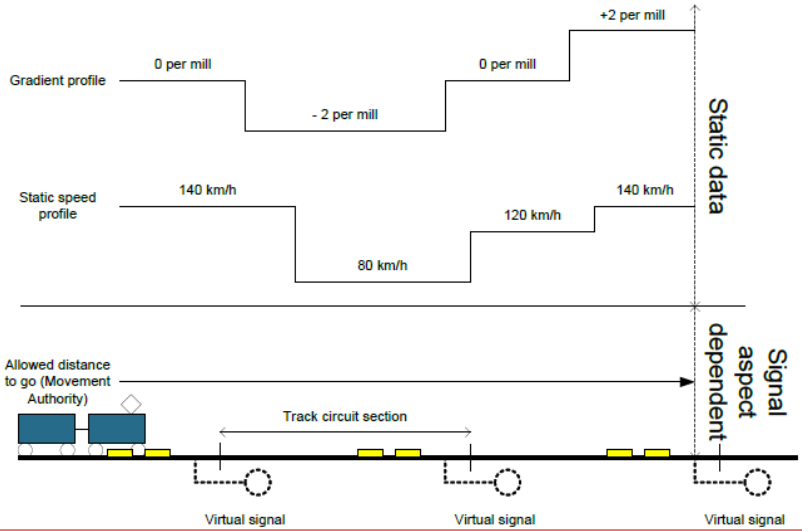
Basic Radio Information in ERTMS Level 2



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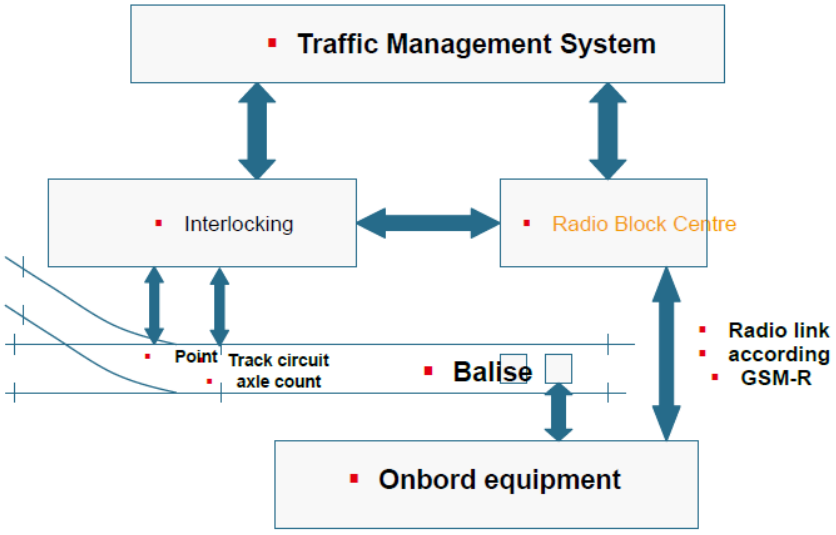
ERTMS Level 2 - System overview



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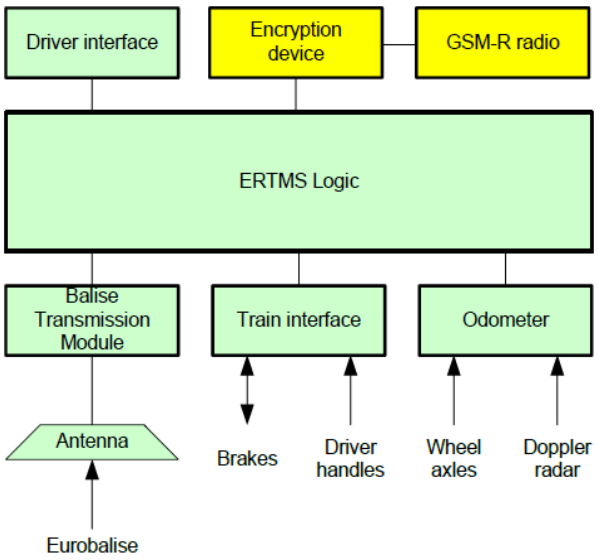
ERTMS Level 2 onboard overview



