附　錄　二

附錄二：資料附件

報告人：張武訓
考察期程：自 **2014.2.22** 迄 **2014.3.02**

資料附件目錄

附件2.1-01： 英國交通部長Baroness Kramer女士爵士致詞書面文件

Suggested Words of Welcome

Welcome to the Department and to London

Pleased to see you all today. Know you're in the capable hands of the Railway Industry Association.

Wish you all successful discussions during the 2nd UK-Taiwan Railway Forum tomorrow

It is an exciting time for the rail industry in Britain

Since rail privatisation in the 1990s, UK passenger numbers have doubled and freight traffic has risen by 60%.

There are 4,000 more services a day than 15 years ago.

In the next 5 years we expect a further 14% rise in passenger numbers and 4% more freight.

Passenger satisfaction continues to improve and we have a safety record to be very proud of.

We have developed a successful rail franchising operation and are encouraging overseas investment and participation in the franchising process – Taiwanese representatives would be most welcome at our Franchising Event on 9 April.

We are now investing in several major infrastructure projects to deliver additional capacity and support economic growth

You have already seen something of Crossrail, which will open in 2018, and boost the capital's rail capacity by 10%.

We are also investing in Thameslink line to significantly boost north-south services through London.

My Department has committed more than £38 billion (1,900 billion Taiwan dollar) for Network Rail to run and improve the network between 2014 and 2019.

We are also making detailed plans for our second high speed line linking London with Birmingham, Manchester and Leeds

Supply Chain

And we are also supporting our railway supply industry to take advantage of this domestic success and to export more of their products and services.

The global market for rail is huge and growing fast. It accounted for more than €100bn in 2010 and is forecast to grow at nearly 3% per annum over the next 5 years.

Heavy rail is the largest rail application segment while light rail, tram and metro is expected to be the fastest growing.

The UK rail supply chain employs 80,000 people, and has a combined turnover of £7bn.

As well as international companies like Alstom, Siemens and Bombardier, we have a diverse range of smaller companies offering world class products and services, some of which you will be seeing later this week.

Britain has a strong reputation for engineering in sectors like automotive and aerospace. But the government is also working closely with the rail industry to invest in skills, research, development and innovation.

A new national rolling stock training academy will open next year, supported by over £3m (150 million Taiwan Dollar) of government funding. This joint initiative between Siemens and the National Skills Academy for Railway Engineering will help to meet our skills needs. Again, I think you will be hearing more about this later.

My Department is also investing heavily to support greater innovation in rail. Over the past two years we have provided £30m to the industry's Enabling Innovation Team to develop and demonstrate innovative concepts.

Finally I would like to stress that the UK government is keen to continue its support for projects in Taiwan, as exemplified by our former minister Mike Penning's visit in 2012 and I know you will hear this week what British industry can offer as you prepare for exciting new developments in your mainline railways and metros.
Thank you

附件2.2-01： RIA Jeremy Candfield Director General簡報GB Railway Industry

UK Trade
& Investment

GB Railway Industry

Presentation to Delegation from Taiwan

London
24 February 2014

Jeremy Candfield
Director General

Railway Industry Association

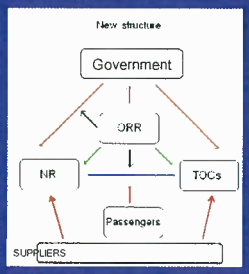
UK Railway Supply Industry

Offers an extensive service covering all aspects of rail transport from feasibility and financing to operation and maintenance.

- **Mainline**
- **Mass transit**
- **Light Rail**
- **High Speed Rail**

Railway Industry Association

Current Mainline Industry Structure



Railway Industry Association

Supply Capability: Products and Services

- Civil infrastructure and track systems
- Rolling stock
- Signalling
- Telecommunications, passenger information systems, ticketing, CCTV etc
- Power and electrification
- Components and Specialist materials
- Operation and maintenance
- Professional services

Railway Industry Association

The Railway Industry Association - RIA

- The UK has a dynamic and growing rail industry
- RIA represents the UK railway supply industry; founded 1875
- Currently around 180 member companies covering the complete range of railway disciplines
- RIA is funded by its members and is not part of Government, but works closely with it, particularly UKTI.
- RIA members supply all the national rail systems and export extensively on a worldwide basis.

Railway Industry Association

Professional Services

UK rail specialists are strong in many countries, with a wealth of UK and worldwide experience and long-established skills in:

- Legal and Financial services (PPPs)
- Feasibility studies, systems engineering & design
- Project & programme management
- Research and Innovation
- Risk, safety and regulation
- Architectural and station design
- Asset management (in remote condition monitoring)

Railway Industry Association

Supply Industry reflects its clients' priorities 1:

- Safety > safest large railway in EU, safety advice
- Capacity > remote condition monitoring, plug & play equipment, modular techniques for speed of installation
- Efficiency > competitive pricing, project and programme management skills

Railway Industry Association

A few Statistics

- The UK rail industry is valued at around £12Bn a year employing approximately 200,000 people.
- Network Rail manages over 32,000 km of track and 2,500 stations
- Over 1.3 billion passenger journeys per annum covering over 50 billion passenger kilometres
- A passenger railway with a freight overlay – around 5% of train movements.
- London is a major rail hub - 65% of all passenger journeys begin or end in London

Railway Industry Association

Improving efficiency

Railway Industry Association

Mainline Privatisation

- Process began in 1994 and took 3-4 years
- During privatisation, infrastructure and rolling stock support activities were sold or contracted out
- Passenger operations were franchised on a highly competitive basis & freight operators sold
- Expertise transferred to the private sector – much of that in the supply industry
- The process has gradually evolved over the last 19 years into the current model which is delivering significant investment.
- Government retains a central role, but private sector delivers

Railway Industry Association

Supply Industry reflects its clients' priorities 2:

- Reliability + delay cost attribution > full service provision contracts, emphasis on low-maintenance, high-reliability equipment – life cycle costing
- Huge infrastructure works programmes > project and programme management skills
- Contractual interfaces > eg emphasis on lighter weight vehicles to reduce track damage

Railway Industry Association

Overview of UK Mainline Network

Railway Industry Association

Mainline Network - Characteristics

- About 40% of network electrified
- Commuter lines south of London 750V DC third rail (and Liverpool)
- 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 200 kph including diesel
- Most other routes 110 – 160 kph
- HS1 (Channel Tunnel & domestic) 300 kph

Railway Industry Association

Rail Transport in London

- Transport for London (TfL) reports to the London Mayor's office.
- TfL looks after the London Underground, London Overground, Docklands Light Railway and the Croydon LRT
- LUL which was 150 years old this year is one of the largest mass transit systems in the world with around 400Km of track and 270 stations.
- The system handles up to 4m passengers per day and is investing around £1.5Bn per year in the biggest upgrade ever.

Railway Industry Association

Growth

Since Privatisation of British Rail in the mid nineties:

- Passenger kilometres up by 102%
- Passenger journeys up by 104%
- Freight demand up by 48%
- Over 5,000 new passenger vehicles on the network
- Infrastructure investment has increased significantly - renewals and enhancements over £5bn in 2012/13
- LUL and UK Metros experiencing similar passenger growth

Source – ORR National Rail Trends Yearbook/DfT

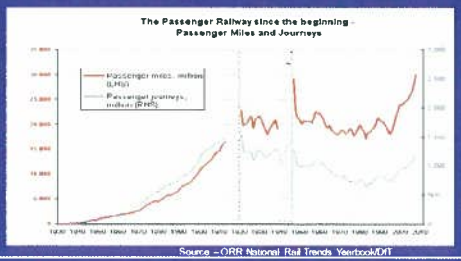
Railway Industry Association

Major investments in the UK

- Thameslink Programme – on going
- Crossrail – ramping up for completion in 2018
- Rolling Stock Procurement
- Electrification
- High Speed 2 - Planning stage
- ERTMS in-cab signalling – Planning/Procurement

Railway Industry Association

Growth

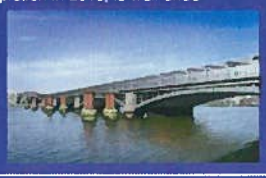


Source – ORR National Rail Trends Yearbook/DfT

Railway Industry Association

Thameslink

- Main-line route running 225 km north to south through London crossing the river Thames.
- The Thameslink Project is a £5.5 billion scheme to extend the service to greatly increase capacity on the central London section to accommodate more frequent and longer trains.
- This scheme, scheduled for completion in 2018, is well under way.



Railway Industry Association

Crossrail

24 trains/hr, 36,000p/hr, £15Bn, 21Km twin bore tunnel, 8 new sub surface stations, completion 2018

High Speed Rail

1994 Channel Tunnel Opens – No HS in UK

Railway Industry Association

Rolling Stock in the UK

- UK industry has just published a Long Term Passenger Rolling Stock Strategy.
- National fleet to grow by between 53% and 99% over next 30 years
- Electric vehicles to rise from 68% today to 80% by 2019. Assumes electrification rises from 40% today to 50% by 2019 and up to 60% thereafter.
- Modelling indicates that between 13,000 and 19,000 new electric vehicles will be needed by 2042.

Railway Industry Association

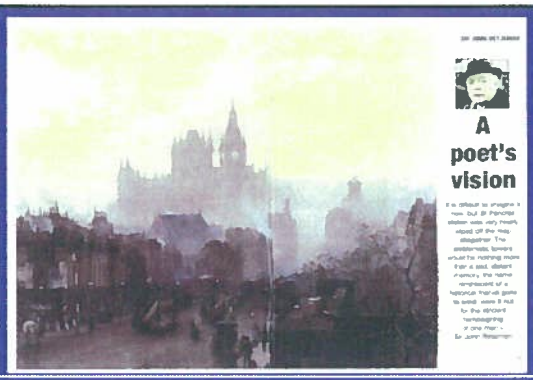
HS1 High Speed Link

Railway Industry Association

Electrification Programme

- Major programme of electrification has commenced to interface with the Rolling Stock investment programme
- Great Western Railway 2018. £35 m investment in state of the art electrification train.
- London to Sheffield
- E-W in the North of England

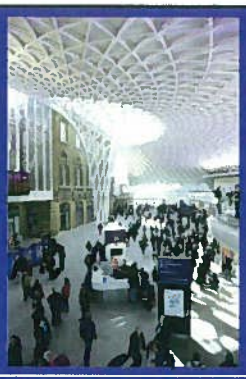
Railway Industry Association



Railway Industry Association

Railway Industry Association

Greater London Rail Network: Some Geography



Kings Cross Western Concourse, opened March 2012

Railway Industry Association

London's Train Stations

Current status

The bill for Phase 1 will go to Parliament in 2014 for approval in 2015.

Phase One: London to West Midlands

- Open 2026
- Through-running services to North of England
- Link to HS1

Phase 2: "Y" to Manchester and Leeds

- Open 2032-33
- Transformational journey times
- Link to Heathrow

Railway Industry Association

... in conclusion

UK companies are playing a key role in delivering the unprecedented investment in rail taking place in both main line and mass transit.

A strong home market provides a solid foundation for exporting

UK companies that succeed in exporting are highly experienced in:

- understanding local markets
- providing strong support to their customers
- identifying and providing best-value solutions, for both existing assets and new projects

because they have to be to be competitive**.....**

Railway Industry Association

Further Information

www.riagb.org.uk
jcandfield@riagb.org.uk

Thank you

Railway Industry Association

附件2.3-01： Presentation on Taiwan Rail by British Trade and Cultural Office, Taiwan, ppt，由李安鈴處長報告.

UK TRADE & INVESTMENT

Current status of Taiwan railway services

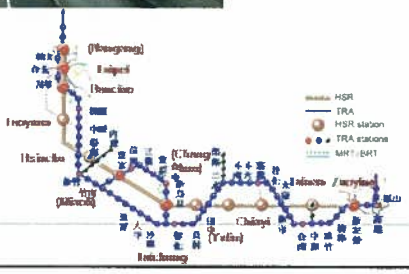
Traditional railways

- Operated by Taiwan Railways Administration (TRA).
- Service routes: 7 main lines & 5 branch lines
- Number of stations: 216
- Total track length: around 1,090.6 km
- Passenger volume: around 20 million passengers in Dec 2013
- Average daily traffic: around 623,000 passengers

Source: Traffic statistics 99@book

The Taiwan Rail Transport Plan for 2014-2030

By Lynn Li, Head of Infrastructure
UKTI Taipei
Lynn.Li@fco.gov.uk



Current status of Taiwan railway services

High-speed railways

- Operated by Taiwan High Speed Rail Corporation (THSRC)
- Current operating stations: Taipei, Banqiao, Taoyuan, Hsinchu, Taichung, Chiayi, Tainan & Zuoying (8 stations)
- Future operating stations: Nangang, Miaoli, Changhua & Yunlin (4 stations)
- Total track length: around 340 km
- Passenger volume: around 4 million passengers in Dec 2013.
- Average daily volume: around 130,000 passengers

Source: Traffic statistics 99@book

5

Contents

- Current status of Taiwan railway structure
- Overview on future railway projects
  - Traditional railways
  - Cosmopolitan MRT & LRRT systems
    - Northern area
    - Central area
    - Southern area
- Conclusion

3

Current status of Taiwan railway services

Taipei MRT

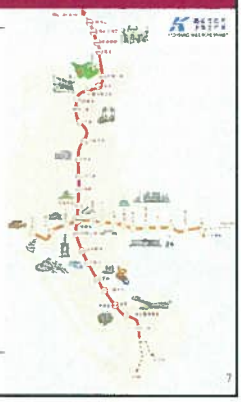
- Planned/built by the Department of Rapid Transit Systems (DORTS)
- Operated by Taipei Rapid Transit Corporation (TRTC).
- Service routes: 11 main and 2 branch lines
  - Main lines: Wenhu, Danshui, Zhonghe, Xindian, Nangang, Xiaonanmen, Banqiao, Tucheng, Luzhou, Xinzhuang, and Xinyi
  - Branch lines: Xinbeitou & Xiaobitan
- Number of stations: 109
- Total track length: 121.3 km
- Average daily traffic: around 1.7 million passengers

6

Current status of Taiwan railway services

Kaohsiung MRT

- Operated by Kaohsiung Rapid Transit Corporation (KRTC) in BOT mode
- Service routes: 2 main lines
  - Orange line: Sizihwan to Daliao
  - Red line: Gangshan South to Siaogang
- Number of stations: 38
- Total track length: 42.7 km
- Average daily traffic: around 166,000 passengers
- Core System: CAF, Spain



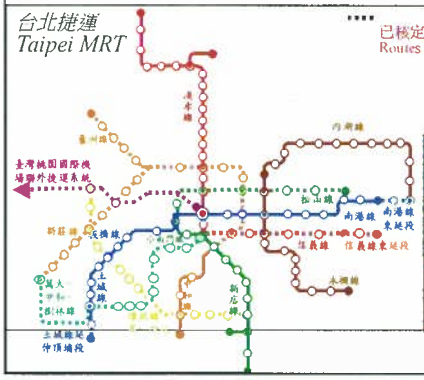
Source: http://www.krtco.com.tw/index_eng.php?id=1 KRTC traffic statistics

7

MRT & LRT PROJECT PLANS – TAIPEI AREA

台北捷運
Taipei MRT

已核定執行中路線
Routes approved for construction



Under constructio n: 73.8km	64 statio ns	II sections in operation
166.7km	146 statio ns	Daily passengers over 2.3 million

10

Traditional Railways Project Plans

Railway Improvement Plan

Executed by TRA	Executed by RRB
6 projects All approved by Executive Yuan Total budget: GBP 2.4 billion	16 projects 12 approved by Executive Yuan 4 under planning Total budges: GBP 7.2 billion

Source: September 14, 2009, TRA, Taiwan Mainline Railway Operating Situation and Improvement Projects

