Delivering the sustainable railway

Tony Mercado
Department for Transport
Technology has key role to play but...

- What do our passengers really want and value?
- A better railway requires a change of culture...so we need to tackle hearts and minds
- Where are best practices to be found and how can we learn from their successes and experiences?
Topics I’m going to touch on

• Recent developments
  – Electrification
  – Value for money study
• The work of TSAG
Electrification: what’s been announced (south of the border)

In July:
• GWML - £1000m
  – Bristol by 2016
  – Swansea by 2017

• Liverpool – Manchester
  – £100m
  – By 2013

In December:
• Preston – Liverpool/Manchester – Blackpool
  – £200m
  – By 2016

Ongoing work to assess other routes
We can’t put wires up everywhere…

- There will always be a need for self powered trains
- Alternatives to diesel fuel are still some way off
- Should we buy new DMUs or life extend?
- How do we cope with growth?
- Need sustainable solutions
Rail Value for Money study

- Announced in the Pre-Budget Report in November 2009
- Aim is to examine the overall cost structure of the railway sector and identify options for improving value for money – deliver the same outputs on half the funding
- Will consider the possible role of new technology, processes and working practices in fostering greater added value
- Jointly sponsored by DfT and ORR. Transport Scotland actively engaged
The Technical Strategy Advisory Group:
Progress so far & future plans
Agenda

• The role of TSAG
  – Contribute to industry planning process
• TSAG’s work plan
• Examples of current activities
  – Route mapping
  – Reliability
  – Rolling Stock
  – Other Strategic Research Activity
Technical Strategy Advisory Group (TSAG) What is it, what does it do?

• TSAG is an independent cross-industry expert group, funded by the Department and established to:
  – Develop and own the Rail Technical Strategy
  – Set the long term technical agenda to meet anticipated industry need (not solutions looking for a problem)
  – Be the strategic research client group
  – Coordinate the activities of the Systems Interface Committees, linking current tactical work to long term strategy

• TSAG focus is therefore:
  – CP5 and beyond
  – Whole life/whole system sustainable solutions
  – Developing and publishing, in 2012, the Rail Technical Strategy that supports HLOS for CP5 and beyond
High level goals – the 4Cs

• Customers
• Cost
• Capacity
• Carbon
TSAG: how does it work?

- Technology Route mapping
  - Where do we want to be? Size the problem and the prize
  - Where are we now? Size the Gap
  - How do we get there? Identify options and solutions
- Strategic Research
  - Horizon Scanning
  - Co-ordination with others (research and planning)
  - Leveraging research funding for the rail industry
- Implementation
  - Contributing to the industry planning process
  - Giving the planners new options
  - Identifying technology insertion points
  - Supporting whole industry, whole system business cases
  - Supporting appropriate technology development
Agenda

• The role of TSAG
  – Contribute to industry planning process

• TSAG’s work plan

• Examples of current activities
  – Route mapping
  – Reliability
  – Rolling Stock
  – Other Strategic Research Activity
TSAG outline timetable

- 2009
  - Draft route maps ✓
  - Initial research projects ✓
  - Establish links with EPSRC, TSB, RRUK ✓
  - Establish technology watch ✓ and rail research ‘clearing house’
- 2010
  - TSAG ‘mid term review’ – 30 year view
  - Initial input to CP5 planning process
- 2012
  - RTS2 published alongside HLOS2
Agenda

• The role of TSAG
  – Contribute to industry planning process
• TSAG’s work plan
• Examples of current activities
  – Route mapping
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  – Other Strategic Research Activity
Beyond 2014: Setting the technical vision for the future

• Why is a vision needed?
  – Look ahead to the requirements of the future
  – Create a coordinated cross-industry approach to developing solutions

• Time required to identify, develop and deploy technical solutions for 2030s means we have to start now
Where we are now?