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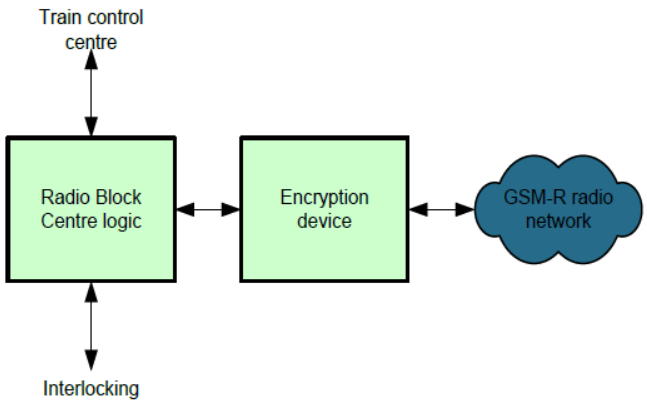
ERTMS Level 2 RBC overview



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Migration ERTMS Level 1 to ERTMS Level 2
Mixed signalling

- A line equipped with ERTMS Level 1 can be upgraded to ERTMS Level 2
- The first step is to install a Radio Block Centre with interface to the interlocking
- ERTMS Level 1 trains will continue with their operation
- ERTMS Level 2 trains will use the ERTMS Level 1 balises as position reference but ignore the rest of the balise information and instead get information over radio
- When all trains have been upgraded to ERTMS Level 2 the optical signals and the LEUs can be removed

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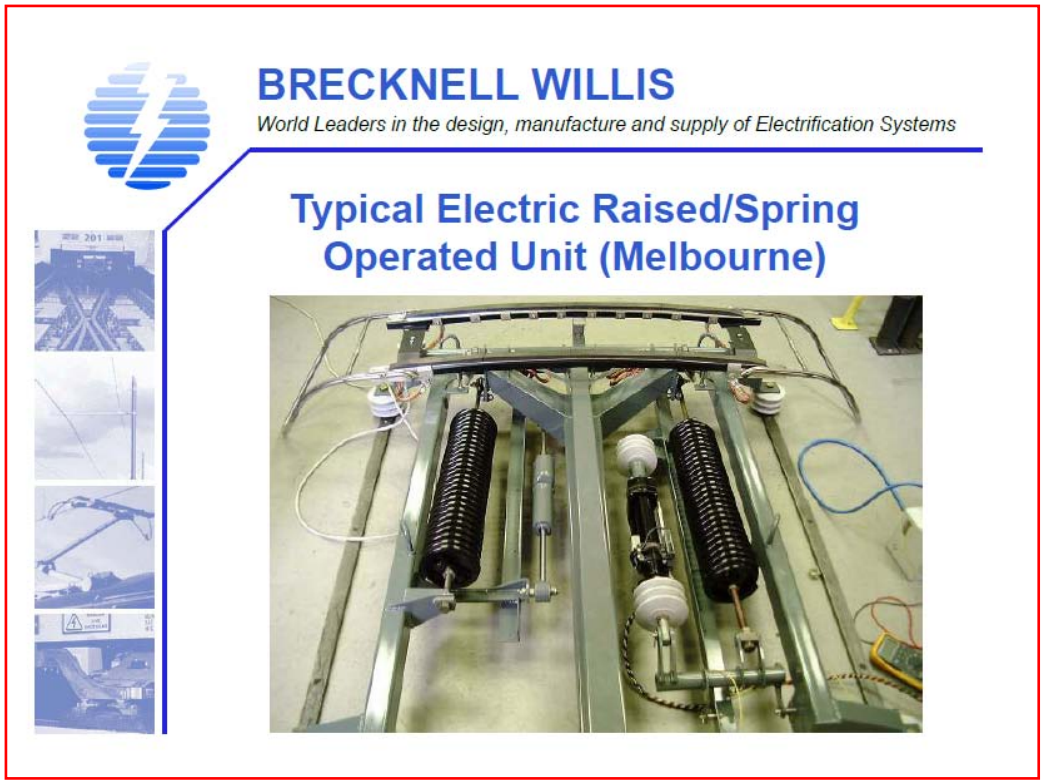
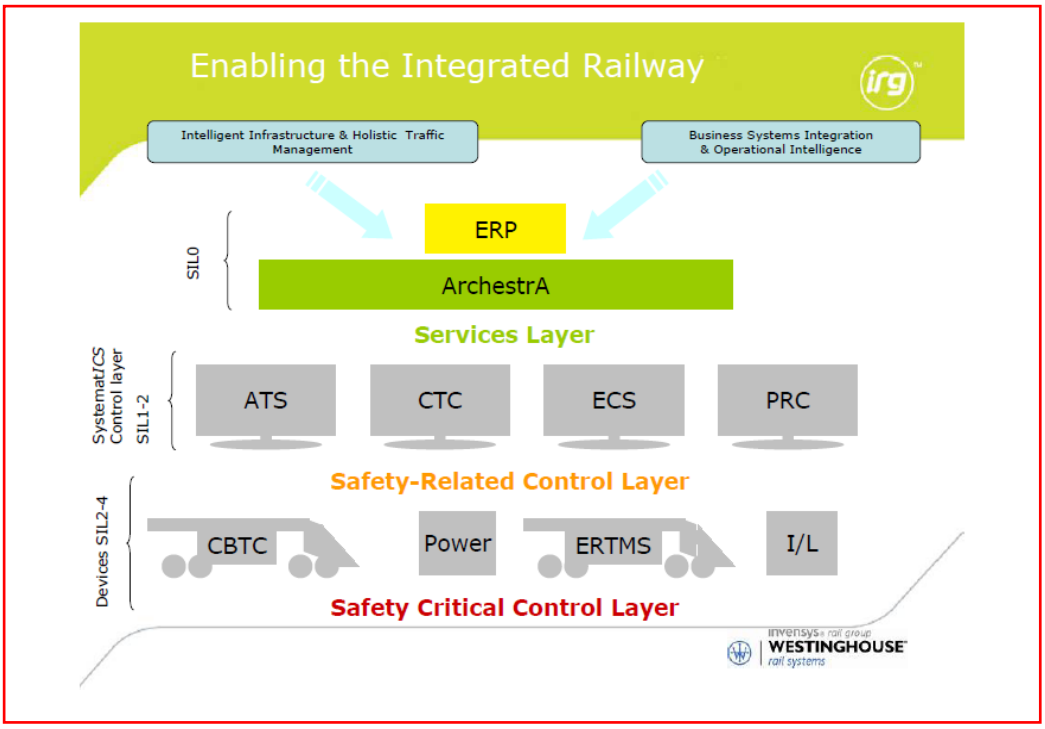
(二) BRECKNELL WILLIS Presentations：Tony White