8

MRT & LRT PROJECT PLANS TAIPEI AREA

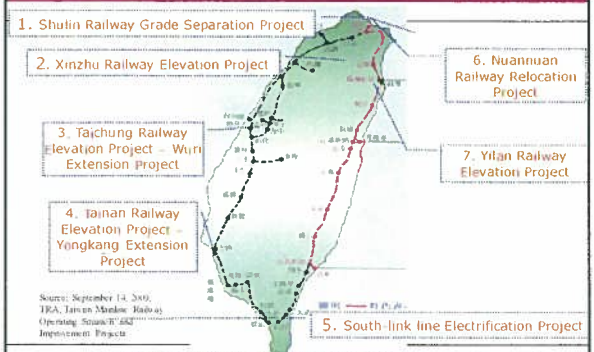
Taipei MRT

Routes under planning

Route name	Route length (Km)		
	Taipei City	New Taipei	Total
South-North line			
Mianhe-Nizhi line	12.0	9.0	13.9
Ankeng line	-	7.3	7.3
Sanying line			
Shenkeng-Beitou Light Rail Network			
Circular line North and South sections	11.9	9.0	19.9
Danshui LRT extension line			
Subtotal	36.2	36.5	102.7
Overall Network	292.7km/ Daily passengers over 3.6 million		

11

Traditional Railway Project Plans



Source: September 14, 2009, TRA, Taiwan Mainline Railway Operating Situation and Improvement Projects

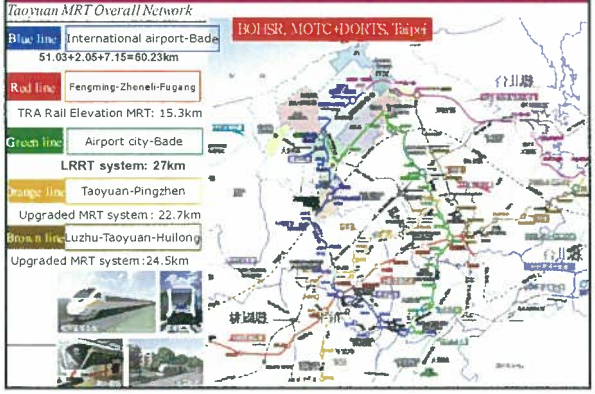
Schematic Map of Railway Reconstruction Projects Under Feasibility Study

MRT&LRT&RAIL PROJECT PLANS TAOYUAN AREA

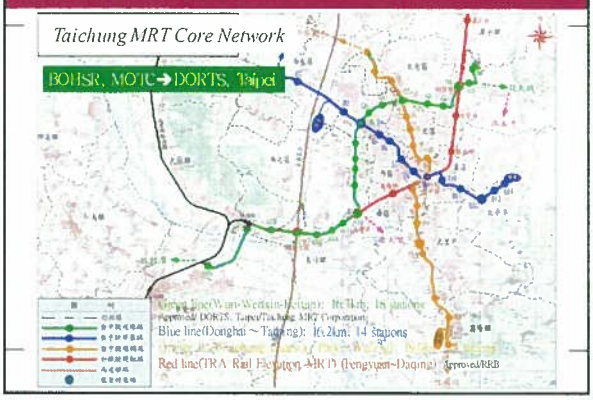
Taoyuan MRT Overall Network

BOT/SR, MOTC+DORTS, Taipei

Blue line	International airport-Bade 51.03+2.05+7.15=60.23km
Red line	Fengming-Zhenei-Fugang TRA Rail Elevation MRT: 15.3km
Green line	Airport city-Bade LRRT system: 27km
Orange line	Taoyuan-Pingzhen Upgraded MRT system : 22.7km
Brown line	Luzhu-Taoyuan-Huilong Upgraded MRT system :24.5km



MRT&LRT&RAIL PROJECT PLANS



List of Major Projects

Project	Budget	Schedule
South Link Electrification Project (Traditional Railway)	£ 410 Million	2016-2018
TRA Nangang to Hualien Speed-up and Improvement Project (Pei-I straight railway)	£ 310 Million	2016-2019
Taipei - Sanying Line (Metro)	£ 610 Million	2016-2018
Taoyuan Green Line (Metro)	£ 1.8 Billion	2016-2018
Taipei - Mingsheng-Xizhi Line (Metro)	£ 1.58 Billion	2017-2019
New Taipei City - Tamsui (Light Rail)	£ 250 Million	2015-2020
Traditional Railway Upgrade and Intelligent System	£ 300 Million	2015-2017

16

MRT & LRT PROJECT PLANS

Kaohsiung Circular Light Rail System - BOT

Kaohsiung MRT

- Route length: 19.6 km
- Stations: 32
- Workshop: TRA Qianzhen switchyard (including Administration Center)
- Total budget: GBP$272 million
- Right of way: At-grade B-type right-of-way; isolated tracks and roads
- Tracks: 1,435mm standard gauge
- Power supply: Overhead line, 750V
- Trams: width: 2.65 m/over 70% low floor
- Stations: Platform width: 2.5~4 m, height: 35 cm (in coordination with low-floor trams)
- Two-stage construction

Sources: http://mtbu.lrg.gov.tw/chtml/lightrail/index.php

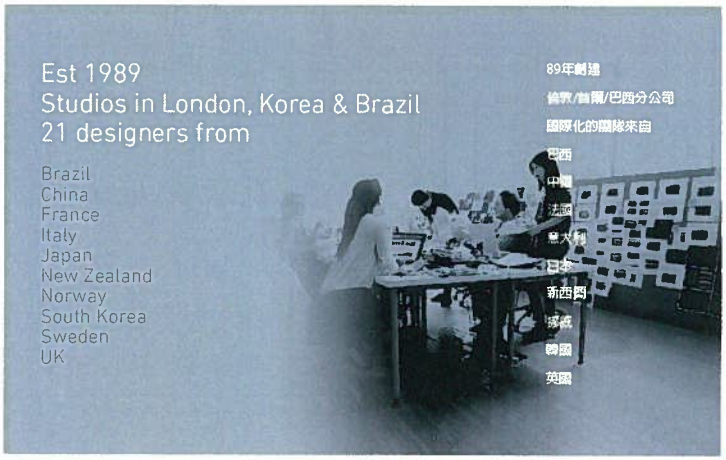
CONCLUSION

- Railway Subcategory in next 8 years(2013~2025)
  - **At least GBP 12.5 billion (35 projects) public investment (approved and under implementation)**
  - **Railway projects under planning (to be approved): 21 projects with budget over GBP 8.3 billion**

Sources: Budget Request for Highway Construction and Rail Construction, MOTC, Dec. 2012

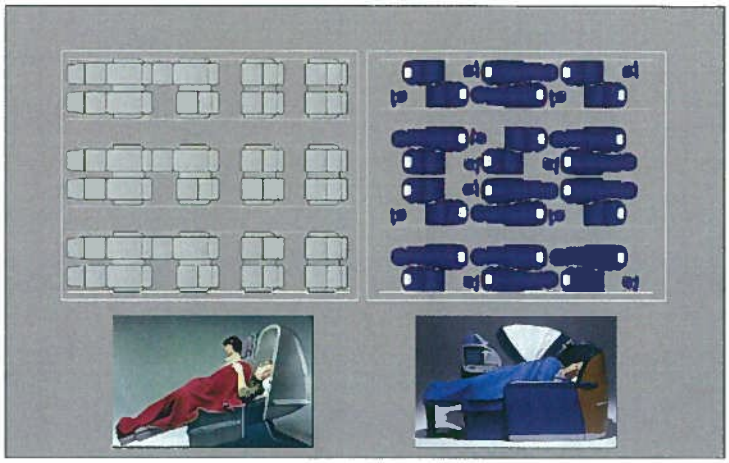
15

附件2.3-02： Tangerine Credentials, ppt by Weiwei He〈何薇薇〉高級設計師



We do seven things really well
我們擅長的七個方面

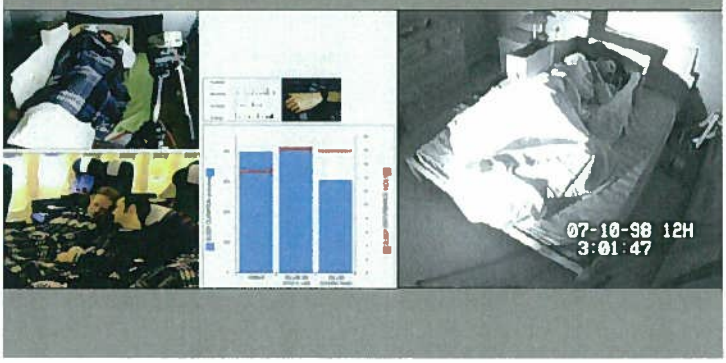
Ask the right questions	找到關鍵問題
Shape design strategies	修訂設計策略
Unlock customer insights	解鎖消費者意圖
Discover powerful ideas	尋找強有力的產品概念
Find gaps you can own	填補市場空白
Create the right stories	恰到好處的講述產品故事
Deliver the best solution	傳遞最優秀的解決方案



Diverse industries: common business problems
不同的產業：普遍的商業問題

Regaining market share	重新獲取市場份額
Re-energising the brand	為產品牌註入新活力
Defining the customer experience	定義用戶體驗
Connecting with customers	連接（產品）與消費者

BA Club World 2000
Sleeping test 睡眠測試



Regaining market share: British Airways (2000 + 2006)
重新獲取市場份額：英國航空（2000 + 2006）

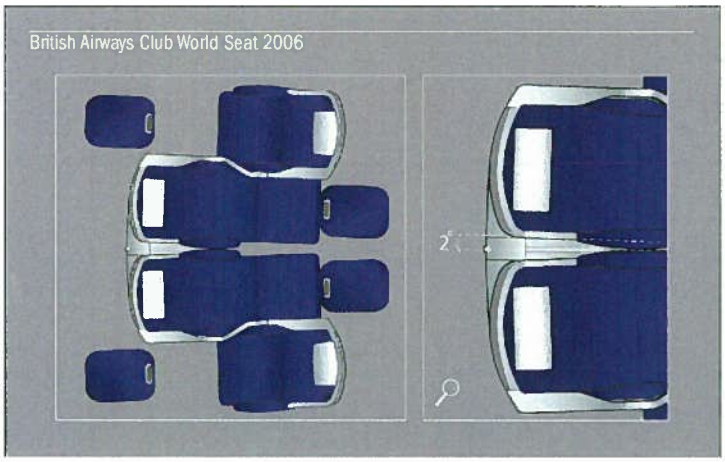
In 1998 British Airways was suffering a server toss of market share. British Airways engaged tangerine to design a solution to this problem that would have passengers flocking back to the airline.

We took a total rethink of the business class travel experience and defined, what remains to this day, one of the most innovative and radical cabins in the sky. We gave business class passengers the ability to have a proper sleep in the World's first fully flat bed in business class.

In 2006 tangerine totally redesigned the second generation of the concept for British Airways which gave passengers more real estate, a 25% wider bed and full upgrade of design quality.

A full return on investment of £200,000,000 in less than twelve months. A 37% rise in passenger numbers following launch. For more than a decade this concept has remained the profit engine of British Airways.

1998年英國航空市場份額下滑，英航委托Tangerine用設計贏回消費者。
我們重新思考商務艙旅行並最終定義了沿用至今的民航設計中最激進的創新。在不損失任何座椅數量的前提下，我們給商務艙乘客提供了可以完全平躺的床。
2006年我們重新設計了第二代商務艙座椅，提供比原來寬25%的床並升級了座椅設計。此設計在12月內收回了2億英鎊的投資，投產後旅客數量增加了37%，在接下來的十年內，英航的主要利潤來自於商務艙。



Re-energising the brand: British Airways (2010)

為舊品牌註入新活力：英國航空（2010）

After the phenomenal success of Club World, British Airways returned to tangerine with the challenge of re-energising its First Class brand.

Tangerine with Forpeople reshaped the travel experience in First Class, unlocking more individual space for each passengers and bringing magic and sparkle to the whole cabin. Our design activity focused not only on creating the ultimate passenger experience in the sky, but also on delivering a solution that would be robust in service and offer significant manufacturing cost benefits.

A true British first class experience of understated elegance.
A 50% cost saving over competitor seats.

在商務艙的巨大成功後，英航再次找到Tangerine為其頭等艙設計。
Tangerine與設計同行Forpeople重新定義了頭等艙的用戶體驗。為每位乘客提供更大的個人空間的同時為機艙設計註入魔力和火花。我們的設計不僅僅創造藍天上的終極用戶體驗，同時還為空中服務提供堅實的基礎並且嚴格控制生產成本。
我們創造出英國頭等艙的低調優雅體驗，並且比競爭者節省50%的制造費用。

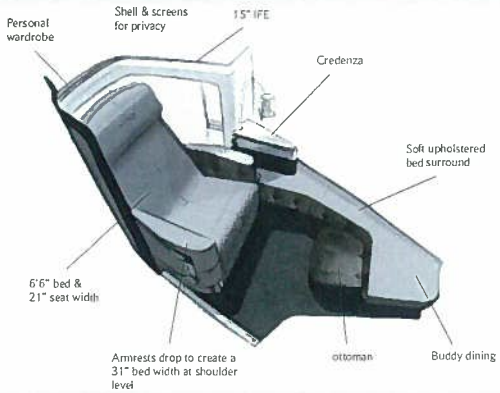
First is

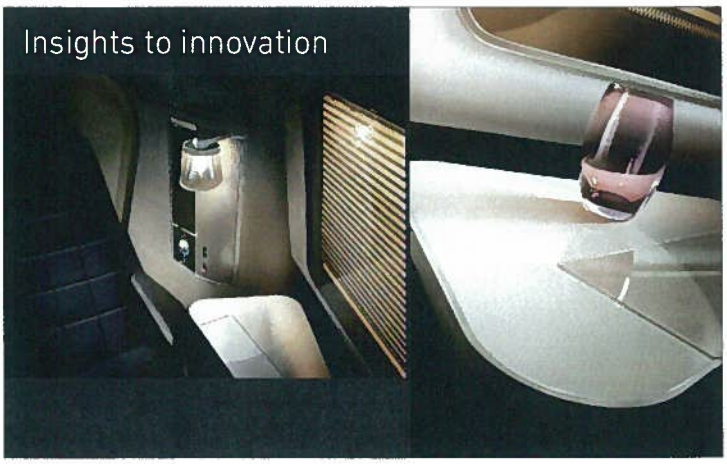
PURE SIMPLE TIMELESS INDIVIDUAL TRIBAL EXCLUSIVE DISCRETE

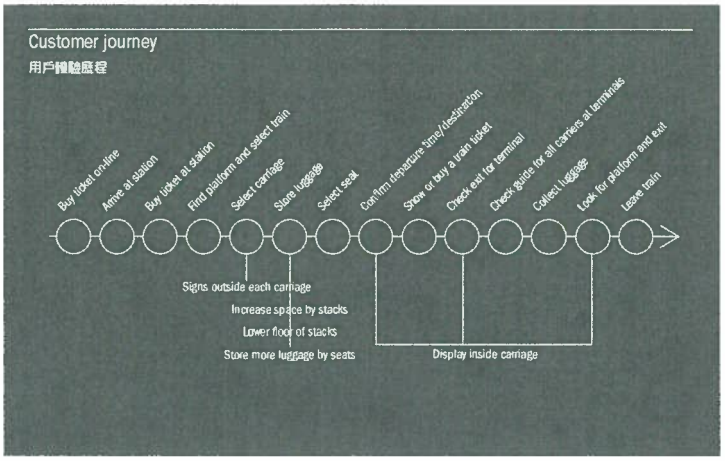
First is not

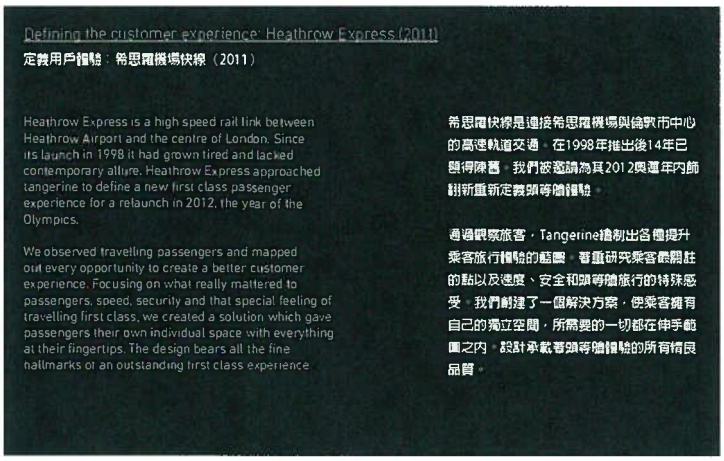
ELABORATE OPULENT SIMPLIFIED OSTENTATIOUS COMPLEX OVERT

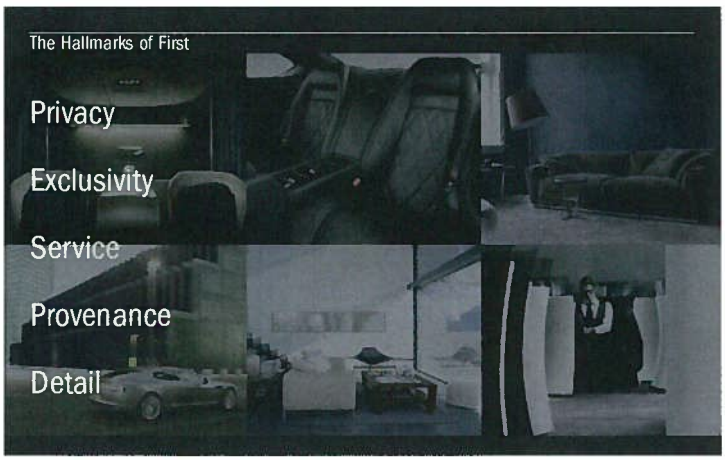
Development






Customer journey
用戶體驗歷程
Buy ticket online
Arrive at station
Buy ticket at station
Find platform and select train
Select carriage
Store luggage
Select seat
Confirm departure time/destination
Show or buy a train ticket
Check exit for terminal
Check gates for all carriers at terminals
Collect luggage
Look for platform and exit
Leave train
Signs outside each carriage
Increase space by stacks
Lower floor of stacks
Store more luggage by seats
Display inside carriage


