Digital Railway Early Contractor Involvement Conference
One Birdcage Walk, London

Thursday, 12 January 2017

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Welcome

Stuart Calvert
Early Contractor Involvement Lead

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## Agenda

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<th>Session</th>
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<td>09:45 – 10:00</td>
<td>Opening address</td>
<td>Stuart Calvert, ECI Lead (Digital Railway Programme)</td>
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<td>10:00 – 10:30</td>
<td>Traffic Management</td>
<td>ECI Work Stream Lead – Rachel Coe (Thales)</td>
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<td>10:30 – 11:00</td>
<td>Programme Costs</td>
<td>ECI Work Stream Lead – David Palmer (Thales)</td>
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<td>11:00 – 11:20</td>
<td>Panel Q&amp;A</td>
<td>Facilitated by Stuart Calvert (Digital Railway Programme)</td>
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<td>11:20 – 11:40</td>
<td>Morning break &amp; Networking Opportunities</td>
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<td>11:40 – 12:10</td>
<td>ETCS Specification</td>
<td>ECI Work Stream Lead – Ewan Spencer (Siemens)</td>
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<td>12:40 – 13:00</td>
<td>Panel Q&amp;A</td>
<td>Facilitated by Stuart Calvert (Digital Railway Programme)</td>
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<td>13:00 – 13:45</td>
<td>Lunch &amp; Networking Opportunities</td>
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<td>14:00 – 14:15</td>
<td>Digital Railway Ready Specification – Infrastructure</td>
<td>ECI Work Stream Lead – Ewan Spencer (Siemens)</td>
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<td>14:15 – 14:45</td>
<td>Working Together</td>
<td>ECI Work Stream Lead – Rebecca Shepherd (Thales)</td>
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<td>14:45 – 15:05</td>
<td>Panel Q&amp;A</td>
<td>Facilitated by Stuart Calvert (Digital Railway Programme)</td>
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<td>15:05 – 15:25</td>
<td>Afternoon break &amp; Networking Opportunities</td>
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<td>15:25 – 15:55</td>
<td>TransPennine Upgrade &amp; Q&amp;A</td>
<td>ECI Work Stream Lead – Rachel Coe (Thales) and Ewan Spencer (Siemens)</td>
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<td>15:55 – 16:10</td>
<td>Developing the Business Cases</td>
<td>James Drury (Digital Railway Programme)</td>
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<td>16:10 – 16:30</td>
<td>Keynote speech to close the conference</td>
<td>David Tonkin, Interim CEO RIA</td>
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<td>16:30 – 16:45</td>
<td>Closing comments</td>
<td>Michael Flynn, Programme Director (Digital Railway Programme)</td>
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Opening Address

Stuart Calvert
Early Contractor Involvement Lead
Digital Railway is an industry programme

Working together for a better railway:

There is an essential need for a strong cross-industry PMO and change control
Delivering Digital Train Control Technology Efficiently
- to drive capacity and performance on the railway

Improving the world through engineering
Team members were selected based on knowledge and experience and cross industry teams formed to support seven work streams:

1. Traffic Management
2. Cost Reduction
3. ERTMS Specification Review
4. ERTMS Capacity Proof
5. ERTMS Ready Spec
6. Working together
7. Trans Pennine Upgrade
Traffic Management

Rachel Coe
ECI Work Stream Lead
# Work Stream 1 Team

<table>
<thead>
<tr>
<th>Team Member</th>
<th>Company</th>
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<tbody>
<tr>
<td>Rachel Coe</td>
<td>Thales</td>
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<tr>
<td>Dave Fidal</td>
<td>Thales</td>
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<tr>
<td>John Hughes</td>
<td>Alstom</td>
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<tr>
<td>Yogesh Chauhan</td>
<td>Alstom</td>
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<tr>
<td>Matthew Diggle</td>
<td>Hitachi</td>
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<tr>
<td>Andy Powell</td>
<td>Siemens</td>
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<tr>
<td>Andy Woods</td>
<td>Siemens</td>
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<tr>
<td>Keith Thomas</td>
<td>Resonate</td>
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<tr>
<td>Javier Pozo</td>
<td>Indra</td>
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<tr>
<td>Matthew Evans</td>
<td>Digital Railway</td>
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What is the full true business case for Traffic Management for UK Plc?
Work Stream 1 Process

- Collaborative process

  - Define Supplier Independent Scope
  - Examine Work Previously Undertaken
    - Business Case
    - Review Reports
  - Performance Analysis
  - Stakeholder Definition
  - Additional Benefits
    - Capacity improvements
  - Complexity of Infrastructure
  - Improved BIT modelling
**M3 TM Isolated (Operational Support) provides the following key aspects**

- Fully linked to information systems
- Informs signallers of routeing requirement
- TOC/FOC integration
- Timetable and contingency plan management
- Conflict identification and decision support
- Improves passenger information
- Can be implemented as first step to Fully Integrated TM
- Simplifies wide-area implementation of Fully Integrated TM
- Signallers display not connected to existing control displays
- Non-disruptive implementation
- Quick to implement compared to Interfaced and Integrated
- An IT as opposed to signalling deployment
**Types of Traffic Management – TM Interfaced**

<table>
<thead>
<tr>
<th>External Business Systems Layer</th>
<th>C-DAS</th>
<th>National Timetabling</th>
<th>TOC Resource Mngt</th>
<th>Customer Information</th>
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</thead>
<tbody>
<tr>
<td>Planning and Operations Layer</td>
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<tr>
<td>Signalling Control Layer</td>
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<tr>
<td>Field Equipment Layer</td>
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- **M4 Interfaced** provides the following key aspects
  - Fully linked to information systems
  - Automatically drives automatic route setting systems
  - TOC/FOC integration
  - Timetable and contingency plan management
  - Conflict identification and decision support
  - Improves passenger information
  - Can be implemented as a geographic pocket within TM Isolated (Operational Support)
  - Limited by lack of open interface to existing control systems
  - Desktop displays linked but not fully integrated
  - Disruptive implementation
  - Slower to implement than Isolated
Types of Traffic Management – TM Integrated

- M5 Integrated provides the following key aspects
  - Fully linked to information systems
  - Integral signalling control system
  - TOC/FOC integration
  - Timetable and contingency plan management
  - Conflict identification and decision support
  - Improves passenger information
  - Can be implemented as a geographic pocket within TM Isolated (Operational Support)
  - Piece-meal implementation can limit wide-area control benefits
  - Desktop displays fully integrated
  - Disruptive implementation
  - Much slower to implement

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<th>TOC Resource Mngt</th>
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</thead>
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<tr>
<td>Planning and Operations Layer</td>
<td>Traffic Management Planning and Operations Management</td>
<td>Operations &amp; Planning</td>
<td></td>
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<tr>
<td>Signalling Control Layer</td>
<td>Integrated Signalling Control System</td>
<td>Integrated Workstation</td>
<td></td>
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<tr>
<td>Field Equipment Layer</td>
<td>ATO</td>
<td>Interlocking/RBC</td>
<td>CCTV</td>
<td>Voice</td>
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</table>
Graph of Annual delay minute reduction by Traffic Management, total delay minutes without Traffic Management is 34,285,201 minutes.
<table>
<thead>
<tr>
<th>Benefit Area</th>
<th>Summary</th>
</tr>
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<tbody>
<tr>
<td>Passenger</td>
<td>Includes improved passenger information, better connection management and improved passenger flow through stations.</td>
</tr>
<tr>
<td>Capacity Utilisation</td>
<td>Includes improved management of timetable allowances and optimising dispatching according to location and time of day.</td>
</tr>
<tr>
<td>Environmental</td>
<td>Includes increase in rail usage (and therefore reduced road usage) and improved train flighting leading to a reduction in pollution, noise and increased energy efficiency.</td>
</tr>
<tr>
<td>TOC/FOC</td>
<td>Includes reduction in staff and vehicle costs due to improved resource utilisation, minimisation of station dwell time and reduction in costs of alternative travel for passengers and staff.</td>
</tr>
<tr>
<td>Possessions</td>
<td>Includes reduction in time associated with granting and hand-back of possessions and predictive based possession planning.</td>
</tr>
<tr>
<td>Incident Management</td>
<td>Includes pro-active management of trains post incident.</td>
</tr>
<tr>
<td>Infrastructure Maintenance</td>
<td>Includes better planning of maintenance using white space in the plan and understanding impact of options. Additional usage information used for preventative actions reducing unavailability of infrastructure.</td>
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Reflections from Initial Deployments