(三) Westinghouse Presentations：Alistair Mcphee & Chris Tyrrell



Current Interlockings

- Legacy systems
  - Relays
  - Solid State Interlocking
  - Both fully supported, and newer systems offer low risk, value for money migration whilst protecting investments
- Current interlockings
  - WESTLOCK
  - WESTRACE
  - GEOLogic
- Market trends are towards modularisation, cost reduction and standardisation

WESTRACE

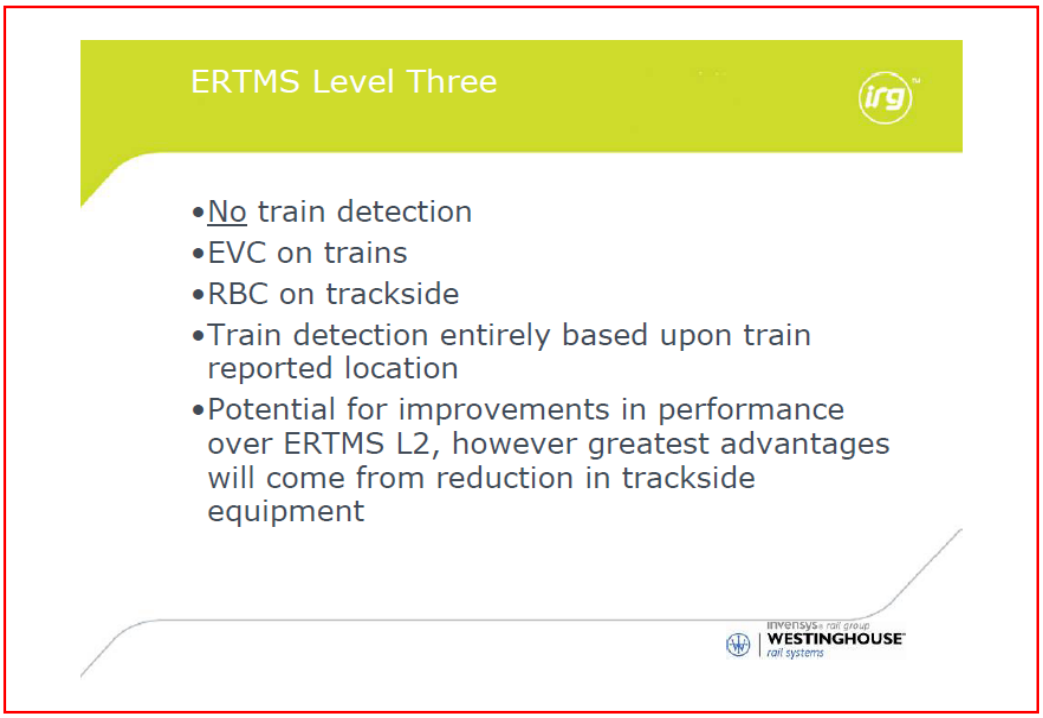
- Originally developed by all the Invensys Rail companies to provide a modular interlocking solution for as many of our markets as possible
- Since the first application in the late 1980s, the system has been constantly upgraded to reap the benefits of improvements in technology
- There are over 1,200 WESTRACE applications worldwide, with hundreds more on order
- WESTRACE makes its next step forward in 2010 with the introduction of the new WESTRACE Mk2 platform