Defining the customer experience: Heathrow Express (2011)
定義用戶體驗：希思羅機場快線（2011）
Heathrow Express is a high speed rail link between Heathrow Airport and the centre of London. Since its launch in 1998 it had grown tired and lacked contemporary allure. Heathrow Express approached tangerine to define a new first class passenger experience for a relaunch in 2012, the year of the Olympics.
We observed travelling passengers and mapped out every opportunity to create a better customer experience. Focusing on what really mattered to passengers, speed, security and that special feeling of travelling first class, we created a solution which gave passengers their own individual space with everything at their fingertips. The design bears all the fine hallmarks of an outstanding first class experience.
希思羅快線是連接希思羅機場與倫敦市中心的高速軌道交通。在1998年推出後14年已顯得陳舊。我們被邀請為其2012奧運年內飾耕新重新定義頭等艙體驗。
通過觀察旅客，Tangerine繪制出各種提升乘客旅行體驗的藍圖。著重研究乘客最關注的點以及速度、安全和頭等艙旅行的特殊感受。我們創建了一個解決方案，使乘客擁有自己的獨立空間，所需要的一切都在伸手範圍之內。設計承載著頭等艙體驗的所有精良品質。

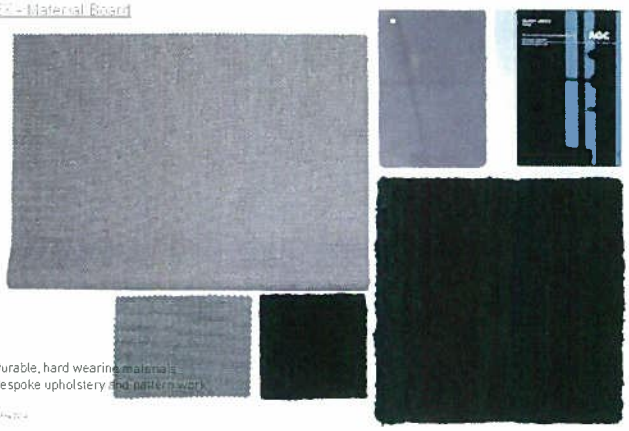

The Hallmarks of First
Privacy
Exclusivity
Service
Provenance
Detail


Heathrow Express original first class carriage
希思羅機場快線頭等艙改良設計之前


HEX - Cabin Vision

Upgrade of the existing seating

HEX - Material Board



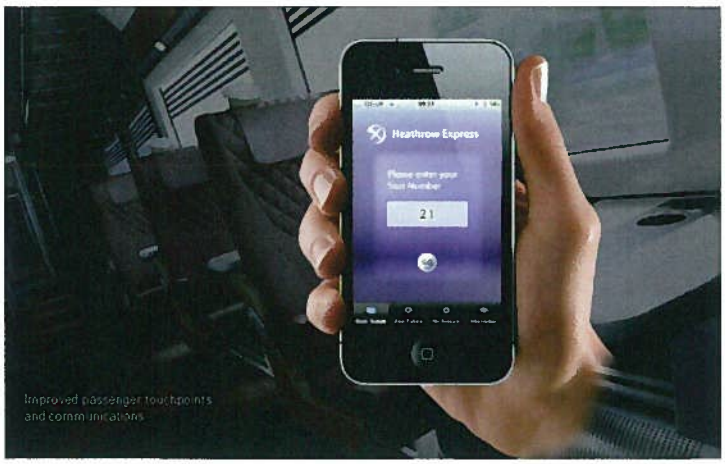
- Durable, hard wearing materials
- Bespoke upholstery and pattern work

Heathrow Express, Cabin Refurbishment (2012)
Setting the vision for first class

Production ready cabin
- Screen printed windows to crea... blind effect

Seating concepts

Insights to innovation



Information & services

Relevant choices Confirmation More

附件2.3-03： 第二屆台英軌道論壇高鐵局書面意見與問題

Mr. Wu-hsun Chang, Deputy Director General of Bureau of High Speed Rail, MOTC
E-mail: wschang@hsr.gov.tw

Second Meeting of the Taiwan/UK Railway Forum

Topic of discussion 1: Life cycle

Subject: According the total life-cycle cost analysis about stainless steel vehicle and aluminum vehicle, how to reduce the cost?

Stainless steel vehicle has high temperature melting point(more than 1400℃ and corrosion resistance properties and no painting. Aluminum vehicle has light and easy forming & machining properties. Therefore, Aluminum vehicle can be manufactured streamline profile and beautiful appearance, but low temperature melting point(630~650℃).

In Taiwan, TTY Airport MRT adapts Stainless steel vehicles. According to E&M contract, the rolling stock shall have a Service Life of at least thirty (30) years, and potential life extension following overhaul and refurbishment, of an additional fifteen (15) years.
According to UK railway experience, Compare to the above-mentioned two type vehicles total life-cycle cost included preliminary purchase cost and maintenance and operation life-cycle cost. Please provide relevant data and recommendation.
For example, how to extend the life cycle and reuse current collector brushes installed in rolling stocks in oder to reduce the life cycle cost? Please provide the UK railway experience.

Topic of discussion 2: System Integration/ Signaling System

Subject: How to urge British Siemens to accomplish the existing TIAAMRT project (ME01) on time and with quality and safety in accordance with its well-known profession and traditions?
And welcome to participate actively future projects such as Zhongli extension line system of TIAAMRT and subsequent works in the

Taoyuan Aerotropolis Project in Taiwan.

brief

Taiwan Taoyuan International Airport Access MRT System Construction Project (TIAAMRT) connects Taoyuan International Airport, Taoyuan County, New Taipei City and Taipei City. The total route length is approximately 51.2 km. There are 22 stations and 2 maintenance depots. The original revenue service date was June 2013, and it is postponed and rescheduled to be in December 2015. Currently, signaling dynamic test and system integration test on mainline are the most important tasks to be overcome in order to fulfill the milestone of substantial completion by the end of this year (2014). And then, the subsequent activities for operation preparation prior to revenue service date can be carried out smoothly. Moreover, it will extend 2.0 km southwards. However, the tender of E&M system for this extension line didn't go smoothly. At present, we are reviewing the tender document according to the comments from potential bidders, and will call for bid in the second half of this year.

1. Difficulties of the Signalling System and System Integration

Signaling of TIAAMRT E&M system (ME01 contract) is supplied by British Siemens Rail Automation Limited (former Westinghouse and Invensys Rail Limited), and the system integration is conducted by Japanese Marubeni Corporation, which is the leading company of ME01. According to the experience of international MRT projects, signaling supplier is the core member for E&M system integration and whole system integration test. Furthermore, signaling is the key factor for train control and operation readiness. Under the combination structure of ME01 contractors, the problems and issues we encounter currently are as followings:

(1) The signaling system of Siemens (Invensys) hasn't ever been used in Taiwan. Therefore, the progress of TIAAMRT, including installation and testing, doesn't go smoothly and fall behind the schedule due to less experience in Taiwan. We still don't have the confidence in Siemens' signaling performance which will affect the forthcoming stability testing and commissioning.

(2) The UK Government might urge Siemens to accomplish successfully TIAAMRT project with every effort under the ME01 contract. We hope

that our airport link MRT system will enter into its revenue operation on the schedule, and its safety and quality have been assured.

(3) Based on the Metro or MRT experience in UK, whether the leading contractor of turn-key project or the contractor of system integration testing will implement effectively system integration and entire system integration test without participation and assistance from original signaling company or not ? And how the safety and quality can be confirmed?

(4) In the interest of slow progress of signaling dynamic test and system integration test for TIAAMRT, would you kindly provide us with comments or recommendations based on the experience of London Metro system which signal system is similar to ours? No matter what the ideas on construction, testing or operation will be highly welcome.

(5) Does the signaling system for the 2 km Extension Line need to be the same system used in the existing 51.3 km Line? Are there better solutions to deal with compatible issue between the original line and extension line? What's the UK experience? Please give us your valuable advice or suggestion on this particular subject.

2. Tender of E&M System for Zhongli Extension Line of TIAAMRT - ME06 Contract

(1) It is our wish that Siemens can participate actively in the ME06 bidding process.

(2) Among which, Siemens may serve as professional subcontractor of signal system and/or professional subcontractor of system integration test. We hope that Siemens can be the bidder.

(3) Considering the compatibility problem between Zhongli extension line (ME06) and existing ME01 contract of TIAAMRT project, it is expected that British Siemens of signaling supplier can participate enthusiastically in the extension line project and assist the potential main contractor at preparing the bidding proposal, including proposing a reasonable quotation and operating in coordination with the tendering procedure.

3. Conclusion

UK railway has been built and operated for more than one century and plenty of experience and technology has been accumulated. Related systems or standards such as ISO, quality assurance (QA), verification and

validation (V&V) are complete. We expect that UK Government Authorities would urge British Siemens to accomplish the existing TIAAMRT project (ME01) on time and with quality and safety in accordance with its well-known profession and traditions. Then, the reputation and confidence of British enterprise can be established. In addition, regarding future projects such as Zhongli extension line system of TIAAMRT and subsequent works in the Taoyuan Aerotropolis Project in Taiwan, we also hope that the Authorities can urge British famous companies such Siemens to participate actively.

附件2.3-04： 第二屆台英軌道論壇UK SRA willison20140330 responses

Second Meeting of the Taiwan / UK Railway Forum

Siemens Responses to Issues List

Issue 1: Whole life cycle procurement (best value for money)		
1.	If electronic device can't last for the whole life cycle how can we be sure that the new device can work out well.	The life of products and systems can be extended though regular servicing. As modern signalling and control systems use more and more technology, particularly information technology, management of obsolescence becomes a greater issue. Planning ahead and identifying components that are likely to become harder to source over the coming years, before it becomes an issue, can help. This can be related to the sub-systems within which they operate. As an example, in Siemens, we provide this service for clients using our Obsolescence Management tool to identify components that are no longer manufactured. We will seek approaches such as 'last time buys' of components to ensure that spare parts can be manufactured, or if necessary – and an appropriate business case exists – we will re-design to remove the issue. We also seek to adopt modular designs so that even if obsolescence becomes an issue for part of a system, it does not have a significant impact on the entire solution. Ultimately if a part becomes obsolete and cannot be replaced, it is best to identify an alternative solution as soon as possible, to enable the railway service to keep running effectively. For information technology items, such as servers, displays, or other parts based on Commercial Off the Shelf (COTS) elements, replacement of individual items is often necessary before the end of the overall system's service life has expired. Mid-life upgrades of such technology is often worthwhile as they not only remove issues related to equipment support and reliability, but will frequently improve system performance and energy usage by replacement of equipment. When new equipment is offered, it is important that it gives clients the functionality they require, that it offers no immediate problems with maintenance and long term support.
2.	What are the key factors when purchasing signalling related electronic information equipment and parts?	Different clients have different priorities when purchasing signalling related equipment – this could be based on initial capital expenditure or optimising whole life costs by reducing the number of operators necessary to run a system, or minimising maintenance or energy usage. We would advocate the use of a whole life or through life approach, ensuring that the system selected is the one that offers consistent performance throughout its service life, with reliability, availability and maintainability prioritised over initial cost. Clearly saving capital expenditure can have a significant impact on operational expenditure over an extended period of time.

Issue 2: System Integration		
1.	Timetable requirement about signal system issue: How to establish the timetable headway requirement.	We would generally advise seeking to build in suitable margins of performance to ensure that a service level is sustainable. Clearly the throughput of a railway is down to a lot more than the signalling and train control. Rolling Stock performance and design, station management, the movement of passengers through the network and a whole range of other factors actually drive the overall capacity of a line. For example having close running between trains does not help the operator if it is not possible to manage dwell times in platforms to very low levels. Maintenance of the timetable can be significantly enhanced by the use of complex Automatic Train Regulation (ATR) algorithms such as those we use on lines such as London's Victoria Line. These interact with the on-board Automatic Train Operation (ATO) system to despatch trains at the optimum time in order to meet one of a number of key performance indicators – perhaps schedule / timetable adherence, or maximum throughput, or energy saving mode. Predictions are made of the likely state of the railway for a period of time ahead of the present, and the timetable is modified in such a way as to prevent minor issues becoming significant disruptions to service. Although the modifications made can be very small, the impact on railway performance can be very high. Simulations help ensure that timetables are sustainable in operation, with detailed calculation being carried out to understand the way in which trains move through the network, and to allow the interaction between various variables to be evaluated.
2.	The discussion of centralising the management of MRT Operation Control Centres together.	There are many benefits realised by both centralising the management of operation control centres and integrating multiple systems in a single system. Centralised management allows consistent performance across and entire railway, and significantly improved management of information across the enterprise. As modern Control Centres are based on networked technology and PC-based control systems they do not need to be located physically close to the railway that they control. That means that there is not technology reason for separate railways to be controlled from separate areas. Having all the operators in one room gives the option for supervisors to 'flex' their operators, with more being moved to lines that have particular issues, or far fewer being used to control all lines in periods of low usage. By using a Control Centres that integrate various functions – e.g. Signalling, Traction Control, Communications, Public Address, Passenger Information etc., into multi-headed workstations, the number of staff required can be further reduced. A smaller number of operators can make – and act

		upon – decisions without having to communicate with a larger number of people – some of whom would not be in the same room.
3.	Is it practical to let vehicle supplier to include signalling equipment in their scope?	This depends upon the supplier of the vehicles. Generally speaking integration risk is removed from the client by such an approach. We would not generally recommend that the trackside equipment came from one supplier and train-carried equipment from another. Whilst this is feasible for systems built around clear engineering standards – for example ERTMS – this is not generally the case for metro railways where proprietary systems are generally selected for the performance and features they can offer. The majority of signalling suppliers are not generally in a position to share the intellectual property around data telegrams and safety coding with other suppliers – generally competitors – in the manner necessary to allow such a split to be realised.
4.	The procurement of signalling system for MRT extended lines and face challenges in system integration.	We do not fully understand this question, but would be happy to discuss further.
5.	The design and equipment for energy-saving.	We believe that there are a number of ways in which energy can be saved in a railway installation. We consider that there are two major elements: (1) Efficient driving of the trains themselves in order to optimise energy consumption (2) Design and application of railway systems – in this case railway signalling and control – in order to optimise energy usage. In terms of railway signalling and control there are a number of ways of optimising energy usage including: (1) Implementation of energy-efficient timetables in conjunction with regenerative braking systems. These ensure that when a train is slowing into a station and pushing power into the traction system, there is an accelerating train in the area ready to receive that energy. (2) Provision of coasting – allowing a train to remove traction when a certain speed is achieved, and remotoring again only when another, lower speed is attained. (3) Advanced energy management systems in which the Train Supervision system sends an 'arrival time' at a waypoint along the journey, and the ATO manages speed in order to arrive at exactly that time, rather than running at full speed for the entire journey. Clearly in all of these instances there is a potential penalty in terms of run-time performance of the railway as the train is

	saving energy by moving more slowly. Electronic systems are stressed when operating too hot. In environments such as Taiwan it is generally necessary to use air conditioning systems to ensure that temperature and humidity is managed within equipment rooms. This is potentially a major whole-life cost, which can be mitigated by careful selection of equipment. In addition, micro-renewable technology, such as small wind turbines and solar installations at remote locations, can help minimise the power demanded from grid systems.