- **Initial Deployments**
  - Package 1: Romford & Wales (Thales Led TM)
  - Package 2: Thameslink (Hitachi Led TM, Siemens Led Signalling)

- All have different challenges, scope and commercial constructs, however key themes have arisen in discussions between suppliers, these are
  - No TM standards
  - Duplication of Effort
  - Use of TM in the delay attribution process
  - LINX’s work will benefit future deployments
The Traffic Management business case is sound and highlights the cost of doing nothing.

Taking into account both business benefit and also technical practicalities, the recommended migration strategy is to deploy TM-Isolated by default to achieve the widest deployment in the earliest timeframe.

Where an ARS has already been deployed then modifying it to connect to the Traffic Management System to provide an Interfaced configuration should be considered. Replacing the ARS system and control system with an Integrated Traffic Management System should also be considered as this could address matters such as existing system obsolescence and realise additional benefits such as workstation integration.
Traffic Management will deliver a significant range of business benefits outside of the commonly stated areas of improving primary and reactionary delay, and such benefits have traditionally tended to be understated in the UK.

Business change must be included as an integral part of any Traffic Management implementation if the associated benefits are to be both maximised and realised. Some change will merely require facilitation but it is also expected that some will require negotiations with unions and operating companies.
Improving the resolution and optimisation of the timetable and providing an improvements feedback mechanism is fundamental to delivering TM benefits.

It is strongly recommended that a central Traffic Management design authority be established to actively manage the evolution of the complex systems landscape that Traffic Management will sit within. To encourage and enable supplier choice, this design authority should initially focus on the definition of standard and open system interfaces, supported by supplier involvement.
Recommendation Areas

- Recommendations Prior to Implementation Phase
  - TM Terminology
  - TM Requirements
  - Open Interfaces and Standards with Design Authority
  - Lessons Learned
  - Migration Strategy for ARS Areas
  - Further Business Case Enhancements

- Recommendations for Realising Benefit
  - Timetable
  - Common Interface File (CIF) data
  - TOC/FOC/Network Rail interaction
  - Schedule 8
  - Legacy Systems
  - System Integrator Function
  - Business Change
Programme Costs

David Palmer
ECI Work Stream Lead
Introduction

- ‘What can we do as a team (‘good customer’ and supply chain) to reduce costs, within a future DR Programme?

- This work identifies a number of causal factors for this difference and a range of opportunities that could be implemented to reduce costs

- The team was formed from Digital Railway, Indra, Thales, Amey, Siemens, Bombardier and Alstom

Terms of reference;
- To be collaborative and open
- Cross company silos to provide an industry collective view
- Guide and support the joint DR Cost Reduction Initiative
- Deliver a robust proposal to DR that helps enable a clear strategy to be set and delivered

Framing the scale of opportunity;
- At least 3 Suppliers, each securing a work bank that;
  - Runs throughout CP6 and into CP7
  - Incorporates the products and solutions as defined in the V20 plan
  - Would include 3 – 4 significant projects within a common geographical area or route
  - Would equate to a value of £0.8 to £1bn
Value Chain & Cost Analysis

Support Activities
- Product Development/R&D
  - Bus Dev & Tendering
  - Management & Admin
  - Commercial Management
  - Sourcing & Logistics
  - Planning
  - QEHS

Primary Activities
- Project Management
- Project Engineering
- Design
- Manufacture/Materials
- Construction & Installation
- Test & Commissioning

Risk

Client Costs
International Experience

Digital Railway OBC v3.04

- DR SEU rate appeared high
- Contradicted supply chain experience
- Lack of comparative data

Supply chain

- International deployment experiences

- Analysis of multiple data points
  - Denmark
  - Hungary
  - Poland
  - Spain
  - France

- Identified a range cost variance causal factors
  - Scale of Commitment
  - Environment
  - Technical
Scale of Commitment

**International Market Data**
- Normalised & plotted
- Market price variance >40%

**Price influencers**
- Scale of commitment
- Market environment factors

**UK**
- Order of magnitude below minimum efficient scale

**Economies of Scale**
- Commitment provides investment confidence
- Enables Innovation
  - People, Process, Products & Infrastructure
- Provides a lever for negotiation

**Denmark**
- Northern European market
- Small network
- Committed to nationwide DR deployment
- Secured low market price
Scale enables additional Economies of Learning
- Typically 20% complex technology
- Repeated task execution develops:
  - Organisational capability
  - Individuals tacit knowledge
- Continuity of work
- Example Jubilee Line/Northern Line

Impact of scale on market attractiveness
- Global market
- Competing for supply chain investment

<table>
<thead>
<tr>
<th>UK</th>
<th>vs</th>
<th>DENMARK</th>
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<tbody>
<tr>
<td>Large</td>
<td>Size of Network</td>
<td>Small</td>
</tr>
<tr>
<td>High</td>
<td>Historical levels of rail investment</td>
<td>Low</td>
</tr>
<tr>
<td>High</td>
<td>Bureacracy</td>
<td>Low</td>
</tr>
<tr>
<td>Low</td>
<td>Commitment to Supply chain</td>
<td>High</td>
</tr>
<tr>
<td>High</td>
<td>Digital Railway unit price</td>
<td>Low</td>
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</table>
Environment factors impacting market price

- Three interdependent causal factors
- Drive cost into value chain

Industry structure

- Complex & fragmented
  - Stakeholder management
  - Risk & accountability
  - Layers of separation between supplier & end customer
  - Extended chains of decision making

- Leading to:
  - Bespoke over-engineered solutions
  - Preferential engineering
  - Late stage changes to programmes

- Increasing costs, prolonged schedules & reduced quality
Environment

Skills & Competencies

UK losing out on investment
- Failed DR procurement events
- Failure to realise anticipated volumes through commercial frameworks
- Level of bureaucracy & high cost of doing business
- Funding cycle impact on business continuity
- High degree of customisation

Challenge retaining key people

Long-term skills drain
- Suppliers lack confidence to invest

Increasing reliance on tier 2 & 3 contingent labour
- Increasing costs
- Quality & performance impact
- Stifling innovation

Knock on effects
- Cycles of rework
- Interactions & unintended consequences
Behaviours
- Technology readiness or behaviours?
- Multiple attempts to implement
  - Lack of skilled resources
  - Individual & organisational behaviours
  - Act as restraining forces
- Lost opportunities
- Fuelled narrative of past failures

Impact
- Exacerbated skills drain
- Added layers of cost throughout the value chain
**Base Infrastructure Information**
- Digital data collect techniques are improving accuracy and quality
- Advent of 3D modelling
- Central management of survey data to ensure accuracy and consistency for current and future projects

**Clear System Definition**
- ETCS Technical specification for Interoperability
- ETCS National Requirements
- Implementation of a UK ETCS Solution
Technical

- Automated and Modular Design Concept
  - Traditional Design Techniques are Labour Intensive
  - Automated Design and Test tools

- Deployment Methodology
  - Delivery Strategy
  - Implementation Strategy
Opportunity

- Three key factors effect the cost of the Digital Railway
  - The scale of commitment to the Supply Chain
  - Britain’s railway environment
  - Technical and process innovations

- Potential cost reduction over the next 6 years if all opportunities realised
Opportunity

• Economies of learning brought about by continuity of work

• Economies of scale delivering volume savings and efficiency gains

• Adoption of a ‘thin client’ DR delivery model to put the supply chain close to the customer eliminating waste and leveraging the supplier’s return on experience.