WESTRACE Benefits

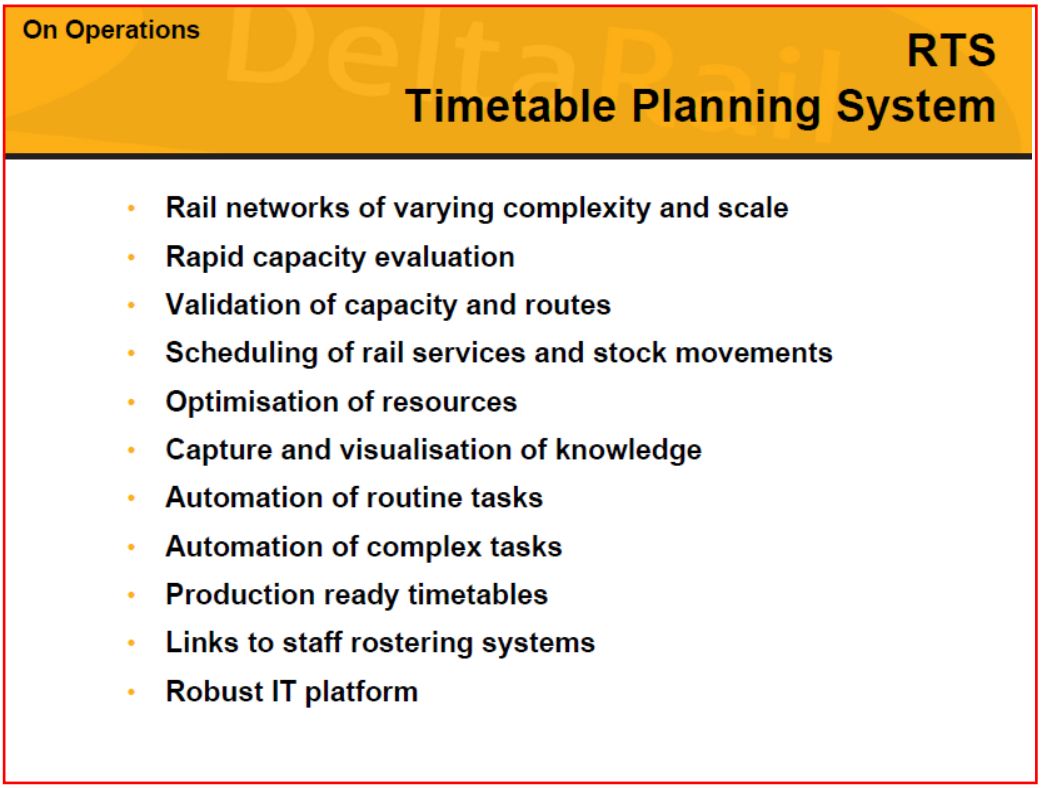
- Modular hardware – processor module and selection of Input / Output modules
  - Relay Output Modules
  - Lamp Output Modules
  - Parallel Input Modules
  - Communication Modules
- Fully network compatible, UDP/IP over standard network infrastructure

ERTMS Level Two

- Conventional Train Detection
- EVC on trains
- Radio Block Centre (RBC) connects to interlocking, and transmits signalling information to trains over ..
- GSM-R radio network
- Fixed Eurobalises used to allow trains to determine accurately where they are
- Continuous ATP system, therefore performance improvements