Issue 3: Intelligent railway information management system	
1. Railway efficiency improvement through intelligent information management.	On the majority of railways there is a wide selection of electronic / computer systems, all of which are generating and storing data. The right data can be useful to the operator and help optimise the operation of the railway. At the simplest level, maintenance of accurate failure-rate information gives an opportunity to improve the reliability of the railway. Knowing that an element of equipment has an increased chance of failure after so many operations or hours of use allows routine scheduling of maintenance to minimise the chances of in-service failure. Service information from interlocking or Control Centre equipment and failure databases allows such an approach to be taken. Where appropriate it is possible to provide instrumentation to monitor equipment performance and determine when a failure is likely to occur. Typically this would be at critical junctions or turnbacks where it may be worth installing current monitoring equipment to determine the length of time for point operation, current demand and so on. Analysis of performance against typical 'norms' would allow determination of when maintenance is required. Track circuits can also be used to provide condition information related to ballast resistance, wheel-rail resistance and so on. This information can be provided to a central monitoring system. In the ideal situation the information from all these diverse systems – and many more – will be brought into one location and provided to the maintainer. His / her work schedules can be created automatically based on prioritisation of activities, and all relevant information can be provided to hand-held terminals so that upon arrival at the work site a clear understanding of the issue to be rectified can be provided, together with certainty that the right tools or parts are available.
2. Discussion on ways to shorten the headway and increase the capacity.	Headway and capacity of railway systems is constrained by a number of factors including: • Geographical layout – particularly at turnbacks • Rolling stock performance • Signalling and train control system performance • Trackside equipment performance (specifically point machine operation time) • Station dwell time • Operational constraints It is the mixture of variables related to all of the above that actually drives capacity and throughput, but ultimately the layout of the railway will be the constraint that cannot be changed.

	The London Underground Victoria Line runs a 33 trains per hour service in morning and evening peaks, which requires a capacity well in excess of that to permit reliable service. This is achieved by optimised fixed block signalling systems and communication based train control systems that allow rapid updates of train location to drive changes in movement authority to following trains. It is our experience that besides ATP and Signalling systems supporting close movement of trains through the railway, close integration between ATO and rolling stock systems is essential. A smooth stopping profile helps ensure that no line capacity is wasted and passenger comfort is enhanced. Dwell time management is critically important to ensuring that headway is optimised. This is in part related to train and platform design allowing passengers to move on and off trains effectively, and the provision of suitable escalators or stairways to allow departing passengers to move. In completely critical stations the use of additional platforms and phased door opening (one side to allow passengers to leave the train, then the other side to allow passengers to join from the departure platform) can offer improvements in capacity, but at significant capital cost. Platform Screen Doors (PSDs) can also have an impact on throughput. If lines are equipped with PSDs then trains can reliably enter the platform and full line speed, but high speed vital communication between train doors and platform doors is essential to ensure that no time is lost due to door operation. Rolling stock performance – not only in terms of achievable acceleration and braking, but in terms of response times, brake build-up, time to achieve full traction effort and so on – is critically important to optimising throughput on a railway, and different rolling stock can achieve very different values of many of these variables. Increased level of automation can offer ways of increasing capacity – for example automation of turnbacks at the ends of the line - although operational approaches such as step back can offer similar improvements in throughput. Detailed and accurate simulation of railway performance is important to fully understand the significance of design decisions made at the specification stage.
3. The need of unmanned operation system.	Should railway authorities choose to adopt fully unmanned operation (Grade of Automation / GoA4), there are a number of considerations that drive capital costs and operational efficiency.

	Whilst modern ATC systems are highly reliable, and are generally configured for optimum availability, a system needs to be established for dealing with failures. Without someone on the train to drive it, decisions need to be made as to whether it is acceptable to wait for station staff to arrive at the train and to move it, whether some form of remote driving from the control centre is possible, or whether it is necessary to couple a following train and push the failed vehicle out – something that is not possible in the event of common mode failures – for example of the radio system. In any case it is necessary to ensure that trains can be guaranteed not to move to ensure that this does not occur either when personnel are approaching trains, or if passengers are being detained. The way in which subsidiary, diverse systems are provided in order to overcome such issues is generally prescribed by our clients, and has significant impact on the costs of equipment provision. Higher grades of automation routinely drive a need for other functionality such as improved communication and video connections between train and trackside so that if incidents do occur it is possible for operators to talk to passengers quickly and accurately. Whilst current technology makes this more straightforward, the bandwidth involved in providing multiple video and voice feeds to multiple vehicles within multiple trains needs careful consideration and management. As a final consideration, the platform / train interface becomes a significant issue for unmanned railways – more so than for lower grades of automation. Platform Screen Doors or Half height screen doors are one solution, but others would include infra-red or radar detection of obstructions on the track.

附件2.4-01： On the National Skills Academy for Railway Engineering by Gil Howarth, Chief Executive

NSARE Overview

The National Skills Academy RAILWAY ENGINEERING

Developed by the industry for the industry

NSARE Ltd Board of Directors

The National Skills Academy RAILWAY ENGINEERING

Pan-Industry Board of 18 Directors

Chairman
Terry Morgan
Chairman, Crossrail

Deputy Chairman
Jeremy Candfield
Director General, RIA

- **Passenger Train Operating Companies**
- **Freight Train Operating Companies**
- **Rolling Stock Companies**
- **Train Build & Maintenance Companies**
- **Network Rail**
- **Transport for London**
- **Infrastructure Contractors**
- **Engineering Consultants**
- **Professional Engineering Institutions**

Why NSARE?

The National Skills Academy RAILWAY ENGINEERING

Recognition of the need for a pan-industry recruitment, training & development strategy

- Forecasting the skills challenges in the short & medium term
- Promoting the industry in Schools, Colleges & Universities
- Professionalising the workforce
- Transforming the quality of the training provision

History

2008	Initial Proposal
2009	Department for Transport/Industry Funded Research
2010	Government Endorsement & 'Start-Up' Grant
2011	Incorporation as a Company & 'Open for Business'
2014	**297** Member organisations and growing

NSARE's Scope

The National Skills Academy RAILWAY ENGINEERING

Included:

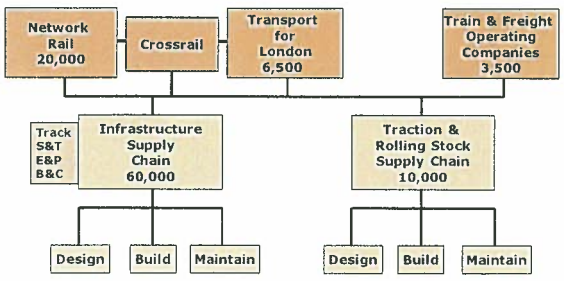
- Power – from Substation to Railway & OHL
- Signalling & Telecoms
- Train Build & Maintenance
- Track Renewal & Maintenance

Not included:

- Civil Engineering Construction
- Power from Grid to Substation
- 'Generic' parts manufacture

NSARE's Scope

The National Skills Academy RAILWAY ENGINEERING



NSARE Skills Forecasting Model

The National Skills Academy RAILWAY ENGINEERING

Type of activity:

- Track
- Signalling & Telecommunications (S&T)
- Electrification & Plant (E&P)
- Traction & Rolling Stock (T&RS)

Skill Level

- Senior Engineer/General Manager
- Technician / Manager
- Skilled Artisan / Supervisor
- Semi-Skilled

Maintenance or Investment Projects & Renewals

Current Workforce

The National Skills Academy RAILWAY ENGINEERING

Railway Engineering

Type of Activity	Number of People
Track	55,500
Signalling & Telecommunications	12,000
Electrification & Plant	3,500
Stations etc.	15,500
Total Infrastructure	**86,500**
Traction & Rolling Stock	**13,500**
Total	**100,000**
% Engineers & Technicians	17%
% Female	4%

Aggregated Programme

The National Skills Academy RAILWAY ENGINEERING

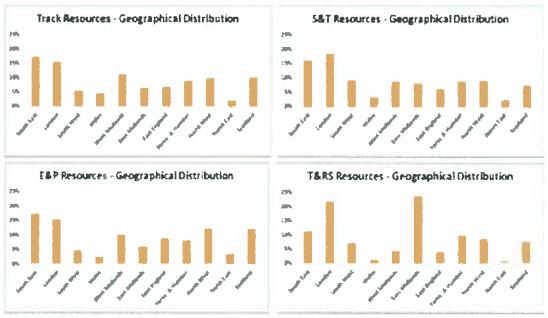
Developed aggregated programme of 200+ projects:

- **Network Rail**
- **Transport for London**
- **Crossrail**
- **High Speed 2**
- **New Trains & Rolling Stock**
- **Light Rail / Metros**

Concentrated on 2013 to 2019 (end of CP5)

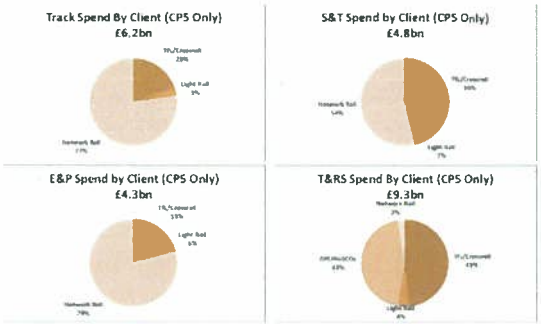
Workforce Geography

The National Skills Academy RAILWAY ENGINEERING



Future Programme – Spend by Client

The National Skills Academy RAILWAY ENGINEERING

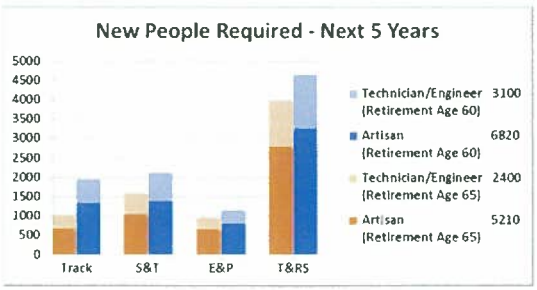


Workforce Age Profile

The National Skills Academy RAILWAY ENGINEERING

Recruitment: Numbers by Discipline

The National Skills Academy RAILWAY ENGINEERING



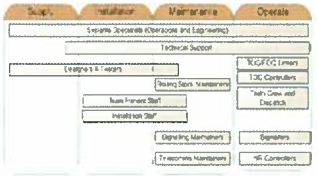
Comparison with Current Workforce

ERTMS Job Families

The National Skills Academy RAILWAY ENGINEERING

Key Role	No of people identified to date
Systems Specialists	400
Designers & Testers	2,400
Infrastructure Installers	2400
Signal Maintainers	3,300
Telecoms Maintainers	1,000
NR Controllers	700
Signallers	5,600
TOC Drivers	14,000
FOC Drivers	2,900
FOC & TOC Controllers	1,000
FOC & TOC Train Crew & Despatch	10,500
Train Fitment	2500
Train Maintainers	8,000
Technical Support	300
Total	55,000

30% of the total rail sector workforce to be up-skilled or recruited over 30 years



Systems Specialists required at the front end of the Programme

SIEMENS National Training Academy for T&RS

The National Skills Academy RAILWAY ENGINEERING

Collaboration between Siemens Plc, NSARE Ltd and Government (BIS & DfT)

National 'hub' at Northampton, 'spokes' around the country

Government invests 50% in return for 50% of training capacity: to be made available to industry through NSARE

Cost: Up to £7m

Huge opportunity for synergy with HS2 College

Training Accreditation

The National Skills Academy RAILWAY ENGINEERING

Rail Training & Assessment Accreditation Scheme (RTAS)

90 companies

450 trainers & assessors

50 major training facilities

All RTAS private sector training now 'Good' (90%) or 'Outstanding' (10%)

Currently expanding scheme:

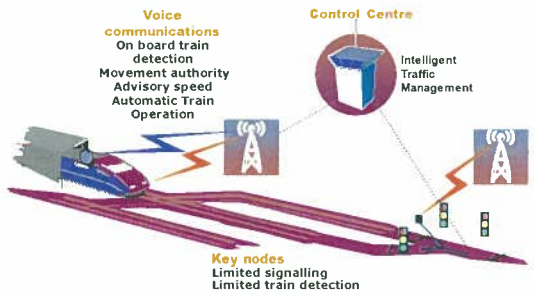
- **All technical training**
- **FE Colleges: 20+ interested**

BUT

Urgent need to up-skill trainer community: 'Train the Trainer'

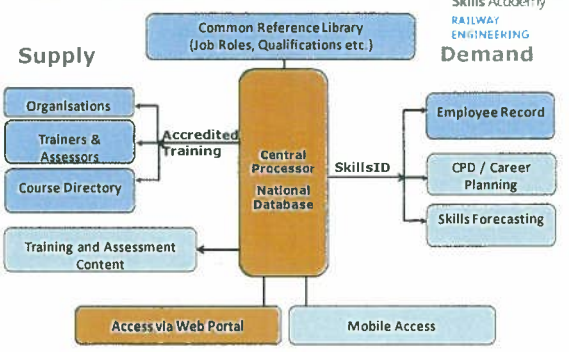
Industry View of Future Train Control System Configuration (ERTMS)

The National Skills Academy RAILWAY ENGINEERING



'Skills Backbone' IT Platform

The National Skills Academy RAILWAY ENGINEERING



SkillsID – What is it?

The National Skills Academy
RAILWAY ENGINEERING

80 companies
employing
16,000 individuals
already registered

Industry wide national competence database
– integrated with Training Accreditation software on 'Skills Backbone'

Online record of an individual's skills, competencies & qualifications

Accessible by employer (sponsor) and individual
– promotes ownership of self development

Updated by employers and NSARE accredited training providers
– verified records

Thank You

The National Skills Academy
RAILWAY ENGINEERING

Developed by the industry for the industry

附件2.5-01： Infrastructure Project by NR by Simon Kirby

NetworkRail

RIA/Taiwan Rail delegation visit

24 February 2014

Kings Place, London

What is Network Rail?

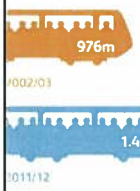
- We own, operate and maintain Britain's rail infrastructure, including 830 signal boxes; 2,500+ stations; 8,200 commercial properties; 6,500 level crossings; 20,000 miles of track; and 40,000 bridges and tunnels
- Under the 2005 Railways Act, we are also responsible for the long-term planning of the network
- We set the timetables and manage 17 of the largest stations on the network

Agenda

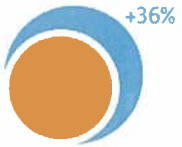
12:30	Lunch
13:30	Introduction & Welcome ~ Simon Kirby, Managing Director, Infrastructure Projects
13:50	Network Rail approach to WLC – Matthew Tattersall, Head of Special Projects, Infrastructure Projects
14:20	GW Electrification: Contracting on a system wide basis ~ Andy Haynes, Finance & Commercial Director: Western, Infrastructure Projects
14:50	Coffee Break
15:00	Using WLC analysis to support Network Rail's Footbridge building programme ~ Rob Olford, Finance & Commercial Director: Central, Infrastructure Projects
15:30	ETCS Procurement strategy ~ Paul Wright, Programme Commercial Manager, Signalling, Infrastructure Projects
16:00	Concluding remarks ~ Jeremy Candfield, Director General, RIA

We have seen extraordinary growth...