Route-mapping helps select the most efficient route through complex issues

Where are we heading?
Gap (to be met by routemapping applications)

Trajectory for current activity vs step change

Performance against the 4C targets

CP4

Current Trajectory

Aspiration

Time

Now

2038
Industry workshops

• 150+ participated
<table>
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<th>TSAG</th>
<th>Past</th>
<th>2008</th>
<th>Short term</th>
<th>2014</th>
<th>Medium term</th>
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<td>Increasing personal mobility</td>
<td>Rising expectations of public service</td>
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<td>Technology costs falling</td>
<td>Transfer of Innovation eg Auto / Aero → Rail industry</td>
<td>New materials / composites / light-weighting</td>
<td>Intelligent Transportation Systems</td>
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<td>National testing facilities</td>
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<td>Good track quality retention</td>
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<td>Yield Management</td>
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### Applications

- Low mass trains
- Ubiquitous data network
- Discontinuous electrification
- Modular trains and infrastructure
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**Technology**

- Passenger flow management
- Positioning and mobile comms
- Traffic management and ATO
- Track quality and cost model

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**Resources**

- Skills & knowledge
  - Leadership & credit
  - Cost / Benefit allocation to correct part of industry
  - Knowledge transfer from other industries
  - Procurement & commercial arrangements
- Industry Strategy
  - Human Factors
  - Public Perception & Risk Averse
  - Risk Management

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**Infrastructure / Other**

- Business Case / Cost model
  - Cost as barrier to implementing new technology
  - Whole life approach to funding / Cost
- Job Skills
  - Senior management / cross-functional / stakeholders
  - Incentives & Targets esp for Innovation

---

**Customer interaction**

- Technology
  - Train drivers work / train management
  - Design
  - Training
- Energy
  - Energy storage
  - Micro-generation / CHP
- Control & signalling
  - Crashworthiness / Bomb proof
  - CM on infrastructure
  - Track Quality & Cost model
- Rolling stock
  - Maintenance & operating processes
  - CM on rail
- Track & structures
  - Data transmission & store
  - Station design Modular infrastructure

---

**Technology**

- Job Skills
  - Skills to Adopt New Technology
  - Working across disciplines / Systems Approach

---

**Skills & knowledge**

- Business Case / Cost model
  - Cost / Benefit allocation to correct part of industry
- Industry Strategy
  - Human Factors
  - Public Perception & Risk Averse
- Partnership & collaboration
  - Attitudes and helpfulness of other sectors
  - Customer decision criteria
  - Passenger Acceptability / expectations
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<th>Trends &amp; Drivers</th>
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<td>- Impact of standards</td>
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**Trend & Drivers**
- Rising expectations of public services
- Incident of innovation eg Auto / Aero → Rail Industry
- New materials / composites / lightweight
- Intelligent Transportation Systems
- Pervasive communications expected everywhere
- Increasing personal mobility
- Oil Price / volatility
- Rail most attractive for long distance / high volume
- Rail Industry Fragmentation
- Europeanisation of
- Increasing taxation of road use
- Standards & Legislation
- Increasing focus on accounting for externalities
- Integrated Rail / Transportation System

**Applications**
- High reliability / high capacity
- Simple, Flexible, precise control system
- Optimised traction power & energy
- Integrated safety, security & health
- Optimised train : track interface
- Rationalisation & standardisation of assets
- Differentiated technical principles & standards
- Optimised train : track interface

**Energy**
- Crashworthiness / impact
- CM on train
- Aero vehicle
- Safety
- Lightweight train
- Driverless train

**Technology**
- Control & signalling
- Rolling stock
- Track & structures
- Customer interaction
- Infrastructure / Other

**Skills & Knowledge**
- Engineering
- Job skill
- Skills to adopt new technology
- Working across disciplines / systems approach

**Policy & Funding**
- Integration
- Incentives & targets esp for innovation

**Industry Funding**
- Regional + inter-modal transport (eg buses)
- Knowledge transfer from other industries
- Integration

**Partnerships & Collaboration**
- Resistance to innovate
- Knowledge transfer
- Customer decision criteria

**Vision**
- 2038
- Increasing personal mobility
- Prioritisation of safety
- Increasing "green" consciousness
- Accessibility needs
- Road freight & Rail
- Rail industry fragmentation
- Europeanisation of
- New materials / composites / lightweight
- Intelligent transportation systems
- Pervasive communications expected everywhere

**Resources**
- Skills to adopt new technology
- Working across disciplines-systems approach
- Costs and benefits correctly apportioned
- Impact of standards
- Whole life approach to funding
The top 20 applications...

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<tr>
<th>Application</th>
<th>4C Impact</th>
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What might our route maps look like?

**Traction power and energy deployment programme**

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<td>c50% of miles/ 80% of demand electrified</td>
</tr>
<tr>
<td>2032</td>
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</tbody>
</table>
What might our route maps look like?