• Development of DR skills and competencies through long-term commitment to the supply chain providing the confidence to invest and reverse the industry skills drain.

• Leveraging digital technologies to dramatically improve the quality of base infrastructure data.

• Collaboration with the supply chain to develop a clear and implementable DR system definition and reference design

• Providing the scale of opportunity to enable the supply chain to invest in design and test automation alongside a modular design concept

• Deployment methodology reducing DR costs through optimising how deployment and delivery is organised and implemented.
Recommendations

- Establish a significant long-term DR deployment commitment
- Continue to collaborate with the supply chain to further refine opportunities
- Further analysis of Supplier costs against the value chain to ensure the model is robust
- Better define key opportunity areas and how they may be achieved - for example data automation
- Investigate how the opportunities identified could improve current conventional schemes
- Investigate how these opportunities could be further exploited by looking beyond the CP6 constraint - whole life operating models
Questions & Answers

Facilitated by:
Stuart Calvert
Early Contractor Involvement Lead

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Morning break & Networking Opportunities

Please return and be ready to start at 11:40
ETCS Specifications Review

Ewan Spencer
ECI Work Stream Lead

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Contents

- What is the Reference Design?
- Overview of Work Stream
- Review Findings
- Recommendations & Next Steps
ETCS - a tool kit which can be used in a variety of circumstances.
Reference Design - the description of how ETCS will be used in the UK
Set of 31 documents written by NR with extensive stakeholder input

Benefits of a mature Reference Design:

- Centralised vehicle for **managing current and future requirements**
- **Common source** for all projects
- Drives **Operational consistency** across supply base
- Enables suppliers to **identify & scope modifications** required of their systems.
- Ensures a rationale and **deliverable set of requirements**
Summary
- A preliminary, supplier-lead review of the Reference Design

Objectives:
- Provide preliminary review comments to identify issues
- Establishing options for undertaking a more complete review in the future.
- Produce a report detailing observations and options for future review work.

Why should the Suppliers review it?
- Reduces risk of including requirement that are costly and/or overly difficult to develop/deliver.
- Identify alternatives
- Lessons learnt from International experience

Haven’t the Supplier’s already reviewed it?
- Yes, but as the Reference Design develops and matures, it requires ongoing reviews.
Workstream Process

- NR released Reference Design documents

- Suppliers reviewed Reference Design documents
  - Each supplier reviewed as many documents as possible in time available
    - Ascribe each document a Maturity Rating (1-5)
    - Note issues for inclusion in findings report

- Suppliers worked collaboratively to identify options for next steps

- Suppliers produced workstream findings report
Workstream 3

Findings

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Findings – Importance

The Reference Design:

- Is required
- Fulfils an important role for a variety of stakeholders
- Once completed, should be maintained and updated as required
Findings - Maturity

The Reference Design:

* Generally has not yet reached the required level of maturity

* Requires further work involving the suppliers
  * There are several options for how to do this
  * Outline proposals and indicative estimates of level of effort provided

* Configuration management to maximise efficiency of review process
Findings - Maturity

- The suppliers have differing views on the maturity of some of the documents:

- A common view of the state of the documents must be reached.
  - Indicative levels of effort established
Effective review of the Reference Design requires people with deep knowledge crossing diverse areas:

- ETCS Specifications
- ETCS Application
- Suppliers’ own ETCS products and systems
- Suppliers’ international experience
- UK Signalling principles and operation practices

Individuals who have this combination of knowledge are in short supply.

**Their availability must be factored in to review schedules.**
Workstream 3

Next Steps Proposals

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Next Steps Proposals

1) Undertake a workstream to harmonise supplier views on where the issues are in each document. Resolve:
   - Differing interpretations of ‘Maturity Rating’
   - Based on understanding? Pre-existing solutions?

2) Decide how to proceed with review / update. Options:
   - Full analysis of reference design prior to projects
   - Partial analysis before projects, partial in projects
   - Full analysis within project(s)

3) Implement Configuration Management process
Summary

- Reference Design is an important asset
- There is good understanding of the work to be done
- Vital to involve the suppliers
- Need to be cognisant of resource constraints
Capacity Proof Points

Tristan McMichael
ECI Work Stream Lead
Agenda

- WS4 Objective
- WS4 Overview
- Workstream Team Members
- Process of Investigation
- Findings
  - Commentary on Railway Models that produce Capacity
  - ECI suggested Capacity Improvement Potential & ECI Conclusion
  - Improvement Figures
  - ECI project evidence on Digital Railway solutions
  - Supplier’s commitment to the UK Network Reliability Requirements
- Conclusions
- Q&A
WS4 Objective

- ECI Workstream 4 – Proof Points’ objective is to provide qualified and quantified evidence that Digital Railway product/solutions (ATO, C-DAS, ETCS, Optimised Timetables and Traffic Management Systems) can deliver greater capacity and greater reliability.
- An ECI Workstream Team was created with representatives from Alstom, Amey, Hitachi, Indra, Siemens and Thales to specifically address an often quoted statement that a combination of Digital Railway products/solutions can improve capacity up to 40%, create better connectivity and deliver better reliability.
- Such figures have received mixed reception within the railway industry.
## Workstream Team Members

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<tr>
<th>Name</th>
<th>Representing</th>
<th>E-mail</th>
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<tbody>
<tr>
<td>Tristan McMichael</td>
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<td>Nathan Sealy</td>
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<td>'Rivilla Lizano, Francisco Javier'</td>
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<tr>
<td>Stuart Calvert</td>
<td>Digital Railway</td>
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Each Supplier provided an expert in the subject matter to review and manage all comments from within their company.
Process of Investigation
WS 4 Question: can the Traffic Management System (TMS) and ETCS suppliers validate the often quoted 40% capacity improvement figure?

The DR solution intended to deliver 40% capacity improvement was a combination of TM, ETCS L3 with Automatic Train Operation (ATO). Therefore, not a practical cross network benchmark.

Not having access to the original model on which the 40% figure was based upon, Workstream Team were presented with the results of a similar model: Great Eastern and East Coast mainline.

The results were similar, albeit resulting in reduced percentage figures to the original, therefore reasonable candidate to use in the investigation.

Before validating the model’s capacity improvement figures, the depth of the model’s integrity and modelled assumptions/omissions needed to be analysed.

In parallel, the Workstream Team then provided their own project experiences of introducing Digital Railway products/solution as to compare with real life examples.
Railway Models that produce Capacity Improvement Figures
Railway Models that produce Capacity Improvement Figures

- If Railway Models are to be used to produce capacity improvement benchmarks then it is essential to have an accurate ‘engineering focused model structure’ that models the target network area, paying particular attention to the current Infrastructure and Signalling constraints in its entirety.

- ECI Workstream Team would like to support the refinement of railway capacity models before fully endorsing its capacity improvement figures.
As a minimum models should be developed with the following recommendations:

- ETCS Braking Curves to reflect the current TSI Standard (Baseline 3 Release 2)

- Model Conventional and ETCS Signalling Principles to the target operational concept.