- In the last decade passenger numbers have gone up by 50%
- By 2020 forecasts suggest an extra 400m journeys – up to 1.8bn
- By 2031 passenger numbers in London are expected to grow by a further 36% on today



Increase in passenger numbers between 2002/03 and 2011/12



Projected growth in demand in London by 2031

NetworkRail

Infrastructure Projects

Simon Kirby

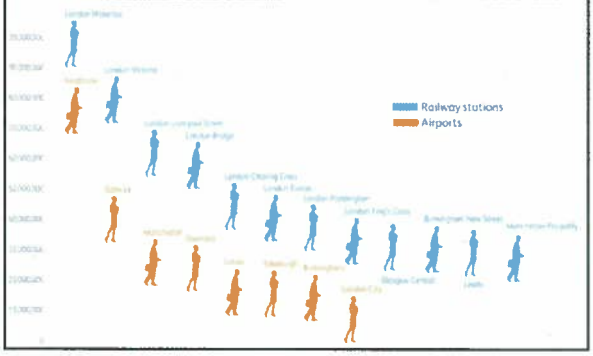
Managing Director

24th February 2014

More passengers arrive on time...

- 500 million more passengers now arrive at their destination on time compared to 2002/03 – when Network Rail took over Britain's rail infrastructure

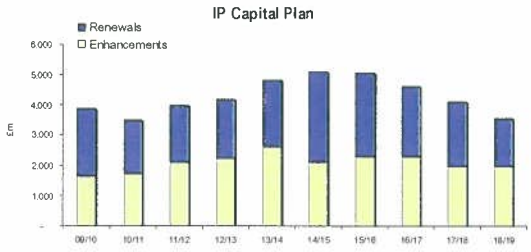
Our stations are used by tens of millions of people each year



Infrastructure Projects

Examples of Projects

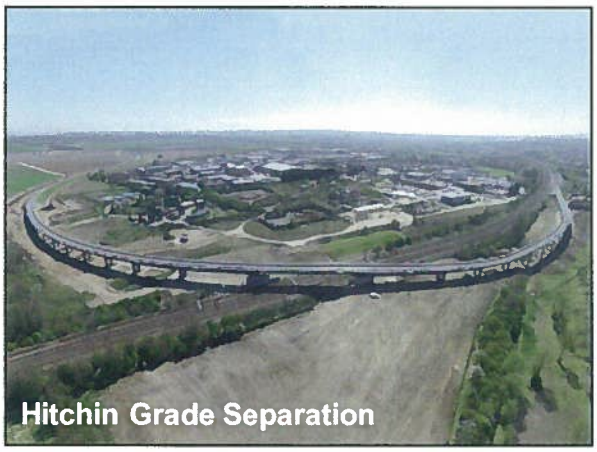
Annual capital spend



Infrastructure Projects ambition

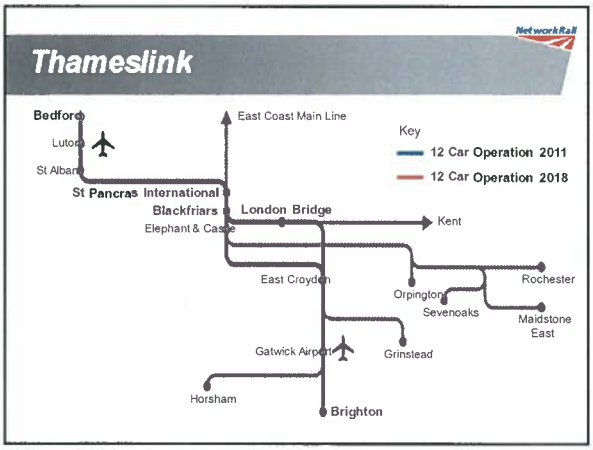
Our ambition is to be the best rail infrastructure project delivery organisation in the UK

We will be a rail infrastructure **solution developer, integrator and deliverer**; whilst also offering additional support services to our clients such as engineering design and asset protection.




Kings Cross Square

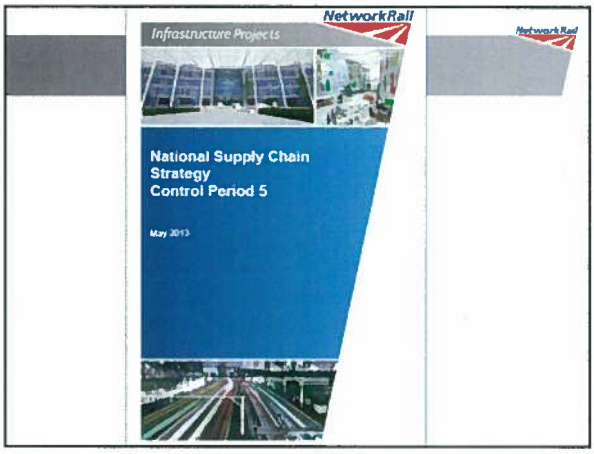

Waterloo Balcony

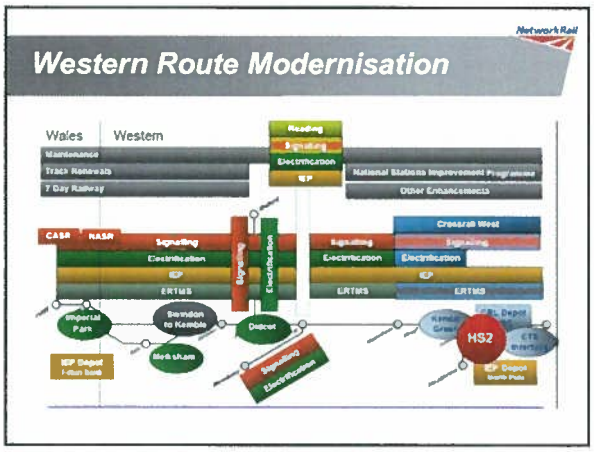

Thameslink
Network Rail
Bedford
Luton
St Albans
East Coast Main Line
Key
12 Car Operation 2011
12 Car Operation 2018
St Pancras International
Blackfriars
London Bridge
Elephant & Castle
Kent
East Croydon
Orpington
Rochester
Sevenoaks
Maidstone East
Gatwick Airport
Grinstead
Horsham
Brighton

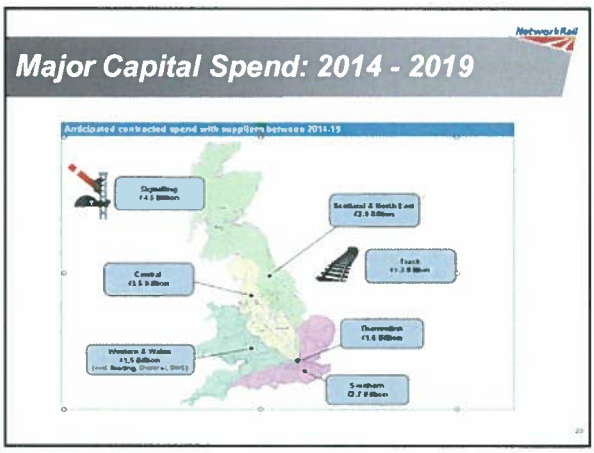

Central - Birmingham Gateway


Thameslink - Blackfriars

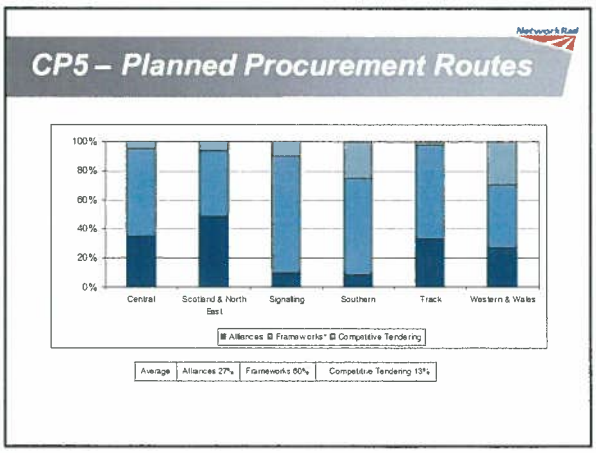

Borders Rail
Shawfair
A720 City Bypass
A7 Hardengreen
Eskbank
Newtongrange
A7 Gorebridge
Gorebridge
Heriot
Fountainhall
Bowshank Tunnel
Torwoodlee Tunnel


Network Rail
Infrastructure Projects
National Supply Chain Strategy
Control Period 5
May 2013


Network Rail
Western Route Modernisation
Wales
Western
Maintenance
Track Renewals
7 Day Railway
Reading
Signalling
Electrification
IEP
National Stations Improvement Programme
Other Enhancements
CABR
NASR
Signalling
Electrification
ERTMS
Crossrail West
Swindon to Kemble
Didcot
HS2


Network Rail
Major Capital Spend: 2014 - 2019
Anticipated contracted spend with suppliers between 2014-19
Signalling
Central
Track
Thameslink
Western & Wales
Southern


Reading


Network Rail
CP5 – Planned Procurement Routes
100%
80%
60%
40%
20%
0%
Central
Scotland & North East
Signalling
Southern
Track
Western & Wales
Alliances
Frameworks
Competitive Tendering
Average
Alliances 27%
Frameworks 60%
Competitive Tendering 13%

BS11000 Development


Certificate of Registration

Network Rail Consulting : service offer

- Advisory
- Strategic Planning
- Asset Management
- Operations
- Maintenance
- Project Development and Feasibility
- Project and Programme Management

Consulting

NetworkRail

Infrastructure Projects

NetworkRail

Simon Kirby

Managing Director

24th February 2012

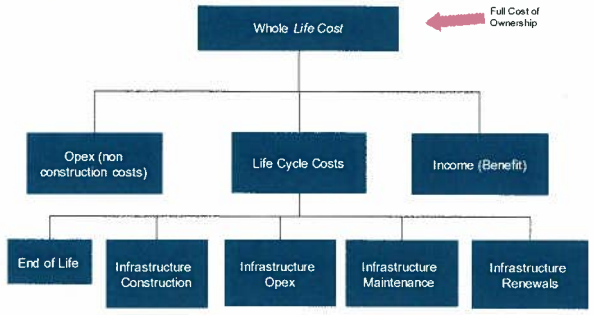
附件2.5-02： Embedding Whole Life Cost in NR Projects by Matthew Tattersall

NetworkRail

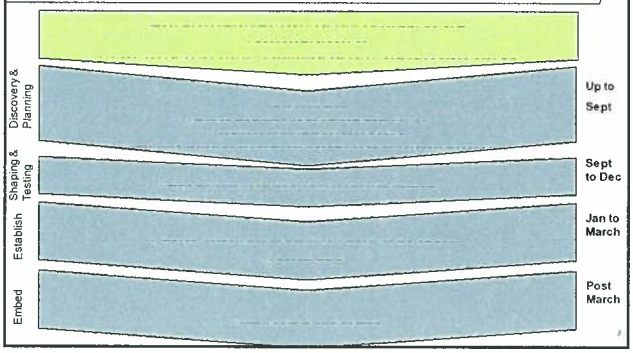
Embedding Whole Life Cost in Network Rail Projects

24 February 2014
Matthew Tattersall

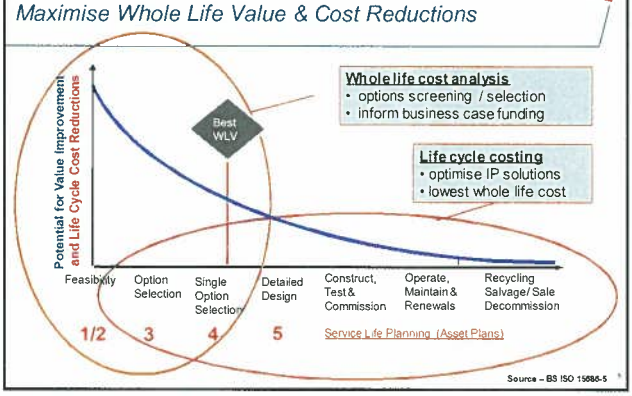
WLC



Network Rail's WLC journey



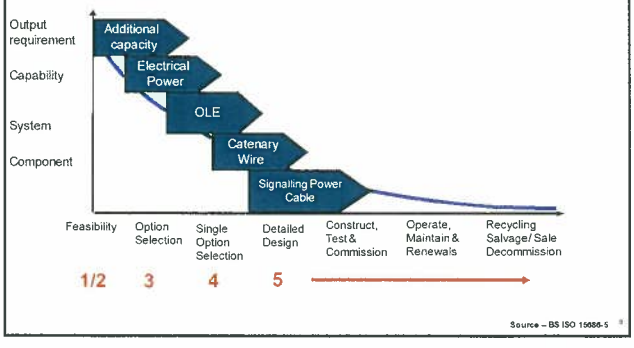
Maximise Whole Life Value & Cost Reductions



Network Rail WLC Manual

Contents

Maximise Value through the Project Lifecycle



Procurement

- CP5 procurement framework strategy already established
- Emphasis is on driving value from suppliers in the Development Process through Early Contractor Involvement (typically GRIP 2 or 3)
- For infrastructure not covered by the Framework Contracts, especially where NR does not have greater knowledge (than the market) of the Asset and Operational Management of the infrastructure (eg asset based on new technology like ETCS) we may want to include WLC in solution and product selection. This could be done in the following ways:
  1. WLC consideration included in the tender evaluation criteria
  2. Problem/Output requirement is provided (which includes WLC considerations) and suppliers tender against this
  3. Suppliers can bid using the alternative bid process

WLC Evidence & Challenges

Evidence

- Included in the project remit
- At the heart of option development and forms part of the business case to secure funding
- Industry wide
- Demonstrated through NPV analysis or BCR

Challenges

- Generating robust assumption in the early stages of project development
- Emphasis on WLC and not only Project Costs

Roles & Responsibilities

- Asset Managers, Project Leaders, Clients and Sponsors all have a role to play in WLC

Client / Sponsor – owns the decision and ultimately accountable to the Board

Route Asset Managers – owns assumption on opex, renewal and maintenance

Project Manager – develops options & compiles evidence as agreed with the client & sponsor

Risk & Value – provides the vehicle for WLC analysis on projects

Investment Control – provides governance

Economic Analysis – develops the WLC business case for enhancements

Estimating – provide capex assumptions & document all other assumptions

Engineering & Design – interpret and apply asset policies in design

WLC Evidence requirements

- All projects whether they are large or small, simple or complex need to consider WLC
- The decisions & options selected need to be explicit & clear about how they have considered WLC.
- The sponsor will be responsible for determining what level of WLC analysis is required and there are two basic options:
  - **Option 1:** Where the project's business case justification will rely primarily on the provision of a benefit e.g. capacity, congestion relief. These projects are typically defined as enhancement projects and are normally funded by Governments or from one of Network Rail's enhancements funds e.g. NRDF.
  - For these schemes the client should require WLC to evidence from GRIP 1 onwards and the primary means of doing this is an economic model (normally undertaken by Economic Analysis at GRIP stage 2).
  - **Option 2:** Projects where the business case justification relies primarily on stewardship of the existing asset base. These projects are typically defined as renewals.
  - For these schemes a WLC analysis is not necessary and an assessment on LCC basis is required.