**Traction power and energy deployment programme**

### Short term CP4
- Secure funds, HLOS 2
- Business Case?

### Medium term CP5
- Implement conventional electrification?
- Industry Business Case?
- Secure funds, HLOS 3 to 5
- Development and pilots

### Longer term CP 6-8
- Implement lower cost conventional electrification?
- Implement discontinuous electrification?
- Secure funds, HLOS 2 to 5

### CP9 vision
- c50% of miles/ 80% of demand electrified
- >>50% of miles/ >>80% of demand electric traction

**Key**
- TSAG promoted activity
- Industry planning activity
- Industry delivery activity
- Industry technical activity
What might our route maps look like?

**Traction power and energy deployment programme**

- **Short term CP4**
  - Secure funds, HLOS 2
  - Business Case?
  - Lower cost conventional electrification research
  - Raise/ lower pan trials
  - Energy Storage research
  - Electrical gap research

- **Medium term CP5**
  - Implement conventional electrification?
  - Industry Business Case?
  - Secure funds, HLOS 3 to 5
  - Development and pilots

- **Longer term CP 6-8**
  - Implement lower cost conventional electrification?
  - and/or
  - Implement discontinuous electrification?

**CP9 vision**
- c50% of miles/ 80% of demand electrified
- >>50% of miles/ >>80% of demand electric traction

**Key**
- TSAG promoted activity
- Industry planning activity
- Industry delivery activity
- Industry technical activity
Agenda

• The role of TSAG
  – Contribute to industry planning process
• TSAG’s work plan
• Examples of current activities
  – Route mapping
  – Reliability
  – Rolling Stock
  – Other Strategic Research Activity
System Thinking: Where is the reliability problem?

- **Infrastructure 29%**
  - Signalling 57%
    - Track Circuit 31%
    - Points 26%
    - Power Supply 15%
    - Signal 15%
    - Cables 7%
    - Level Crossing 4%
    - Other 2%
  - Track 26%
    - Broken rails/bolts 33%
    - TSBs due to track 13%
    - Reaction to P-coded TSBs 10%
    - Incomplete possession 5%
    - Trackside signs 3%
    - Fires 2%
    - Gauge Clearance C2%
    - Vegetation Mgt 2%
- **Civils, E&P, Telecoms 17%**
  - OLE 3rd rail 31%
  - Other 27%
  - Mistrip 23%
  - Lineside structure 10%
  - Telecoms 9%

- **Train 15%**
  - Driver/Control 26%
  - Possession overrun 47%
  - Doors 20%
  - Depot process 30%
  - Air system 16%
  - Track patrols 16%
  - Other systems 9%
  - Depot Mgt. 7%
  - Signalling & Warning 9%
  - Cooling system 6%
  - Underframe & bogies 5%
  - Engine 5%
  - Motor & alternator 4%
  - Brakes 3%
  - Bodywork 2%

- **Rules/Processes 3%**
  - Transcrew 31%
  - Train Ops 21%
  - Station delays 14%
  - Signalling Ops 14%
  - Planning 13%
  - Other 6%
  - Infrastructure Control 2%
  - Railhead trains 1%

- **Operations 21%**
  - Passengers, freight & vandals 24%
  - Fatalities/ Trespass 19%
  - Weather 15%
  - Vandalism theft (inf 13%)
  - Low adhesion 9%
  - Bridge Strikes 6%
  - Animals on line 3%
  - L/road incidents 2%
  - External fires 1%
  - Police & security 1%

- **External 24%**
  - Fleet un-coded 31%
  - Unexplained (inf 27%
  - Commercial vehicles 22%
  - Non-technical feet 20%

**Key:**
- Asset failure groups:
  - The colour indicates impact on overall system reliability.
  - $5 > 7%$
  - $> 5%$
  - $3 > 3%$
  - $< 3%$

29
• 44% of system unreliability is caused by Infrastructure and Trains

• These are traditionally considered amenable to technological solutions

• Only one issue – Train Detection – causes more than 5% of the total system unreliability

• Another 3 issues cause between 3 and 5%
• 45% of system unreliability is caused by Operations and External Factors

• Another 9% is ‘Other’; fleet uncoded, unexplained, commercial takeback, non-technical fleet

• There is a challenge to understand whether and how technology and process improvement can be applied
Remote Condition Monitoring