- Creation of a baseline infrastructure model to be used throughout time steps comparison (e.g. 2020 and 2043) and evolving technologies.

- Represent the full target area of the network including terminus stations.

- Represent industry approved System Latency constraints for signalling.

- Represent realistic driving behaviour.

- Test scenarios other than capacity. Journey time improvements, Service reliability and continuous speed supervision can be just as important as Capacity to other industry Stakeholders. For example, for some railways Journey Time Improvement is considered the primary driver, and capacity improvements possibly less so.

- Stochastic analysis should be undertaken to consider variance to the timetable.
ECI Suggested Capacity Improvement Potential

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Scenario 1: Max Railway capacity with Conventional Signalling

- There is a theoretical maximum capacity which is restricted by the constraints of the track topology and the signalling system.
- One key to unlock capacity improvements is de-conflicting the current timetable and introducing Interfaced or Integrated TM which may provide additional useable capacity in the region of 10%.
- Noted that there are areas of the network operating at minimum headways and to the limits of the conventional signalling system. Therefore, only with civil engineering and signalling intervention, can useable capacity be unlocked.
Scenario 2: Max Railway capacity with ETCS L2 and optimised track detection

- ETCS L2 overlaid onto a conventionally signalled railway can provide improved capacity benefit for ETCS-fitted trains. This is achieved by subdividing conventional block sections into ETCS block section to permit ETCS-fitted train to proceed beyond conventional block sections.
- ETCS L2 without Signals introduces the real benefits of in-cab signalling.
- In conjunction with TM, civil engineering and signalling intervention, an increase in the region of 10% to 20% capacity is possible.
- It is assumed that a further 5% to 10% capacity may be delivered with the introduction of ATO.

Note:
There are areas of the network with infrastructure constraints, such as complex junctions and extreme track layout, that would impede capacity improvements.

Only with civil engineering and signalling intervention, would useable capacity be unlocked.
It is agreed within the ECI Workstream Team that stating capacity improvement figures, with the introduction of Digital Railway product/solutions without infrastructure changes, over estimates potential benefits.

Civil engineering and conventional signalling interventions, such as simplifying complex junctions and curvature reductions, should not be ignored as a key factor in creating ‘new’ capacity potential.

Traffic Management Systems and ETCS should not be considered as a ‘silver bullet’ to solely create railway benefits, such as capacity improvements, but should be seen as enablers to deliver network area’s potential.

The benefits of Digital Railway products/solutions should be focused ‘line by line’ rather than applied holistically across the network.
ECI project evidence on Digital Railway solutions
**ECI project evidence on Digital Railway solutions**

<table>
<thead>
<tr>
<th>Company</th>
<th>Project &amp; Digital Railway Solution</th>
<th>DR Solution &amp; proposed Improvement</th>
</tr>
</thead>
</table>
| Alstom    | **Banedanmark** worked in collaboration with Alstom targeting specific network areas that suffered with poor capacity. Conventional trackside modifications created a potential for additional capacity improvements. In certain areas of the network the target is to achieve a capacity improvement of 30% with the introduction of the Alstom ICONIS TM and ATLAS ETCS Level 2 (no signals). | TM + ETCS L2 (No Signals)  
30% Capacity Improvement |
| Bologna Railways - Tirano railway station (RFI) | In operation since 2006/07, a significant performance improvement, which can be quantified as up to 30% capacity increase |                                                                 |
| Hitachi   | **Lab Simulation applied to Rome’s Railway Node.**  
includes data that detailed track works modifications (e.g. rail alignments, curvature reductions), change in Operational rules, Signalling rearrangement (e.g. track sections length), and Timetables optimisation | Level 2 between +8% and 13% Capacity Improvement  
Level 3 between 18% and 22% Capacity Improvement |
## ECI project evidence on Digital Railway solutions

<table>
<thead>
<tr>
<th>Company</th>
<th>Project &amp; Digital Railway Solution</th>
<th>DR Solution &amp; proposed Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indra</td>
<td><strong>Spanish Railway Network</strong>, managed and controlled by Indra’s TM technologies. TMS alone does not create new capacity on the railway network, but delivers optimum use of existing capacity and improved timetable reliability.</td>
<td>TM (only)</td>
</tr>
</tbody>
</table>
| Siemens  | **Thameslink, UK**  
System requirements of increasing service from 20 tph to 24 tph (20% increase). However, the system is designed to support 30 trains per hour, hence further capacity improvement is possible. | TM + ETCS L2 (with Signals) + ATO | 20% Capacity Increase |
|          | **Erfurt – Leipzig line**  
A reduction in journey time of approximately 40% as the enhanced safety |
## ECI project evidence on Digital Railway solutions

<table>
<thead>
<tr>
<th>Company</th>
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<th>DR Solution &amp; proposed Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thales</td>
<td><strong>Munich, Stuttgart and Frankfurt lines</strong>&lt;br&gt;Improved flighting at bottleneck junctions can result in 7% improvement and major stations see significant improvements over 15%&lt;br&gt;&lt;br&gt;<strong>Austrian rail network</strong>&lt;br&gt;TM with ETCS with L2 has been seen to improve capacity at Austria by 30% on specific lines.</td>
<td>TM + C-DAS or ATO +15% Capacity Increase 30% Capacity Increase</td>
</tr>
</tbody>
</table>

Note that large capacity improvement gains and other benefits were only possible by working in collaboration with each customer to target specific areas of the network that suffered with capacity bottlenecks. All the Digital Railway solutions incorporated conventional intervention, enhancing the Operational Rules and Timetable Optimisation.
Each ETCS Supplier within this ECI Workstream Team has signed up the National Reliability targets and therefore, in theory, on an ETCS L2 line, the MTBSF value is conditional on the points machines and track detection devices and not the ETCS products.
ECI report demonstrates that it would be incorrect to state that a 40% increase in capacity can be achieved across the network by only adopting Digital Railway solutions, such as Traffic Management Systems and ETCS.

But rather Digital Railway solutions are enablers to unlock the maximum potential of network areas. The benefits should be realised on a line by line basis instead of a holistic capacity improvement statement.

Where an area of the network is already at, or close to its maximum physical capacity, Digital Railway solutions cannot bring about further capacity improvements but can provide additional benefits in availability, journey time saving and reliability of the service.

A maximum of 30% capacity improvement is considered more achievable and further supported with TM and ETCS suppliers project evidence.

The Workstream Team would like to see the Capacity models fine-tuned to truly reflect the target network area. This should then result in a model which can be used with confidence for the development of outline business cases for both economical and performance purposes.
Questions & Answers

Facilitated by:
Stuart Calvert
Early Contractor Involvement Lead

@Digital Railway  #BetterRailway
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Lunch & Networking Opportunities

Please return and be ready to start at 13:45
Digital Railway Ready
On Board

Tristan McMichael
ECI Work Stream Lead

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Agenda

- Workstream 5 Objective
- Workstream 5a Overview
- Workstream Team Members
- Defining a specific & definitive list of standards
- ETCS Products and Primary Installation Constraints
- Worked example – DMI Product Requirements Extract
- Train Interface Requirements
- Application of ‘ETCS Ready’ Specification & Next Steps
- Q&A
Workstream 5 Objective