附件2.5-03： European Train Control System (ETCS) On Board Freight Fitment programme By Paul Wright

NetworkRail

Infrastructure Projects

European Train Control System

(ETCS)

On Board Freight Fitment Programme

Paul Wright

February 2014

everyone home safe every day

Programme Overview

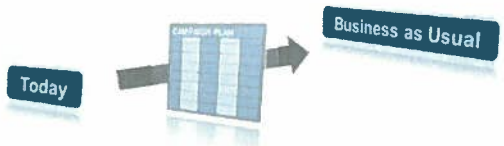
- ETCS Onboard Freight is part of the wider European Rail Traffic Management System Programme (ERTMS)
- ERTMS is a complex cross industry business change programme facilitated by new technology
- It will deliver cost savings and capacity benefits

ETCS Onboard Freight

- Programme Overview
- Whole Life Costs

Programme Overview

- The objective of the cross industry programme is to 'make ERTMS day job for industry'
- This is being achieved by delivery of a series of projects which are managed through a 'Campaign Plan'

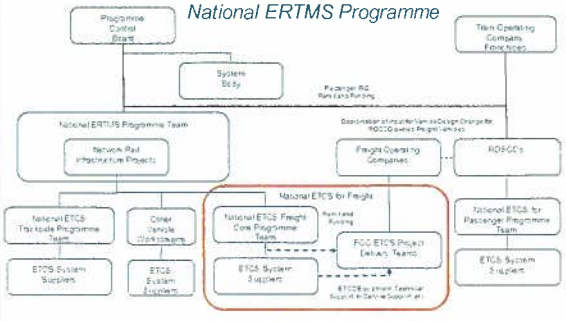


ETCS Onboard Freight

- Programme Overview
- Whole Life Costs

Programme Overview

National ERTMS Programme



Programme Overview

- Network Rail is leading the ETCS Onboard procurement process supported by the Freight Operating Companies (FOC)
- Trackside infrastructure and traffic management also delivered by Network Rail under same programme as Freight Onboard
- Passenger trains fitted with ETCS equipment under separate programme lead by Rolling Stock Companies (ROSCOS)

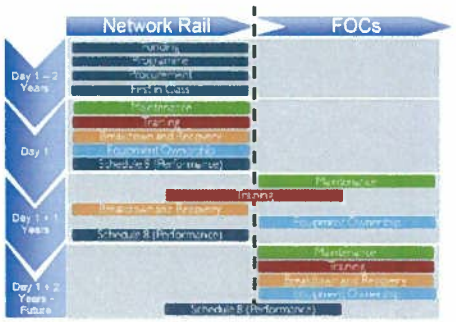
ETCS Freight Operator's View

- There is no business case for the FOC to implement ETCS
- FOC have serious concerns about business impact of its implementation and the potential effect on their ability to remain competitive with other forms of transport
- Maintaining reliability / availability of service during implementation is vital for the FOC and this will form a key part of the commercial agreement with Network Rail

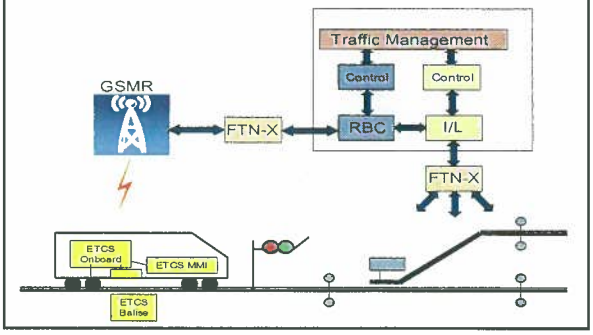
Infrastructure Fitment - Indicative

- Hertford Loop test site – 2013
- Thameslink Core – 2015
- Paddington to Bristol and Newbury as an overlay system operational by 2020 until 2025 when signals will be removed
- Kings Cross/Moorgate to Doncaster South by 2020
- Midland Mainline to south of Derby - 2020 – 2023
- WCML North late 2020s
- South of England late 2030s

ETCS Freight Operator's View



ETCS

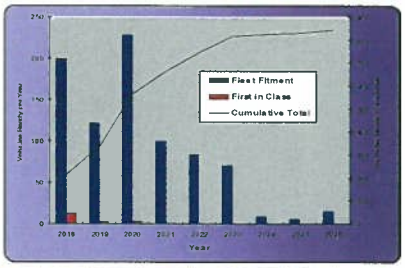


Project Scope

- 7 Freight Operating Companies
- Total of 845 locomotives
- 17 different classes of vehicles
- The scope includes:-
  - Design
  - Fitment
  - Approvals / Certifications
  - Testing and Commissioning
  - Training
  - Ongoing Maintenance & Support for up to 25 years

Project Scope

- Current vehicle ready profile
- Includes a number of assumptions that require supplier validation



	2019	2019	2020	2021	2022	2023	2024	2025	2026
Fleet Fitment	109	122	228	99	83	70	9	5	14
First in Class	12	2	2	1	0	0	0	0	0
Cumulative Total	211	335	565	665	748	818	828	833	845

Supplier Engagement

"What will be gained?"

- Sharing of information, communication of requirements, understanding of the challenges for all parties
- Production of a tender document that:-
  - Is clear
  - Is understood and accepted by all parties
  - Allocates risks and responsibilities to those best placed to manage them
  - Ultimately delivers a successful contract for all involved

Supplier Engagement

"Why is early supplier engagement necessary?"

- Early supplier engagement is vital to enable Network Rail to procure the best solution for Freight ETCS Onboard solution
- System change project introducing new technology developed by suppliers - suppliers are the experts
- Multiple stakeholders covering the whole industry

Whole Life Costs

- Programme Overview
- Whole Life Costs

Supplier Engagement

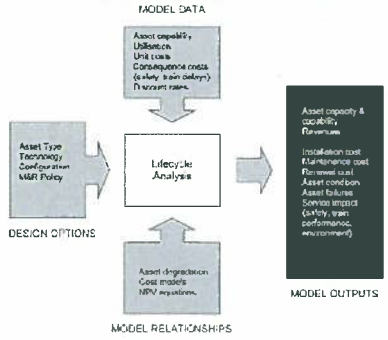
- Challenging programme
- Finite resources with the necessary expertise
- Significant number of programmes under way in UK and Europe
- Collaboration vital for the Project to succeed solution

Whole Life Costs

"In the context of the delivery of projects by Network Rail, Whole Life Cost ("WLC") is an economic and financial assessment considering all agreed projected significant and relevant cost flows over a defined period of analysis expressed in monetary value adjusting for the time value of money."

"The projected costs are those needed to achieve defined levels of performance, including reliability, risk, safety and availability."

Whole Life Costs



Whole Life Costs

- The model will be developed and its specific evaluation criteria shared with the Suppliers
- The model will evaluate Capex and Opex costs assessing areas such as; first in class design, first in class and fleet fitment, maintenance, ongoing product support, spares holding and training
- The level of performance required by the project is a minimum of 50,000 hours Mean Time between Service Affecting Failures (MTBSAF)

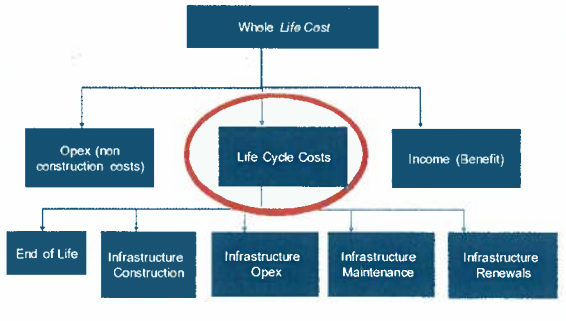
Whole Life Costs

- In addition to implementation works, Suppliers bidding for the ETCS Onboard Freight contract will offer prices for providing ongoing maintenance, support and training, for a potential duration of up to 25 years
- Bids for the ETCS Onboard Freight will be evaluated using a Life Cycle Cost model

Whole Life Costs

- Reliability is a key part of the commercial principles agreed between Network Rail and the FOC
- It is accepted that new system will initially introduce reliability issues and that there will be a growth period until a steady state of reliability is achieved
- Reliability impacts FOC through the availability of their locomotives to carry out services for their customers

Whole Life Costs



Whole Life Costs

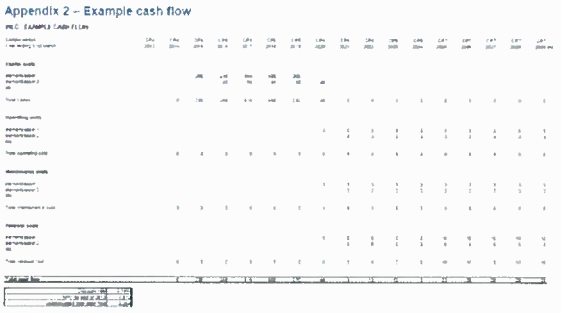
The FiC phase shows a time curve based on the following stage timings:
Infancy – 6 months
Growth – 12 months
Steady State (milestone) – 18 months

Whole Life Costs

- Suppliers will be incentivised to design the necessary redundancy and support levels into their onboard solution to achieve the reliability target
- It is important a fault reporting system is in place which can differentiate between Onboard System and other system failures (e.g. trackside)

Whole Life Costs

Appendix 2 – Example cash flow



Whole Life Costs

- The lifecycle cost model will be populated with cost details of the suppliers proposals to achieve this target over a 25 year period
- This will include planned maintenance and renewal cycles and costs for all onboard equipment and systems, necessary spares holdings, training requirements etc.

Whole Life Costs

- The populated model will generate a cash flow which will be expressed in real terms excluding inflation and discounted in line with Network Rail's corporate guidance
- Sensitivity analysis will be applied to the model to look at areas such as asset life and programme variations.

附件2.5-04： National Level Crossings Risk Reduction – Footbridge Programme by Rob Offord

NetworkRail

Infrastructure Projects

National Level Crossings Risk Reduction – Footbridge Programme

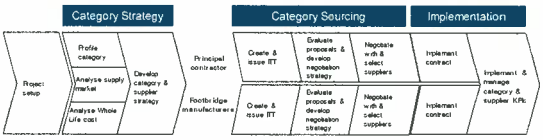
Rob Offord
24 February 2014

- Context
- **Sourcing Process**
- Material Choice
- WLC Model
- Conclusion and Recommendations

- **Context**
- Sourcing Process
- Material Choice
- WLC Model
- Conclusion and Recommendations

We ran a tender process with both Design & Build contractors and Footbridge manufacturers in 3 material lots

Sourcing approach



Activities

- Spend data analysis
- Understanding business needs
- Supplier and market profiling
- Identification of total cost and drivers
- *Develop a whole life cost model*
- Development of strategic options
- Selection and approval of sourcing strategy
- ITT planning and creation
- ITT launch event and issue
- Management of supplier questions
- Development of consolidation and evaluation tools
- ***Model Whole Life cost***
- ITT response and evaluation analysis
- Development of clarification meetings documents
- Clarification meetings
- Supplier selection
- Communication of results
- Internal governance and approval
- Alcatel letter issue
- Contract sign
- Transition plan and full mobilisation

Context

- The National Level crossing Risk (NLX) reduction programme is high profile and has a budget of £42m assigned for the replacement of pedestrian crossings with footbridges. The drive is to erect the **maximum number of footbridges** over a 4 year period to maximise **the reduction of public harm risk**
- Historically Concrete bridges have been prohibitively expensive to install (Capex) and as such few such bridges exist on network, with no standard NR design.
- Steel has been the preferred material as it is cheaper to produce & install. Maintenance costs and intervals have not historically been assessed in a consistent manner.
- A comprehensive WLC modelling exercise was conducted to inform the choice of material type with wide involvement of NR technical, Route Asset Managers, bridge manufacturers and paint systems suppliers & maintainers

---

WLC was not a specified evaluation criteria, but was fully taken into account in the analysis to define the best material choice.

Evaluation criteria for Principal Contractors

Principal Contractor Tender Evaluation Criteria	
Criteria	Sub Category
Health, Safety & Environment	Health & Safety Environment & Sustainability
Delivery	Approach to Delivery Working with Network Rail Planning and Programming Management, Control & Governance
Technical & Methodology	Technical Compliance Methodology
Service	Standards of Service Customer & Stakeholder Engagement Communication & Reporting
Value/ Commercial	Commercial Proposal Risk Management Contractual Compliance

Overall scoring			
Technical	40%	Commercial	60%

Comments

- WLC cost was not a specified separate evaluation criteria as at the time of tender, the basis for a solid WLC evaluation was judged to not be sufficiently clear or developed to make it a separate criteria (subject to OJEU rigour) - i.e.:
  - no model existed
  - insufficient and inconsistent data existed
  - critical parameters were not defined
- However, WLC was mentioned in both the T1 and T2 bidder presentations as being "taken into account" in making the final material choice

Context

Sourcing Process

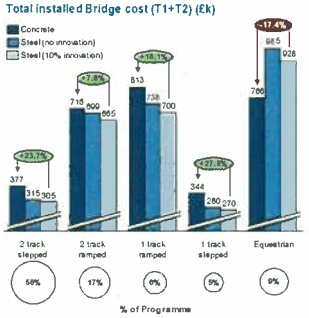
Material Choice

WLC Model

Conclusion and Recommendations

Capex: Concrete was more expensive than steel (range of 8% - 28%) in all bridge types except equestrian bridleways

Total installed Bridge cost (T1+T2) (£k)



Commentary

- On a pure installed capex basis Steel bridges were significantly cheaper than concrete with the sole exception of Equestrian Bridleways
- This analysis assumed 2 scenarios
  1. No innovation (highly improbable)
  2. Innovations result in a 10% price reduction on the price of the bridge structure after year 1

Source: Final Tender responses

There were 4 major variables that shaped the WLC and material choice

1. **Innovation opportunities** – i.e. the scope for value engineering the bridge structure to reduce capex cost (both manufacturing cost and installation cost)
2. **The installed Capex cost** (i.e. manufacture and installation) – which determines the number of bridges that can be procured for the £42M budget – this drives reduction of FWI
3. **The WLC assessment point** – 30 or 60 years
4. **Maintenance interventions** – their cost, timing (i.e. when in the 30 or 60 year view) and their frequency

Context

Sourcing Process

Material Choice

WLC Model

Conclusion and Recommendations

Fostering Innovation was a main objective for the project. Innovation has a significant impact on determining the material choice and WLC

- Innovation workshops were held with the main incumbent steel and concrete bridge suppliers
- The innovations submitted had the potential to significantly reduce the Capex cost of the bridge and therefore significantly alter the WLC picture
- The tender required the market to submit fully costed innovation ideas

Concrete

- The concrete suppliers "forward sold" all their innovation pipeline and took this risk in their price. This had a value of £3M in the final negotiation round but was largely based on conceptual benefits

Steel

- Over 90 value engineering ideas were submitted with the tenders
- The steel suppliers consistently estimated that 10-15% could be taken out of the bridge structure price, with the engineering acceptance of just detailed 5-6 innovations.
- We therefore modelled 3 scenarios, to enable a true comparison of material including innovation:
  1. 5% reduction on the steel bridge
  2. 10% reduction on the steel bridge
  3. 15% reduction on the steel bridge

A WLC model was developed with the key stakeholders, which used four data points that were gathered and validated from multiple sources

Key elements of the model and data source

1 List of key interventions	2 Cost of each intervention	3 Intervention cycles	4 Discount rate
• Asset Management Plans • Policy on a Page • CAF Data	• Input from Civils maintenance suppliers • Input from LOR – all costs validated • CAF 7 report • Civils Budget Calculator • Inspection reports • Painting contract	• Input from Civils maintenance suppliers • Bridge suppliers • Paint system suppliers • Survey sent to all Route Asset Managers asking them to specify intervention cycles against each key intervention	• A discount rate of 4.75% was used

An Excel tool was built that allowed dynamic modelling of the various scenarios based on the main input variables

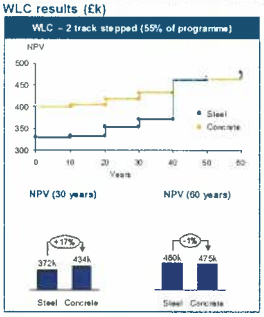
Dashboard screenshot

Comments

- The model includes four major variables which can be manually selected
  1. Asset subclass (e.g. stepped or ramped bridge)
  2. Location
  3. Asset life (up to 150 years)
  4. Discount factor (%)
- The user can modify Capital costs for both T1 and T2 as well as the intervention cycles
- The Whole Life Cost includes the following cost components:
  - Capital cost
  - Maintenance cost (planned and reactive)
  - Costs of decommissioning
- The maintenance regime varies by material type and by bridge location

Steel has a much better WLC until the 1st major refurbishment at 40 years, driven by significantly cheaper capex

WLC results (£k)



Commentary

- 2-track stepped bridges comprise 55% of the total programme
- Capital costs drive the gap - Steel 2-track bridges are currently 17% cheaper than the concrete version. When innovations are approved and implemented they will be 21% cheaper
- This lower capex costs means steel has a much better WLC for the first 40 years
- The WLC gap is closed at 40 years due to the large refurbishment at this point
- For the remaining asset life, the WLC remains close, until the next major refurbishment at 80 years
- The NPV 'parity point' is reached at 60 years