- **Short term output**
  - c45% of current delays technically related
  - ‘straight forward’ RCM could reduce this by a quarter i.e. save 10-12% of delay minutes
  - this equates to roughly one ‘PPM point’
  - ‘advanced’ RCM could potentially double the benefit
- **‘Non-technical’ delays**
  - What are we doing to reduce this c55%?
- **Longer term**
  - System reliability approach (not just hardware; people)
  - Support innovation
  - Longer term plan, ….vision
High Reliability/ High Capacity

- Industry is already focussed on delivering the CP4 target
- TSAG working closely with NFRIP, Fleet challenge and Network Rail to develop integrated rail reliability programme for the longer term – needs different thinking
  - High level approach ‘launched’ at 7 October NFRIP seminar
- Research being commissioned
  - Innovation analysis and strategy development
  - Assessment of UK rail systems engineering capability
Cross cutting themes eg: reliability

- Strong engagement with other players to maximise overall effectiveness

From this

To a joined up collaborative approach
Reliability - Customer Expectations?


By 2014 we expect:
• Improvement to 92.6% in punctuality (from current 90.9%)
• 25% reduction in delays of more than 30 minutes

Is this really a challenge...

• Passengers priorities for improvement
  – Value for money fares
  – Frequency of services
  – Punctuality
  – Able to get a seat

Source: Passengers’ Priorities for Improvements in Rail Services
Passenger Focus, June 2007
Benchmarking performance

MTR network in Hong Kong
• 28 years of operation without any passenger fatalities
• Up to 85,000 passengers/hour/direction
• Only one delay per day of more than 5 minutes in 2006
## MTR: 2006 operational performance

<table>
<thead>
<tr>
<th>Service Area</th>
<th>Target (%)</th>
<th>Performance (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Train Service Delivery</td>
<td>99.5</td>
<td>99.9</td>
</tr>
<tr>
<td>Journey on time</td>
<td>MTR Lines</td>
<td>99.5</td>
</tr>
<tr>
<td></td>
<td>Airport Express</td>
<td>99.0</td>
</tr>
<tr>
<td>Train Punctuality</td>
<td>MTR Lines</td>
<td>99.0</td>
</tr>
<tr>
<td></td>
<td>Airport Express</td>
<td>99.0</td>
</tr>
<tr>
<td>Add Value Machine Reliability</td>
<td>98.0</td>
<td>99.4</td>
</tr>
<tr>
<td>Ticket Machine Reliability</td>
<td>98.0</td>
<td>99.6</td>
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<tr>
<td>Ticket Gate Reliability</td>
<td>99.0</td>
<td>99.8</td>
</tr>
<tr>
<td>Escalator Reliability</td>
<td>99.0</td>
<td>99.9</td>
</tr>
<tr>
<td>Passenger Lift Reliability</td>
<td>99.0</td>
<td>99.9</td>
</tr>
</tbody>
</table>
This level of train punctuality is not a one-off...
What can we learn?

- Benchmark performance and work with other railways to understand how improvements can be made
- Culture: continuous improvement and continuous change, a journey
- Adopting new technologies and approaches from elsewhere, overcome the NIH hurdle
- Rigorous fault reporting and data management
- Identifying root cause of problems (system perspective) – no “one-off” attitude
- Invest in people first, equipment will follow
- Work in partnerships with suppliers and infrastructure providers, share goals and rewards
Agenda

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Rolling Stock

- IEP preferred bidder negotiations ongoing
- Thameslink selected two bidders
- Electrification reduces need for new diesels and offers opportunities to cascade existing diesels
- Economic climate means less money available for new trains so need to develop life-extension options
- What does passenger of the future need/want? Is it just about journey time, …or more about what can be done whilst travelling, the ability to work and communicate on the move?
  - How would he value service offerings?
Agenda

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  – Reliability
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  – Other Strategic Research Activity
## Some strategic research themes

<table>
<thead>
<tr>
<th>Intelligent traffic management</th>
<th>Energy efficient timetables combined with real time traffic control feeding intelligence between track and train to manage perturbations.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy efficiency</td>
<td>Discontinuous electrification to reduce cost and complexity of electrification. Considering coasting vs on board energy storage</td>
</tr>
<tr>
<td>Station design and crowd control</td>
<td>Assessing how existing stations could deal with increased capacity by utilising technology to provide a safe/seamless/secure transition for customers</td>
</tr>
</tbody>
</table>