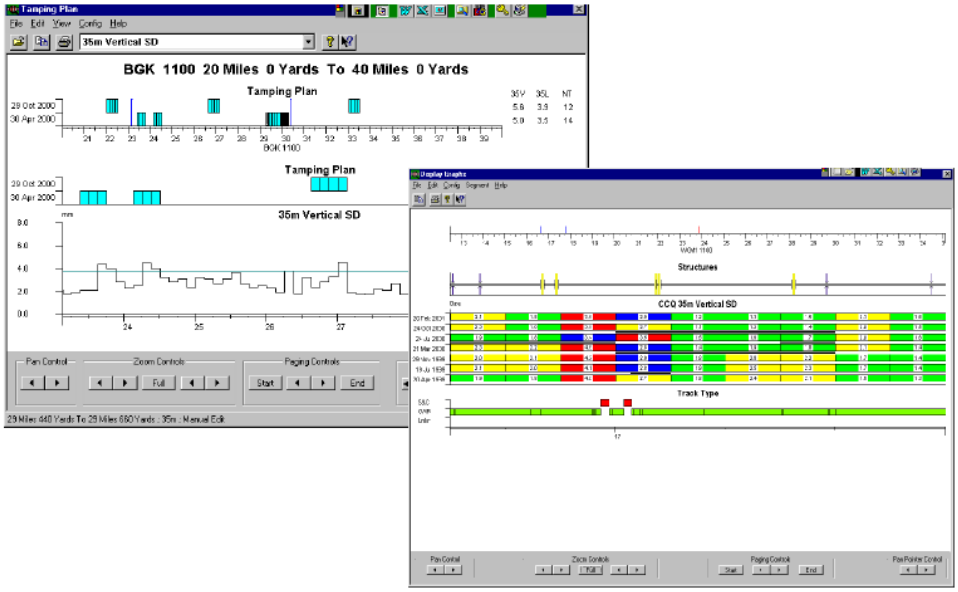


(四) Delta Rail Presentations：Jon Zieve , Adrian Golby



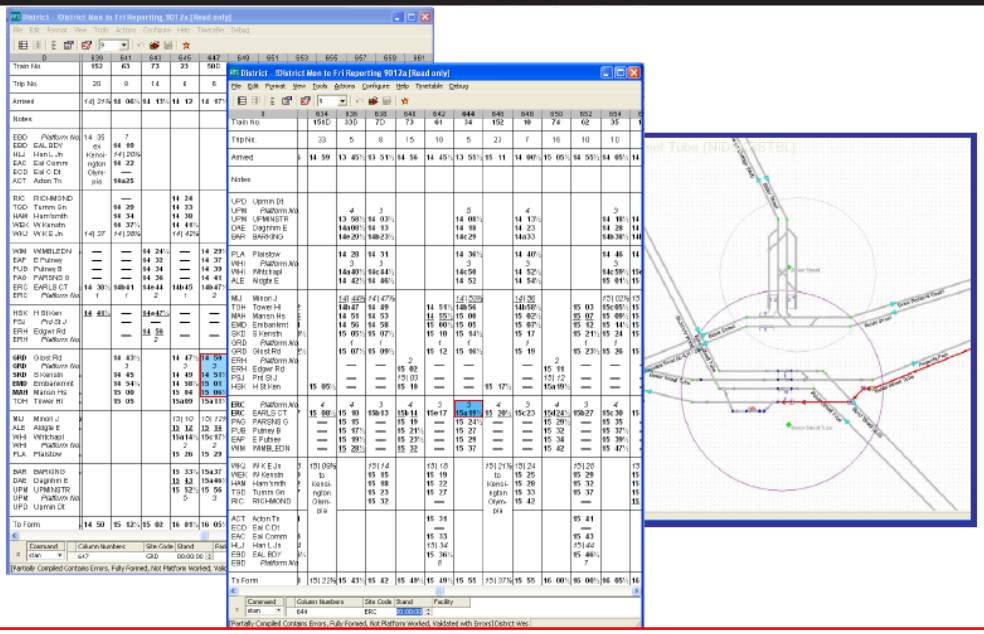
On Track

TrackMaster
Track Maintenance Planning

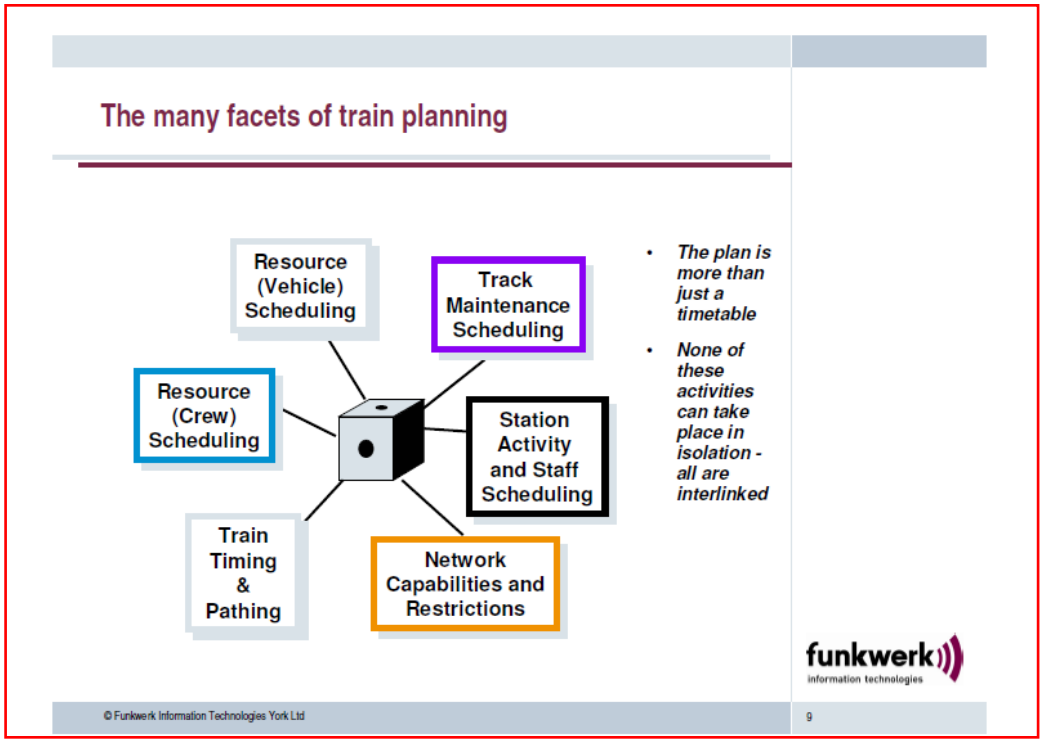


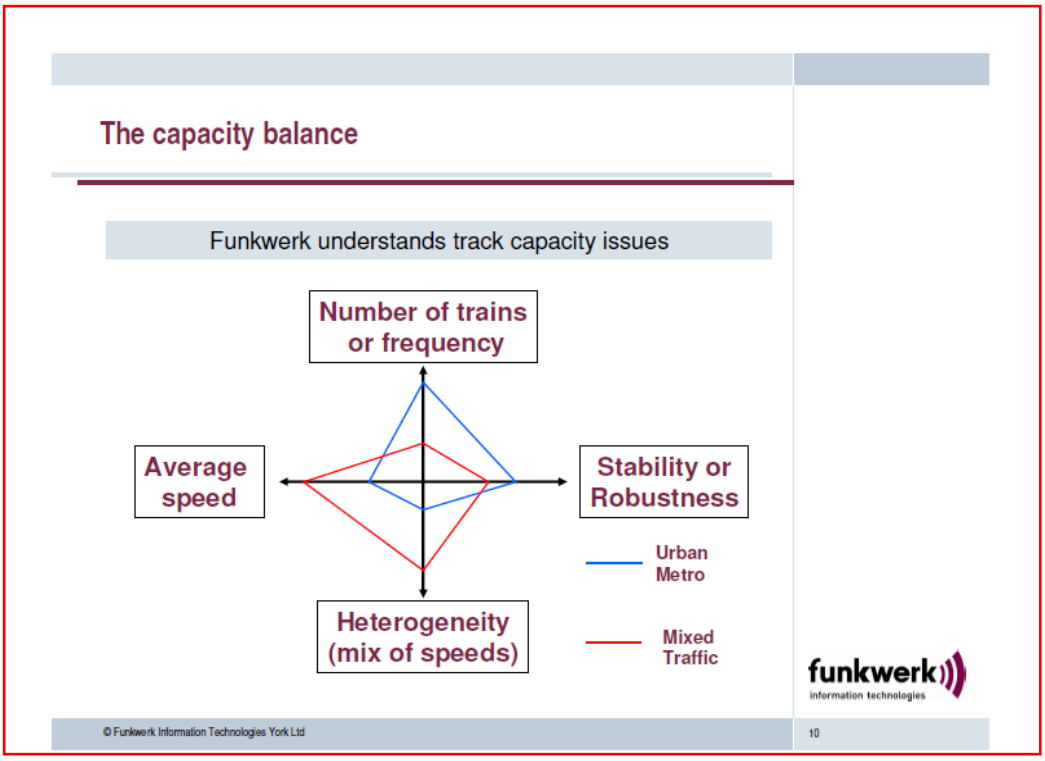
On Operations

RTS
Information you need - easily understood

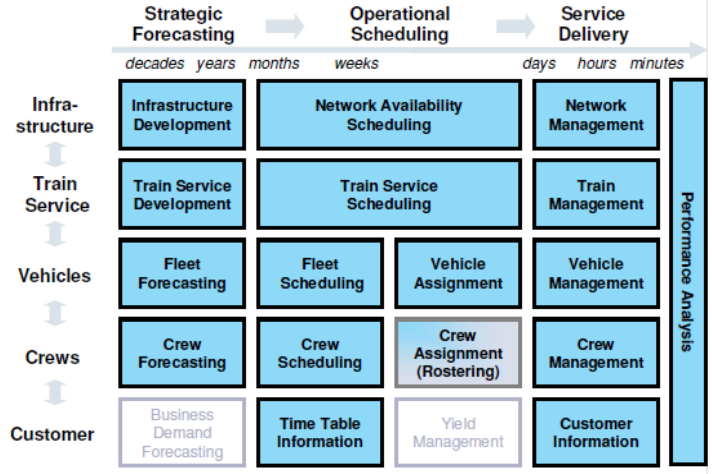


(五) Funkwerk Presentations：Ian Brown & John Meredith