Notes: 1. Capex costs based on Final submissions
Source: WLC model developed by Ertop input from RAM's/ AM, Engineering, IP and Contractors

A full list of key interventions for a standard 2 track stepped bridge was created for each material type, with the intervention cycles and costs

Key interventions (Stairs only – c. 60% of programme volume)

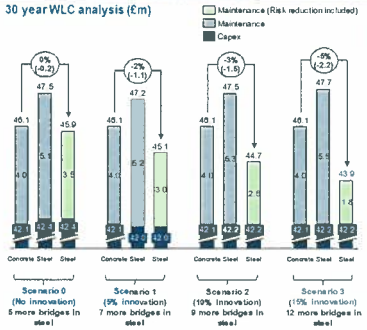
Steel – 2 track ramped					
Type of maintenance	Key intervention Type	Intervention cycle		Coastal affected (Y/N)	Cost of intervention
		Coastal / Lower	In-land / Upper		
Planned	Spot touch up and remedial	10	15	Y	14.1k
Planned	Full Painting	25	40	Y	185k
Planned	Repair to anti-slip surfacing	12.5	12.5	N	10k
Planned	Repairs to steel plates & connections	20	30	Y	10k
Planned	Repair/replace drainage	25	25	N	5k
Inspection	Visual	1	1	N	0.25k
Inspection	Detailed Examination	6	6	N	1k
Decommissioning	Removal at end of life	120	120	N	80k

Concrete – 2 track ramped					
Type of maintenance	Key intervention Type	Intervention cycle		Coastal affected (Y/N)	Cost of intervention
		Coastal / Lower	In-land / Upper		
Planned	Spot touch up and remedial	10	15	Y	4.4k
Planned	Full Painting	25	40	Y	19.6k
Planned	Concrete repairs	25	35	Y	25k
Planned	Repair to anti-slip surfacing	12.5	12.5	N	10k
Planned	Repair/replace drainage	25	25	N	5k
Inspection	Visual	1	1	N	0.25k
Inspection	Detailed Examination	6	6	N	1k
Decommissioning	Removal at end of life	120	120	N	130k

Source: RAM Surveys, Asset Management Contractors, Engineering, AMPs, CAF Data, Painting Contractors

Further WLC benefit is achieved with steel as the lower steel costs enables more bridges to be delivered for the £42M budget offsetting the higher maintenance cost through FWI reduction

30 year WLC analysis (£m)



Commentary

- Steel has a better WLC
- There were over 50 innovations submitted many of which had high probability – the range of 5-15% innovations is very achievable
- As the innovations are implemented you can see the benefit this reduced capex has on the FWI impact (i.e more bridges for your money = reduced risk)
- We recommend that the 8 CP5 Equestrian bridges are built of concrete and delivered by May Gurney in Years 2 or 3 of the programme this would save a further £1.2 M, enabling the installation of 4 additional steel bridges (with a further £1.3M FWI / risk reduction benefit)

Source: T1 programme proposed programme delivery schedules, Final tender responses

A full list of key interventions for a standard 2 track ramped bridge was created for each material type, with the intervention cycles and costs

Key interventions (Stairs and ramps – c. 20% of programme volume)

Steel – 2 track ramped					
Type of maintenance	Key intervention Type	Intervention cycle		Coastal affected (Y/N)	Cost of intervention
		Coastal / Lower	In-land / Upper		
Planned	Spot touch up and remedial	10	15	Y	29.3k
Planned	Full Painting	25	40	Y	250k
Planned	Repair to anti-slip surfacing	12.5	12.5	N	30k
Planned	Repairs to steel plates & connections	20	30	Y	20k
Planned	Repair/replace drainage	25	25	N	10k
Inspection	Visual	1	1	N	0.25k
Inspection	Detailed Examination	6	6	N	1k
Decommissioning	Removal at end of life	120	120	N	110k

Concrete – 2 track ramped					
Type of maintenance	Key intervention Type	Intervention cycle		Coastal affected (Y/N)	Cost of intervention
		Coastal / Lower	In-land / Upper		
Planned	Spot touch up and remedial	10	15	Y	19.6k
Planned	Full Painting	25	40	Y	79.7k
Planned	Concrete repairs	25	35	Y	50k
Planned	Repair to anti-slip surfacing	12.5	12.5	N	30k
Planned	Repair/replace drainage	25	25	N	10k
Inspection	Visual	1	1	N	0.25k
Inspection	Detailed Examination	6	6	N	1k
Decommissioning	Removal at end of life	120	120	N	160k

Source: RAM Surveys, Asset Management Contractors, Engineering, AMPs, CAF Data, Painting Contractors

Conclusions

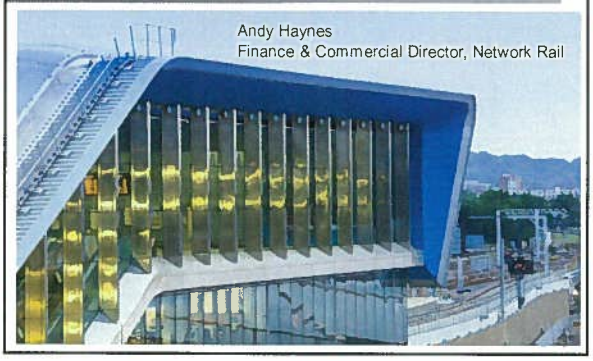
- Steel was the recommended material based on 30 year WLC cost, with a widening advantage over concrete once scheduled innovations approved.
- Invest in external support to accelerate the steel innovation assessment process, with the aim of assessing all the "high-potential" steel innovations so they can be approved and implemented for April 2014 (the start of Year 2 of the programme)
- Continue to investigate concrete equestrian bridges, and variant hybrid "concrete/steel" bridges as an innovation development activity.
- Consider the use of concrete bridges in coastal applications where the environment is more hostile to steel and where higher frequency of maintenance interventions is required.
- Take the 9 Equestrian bridges out of the steel programme, and develop a concrete solution for implementation in Year 2 or 3 of the programme – this is the only bridge type where a concrete solution will be more cost effective.

The following parameters were considered but not included in the WLC model. These areas offer further opportunity for development in future comparisons.

Criteria	Why not included
Embedded carbon	No clear methodology for calculation, marginal impact without a policy of applying significant financial benefit to cost of CO2
Differential between steel and concrete inflation rates	Insignificant when modelled over a 2.5 year build programme
Schedule 4 costs associated with maintenance regime	All maintenance works can be undertaken within an undisruptive possession strategy
Potential safety risk of undertaking various maintenance interventions	Highly complex to quantify reliably and not significantly different between material types within the 30 year WLC analysis.
Potential risk of operational disruption in undertaking various maintenance interventions	Highly complex to quantify reliably and not significantly different between material types within the 30 year WLC analysis.

附件2.5-05： Contracting GW electrification by Andy Haynes Finance & Commercial Director, Network Rail

Contracting GW electrification



Andy Haynes
Finance & Commercial Director, Network Rail

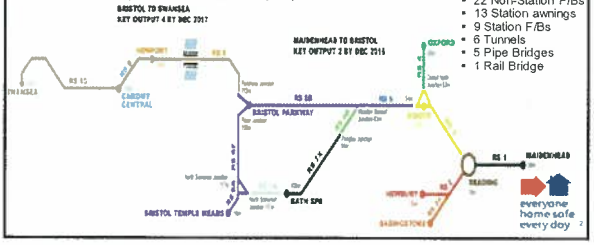
Transforming the Reading Area

Great Western Electrification overview

- Aim of the programme is to enable electric trains to operate between Paddington and:
  - Newbury, Oxford (EMU) & Bristol (IEP) by Dec 2016
  - Cardiff by Dec 2017 & Swansea by May 2018

Key Quantities

- 14,493 OLE Foundations
- 13,494 OLE Masts/Legs
- 1,655 OLE Portal/Booms
- 164 Structure modifications:
  - 108 Road Bridges
  - 22 Non-Station F/Bs
  - 13 Station awnings
  - 9 Station F/Bs
  - 6 Tunnels
  - 5 Pipe Bridges
  - 1 Rail Bridge



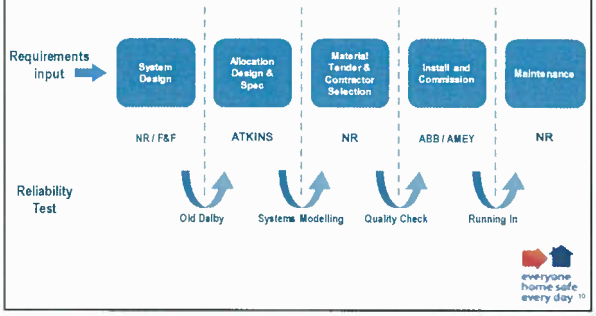
Transforming the Reading Area

World Heritage Site

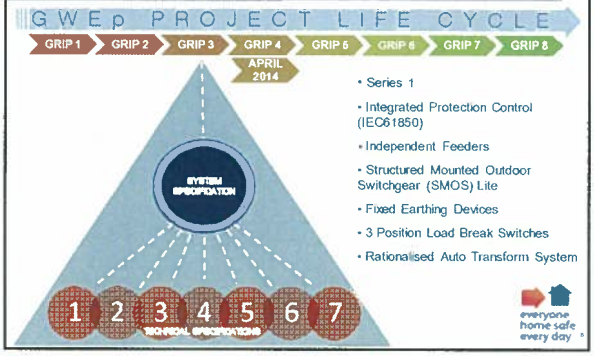
Series One electrification system

High Output Plant System (HOPS)

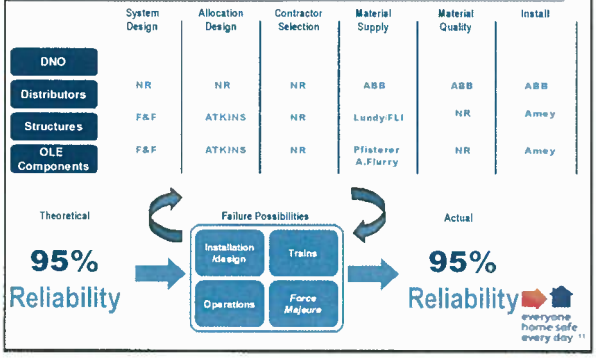
Managing liabilities



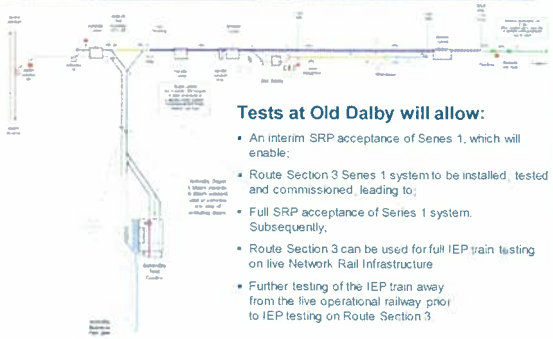
System approval in principle



Managing liabilities



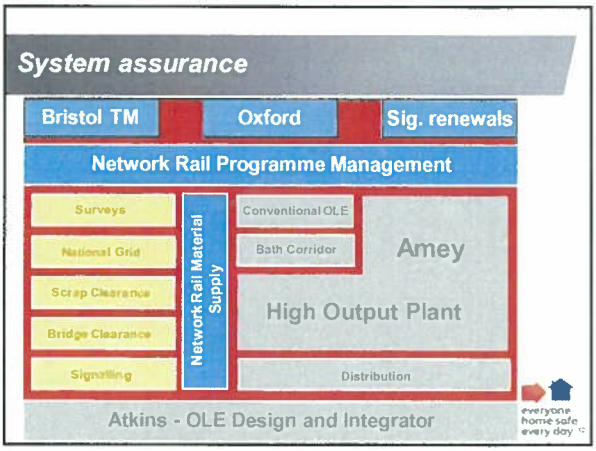
Validation at Old Dalby Site

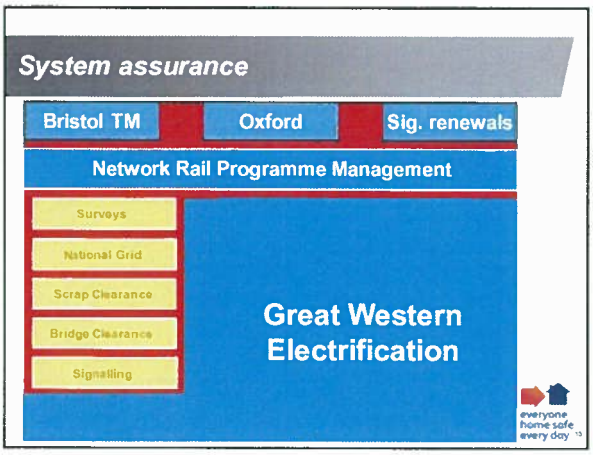


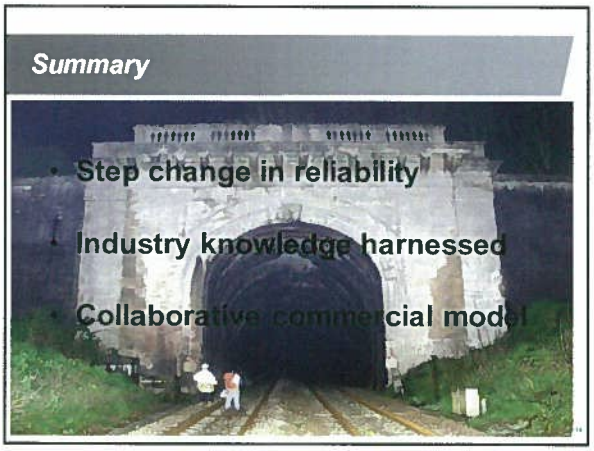
Tests at Old Dalby will allow:

- An interim SRP acceptance of Series 1, which will enable;
- Route Section 3 Series 1 system to be installed, tested and commissioned, leading to;
- Full SRP acceptance of Series 1 system. Subsequently;
- Route Section 3 can be used for full IEP train testing on live Network Rail Infrastructure
- Further testing of the IEP train away from the live operational railway prior to IEP testing on Route Section 3

System assurance




System assurance
Bristol TM
Oxford
Sig. renewals
Network Rail Programme Management
Surveys
National Grid
Scrap Clearance
Bridge Clearance
Signalling
Great Western Electrification
everyone home safe every day


Summary
Step change in reliability
Industry knowledge harnessed
Collaborative commercial model

附件2.5-06： Whole Life Costing by Rail & Underground Geoff Gilbert & Collan Murray

Transport for London

Rail & Underground
Geoff Gilbert & Collan Murray

24th February 2013

Whole Life Costing

1

Our priorities to transform London's Tube & Rail Network

1 **Reliability** *to stabilise performance*

2 **Capacity from the** ***current*** **network** *to cater for existing demand*

3 **Capacity** ***from growing the network*** *to meet future demand*

4 **Customer Service** *to meet changing customer expectations*

Underpinned by:

Efficiency | People | Technology

We need your help & support to deliver this plan for the future

4

Introduction

1 **LU Background**
Priorities

2 **Whole Life Costing**
LU Approach

3 **Case Study**
Pan-TfL Lifts and Escalators Framework

2

Core asset investment is critical

Target: 30% More reliable by 2015

Over the next 10 years:

c.200+ new trains
c. 80 trains refurbished

c.50% of network re-signalling

c.160 km of track replaced

38 lift refurbishments
107 escalator refurbishments

74 stations - asset stabilisation works

c.490 civils assets renewed

5

1

LU Background
Priorities

2

Whole Life Costing
LU Approach

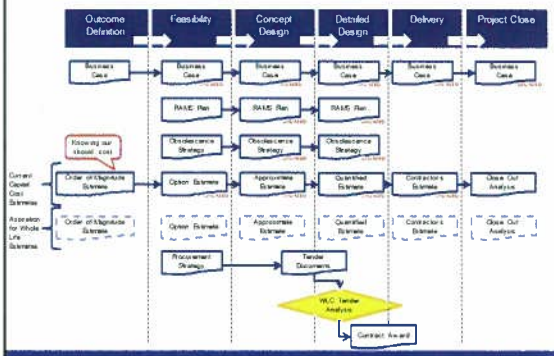
LU Asset Management Policy

*London Underground shall make decisions based on an affordable **whole life cost asset** management approach to optimise the performance, cost (capital and operating) and risk of the assets throughout their lifecycle whilst ensuring safety, environmental, and legal statutory compliance*

LU is PAS55 certified
WLC is a core part of Whole Life Asset Management identified within the specification.