- WS5 objective intends to ensure train construction and trackside infrastructure works coincide with the Digital Railway Programme.
- This will provide a number of advantages to Network Rail, namely:
  - Existing rolling stock and infrastructure projects can continue while the Digital Railway solution and programme are developed and finalised;
  - Existing train refurbishment programmes and new train builds can incorporate the equipment required for the Digital Railway or provide provision for subsequent installation;
  - Resignalling projects can be designed to facilitate an upgrade to a later Digital Railway solution;
  - The Digital Railway “Ready” concept will minimise abortive work and allow a staged introduction of the Digital Railway solution.
- WS 5 has been split into two: **Trainborne** (5a) & Trackside (5b)
WS 5a’s purpose is to provide a specification for an ‘ETCS Ready’ Requirements for New Rolling Stock that will provide requirements for:

- Target locations of the generic ETCS products
- Specification of the generic ETCS train interfaces
- ETCS product space envelopes common across all ETCS suppliers
- Detailing common installation design constraints
- Specific & definitive list of standards

All of which can be used within the procurement of New Rolling Stock that coincides with the Digital Railway Programme
<table>
<thead>
<tr>
<th>Name</th>
<th>Supplier</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tristan McMicheal</td>
<td>Alstom</td>
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<tr>
<td>Mark O’Neil</td>
<td>Amey</td>
<td>Mark.O’<a href="mailto:Neil@amey.co.uk">Neil@amey.co.uk</a></td>
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<td>Thomas Godfrey</td>
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<td>Digital Railway / Network Rail</td>
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<td>Digital Railway / Network Rail</td>
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<tr>
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</tr>
<tr>
<td>Zeph Grant</td>
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<td><a href="mailto:zeph.grant@thalesgroup.com">zeph.grant@thalesgroup.com</a></td>
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<tr>
<td>Severin Thiebaut &amp; Paul Wilson</td>
<td>Siemens Rail Automation</td>
<td><a href="mailto:severin.thiebaut@siemens.com">severin.thiebaut@siemens.com</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td><a href="mailto:Wilson.paul@siemens.com">Wilson.paul@siemens.com</a></td>
</tr>
</tbody>
</table>

Each Supplier provided an expert in the subject matter to review and manage all comments from within their company.
The ‘ETCS Ready’ specification for New Rolling Stock details requirements for ETCS product functional (Train Interfaces) and non-functional requirements (Power, dimensions and Standards), with the addition of target locations for their installation.

These requirements would be implemented across 3 phases and 2 different configurations as to provide guidance at the procurement stage.

Each phase coincides with the target train supervision technology required at that time:
- Phase 1 – AWS/TPWS shall be the primary train protection system and space envelopes for ETCS product.
- Phase 2 – AWS/TPWS and ETCS will cohabitate together.
- Phase 3 – ETCS shall be the primary train protection system and AWS/TPWS system shall be decommissioned (Make Cable safe and blank Control and Indications) or not installed.

Requirements for 2 different configurations based on ETCS installation design constraints
- 1 EVC application – No greater than 5 car consist (DMU/EMU/Locomotive)
- 2 EVC application – Greater than 5 car consist (HST)
The specification aims to provide a specific and definitive list of standards associated with the ETCS functional system requirements and non-functional installation requirements.

This will be an iterative process but will ultimately provide the industry with the scope and the means to tender and to deliver the project.
Common ETCS Product Requirements (installation, dimensions, power requirements, applicable standards, interface requirements and ETCS configuration requirements)

**ETCS cubicle Vertical**
EVC, JRU and other auxiliary equipment such vans, termination points, CMD and circuit breakers are contained in 1 protective housing and installed in the train’s available space.

**ETCS cubicle Vertical**
Each product is grouped in a modular fashion and installed in the train’s available space.

**ETCS DMI**
Displaying speed, ETCS Control and Indication and the option of integrated AWS/TPWS/C-DAS controls and indications.

**Eurobalise Antenna**
ERTMS telegrams from the trackside balises installed on the track when the train crosses over them.
Common ETCS Product Requirements (installation, dimensions, power requirements, applicable standards, interface requirements and ETCS configuration requirements)

**Doppler Radar & Speed Sensor**
A train motion sensors which provide raw information to the EVC in order to measure the train speed, distance covered, running direction, etc.

**GSM-R Antennas**
GSM-R antennas allow the communication between the train and the trackside for ETCS Level 2 communication.

**Inter-Vehicle Jumpers**
Inter-vehicle jumper ports for ETCS cabling across carriages.

**ETCS Cabling**
Designated ETCS cabling trunk for all internal and external ETCS cabling throughout the train.
Installation Constraints

Balise Antenna Cable

- The primary design constraint for installing an ETCS system is the length of the Balise antenna cable.
- A universal rule of thumb is that the Balise antenna cable can only be broken (inter-vehicle jumpers) two times.
- With more than 2 breaks in the Balise cable, the signal drops below the specified rate for signal integrity.
- As a result, a train set with 5 cars or less, utilises a one ETCS on-board system (Locomotive, DMU/EMU).
- A train set with more than 5 cars utilises a two ETCS on-board system, one ETCS system in each driving end.
- There are solutions to facilitate a one ETCS on-board system with longer trains, however, higher expense of installation make this solution less economically viable than installing a two ETCS on-board solution.
EVC location

- The location of the EVC dictates the location of the GSM-R Antennas, Radar and Speed Sensor.
- In order to avoid unnecessary inter-vehicle cabling, the GSM-R Antennas, Radar(s) and Speed Sensor(s) should be installed on the same carriage as the EVC as these are direct interfaces to the EVC.
Example – DMI extract from the specification

Phase 1
- Provide speed signal direct from the train for Speed display on the Additional Speed Display or DMI
- Provide a non-ETCS dependant DMI (capable of displaying speed and the option of integrated AWS/TPWS/C-DAS controls and indications). If AWS/TPWS/C-DAS is not integrated on the ETCS designated DMI then there must be separate DMIs fitted for these systems.

Phase 2
- The ETCS DMI shall have precedence of position over all other Driver controls and indications.
- Provide speed signal from the ETCS system for speed display on the DMI.
- The DMI shall be compliant to all relevant requirements within the TSI (Baseline 3 Release 2) and the Great British On-board Subsystem Specification.

Phase 3
- If transitioning from phase 2 decommission AWS/TPWS controls and indications.
- AWS/TPWS system shall be decommission (Cables made safe and blank Control and Indications) or not installed.
- All ETCS Modular Cabinet Train Interfaces shall remain the same as per phase 2.

1 EVC Application
- There shall be 2 DMIs for a 1 EVC application.
- DMI shall be installed in each driving cab.

2 EVC Application:
- There shall be 1 DMI per EVC in a 2 EVC application
- DMI shall be installed in each driving cab.

Non-Functional Requirements
- The space provision for the DMI shall be no bigger 100mm x 300mm x 240mm.
- DMI shall operate under a local power e.g. 110V and/or 24V.
- DMI product and position shall be installed according to Human Factors guidelines.
• SUBSET 34 and SUBSET 119 refines the ETCS train interface requirements to make them more specific for the GB network.
• SUBSET 34 and 119 details the type of interface to realise the ETCS function – Serial and Parallel.
  • Serial interface is where multiple signals are transmitted via a bus/network or a point-to-point connection.
  • Parallel interface is where each signal is transmitted by discrete wires.
• An analysis was completed on all safety related interfaces
• From a Cyber Security point of view, all safety related functions and parallel interfaces are mandated. If a Serial interface is considered appropriate, then a full security risk assessment and independent penetration test should be conducted.
The ‘ETCS Ready’ Specification for New Rolling Stock provides a foundation for other ETCS suppliers targeting the UK market to state their compliance (or modify requirements). Therefore, further refining the UK ETCS requirements.