Our coverage of railway processes



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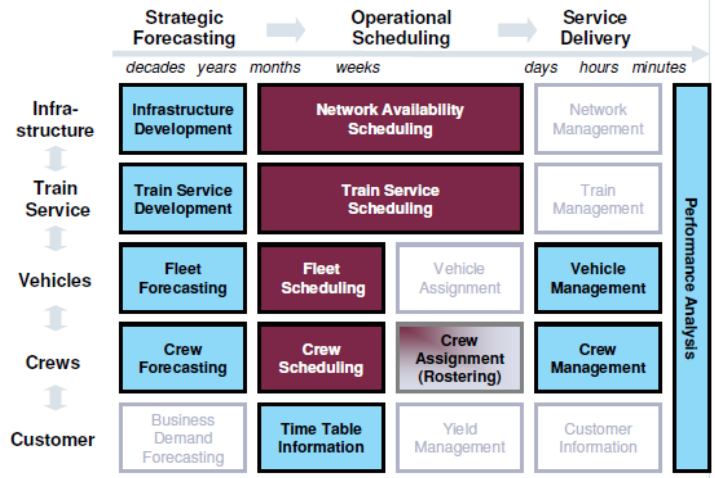
TrainPlan with ResourcePlan



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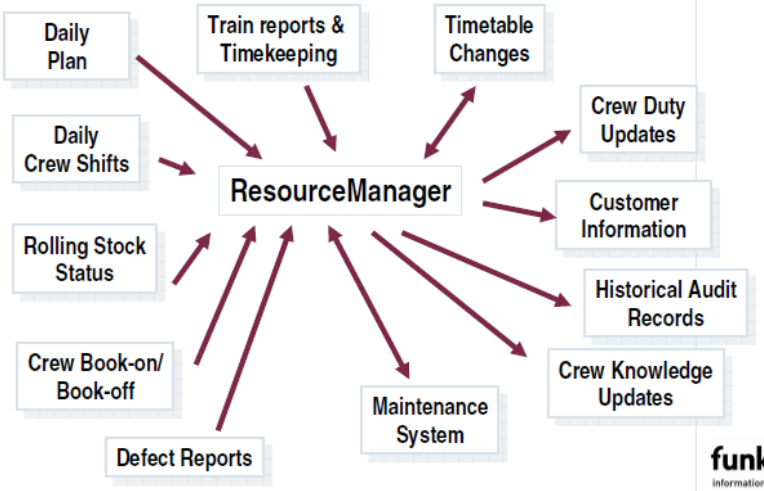
Data inputs & outputs



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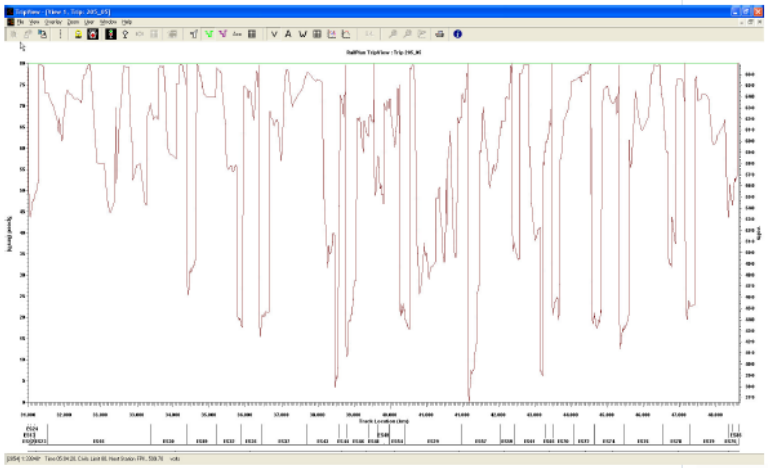
PowerPlan – Tripview Voltage



- Electrical results can be displayed graphically

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(六) Railway Industry Association Presentations：Jeremy Candfield

The Railway Industry Association - RIA

- Represents the UK railway supply industry
- 150+ member companies
- Members supply national rail, London Underground, light rail, exports
- c.100% membership growth in the last ten years
- Includes great bulk of sector by turnover
- Is funded entirely by its members.