7

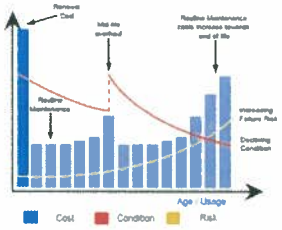
Whole Life Costing Within Project Lifecycle



10

Whole Life Asset Management

TfL seeks to make its investment decisions on a 'Whole Life Asset Management' (WLAM) basis, optimising decisions based on, risk, cost and performance.



There is a need to understand the life of the system not just the life the asset.

8

Procurement Strategy – WLC Implications

Choices informed by engagement with the market and consideration of;

- In-house & market capability and capacity
- Nature of supply market
- Reliability, Availability, Maintainability Safety (RAMS)
- Sensitivity of operational railway to asset reliability
- Maturity of technology being deployed

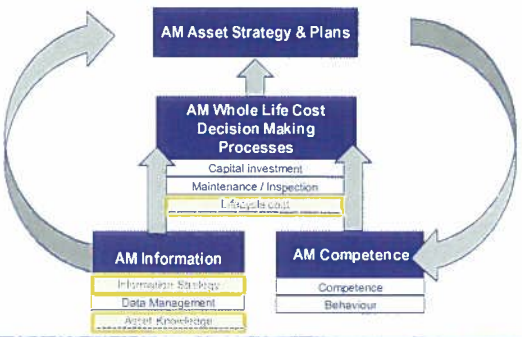
Informs level of risk and procurement model

Decision at this point drives:

- Who is responsible for costs and performance across life of asset
- Scope for supplier innovation

11

Asset Management Capability



9

Commercial Considerations

- Supplier Assurance (Pre-Tender)
  - Demonstrating prospective suppliers have capability in RAM engineering and quality management
- Aligned Commercial Models
  - Incentivisation – design/build/maintain
  - Ensuring whole life in design, manufacture and commissioning
  - Proving asset and system reliability in completion
  - 'Soft Landings' Contractor is not responsible for maintenance
- Intellectual Property
  - Ownership and exploitation
- Asset Information
  - Closed loop to ensure we improve asset information to inform future WLC decisions

12

WLC Tender Evaluation

Where we set outcome requirement (specification) how to test level of confidence in the delivery of the outcome?

Whole Life Cost Model	Level of Confidence in WLC Model	Confidence in Capability to Deliver Whole Life Performance
• Capital Cost • Maintenance Cost • Operational Cost	• Whole Life Plan • Availability of data to support RAM proposals • Theoretical vs Performance based data	• Team capability • Ways of Working • Approach to managing asset performance – ability to predict • Understanding why things fail

Performance Specification

- Package of 108 escalators
- HD-M escalator (industry standard for Metros)
- Availability – at least 99.4%
- Mean Time Between Failures

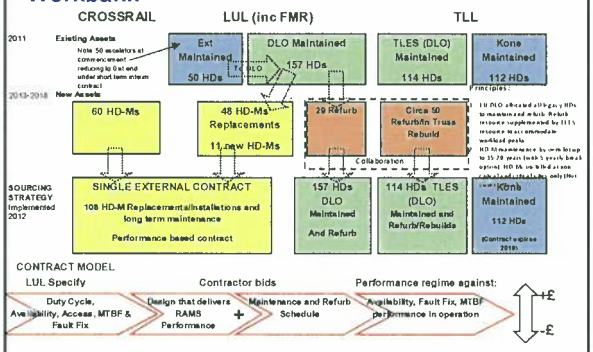
Whole Life Cost vs. Quality

•Cost and quality can not be considered in isolation

•WLC proposals need to be backed up by commensurate capability

•RAMS performance core to WLC

Workbank

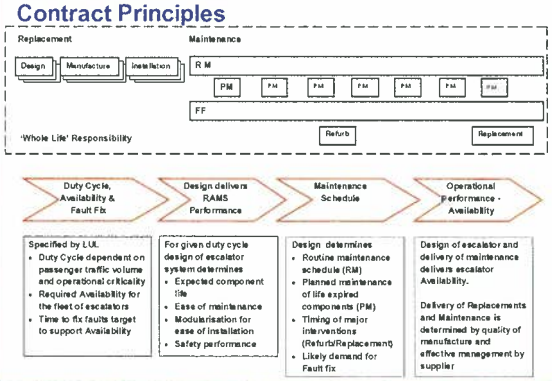


3

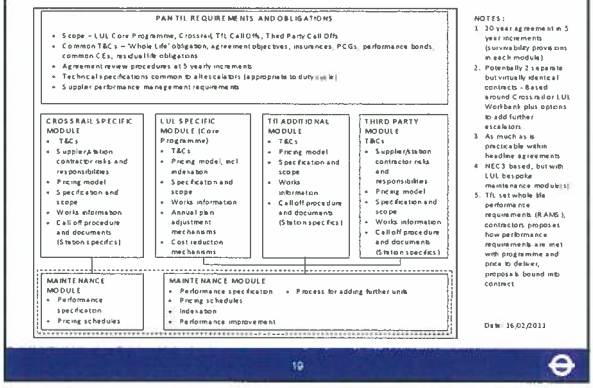
Case Study

Lifts and Escalators

Contract Principles



Contract Structure



What Has Been Achieved

- Reduced capital costs – 60%
- Reduced WLC – 30%
- Reliability growth to – 99.6% (98.8%)
- MTBF 2,200hr (1,300hrs)

(Note: - Reliability and MTBF to be demonstrated in delivery)

20

附件2.5-07： Full Service Procurement Incentivising for the Life Cycle by Alston Piers Wood

Full Service Procurement
Incentivising for the Life Cycle

Piers Wood

24/2/2014

ALSTOM
Shaping the future

What is Full Service Procurement?

Risk transfer through a Whole Life Cost approach

- Hand over of complete maintenance control to the supplier
  - All maintenance and overhaul activities
  - Full responsibility at depot level
  - Full risk transfer, including obsolescence
  - Performance commitments
  - Delivery of a timetable
- Normally associated with "bundled" package of rolling stock and maintenance
- Longer term view required by Operator
- Our experience has shown that in the long term, benefits are not achieved through a lower capital cost

ALSTOM

Agenda

- What is Full Service Procurement?
- Overview of Alstom's Service Provision Contracts
- Examples of Whole Life Cost Improvements
- The Importance of Process, Depot Layout and Innovation
- Risk vs Reward

ALSTOM

Agenda

- What is Full Service Procurement?
- Overview of Alstom's Service Provision Contracts
- Examples of Whole Life Cost Improvements
- The Importance of Process, Depot Layout and Innovation
- Risk vs Reward

ALSTOM

Agenda

- What is Full Service Procurement?
- Overview of Alstom's Service Provision Contracts
- Examples of Whole Life Cost Improvements
- The Importance of Process, Depot Layout and Innovation
- Risk vs Reward

ALSTOM

Project: West Coast Main Line

Pendolino

Virgin trains

- 53 nine-car tilting Pendolinos for Virgin Trains entered service in 2003
- Four new 11-car Pendolinos entered service in 2012
- 31 nine-car Pendolinos converted to 11-car sets, with work completed in 2013
- Complete service provision until 2022
- Timetable requirement met by providing 47 trains every day from five Traincare Centres

ALSTOM

Project: London Underground

Northern Line

Tube Lines

- Design, supply, modification and maintenance of 106 x 6-car trains plus associated Depot and Equipment maintenance
- Contract signed April 1995 with a maximum 33 year duration, with break points
- Guaranteed availability and reliability commitments
- Timetable met by providing a minimum of 91 trains every day
- Pan / pantomechanism
- Northern Line trains travel 11 million km a year and doors open (and close) over four million times a week

ALSTOM

Examples : London Underground : Northern Line
Seat change

BEFORE	AFTER
• Seats with springs • Frequently replaced due to damage caused by springs	• Spring less seats • Labour and material costs reduced
	

ALSTOM

Agenda

- What is Full Service Procurement?
- Overview of Alstom's Service Provision Contracts
- Examples of Whole Life Cost Improvements
- The Importance of Process, Depot Layout and Innovation
- Risk vs Reward

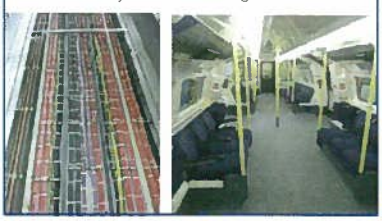
ALSTOM

Examples : London Underground Northern Line
Axlebox & Bearing Modifications

BEFORE	AFTER
• Original bearings failing after 4 years • Grease and vibration monitoring cost 4,000 hours pa	• New bearing developed • Fleet refit in 2007 • No failures since
	

ALSTOM

Examples : London Underground : Northern Line
Flooring

BEFORE	AFTER
• Cabling damaged by water ingress • Floor lift very time consuming	• Modular flooring • 20% labour saving
	

ALSTOM

Examples : London Underground : Northern Line
Train Diagnostics

BEFORE	AFTER
• Each train visited by laptop	• Improved TMS software allows remote uploads, saving 200 hours • New Incident Recorder, allows design downloads to be taken in under a minute using a USB connection • Around 1500 downloads are taken each year saving close to 750 man hours.
	

ALSTOM

Examples : London Underground Northern Line Shoegear Improvements (1)

BEFORE	AFTER
• Collector equipment was fracturing 	• Design and material changed • Both material and maintenance savings over 10 year period 

ALSTOM

Examples : West Coast Mainline Pendolino Surge Pipe Repair Kit

BEFORE	AFTER
• The class 390 air suspension surge pipe assembly has been suffering with fatigue failure of the internal flexible bellows assembly and consequent air leaks. • In extreme cases this causes an in **service failure.** • The rectification requires the train to be stopped, the bogie removed, major under-frame disassembly and renewal of the complete pipe assembly.	• The new design repair kit, although still requiring bogie removal, can be installed without any under-frame disassembly and in the event of future failure/leaking can be replaced without removing the bogie 

ALSTOM

Examples : London Underground Northern Line Shoegear Improvements (2)

BEFORE	AFTER
• Collector shoes are the highest wearing part of the train • Shoe hardness differed from same supplier 	• Harder material = longer life • Reduced weight = longer life (upto 50%) • Cost savings over life 

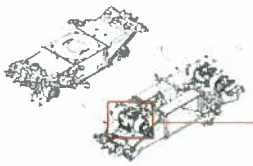
ALSTOM

Examples : West Coast Mainline Pendolino Wheelsys

BEFORE	AFTER
• We don't change car tyres at the same time, so why do we maintain wheelsets all at the same time? • There are over 2,500 wheelsets on the UK Pendolino • A key element of wheel maintenance is wheelset re-profiling. • Wheels deteriorate over time, re-profiling restores its condition. • But each wheel is different	• A custom designed SAP interface which store the re-profiling data, with Business Objects and Microsoft Excel as reporting tools • Engineering cut from 2 days a week to 4 hrs! • Potential saving of 50% per wheelset to support wheelset re-use. • Big reduction in process flow and time to plan. • Valuable wheel size data is available to all maintenance personnel. • Reduction in human error and risk of accidental wheel change. • System design now being used to manage gearbox leaks, pan carbon thickness and compressor hours.

ALSTOM

Examples : West Coast Mainline Pendolino Tilt Roller Pad

BEFORE	AFTER
• Original design of tilt roller glide required bogie removal and strip down 	• New design of glide negates need for bogie removal and strip down • This saves taking a train out of service and 1 man can fit the new design in 0.5 man hours. 

ALSTOM

Examples : West Coast Mainline : Pendolino Wheeltag

BEFORE	AFTER
• There are over 2,500 wheelsets on the UK Pendolino • A key difficulty with this quantity is accurate configuration management. • Labour intensive process to recheck serial numbers.	• Wheel-Tag is a radio tag installed onto the rotating axle • The tag stays for the life of the axle. The tag is read at each depot • Cost savings from labour and data improvement • Savings on man hours by changing a manual process to a non invasive automated identification process • No train exam required • Improved configuration control accuracy within Alstom internal systems and external Network Rail systems.

ALSTOM

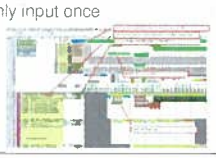
Own goals!
Cheap build leads to expensive problems

BEFORE	AFTER
• Cheap selection of cable type used for application • Poor design in relation to under-frame cable installation methodology • Poor initial build quality • Wiring problems (chafing / thermal) during service • After 2 years major mod programme needed	• Estimated cost of doing nothing over 9 year maintenance contract : £1.5m • New wiring system cost £0.35m • Wiring problems resolved

ALSTOM

The Importance of Process, Depot Layout and Innovation

Integration of Roster, PM log file and night board	SQDC Boards
• To rationalize data input for activities on trains during nights in depots. • Time is wasted to re-type the same info in different places for different instances. Now data only input once	• The data is on display and it can be seen by all parts of the business and by our customer. • Drives the changes and modifications required to improve reliability and availability – speak with data!



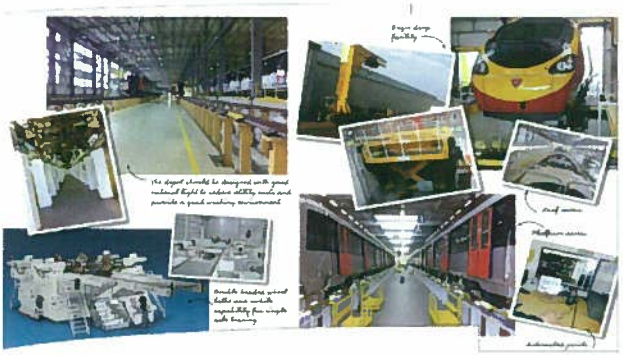
ALSTOM

Agenda

- What is Full Service Procurement?
- Overview of Alstom's Service Provision Contracts
- Examples of Whole Life Cost Improvements
- The Importance of Process, Depot Layout and Innovation
- Risk vs Reward

ALSTOM

The Importance of Process, Depot Layout and Innovation

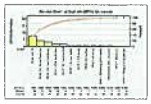


Industrial Layout

ALSTOM

The Importance of Process, Depot Layout and Innovation

Six Sigma	SAF Predictor
• Allows us to use historical performance data to drive reliability growth. • Through Deviation Metrics, the train systems that are hurting the business the most can be ranked and prioritised accordingly.	• The SAF predictor allows us to focus on the most frequent SAF issues • Predictor allows us to accurately measure reliability performance, and by categorising each failure mode we can target the least reliable systems.



ALSTOM

The Importance of Process, Depot Layout and Innovation

The Alstom "Health Hub"

- A "drive through" rolling stock health scanner
- Provides health reports for individual trains including:
  - Wheel measurements and wear
  - Brake pad integrity /thickness
  - Carbody integrity information
  - Pantograph carbon measurements
- Uses a robust statistical analysis of the measured data, that predicts the remaining useful life of components the implementation of a Condition Based Maintenance regime

ALSTOM

Agenda

- What is Full Service Provision?
- Overview of Alstom's Service Provision Contracts
- Examples of Whole Life Cost Improvements
- The Importance of Process, Depot Layout and Innovation
- Risk vs Reward

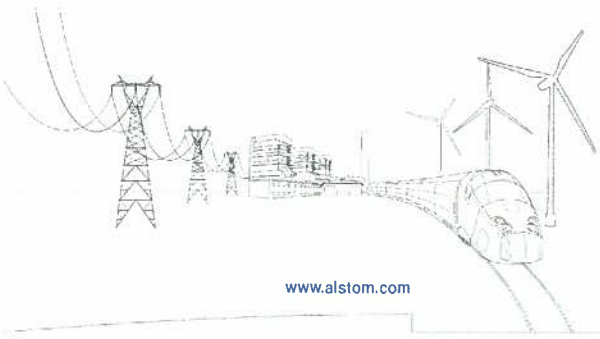
ALSTOM

Risk and Reward

Service Provision relies on risk and reward

The ethos of risk and reward must be respected

ALSTOM



www.alstom.com

ALSTOM
Shaping the future