It provides Rail Delivery Group, TOC and FOC with requirements on:

- Target locations of the generic ETCS products
- Specification of the generic ETCS train interfaces
- ETCS product space envelopes common across all ETCS suppliers
- Detailing common installation design constraints
- Specific & definitive list of standards

However, this is work in progress…
Next Steps

- There is still work required on this specification and it will evolve over time to accommodate:
  - other ETCS suppliers who wish to enter the market
  - develop requirements further in accordance with other stakeholders
  - develop requirements to address evolving technologies such as ATO and ETCS Level 3.
Digital Railway Ready Infrastructure

Ewan Spencer
ECI Work Stream Lead

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Digital Railway Ready Signalling Specification
- What is it?
- Why do we need it?
- ECI scope

Key technical issues

How will the DR Ready Signalling Spec be used
The Digital Railway Ready Signalling Specification (DRSS)

- Is a Requirements Specification
- Requirements define measures to enable efficient future addition of Digital Signalling

DRSS allows resignalling work to continue and accept forthcoming Digital Railway solutions with minimal disruption and cost (i.e. designed as an enabling stage).
DR Ready Signalling Spec – Scope

- Interlocking Requirements:
  - RBC Interface
  - TMS Interface
  - Interlocking hardware
  - Application Data

- Trackside Design Requirements:
  - Train Detection
  - Lineside Signals
  - Equipment Housings
  - Power Supply

- Scheme Design Requirements

- Traffic Management System Requirements:
  - RBC/IXL Interface
  - Power Supply
  - Space

- Telecommunications Design Requirements

- System Acceptance Requirements
ECI Team Involvement

- NR produced draft DRSS
- ECI team asked to collaboratively review/update
  - NR, Alstom, Amey, Hitachi, Indra, Siemens, Thales
- Several workshops and update cycles until stabilised
ECI Team Involvement

- Collaborative approach advantages:
  - A peer review from the target audience (supplier and contractor experts)
  - Open technical debate with Network Rail experts and a full discussion of the issues.
  - Allowed re-focusing on outcomes rather than specifying solutions. Allows freedom for innovation.

- Most importantly, the ECI team involvement provided input and agreement of the specification for this essential Digital Railway task.
Vibrant, open discussions across a wide variety of topics.

- Key discussion points:
  - Interlocking Capacity
  - Interfaces
  - Removal of signals
  - Alteration of train detection sections
  - ETCS overlay implications
Key Technical Issues & Findings

Interlocking Capacity

- ETCS operation requires additional/different data in interlockings including:
  - Additional classes of routes
  - Block markers
  - Interface to RBC
  - Desirable to include bi-directional running

- Allowance needs to be made for this to avoid hardware and/or layout changes in the future

- Debates on
  - How much spare capacity to specify?
  - What data to specify at outset
Key Technical Issues & Findings

Interfaces

- NR keen to have standard/open interface protocols
  - Interlocking - RBC and ETCS.
  - Interlocking – TMS

- Impacts and benefits of EULYNX compliance widely discussed

- For further consideration when/ if specification available
Accommodating Changes to Trackside Infrastructure

Signalling system architecture shall

- Allow easy removal of lineside signals
  - To simplify the introduction of full ETCS Level 2 without signals.

- Allow easy reconfiguration train detection sections
  - To allow train detection sections to be changed to provided an optimised ETCS Level 2 layout
  - More easily achieved with axle counters
Use of DR Ready Signalling Spec

- The DRSS will be issued with all resignalling tenders.

- Extent of compliance will depend on which Digital solution required in that area (i.e. TMS, ETCS Level 2, or both) and when.

- DRSS provides guidance on which requirements are mandatory and which are optional, depending on when Digital Railway is planned for implementation.
  - Basic Guidance is:
    - DR rollout within 5 years – all requirements mandatory
    - DR rollout between 5 and 10 years – most requirements mandatory
    - DR rollout over 10 years – most requirements optional
Summary

- DRSS is an important asset to future-proof signalling deployments

- NR and the Suppliers able to agree on the majority of details

- Essential to embody in new tenders

- Excellent collaboration between all parties
How can we work better together to deliver the Digital Railway?

Rebecca Shepherd
ECI Work Stream Lead

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Process

Solution Lifecycle
- Product Development
- Bidding & Procurement
- Project Delivery
- Operate & Maintain

Enablers
- Business Change
- Contract Model
- Customer-Supplier Interface
Recommendation 1: Early Engagement Between the Suppliers and End Users

Well established and **targeted engagement** ensures the best chances of success.

- Depending on the chosen procurement strategy the supply chain should be heavily engaged with the end-users to help develop, or at least validate the:
  - **Scheme design(s)**; and
  - **Implementation plan(s)**, which should include how the parties will work together in the **delivery stage** to outperform the Project Objectives.

- By engaging the supply chain **early**:
  - Realistic **expectations** can be set regarding timescales, cost and outcomes leading to successful and reliable delivery programmes;
  - Perception and **management of risk** can be fundamentally changed;
  - More time can be spent on **innovation**;
  - More **robust** technical proposals;
  - **Accelerated** delivery and **minimisation** of change.

The **overall result** being a reduction in cost and an increase in value.
Recommendation 2: The Supply Chain Needs a Long Term Commitment

- **Securing of R&D funding**: Large companies have to compete in a global market place to secure funding. Smaller companies won’t be willing to commit precious resources unless they have certainty and commitment of the market.

- **Build confidence and momentum**: Confidence within the industry is currently low, as a result of failed procurement exercises and uncertainty of the DR procurement strategy.

- **Resources**: If the industry are serious about a large scale roll out of Digital Railway schemes then all stakeholders will have to train and upskill the existing workforce. Currently there is a very limited resource pool within the UK.

- **Change process**: It will take time for all stakeholders to devise the best way to deliver the DR. The learning curve will be incredibly steep however there must be continuity.

- **Time to realise benefits**: The benefits of a DR will be realised over the whole life of the assets and this will increase as more systems are introduced and integrated.

- **Building relationships with the customer**: It will take time to understand the customers needs given such a change in technology. There is a significant opportunity to unlock further benefits to the customer as we increase our knowledge of these challenges and needs.
Recommendation 2: The Supply Chain Needs a Long Term Commitment

Solutions

* **Procurement Strategy:** The creation of a objective and realistic procurement strategy with the supply chain and customers. The delivery of this strategy will start to build confidence.

* **Long term frameworks:** Framework agreements of at least 10 years with a minimum commitment to ensure continuity of resources.

* **Longer term contracts:** Flexibility to award longer term contracts or extensions to contracts would help overcome some of the challenges of first deployment.

* **Financing:** If the supply chain were to finance certain projects then they would have a larger and more integrated commitment to the whole life of the assets.

* **Commitment to product requirements:** A clear commitment to the future requirements of the technology so that the supply chain can instigate a R&D strategy.
Recommendation 3: NR’s Procurement Behaviour Requires Transformation

Challenges:

• **Bidding Certainty:**
  • Over the past 5 years, there has been a considerable number of tenders that have been cancelled, rebid, stalled or scaled back.
  • There is no reliable and visible bid pipeline emanating from a procurement strategy.

• **Bidding Behaviours:**
  • Hierarchical/transactional relationship has developed
    • Expectation of commitment and agility Vs limited reward over time
    • Focus on binary cost reduction rather than value
  • Lack of collaborative behaviours;
    • Tender evaluation approach;
    • Contract Model;
    • Not utilising early engagement potential.
  • To succeed the DR Programme will requires a number of strategic partnerships with collaboration, co-operation and mutual trust/success criteria.

• **Bidding Commitment:**
  • Commitment to Scope – Long term commitment;
  • Commitment across Control Periods.
Recommendation 3: NR’s Procurement Behaviour Requires Transformation

Effects:

- **In the short to medium term, this has resulted in:**
  - Considerable loss of time, money and effort.