Size of the UK National Rail Network

- 34,000 kms of track
- 2,500 stations
- c.11,000 passenger vehicles
- Over 1.2 billion passenger journeys made in 2007/8 covering some 49 billion passenger kms
- 65% of all passenger journeys begin or end in London
- 21.1 bn tonne-kms of freight moved in 2007/8
- Around 180,000 Employees

Traction, Speeds

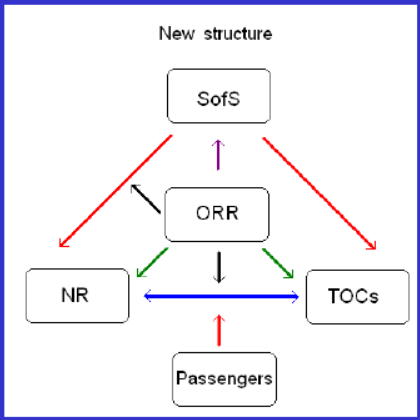
- About 30% of network electrified,
- Commuter lines south of London and in Liverpool 750V DC third rail
- London Underground 630V DC four rail
- Main lines to north-east and north-west and other commuter lines 25kV AC overhead
- Remainder operated by diesel
- Principal main lines 125mph (200 kph) including diesel
- Most other routes 70 -100 mph (110 – 160 kph)
- Channel Tunnel Rail Link 186 mph (300 kph)

Railway Industry Association

UK Privatisation – Main Operational Components

- Network Rail (replaced Railtrack) which owns the infrastructure and is responsible for its maintenance
- c20 TOCs which operate passenger services under franchise from Government
- c8 Freight train operators providing open-access services commercially
- The supply industry (which RIA represents), including
- 3 Rolling Stock Leasing Companies (ROSCOs) which own the passenger rolling stock

Current Rail Industry Structure



- Government sets strategy for the railways and 'contracts' with Network Rail (via independent economic regulator) and TOCs to deliver
- Network Rail has responsibility for operating the network and accountable for performance
- Train operating companies (TOCs) provide passenger services
- Office of Rail Regulation ensure NR does not abuse its monopoly power, and responsible for safety

Source - DfT

Department for Transport, Office of Rail Regulation

- Completely separate public-sector organisations
- Basic model clear: public sector (DfT) specifies what it wants to buy; private sector competes to provide it
- ORR decides the cost of the specified service level and sets TOCs' access charges accordingly
- ORR also safety regulator
- Presented in Taipei by Michael Beswick, ORR

Network Rail

The infrastructure manager

- owns and operates the track, signalling, electrification and telecommunications networks
- manages the timetable
- most of its work is carried out by suppliers, except infrastructure maintenance.

- NR is a not-for-dividend private-sector company and has no shareholders
- any profits are reinvested in infrastructure work
- receives revenues from train operators (access charges) and direct grant from Government.

Relationship between NR and Government

- Government does not own or control NR
- Government specifies the level of service it wants NR to provide
- ORR decides the cost of the specified service level and sets TOCs' access charges accordingly
- Government compensates TOCs for changes in access charges
- Government is the ultimate guarantor of NR's debts.

Passenger Train Operating Companies

- Passenger services are provided by individual train operating companies (TOCs) under franchise from the Government – typically 7 years
- TOCs are contracted to provide at least a minimum service pattern in return for a pre-determined subsidy (or premium)
- TOCs retain fare revenues, an incentive to
  - grow market
  - keep costs down
  - prevent fare evasion

Freight Operating Companies

- Some eight FOCs
- Not franchises and not subsidised – operate as purely market organisations
- Access charges normally related to extra cost of freight trains only – basic costs paid by passenger TOCs

Strategic Issues

- Handling the great increase in demand on a capacity-constrained railway
- And further improving reliability and punctuality
- While simultaneously carrying out major infrastructure renewals works

and

- Controlling costs, maximising revenues
- Optimising the engineering interfaces
- Further improving the way in which companies work together