- **In the medium term:**
  - Loss of confidence in NR procurements within:
    - Local businesses;
    - Removed approval levels with broader agendas.
  - Seeking recovery of losses via alternative avenues such as:
    - Existing contracts;
    - New opportunities;
    - Annual adjustments to rates/ business costs.

- **In the long term:**
  - ‘No bid’ decisions will increase;
  - Reduction in levels of investment in rail;
  - Alternative, more profitable and reliable areas for investment will be prioritised;
  - Loss of key industry skills and resources.
Recommendation 3: NR’s Procurement Behaviour Requires Transformation

Solutions:

- **A clear and reliable procurement strategy**
  - With a sufficient workbank to maintain a diverse supply chain.

- **Confidence in tenders**
  - Bids issued on time and as expected;
  - Maintaining the intended procurement process and timescales;
    - Reduction in number of rebids, scaling back or stalling of tenders.
    - Reduction of the number of bids cancelled.

- **Equitably restructure tender evaluation**
  - Reduce weighting on price in favour of factors that deliver value;
  - Normalise capabilities to determine value.

- **Consider the supply chain as strategic partners rather than suppliers**
  - Promote early engagement;
  - Use supply chain knowledge;
  - Work in a truly collaborative manner;
    - Contract;
    - Behaviours;
    - People.
Recommendation 4: Procure Whole Life, Outcome Based Projects

Today’s procurement models:

- **Capital expenditure programmes**
  - Often driven by lowest tendered price
  - Transactional relationship encouraging a “race to the bottom”
  - Focus on products with relatively easily defined deliverables

- **Technology**
  - Built around slow moving legacy technologies
  - High levels of competence & capability within the procuring organisation
  - Infrastructure Manager takes on design risk

- **Operation**
  - Inflexible systems
  - Open loop data from operations not fed back into development cycle
  - Performance & obsolescence risk with Infrastructure Manager

![Diagram showing Infrastructure Manager competencies and technology rate of change](image-url)
Recommendation 4: Procure Whole Life, Outcome Based Projects

The changing environment:

- Societal demands on the railway
- Rate of technology evolution

The Digital Railway

- Combines fast moving technologies with signalling & control
  - Rising complexity
  - System of Systems
  - Future technology disruptions likely
  - Increasing obsolescence risks

- Global product platforms
  - High cost of development
  - Leverage return on experience
  - Continuous evolution & opportunities to unlock value

- Migration complexity
  - Scale of UK network
  - Timescales
Recommendation 4: Procure Whole Life, Outcome Based Projects

Solution:

- **Shift in orientation from:**
  - Products to performance outcomes
  - Projects to whole of life services
  - Transactional to long-term strategic partnership

- **Whole of Life Performance Outcomes**
  - Design, creation & in-service sustainment
  - Integrates production, engineering, development & in-service data
  - Align Incentives
    - Maximise service value over the operational life
    - Value creation through Innovation
  - Transfers risk to the supply chain
  - Rewards value creation based on ROI
**Recommendation 5: Collaboration is Key**

*Challenges today caused by a transactional approach to suppliers will be augmented for deployment of transformative technology into a new environment.*

<table>
<thead>
<tr>
<th>Create the environment</th>
<th>Change Behaviours</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ Collaborative contract model (e.g. NEC3)</td>
<td>+ Shift emphasis in tender evaluation criteria from price to culture and behaviour of suppliers</td>
</tr>
<tr>
<td>+ B11000 (clarity and stability of business outcomes)</td>
<td>+ Equitably normalise capabilities demonstrated in tender submissions</td>
</tr>
<tr>
<td>+ Collaborative working practices (e.g. team charter, co-location and open book record keeping)</td>
<td>+ NR must approach suppliers as strategic long-term partners rather than arms-length transactions</td>
</tr>
<tr>
<td>+ Equitable assignment of risk and shared risk ownership where appropriate</td>
<td>+ Maintain collaborative behaviour from day one, day one hundred and one and one thousand and one</td>
</tr>
<tr>
<td>+ People are paramount (select people with a collaborative track record)</td>
<td>+ Learn from experience and apply this to improve the project over time</td>
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Need both for effective collaboration
Recommendation 6: Customer/supplier interface – bringing them closer together

ISSUES
Amplified by the transformational nature of Digital Railway solutions
NR is complicated, fragmented and internally disconnected with poor communications
NR departmental and team objectives, methodology and processes are inconsistent and not fully aligned
The Supply Chain and the Routes are disconnected
NRIP is project not operational outcomes focused

BENEFITS
Required to achieve the transformational change Digital Railway solutions promise

Current model  Recommended model
Recommendation 1: Early Engagement Between the Suppliers and End Users

Recommendation 2: The Supply Chain Needs a Long Term Commitment

Recommendation 3: NR’s Procurement Behaviour Requires Transformation

Recommendation 4: Procure Whole Life, Outcome Based Projects

Recommendation 5: Collaboration is Key

Recommendation 6: Customer/supplier interface – bringing them closer together

Any questions?
Questions & Answers

Facilitated by:
Stuart Calvert
Early Contractor Involvement Lead

@Digital Railway  #BetterRailway
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Afternoon break & Networking Opportunities

Please return and be ready to start at 15:55
TransPennine Upgrade followed by Q&A

Rachel Coe & Ewan Spencer
ECI Work Stream Leads

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Scope & Team

- **Summary**
  - A collaborative assessment of the TRU aims and applicability of Digital Technologies

- **Objectives**
  - Assess the application of Digital technologies to TRU.

- **Representatives from:**
  - Alstom
  - Ansaldo
  - Hitachi
  - Resonate
  - Siemens
  - Thales
Summary & Findings

• Digital Technologies:
  • ETCS L2 (overlay based on current rolling stock fitment…. then L2 no signals )
  • Isolated Wide Area Traffic Management as early as possible west of Leeds
  • Interfaced Wide Area Traffic Management in Leeds and East of Leeds

• Conventional Interventions:
  • Additional crossovers and bi-directional sections to assist in major disruptive events
  • Passing loops to assist in the regulation of fast/stopping services

• With pan-industry support, produce a whole-railway migration plan to include
  • Electrification, Digital Rail Technologies, Conventional Signalling, Communications, Civil Engineering

• No silver bullet
  • There are many aspects of the TransPennine Route that require upgrade work
  • Digital Technologies can provide a more efficient path to delivering a better performing railway than achievable with conventional technologies

• Effective supplier collaboration
TransPennine Route Challenges:
- Complex Line Speed profile
- Signal sighting issues
- Challenging access for maintenance
- Scheduling/ Routing challenge

Benefits of ETCS:
- Remove signal sighting constraints
- Enable running at closer to Line Speed
  - Reduces need for some margins
  - Conventional interventions to remove physical restrictions
- Reduce trackside infrastructure
- Increase granularity of train control in conjunction with TM.

Recommendations:
1) Improve modelling work to better define benefits of ETCS and other Digital interventions
2) Collaboratively produce a detailed, benefits-driven migration strategy to establish best approach to conventional and Digital intervention deployment
3) Based on current understanding of constraints (eg Fleet fitment) Deploy ETCS L2 Overlay. Upgrade to L2 (no signals) when ETCS Onboard fitment complete
TM & Interfaces

TransPennine Route Challenges:
- Increase in services
- Journey Time Improvement
- Time table adherence at key junctions
- Managing disruption during upgrade
  - Use of diversionary routes
  - Bi directional working

Recommendations:
1) Isolated Wide Area TM across the route with 20 minute visibility in each direction
2) Interfaced TM where route setting systems exist – reuse the benefit from existing capabilities and investment
3) Integrated TM when recontrolling an area

Benefits of TM:
- Disruption Management
- Improved Timetable
- Adherence to timetable
  - Reduces need for some margins
- Improved capacity
- Enable running at closer to Line Speed
- Enables C-DAS

<table>
<thead>
<tr>
<th>External Business Systems Layer</th>
<th>C-DAS</th>
<th>National Timetabling</th>
<th>TOC Resource Mngt</th>
<th>Customer Information</th>
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</thead>
<tbody>
<tr>
<td>Planning and Operations Layer</td>
<td>Traffic Management Planning and Operations Management</td>
<td>Operations &amp; Planning</td>
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<tr>
<td>Signalling Control Layer</td>
<td>Simplifier Display</td>
<td>Existing Control Panel or Display</td>
<td>Existing Signalling Control System</td>
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<tr>
<td>Field Equipment Layer</td>
<td>Existing Interlocking</td>
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ATO & C-DAS

Automatic Train Operation

• Automates some/all aspects of train acceleration and braking.

• Provides highly consistent & accurate train control/operations
  • Supports consistent delivery of intensive service
  • Supports safe and accurate driving to speed profile

Connected Driver Advisory System

• Provides dynamic, TMS-derived driving advice to Driver

• Can improve:
  • Service performance
  • Timetable adherance
  • Recovery from disruption
  • fuel efficiency

• TRU has a number of areas in which C-DAS may provide enhanced or additional service benefits

Recommendations:

• ATO and C-DAS should be considered in the proposed enhanced modelling work to establish extent of benefits.
Electrification brings various benefits as part of the wider upgrade strategy. However:

The introduction of electrification will involve upgrades/changes to the following:
- Immunisation of the train detection mechanisms
- Possible replacement of point machines
- Upgrading of interlockings in association with the above
- Signal Sighting impact of stanchions and other OLE equipment
- Electrification of diversionary routes (or establish alternate routes)

Enabling work is intrusive so essential to consider as part of wider migration strategy.
- Consider implementing at the same time as other interventions.

To achieve objectives electrification is not a driver.

Part of new train order is electric trains – Constraint

Recommendation:
- Create an integrated plan as part of an integrated team
Migration Principles

Digital technologies will play a significant role in achieving the TRU Journey Time.

- Requires enabling works be undertaken
  - Electrification, new trains, onboard fitment, track work, re-signalling and more

- Highly Complex set of interdependencies between the roll out of Digital Technologies and the enabling works

Understanding these, defining the constraints and plotting an efficient migration path through them may well be the single most important step in delivering TRU

Recommendations:

- Produce a detailed whole-system migration strategy up-front, involving a suitable cross-section of stakeholders (including the supply chain).
- Ensure that lessons learnt are accommodated
Business Change

- To deliver TransPennine objectives Business Change is key to maximise the benefit of digital technology.
  - Shift from reactive to pro-active rail management
  - Cultural Shift required
  - CONOPs to support
  - Revised training
  - Changes start with planning
  - Split between ROC’s

Recommendation:
- Business changes are planned around the migration plan to maximise benefit of Digital Railway technologies
Lessons Learned from Global Projects

- Scheme stability, change management and data sources
- Lab-based System Integration and Test, from the outset of a project
- System Integrator role and responsibility
- GRIP to support requirements definition and development
- ETCS/ Conventional transitions

- Time to update operational rules and procedures
- Training of the users
- Safety Assessor familiarity with national signalling principles, operational rules and principals of ETCS;
- Integrated Programme Plan showing interdependencies across all interventions
Recommendations for Future Work to scope Implementation Phase:

- Assemble a planning team to develop an integrated migration plan.
- Create a TransPennine Route data baseline
- Engage experienced Digital Railway suppliers to model Digital Railway interventions.
- Investigate the benefits of
  - Application of additional Bi-directional signalling
  - Addition and extension of passing loops
- Analyse TM geographic span taking account of train ordering requirements and optimal boundary between ROCs
- Make a consistent decision on the planning horizon for installed TM systems and agree and implement processes to facilitate short and very short timetable changes that cross multiple TM areas and/or non-TM areas during this period.
- Define open interface between Signalling Control and TM.
- Update standards to take account of TM, ETCS and other Digital Railway technologies.
- Refine and implement TM – LINX - CDAS open interface
Recommendations for Implementation:

- A System Integrator function should be established for TransPennine rollout.
- ETCS L2 overlay be targeted (based on current rolling stock fitment).
- Isolated/Interfaced (depending on existing systems) TM is installed Manchester Piccadilly to Leeds
- Interfaced TM from Leeds to York with key feeder routes included.
- On re-controlling an area TM is upgraded to TM Integrated.
- Business Changes are planned around a migration plan which has been developed to maximise the benefits of Digital Railway technologies.
Developing the Business Case

James Drury
Head of Finance & Commercial Case,
Digital Railway Programme

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The purpose of the Strategic Outline Business Cases (SOBCs) is to provide the Digital Railway and the DfT with the necessary information to make an informed decision as to which schemes to fund for development purposes.

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<tr>
<th>#</th>
<th>Candidate schemes</th>
<th>Status</th>
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<tbody>
<tr>
<td>1</td>
<td>South East Route, East Coast, Great Western, Anglia and Wessex (SOBCs)</td>
<td>Digital Railway (DR) developing the business cases in collaboration with each Route and its stakeholders. All initial workshops on the problem statements held. Board meetings arranged and the one for East Coast Main Line has taken place. Variety of parties partaking such as RDG: involved with timetable/capacity analysis, Suppliers: ‘ECI’ inputs &amp; TOC/FOCs: at Route Boards. <strong>Overview:</strong> Wessex: Capacity need SW Mainline and interface with Crossrail2 Anglia: Capacity need GE Mainline and new fleet of rolling stock to be ordered South East: Performance and Capacity need/TM potential to address performance in the short medium term. Western: Safety imperative for ATP plus addressing performance issues/interface to CR LNE: ECML Signalling to be renewed, In-cab fitment part of franchises e.g. VTEC</td>
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<tr>
<td>2</td>
<td>Trans Pennine Upgrade</td>
<td>Early Contractor Involvement supporting options. DfT responsible for SOBC at end of 2017. TPU, Digital Railway and DfT working together to make sure this is coordinated.</td>
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<td>3</td>
<td>East London Line (TfL)</td>
<td>Network Rail and TfL are working together to understand the operational feasibility of a 24 tph East London Line to meet current and forecast demand. This initial work will concluded in January. If positive, then TfL would progress a business case. Digital Railway and Thameslink Programme supporting</td>
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<td>4</td>
<td>NPIF – Autumn Statement “Digital Signalling” - £450m</td>
<td>In parallel with (1) above DR are working closely with the DfT over a selection candidates for use of the National Productivity &amp; Investment Fund (NPIF) which was announced in the Chancellor’s Autumn Statement 2016. Many of which will have a close synergy with the SOBC’s scope. This is aimed at the delivery of nearer term benefits via digital technologies</td>
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Digital Railway SOBCs “Plan on a Page”

1. Scope, problem statement and option identification
   - Problem and opportunity statements and options to achieve these outcomes
   - Project boards and working groups constituted and feeding into and endorsing

2. Feasibility and option development (analysis)
   - Cost/benefit
   - Options development, cost and benefit analysis
   - Comparison of DR option to heavy conventional

3. Business Case Drafting and presentation
   - Decision on SOCs to be taken forward for CP6 pipeline
   - SOBC editing, endorsement and submission
Closing Comments

Michael Flynn
Programme Director, Digital Railway

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Thank you for attending the Digital Railway Early Contractor Involvement Conference

We wish you a safe journey.

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